Long-term Energy Plan 2017

The Society of Energy Professionals

This report is SEP's contribution to the process of updating Ontario's Long-term Energy Plan. SEP focuses on the role of nuclear power in the energy supply mix, ensuring Ontario's transmission and distribution systems are reliable and efficient, and leveraging efficient renewable energy opportunities to improve economic opportunities for the North and First Nations communities.

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Introduction

The Society of Energy Professionals (The Society) is pleased to submit our comments to the Ministry of Energy as part of Ontario's Long-Term Energy Plan (LTEP) consultation. The Society represents more than 8,000 professional employees across the electricity industry in Ontario, including engineers, scientists, grid operators, supervisors, and market and finance specialists. Originally formed in 1948, The Society has contributed to making improvements to the industry for more than 50 years, advocating for long-term, evidence-based planning and decision-making in the energy sector. Everyday our members work to ensure that Ontarians have the safest, and most reliable, affordable and environmentally sustainable energy system possible.

Our submission seeks to build on the 2013 LTEP. That plan promoted a balanced clean supply mix with nuclear as its foundation, transmission enhancements to support system goals, and bioenergy facilities that provide a flexible power supply and support local jobs in forestry and agriculture. This updated plan should strive to achieve the same balance. While the Independent Electricity System Operator (IESO) anticipates that Ontario will remain relatively well supplied until the early-2020s, there are many moving pieces to consider looking forward, including: extended nuclear refurbishment outages, eventual nuclear retirements, additional renewable and natural gas resources coming on-line, non-utility generator (NUG) contracts reaching their term, and larger natural gas contracts beginning to expire. In all, nearly half of Ontario's currently installed capacity will reach contract term or end of service life before 2035. While there is some time, this substantial uncertainty in supply availability coupled with the likelihood of increasing demand to accommodate climate change objectives requires detailed planning to begin immediately from the supply mix down to the distribution level.

The past decade has seen dramatic transformation occur across the electricity system including coal phase-out, the full deployment of smart meters and integration of renewables, nuclear unit restarts, the completion of major transmission and hydroelectric projects, and most recently a closer relationship with the Province of Québec. Looking forward, over the next two decades as Ontario prepares to simultaneously tackle the challenges of electrification of transportation and heating, deeper decarbonization, successfully executing the refurbishment of 10 nuclear units, all while improving reliability and ensuring ratepayers see value for money, the task is certainly no less substantial. The Society looks forward to working with the province to achieve these objectives, and to that end believe that this LTEP should explicitly address several areas.

Nuclear

The Society recommends the LTEP reflect:

1. **The refurbishment of 10 units at the Darlington and Bruce Nuclear Generating Stations;**
2. **Ongoing operations at the Pickering Nuclear Generating Station through 2024; and**
3. **Planning for a future low-carbon, cost-effective supply mix which includes replacement nuclear capacity built at the Darlington site.**

The Society was encouraged by the Ontario Planning Outlook (OPO) issued in September by the Independent Electricity System Operator (IESO) which reinforced nuclear power's critical role as the backbone of Ontario's supply mix. The reflection of the 10-unit nuclear refurbishment schedule for Darlington and Bruce, as well as the continued operation of six Pickering units beyond 2020 as core assumptions of the OPO help to more accurately define when the need for incremental supply begins to materialize. The Society also welcomed the Ministry of Energy's acknowledgment of the ratepayer benefits and environmental attributes of nuclear by including it as part of the Clean Energy Supply section of the LTEP Discussion Guide, as well as noting the significant savings accruing to ratepayers both due to ongoing operations at Pickering and the adjustment to the refurbishment schedule.

Quite clearly, nuclear has been and will continue to be an enormous contributor toward Ontario meeting its greenhouse gas (GHG) emissions targets and climate change goals. Nuclear, largely due to the restart of Bruce units 1 and 2, represented the single largest source of replacement energy for coal over the phase-out period. With refurbishment at Darlington already underway and Bruce soon to begin, it is worth acknowledging that refurbishment at the two sites will ensure avoided CO2 emission of 30 million tonnes annually over the long term. Additionally, up to 17 million incremental tonnes of GHG emissions will be avoided in the near term due to the continued operation of the Pickering units beyond 2020. This alone represents the equivalent GHG emissions savings of taking 3.4 million cars off the province's roads each year, and provides a greater reduction in emissions than any single program in Ontario's Climate Change Action Plan (CCAP) over four years.

The combination of refurbishment and responsible nuclear asset management will ensure emissions from Ontario's electricity sector remain as low as possible, and that the province has a strong footing to pursue additional decarbonization over the course of this LTEP planning horizon if desired or if required by the CCAP.

Nuclear energy also represents the most significant economic footprint in Ontario's electricity sector. A study conducted by the Conference Board of Canada in 2015 concluded that the refurbishment of Darlington would contribute $15 billion to Ontario's GDP over the course of the project, with employment increasing by an average of 8,800 jobs and peaking with 11,800 jobs between 2014 and 2023. The operations of Darlington post-refurbishment will secure approximately 5,700 jobs solely in Durham Region until the 2050s and approximately $4 million per year in property tax revenue.

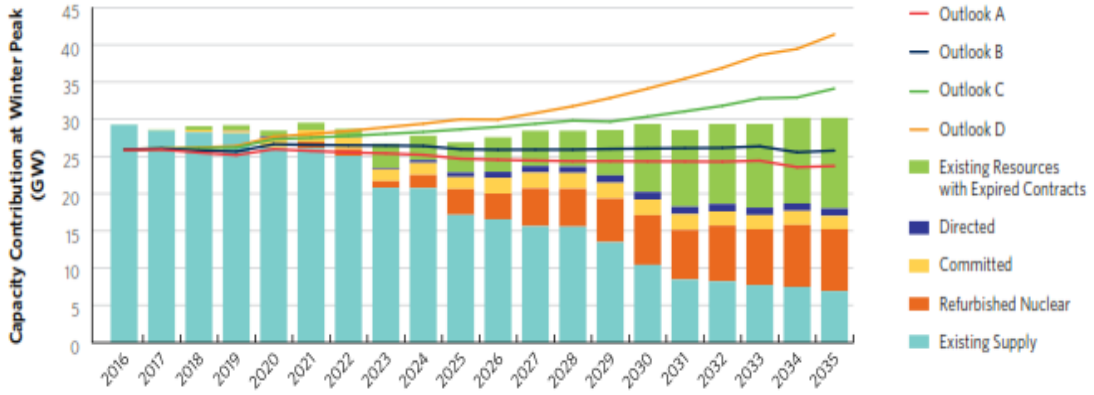
With respect to Bruce Power's refurbishment, the Canadian Council for Public-Private Partnerships conducted a detailed study in 2015 which concluded that during normal site operations, Bruce supports 18,000 direct and indirect jobs each year and delivers $4 billion in annual economic benefit to the province. During refurbishment the site will support an additional 5,000 direct and indirect jobs

annually, and contribute an additional $1.7-2.3 billion in annual economic benefit through direct and indirect spending on operational equipment, supplies, materials and labour income in Ontario.

Operating Pickering beyond 2020 likewise accomplishes many important public policy objectives, including reducing GHG emissions, reducing costs for ratepayers, sustaining economic activity in Durham Region, and supporting Ontario Power Generation's (OPG) net income. The government's Speech from the Throne as well as the LTEP Discussion Guide indicate that ongoing operations at Pickering will save Ontario ratepayers up to $600 million between 2020 and 2024, meaning lower consumer electricity bills. Both the IESO and OPG have similarly completed assessments of Pickering operating through 2024 and have concluded that it provides the greatest benefit to both ratepayers and the electricity system.

As Durham Region's largest employer, Pickering supports about 4,500 jobs and represents an annual community economic benefit of approximately $1.3 billion. When Pickering is shut down there will be a significant economic impact to Durham Region resulting from the loss of approximately 4,000 highly skilled jobs coupled with electricity rate increases. Opportunities exist to reduce the inevitable impacts of Pickering's retirement if the date is later; no opportunities exist should it come earlier.

The OPO presents a supply/demand overlay that projects over the next 20 years that roughly 50 per cent of Ontario's currently installed capacity will reach contract term or end of service life. With such pronounced uncertainty in demand, in conjunction with large blocks of currently relied upon energy and capacity potentially not available in the future, Ontario must make a decision relatively soon on not just how it intends to secure resources to fill those needs but what characteristics those resources will need to have.



Source: IESO Ontario Planning Outlook, September 2016

An increasing CO2 price and an aggressive 2030 provincial emissions target requires, both practically and economically, that GHGs generated from the electricity sector remain essentially at present day levels. This necessarily means that as the supply-demand gap begins to widen, natural gas cannot be the resource which is leaned upon more heavily to satisfy the system's requirements. There are newer reactor designs, including small modular reactors (SMR) which are in mature stages of their design process which have load following characteristics that can provide the support to renewables that natural gas currently serves. Ontario should closely monitor the development and licensing of these technologies and assess the utility-scale applications for them in the interest of cost-effective carbon suppression over the course of the LTEP planning period.

Ontario is fortunate to have several currently licensed nuclear sites with a highly skilled nuclear workforce and existing transmission infrastructure required in order to develop replacement nuclear supply at the appropriate time. Darlington would be the most appropriate as it possesses a standing site preparation licence from the Canadian Nuclear Safety Commission (CNSC) which Ontario should maintain going forward in order to preserve maximum planning flexibility.

Pickering's annual energy and capacity contribution to Ontario is significant enough that if equivalent, non-emitting resources are not in place by the time of its retirement, more natural gas generation will occur even if demand remains unchanged. Procuring, constructing and commissioning electricity infrastructure on this scale, on one site or across multiple, requires several years in order to simply secure approvals. It is therefore important that the province not delay in formalizing how it plans to address the mid-2020s supply-demand gap.

It will be likely that such a gap cannot be addressed by demand-side resources and imports alone, and will require a better capacity and carbon profile than can be provided by non-hydro renewables and natural gas. For 50 years nuclear energy has been a central piece of Ontario's reliable power supply, serving the province safely and cleanly while growing prosperous host communities in Durham Region and Bruce County, a globally recognized skilled nuclear workforce, and a domestic supply chain that employs thousands of Ontarians. Refurbishment at Darlington and Bruce is an investment in the future and a testament to the reliable, cost-effective product that nuclear power provides every day. As Ontario looks ahead, it should closely observe emerging nuclear technologies concurrent with its changing supply mix and emerging demand needs.

Transmission & Distribution

The Society recommends that the LTEP reflect:

1. **Transmission enhancements and expansion in the province to unlock incremental supply potential, including a North-South transmission reinforcement to access clean generating assets across Northern Ontario; and**
2. **The technical as well as regulatory preparedness for Local Distribution Companies to implement climate change-driven electrification**

As noted by the OPO, over the next two decades, several emerging factors and systemic changes will likely change the reliability and operability of the transmission and distribution system. These changes include policy decisions related to clean energy integration and demand growth related to electrification of buildings and transportation, the increasing proliferation of distributed generation (DG), major plant turnover across the supply mix, and transmission facilities reaching their end-of-life. New infrastructure, planning considerations and technical solutions will have to be considered and developed in advance to respond to the changes that are looming to ensure that Ontarians continue to be reliably served by a modern grid. Maximizing the use of existing assets, including transmission as a cost-effective alternative to new natural gas generation to supply load centres, should be a primary consideration for the LTEP. This should include gaining a full understanding of the potential of transmission infrastructure to reduce the supply required by the province.

It is known that transmission constraints limit transfer capability between regions and that alleviating them through investment not only opens possibilities for new, clean generation when it is needed, but the cost-effective movement of additional energy potential from existing stations to where it is needed. The Lower Mattagami Hydroelectric Project is an example of where nearly 450 MW of additional capacity was added to existing generating facilities in OPG's Northeast Plant Group. While the East-West Tie will add approximately 500 MW of interface transfer capability between Northeast and Northwest Ontario, load growth and peak demand needs are highest in Southern Ontario, in particular the Greater Toronto & Hamilton Area (GTHA).

The OPO indicates that a North-South reinforcement between Sudbury and the GTHA in an existing right of way could enable an additional 1,000-1,500 MW of transfer capacity between Northern and Southern Ontario. Given the lead time associated with major transmission projects (7+ years) feasibility work on both the reinforcement itself and the incremental clean supply that could be facilitated to load centres should be an identified undertaking of the LTEP.

OPO Outlooks C and D are meant to include existing supply commitments and directions, as well as other related government commitments contained in the CCAP. These commitments follow the 2013 LTEP, and have the potential to materially alter planning assumptions that were made less than three years ago which directly concerns LDCs from an infrastructure perspective and also from a CDM program alignment perspective. Looking forward, meeting the 2030 and 2050 CCAP emission reduction targets will require substantial electrification of transportation and buildings. While OPO Outlooks C and D model the impacts of electrification on bulk system demand, the IESO concedes the most significant challenges will experienced at the distribution level.

In addition to the $1-1.32 billion that is earmarked from the Greenhouse Gas Reduction Account (GGRA) to offset the impact of Cap & Trade on electricity rates, the most significant consideration is the extent

of the inducements and subsidies for gradual transition away from fossil energy for transport and heating to lower-carbon sources, primarily electricity. Additionally, over $1 billion will be spent between 2017-2020 building electric vehicle (EV) infrastructure, subsidizing the purchase price of EVs, expediting the installation of air and ground-source heat pumps in buildings, and providing substantial rebates for the purchase or construction of near net zero carbon emission homes.

In the instance of EVs, OPO Outlooks C and D reflect 2.4 million electric vehicles on the road by 2035, which translates into an incremental net energy demand of approximately 8 TWh annually and a potential 1,200 MW increase in peak demand. While the OPO does not specify the geographic distribution of those EVs, it can be assumed that the majority will be served by urban LDCs. The technical ability of existing distribution infrastructure to accommodate a rapid deployment of EVs accompanied by different sizes of public and private charging stations is an issue that requires serious consideration. Likewise, how any incremental infrastructure investment required to accommodate large-scale, climate-related electrification is paid for is another important question for the LTEP to consider in the context of the Distribution System Code as well as the Ontario Energy Board (OEB) regulatory environment.

Using the example a pole-mounted transformer with a 100 kVA capacity serving 19 households, a high degree of penetration of EVs could be accommodated assuming each household uses a 3.3 kW capacity charger or less. However as faster, higher capacity chargers become more economic or appropriately subsidized, consumers will prefer them, and in this case transformer overloading can occur quickly. The below chart illustrates that if 16 or 20 kW capacity chargers become more widespread, just 4 or 5 EVs generate an overload.

Air-source heat pumps (ASHP) and ground-source heat pumps (GSHP) widely deployed across the residential base significantly exacerbate the risk of overloading, particularly in the winter. For example, some distribution infrastructure is built for a 5 kW peak load per household. On a cold day, a single household with an ASHP could have a peak demand requirement of three times that amount.

The LTEP should as well give consideration to how the OEB will assess incremental capital requirements of utilities that result from a policy-driven shift toward electrification. Ontario must fully understand the regulatory mechanics of how a large and inevitable cost to utilities of enabling behavioural changes by only some of their customers accessing government subsidization should be the responsibility all utility consumers, if at all. Perhaps the GGRA is a more appropriate funding mechanism for the system-side upgrades designated as qualifying infrastructure required to enable GHG emission reductions. This, along with the technical implications of electrification, should be reflected as an area of further engagement with industry stakeholders in the LTEP.

Number of EVs in addition to household load	Transformer load (kVA) EV charger capacity						
	1.4 kW	1.9 kW	3.3 kW	6.6 kW	10 kW	16 kW	20 kW
1	37.2	37.6	38.9	41.9	45.1	50.8	54.6
2	38.4	39.4	41.9	48.1	54.6	66.2	74.0
3	39.7	41.1	45.0	54.4	64.2	81.8	93.6
4	41.0	42.9	48.1	60.8	74.0	97.6	113.4
5	42.3	44.6	51.3	67.2	83.8	113.4	133.2
6	43.6	46.4	54.4	73.6	93.6	129.3	153.1
7	44.9	48.2	57.6	80.1	103.5	145.2	173.0
8	46.2	50.0	60.8	86.5	113.4	161.1	192.9
9	47.6	51.8	64.0	93.0	123.3	177.0	212.9
10	48.9	53.6	67.2	99.5	133.2	192.9	232.8
11	50.2	55.5	70.4	106.1	143.2	208.9	252.8
12	51.5	57.3	73.6	112.6	153.1	224.9	272.8
13	52.9	59.1	76.8	119.1	163.1	240.8	292.7
14	54.2	61.0	80.1	125.7	173.0	256.8	312.7
15	55.6	62.8	83.3	132.2	183.0	272.8	332.7
16	56.9	64.6	86.5	138.8	192.9	288.7	352.7
17	58.3	66.5	89.8	145.4	202.9	304.7	372.6
18	59.6	68.3	93.0	151.9	212.9	320.7	392.6
19	61.0	70.2	96.3	158.5	222.9	336.7	412.6

Impact of electric vehicles at the neighbourhood level
Source: Electric Mobility Adoption and Prediction (Toronto), Pollution Probe

Renewable Energy – Biomass & Hydroelectric

The Society recommends that the LTEP plans for:

1. **Continued operation of renewable bioenergy facilities in Northern Ontario; and**
2. **Additional renewable energy partnerships with First Nations.**

The successful conversions of Atikokan Generating Station (AGS) to biomass and Thunder Bay Generating Station (TBGS) to advanced biomass from coal have made Ontario a North American leader in bulk-scale renewable capacity with dispatchable properties. While these stations are required primarily for peaking needs, as they were multiple times this past summer, they are able to provide the IESO with a degree of flexibility that wind, solar and run-of-river hydro do not, and do so without relying on fossil fuel. Part of the attractiveness of an advanced biomass conversion for TBGS was the potential that an Ontario-based supplier could be established at a price that is competitive with the cost of imported fuel. Several companies, including OPG's current supplier of advanced biomass, have expressed an interest in anchoring a North American production facility in the Thunder Bay area. However, a five-year off-take agreement has proven not to be sufficient to warrant the capital investment in a new plant.

Extending the life of TBGS as an advanced biomass plant beyond its current five-year plan would likely enable a biomass industry cluster in Northern Ontario, supporting the forestry industry, creating opportunities for First Nations and opening up export potential for product and expertise globally. Additionally, the presence of TBGS reduces the likelihood that a special protection scheme is activated regionally which would cause load rejection if a contingency such as an equipment failure on the transmission system occurs.

Peaking facilities that do not rely on fossil fuel will become more valuable to the province as time goes on and transmission investments reinforcing the connection between regions at both ends of Lake Superior means that access to resources to meet local needs do not need to be confined to that region alone. The addition of a North-South transmission reinforcement would mean that renewable supply across Northern Ontario could be accessed as part of meeting demand growth without increasing emissions.

Clean energy projects can also provide a significant benefit to First Nation communities. Examples of this include OPG's partnerships with the Moose Cree First Nation on the Lower Mattagami Hydroelectric Project and Coral Rapids Power, a company wholly owned by Taykwa Tagamou Nation. Coral Rapids Power is building the new Peter Sutherland Sr. Hydroelectric Generating Station on the Abitibi River. Further potential exists on the Little Jackfish River, where nearly 100 MW of additional hydroelectric capacity has been identified, offering the opportunity for a clean energy partnership with the First Nations surrounding Lake Nipigon.

Conclusion

The Society believes that an LTEP can be both forward thinking and pragmatic, environmentally sustainable and respectful of ratepayers. The 2013 LTEP provides a strong foundation to build from, and while new challenges have presented themselves as a result of necessary decisions made subsequently, working together we believe these challenges can be overcome like those before. We look forward to continuing the discussion on how best this can be done, and would be pleased to meet with the Ministry of Energy in this regard in the near future.

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