Feedback Form

Gas Phase-Out Impact Assessment – May 27, 2021

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To promote transparency, feedback submitted will be posted on the Gas Phase-Out Impact Assessment webpage unless otherwise requested by the sender.

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Feedback - Gas Phase-Out Impact Assessment

Questions

Topic	Feedback
Are there additional considerations the IESO has not identified in defining the scope of the assessment to examine the reliability, operability, timing, cost and wholesale market implications of reduced emissions on the electricity system?	Click or tap here to enter text.

General Comments/Feedback

Thank you for the opportunity to provide feedback on the scope of the IESO's Gas Phase-Out Impact Assessment.

The primary goal of the IESO's Gas Phase-Out Impact Stakeholder Engagement originally scheduled for May 27th, 2021 was to seek stakeholder input on the scope of the assessment related to the reliability, operability, timing, cost and wholesale market issues that would need to be addressed should the phase-out of natural gas be considered.

This feedback answers the question put forth by the IESO: "Are there additional considerations the IESO has not identified in defining the scope of the assessment to examine the reliability, operability, timing, cost and wholesale market implications of reduced emissions on the electricity system?"

The three main scenarios proposed by the IESO to be assessed can be found on page 26 of the presentation dated May 27, 2021. A summary of these follows:

<u>Scenario 1</u>

Complete phase-out of gas by 2030 with a supply mix approach of new resources, in response to municipal city council resolutions.

<u>Scenario 2</u>

A market-based approach that examines the potential for higher gas prices to reduce the utilization of the gas fleet to reduce emissions by 2030 and to provide market signals to clean energy projects

<u>Scenario 3</u>

Reduce emissions by 2030 with a supply mix approach of new resources.

The efforts to tackle climate change have put a focus on the future of gas generation in Ontario. If natural gas was completely removed from the supply mix, the electricity system would face significant challenges that would require an unprecedented level of planning to develop and invest in suitable replacement energy and capacity to maintain the diversity (flexibility/resiliency), and reliability of the generation mix enjoyed today.

Retention of gas generation assets enables the electrification of the economy by providing energy to address demand growth uncertainty before new, longer lead-time, non-emitting baseload generation can be built. Gas assets are also a less expensive capacity resource that can continue to address the intermittency of renewables while balancing emission impacts.

With this in mind, OPG would like the IESO to consider the following ideas to expand the scope and range of scenarios related to the areas under examination in the assessment:

Cost Effectiveness

1. The baseline for comparisons with the scenarios should assume natural gas assets operating to the end of their useful life.
2. Technology policy choices should consider the least implied marginal CO_2 cost and land use.
3. The next opportunity for carbon emission reduction lies in the transportation sector. The IESO's report should consider the economy wide carbon impact, not just focus on the electricity sector.

Reliability

4. A new high electrification scenario should be stress tested.
5. Any reliance on imports needs to be carefully considered.
6. Uncertainties in the range of emerging CO_2 policies and regulations should be evaluated, as the electricity system will need to respond to these uncertainties.

Operability

7. The cumulative impact from incremental solar and additional energy storage has diminishing value. This needs to be factored into the supply mix analysis rather than just assuming a set impact for each source added.
8. The benefits gas brings (within the day and intraday), including the ability to balance renewables needs to be considered in the analysis.

For each of the above areas OPG has detailed our perspective.

1. The baseline for comparisons should assume natural gas assets operating to the end of their useful life.

Ontario's current gas-fired generation installed capacity is about 11,000 MW, accounting for about 25% of total installed capacity in the province and about 7% of energy production. The useful economic life of most plants, based on a total life of 35-40 years, can stretch to 2040 and beyond. Much of Ontario's current natural gas-fired generation is under contract. Approximately 8,000 MW will reach the end of its contractual term by 2030 with the remainder expiring by 2040. Shutting down a plant that still has useful life removes a cost-effective source of capacity from the system that may only need limited sustaining capital and fixed costs to operate. Continued operation of these gas plants is a cost-effective option for the ratepayer, until new non-emitting generation is built. Retiring the plants early will result in stranded natural gas generation assets, in addition to numerous pipelines and other infrastructure that may no longer be required, but will continue to be paid for by Ontario's energy customers.

2. Technology policy choices should consider the least implied marginal CO2 cost and land use.

The Federal Government's goal is to achieve a net zero carbon economy by 2050. This will require the addition of substantial new baseload generation to the system. While wind and solar are expected to have a lower average cost than say Small Modular Reactors (SMRs), they are less effective at removing CO2 due to their low annual capacity factor and low peak contribution factor. As more non-emitting generation is added to the system, more of their contribution will be contributing to surplus generation and less towards displacing gas generation. Wind and solar's contribution to displacing gas diminishes much faster than nuclear's and therefore the amount of CO2 they displace, diminishes faster. Incremental wind and solar add little to meeting the peak demand, thus the implied CO2 cost for these renewables increases dramatically as more are added to the system. Technology policy choices, in general, should be based on the least implied marginal CO2 abatement cost and not the average cost of energy. In addition, considering the life cycle CO2 emissions further increases the marginal CO2 abatement cost of renewable generation, especially solar compared to nuclear.

SMRs are one efficient option in particular when considering land use. Solar's land-use requirements are approximately 100 times more than nuclear's and wind's are about 500 times that of nuclear. The output of Darlington Nuclear, at about 28 TWh/year, is about the same amount of natural gas generation that is expected to be dispatched in Ontario when Pickering closes its operation. The land-use of Darlington is approximately 5 sq. km. To supply the same amount of energy would require 500 sq. km for solar and 2,500 sq. km for wind.

3. The next opportunity for carbon emission reduction lies in the transportation sector. The IESO's report should consider the

economy wide carbon impact, not just focus on the electricity sector.

Although OPG understands the IESO is not intending to address the economy wide carbon impact in its scenarios, as it is an important factor in the assessment of phasing out gas plants, it should be referenced in the report perhaps outside of the specified scenarios.

CO2 emissions from the province's electricity system account for just 2% of all CO2 emissions – compared to more than 17% of all CO2 emissions in 2005. Compared to other progressive jurisdictions from a carbon intensity perspective, Ontario ranks amongst the best globally - Ontario's electricity system is the lowest emitter when compared to the Canadian average, USA, UK, France and Germany by a wide margin.

This means that 98% of CO2 emissions are from other sources, which the province's electricity system can help reduce. CO2 emissions from the Ontario Power System are expected to remain relatively low over the next decade – even with the planned retirement of Pickering and refurbishments of other nuclear generators. By 2030, CO2 emissions are expected to be around 70% below those of 2005.

Rather than removing the last bit of carbon from the electricity sector, Ontario should focus on decarbonizing the transportation sector next. The use of existing natural gas would support electrification growth until Ontario can add a greater amount of non-emitting baseload generation to sustain low CO2 emissions. If all gas-fired generation is phased out, the supply deficit could reach up to 14,000 MW as opposed to the roughly 3,000 MW deficit reported in the Annual Planning Outlook.

4. A new high electrification scenario should be stress tested.

As discussed above, natural gas is essential to enable electrification and will help to respond to a range of future realities.

OPG has developed a high electrification scenario with the assumption that forecast Ontario demand would reach about 200 TWh by 2040 from 139 TWh in 2020. This increase would be fueled by economic growth, electrification of transportation and offset by conservation and energy efficiency.

The transportation sector is now the province's largest source of carbon emissions at more than 30%. Powering cars, trucks, trains, boats and buses with clean electricity, rather than gasoline or diesel, will make a significant impact to reducing carbon emissions in Ontario. Substantial gains in carbon reduction will inevitably result from significant electrification. Existing natural gas generation is uniquely positioned to help deal with the uncertainty of future demand due to electrification, as existing CCGT's can be easily ramped up until longer lead-time, emission free baseload generation can be added to the system.

Ontario's electricity system will have both a very significant capacity and energy shortfall if this high electrification scenario comes to fruition and especially so if gas is phased-out. As part of the scenario review for the gas phase-out assessment, as well as its next Annual Planning Outlook, the IESO should consider higher electrification scenarios. Studies have shown that burning gas to help electrify the transportation sector is an economically prudent way to deliver targeted CO2 savings. Switching from higher-emission fuels to low-carbon electricity could play a significant part in reducing overall province-wide emissions.

5. Any reliance on imports needs to be carefully considered.

If the system needs to rely on less gas generation, its contribution needs to be replaced to maintain reliability of the grid. Currently there are over 6,500 MW of import capability from interconnections with neighboring markets, however, only a fraction would be available at the time of system need. Ontario's transmission system has been designed and constructed based on existing load centers and large generators. Gas-fired generators are already built and strategically located where demand is highest. This helps to reduce congestion on transmission lines that may reduce the amount of supply that can flow from distant generators. A shift to large-scale imports would require an expansion of the transmission system that moves electricity from one region of the province to another. Large transmission system expansions generally take seven to ten years to complete and include rigorous environmental assessments, local community engagement (and opposition in some cases) and engineering.

Gas is a peaking resource and is relied upon when the province needs it the most. In addition to an increase in costs to build transmission, without gas Ontario would be more reliant on other jurisdictions to supply electricity.

Ontario's electricity trading partners are more carbon-intensive, except for Quebec. Phasing out Ontario natural gas plants and importing cheaper but dirtier electricity from the US could result in an increase in regional CO2 emissions. In order to level the playing field between Ontario and US electricity trade, imports could incur a Carbon Border Adjustment (CBA). However, a CBA would increase costs as it limits cheaper energy imports.

- Modelling indicates that at $170/t carbon, if natural gas generation is subject to a progressively lower performance standard, transitioning to 0 Teragrams/GWh:
    - With no CBA - US thermal generation would be economic, and imports of U.S. thermal generation would increase dramatically. This would result in increased regional total carbon emissions, and Ontario's electricity price would increase significantly.
    - With a CBA - US thermal generation would not economically be able to displace Ontario gas generation (decreased imports). However, it will push electricity prices

even higher, and would not save a significant amount of regional total CO_2 emissions.

Capacity imports should still be procured as part of the IESO's Capacity Auction, as this will be required in the post-Pickering world even without phasing out existing natural gas generation. Note that importing capacity with little energy content has a negligible impact on CO_2 emissions, similar to capacity from Ontario gas generation.

6. Uncertainties in the range of emerging CO2 policies and regulations should be evaluated, as the electricity system will need to respond to these uncertainties.

Currently, there are various carbon policies being considered by the federal government that may constrain natural gas generation in the future, including carbon pricing and emissions performance standards. The IESO should consider factoring in the potential range of policies. This is especially important when considering Scenario 2.

Ontario's CCGTs currently pay a nominal cost on their CO_2 emissions under the federal Output-based Performance Standard (OBPS). However, there are various carbon policies being considered by the federal government that may change the future regulatory landscape for natural gas and constrain its generation. These include:

- The Government of Canada (GoC) is expected to increase carbon pricing, as indicated in its 2020 A Healthy Environment Healthy Economy (Climate Plan). The carbon tax paid by large emitters (including electricity) would go from $40 in 2021 and $50/tonne in 2022, increasing by $15 annually thereafter, until it reaches $170/tonne in 2030.

- The Climate Plan also made commitments for 90% non-emitting electricity by 2030, and a net-zero grid before 2050. Under OPG's current projections, Ontario's grid will be close to 90% non-emitting by 2030 with the existing gas generators in service.

- In April 2021, Canada strengthened its Paris Agreement targets to 40 - 45% reduction below 2005 levels by 2030 (up from 30% reduction).

- In summer 2021, the GoC is expected to start consultations on new CO_2 emissions performance standards for fossil-fueled electricity for post-2022 in the context of the above.

A carbon price increase would increase the cost of operating the natural gas plants and would naturally raise electricity market clearing prices. This would result in some of these gas resources being dispatched less, due to real time imports being more competitive and assuming there is no carbon border adjustment. However, these gas assets would still provide valuable capacity to the Ontario grid.

7. The cumulative impact from incremental solar and additional energy storage has diminishing value. This needs to be factored into the supply mix analysis rather than just assuming a set impact for each source added.

In the past few years changes in grid-connected demand shape (due to increasing embedded generation, storage, demand management, etc.) has caused a shift of the peak hours and summer-peak season. The addition of embedded solar capacity over the past several years has shifted the peak demand hour to later in the day and later in the summer season. Several seasonal peaks have occurred in September after sunset, diminishing the peak contribution of solar capacity. When the peak is pushed to the hours when solar can no longer generate, there is no additional peak contribution from incremental solar generation.

Special consideration must be given to energy storage and its peak contribution, as more storage is added to the system. In 2006, the maximum differential between the daily minimum and maximum demand was close to 11,000 MW, which was the highest in history. This is the amount of flexible generation that has to be online during the peak of the day but off-line at night. The addition of new solar generation over the last decade has reduced this differential. This diminishes the value of energy storage for the grid. The peak contribution from energy storage flattens with increasing installed capacity and, shorter duration energy storage offers less and less effective capacity. OPG estimates there is no more than 3,000 MW of intra-day energy storage that is going to be useful to the system with the currently expected demand and supply mix post-Pickering. . Above this 3,000 MW, additional intra-day energy storage would be ineffective at reducing peak demand, as the amount of energy storage that can be charged off-peak is limited. In moving from 4 to 8 hour storage the costs would increase roughly by 25%. In the extreme, multi-day storage may be required to handle peaking demand during a heat wave or cold weather event.

8. The benefits gas brings (within the day and intraday) including the ability to balance renewables needs to be considered in the analysis.

Not many other supply resources in Ontario are capable of fully replicating the range of supply attributes provided by gas-fired generators. By contrast, given that wind and solar supply resources are dependent on the weather to provide energy, their supply can change very quickly, even minute-by-minute – the result of a sudden change in wind patterns or cloud cover, amongst many other factors. Once a gas-fired generator is on-line, it is capable of quickly increasing or decreasing supply in response to conditions on the grid and within the electricity market. The gas units support wind and solar generators when their supply changes unexpectedly. The timing problem between renewable generation and demand would require renewable generation to be overbuilt to minimize the total cost of renewables plus storage at a significant cost to customers. This would create large energy surpluses, potentially much larger than what Ontario experienced in the latter half of the last decade. The emerging technologies for multi-day or seasonal storage are not yet commercially mature.

OPG looks forward to working with the IESO on the next steps for this important issue.

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