

Delivering Fairness and Choice

2017 LTEP

Chapter 2. Ensuring a Flexible Energy System

Ontario has made significant progress in rebuilding its electricity system. In addition to the much-needed upgrades to our transmission and distribution system, the Province invested over \$35 billion in generation between 2005 and 2016 to ensure we have a clean and reliable supply of electricity for households and businesses. Ontario now has an electricity system that is well-positioned to pursue emerging opportunities and meet any future challenges.

One of these challenges is climate change. Ontario's fuels sector currently supplies most of the energy needed for our transportation, heating and manufacturing. Our electricity system is strong enough to support the electrification of some of these uses, and the existing network of pipelines and retail outlets can be used to deliver future alternative fuels, such as renewable natural gas (RNG).

What Ontarians said in the LTEP Consultations and Engagements

- Use competitive process to acquire technology-neutral supply
- Optimise use of existing assets, including nuclear
- Expand access to natural gas
- Acquire more power from neighboring jurisdictions
- First consider costs when deciding on supply
- Support and opposition to nuclear and renewables
- Storage can solve problems

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 served Ontario well for many years, 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 regardless of the technology, as well as the flexibility to react quickly to system changes. 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 The cost of these resources, particularly wind and solar, have declined substantially in the last 10 years², and they will be required to play an important role in helping Ontario meet its climate change goals. System flexibility will therefore continue to be important as changes to the market are considered and as renewable resources compete with other sources of electricity to deliver clean, and reliable power to all Ontarians.

Ontario has a limited window in which to make the necessary changes. While there is currently a robust supply of electricity, this amount is expected to decrease when existing contracts expire and during the refurbishment of the Darlington and Bruce nuclear facilities. The current robust supply gives Ontario an opportunity to adopt a different approach to meeting the province's future energy needs.

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 a 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 in a technology-neutral manner.

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 the export and import of electricity from other jurisdictions. More efficient scheduling will allow for 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.

Electricity: Supply and Demand

¹ Ontario Planning Outlook 2016 Figure 1.

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

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

Supply and Demand Forecast

Transmission Forecast

The IESO's outlook for demand indicates there will be no need for any major expansion of the province's transmission system, beyond the projects already planned or under development.]³ See figure x on page x for the projects planned or underway on the high-voltage transmission system.

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 Development⁴

³ TBD based on IESO modelling

⁴ **Northwest Bulk**

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EWT

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Clarington Transformer Station

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

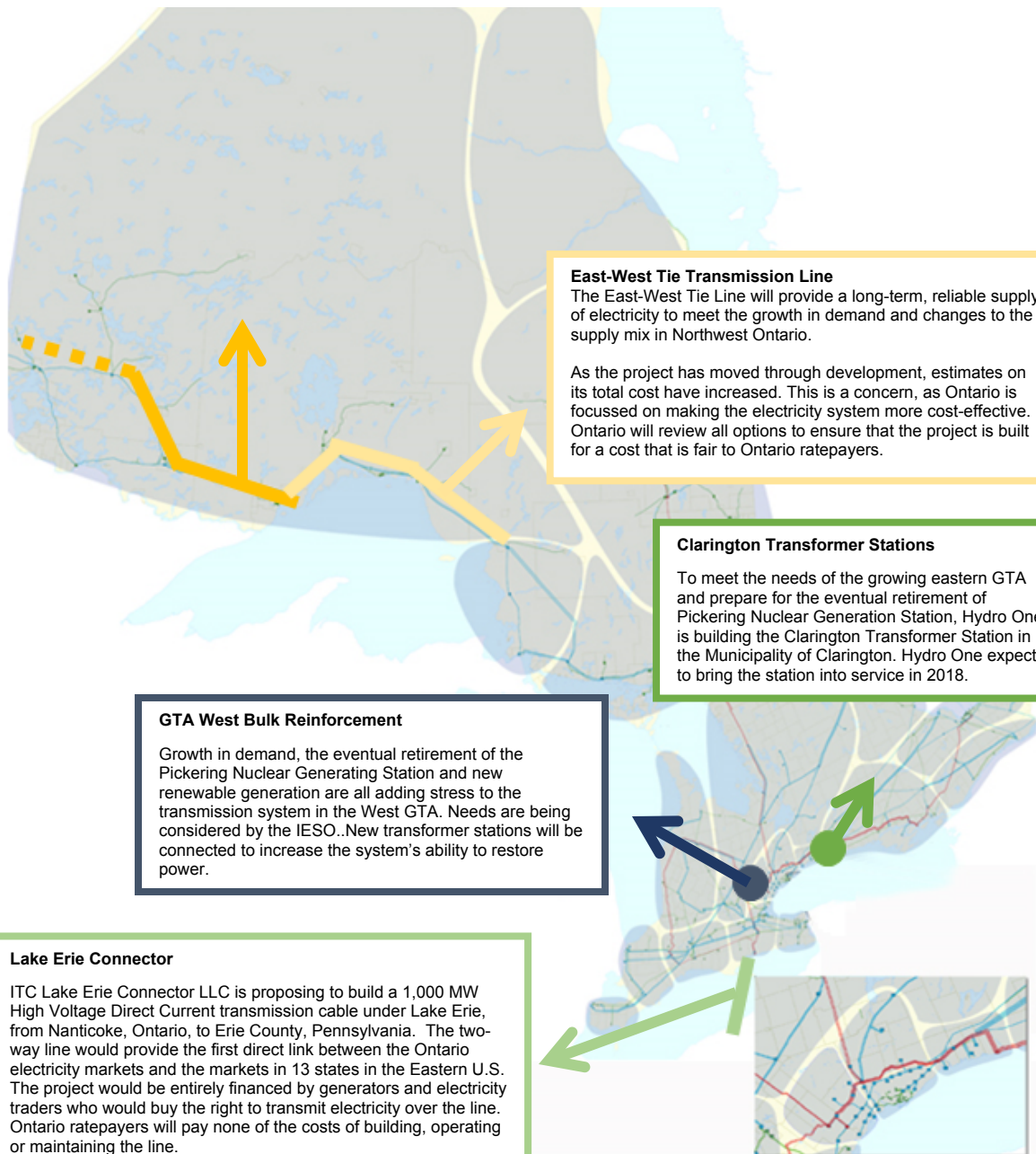
<http://www.hydroone.com/Projects/Clarington/Pages/Timeline.aspx>;

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

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Fuels: Supply and Demand

LTEP 2017 is not forecasting any issues with the supply of fuels to, and within, Ontario. It believes there will continue to be an appropriate level of reinvestment and maintenance in processing, storage, transmission and distribution facilities in 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, as well as more efficient natural gas generation.

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 big industrial plants consuming natural gas will determine the manner in which they pass on compliance costs.

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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

Ontario can maximize the use of its existing renewable energy assets by negotiating new contracts for the facilities when current contracts expire.

Between 2026 and 2035, contracts will expire for over 4,800 MW of wind energy and over 2,100 MW of solar energy. The 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. In both cases, consumers would get additional benefits from the new contractual arrangements. As part of its support for the province's climate change goals, Market Renewal will enable future opportunities and investment in existing and new renewable energy resources.

Natural Gas

Most experts agree that natural gas turbines can 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, there will no longer be enough contracted capacity to meet reliability requirements.

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 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 percent 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 REFURBISHMENT

PROMATION NUCLEAR



In May 2017 Nu-Tech delivered the first 513 pressure tubes destined for Darlington ahead of schedule and on budget.⁹

THE BRUCE REACTOR INSPECTION AND MAINTENANCE SYSTEM (BRIMS) TOOL

A consortium of Ontario-based companies has developed a new, state-of-the-art tooling system that will reduce the time and cost associated with reactor inspections and maintenance, as well as improving worker safety.

The innovative Bruce Reactor Inspection and Maintenance System (BRIMS) tool is the result of a collaboration involving Bruce Power, ATS Automation, BWXT Canada Ltd., Candu Energy Inc. and others.¹⁰

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. Work on the first unit will begin in 2020.

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.¹¹

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 Life-Extension Program. 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.

⁹ OPG, http://www.opg.com/news-and-media/our-stories/Documents/20170531_NuTech_PressureTubes.pdf

¹⁰ Bruce Power, 9 July 2015, <http://www.brucepower.com/new-made-in-ontario-tooling-to-support-bruce-power-operations-for-decades-to-come/>

¹¹ According to a 2014 joint economic impact study from the Provincial Building and Construction Trades Council of Ontario, the Canadian Manufacturers & Exporters and Bruce Power.

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Commented [JM3]: From latest industry study

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

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 “off-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.

Under its agreement with the IESO, Bruce Power assumes the full risk of cost overruns on the refurbishing 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 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.

Ongoing Operation of Pickering

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.¹²

The Province announced on January 11, 2016 that it had approved OPG's plan to ask the Ontario Energy Board and the Canadian Nuclear Safety Commission to approve the continued operation of Pickering until 2024.

¹² According to an independent October 2015 assessment by the IESO.