BRIEFING NOTE – IVEY BUSINESS SCHOOL: ECONOMIC COST OF ELECTRICITY GENERATION IN ONTARIO

ISSUE:

Ministry of Energy staff comments on a draft Ivey Business School report on the cost of electricity generation in Ontario and proposals to reduce system costs.

SUMMARY:

- The Ivey report describes three "structural changes" that have occurred in Ontario's generation sector since the 1990s:
    - The addition of nuclear generation concluding in a price freeze in the 1990s;
    - The 2002 rate freeze following the opening of the wholesale market in the same year; and
    - The "rebalancing of the supply mix" that began in the mid-2000s.
- The Ivey report goes on to highlight following factors that have contributed to higher generation costs in Ontario:
    - Phase out of coal-fired generation;
    - Increasing share of renewable fuels;
    - Overall growth in installed generation capacity; and
    - Increasing electricity exports and associated Global Adjustment (GA) costs.
- The Ivey report outlines proposals for reducing system cost in Ontario:
    - Smoothing generation costs over a longer period of time than is currently planned to lessen rate impact; and
    - Promoting the introduction of a capacity market to improve long run efficiency in generation investment.
- The "smoothing of generation" costs is premised on the concept that the useful service lives of contracted generators exceed the duration of the contracts, presenting an opportunity to spread the costs over a longer period of time. The report suggests three ways that the smoothing initiative could be accomplished:

- Offer contracted generators the opportunity to bid for new contracts that would supersede their current contracts;

- Reduce consumer bills by an amount equal to the difference in generation costs based on current contract lengths and contract lengths that reflect useful service lives; and

- In future contracting exercises, invite generators to submit bids that include the proposed contract duration.

- The authors use U.S. Energy Information Administration and International Energy Agency assumptions to estimate likely generator lifespans. Taking into consideration IESO data on generation cost, the authors determine that consumer bills could be reduced by $1.7 billion annually in the short term once the costs are spread out over a longer timeframe.

ENERGY COMMENTS:

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Page 2 – "This means that governments, even in deregulated markets, must rely on complimentary policy mechanisms to enable generators to recover their fixed costs of electricity generation and to remain in the market."	• "Complimentary" should be "complementary".
Page 3 – "Invariably, however, additional policy instruments do not operate independently but have spillover effects, introducing further complexities and distortions into the operation of wholesale markets."	• Suggest being more specific on the type of distortions and making it clear that long-term contracts are not part of the market price of electricity.
Page 3 – "The third structural shift began in the mid-2000s under a newly-elected Liberal government that initiated a significant rebalancing of the supply mix…"	• The reference to the "third structural shift" refers only to "rebalancing of the supply mix" starting in the mid-2000s. Equally important was rebuilding the supply portfolio to address a generation shortfall. • Reference could be made to Ontario's procurement of temporary generation in 2003 to avoid potential outages and the lack of private investment in new generation capacity.

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Page 3 – "Since 2005, the OPA (now the IESO) has contracted for approximately 6,000MW of wind capacity and more than 2,600MW of solar capacity (IESO, 2016a). The province officially eliminated coal from its generation mix in April 2014. In total, the IESO has contracted for more than 27,000MW of energy. This matches the province's highest ever peak demand, which occurred in August 2006, and is in excess of peak demand over the past five years (IESO, 2017a). Ontario Power Generation (OPG) controls additional significant nuclear and hydroelectric capacity."	• References to the amount of generation contracted and comparisons with peak demand creates a misleading impression that generation capacity should be directly linked to peak capacity. • In addition, it does not reflect that the relevant capacity for peaking purposes must reflect the contribution to peak supply that can be relied on for planning purposes, which varies by technology, but is always less than 100%. – For example, the contribution from solar and wind is notably lower than dispatchable generation (i.e., for solar PV the contribution to winter peak is 5% of capacity and contribution to summer peak is 30%) so that a supply mix with wind and solar will necessarily have generation capacity that significantly exceeds peak demand. • Also, references do not reflect the need for having an excess of capacity for reliability purposes (as noted on page 15, last paragraph).
Page 4 – "In total, the Global Adjustment and Hourly Ontario Energy Price sum to the compensation needed to cover the contracted fixed rates paid to generators. The Global Adjustment exists because, in general, market-based revenues are insufficient to cover both variable and fixed costs of generating electricity. The combination of the Global Adjustment and the Hourly Ontario Energy Price effectively represent average cost pricing, enabling generators to recover their total costs."	• Suggest including this point in the introduction/summary up-front.
Page 5 – Wholesale Electricity Market section	• Suggest clarifying that the term "wholesale electricity market price" is interchangeable with "hourly market price".
Page 7 – "Further, it is incorrect to interpret the Global Adjustment as an overpayment or 'above-market' payment for generation, as some	• Suggest including this point in the introduction/summary up-front.

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commentators have claimed, since the wholesale price is not a true market price as would be observed in normal competitive markets."	
Page 8 – "While a formal analysis of the sources of these rate increases is beyond the scope of this report, it is valuable to briefly review some of the underlying reasons for these increases."	• Suggest deleting "While a formal analysis of the sources of these rate increases is beyond the scope of this report", as it may not be clear to readers what the term "formal analysis" means.
Page 8 – "Much of the increase in electricity rates is due to a combination of structural changes to Ontario's electricity system and investments to upgrade and refurbish aging transmission, generation, and distribution assets."	• Suggest including this point in the introduction/summary up-front.
Page 9 – **"**The *Green Energy and Green Economy Act of 2009*, and initiatives such as the Renewable Energy Standard Offer program launched in 2006, have led to the development of a significant amount of wind, solar, and bio-energy capacity, supported by fixed feed-in tariffs guaranteed for 20 years."	• Need to include hydroelectric generation. • "…a significant amount of wind, solar, hydroelectric and bio-energy capacity…"
Page 9 – Table 1: Average Cost of Generation Per MWh by Fuel Type	• Prices stated are in kWh not MWh.
Page 9 – "The rates paid for renewable power are much greater than rates paid for other fuel sources, for instance ranging from $135/MWh for on-shore wind to $802/MWh for	• It is misleading to include wind prices in this statement as their rates (i.e., $135/MWh) are not significantly different from Bio-energy average costs of $131/MWh and is less than Natural Gas average costs of $173/MWh stated in Table 1. • It is also misleading to use the microFIT (projects less than 10kW) price to represent solar rates. Only 200 MW of the

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small scale rooftop solar PV under the 2010 FIT pricing schedule."	2,200 MW of solar capacity online has been contracted under microFIT program and a subset of that 200 MW capacity was contracted at the $802/MWh. • Wind and solar costs referenced in the discussion should be consistent with the costs presented in the adjacent Table 1.
Page 9 – One of the consequences of expanding renewable power generation, which is intermittent, is the need to invest in complementary natural gas or other dispatchable capacity that can operate during periods when renewable power is not available. Ontario added 5 GW of natural gas capacity between 2005 and 2015, much of which provides peak and mid-peak power.	• Not all investment in new natural gas electricity generation was made to address expansion of variable renewable generation. Natural gas investment was also done to ensure reliability, replace coal and satisfy regional needs.
Page 10 – "While forecasting long-term electricity demand is notoriously difficult, the province has invested in new generation capacity that has proved to be considerably in excess of needs, contributing to higher system-wide costs and consumer bills."	• Suggest adding a sentence to indicate that a significant portion of the new generation capacity was initiated prior to the 2008 recession – to highlight the point that long-term forecasting of electricity demand is difficult.
Page 10 – "Under the terms of power purchase contracts, however, contracted generators must be compensated for the full rate for their power, which in all cases is more than the average wholesale market price in 2015 (e.g., $135/MWh for wind, $66/MWh for Bruce nuclear power). The difference between the contracted rate and the wholesale market price is incorporated into the Global Adjustment amount paid by Ontario rate payers. Hence, as	• The assertion that increased exports have contributed to the upward trend in the unit cost of electricity generation is not factually correct. • For example, the "take or pay" nature of IESO contracts means that the electricity must be paid for whether it is exported or not. • In addition, exports generate revenue for the province. The IESO estimates that the benefit to Ontario from electricity trading in 2015 was approximately $228 million. An important point of clarification to include.

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exports increase so do domestic rates."	
Page 10 – Smoothing Contracted Generation Costs section	• Suggest including the impact of "conservation amortization" into the report. That is, indicate that in addition to generation costs, conservation expenditures could be amortized over a longer period of time in order to yield customer savings in the short term. • Ministry of Energy analysis has determined that conservation amortization would result in a reduction in system costs in the short term of about $300-500 million, depending on the year. Adding this value to the $1.7 billion in annual savings as a result of smoothing generation costs, the total savings to consumers would exceed $2 billion. • Suggest presenting the total annual short term savings in the report as a range of $1.5-2 billion, given the uncertainty related to the savings.
Page 11 – "The subsidy each year would equal the difference in annual amortization currently charged (based on the contract duration) and the annual amortization amount calculated using the productive life of the asset." "From the generator's perspective, this provides an opportunity to lengthen the time horizon of financial returns on their investment, and to increase the expected net	• Realizing the $1.7 billion in annual savings linked to smoothing costs is contingent on discussions/negotiations with generation and land owners, the outcome of which is highly uncertain. • It is problematic to assume that this level of reduced costs is achievable by 2018 given that it rests on the assumption all contracts would be renegotiated within one year. The negotiation process would be complex and lengthy. • Other factors that would be expected to impact the outcome/ratepayer benefits of a contract negotiation process and not discussed in the Ivey report analysis include: – The costs associated with restructuring debt; – The involvement of community and Indigenous groups in renegotiations; – The assumed social discount rate for future generations; and – The future marginal cost of clean energy. • The attractiveness of this extension option would vary from project to project since contract holders may have to renegotiate their project financing arrangements to satisfy numerous equity partners and extend land leases, among other considerations.

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present value of the project." "…this process would create bidding competition between generators – competitive pressures could lead to much lower average power purchase rates in new long-term contracts." An alternative approach for smoothing the amortization of generation costs is for the government to subsidize in the short to medium term a portion of annual contracted payments to generators operating under existing contractual terms, and to reduce consumer bills by the corresponding amount.	– In addition, should Ontario be successful in negotiating lower prices in the near term, contract holders would be in a strong bargaining position to extract additional value from the negotiations (e.g., for required investments in component replacement, additional operation and maintenance costs, an increased Return on Investment (ROI) to cover additional risks in the future (i.e., interest rate risk), etc. • While pricing could be lower under the new contracts, total project costs would increase in consideration of any costs required to maintain aging assets for the extended term along with the additional value contract holders are likely to demand. • While Ontario's cost of borrowing is low as the author states, the funds would need to be borrowed by Ontario, which would add to the public sector borrowing requirement.
Page 13 – "For natural gas and wind generation, as well as solar, contract periods appear to be somewhat shorter than typical estimates of expected lifespans (see Table 2), though lifespan estimates depend on a multitude of factors such as the specific technology type within a broad category, capacity utilization, and climate conditions. Some caution must thus be used in applying average industry lifespans to the specific case of generators	• The report makes assumptions about remaining generator life by comparing U.S. Energy Information Administration estimates of generator lifespans to IESO contract duration for each technology type, which may not be appropriate: – EIA figures represent expected lifespans as of 2016 for generators entering service in 2018, whereas the average Ontario "new" natural gas plant is about eight years old. Generators designed and built a decade ago may have a different lifespan than ones built today. – EIA figures are representative of the U.S., which has a different climate than Ontario, and may not reflect the Ontario experience (e.g., a solar panel may last 20 years in California but have a shorter or longer life in Ontario).

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in Ontario."	– The report lists the average IESO contract duration for natural gas as 15 years, whereas a proper weighted average for natural gas contract duration in Ontario would be close to 20 years. Using a 15-year duration has the effect of overstating the remaining lifespan of natural gas generators in Ontario and thus the potential for bill savings as a result of increasing the amortization.
Page 14 – "In 2018, the total value of reductions in natural gas, wind and solar generation capital charges is estimated at approximately $1.7 billion (see Figure 7, equivalent to 8% of total expected electricity system costs."	• Suggest providing a range here to reflect uncertainty, for both the reduction in capital charges and the corresponding percentage share of electricity system costs.
Page 16/17 – Discussion of Demand Curve	• Compared to the discussion of other attributes, the discussion on the demand curve is somewhat abstract and would benefit from an explanation of how this is applied in practice. – For example, it is not clear from the discussion to what extent the demand curve is supposed to be derived from reality or is arbitrarily set to achieve the desired result. – Also graph labelling isn't clear, with "Q=Q2" but no P2 or Q1, and discussions referring to Q* which is not labelled on the graphs.
Page 19 – "Thus, the average capacity market clearing prices and all-in costs are significantly lower than the administratively estimated cost of new generation entry in both markets."	• Consider adding a sentence to indicate whether this factors in a carbon price or shadow pricing for carbon.
Page 19/20 – "If similar prices could be achieved to procure capacity in Ontario, these estimates suggest the potential for large cost savings for the province by transitioning to a	• The report indicates that recent Brattle Group estimates of the potential efficiencies of an Ontario capacity market are similar to the $250-500 million estimate in a 2014 IESO report. • More recently Brattle group has estimated savings of $300

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capacity market as current generation contracts expire. In 2014, the IESO estimated these savings at $250 million to $500 million per year based on average capacity price figures. Updated preliminary estimates from The Brattle Group in 2016 produced similar total benefits with a somewhat different distribution over the planning period.”	million annually, beginning in 2021. Net customer benefits would be below this amount.
Page 20-22 – Section on capacity markets in other jurisdictions	• Suggest acknowledging some of the challenges that have occurred in jurisdictions with capacity markets, and indicate that there is an opportunity for Ontario to learn from those challenges.

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