

MINISTRY OF ENERGY'S 2017 LONG-TERM ENERGY PLAN MODELLING ASSUMPTIONS

This document summarizes the modelling assumptions for the reference outlook to inform the Ministry of Energy's 2017 Long-Term Energy Plan ("2017 LTEP").

The document reflects the IESO's understanding of the assumptions to be assumed for the 2017 LTEP based on IESO/ENERGY discussions between February and April 2017 and comments received from ENERGY staff on April 1, 2017.

In order to proceed with analytics, the IESO is seeking Ministry sign off on this document no later than Friday April 7, 2017

Section 1 – Assumptions**Outlook Timeframe**

- The IESO will model the LTEP for the period 2017 to 2035 to align with the timeframe presented in the 2016 Ontario Planning Outlook (OPO).

Demand

- It is the IESO's understanding that ENERGY's preference is to consider a single demand outlook as the reference forecast. The reference demand forecast for the 2017 LTEP will be OPO Outlook B with the addition of electric vehicle (EV) demand assumptions per Outlook D (i.e., 2.4 million EVs by 2035).
- It is the IESO's understanding that ENERGY's preference is to consider a range of sensitivities around the reference demand forecast, with the range of sensitivity starting in 2026. Therefore, two sensitivities will be developed around the reference demand forecast to illustrate higher and lower ranges beginning in 2026:
 - The lower range will have similar assumptions to OPO Outlook A.
 - The higher range will assume higher household growth, higher new square footage growth in various commercial buildings, and greater growth in the industrial sector.
- Detailed energy/costing analysis will not be performed for the low and high demand sensitivities. Instead, their implications may be described qualitatively.

Conservation and Demand Response

- The 2013 LTEP targets 30 TWh of energy efficiency by 2032 and assumes that the near term target set in the Conservation First Framework and Industrial Accelerator Program of 8.7 TWh will be achieved by 2020.
- The IESO understands that ENERGY is seeking analysis on modeling a higher than 2013 LTEP conservation target within the OPO Outlook B. Based on discussions with the ADM and Michael Lyle, the IESO will perform analysis assuming 1) the 2013 LTEP conservation targets and 2) a higher conservation target.

- The 2013 LTEP included a Demand Response target which includes Time-of-Use (TOU), Industrial Conservation Initiative (ICI) and demand response (DR) auction combined to meet 10% of peak demand by 2025. It is the IESO's understanding that ENERGY requests to eliminate the demand response target that was established in 2013 LTEP for the 2017 LTEP base case. The IESO will assume for the 2017 LTEP base case that TOU and ICI will continue to persist throughout the planning horizon and any DR currently procured through the DR auction would continue to be available in future auctions. Should there be capacity needs moving forward, additional demand response could be procured through the capacity auction.

Supply

- The IESO will assume the nuclear schedule that is consistent with OPO, which reflects OPG's current business plan and the amended Bruce refurbishment agreement:
 - Bruce as per the schedule in the finalized ABPRIA;
 - Pickering continued operations to 2022/2024 (Note from ENERGY: In March 2017, OPG Board approved operation of all six units to 2024 subject to system needs and project economics. As such, the additional two years is considered a supply option/scenario rather than a base case);
 - Darlington as per the finalized refurbishment schedule.
- It is the IESO's understanding that ENERGY does not want to consider operation of all six Pickering units to 2024 as part of the analysis. The IESO will assume Pickering continued operations to 2022/2024 for the base case.
- The IESO will reflect the October 2016 Ontario-Quebec Electricity Trade Agreement.
 - Energy 2.3 TWh per year (2017 to 2022 inclusive) Quebec to Ontario;
 - 500 MW capacity per winter December to March (2016/17 to 2022/23 inclusive) Ontario to Quebec; and
 - 500 MW capacity Quebec to Ontario in return for delivery of 500 MW to Quebec in 2015/16 as part of original capacity swap.
- The IESO will reflect recently contracted new resources e.g. Chaudiere Falls Gatineau No.1 and Hull No.2 waterpower contracts.
- The IESO will assume the suspension of Large Renewable Procurement II and Energy From Waste Procurement as a result of the September 2016 direction.
- The IESO will assume FIT 5 and microFIT 2017 are the remaining renewable programs to be procured that are not yet online or contracted.
- The 2013 LTEP set renewable capacity targets of 10.7 GW for non-hydroelectric by 2021 and 9.3 GW for hydroelectric by 2025. The IESO will assume the elimination of hydro and non-hydro renewable targets and that there will be no further renewable procurements beyond FIT 5 and microFIT 2017 in the 2017 LTEP reference outlook.

Costs

Commented [IESO1]:

The IESO will assume Pickering continued operations to 2022/2024 for the base case.

Commented [AH(2)]:

Request: IESO to confirm what assumptions it will make about potential attrition for future contracts. Also, IESO to confirm what attrition (if any) it is assuming for existing contracts where projects haven't yet come into operation.

Commented [IESO3]: A 15% attrition is assumed for all contracted FIT and LRP 1 that has not yet reached COD, with the exception of FIT 1, as it is assumed those contracts will likely reach COD. Attrition is not assumed for the procurement targets for FIT 5 and microFIT 2017.

Commented [CH(4)]: CRED: What is the cut-off date for determining currently contracted resources (e.g. Dec 31, 2016)?

Request:

IESO to reflect anticipated uptake of net metering, and modeling to consider recent Part 1 regulatory amendments and potential part 2 changes. Modeling should consider uptake driven by potential CCAP/GreenON incentives.

Commented [IESO5]: Chaudiere Gatineau No. 1 and Chaudiere Hull No. 2 hydro facilities will be in the base case. The contract list will be updated to January 31, 2017.

The IESO assumes the impact on net metering will be relatively small as compared to previous IESO procurement programs (ex. microFIT). For simplicity, no explicit net metering uptake is assumed. The IESO will incorporate anticipated uptake of net metering if assumptions are provided by ENERGY.

Commented [IESO6]: The transmission outlook is not expected to be significantly different than OPO Outlook B, and end of life considerations will be investigated as part of the implementation plan.

Commented [IESO7]: The distribution cost forecast will be based on the most recent historical base data for electricity distribution costs for the province from the OEB year book. In OPO, the base distribution cost is the actual 2015 costs. This historical base is indexed to increase based on the year over year change of the housing stock assumption in the load forecast.

The forecast is not Toronto Hydro specific, and is not a forecast based on the change due to inflation.

- The IESO will assume natural gas price forecast per the Sproule projection as of February 2017. Further updates to the gas price forecast will lengthen modelling timelines. The IESO will assess a lower and higher gas price forecast for sensitivity.
- The IESO will include new higher contracted price information for existing NUG contracts..
- The IESO will assume carbon cost as the reserve price (i.e., the floor price) projection in the 2017 LTEP base case, and the “updated CA-QC-ON Bloomberg Nov 2016” projection for the sensitivity.
 - Note that the reserve price projection is slightly different from the OPO forecast; it now includes the actual floor price for the March 2017 cap and trade allowance auction as notified in January 2017, and this value is inflated by 5% as per the cap and trade regulations and added an assumed inflation factor of 2%.
 - The “updated CA-QC-ON Bloomberg Nov 2016” projection has been provided to IESO via ENERGY.
 - See Appendix for the carbon price projection values.
- The IESO will assume OPG nuclear rates to be consistent with the revised OPG Rate Smooth received from Tim Christie on March 13, 2017. The IESO will use the OPG nuclear outage data received from Tim Christie on March 10, 2017, and the nuclear production data received from Tim Christie on March 13, 2017. No change to Bruce Power nuclear prices from OPO.
- The IESO will assume OPG hydro rates to be consistent with the data received from Tim Christie on March 23, 2017.
- Upon contract expiry, for modelling purposes, the IESO will assume the assets will continue to be available for the duration of the planning outlook (i.e. similar to Outlook B in OPO). This recognises that the system can benefit from a portion of ongoing value from these assets with some re-investment, rather than requiring complete new build to meet the demand. The results of the “Benefits Case Assessment of the Market Renewal Project” prepared by the Brattle Group indicates that the cost based methodology used in the 2016 OPO would generate slightly lower results than the market based methodology pricing for these assets after contract expiry. The capacity market will be the implementation mechanism that achieves these cost based values for these assets after contract expiry.

For the 2017 LTEP, the following assumptions will be used for costing expired contracts:

	Contract Expiry Cost Assumptions
Natural Gas	The contract information converted to a generic gas plant with re-investment proportions assumptions per Hatch Report.
Wind	Based on LRP I, with a discounted capital cost re-investment assumption for end of life components and accounting for on-going value from the balance of the asset. This cost assumption is lower than that used in 2016 OPO.
Solar	Based on LRP I, except that future investments for end of life components that need to be replaced decline in cost to recognise technological improvements. This cost assumption is lower than that used in 2016 OPO.

Industrial Rates and Residential Bills

Commented [MR(8): Unclear what is being said here – isn’t the broad assumption that re-contracting will be based on the market-based methodology that will re-contract at a lower price than the cost-based model?

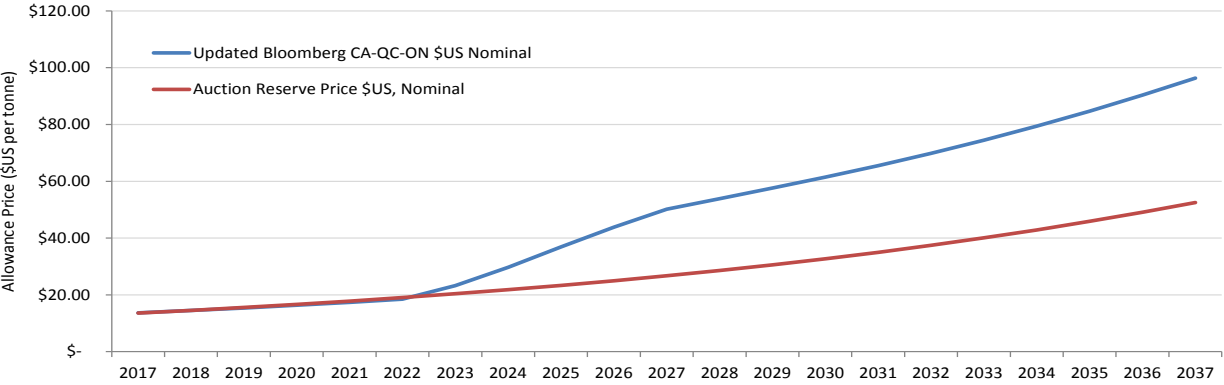
Commented [MR(9): Confusing as above – the CM will use a market-based approach?

- The industrial rates and residential bill impacts will not reflect recycling of proceeds from the Cap and Trade program.
- The residential bills will be the base bills, prior to the application of the Ontario's Fair Hydro Plan.
- Application of the Ontario's Fair Hydro Plan to the residential bills will require specific guidance and direction from ENERGY.

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Appendix Carbon price projection

	Assume same rate of increase as that observed from 2029 to 2037																				
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Updated CA-QC-ON (\$US, Nominal) - Bloomberg Nov 2016 (Provided by ENERGY)	\$13.62	\$14.47	\$15.39	\$16.34	\$17.37	\$18.47	\$23.21	\$29.67	\$36.85	\$43.85	\$50.13	\$53.87	\$57.60	\$61.43	\$65.50	\$69.85	\$74.49	\$79.44	\$84.71	\$90.34	\$ 96.33
Auction Reserve Price (aka Floor Price) (\$US, Nominal) - Derived from Feb 2017 Auction Reserve Price, which is inflated by 5% plus inflation each year. Inflation assumed to be 2%. Reserve price is determined prior to each auction, and is taken as the higher of the CA and QC reserve price, converted to the same currency. The prevailing reserve price in a given year will depend on the exchange rate, as well as the inflation in each of the two jurisdictions.	\$13.57	\$14.52	\$15.54	\$16.62	\$17.79	\$19.03	\$20.36	\$21.79	\$23.32	\$24.95	\$26.69	\$28.56	\$30.56	\$32.70	\$34.99	\$37.44	\$40.06	\$42.87	\$45.87	\$49.08	\$ 52.51



Commented [IESO10]: Yes, the minimum price for each auction is determined by selecting the higher of the QC and CA minimum prices, including the prevailing currency exchange rate. This approach is outlined in section 71 of O.Reg. 144 “The Cap and Trade Program”, as shown below.

Minimum price

71. (1) The minimum price of an emission allowance in an auction is the higher of the annual auction reserve prices most recently established, as of the day of the auction, for each of Quebec and California.

(2) The annual auction reserve price for each of Quebec and California is the price set out for each jurisdiction in the annual auction reserve price notice published by and available on the website of the California Air Resources Board.

(3) If an annual auction reserve price is listed in a currency other than Canadian dollars, the price is deemed, in Canadian dollars, to be the amount that would be realized by converting to Canadian dollars the amount at the following rate:

1. If, on the day before the day of the auction, the Bank of Canada provided a Canadian dollar exchange rate for that currency, the currency conversion is calculated at that rate.
2. If paragraph 1 does not apply, the currency conversion is calculated at the Canadian dollar exchange rate for that currency as provided by the Bank of Canada for the date that is before, and is as close as possible to, the day of the auction.