

Delivering Fairness and Choice 2017 LTEP

Chapter 2. Ensuring a Flexible Energy System

Ontario has made significant progress in rebuilding its electricity system. Of the Province's investments in the electricity system since 2003, more than \$35 billion has been invested in generation to ensure we have a clean and reliable supply of electricity for households and businesses. This is in addition to the much-needed upgrades we have made to our transmission and distribution system. Ontario now has an electricity system that is well-positioned to pursue emerging opportunities and meet future challenges, one of which is the global fight against climate change.

Ontario's fuels sector currently supplies most of the energy needed for our transportation, heating and manufacturing. However, Ontario's clean and reliable electricity system is strong enough to support electrification of other sectors of the economy, in order to reduce greenhouse gas emissions. The existing network of pipelines and retail outlets can also be used to deliver future alternative fuels, such as renewable natural gas (RNG).

What Ontarians said in the LTEP Consultations and Engagements

- First consider costs when deciding on supply
- Use a technology-neutral competitive process to acquire electricity supply
- Optimise use of our existing energy facilities and infrastructure, including nuclear
- Expand access to natural gas
- Acquire more power from neighboring jurisdiction Both support and concerns expressed about nuclear and renewables
- Storage can solve problems

Commented [AG1]: Is "technology-neutral" actual language used in feedback from Ontarians? It definitely wasn't the main message in Indigenous engagements, where competition and electricity costs were raised, but renewables were always the preferred way to supply electricity. If this is really a cost issue, can we cut the tech-neutral reference, and let the bullet below on renewables and nuclear speak to the various views of different supply resources?

Commented [MO2]: Paragraph revised to make stronger link to climate change, per feedback from MO.

The Need for Flexibility

To reduce costs and ensure it has the flexibility to meet these future challenges, Ontario is moving away from using long-term contracts to ensure it has enough electricity supply. While long-term contracts have ensured reliability, they have also added to the increases in electricity prices. The current electricity market structure and mechanisms have kept the lights on in Ontario, but it is time to adjust and to keep pace with our evolving supply mix. More competitive, market-based approaches can provide a cost-effective supply of electricity, as well as the flexibility to react quickly to energy needs. System operators in New England, New York and the Pennsylvania-New Jersey-Maryland Interconnection have successfully implemented this sort of approach.

Part of the need for additional flexibility is to accommodate the recent addition of large amounts of renewable generation whose output can vary. For example, solar power is only available when the sun is shining and wind power is only available when it is windy.

Over 7,800 MW of wind, solar, hydroelectric and bioenergy capacity were connected to the province's transmission and distribution networks between 2005 and 2015.¹ Over the same period, the cost of these technologies, particularly wind and solar, has declined substantially.² As renewables will continue to play a key role in helping Ontario meet its climate change goals, the need for system flexibility will continue to be important as changes to the market are considered to enable competition amongst energy resources to deliver clean and reliable power to all Ontarians. Ontario is at an ideal moment to make these necessary changes. The current robust supply of electricity gives Ontario an opportunity to adopt a different approach to meeting the province's future energy needs when they begin to emerge.

Commented [FE3]: Edits more clearly connect the two statements about renewables (1. That costs are coming down and 2. That they will be a part of the climate change mitigation) to establish the reason why there will be a continued need for system flexibility.

To meet these long-term needs, the Independent Electricity System Operator (IESO) has begun a Market Renewal initiative to redesign the province's wholesale electricity markets. This undertaking forms a key component of Ontario's plan to bring down the cost of electricity and is expected to save up to \$5.2 billion over a 10-year period starting in 2021. The IESO is developing an incremental capacity auction that will, over time, increase the use of competition to secure the resources we need, regardless of the technology. Generators, demand response providers, and importers could all participate in the auction, with the lowest-cost resources being selected.

Market Renewal will ultimately result in a more competitive marketplace that efficiently meets system needs at the lowest cost and ensures Ontario's climate change commitments are met. It will also help Ontario prepare for the future by creating a framework that can effectively incorporate new and emerging technologies.

A reformed electricity market will not only reduce costs, but it will also increase two-way electricity trade with other jurisdictions. More frequent and improved intertie scheduling will lead to more efficient market outcomes by enabling increased imports of lower-cost generation, and greater revenue for Ontario generators who will have more flexible access to export markets.

The IESO is working closely with partners in the electricity sector to develop high-level designs and a plan for bringing in the significant changes that will become the foundation of Market Renewal. The plan will set out the specific changes that will be implemented and the timelines for completing the work. This will allow the IESO and its partners to address the known challenges of our existing markets while laying a solid foundation for a more competitive and flexible energy market that can meet future needs.

Commented [MO4]: Andrew requested more be added re: intertie scheduling

>> Addressed in paragraph above.

Electricity: Supply and Demand

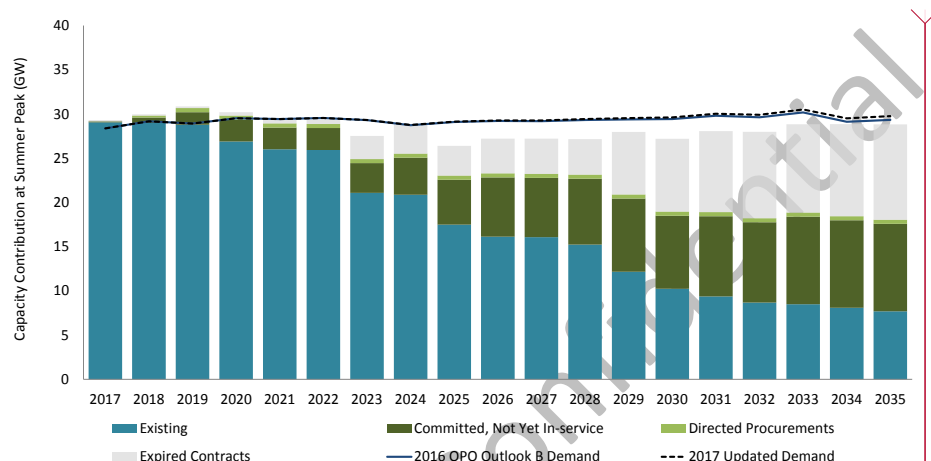
[Placeholder for descriptive text once forecast is available and to accompany graphs.]

¹ Ontario Planning Outlook 2016 Figure 1.

² Ontario Planning Outlook (Pg. 13) reports solar PV module prices have declined by 70-80 per cent over the last decade.

Supply and Demand Forecast

While there is currently a robust supply of electricity, there is expected to be a capacity shortfall when existing contracts begin to expire and the Darlington and Bruce nuclear facilities are refurbished, resulting in the need to procure capacity in the early-mid 2020s.



Commented [PZ5]: Have underlying data – will work with Comms to create own figure.

Under the IESO's market renewal initiative, this capacity requirement will be met through the proposed incremental capacity auction, allowing existing and new clean generation facilities to compete with clean imports, conservation and other demand-side initiatives. The continued growth of embedded wind and solar power is also expected to reduce the need for grid-supplied electricity.

Demand is forecasted to be relatively steady over the planning period. In the long-term, the IESO is forecasting an increase in overall demand as electrification of the economy occurs. Electrification potential exists in nearly every part of the energy system. In particular, there is great potential for electrification in the transportation sector, which would be an economical and clean alternative to fossil-fuel powered engines. For example, the above demand outlook assumes that there will be approximately 2.4 million electric vehicles (EVs) on the road by 2035.

Transmission Forecast

[TBD: IESO to input transmission outlook]³ See figure x on page x for the projects planned or underway on the high-voltage transmission system.

Commented [DK(6)]: IESO input required

³ TBD based on IESO modelling

The Province will direct the IESO to establish a formal process for planning the future of the integrated province-wide “bulk” system, which includes the high voltage system that is typically 230 kV and 500 kV in Ontario. As part of the process, the IESO will consult with its partners and communities.

Major Province-Wide Transmission Projects Under Development ⁴

Commented [DK(7)]: Questions for IESO:
- Is there any update on the GTA West Bulk Reinforcement? Can the language be more specific?
Has work been initiated on Hawthorne to Merivale?

Hawthorne to Merivale

IESO, Ontario- Quebec Interconnection Capability: A Technical Review, page 19, <http://www.ieso.ca/-/media/files/ieso/document-library/power-data/supply/intertiereport-20170508.pdf?la=en> ; and Hydro One's 2017/18 transmission rate application, Exhibit B1, Tab 3, Schedule 3, pages 7 and 10 of 35, http://www.hydroone.com/RegulatoryAffairs/EB20160160/HONI_Tx_Appl_Ex_B1_20160531.pdf

Clarington Transformer Station

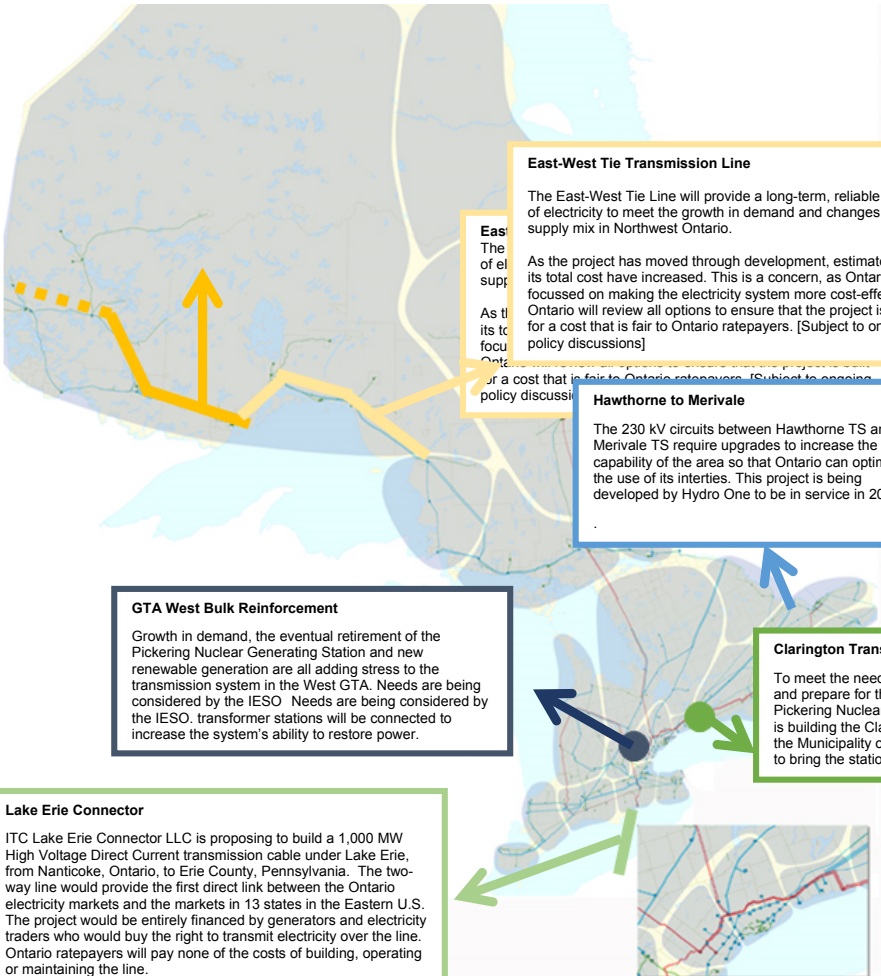
<http://www.hydroone.com/Projects/Clarington/Pages/default.aspx>;
<http://www.hydroone.com/Projects/Clarington/Pages/Timeline.aspx>;

GTA West Bulk Reinforcement

<http://www.ieso.ca/-/media/files/ieso/document-library/regional-planning/northwest-greater-toronto/2015-northwest-gta-irrp-report.pdf?la=en>; <http://www.ieso.ca/get-involved/regional-planning/gta-and-central-ontario/gta-west>

Lake Erie Connector

<http://www.itclakeerieconnector.com/>



[Note: Northwest Bulk section was deleted; assuming this was an accident?]

Commented [AH(8)]: John, do you have previous content on this, or do you want me to dig it up? It's explicit in our Cabinet submission, so we'll need to add.

Fuels: Supply and Demand

LTEP 2017 is not forecasting any fuel supply issues and anticipates continued reinvestment and maintenance of supporting facilities within Ontario. While the existing infrastructure is likely to be sufficient for conventional fuels, new investments in processing and delivery may be required to handle increases in the use of alternative fuels such as ethanol, renewable natural gas, biodiesel and other biofuels.

[placeholder for key charts/graphs from LTEP]

The Influence of the Carbon Market

On January 1, 2017, Ontario implemented a cap and trade program. It will increase the cost of fuels and influence how Ontario plans the province's energy supply and achieves cost-effective reductions in greenhouse gas (GHG) emissions in the future.

The carbon price that fossil-fueled generators pay will affect how often they get called on to meet the demand for electricity. A natural gas-fired generator of electricity would, for example, have to increase the price at which it offers electricity into the wholesale market. The cap and trade program will increase the competitiveness of non-emitting electricity generation and clean energy imports from neighbouring jurisdictions.

Cap and trade also increases the price consumers pay for fossil-fuels such as natural gas, gasoline, diesel and propane. The OEB has to approve the costs that regulated natural gas utilities incur when they comply with cap and trade, including the cost of acquiring emission allowances. These costs are then added into the rates charged to their customers. Natural gas utilities that are not regulated by the OEB and facilities with a direct compliance obligation under cap and trade consuming natural gas will determine the manner in which they pass on compliance costs.

For other fuels such as gasoline, diesel and propane, fuel suppliers in Ontario operate in a competitive market which is not subject to economic regulation. These fuel suppliers are responsible for complying with cap and trade regulations and are expected to pass through their compliance costs, including acquiring emission allowances, to retail consumers.

Maximizing Existing Assets

LTEP 2017 is maximizing the use of the province's existing energy assets in order to limit any future cost increases for electricity consumers. Ontario can do this because it is benefitting more than originally expected from the investments it made in the electricity system.

Renewable Energy

Commented [JM9]: Couldn't find good definition for large final emitters, which is not illustrative enough.

>> FPL: This is a fair representation. The threshold is 25,000 tonnes of CO2 per year and covers a range of industrial processes.

Over 4,800 MW of wind energy and over 2,100 MW of solar energy contracts will expire between 2026 and 2035, with most occurring after 2030. While these contracts typically last for 20 years, in some cases, the wind turbines and photovoltaic panels will still be able to generate electricity after their contracts expire. In other cases, new or more efficient technology could be added to upgrade these renewable energy facilities so they could continue operating or increase their output.

Commented [MO10]: Language in this section revised per MO's comment that most don't expire until 2030s.

Market Renewal will enable future opportunities and investment in existing and new renewable energy resources, as part of its support for Ontario's climate change goals.

Natural Gas

Most of Ontario's natural gas turbines are expected to operate beyond the life of their typical 20-year contract. This will be important over the coming decade, as the need for electricity will increase with ongoing nuclear refurbishments and the retirement of the Pickering Nuclear Generating Station in 2024. Sometime in the early 2020's, it is forecasted that there will no longer be enough contracted capacity to meet reliability requirements.

Commented [CQ11]: Since the "examining opportunities for negotiating new contracts" paragraph above has been removed, this paragraph is no longer needed.

Commented [ES12]: Revised this section to reflect that signing new contracts and participating in opportunities under market renewal are both possibilities for existing renewables assets.

Many existing generation contracts will expire over the same time frame, predominantly the natural gas generators that came online in the 2006–2014 period. These facilities could continue to generate electricity past their contract life by participating in the incremental capacity auctions being considered under Market Renewal.

Refurbishing Nuclear

Refurbishing Ontario's nuclear generating stations is the most cost-effective option for producing the required baseload generation while producing no GHG emissions. Ontario is moving forward with the plans laid out in LTEP 2013 to refurbish a total of 10 nuclear units between 2016 and 2033: four units at Darlington and six units at Bruce.

The Darlington Nuclear Generating Station, in the Municipality of Clarington, is one of the best performing nuclear power plants in the world. The Bruce Nuclear Generating Station, in the Municipality of Kincardine, is the largest nuclear facility operating anywhere in the world. Together, Darlington and Bruce provide around 50 per cent of Ontario's electricity needs.

Refurbishing these 10 units will secure over 9,800 MW of affordable, reliable and emission-free generation capacity for the long-term benefit of Ontario. It will also support the 180 companies and 60,000 jobs that make up the province's globally-recognized nuclear supply chain.

Ontario Power Generation (OPG) is undertaking a multi-year phased approach to refurbishing the Darlington Nuclear Generating Station. This approach benefits from the lessons learned

during previous refurbishment projects, which highlighted the need for in-depth planning and preparation prior to beginning the work.

In November 2015, OPG's Board approved a total estimated cost of \$12.8 billion for refurbishing all four Darlington units, which includes all spending to-date, interest and inflation. This is \$1.2 billion lower than OPG's original estimate in 2009.

In January 2016, Ontario gave OPG approval to proceed with refurbishing the first of the Darlington units, Unit 2. On April 13, 2017, OPG announced it had successfully completed Phase One of the Unit 2 refurbishment and isolated the unit from the rest of the Darlington plant. OPG has now moved on to Phase Two and the entire project is on track to be completed on budget and schedule.

The refurbishment of Darlington and its continued operation will contribute a total of \$90 billion to Ontario's GDP and increase employment by an average of 14,200 jobs annually.⁵

Breakout Box

ONTARIO COMPANIES WORKING ON NUCLEAR REFINISHMENT

CAMECO

Cameco is one of the world's largest uranium companies with facilities in Blind River, Cobourg and Port Hope⁶.

In May 2017, Bruce Power and Cameco extended their exclusive uranium fuel supply arrangement for an additional 10 years, reducing the cost of electricity to ratepayers by an estimated \$200 million. This stable partnership will also bring long-term economic benefits to the Northumberland Region.⁷

Cameco is also supporting Darlington refurbishment, and in May 2017, delivered a first shipment of more than 200 calandria tubes ahead of schedule and on budget.⁸

BWXT

Commented [MO13]: MO requested we use BWXT, Laker, Cameco.

⁵ According to an October 2016 economic impact study by Conference Board of Canada.

⁶ Cameco, <https://www.cameco.com/about>

⁷ Bruce Power and Cameco announce long-term arrangement for life extension activities, 25 May 2017, <http://www.brucepower.com/bruce-power-cameco-longterm-arrangement/>

⁸ http://www.opg.com/darlington-refurbishment/Pages/20170524_CamecoDelivery.aspx

BWXT Canada Ltd, headquartered in Cambridge, Ontario, is a leader in the design, manufacturing, commissioning and service of nuclear power generation equipment and employs 850 people across the province.⁹

BWXT played a key role in the early completion of the defueling of Darlington's Unit 2 in January 2017.¹⁰ The company will also continue to manufacture feeders to support the Darlington refurbishment program.¹¹

In addition, BWXT will supply eight replacement steam generators for the Bruce refurbishment in a contract worth about \$130 million and securing more than 100 jobs as a result.¹²

Laker

Laker Energy Products is a leading supplier of nuclear reactor components for the CANDU nuclear power industry. The Ontario company is building on this success to export its precision-tooled products around the world.¹³

Laker recently purchased a new 65,000 sq. ft. facility to handle more than \$130 million in contracts to help refurbish the Bruce and Darlington nuclear reactors. The facility will also support Laker's sales to international markets, including existing and new-build projects in Argentina, Romania, China and the UK.¹⁴

Commented [PE(14)]: Note that Laker has also been proposed as a potential example of exporting innovation in Chapter 5.

John, do you think we should keep here, or chapter 5? Happy for advice!

Commented [PE(15)]: Calloutbox ends here.

On December 3, 2015, the IESO updated its contract with Bruce Power, which plans to invest approximately \$13 billion of its own funds to refurbish six nuclear units at the Bruce Nuclear Generating Station. The government was further able to optimize the nuclear refurbishment schedule in order to maximize the value of existing nuclear units. The revised timeline will mean construction commences in 2020, rather than the previously estimated start date of 2016. Accordingly, the updated agreement has achieved \$1.7 billion in savings for electricity customers when compared to the forecast in LTEP 2013.

Commented [MO16]: MO requested more be added about the change to the Bruce schedule, and "publish new schedule"

⁹ BWXT awarded \$55M contract for feeder supply in support of OPG Darlington refurbishment, 13 April 2017, <http://www.bwxt.com/news/2017/04/13/BWXT-Awarded-CA55-Million-Contract-for-Feeder-Supply-in-Support-of-OPG%E2%80%99s-Darlington-Refurbishment>

¹⁰ First phase of Darlington Refurbishment Complete, <https://ocni.ca/public-resources/publications/darlington-refurbishment/>

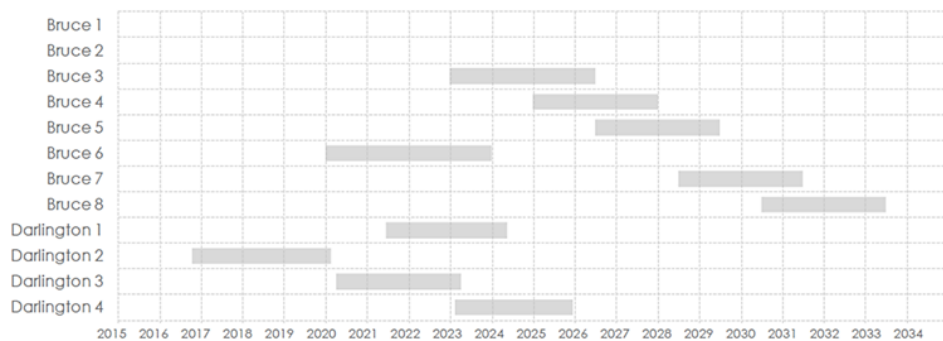
¹¹ Ibid, BWXT awarded \$55M contract for feeder supply in support of OPG Darlington refurbishment

¹² BWXT lands \$130M contract for Bruce Power refurbishment, The Record, 12 July 2016, <https://www.therecord.com/news-story/6763273-bwxt-lands-130-million-contract-for-bruce-power-refurbishment/>

¹³ Bruce power signs \$35M agreement with Laker Energy Products, 4 December 2015, <http://www.brucepower.com/bruce-power-signs-35-million-agreement-with-laker-energy-products/>

¹⁴ Op. Cit.

Updated Nuclear Refurbishment Schedule



Commented [ZA17]: To Comms regarding graphics: Chart from IESO OPO, Module 4 "Supply Outlook", slide 23 & 24.

Bruce Power is currently undertaking a number of activities, including:

- implementing an asset management program to optimize the life of the Bruce units before and after refurbishment;
- developing a final cost estimate for refurbishing the first unit, Unit 6; and
- executing contracts with suppliers, including BWXT Canada and SNC-Lavalin.

The Bruce refurbishment is expected to generate up to \$4 billion in annual economic benefits and increase employment by up to 22,000 jobs a year.¹⁵

Bruce Power has begun a Nuclear Economic Development and Innovation Initiative with the County of Bruce to maximize the local economic impact of Bruce Power's \$13 billion investment. This program seeks to ensure there are long-term benefits for the counties of Bruce, Grey and Huron by:

- asking suppliers to open offices in Bruce, Grey and Huron counties, and hire local people.
- giving preference to suppliers who generate jobs and economic benefit in Ontario, and where possible, operate close to the Bruce nuclear site.

This effort will have spin-off economic benefits for the region, such as the construction of needed new housing.

¹⁵ According to a 2016 joint economic impact study (updated from 2014) from the Provincial Building and Construction Trades Council of Ontario, the Canadian Manufacturers & Exporters and Bruce Power.

Managing the Risks

One of the principles of LTEP 2013 was the inclusion of potential off-ramps for nuclear refurbishment. Off-ramps ensure that refurbishments are only undertaken if they continue to deliver value for ratepayers.

OPG must get provincial approval before refurbishing each remaining unit at Darlington. These decision points act as “on-ramps” for the project. Ontario’s decision to proceed will depend on:

- OPG’s adherence to the approved costs and schedules from previous refurbishments; and
- whether the project provides ongoing value to ratepayers.

Ontario’s refurbishment contract with Bruce Power also includes robust protection for ratepayers from project cost overruns. For example, Ontario’s ratepayers were protected from around \$2 billion in cost overruns when Bruce Power refurbished and restarted two of the Bruce units in 2012.¹⁶

Under its recently updated agreement with the IESO for the remaining six Bruce units, Bruce Power assumes the full risk of cost overruns on executing the refurbishments for the life of the contract, as well as the operating risk for the units.

Contractual off-ramps allow Ontario to stop work on any Bruce refurbishment if the estimated cost exceeds a pre-defined amount. Refurbishment at Bruce can also be stopped if demand drops or lower-cost resources emerge.

Ontario will proceed with caution and protect ratepayers by strictly controlling the cost and timetable of refurbishments. OPG and Bruce Power will be subject to strict oversight to ensure that they complete the refurbishments on time and on budget.

In addition to OPG’s oversight of the Darlington refurbishment, Ontario has an independent advisor to ensure continued and effective oversight, with support from Infrastructure Ontario. All of OPG’s expenditures on nuclear refurbishment will also be reviewed by the OEB as part of its rate-setting process.

The Province gave the updated agreement with Bruce extensive due diligence, as did the financial and technical advisors who were engaged by the IESO when it negotiated the contract.

The IESO will continue to manage the Bruce contract and conduct an “open book” review of costs. It has full-time representatives on-site and will regularly report back to the Province.

Commented [NA(18)]: Note: Use of the term “on-ramp” is inconsistent with the paragraph above (i.e., 2013 LTEP principle was for off-ramps) as well as the introductory paragraph of the refurbishment section (i.e., Ontario is proceeding with a plan to refurbish 10 units). This would be a shift from existing Ministry messaging and OPG’s position at the OEB that we are proceeding with four units at Darlington in the absence of exercising off-ramps.

Commented [AH(19)]: Added at MO request.

¹⁶ “Bruce nuclear refit \$2 billion over budget”, Toronto Star, November 4, 2010, https://www.thestar.com/business/2010/11/04/bruce_nuclear_refit_2_billion_over_budget.html

Pickering Nuclear Generating Station

OPG is working on plans to continue to operate the Pickering Nuclear Generating Station until 2024. Two of the units would be shut down in 2022, with the remaining four units shut down in 2024. The continued operation of Pickering will ensure Ontario has a reliable source of emission-free baseload electricity to replace the power that will not be available during the Darlington and initial Bruce refurbishments. It would also reduce reliance on electricity generated from natural gas, saving \$600 million for electricity consumers and reducing GHG emissions by at least eight million tonnes.¹⁷

The Province announced on January 11, 2016 that it had approved OPG's plan to ask the Ontario Energy Board (OEB) and the Canadian Nuclear Safety Commission (CNSC) to approve the continued operation of Pickering until 2024. OEB will ensure that costs to enable OPG's plan for continued Pickering operation are prudently incurred while CNSC will ensure that Pickering is only allowed to operate during this period if it is safe to do so. OPG will seek final government approval to proceed with continued Pickering operation after these regulatory reviews are complete.

Commented [MO20]: More on next steps added at MO request.

Summary

- Market Renewal will redesign Ontario's wholesale electricity markets and will ultimately result in a more competitive marketplace that efficiently meets system needs at the lowest cost and ensures Ontario's climate change commitments are met.
- The Incremental Capacity Auction will increase the use of competition to secure the technology-neutral resources we need and will help reduce the cost of procuring resources to meet long-term demand.
- Market Renewal will also help Ontario prepare for the future by creating a framework that can effectively incorporate new and emerging technologies, including non-emitting resources.
- Cap and trade will increase the cost of conventional fuels and will impact how often fossil-fueled generators will get called on to meet the province's electricity demand. This will help reduce the province's GHG emissions and shift Ontario towards a low-carbon economy.
- Market Renewal will provide future opportunities for investment in existing and new renewable energy resources, providing benefits to consumers and supporting Ontario's climate change goals.
- OEB staff indicated they are targeting September 2017. OEB also reviewed this section and had no comments on the timeline. The Province will direct the IESO to establish a formal process for planning the future of the integrated province-wide "bulk" system.

¹⁷ According to an independent October 2015 assessment by the IESO.

- The Northwest Bulk transmission project will proceed in phases, with Phase One to come into service as soon as is practical and development work for the first two phases to proceed at the same time.
- The Province will review all options to ensure the East-West Tie project is built for a cost that is fair to Ontario ratepayers.
- Ontario will exercise strict oversight of nuclear refurbishments and ensure they are only undertaken if they provide value for ratepayers.

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