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CANADIAN WIND ENERGY ASSOCIATION SUBMISSION TO THE LONG-TERM ENERGY PLAN REVIEW

The Canadian Wind Energy Association (CanWEA) is pleased to submit comments in response to EBR posting 012-8840, *Planning Ontario's Energy Future*, a review of the Long-Term Energy Plan. CanWEA is the voice of Canada's wind energy industry, actively promoting the responsible and sustainable growth of wind energy on behalf of its members. Our members are Canada's wind energy leaders. They are wind energy owners, operators, manufacturers, project developers, consultants and service providers. CanWEA leads the effort to ensure Canada fully realizes its abundant wind energy potential on behalf of its members - and for the benefit of all Canadians – to build a cleaner, stronger and more affordable energy future.

WIND ENERGY IN ONTARIO

Ontario is Canada's leader in clean wind energy with 4,781.35 MW of installed capacity, supplying approximately five per cent of the province's electricity demand. The province also led the country in new installations in 2015 and 2016, adding 870 MW and 413 MW respectively, representing over $2.5 billion in new investment in those two years. Ontario wind farms currently generate, on an annual basis, the energy equivalent to the electricity demand of approximately 1.5 million average Canadian homes.

In 2014, Ontario became the first jurisdiction in North America to eliminate coal as a source of electricity generation. By replacing a portion of that generation with new renewable sources of energy, like wind and solar, it has positioned itself to lead Canada's transition to a low-carbon economy. Ontario has seen an 80 per cent reduction in greenhouse gas (GHG) emissions from its electricity sector since 2005, and the addition of significant amounts of wind and solar energy to the grid are helping to protect the province from unpredictable, but inevitable, carbon cost increases over the long-term and ensuring consumers won't be held hostage to volatile fossil fuel prices.

Ontario has built a clean, reliable, affordable and modern grid with the flexibility to respond to changing economic and environmental circumstances. At the same time, Ontario's wind industry has created thousands of well paying, much-needed jobs in manufacturing, construction and local services. Across Ontario, jobs, wages and benefits, GDP and infrastructure investment are benefiting from growth in the wind energy sector. According

to a 2015 Compass Renewable Energy Consulting report[1], between 2006 and 2030, based on Ontario's last long-term energy plan, wind energy in Ontario will have the following economic impacts:

- 73,000 direct and indirect full-time equivalent jobs;
- $5.1 billion of wages and benefits for Ontario workers;
- $7 billion of direct and indirect GDP benefits; and
- $14 billion in total investment.

Wind energy has been the largest source of new electricity generation capacity in Canada over the last decade. It has become the electricity supply option of choice because many jurisdictions, such as Ontario, have provided stable policy that has allowed industry to invest in continuously improving the technology. As a result of R&D, capacity factors have increased, resulting in a reduction in overall cost of project execution. Those savings in execution are being passed directly to the ratepayer.

System planners are also taking note of the fact that wind energy has not produced a track record of significant cost overruns such as we have seen in other jurisdictions with the nuclear industry, and that it does not face the commodity cost risks of natural gas. With no carbon price risk, and an infinite amount of free fuel, the evidence is clear - **wind energy has become the low-cost, emissions-free electricity source of choice around the globe**, and an increased reliance on it here in Ontario going forward makes great sense. In light of Ontario's recent decision to suspend a planned large renewable energy procurement that would have seen low-cost energy procured, it is critical that Ontario's new Long-Term Energy Plan (LTEP) once again provide the policy certainty required to enable the province to continue to capitalize on its massive wind energy potential for the benefit of all Ontarians.

Ontario's next LTEP will need to build on the gains the province has made. Meeting its GHG emission reduction target of 80 per cent by 2050 will require Ontario to continue to prioritize emissions-free generation, and use the electricity to power all sectors of its economy, from transportation to industrial processes. Fortunately, there are enormous untapped wind resources across Ontario that are economically competitive and can be deployed quickly at whatever scale is required to match load growth and system need. As a low-carbon, low-cost and low-risk source of power, wind energy has an important and growing role to play in Ontario's energy future.

[1] http://canwea.ca/wp-content/uploads/2015/12/FINAL-CanWEA-Economic-Analysis-Report-Nov_25-2015_PUBLIC.pdf

PLANNING ONTARIO'S ENERGY FUTURE – UNCERTAIN DEMAND AND SUPPLY OUTLOOKS

The IESO outlines four demand outlooks in the Ontario Planning Outlook (OPO)[2], referred to as Outlooks A through D, which vary from declining demand (Outlook A) to increasing demand (Outlooks C and D). CanWEA believes that a demand range between outlook B and C is most practicable to plan against at a time where both the provincial and federal governments have indicated the intention to enact strong climate change policies that will require increased electrification and suppression of GHG emissions (Appendix A, slide 3).

The OPO acknowledges that actions which would trigger Outlooks C and D will in fact create a supply need. We have evaluated several scenarios against outlooks B and C and believe that **additional, new supply will be required** within those scenarios. Unfortunately, the OPO is silent on how that supply will be fulfilled. According to the OPO, if all existing generation resources were to continue to operate after the expiry of their contracts and if refurbishments of applicable nuclear generating units at Bruce generating station (GS) and Darlington GS along with committed resources and directed resources come into service as scheduled, Ontario will have a total installed capacity of nearly 43 GW by 2035. This is an extremely optimistic scenario in that it ignores a host of potential risks that make these very questionable assumptions. If the assumptions are indeed incorrect, the implications for Ontario's electricity supply can be quite significant. Just to take one example, if all existing generation resources are removed from service after contract expiry, Ontario will only have a total installed capacity of approximately 25 GW by 2035. The most likely outcome when contracts expire is, of course, somewhere in between the two extremes, but the OPO does not provide for the procurement of any additional supply to manage this risk.

In reality, there are actually several different risks that could significantly affect the availability of supply over the planning outlook,(Appendix A, slides 5, 6):

- Timing to retire the nuclear generating units at Pickering GS:
    - Regulatory approvals to enable the life extension of the Pickering GS require submission of detailed evidence that will be vetted by regulators and concerned stakeholders. Success in both regulatory proceedings is not guaranteed and is overseen by independent and separate jurisdictional

[2] http://www.ieso.ca/Documents/OPO/Ontario-Planning-Outlook-September2016.pdf

regulatory bodies. If the life extension is not granted, there will be a need for new supply;

- Cost overruns and delays to the refurbishment of the applicable generating units at Bruce GS and Darlington GS:
    - Nuclear refurbishment is a complex undertaking that requires a high level of coordination and financial commitment. From 2020 to 2030 at least two units and as many as four units are expected to be offline for refurbishment in a year. In recognition of the risks associated with such a massive undertaking, the government has retained off-ramps for both Darlington and Bruce if costs exceed specific thresholds or if the refurbishment schedule is delayed for any units. CanWEA believes that decisions on these "off ramps" should be informed by public consultation and consideration of alternative supply options (Appendix A, slides 21, 22). If there is limited flexibility in the refurbishment schedule, any factor that delays one unit such that it overlaps with the start of work on other units would decrease the available resources to meet demand needs and create a need for new supply;
- Availability and operation of generation post contract expiry / overall general effects of aging on the performance of Ontario's present generation fleet could make these resources less productive
    - Lack of revenue certainty for repowering or maintaining operation of expired generation means that there is no guarantee that such generation will continue to operate post contract expiry, creating a need for new supply(Appendix A, slide 9); and
- The Conservation and Demand Management (CDM) target in the OPO assumes that all of the identified potential in the Achievable Potential Study (APS) is achieved by 2035. The CDM target is unchanged from the target in the LTEP 2013. If CDM programs do not meet the ambitious objectives outlined, there will be a need for new supply (Appendix A, slide 4).

Despite the above noted risks on the supply side, the IESO states that if the planned resources come into service and existing resources continue to operate, Ontario's existing, committed, and directed resources will be sufficient to meet demand Outlooks A and B. While the IESO acknowledges that additional supply resources will be required to meet increased growth in demand such as the case within demand Outlooks C and D - even absent these risks - the OPO does not propose any recommended actions in the near-term (through 2021) for the Ontario power system due to the variations of the demand outlook, and assumed adequate supply. Furthermore, the OPO does not provide any indication on what

the supply needs may be in the future in terms of the types of supply resources that should be maintained and/or developed based on their attributes and system needs. That is, the IESO has not made any attempt to create different supply mix scenarios integrated with the four demand outlooks by meeting different future system needs. CanWEA strongly believes that the LTEP must factor in the above noted risks and contingencies related to the higher demand profiles outlined in Outlook C and D and that prudent planning requires consideration of alternative supply plans with a reasonable amount of less nuclear supply.

Ontario has many resource options available to address the potential supply need, and in order to meet the policy goals of low cost, low emissions and reliability, will require a diverse supply mix. In an assessment of the various resource options and their attributes, wind energy demonstrates favourably (Appendix A, slide 22) and CanWEA believes that new and repowered wind energy can have a leading role in achieving the policy objectives as Ontario moves toward a new LTEP aimed at strengthening the economy and ensuring an affordable, reliable and sustainable energy future.

CanWEA 2017 LTEP Recommendations:

Given the fact that CanWEA's analysis suggests that there will be a need for increased electricity supply in Ontario beyond that suggested by the OPO to meet the government's climate change objectives and to manage multiple risks and uncertainties associated with the assumptions currently underlying the LTEP, CanWEA believes the LTEP should make the following recommendations to ensure that new non-emitting electricity supply is available when required.

Recommendation 1:

New non-emitting generation should continue to be competitively developed in Ontario in order to maintain low emissions in the electricity sector in the medium- to long-term

Recommendation 2:

Close Pickering NGS in 2018 to alleviate cost pressures

Recommendation 3:

Utilize competitive procurements for long-term contracts to secure the lowest cost, non-emitting electricity generation to ensure the best value for rate-payers

Recommendation 4:

Re-power existing wind generation through competitive re-contracting and enable other earlier optimizations to ensure adequate, affordable, non-emitting supply

Recommendation 5:

Ensure Market Renewal Initiatives support renewable energy

ANALYSIS TO SUPPORT THE RECOMMENDATIONS:

CanWEA retained Power Advisory LLC (Power Advisory) to perform a detailed assessment (Appendix A) of Ontario's wholesale electricity market and the outlook for wind generation within that market. Power Advisory critically assessed the recently published technical report, *The Ontario Planning Outlook* (OPO), from the Independent Electricity System Operator (IESO) and determined future supply need and potential resource options.

Building on the above mentioned analysis, Power Advisory produced alternative generation outlooks and cost to customer estimations which CanWEA has used to support this submission to the Ontario government for the LTEP consultation.

Power Advisory also reviewed potential mechanisms to procure wind generation in the future in Ontario and identified potential changes to the electricity market structure that would enable Ontario to continue to rely on wind energy assets as competitive resource options that meet the objectives of the next LTEP.

RECOMMENDATION 1:

New non-emitting generation should continue to be competitively developed in Ontario in order to maintain low emissions in the electricity sector in the medium- to long-term.

Power Advisory's generation development scenarios estimate that GHG emissions in Ontario will increase throughout the planning period from the expected low of 4 MT in 2016 (according to OPO) to 12 MT-14 MT in 2035 (Appendix A, slide 20). This is clearly inconsistent with the Ontario Government's GHG emission reduction objectives.

Why is this the case? Notably, surplus baseload generation has dramatically reduced the output from gas-fired generation to date. This underutilization has resulted in low GHG emissions output in recent years. During nuclear refurbishment, increased gas-fired generation energy production will drive emissions above 10 MT throughout the planning period. Development of renewable resources to reduce the energy output of gas-fired generation caps emissions from increasing further under all scenarios (Appendix A, slide 20).

Ontario's CCAP announced on June 8, 2016 also outlines a series of incentives and programs for a greener transportation system, more efficient buildings, and more rapid adoption of clean technology. The CCAP initiatives are expected to cost $8 billion and reduce carbon

emissions by almost 10 million tonnes over the next four years. Impacts of CCAP on other sectors are likely to increase electricity demand (i.e., increased electrification). As a result, an increased reliance on non-emitting generation will need to be balanced against an over reliance on emitting generation (e.g., natural gas). This, at the same time that a large quantity of baseload nuclear supply will be offline for refurbishment.

Furthermore, the federal government's announcement of a floor carbon price of $10/tonne in 2018, increasing by $10 annually to $50/tonne by 2022 supports increased electrification and Outlook C. Outlook C has almost 600 MW winter peak load difference by 2020 and 2,000 MW difference by 2025 relative to Outlook B. This implies mobilization of programs and incentives relatively soon, which place uncertainty on the current supply outlook that is portrayed in the OPO.

The future supply need in Ontario and potential Generation Development Scenarios suggests that there will be a need for repowered and new wind generation in the future (Appendix A, slides 14-18). While it is true that Ontario has multiple options to meet an increased supply need, CanWEA believes that wind energy offers many benefits. If procured competitively, wind energy provides a hedge not only on costs but on GHG emissions. The need to minimize the utilization factor of gas-fired generation to maintain low GHG emissions supports continued development of low-cost renewable generation over all scenarios (Appendix A, Slide 20).

All new supply should come from non-emitting resources. Ontario has made great achievements in avoiding smog days and the associated health effects. Support for deeper electrification cannot come with deeper carbonization through the increased use of fossil fuels, as currently predicted in the OPO. Ontario can and should continue to secure non-emitting resources in a competitive fashion (see **RECOMMENDATION 3**) when the need arises to do so to maintain a low-emissions electricity system.

RECOMMENDATION 2:

Close Pickering NGS in 2018 to alleviate cost pressures

Provincial priorities to restrict the rise in emissions and to control and alleviate costs for ratepayers, can be supported by an increased reliance on existing non-emitting resources combined with new procurement of cost competitive wind energy to align with the Pickering NGS coming offline as early as 2018.

In October 2015, the IESO updated its evaluation of the merits of Pickering extension, with focus on the extension to 2022/2024 option in particular, in light of updated technical and

economic information from OPG and changes to the electricity planning context since a March 2015 study. The Oct 2015 study concluded net-benefit of $300M to $500M for electricity system costs. Depending on assumptions for total energy production from the extended Pickering NGS operation, capital and operating cost increases of 15% to 22% will eliminate the cost savings.

Pickering NGS cost savings assumes natural gas pricing must increase beyond current future market prices to over $4/MMBTU (as of October 2016, natural gas pricing from 2020 to 2024 was $2.70/MMBTU to $3.70/MMBTU (USD)). In other words, if the life extension costs for Pickering NGS moderately increase or natural gas pricing remains low, the cost -benefit case for continued operation of Pickering NGS weakens substantially. The lack of a positive cost -benefit assessment increases the risk that Pickering NGS will not operate economically to the 2022/2024 target, placing upward pressure on the cost curve borne by the ratepayer.

Additionally, Ontario Power Generation (OPG), the owner/operator of Pickering NGS, must receive two key regulatory approvals to continue operation beyond 2018, one from the Ontario Energy Board and another from the Canadian Nuclear Safety Commission (CNSC).

Both regulatory approvals require submission of detailed evidence that will be vetted by regulators and concerned stakeholders. Success in both regulatory proceedings is not guaranteed and is overseen by independent and separate jurisdiction regulatory bodies.

Cost-benefit analysis by the IESO indicates that if the life extension costs for Pickering NGS moderately increase or natural gas pricing remain low, the cost-benefit case for continued operation of Pickering NGS weakens substantially. **In the interest of alleviating costs to the ratepayer, the LTEP should strongly commit to the 2018 timeline for closure of the Pickering NGS.**

RECOMMENDATION 3:

Utilize competitive procurements for long-term contracts to secure the lowest cost, non-emitting electricity generation to ensure the best value for rate-payers

Two fundamental issues exist within the OPO concerning the supply outlook. First, the IESO does not provide any risk assessments or contingency plans regarding supply adequacy, including components of the future supply mix. For example, the risks of refurbishing nuclear generating units have been well documented within and outside of Ontario, yet these risks are only briefly acknowledged within the OPO simply by noting the potential for

off-ramps in the event of refurbishment issues. Second, the IESO does not provide any analysis regarding the potential for different supply mix scenarios and therefore does not provide optimal future supply mix scenarios that could meet policy objectives while maintaining power system reliability in a cost effective manner.

As such, CanWEA asked Power Advisory to develop a number of potential generation development scenarios to determine the scope of potential supply required and over what period of time. Power Advisory created four generation development scenarios based on Outlooks B and C (Appendix A, slides 14-18). The generation development scenarios support repowering or maintaining operation of existing facilities over the planning period. Slide 19 goes further to illustrate the range of supply required that could be filled by renewable energy.

Not surprisingly, if demand in Ontario trends towards Outlook C due to aggressive climate change policies by the federal and provincial governments, Ontario will require a large amount of new renewable generation to meet growing demand and to achieve GHG emission targets by keeping emissions in the electricity sector low (Appendix A, slides 19, 20).

As such, the LTEP should endeavour to outline mechanisms to ensure future resource adequacy will significantly factor into the future composition of Ontario's supply mix. That is, Ontario's supply mix has been developed and maintained largely resulting from revenue certainty through long-term contracts as is the case with most Independent Power Producers with Ontario generation assets and in the case of most Ontario Power Generation (OPG) assets through rate regulation (where the remaining OPG generation assets are under IESO contracts).

Power Advisory's assessment indicates that competitive procurement for long-term contracts for electricity generation clearly provides the best value for ratepayers, enabling adequate risk allocation between developers and rate-payers. The competitive tensions and long-term financial commitments allow rate-payers to realize the benefits through lower prices over the long term. Competitive procurement is the primary procurement mechanism used by other Canadian jurisdictions for this reason (Appendix A, slides 23, 24).

CanWEA recommends the use of competitive procurements, though managing risk through an effective procurement design is paramount, in order to continue to achieve the result of lowest cost of power while meeting other policy and operability priorities of non-emitting and reliable. One way to achieve this is to set an aggressive price ceiling within the bid process to ensure lowest cost of power is achieved. LRP 1 had a price ceiling of 11.5 cents/KWh and resulted in an average price of 8.45 cents/KWh. CanWEA recommends that

in future procurements, wind should be capped at a much lower price per KWh. CanWEA would be pleased to consult further on the specifics of how to determine the price ceiling.

CanWEA notes that wind energy increasingly demonstrates that it is able to offer the lowest cost of power in competitive bids for long term contracts in multiple jurisdictions. Bloomberg New Energy Finance recently outlined how wind energy's Levelized Cost of Electricity in Ontario is in fact lower than the residential rate trajectory in Ontario[3] – due in large part to the contribution of the most recent round of competitive contracts offered under the LRP I and as evidenced in global trends.

The Bloomberg calculation (Appendix B) illustrates the fact that any new wind projects will offer cheap energy, and that is good for Ontario ratepayers. While historically higher prices were required to motivate investment in innovative, non-emitting technologies, the global industry has evolved and performance is easier to predict, resulting in wind energy outperforming almost all new sources of generation as the cheapest form of electricity today.

Notably, in the most recent procurements in Ontario, the lowest wind projects were secured on a 20-year basis at 6.45 cents per kilowatt hour, far less than most other sources of generation in Ontario. These prices are forecasted to decrease in the future, to a point where wind power in Ontario will offer the lowest cost energy source amongst all classes – emitting and non-emitting.

Ultimately, the future supply outlook remains volatile despite the OPO prediction of limited supply need in the future. Volatility exists in the absolute support of the nuclear refurbishment program – the most ambitious of such efforts ever confronted by any jurisdiction globally. The risk associated with major refurbishments of most of our baseload nuclear fleet, plus the shut-down of Pickering NGS in the coming years, will mean that additional resources will be required. While hydroelectric imports could support a portion of this need, available transmission infrastructure to meet the need is absent. Therefore, new, low-cost, non-emitting resources will be required. As such, **CanWEA recommends that the LTEP provide direction related to securing the lowest cost of power through the use of competitively bid long-term contracts for non-emitting generation.**

[3] Bloomberg New Energy Finance, the Bloomberg Terminal, *Canada wind forecast decreases with Ontario LRP II contract suspension*, or reach out to support.bnef@bloomberg.net for more information.

RECOMMENDATION 4:

Re-power existing wind generation through competitive re-contracting and enable other earlier optimizations to ensure adequate, affordable, non-emitting supply

Enabling opportunities to optimize efficiency through greater utilization of existing infrastructure in Ontario while still under contract will help to maximize the value we can garner in the short and longer term.

Additionally, as existing generation contracts expire, there is expected to be a supply need that repowered generation can fulfil. At present, it is not clear, in terms of future supply mix scenarios, how existing generation resources may be commercially maintained going forward and how needed generation may be developed going forward. In other words, the OPO does not provide strong indications as to the mechanisms that may be required or developed to best ensure that generation adequacy is maintained in the future.

While the IESO has started its Market Renewal Initiative which includes a capacity stream within the Initiative, it is not yet clear as to the degree to which contracting will continue or whether mechanisms like capacity markets will be developed in place of contracts or to complement contracts. In part, depending on future decisions as to what mechanism(s) may be used to help ensure future resource adequacy, this will partially drive Ontario's future supply mix (e.g., some generation projects are more challenged to be maintained or developed solely through combined energy and capacity market revenues, in absence of financeable contracts).

In short, there is no clear process or transparent market mechanism for repowering or maintaining operation of expired generation (Appendix A, slide 9). **The next LTEP should ensure that there is a clear path for securing revenue certainty required to invest in repowering of existing sites that will provide adequate, affordable and non-emitting future supply options.**

RECOMMENDATION 5:

Ensure Market Renewal Initiatives Support Renewables

The LTEP should provide clarity and/or leadership in addressing issues that arise through the Market Renewal Initiative process recently launched by the IESO. Existing and new resources may decide to exit the market otherwise. If existing resources do not extend

operation after contract expiries, a supply gap in Ontario will occur earlier than currently projected and will be more significant over the long-term. Further, it is not certain that existing resources will be the most cost-effective or have the attributes the future Ontario electricity market will need and/or desire, and therefore the IESO may wish to secure new generation resources for the evolving power system needs and/or consumer preferences.

These risks related to the Market Renewal Initiative should be considered in various planning scenarios where not all generation resources remain in-service after contract's expiration. Any market mechanism (regulatory change, procurement mechanism, RECs, etc.) must prioritize zero carbon emitters such as renewables.

Currently the market renewal initiative is heavily focused on capacity auctions. Wind energy for example, is willing to compete, but capacity auctions would favour emitting resources blocking out the potential for non-emitting resources to be further deployed. The long-term outlook clearly shows need for additional generation. A capacity market is a difficult system for renewables to operate under since financial commitments are for a short time period, necessitating generation developers to front load risk to the detriment of rate-payers. This system can work with dispatchable, emitting fossil fuel sources such as coal and natural gas, but with a variable fuel type, like renewables, this system could make a new wind project uneconomic and therefore unable to compete. The inability of renewable generators to compete reduces the pool of participants and impacts the price as less competition often does.

A focus on capacity auctions in market renewal discussions also ignores the fact that Ontario will want its future market design to encourage investment in new electricity supply that addresses a range of objectives – not just availability of capacity. For example, Ontario's GHG emission reduction objectives make it clear that future market designs must also incent / enable the deployment of non-GHG emitting electricity generation.

The unique characteristics of Ontario's market structure requires any policy shift to undergo unwinding of previous decisions and establishment of new market practices. In particular, who and how obligations to fund global adjustment must be addressed before any external market can be established. The same market restructuring issues exists for opportunities related to bi-lateral contracts for example. However, this does not preclude the LTEP from setting a path for consideration of all market opportunities that would bolster the priorities of non-emitting and low cost options. For example:

- Bundling of new and existing resources - in addition to participating fully in real-time electricity markets, wind generation can be a cost-effective option for long term power system capacity and energy requirements. Wind generation is a highly

flexible resource that can be partnered/coupled/bundled with other resources and technologies to meet specific power system needs (e.g., dispatchability, storage, demand response, hydro etc.). The market renewal initiative should consider the potential and cost effectiveness of coupling/bundling of the various complementary resources.

- Bilateral contracting with end users – The market renewal initiative should explore how a bilateral contracting market can evolve with buyers (i.e., not IESO or Ontario Government) for clean energy and its attributes (e.g., Renewable Energy Credits (RECs)), - some companies (e.g., Google IKEA, etc.) have begun contracting for clean energy and RECs.
- Export opportunities (e.g., clean energy, RECs, etc.) to the U.S. based on federal Clean Power Plan (CPP) and/or state Renewable Portfolio Standards (RPS) requirements, and/or supply needs e.g., New England Clean Power RFP permits export developments (Appendix A, slides 23 and 25).

CanWEA will participate in the Market Renewal Initiative to ensure that the value of low emission generation through a competitive process for long-term contracts is considered as part of any market process, however, Ontario's next LTEP should provide support for this type of direction in an effort to strengthen the current market renewal approach.

The current approach of the Market Renewal Initiative does not address the uniqueness of Ontario's hybrid market and therefore must be refocused if it is to provide opportunities for the lowest cost, technology agnostic generation that benefits Ontario. If the issues are not addressed, the drawback for Ontario is that the balance between the competing objectives of reliability, non-emitting, and rate payer value will be difficult to achieve.

SUMMARY:
BALANCING RATEPAYER COSTS, SYSTEM RELIABILITY AND GHG EMISSIONS IN THE SUPPLY MIX

Ontario still faces a challenge in ensuring that new electricity demand will be met by clean and affordable sources. As electrification of the economy proceeds, the province is aiming to refurbish nuclear units at the Darlington and Bruce generation facilities, and will eventually remove over 3 gigawatts of nuclear supply at the Pickering Generation Station.

Understandably, Ontario has no plans for capital-intensive and expensive new nuclear stations. There are few sites for economical, large-scale hydroelectric development, and increased imports of Manitoba and Quebec hydro power would necessitate major transmission expansions. In order to maintain a reliable flow of non-emitting and affordable electricity, the province cannot simply ramp up its electricity generation from natural gas, as that would work against accomplishing the goals of the Climate Change Action Plan and would come at a cost.

Wind energy is the most promising technology available to meet increased electricity demand while helping to build a de-carbonized economy. The case for adding new wind energy in Ontario is compelling.

New wind facilities are economic now and will help mitigate electricity cost pressures in the future. In its most recent procurement, the IESO selected 300 megawatts of wind projects at costs as low as 6.45 cents per kilowatt hour – well under Ontario's average supply cost of 11.14 cents. Even better, wind energy costs are projected to continue to decline as a result on ongoing improvements in technology while other technologies are forecast to rise in cost, as a result of increased fuel costs or environmental regulations such as carbon pricing or water restrictions. Wind energy uses a free fuel, has no carbon costs, and does not use water resources.

Wind energy can easily play a much larger role in meeting Ontario's electricity needs. The recently-released Pan-Canadian Wind Integration Study[4] finds that increased use of

[4] http://canwea.ca/wind-integration-study/full-report/

Ontario's high-quality wind resources would displace fossil-fuelled electricity and would not require a large addition in electricity regulation reserve requirements. Additional wind energy can be easily integrated into the existing electricity system.

Ontario has already benefited from the development of the province's wind energy sector in terms of jobs, and community and GDP benefits. It is an important foundation of the growing clean-tech industry and it promises to help make Ontario's electricity supply more affordable well into the future.

Ontario's wind energy sector is poised to help the province reap the benefits of an expanded green and de-carbonized economy with affordable, emissions-free electricity generation.

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APPENDIX A

CanWEA Submission to the Long-Term Energy Plan Review

Power Advisory Report Summary

Support for Long-Term Energy Plan Consultation

December 2016

Summary Report

Power Advisory LLC

www.poweradvisoryllc.com

Canadian Wind Energy Association

Background

- The Canadian Wind Energy Association (CanWEA) retained Power Advisory LLC (Power Advisory) to perform a detailed assessment of Ontario's wholesale electricity market and the outlook for wind generation.
- CanWEA requested Power Advisory to critically assess the recently published technical report from the Independent Electricity System Operator (IESO) and determine future supply need and potential resource options.
- Building on the above mentioned analysis, Power Advisory was asked to produce alternative generation outlooks and cost to customer estimations to assist CanWEA in preparing a submission to the Ontario government for the upcoming Long-Term Energy Plan (LTEP) consultations.

CANWEA

DECEMBER 2016

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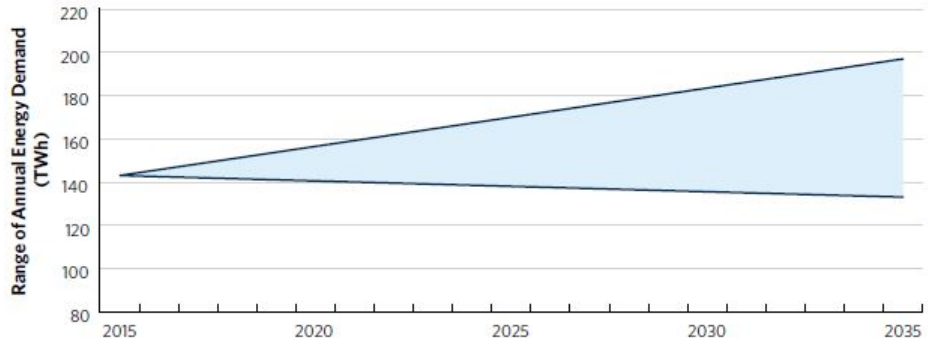
OPO Critical Assessment – Demand Outlook



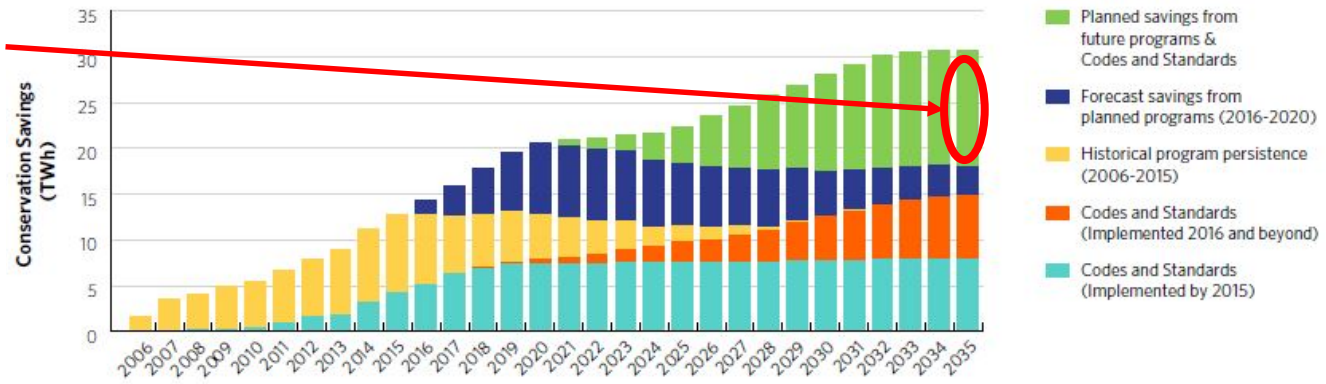
Source: OPO

- Power Advisory critically assessed the Ontario Planning Outlook (OPO) and concluded that large risks and uncertainty face the Ontario electricity market over the planning period (i.e., 2016-2035).
- The OPO states that the demand outlook is uncertain and presents four different outlooks (i.e., A, B, C, & D) due to the unknown impact of climate change policy from the federal and provincial governments.
  - Power Advisory's assessment concluded that Ontario's demand outlook is likely to end up between Outlook B (i.e., flat net demand) or Outlook C (i.e., growing net demand).
  - Outlook A (i.e., decreasing demand) diverges from the economic and population growth expectations for Ontario in the future, while Outlook D (i.e. higher growth than Outlook C) is considered too aggressive.
  - Whether Ontario's future demand ends closer to Outlook B or Outlook C will depend on the actions (and reactions) to climate change policy. At this time both the provincial and federal governments appear to be enacting aggressive climate change policies that will trend towards Outlook C. If policy action is slow or programs are weak, the electricity demand will trend towards Outlook B.

Power Advisory LLC

OPO Critical Assessment - CDM

Over 10 TWh of conservation savings, or one-third of the total savings, is expected to come from future programs that are not yet developed.



Source: OPO

- The Conservation and Demand Management (CDM) target in the OPO assumes that all of identified potential in the Achievable Potential Study (APS) is achieved by 2035. The CDM target is unchanged from the target in the LTEP 2013.
  - One-third of the total 30 TWh of programs in the CDM target is undefined at this point, representing a significant amount of uncertainty both in terms of the amount of CDM that might be achieved and the timing of CDM achievement. The uncertainty suggests that a prudent approach would be to assume only a portion of the APS are delivered instead of the full amount for planning purposes.
  - A recent Berkley study* concluded that the results from a energy efficiency program in California showed that projected CDM activities were roughly 2.5 times higher than the actual results. The study indicated that in many cases inadequate measurement and verification was employed to certify the conservation activities. The research conclusions supports a conservative approach to the amount of CDM that will be achieved during the planning period
- In short, Power Advisory expects future demand to range between Outlook B and Outlook C, with less CDM activities achieved over the planning period for both outlooks.

*Source: "Do Energy Efficiency Investments Deliver? Evidence from the Weatherization Assistance Program" Meredith Fowlie, Michael Greenstone, and Catherine Wolfram – June 2015

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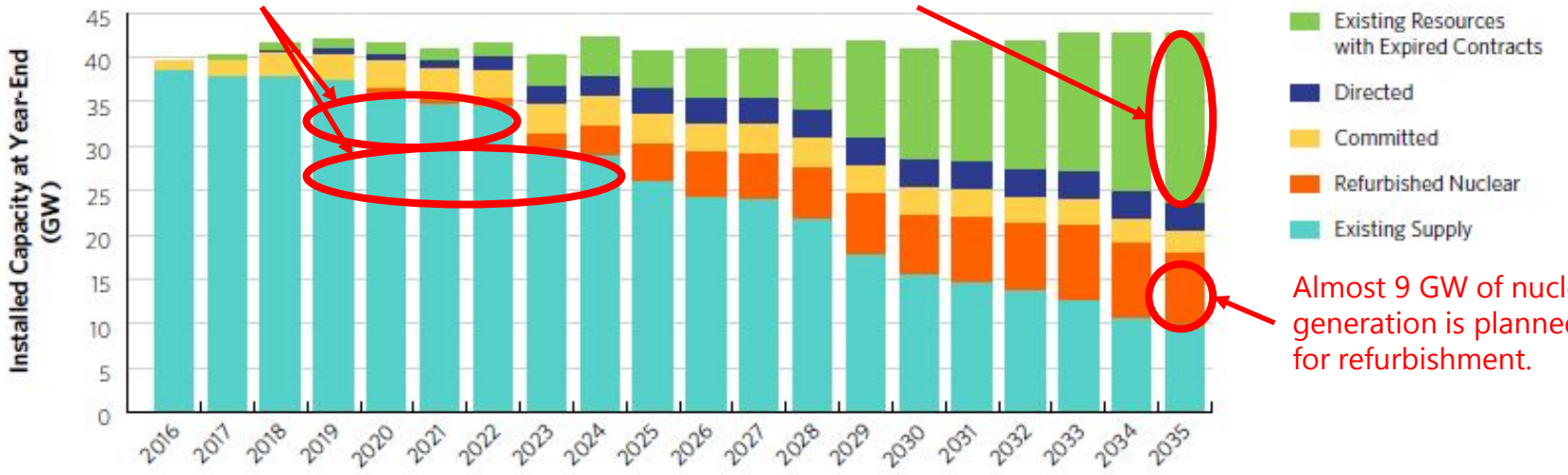
OPO Critical Assessment – Supply Risks

Pickering GS capacity from life extension to 2022 & 2024 from current operating licence.

The IESO expects the all expired generation to be able to be repowered or maintained throughout the planning period.



Almost 9 GW of nuclear generation is planned for refurbishment.

- On the supply side, Power Advisory concluded that there are two primary risks over the planning period
  - Nuclear Supply
    - Life extension of Pickering Nuclear Generation Station (NGS).
    - Refurbishment of units at Darlington and Bruce.
  - Expired Generation
    - Lack of revenue certainty for repowering or maintaining operation of expired generation.

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Potential Supply Need

- Power Advisory has reviewed and performed a critical assessment of the OPO 2016. The assessment identified a number critical components that will impact the demand outlook and supply outlook for Ontario and ultimately influence the future generation need in the province.
  - Power Advisory has updated the OPO 2016 assumptions to reflect changes to the projected supply mix since the release of the OPO 2016
    - e.g., cancellation of Large Renewable Procurement II (LRP II) and Energy-From-Waste Standard Offer Program (EFWSOP).
- Power Advisory has summarized the impact of the critical components on the future generation need before assessing resource options to meet the generation need.

  A) Outlook B compared to Outlook C
    - This scenario assumes lower CDM and all supply resources identified in the OPO are available.
    - All other scenarios will be driven off this scenario.

  B) Less Nuclear
    - Pickering retires in 2020.
    - Nuclear refurbishment at Darlington and Bruce Power is delayed.

  C) Limited Revenue Certainty for Repowering Generation
    - Future revenue is uncertainty for repowered generation resources.

  D) Range of Supply Needs
    - Range of supply need based on critical components.

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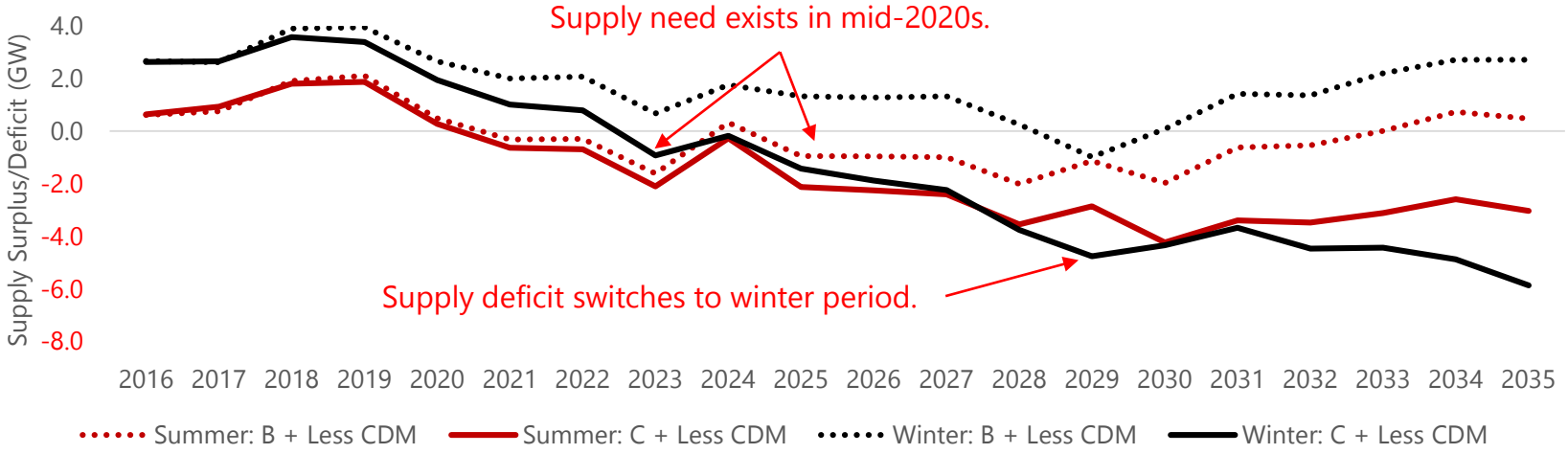
Outlook B Compared to Outlook C



- Strong policy action by the federal and provincial governments will trend towards Outlook C.
  - The introduction of a carbon price combined with strong fuel-switching policy now could support broad electrification in other economic sectors (namely buildings and transportation).
- If programs to support electrification are delayed or innovation slow to appear, net demand will trend towards Outlook B.
- The assumption that the full amount of CDM and supply assumed in the OPO can be secured appears to be overly aggressive.
  - A percentage of the total APS results would reflect the risk that the total CDM target is not achieved or that CDM results are achieved on different timelines compared to the current target.
  - For the Higher Net Demand Scenario, Power Advisory has assumed that 75% of the CDM target is achieved, which increases the Outlook B and C demand by roughly 3% in 2035.

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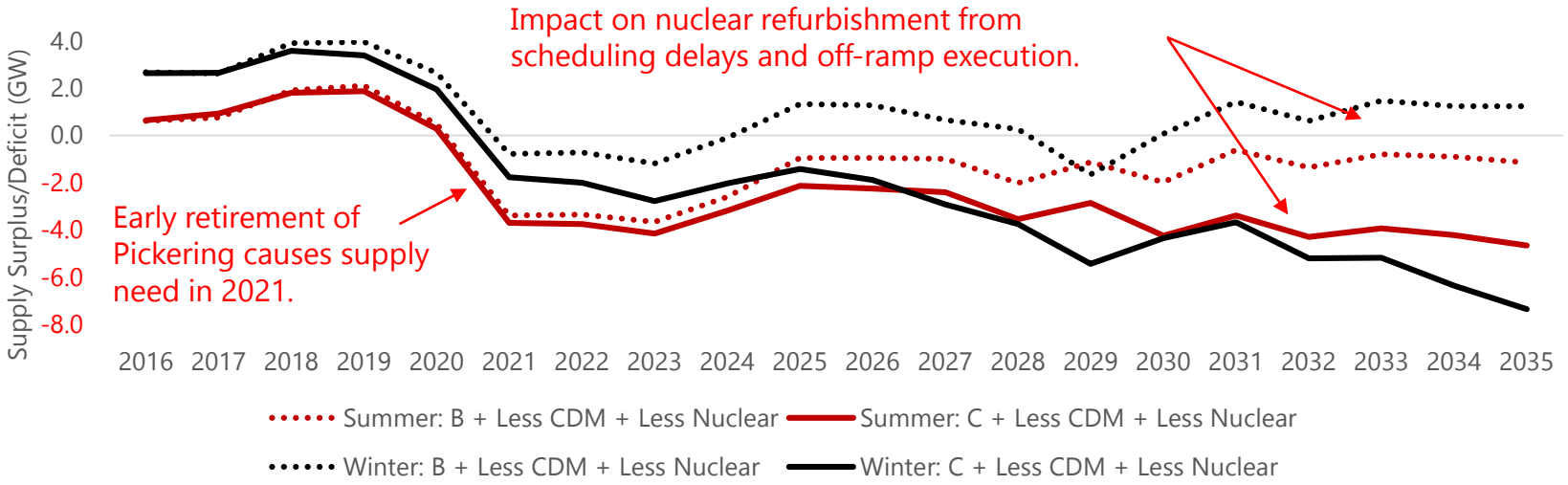
Less Nuclear Generation



- The dual regulatory risk of safety (i.e. technical capability to extend the life) and economic approval (i.e., cost to customer) for the life extension of Pickering NGS are assumed to restrict the operating life to the end of 2020.
- To reflect the risk in the nuclear refurbishment program, some delays are assumed with the overlapping nuclear refurbishment schedule.
  - Half of the units will experience a delay of one peak period (i.e. returning in winter instead of summer).
- Finally, this scenario expects that the off-ramps for more economic supply in the ARBPRIA will be executed for the final two units at Bruce Power (i.e. unit 7 and 8).
  - Cost escalations with the refurbishment process from labour and materials combined with continued drop in renewable costs results in renewable resources becoming more cost effective than continued refurbishment of nuclear units.

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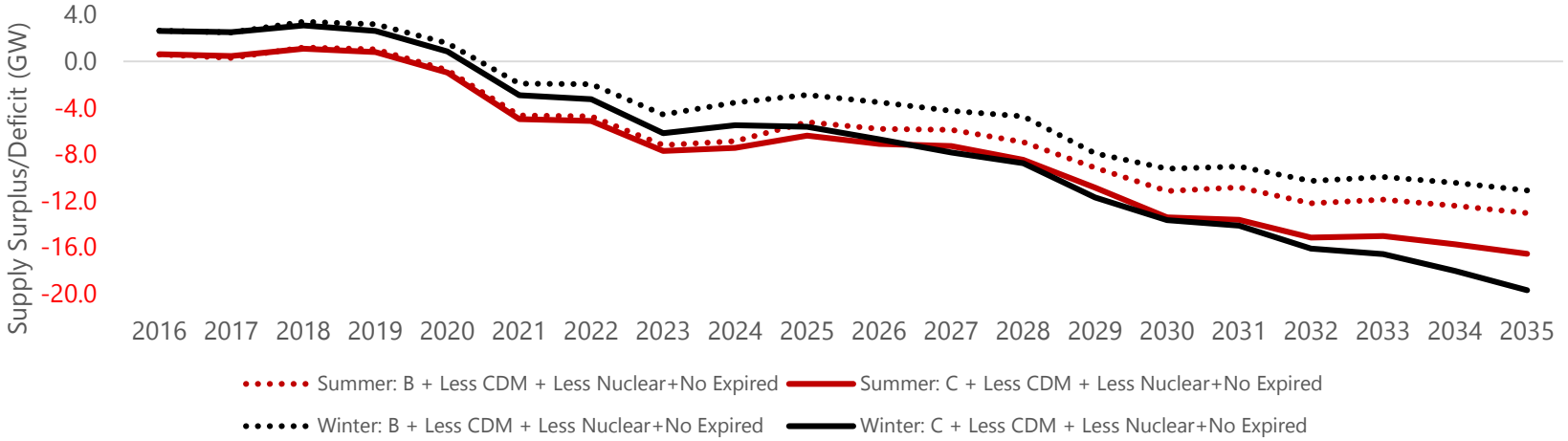
Limited Revenue Certainty for Repowering Generation



- Limited revenue certainty for repowering generation reduces the confidence that existing generation will be available to meet supply need after the end-of-contract term or end-of-life.
  - Repowering generation may require higher revenue to offset increased risk from uncertainty.
  - Asset owners may be unable to justify investments required to continue operation due to controllable factors (e.g., revenue certainty to support investment life of asset) or uncontrollable factors (e.g., financial market conditions at the end of asset life).
- Although it is reasonable to assume some portion of the repowering generation will continue to operate even with limited revenue certainty, estimating the portion of repowering assets and their possible contribution to meeting peak demand needs will depend on the generation mix and the supply need outlook at the time of repowering.
- In other words, the supply need assessment should assume no repowered assets are committed to meet system peak until the capability and cost of those assets are compared against other resource options.

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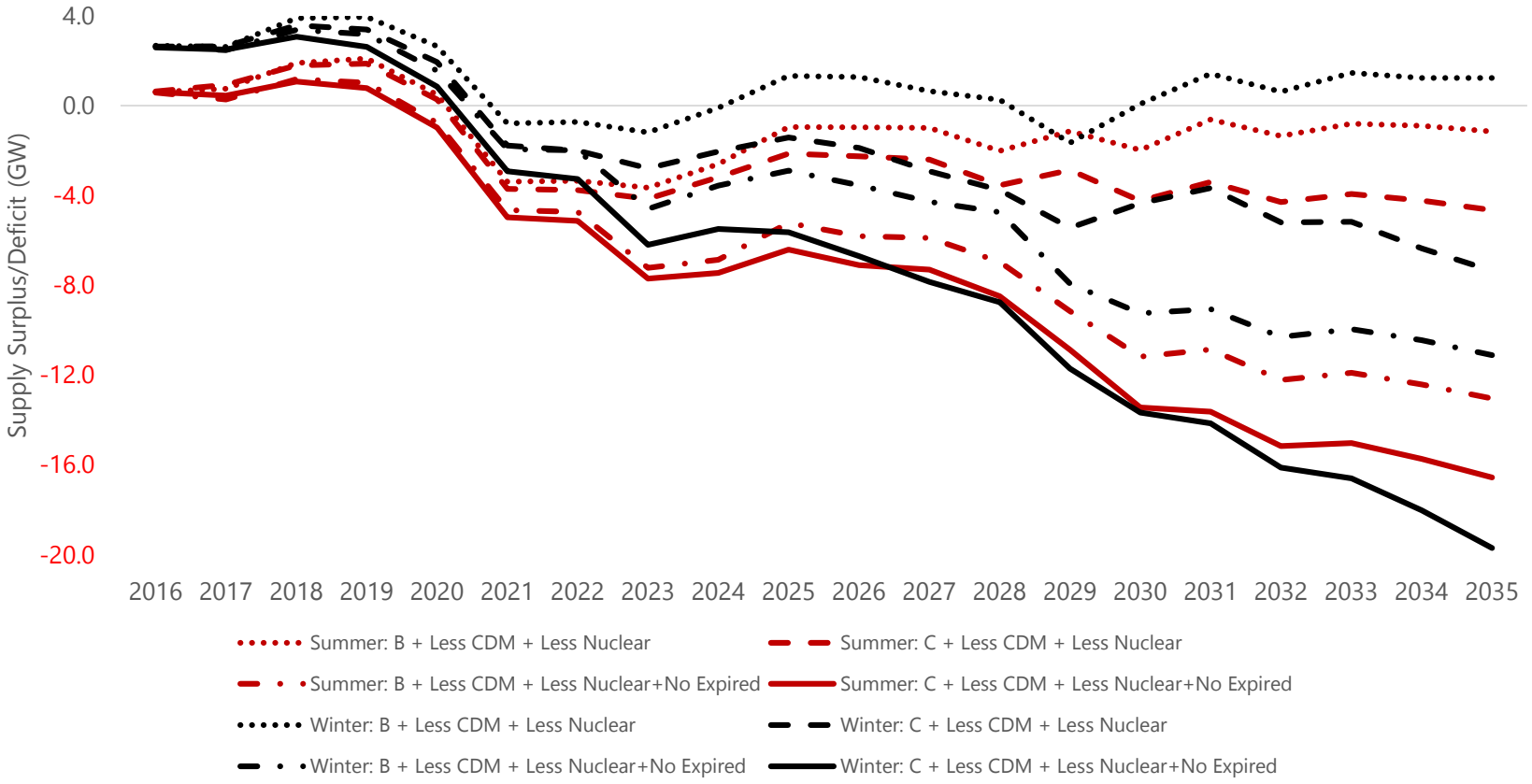
Range of Supply Needs



- The considerable uncertainty facing Ontario's electricity system results in a wide range of future supply needs.

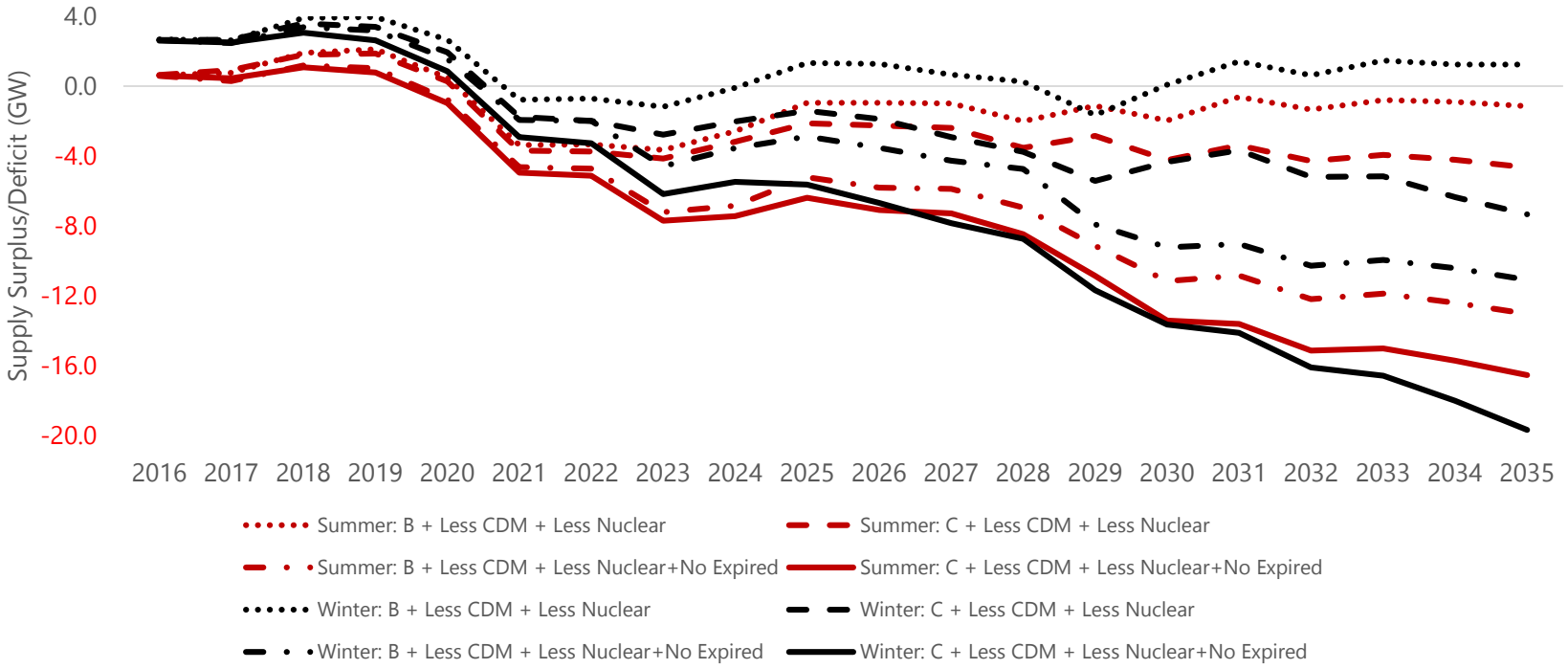
OPO Critical Assessment – Nuclear Supply

- Life extension of Pickering NGS to 2022/2024.
  - Ontario Power Generation (OPG), the owner/operator of Pickering NGS, must receive two key regulatory approvals to continue operation beyond 2018, one from the Ontario Energy Board and another from the Canadian Nuclear Safety Commission (CNSC).
  - Both regulatory approvals require submission of detailed evidence that will be vetted by regulators and concerned stakeholders. Success in both regulatory proceedings is not guaranteed and is overseen by independent and separate jurisdiction regulatory bodies.
  - Cost-benefit analysis by the IESO indicates that if the life extension costs for Pickering NGS moderately increase or natural gas pricing remain low, the cost-benefit case for continued operation of Pickering NGS weakens substantially.
    - Gas-fired generation will become relatively more economic if natural gas prices remain low
- Refurbishment of nuclear generation units at Darlington and Bruce on time and on budget.
  - Nuclear refurbishment is a complex undertaking that requires a high level of coordination and financial commitment. From 2020 to 2030 at least two units and as many as four units are expected to be offline for refurbishment in a year. If the refurbishment schedule has limited flexibility, then delays of one unit could overlap the start of other units and decrease the available resources to meet demand needs.
  - The refurbishments will require a significant number of skilled nuclear professionals and tradespeople. The availability of labour resources is limited and may impact the ability to meet the schedule as currently planned.
  - The government has retained off-ramps for both Darlington and Bruce if costs exceed specific thresholds or if the refurbishment schedule is delayed for any units.
- Overall, the likelihood that the nuclear supply plan will proceed on the current path is very low due to the complexity and cost, therefore prudent planning should consider alternative supply plans with a reasonable amount of less nuclear supply.

OPO Critical Assessment – Expired Generation

- There is a lack of revenue certainty for generation with expired contracts or reaching end-of-life (i.e., expired generation).
  - The Ontario government announced the cancellation of the Large Renewable Program II (LRP II) and provided no new timelines for possible future procurements.
  - The recent Market Renewal Initiative (MRI) launched by the IESO intends to undertake significant market design changes including the possible adoption of locational marginal pricing, day-ahead commitment process and capacity market/auction.
  - The abrupt cancellation of competitive procurement processes combined with the complex undertaking of the MRI means generators do not have a clear understanding of future revenue sources or the value of generation attributes.
  - In addition, the risk to revenue may lead generation resources that do decide to remain in-service to demand higher market revenue (i.e., require shorter payback for operational investments).
- In short, there is no clear process or transparent market mechanism for repowering or maintaining operation of expired generation.

Potential Supply Needs



- The critical assessment of the OPO identified four critical components that will influence potential supply need in the future. The chart above shows seasonal supply need based on the four components.
  - Demand Outlook uncertainty – Supply need differences under Outlook B and Outlook C.
  - Lower CDM – Risk that CDM does not materializing on schedule or a lower amount than expected is achieved.
  - Less Nuclear - Pickering retires in 2020 and refurbishment of units at Darlington and Bruce Power is delayed.
  - Expired Generation - Limited revenue certainty for repowering or maintaining generation decreases the likelihood that all expired generation will be available for future supply need or will be a cost-effective option. Expired generation should be considered as a resource option to compare to new generation development.

Generation Development Scenarios

- Power Advisory created four generation development scenarios to assess the potential supply mixes that may result under different reasonable supply needs.
  - Scenario 1: Outlook B + Less CDM
  - Scenario 2: Outlook B + Less CDM + Less Nuclear
  - Scenario 3: Outlook C + Less CDM
  - Scenario 4: Outlook C + Less CDM + Less Nuclear
- Power Advisory attempted to balance the multiple objectives (i.e., reliability, low emissions, and cost-effectiveness) while meeting potential supply needs for each scenario.
  - Under all scenarios, some expired generation will need to be repowered or maintained to address supply need (i.e., gas-fired generation) and keep emissions low (i.e. renewables) in the electricity sector.
  - Gas-fired generation along with a limited amount of DR and clean imports are the primary options available to meet peak demand needs. The drawback is that gas-fired generation could operate with a high capacity factor resulting in increased GHG emissions.
  - To counter the risk of increased GHG emissions from a higher capacity factor of gas-fired generation, Power Advisory expects that new, repowered or maintained renewable generation (i.e, wind generation) can be used to fill in the energy needs outside of peak demand periods.
  - Power Advisory believes that to maintain and maximize the value of renewable generation, some form of flexible capacity (i.e. storage, large hydro or import agreement with neighbouring jurisdictions) will be required to shift excess energy to higher consumption periods.

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Scenario 1: Outlook B Less CDM

Scenario 1: Outlook B (GW)	Near	Medium	Long
Supply Need	**-1.6**	**-5.8**	**-11.4**
Expired - Gas	0.4	3.1	5.1
Expired - Renewables	0.2	0.3	2.2
Previous Period Renewed or New Supply	0.0	1.1	5.6
Potential Net Supply Need	**-1.0**	**-1.3**	**1.5**
Repowered - Gas	0.40	3.10	3.20
Repowered - Renewables	0.21	0.29	2.15
New Supply	1.0	1.3	0.5
Supply Surplus/Deficit	**0.0**	**0.0**	**0.0**

- In the near-term, there is a supply need due to expired DR and less CDM.
  - The supply need can be addressed by repowering of existing resources gas-fired or contracting new demand responses.
  - The import agreement for 500 MW with Hydro Quebec provides some new supply relief.
  - Expiring renewable generation is expected to continue to operate to reduce total emissions (i.e. reduce the need to operate existing gas-fired generation).
- In the medium-term, supply need is primarily resolved through repowering of existing resources.
  - The import agreement with Quebec is likely expanded to 1 GW. The remaining supply need is addressed through new DR.
  - Renewable generation is expected to repower to continue to assist in emissions reductions. Minor development of new renewable generation (couple hundred MWs) may occur to further reduce emissions.
- In the long-term, the import agreement and repowering of existing assets resolves most of the supply need.
  - Most of the gas-fired generation with contract terms expiring in the long-term will be repowered.
  - To maintain low emissions of the repowered generation fleet, some new renewable generation development may be required.

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Scenario 2: Outlook B Less CDM Less Nuclear

- The shorter operating life of Pickering NGS results in a significant supply need in the near-term.
  - All expired generation is repowered.
  - The import agreement with Quebec is expanded to 1 GW total.
  - New gas-fired generation, expanded capacity at existing facilities and/or DR is likely developed to meet the supply need in the short-term.

Scenario 2: Outlook B Less Nuclear (GW)	Near	Medium	Long
Supply Need	**-4.6**	**-6.6**	**-13.0**
Expired - Gas	0.4	3.1	5.1
Expired - Renewables	0.2	0.3	2.2
Previous Period Renewed or New Supply	0.0	3.2	6.5
Potential Net Supply Need	**-4.0**	**0.1**	**0.8**
Repowered - Gas	0.4	2.9	4.2
Repowered - Renewables	0.2	0.3	2.2
New Supply	4.0	0.1	0.1
Supply Surplus/Deficit	**0.0**	**0.0**	**0.0**

- New generation developed in the near-term is utilized to meet the medium term supply need.
  - The new generation likely means that some existing generation is retired in the medium term.
  - Renewable generation is expected to repower to continue to assist in emissions reductions. Minor development of new renewable generation (500 MW to 1 GW) over the near-term and medium-term may occur to further reduce emissions.
- Slow demand growth in the long-term along with near-term generation development reduces the need to repower some expired generation.
  - All renewable generation is expected to be repowered to maintain lower emissions.

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Scenario 3: Outlook C Less CDM

- New supply is required in the near-term to meet growing demand under Outlook C.
  - The import agreement with Quebec of 500 MW partially addresses the supply need.
  - All expired generation is likely required, with some gas-fired generation expanding capacity to address the remaining supply need. New DR is also an option.
- Continued demand growth in the medium-term supports further new supply development and repowering of all expiring generation.
  - New gas-fired generation is likely required for peak demand requirements. With additional new gas-fired generation, there is likely support for continued development of new renewable generation (greater than 1 GW) to reduce total emissions growth in the electricity sector.
- In the long-term, the peak demand shifts from summer period to winter period.
  - The shift to winter peaking reduces the availability of imports from Quebec due to the winter peaking need in that jurisdiction.

Scenario 3: Outlook C (GW)	Near	Medium	Long
Supply Need	**-1.9**	**-7.1**	**-18.2**
Expired - Gas	0.4	3.1	5.5
Expired - Renewables	0.2	0.3	2.3
Previous Period Renewed or New Supply	0.0	1.2	6.4
Potential Net Supply Need	**-1.3**	**-2.5**	**-4.1**
Renewed - Gas	0.4	3.1	5.5
Renewed - Renewables	0.2	0.3	2.3
New Supply	1.3	2.5	4.1
Supply Surplus/Deficit	**0.0**	**0.0**	**0.0**

- In addition to repowered generation, a large amount of new generation is needed in the long-term.
  - Continued development of new renewable generation is likely to occur.
  - The development of large flexible generation (i.e., large hydro, large storage, expanded import agreements) could be supported and provide ability to maximize the value of renewable generation development.

Scenario 4: Outlook C Less CDM Less Nuclear

- The shorter operating life of Pickering NGS results in a significant supply need in the near-term.
  - All expired generation is repowered and the import agreement with Quebec is expanded to 1 GW total.
  - New gas-fired generation, expanded capacity at existing facilities and DR are all likely developed to meet the supply need in the short-term.
- Continued demand growth in the medium-term supports further new supply development and repowering of all expiring generation.
  - New gas-fired generation is likely required for peak demand requirements along with development opportunities for new renewable generation.
- In the long-term, the peak demand period shifts from summer to winter, reducing the cost-effectiveness of imports from Quebec.
  - The large supply need supports repowering of all expired generation with possible consideration for expanded capacity at gas-fired generation sites.
  - The long-term offers significant opportunities for new renewable generation development.
  - The renewable generation development can be expanded with investment in flexible capacity (i.e., large hydro, large storage or expanded import agreements).

Scenario 4: Outlook C Less Nuclear (GW)	Near	Medium	Long
Supply Need	**-5.0**	**-7.8**	**-19.7**
Expired - Gas	0.4	3.1	5.5
Expired - Renewables	0.2	0.3	2.3
Previous Period Renewed or New Supply	0.0	3.7	7.9
Potential Net Supply Need	**-4.4**	**-0.7**	**-4.0**
Repowered - Gas	0.4	3.1	5.5
Repowered - Renewables	0.2	0.3	2.3
New Supply	4.3	0.8	4.0
Supply Surplus/Deficit	**0.0**	**0.0**	**0.0**

Wind Generation Ontario Opportunity

Scenario	Renewable Generation Opportunity	Near (MW)	Medium (MW)	Long (MW)
1: Outlook B	Repower or maintain	200	300	2,200
	New	0-200	250-500	500-1,000
2: Outlook B less Nuclear	Repower or maintain	200	300	2,200
	New	200-300	250-500	250-500
3: Outlook C	Repower or maintain	200	300	2,200
	New	200-300	1,000-2,000	1,000-3,000
4: Outlook C less Nuclear	Repower or maintain	200	300	2,200
	New	200-300	1,000-2,000	2,000-5,000

- For wind generation, the Power Advisory generation development scenarios support repowering or maintaining operation of existing facilities over the planning period.
  - Regardless of future demand growth (i.e., Outlook B or Outlook C), Power Advisory expects some new wind generation development will be required to limit emission increases during the nuclear refurbishment period.
  - Not surprisingly, if demand in Ontario trends towards Outlook C due to aggressive climate change policies by the federal and provincial governments, Ontario will require a large amount of new renewable generation to meet growing demand and to achieve GHG emission targets by keeping emissions in the electricity sector low.
  - Flexible capacity (i.e., large hydro, storage or import agreements) in the long-term can maximize the benefits of wind generation and address multiple objectives of the Ontario electricity system.

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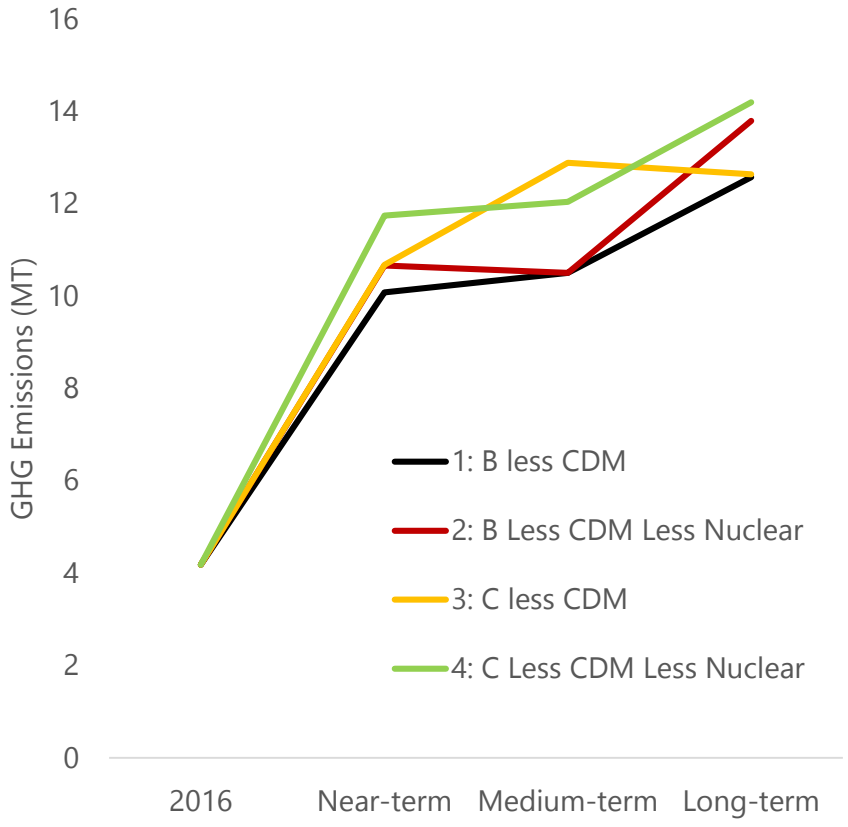
GHG Emissions Outlook

- Power Advisory's generation development scenarios estimate that GHG emissions in Ontario will increase throughout the planning period from the expected low of 4 MT in 2016 (according to OPO) to 12 MT-14 MT in 2035 (according to Power Advisory forecasts).
  - Surplus baseload generation has dramatically reduced the output from gas-fired generation. The underutilization has resulted in low emissions output in recent years.
  - During nuclear refurbishment, increased gas-fired generation energy production will drive emissions above 10 MT throughout the planning period.
  - Development of renewable resources to reduce the energy output of gas-fired generation caps emissions from increasing further under all scenarios.



Comparison of Resource Options

- Ontario has many resource options available to address the potential supply need, however the future supply mix must balance multiple objectives (i.e., reliability, low emissions, and cost-effectiveness).
- Each resource option has advantages and drawbacks that must be considered when determining the optimal resource to meet future power system needs.
  - Resources with the benefit of strong capability to supply during peak demand periods or have strong dispatchability are offset by the disadvantage of high fuel supply risk (i.e., biomass) or low long-term fuel supply cost certainty (i.e., gas-fired, storage).
  - Large hydro has low fuel supply risk and high capacity contribution/dispatchability, but requires significant financial commitment and long development timelines.
  - The flexibility benefits of gas-fired generation are off-set by being the only resource with high GHG emissions.
    - A majority of gas-fired generation in Ontario has been under utilized due to surplus baseload generation, therefore there should be ample life remaining in the assets to continue operation following end of contract term.
  - There is the ability to import up to 3,300 MW of firm capacity from Quebec, however significant transmission investments are required.
  - Renewable generation benefits from low emissions and very low operating costs. There is a low capacity contribution to peak demand and the need for long-term financial commitment to offset high capital costs and ensure value to ratepayer.
- In short, policy goals of low cost, low emissions and reliability requires a diverse supply mix.
  - The table on the following slide summarizes the different resource option attributes.

Resource Options

Resource Option	Siting Constraints	Development Time	Financial Commitment	Fuel Price Risk	GHG Contribution	Dispatchable	Capacity Contribution At Peak	LUEC ($/MWh)
Natural Gas-fired	Can be sited close to load centers, requires access to gas pipelines	2-4 years	7 -10 years	High	High	Yes	Summer: Full Winter: High	$50 - $220
Large Hydroelectric	Needs specific geographic attributes (i.e., Ontario far north)	8-12 years	40 years	Low	Low	Yes	Summer/Winter: Full	$100 - $140
Run-of-river Hydroelectric	Needs adequate river head	7-8 years	40 years	Low	Low	No	Summer/Winter: Site dependant	$120 - $160
Solar PV	Highly flexible, can be sited on existing infrastructure	2-3 years	20 – 30 years	Low	Low	Partial	Summer: Low Winter: Minimal	$100 - $180
Wind	Needs adequate wind regime	4-5 years	20-25 years	Low	Low	Partial	Summer: Low Winter: Medium	$60 - $110
Demand Response (DR)	Requires available DR customers	1-2 years	1 year +	Moderate	Low	Partial	Summer/Winter: Full	N/A
Bioenergy	Need security of fuel supply	3-5 years	20 - 30 years	High	Low	Yes	Summer/Winter: High	$80 - $160
Storage	Highly flexible	1-2 years	7-15 years	High	Low	Yes	Summer/Winter: Full	N/A
Imports	May require transmission investment inside and outside Ontario	0-5 years	0-10 years	High	Low (assuming hydro imports)	Partial	Summer: High Winter: Low	$120 - $160

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Implementation Plan Options

Procurement Mechanism	Effectiveness in Promoting Wind	Competitive Tension & Cost Minimization	Consistency with Current Market Structure
Competitive Procurement	High	High	High
Capacity Market	Low	High	Med. High
RPS	High	Med. High	Moderate
Regulated Development	High	Low	Med. High

- Power Advisory reviewed four different procurement mechanisms that could be used in the future to secure new wind generation supply.
  - Capacity markets were deemed inappropriate since the portion of wind generation's nameplate capacity eligible for capacity payments is less than 1/3 due to contribution during peak demand. Further, capacity market financial commitments have been typically for a short time period which would incent generation developers to front load risk to the detriment of rate-payers.
  - While RPS are intended to be a market-based approach that seeks to minimize the cost of realizing renewable energy objectives, experience suggests that RPS are imperfect at best and not fully effective in promoting the objectives of competitive wholesale electricity markets due to the ever changing nature of climate change policy (i.e. reduces certainty of RPS framework).
  - Regulated development are best suited for large, long-lead time and complex infrastructure projects that require government financial backing (e.g., large hydro and nuclear). In contrast, low risk resources such as wind are more likely to benefit from the lower costs produced by competition between developers and different project sites.
  - Competitive procurement for long-term contracts of wind generation provides adequate risk allocation between developers and rate-payers. The competitive tensions and long-term financial commitments allow rate-payers to realize the benefits through lower prices. Competitive procurement is the primary procurement mechanism used by other Canadian jurisdiction

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Recommendations

- Power Advisory's assessment of the future supply need in Ontario and potential generation development scenarios suggests that there will be a need for wind generation in the future.
- As part of the LTEP consultation, CanWEA should consider the following recommendations:
  - Due to the demand outlook uncertainty and risk of increasing emissions from higher utilization of gas-fired generation during the nuclear refurbishment time period, wind generation should continue to be developed in Ontario to maintain low emissions in the electricity sector.
  - The risk of rising emissions should be clearly articulated to counter the expectation in the OPO of flat emissions over the planning period.
  - As existing wind generation contracts expire, there is expected to be a supply need that repowered or maintained operation of wind generation can fulfil. CanWEA should ensure that there is a clear path for securing revenue certainty required to invest in repowering of the wind sites.
  - Power Advisory's assessment indicates that competitive procurement for long-term contracts provides the best value for rate-payers to secure low cost wind generation under Ontario's current electricity market framework. CanWEA should recommend relaunching competitive procurements for wind generation and support integration of awarded contracts into the new market structure following the conclusion of the Market Renewal Initiative.

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Recommendations

- An alternative option to competitive procurements would be to determine a process to monetize the value of EAs as part of a broader climate change policy in Ontario.
  - EAs, combined with some energy market revenue and minor revenue from capacity markets should be able support wind generation repowering/maintaince or new development in the future. The drawback is significant electricity market restructuring requirements to establish a market for EAs.
- Export opportunities exist in neighbouring jurisdictions for clean energy with well-established RPS or REC markets.
  - Physical and policy constraints restrict the capability of Ontario wind generation to participate.
  - Determining the relative value of Ontario wind generation to neighbouring "local" wind development will aid in determining if it is appropriate to address the physical and policy constraints.
- Overall, the opportunity for wind generation in Ontario should be focused on restricting the rise in emissions within the province.
  - CanWEA should participate in the Market Renewal Initiative to ensure that the value of low emission generation through a competitive process for long-term contracts is considered as part of any market reforms.
  - Shifting policy approaches in Ontario's complex hybrid electricity market requires a significant effort to restructure and unwind the existing framework. This process becomes more difficult in the future as Ontario attempts to balance competing policy objectives (i.e., reliability, low emissions, cost-effectiveness). CanWEA should recognize and communicate to Ontario policy makers the many interconnected actions required to meet all of those policy goals.

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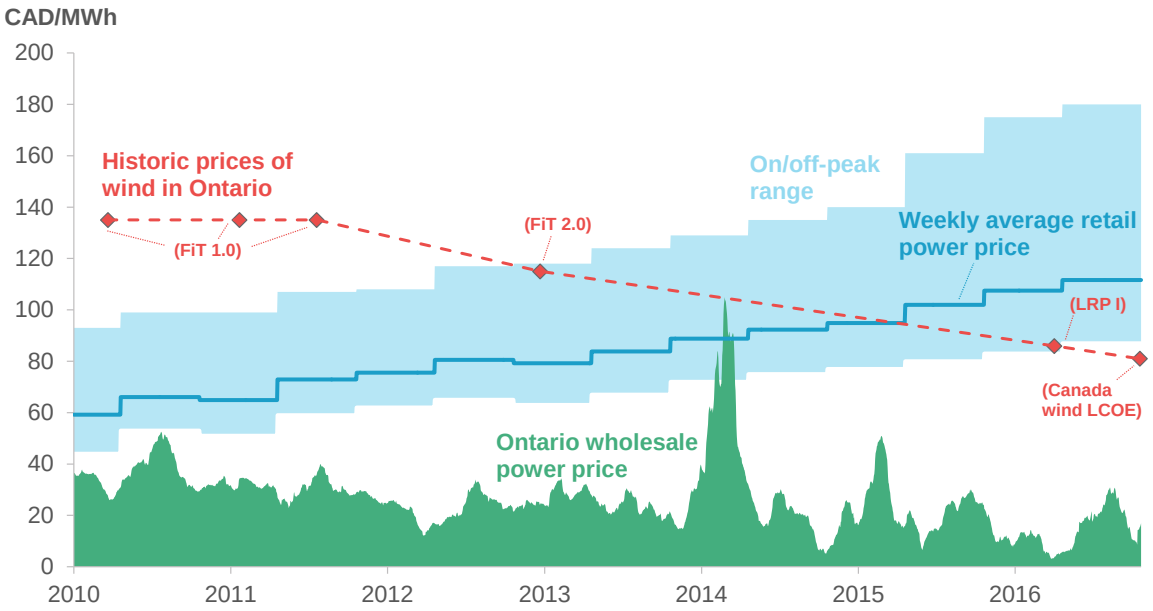
APPENDIX B – CANWEA SUBMISSION TO THE LONG-TERM ENERGY PLAN REVIEW

Ontario 24hr wholesale power prices, historic wind contract prices and current LCOE, and residential rates



Source: Bloomberg New Energy Finance, the Bloomberg Terminal, Ontario Energy Board. Note: Reported wholesale prices are 30-day moving averages of 24hr prices. On/off-peak range reflects range for retail time-of-use pricing. Underlying data, which can be seen here, is through Oct 2016. See report *Canada wind forecast decreases with Ontario LRP II contract suspension* (web| terminal), or reach out to support.bnef@bloomberg.net for more information.