

Delivering Fairness and Choice LTEP 2017

Chapter 2. Ensuring a Flexible Energy System

Ontario has made significant progress in rebuilding its electricity system. In addition to much-needed transmission and distribution system upgrades, we have 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's fuels sector cannot supply all the energy needed for our transportation, heating and manufacturing, but the existing network of pipelines and retail outlets can be used to deliver alternatives, such as renewable natural gas (RNG). Ontario now has a clean and stable supply of energy, and an electricity system that is well-positioned to pursue emerging opportunities and meet any future challenges.

The Need for Flexibility

To meet these challenges, Ontario is moving away from the use of long-term contracts to ensure it has enough electricity supply to relying more on market-based structures. While long-term contracts have ensured reliability, they have also contributed to increases in electricity prices. **Market-based** approaches to procuring new generation have been successful in other jurisdictions, and can provide a cost-effective supply of electricity regardless of the technology, along with more flexibility to react quickly to system changes.

Part of the need for additional flexibility is to accommodate the recent addition of large amounts of renewable generation, which are generally variable in nature. For example, solar power is only available when the sun is shining and wind power is available when it is windy.

Over 7,000 MW of wind, solar and bioenergy capacity has been connected to the province's transmission and distribution networks in the last 10 years. Over this same period, the cost of these technologies has declined substantially.¹ These renewable energy resources will be required to play a vital role in helping Ontario meet its climate change goals. The need for system flexibility is therefore expected to continue as renewable resources compete with other sources of electricity in a dynamic marketplace to deliver **reliable** power to all Ontarians.

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

¹ For example, OPO (Pg. 13) reports solar PV module prices have declined by 70-80% over the last decade.

Commented [JM1]: What about transmission, and distribution. That surely increases reliability, perhaps use that combined figure here.

>> Expanded on this a bit more. Don't think we want to repeat \$50 billion figure again – and think that makes sense at beginning of chapter 1 as it leads into discussion re: increasing electricity prices and "making energy affordable" actions.

Commented [FE2]: The purpose of edits in this paragraph are to make the distinction that the supply of energy (i.e. generation) is already market-based. Ontario is introducing a market-based approach to procuring new supply (i.e. a capacity market) instead of long term contracts.

Commented [FE3]: REFO to work with ESP to fact check original source.

Commented [AH(4): The first two sentences in this paragraph read as if the need for flexibility is because of large amounts of renewables being too intermittent to handle. But then it goes on to talk about how renewables are likely to compete in future due to price depression. Can we reconcile this?

REFO Response: Agree with comment. Revised to connect paragraph 1 and 3 and ensure statements about renewables, flexibility and cost competitiveness are logically consistent.

Commented [AG5]: Purpose of this edit: Renewables are not competing with other sources to supply the benefits of clean power to Ontarians ; they are competing to supply electricity period.

Commented [HJ(6): Purpose of this edit: suggest changing as "current period of energy security" might lead the reader to think that ON's energy security/reliability will be in danger during the period of nuclear refurbishments, which is not the case.

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. A key aim of Market Renewal is to acquire the electricity resources we need more cost-effectively. In the past, Ontario relied on long-term contracts to ensure sufficient generating capacity. The IESO is now developing a capacity auction that uses competition to secure the resources we need in a technology-neutral manner. Generators, demand response providers, and importers could all participate in the auction, with the lowest-cost resources being selected.

Commented [AG7]: Consider cutting, as is a repeat of points made in the paragraphs above.

Another important aim of Market Renewal is to get additional benefits from Ontario's existing generation assets by extending their use. This will deliver further cost savings to electricity consumers.

Commented [FE8]: Suggest cutting this sentence. Not a key outcome of Market Renewal and this paragraph does not fully describe *how* Market Renewal would achieve this outcome or how further cost savings would be delivered to ratepayers.

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 policy objectives are met. It will also help prepare Ontario for the future by creating a framework that can effectively incorporate new and emerging technologies.

>> One of the outcomes of MR is in fact to maximize benefits and extend use of existing/expiring assets by making them compete against other existing sources.

A reformed electricity market will not only reduce costs by improving the efficient use of our generation facilities, but it will also increase the import and export 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 stakeholders to develop high-level designs and a work plan for the significant changes that will become the foundation of Market Renewal. The work plan will set out the specific changes that will be implemented and the timelines for completing the work. This will allow the IESO and stakeholders 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

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

Supply and Demand Forecast

Transmission Forecast

The IESO has indicated that if there is no increase in the forecast for electricity demand, new major transmission expansion projects are not expected to be needed beyond those currently under development. See figure x on page x for projects planned or underway on the high-voltage transmission system.

Commented [GC(9)]: Note that there is always a need for ongoing investment to sustain the existing system to ensure it is reliable.

Commented [DK(10)]: This will depend on the supply and demand forecast above. The IESO has indicated that, in an outlook of flat electricity demand, no new major transmission investments beyond those currently under development are expected to be needed. The IESO has not indicated that there is no increase in demand forecast.

This will change if there is significant electrification of activities that currently use fossil fuels, such as space and water heating and the transportation of people and goods. New transmission lines would be needed to connect additional sources of generation to users.

The Ministry 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 stakeholders and communities.

Commented [AH11]: We don't discuss this huge level of electrification in Chapter 6, and it doesn't seem consistent with how we're approaching climate change targets etc.

Commented [SA12]: Wording changes to be consistent with current IESO directive.

Major Province-Wide Transmission Projects Under Development

Northwest Bulk Transmission Line

The Northwest Bulk line is needed to support growth and maintain a reliable electricity supply to areas west of Atikokan and north of Dryden. The project will proceed in phases:

- Phase One is a line from Thunder Bay to Atikokan and should come into service as soon as is practical, and no later than 2024.
- Phase Two will be a line from Atikokan to Dryden and should come into service by 2034 unless IESO's outlook on the demand forecast suggests an earlier date.
- Phase Three will be a line from Dryden to the Manitoba border that is needed post-2035 (or earlier if recommended by the IESO) to accommodate better integration of provincial electricity grids.

Development work for the first two phases will proceed at the same time.

East-West Tie Transmission Line

The East-West Tie Line will provide a long-term, reliable supply of electricity to meet the growth in demand and changes to the supply mix in Northwest Ontario.

As the project has moved through development, estimates on the total cost have increased. With Ontario's focus on making the electricity system more cost-effective, this is a concern. Ontario will review all options to ensure that the project is built for a cost that is fair to Ontario ratepayers.

Clarington Transformer Stations

To meet the needs of the growing eastern GTA and prepare for the eventual retirement of Pickering Nuclear Generating Station, Hydro One is building the Clarington Transformer Station, in the Municipality of Clarington. Hydro One expects to bring the station into service in 2018.

GTA West Bulk Reinforcement

Growth in demand, the eventual retirement of Pickering Nuclear Generating Station and new renewable generation are all adding stress to the transmission system in the West GTA. New transformer stations will be connected to increase the system's ability to restore power.

Lake Erie Connector

ITC Lake Erie Connector LLC is proposing to build a 1,000 MW High Voltage Direct Current transmission cable under Lake Erie, from Nanticoke, Ontario, to Erie County, Pennsylvania. The two-way line would provide the first direct link between the Ontario electricity markets and the markets in 13 states in the Eastern U.S. The project would be entirely financed by generators and electricity traders that buy the right to transmit electricity over the line; Ontario ratepayers will pay none of the costs of building, operating or maintaining the line.

Commented [AH(13)]: We should cut back some of the content in these boxes, because right now you can't see the map.

SNAP comment: this map is illustrative only. Comms will work with a graphic designer to prepare it.

Fuels: Supply and Demand

The 2017 LTEP is not forecasting any issues with the supply of fuels to, and within, Ontario. It believes there will be appropriate levels of reinvestments 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, biodiesel, other biofuels and renewable natural gas (RNG).

[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 influence how we plan the province's energy supply and achieve cost-effective reductions in greenhouse gas (GHG) emissions going forward.

The carbon price paid by fossil-fueled generators will affect how often they get called on to meet the demand for electricity. A natural gas-fired electricity generating facility, for example, would have to factor in the costs of the cap and trade program and 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 imports, as well as more efficient natural gas generation.

Cap and trade also affects the price consumers pay for fossil-fuels such as natural gas, gasoline, diesel and propane. For natural gas, the OEB approves the costs incurred by regulated natural gas utilities to comply with cap and trade, including acquiring emission allowances, that are then collected in rates charged to their customers. Natural gas utilities not regulated by the OEB and large final emitters consuming natural gas are responsible for acquiring their own allowances.

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 it is expected their compliance costs, including acquiring emission allowances, will be passed through to retail consumers.

Maximizing Existing Generation Assets

The 2017 LTEP is maximizing the use of the province's existing energy infrastructure in order to minimize any future cost increases for electricity consumers. Ontario can do this because it is benefiting more than originally expected from the investments made in procuring a clean and reliable supply of electricity.

Commented [AH(14)]: Should we mention that C+T increases the price of fuels for Ontarians?

Commented [PZ15]: Suggestion to change to Maximizing Existing Generation Assets – we don't really talk about infrastructure below, but rather focus on different supply options.

Commented [AH(16)]: What do we mean by this?

Renewable Energy

One opportunity to maximize the use of existing infrastructure is the contracts for renewable energy that have helped build up Ontario's additional supply of emission-free electricity.

Between 2026 and 2035, long-term contracts for over 4,500 MW of wind energy and 2,200 MW of solar energy will be expiring. In some cases, the wind turbines and photovoltaic panels will still be able to generate electricity after their usual 20-year contracts expire. In other cases, these renewable energy facilities could be upgraded to continue operating or increase their output by replacing equipment with new or more efficient technology.

Market Renewal is expected to provide a framework that will, in addition to other objectives, support Ontario in meeting its stated climate change goals. This would include enabling future opportunities for, and investment in, existing and new renewable energy resources.

Natural Gas

Most experts agree that natural gas turbines can operate beyond their typical 20-year contract life. This will be important over the coming decade, as the need for electricity will increase with nuclear refurbishment and the retirement of the Pickering Nuclear Generating Station. By sometime in the early 2020's, there will no longer be enough contracted capacity to meet reliability requirements.

Many existing contracts will expire over the same time frame, predominantly natural gas generation that came online in the 2006–2014 period. These facilities could generate electricity past their contract life by participating in a capacity auction that is being designed through the IESO's Market Renewal initiative.

Refurbishing Nuclear

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

Darlington Nuclear Generating Station, located in the Municipality of Clarington, is one of the best performing nuclear power plants in the world. Bruce Nuclear Generating Station, located in the Municipality of Kincardine, is the largest operating nuclear facility in the world. Today, Darlington and Bruce provide around 20 percent and 30 percent of Ontario's electricity needs respectively.

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 Ontario's globally-recognized nuclear supply chain.

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, the government 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.

Darlington refurbishment and continued operation will contribute a total of \$90 billion to Ontario's GDP and increase employment by an average of 14,200 jobs annually.²

Commented [ZA17]: To mirror what's included for Bruce refurbishment.

ONTARIO COMPANIES WORKING ON NUCLEAR REFURBISHMENT

PROMOTION NUCLEAR

Commented [NA(18)]: Note: Could not find a primary source for Liburdi Automation's contract with OPG for Darlington refurbishment. As such, we suggest using a different company example.

In May 2017 Nu-Tech delivered the first 513 pressure tubes destined to Darlington ahead of schedule and on budget.⁶

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.⁷

On December 3, 2015, the IESO updated its contract with Bruce Power. Bruce Power 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.

Commented [ZA19]: To maintain consistency and flow between Darlington and Bruce texts.

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 \$6.3 billion in annual economic benefits and increase employment by up to 23,000 jobs a year.⁸

Commented [ZA20]: For DMO consideration: The 23,000 jobs number and \$6.3 billion economic benefits is consistent with current Ministry messaging which is based on the 2014 joint industry study.

Bruce Power has launched the 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 opening 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.

However, in 2016, the study was updated and the 2017 LTEP may be an opportunity to cite updated numbers going forward and make Ministry messaging consistent with the latest study and how the Ministry reports on Darlington refurbishment employment benefits.

If so, the "up to 23,000 jobs" number should be revised to "22,000 jobs". The 22,000 jobs reflect the direct and indirect jobs resulting from the continued operation of the Bruce stations following refurbishment. Similarly, the economic benefits should be revised to "\$4 billion."

The 22,000 jobs number would be consistent with how Ministry references the long-term job benefits of Darlington continued operation (i.e., the 14,200 jobs annually) in its messaging on Darlington refurbishment.

⁶ OPG, http://www.opg.com/news-and-media/our-stories/Documents/20170531_NuTech_PressureTubes.pdf

⁷ Bruce Power, 9 July 2015, <http://www.brucepower.com/new-made-in-ontario-tooling-to-support-bruce-power-operations-for-decades-to-come/>

⁸ 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.

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

Commented [AH(21)]: Would this make more sense to move to nuclear innovation?

Managing the Risks

One of the principles of the 2013 LTEP 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 government approval before refurbishing each remaining unit at Darlington. These decision points act as “off-ramps” for the project. The government’s decision to proceed will depend on:

- OPG’s adherence to approved costs and schedules for 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, as well as the operating risk for the units over the life of the contract.

Contractual off-ramps allow the government 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.

Commented [NA(22)]: We cannot say it is like Darlington which doesn’t have contractual off-ramps nor a specified cost threshold.

The government will protect ratepayers by strictly controlling the cost and timetable of refurbishments, and will proceed with caution. 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 project, the government has an independent advisor who is ensuring 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

Commented [AH(23)]: Darlington? We should be specific about which projects we’re referring to in here.

The updated agreement with Bruce underwent extensive due diligence by the Province, as well as by 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 government.

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. Their continued operation will ensure the province 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 megatonnes.⁹

The government announced on January 11, 2016 that it had approved OPG's plan to seek the necessary regulatory approvals from the Ontario Energy Board and the Canadian Nuclear Safety Commission to continue to operate Pickering.

Commented [NA(24)]: Suggest dropping the quotation marks as we do not qualify nuclear as being emission-free elsewhere in the document or government communications.

Commented [ZA25]: For DMO consideration: The 8 megatonnes GHG reduction is from the IESO assessment and consistent with current Ministry messaging.

However, in its most recent public messaging and in the ongoing 2017-2021 Rate Application, OPG has been citing a GHG reduction of 17 megatonnes from ongoing Pickering operation. For example, see http://www.opg.com/news-and-media/news-releases/Documents/20170524_OSART_Report.pdf.

⁹ According to an independent October 2015 assessment by the IESO.