#	Request	Response	Public Source?
Power System Planning			
1	With the release of the LTEP, is the Ontario Planning Outlook (OPO) expected to be updated (e.g. changes to assumptions regarding supply, demand, price, etc.)? If so, how?	The IESO produced the Ontario Planning Outlook in 2016 in response to a request from the Minister of Energy for a technical report in support of the development of the 2017 Long-Term Energy Plan (2017 LTEP), pursuant to Section 25.29 (3) of the *Electricity Act, 1998* ("The Act"). The 2017 LTEP was issued on October 26, 2017. Pursuant to O. Reg 355/17 section 1(2), each subsequent LTEP shall be issued within three years of the approval by the Minister of all implementation plans submitted under section 25.31 of the Act in respect of the preceding long-term energy plan, or, within three years of the issuance of the preceding long-term energy plan if no implementation plans were required to be submitted in respect of it. The IESO will deliver its Implementation Plan for to the Minister by January 31, 2018. The Ontario Energy Board is also required to submit an Implementation Plan to the Minister January 31, 2018. The IESO does not know when the Minister will approve all implementation plans. The IESO does not plan to issue an update to the 2016 OPO, but will issue a new OPO in support of the development of a subsequent LTEP, if requested by the Minister of Energy. LTEP Implementation Directive to IESO: http://www.ieso.ca/-/media/files/ieso/document-library/ministerial-directives/2017/directive-2017-ltep-20171026.pdf?la=en LTEP Implementation Directive to the IESO: https://www.oeb.ca/sites/default/files/Directive_to_OEB_LTEP_Implementation_Plan_20171026.pdf As part of its mandate, IESO will continue to planning for the province's future energy needs including: • Quarterly 18-month Outlook • Regional Planning for the 21 regions across the Province: http://www.ieso.ca/get-involved/regional-planning	Public

#	Request	Response	Public Source?
Power System Planning			
		• Annual submissions, as required, as part of NERC's Long-Term Reliability Assessment process	
2	Please provide an update with 2016 data for the cost of service tables on slides 42 and 43 of OPO Module 1.	Refer to "ECO Information Request – Supporting Tables.xlsx" tab 2.	2016 data is not public yet – confirming timing
3	Please clarify if the cost of service in the above tables is shown before or after the impact of any rebates/expenditures funded through the tax base (e.g. the Ontario Clean Energy Benefit, Northern Industrial Electricity Rate Program).	The total cost of electricity service is before rebates that are funded through the tax-base	Public
4	Please explain why the cost of electricity service decreased between 2005 and 2006 (OPO Module 1, Slide 42).	2005 was an anomalous year. Unusual weather and tight supply conditions led to very high demand and record market prices for power. – Ontario Demand in 2005 was a peak demand year at 158.8 TWh, the highest over the decade as shown in OPO Module 1, Slide 3. – Installed Generation capacity was lower in 2005 compared to 2006. – Ontario was a net importer in 2005, as shown in OPO Module 1 slide 24. These conditions resulted in higher generation costs in 2005. In 2006, the Ontario demand reduced by 6 TWh to 152.8 TWh, thus the generation cost to meet the reduced demand also declined. Ontario also returned to being a net exporter in 2005 (see OPO Module 1 slide 24).	Public OPO Module 1

#	Request	Response	Public Source?
Power System Planning			
	a. In the response, please explain how the cost of service decreased over this period while the rates set by the OEB's Regulated Price Plan increased.	The Environmental Commissioners Office confirmed on December 6th that a response is not required from IESO for this portion of the question. Note to ECO: OEB best suited to respond	
5	If possible, please provide details about how much the gas plant relocations has impacted the cost of electricity service.	The IESO view on the costs of the gas plant relocations is contained in the reports issued by the Auditor General of Ontario: *Mississauga Power Plant Cancellation Costs, Special Report, April 2013* http://www.auditor.on.ca/en/content/specialreports/specialreports/mississaugapower_en.pdf *Oakville Power Plant Cancellation Costs, Special Report, October 2013*: http://www.auditor.on.ca/en/content/specialreports/specialreports/oakville_en.pdf	Public
6	Please include forecasts up to 2030 if possible for the cost of service tables on slides 42 and 43 of OPO Module 1, as well as the key assumptions in the forecast (e.g. amount and cost for new supply resources).	The OPO developed a number of forecast cases which has the cost of electricity service results provided in the following link (see Module 7: Electricity System Cost Outlook): http://www.ieso.ca/en/sector-participants/planning-and-forecasting/ontario-planning-outlook	Public
7	Please clarify how the Fair Hydro Plan's refinancing of the Global Adjustment is treated in the above cost of service forecasts.	The Cost of Electricity Service forecast would not have been impacted by Ontario's Fair Hydro Plan's refinancing plan to provide rate payers with a 25% bill reduction. The various electricity cost components would still to be incurred irrespective of Ontario's Fair Hydro Plan. However, under Ontario's Fair Hydro Plan, costs collected from ratepayers is lower to achieve the 25% bill reduction so customers will only pay a portion of the applicable Global Adjustment (GA) with the remaining shortfall to be funded by the financing plan of Ontario's Fair Hydro Plan.	Public
8	Please provide any additional relevant assumptions incorporated into the residential bill forecast (LTEP 2017, Figure 5)	The residential bill forecast in the 2017 LTEP is the Ministry of Energy's Outlook that includes Ontario's Fair Hydro Plan. The IESO has no additional relevant assumptions. The Residential Bill Forecast will be included in the 2017 LTEP Modules published by the Ministry of Energy.	Public

#	Request	Response	Public Source?
Power System Planning			
9	Has the IESO modeled the cost and bill impacts of the "low emission outlook" shown in Figure 19 of the 2017 LTEP? If so, please provide.	The IESO has not modeled cost and bill impacts for this low emission outlook shown in Figure 19 of the 2017 LTEP. The low emission range was derived by reducing the gas burn and assuming the energy could be provided by non-emitting resources. The non-emitting resource could be from multiple non-emitting resources and in various combinations, so no costing or bill impacts are available.	NA
10	Please provide the 10-year energy and demand forecasts (and any supporting documents) that have been submitted to NERC for its Long Term Reliability Assessments, from 2005 onwards.	The demand and energy forecasts submitted by IESO to the North American Electric Reliability Corporation (NERC) for the Long Term Reliability Assessments (LTRA) from 2005 onward are in the attached spreadsheet. Supporting yearly narrative word documents are also attached.  ECO Information Requestion #10.zip Note: The energy and demand forecasts in the attached for each year are superseded by each successive year, taking in to account known policy and economic conditions. This information was only released to NERC and not otherwise released in this form.	No – See Note

#	Request	Response	Public Source?
Power System Planning			
11	Are there methodological differences between these forecasts and the forecasts that have been developed for the LTEP/IPSP during this time frame? If so, please describe.	The LTRA forecasts are a combination of the near term forecast generated under the 18-Month Outlook process and the long term demand forecast that forms the basis of the LTEP and IPSP. The first two years of the LTRA forecast come from the 18-Month Outlook and the remainder comes from the forecast underpinning the LTEP/IPSP. The only difference between the long term forecast in the LTRA and that in the LTEP/IPSP is that the LTRA forecast requires demand at the grid level whereas the LTEP/IPSP demand forecast is based on net electricity demand. The difference between grid and net demand is the impact of embedded or distribution connected generation. The LTRA submission uses the long term forecasts from the LTEP/IPSP and adjusts them downward for the projected output of embedded generators.	No
12	Several years ago (around 2014), the IESO's Power System Planning group produced a detailed report/slide deck forecasting Ontario's future demand. This report is no longer on the IESO website – can the IESO please provide?	The report "Ontario Electricity Demand: 2012 Annual Long-Term Outlook". is available here: http://cms.powerauthority.on.ca/sites/default/files/news/Q2-2012LoadForecast.pdf Note to ECO: Confirm this is relevant since it was superseded by OPO	Public
13	Please provide the installed grid-connected capacity of different electricity supply sources every year at year end, starting in 2005 (please refer to Fig 2 of the Auditor General's 2015 report on power system planning for reference: http://www.auditor.on.ca/en/content/annualreports/arreports/en15/3.05en15.pdf).	Refer to "ECO Information Request - Supporting Tables.xlsx" tab #13 for grid-connected, embedded, and total installed capacity by resource type. Note to ECO: Confirm ECO is looking for grid connected or if all installed capacity as in OPO is OK. AG report did not identify as grid connected (unclear)	Public
14	Please provide a table with electricity generation costs (including both HOEP and GA) as well as electricity production data for each generation source	Refer to "ECO Information Request – Supporting Tables.xlsx" tab #14 for electricity generation costs by Market costs (i.e., HOEP) and Global Adjustment (GA). Costs are in nominal dollars.	Public

#	Request	Response	Public Source?
Power System Planning			
14a	a. broken down so that we can recreate the following table for as many years between 2005 and 2016 as possible (please indicate whether costs are provided in real dollars (ideally)): **Figure 5: Breakdown of Generation Cost By Energy Sources, 2014** Source of data: Independent Electricity System Operator | Technology	Cost ($ million)	Total Production (TWh)
---	---	---
Nuclear	5,900	**94.9**
Hydro	1,835	**37.9**
Gas/Oil	2,287	**14.9**
Wind	935	**7.8**
Solar	884	**1.8**
Bioenergy	100	**0.5**
Coal	7	**0.1**
Other*	186	**1.6**
Imports	251	**4.9**
Export (Revenue)	(636)	**(19.1)**
Total Generation Cost	**11,749**	| * Includes electricity produced via storage Source: Auditor General's 2015 report, p. 212: www.auditor.on.ca/en/content/annualreports/arreports/en15/3.05en15.pdf	Refer to "ECO Information Request - Supporting Tables.xlsx" tab #14a. Costs are in nominal dollars.	No
14b	b. if possible, please also include annual cost and "production" data for conservation/demand response.	Refer to "ECO Information Request – Supporting Tables.xlsx" tab #14b for 2005 to 2016. Forecast data will be available in the 2017 LTEP Modules to be published by the Ministry of Energy.	Public

#	Request	Response	Public Source?
Power System Planning			
14c	c. If similar modeling has been done for the 2017 LTEP to estimate expected cost and production by energy source in future years (out to 2035), please provide.	This forecast data will be available in the 2017 LTEP Modules to be released by the Ministry of Energy.	Public
15	Please provide a copy of the Navigant report prepared for IESO, which provides a breakdown of the contributing elements of the global adjustment over time At one point the report (from 2016?) was available on the IESO website at this link: www.ieso.ca/documents/consult/se106/se106-20140128-Global_Adjustment_Review_Report.pdf	The Navigant Report is available through the following archive starting at page 20: http://www.ieso.ca/-/media/files/ieso/document-library/engage/completed/ga-review_completed-engagement.pdf	Public
16	Please provide a list of the IESO's current estimate of the levelized unit electricity cost (LUEC) of different types of new electricity resources (gas, nuclear, wind, firm imports, conservation, demand response, etc.), per kWh or per MW as appropriate, and any key assumptions behind these estimates (e.g., are associated transmission/distribution infrastructure costs to connect generation included).	IESO's current estimate of the levelized unit electricity cost is found in the OPO Module 7: Electricity System Cost OPO, slide 33 and OPO Module 4: Supply Outlook, Slides 55 to 62. http://www.ieso.ca/en/sector-participants/planning-and-forecasting/ontario-planning-outlook OPO Module 7 slide 33, "Simple Cycle Natural Gas-Fired Turbine and Demand Response are capacity based resources. The cost of these resources is not expressed as a LUEC (levelized unit energy cost) due to the limited amount of energy these resources are expected to provide (due to their low utilization)." However, the most readily available Gas Turbine LUECs range can be found in the 2013 LTEP which range from $85/MWh to $300/MWh ($2013), on page 22 http://www.energy.gov.on.ca/en/files/2014/10/LTEP_2013_English_WEB.pdf	Public OPO Module 4 NTD: possible more current info?
16a	a. If LUECs do not include a cost of carbon, please also include a column with LUECs that incorporate a cost of carbon.	The 2013 LTEP did not include a cost for carbon. The gas turbine LUECs with carbon would change the above gas LUEC range to $90/MWh to $318/MWh ($2013). [NTD: possible more current info?]	

#	Request	Response	Public Source?
Power System Planning			
16b	b. If possible, please also include estimates for the current cost of electricity storage per unit.	Contract prices from previous energy storage procurements (i.e., Alternative Technologies for Regulation, Energy Storage Phase 1 and Energy Storage Phase 2) are commercially confidential. Furthermore, these are procurements with pricing submitted by proponents through a competitive procurement process. The cost of electricity storage will vary widely by technology, connection point, application, and for the services provided. Estimated cost of residential-scale lithium-ion batteries is projected to decline from $640/kWh today to $300/kWh by 2032 (see OPO Module 4, slide 62). An example of publicly available information on the estimated costs of energy storage includes the annual energy storage cost analysis conducted by the consultancy Lazard: https://www.lazard.com/perspective/levelized-cost-of-storage-2017/	Public OPO Module 4

#	Request	Response	Public Source?
Grid Reliability			
17	Please provide any metrics the IESO uses to assess the reliability and resource adequacy of the IESO-controlled grid, and performance against these metrics from 2005 to the present. Some examples (not exhaustive – the IESO may be able to suggest additional metrics), could include:	The IESO complies with all applicable North American Electric Reliability Corporation (NERC) reliability standards; Compliance with reliability standards has always been mandatory and enforceable in Ontario through the Market Rules. The IESO is subject audit for compliance with these standards every three years and the IESO has always been found fully compliant with reliability standards. The IESO uses the Ontario Reliability Compliance Program (ORCP) to monitor, assess and enforce compliance with reliability standards and criteria in Ontario by all Market Participants. The IESO has several Corporate Performance Measures (CPMs) and one of which includes tracking for compliance to critical reliability standards. Specifically we state a goal of "100% compliance to North American Electricity Reliability Corporation high violation risk factor reliability standard requirements (including audit requirements) is self-certified by the IESO, demonstrating ability to sustain the reliability of the power system." Details can be found at http://www.ieso.ca/corporate-ieso/corporate-strategy-and-business-planning/corporate-performance In the OEB Decision and Order to approve the IESO's 2017 expenditure, revenue requirement and fees (EB-2017-0150), the OEB also determined that the IESO's proposed Regulatory Scorecard was acceptable; the Scorecard includes a measure that the IESO is compliant with NERC high risk reliability standards (i.e. high Violation Risk Factor (VRF) standards). For assessing resource adequacy in the planning timeframe, IESO utilizes the following indices/metrics: 1) **Annual Loss of Load Expectation (LOLE)** is calculated to satisfy the Northeast Power Coordinating Council (NPCC) resource adequacy design criterion stated in NPCC Regional Reliability Reference Directory # 1: Design and Operation of the Bulk Power System. LOLE is calculated under various conditions: with activation of operating	Public

#	Request	Response	Public Source?
Grid Reliability			
		procedures, with interconnection assistance, with rescheduled outages etc. 2) **Reserve Margin requirements** are calculated for 5-year period using the NPCC LOLE criterion. This margin identifies that minimum reserve requirement on the system to meet the NPCC LOLE criterion. These are planning metrics/indices used to measure the reliability of the system to a set standard, NPCC criterion (Directory 1). The indices are calculated probabilistically accounting for uncertainty associated with supply and demand. A certain level of loss of load identified in the planning timeframe does not translate into the same amount of loss of load events in real time. Further, in the actual operation of the system, any potential loss of load would be managed through actions available in real-time without causing any significant impact to customers. As such these indices are not tracked.	
17a	a. Number of weeks that Reserve Above Requirement has been forecast to be below zero (in 18-month outlooks), under normal and extreme weather conditions;	Refer to "ECO Information Request – Supporting Tables.xlsx" tab 17a for the number of weeks when Reserve Above Requirement (RAR) was forecasted to be below zero from 2005 onwards.	Public (all prior 18 month outlooks)
17b	b. Frequency and duration of events where the IESO has needed to use emergency operating procedures (as defined in Ontario Reserve Margin Requirements: 2017 – 2021) or other control actions to mitigate resource shortfalls in the operating timeframe.	Refer to Appendix 17b	Public

#	Request	Response	Public Source?
Grid Reliability			
17c	c. Frequency and duration of outages on all or part of the IESO-controlled grid (would this be identical to the SAIDI/SAIFI statistics reported by Hydro One's transmission arm? Why or why not?).	The IESO complies with all applicable NERC reliability standards; Compliance with reliability standards has always been mandatory and enforceable in Ontario through the Market Rules. The IESO does not track this information as it is not required by NERC Reliability Standards or Market Rules applicable to IESO. [NTD: Discussed with ECO – prepared for this response]	
18	Does the IESO have any data/reports that present the IESO's performance against other comparable jurisdictions such as NY or Massachusetts in terms of grid reliability over the years?	The IESO complies with all applicable NERC reliability standards; Compliance with reliability standards has always been mandatory and enforceable in Ontario through the Market Rules. The IESO measures its reliability in the planning timeframe based on the LOLE metric that is used by many other jurisdictions including all the Reliability Coordinators that fall under NPCC jurisdiction. However, IESO does not compare its performance against other jurisdictions because every region is unique in terms of its supply mix, demand levels and transmission assets. [NTD: Discussed with ECO – prepared for this response]	

#	Request	Response	Public Source?
Surplus Baseload Generation			
19	Please define which electricity resources the IESO considers as "baseload generation" and break down the amount of baseload generation capacity (MW) by resource type (e.g. wind, solar, hydro, NUGs, etc.) on the system at year-end, for each year from 2005 onwards.	Surplus Baseload Generation (SBG) occurs when the baseload generation is higher than the Ontario Demand plus net exports. SBG typically occurs during periods of low demand in Ontario. The resources referred to as "baseload generation" that drive this surplus is related to resources that at that time cannot be turned down without economic consequences and can include nuclear generation, run of river waterpower generation, and intermittent generation such as wind and solar. These latter resources are turned down and their "fuel" (water, wind, or solar energy) is "spilled". In the case of nuclear the units can be turned down to some extent or shut down and in either case fuel continues to be consumed. Also refer to OPO Module 1, slide 28 (http://www.ieso.ca/en/sector-participants/planning-and-forecasting/ontario-planning-outlook). The IESO does not breakdown baseload generation capacity by resource type since SBG occurs on an energy basis based on load requirements and generation output. For example hydroelectric baseload is subject to the water flow conditions. When the flow is high, more hydroelectric would become baseload. When the flow is low, less hydroelectric would become baseload as lower the river water conditions may allow water to be stored. As a result, IESO does not break the generation capacity by baseload vs. non-baseload. See the response to question 13 for a breakdown of installed capacity by resource type.	Public

#	Request	Response	Public Source?
Surplus Baseload Generation			
20	Please provide the expected amount of baseload generation capacity (MW) by resource type in future years (as far out as IESO has projected), based on existing contracts, and committed and directed resources.	The IESO does not breakdown generation capacity by baseload vs. non baseload since SBG occurs on an hourly energy basis from the difference between the load requirements versus base load generation output. For example hydroelectric baseload is subject to the water flow conditions and is not capacity related. When the flow is high, more hydroelectric would become baseload. When the flow is low, less hydroelectric would become baseload as lower the river water conditions may allow water to be stored. Year-end capacity by fuel type for future years, for existing, committed and directed resources, can be found in the 2016 Ontario Power Outlook Module 4: Supply Outlook on slides 7, 11, and 13 respectively (http://www.ieso.ca/-/media/files/ieso/document-library/planning-forecasts/ontario-planning-outlook/module-4-supply-outlook-20160901-pptx.pptx?la=en) Capacity data by resource type in future years based on the 2017 Long Term Energy Plan will be available in the 2017 LTEP Modules to be published by the Ministry of Energy. The IESO included analysis of baseload generation in future years in evidence filed to the OEB for Ontario Power Generation's (OPG) 2017 – 2021 rate application (EB-2016-0152) and plan to extend the safe operation of Pickering nuclear station: https://www.opg.com/about/regulatory-affairs/Documents/2017-2021/F2-02-03_Pickering_Extended_Operations_20161110.pdf The IESO's analysis was included as part of the evidence at Exhibit F2-2-3, Attachment 1, pages 1 – 116.	Public
21	Please provide the number of hours in which each type of electricity resource (e.g., gas, nuclear, etc.) was on the margin in 2016, and 2017 (indicate end date of data for 2017). Please clarify the number of hours in which the marginal resource was considered "baseload generation".	Refer to Appendix 21	No

#	Request	Response	Public Source?
Surplus Baseload Generation			
22	In the hours where hydro is the marginal resource in 2016 and 2017, can the IESO estimate (qualitatively or quantitatively) what % of hours this marginal hydro resource is baseload (i.e. it must either be used or spilled) and what % of hours this marginal hydro resource is “peaking hydro” (i.e. it could be saved and used at a later time).	It is possible that the hydro at the margin can be stored and used in other hours; however the only pumped hydro storage facility in Ontario is Sir Adam Beck Pump Generation Station. The IESO does not define "Peaking Hydro". The data provided is for any marginal hydro resources offered above $20 for the hour (Note 1). The % of hours of hydro marginal resources with offers above $20: 2016: 3.2% 2017: 5.0% (Note 2) Note1: The $20 threshold is determined based on the assumption that most water rental cost for hydro plants is from $13 to $20. Note 2: through November 30,2017 **NOTICE: CONFIDENTIAL - INFORMATION IN THIS RESPONSE IS NOT PUBLIC**	No MP offer/bid information is used but individual MP’s offers/bids are not disclosed and not identifiable

#	Request	Response	Public Source?
Surplus Baseload Generation			
23	Please provide the IESO's most recent surplus baseload management plan, which estimates the amount of expected surplus baseload generation (TWh) in future years, and the mechanism that will be used to deal with this surplus (in other words, an updated version of Figure 11 from the Auditor General's Power System Planning report: http://www.auditor.on.ca/en/content/annualreports/arreports/en15/3.05en15.pdf	Refer to "ECO Information Request - Supporting Tables.xlsx" tab 23 for total SBG potential over the planning period. Figure 11 of the Auditor General's Power System Planning report was provided to the AG for illustrative purpose only, to describe potential actions that could be used to mitigate SBG and is not a management plan. The IESO issued the *2016 IESO Operability Assessment Review of the Operability of the IESO-Controlled Grid to 2020 ("Operability Study")* in June 2016 which considers the changes expected on the power system and identified operating challenges: http://www.ieso.ca/-/media/files/ieso/document-library/engage/esf/esf-20161208-2016-ieso-operability-assessment-summary.pdf?la=en The Operability Study (page 11) noted that, the IESO's current SBG mitigating measures are expected to be sufficient to manage SBG. These mitigating measures include: hydroelectric spill, economic exports, variable generation dispatch and nuclear manoeuvers/shutdowns.	Public
24	Please provide the amount of electricity that was curtailed by the province annually since 2005. Please break down the data by supply source (wind, solar, NUG, hydro, nuclear etc.)	Refer to Appendix Item 24	No
25	Our understanding is that the IESO does not directly curtail hydroelectric generators in surplus conditions, but that hydro operators without storage options may spill water instead of generating electricity if the HOEP drops below a certain level. Does the IESO collect data on the amount of hydro spill? If so, please provide, for 2005 onwards, if possible.	The IESO does not collect this information; this information is available from hydroelectric generators. [Note to ECO: As discussed, the IESO does not collect this information; this information is available from hydroelectric generators (e.g., OPG).]	Public

#	Request	Response	Public Source?
Surplus Baseload Generation			
26	Please provide the $ that generators were compensated annually for curtailment due to surplus baseload conditions since 2005. Again, please break down data by supply source, i.e. compensation paid in total for wind curtailment vs. nuclear curtailment etc.	Refer to "ECO Information Request – Supporting Tables.xlsx" tab 26 for annual compensation payments for curtailment due to surplus baseload conditions. [NTD: ECO is willing to review 2013 onward before determining need to review confidential information pre-2013.]	No
27	A December 16, 2016 directive from the Ministry of Energy enabled the IESO to negotiate replacement contracts with NUGs, which could potentially change their operating practices such that they are no longer a source of baseload generation. Has any progress been made on this initiative? If so, please describe.	The IESO executed five, short-term (less than two years in duration) enhanced dispatch agreements with NUGs in December 2016. Three of these agreements involved NUGs with two years or less remaining on their OEFC contracts. The other two short-term agreements involved NUGs with more than two years remaining on their OEFC contracts and, to date, subsequent negotiations have resulted in a long-term agreement (to cover the remainder of term of the OEFC contract) with one of these facilities; negotiations are still in progress on the other. In addition to the facilities, IESO is pursuing similar enhanced-dispatch opportunities with the remaining two thermal NUGs under OEFC contract.	Public
28	What were the results of the Industrial Electricity Incentive program (e.g. amount of electricity contracted through this program, and load shape of contracted electricity)? What lessons did the IESO learn as to whether the IEI's approach (providing discounted rates for new use of electricity in off-peak hours) is a useful tool to flatten Ontario's load curve and make use of surplus baseload generation?		

#	Request	Response	Public Source?
Surplus Baseload Generation			
29	Has the IESO considered restructuring electricity prices for uses other than storage (which was discussed in the 2017 LTEP)?	The Ministry of Energy and the OEB have the authority to restructure electricity prices. The IESO has initiated a $200 million comprehensive program to fundamentally overhaul Ontario's electricity market. Market Renewal is estimated to result in up to $5.2 billion in savings, the majority of which is estimated to be realized by ratepayers: "The Future of Ontario's Electricity Market, A Benefits Case Assessment of the Market Renewal Project" http://www.ieso.ca/-/media/files/ieso/document-library/engage/me/benefits-case-assessment-market-renewal-project-clean-20170420.pdf?la=en Under Market Renewal, one expected outcome is a restructuring of market prices with the implementation of the Single Schedule Market (SSM). The IESO is currently exploring design options and approaches for the SSM with stakeholders. The primary objective of the SSM is to reduce cost and gain efficiency in scheduling energy to meet provincial demand. The options represent the potential for a substantial change from uniform pricing; the approaches taken must be practical for suppliers and consumers but no decisions have been made.	Public
	a. In particular, reducing rates for electrification of fossil fuel uses to meet Ontario's climate goals, through selling electricity that would otherwise be sold cheaply to neighbouring jurisdictions (similar to proposal made by Professional Society of Engineers, here: https://www.ospe.on.ca/public/documents/advocacy/2016-ontario-energy-dilemma.pdf)		

#	Request	Response	Public Source?
Electricity Exports			
30	Please provide the annual electricity export revenue since 2005 (revenues from exports in hours when HOEP was positive minus revenue loss from exports in hours when HOEP was negative). Please indicate the amount of revenue loss from the hours when HOEP was negative.	Since the energy market does not reflect all costs of electricity, energy exports do not pay the HOEP and exports scheduled from Ontario are charged the market clearing price at the destination intertie zone (http://www.ieso.ca/-/media/files/ieso/document-library/training/qt-scheduling-limits-and-intertie-prices.pdf?la=en). This is known as the Zonal Clearing Prices (ZCP), which is established every five-minutes. The ZCP can be different from HOEP when an intertie is congested. Export congestion occurs when the total quantity of exports that is economic is unable to be scheduled due to the physical limits of the intertie. Historical ZCPs are published in the IESO's Real-time Market Price Report available under the "Price" tab at http://www.ieso.ca/power-data/data-directory. Refer to "ECO Information Request - Supporting Tables.xlsx" tab 30 for Annual export payments between 2005 and 2017 (YTD), separated by Energy payments and Other payments. Energy payments are further divided into two additional categories: a) Energy payments from exports when the ZCP at an intertie is below $0/MWh; and b) Energy payments from exports when the ZCP at an intertie is positive. The Other payments represent net payments from exports for wholesale market uplifts that recovered from energy consumers.	Data is aggregated from mostly publicly available data. No concerns releasing it in the aggregated annual form.

#	Request	Response	Public Source?
Electricity Exports			
31	Can the IESO estimate the reduction in GA costs due to export revenue annually since 2005? If this is not possible, can the IESO qualitatively describe the general impact of export revenue on generator cost guarantees, and how this might differ depending on generator contractual arrangements.	To clarify, Global Adjustment (GA) represents the costs associated with building new electricity infrastructure in the province, maintaining existing resources under contract, as well as providing conservation and demand management programs (http://www.ieso.ca/power-data/price-overview/global-adjustment). An estimation of the reduction in GA due to export revenue cannot be calculated. Resources under contract receive revenues from GA payments and wholesale energy revenues. Wholesale energy revenues are based on the amount of energy consumption (including exports) and the market clearing price of energy. Wholesale energy revenues have offsetting effects on the GA. For example, increases in wholesale energy revenues as a result of higher market clearing prices result in decreases in the GA. The reduction of GA for the different contract types as offset by consumption also cannot be calculated.	Public
32	Please provide projections of annual electricity exports (in $ of revenue expected and in TWh) until 2035.	Refer to "ECO Information Request – Supporting Tables.xlsx" tab 32 for the projections of annual electricity export revenues and energy for OPO Outlook B, and 2017 LTEP.	No
33	Please break down electricity exports by the marginal generation resource for 2015 and 2016, i.e. for each type of resource (nuclear, gas, etc.), provide the volume of electricity exports (TWh) when this resource type was at the margin.	It would not be possible to calculate the volume of electricity exports (TWh) for each marginal resource type as there could be more than one marginal resource type for one particular hour (i.e., there would be double counting of hours for each resource type as there might be multiple resource types at margin for each hour).	No

#	Request	Response	Public Source?
Electricity Exports			
34	Has the IESO done any analysis to estimate the price-sensitivity of the demand for electricity exports (e.g. would a higher average export price increase revenue, or decrease it due to reduced volume of exports)?	The IESO has not done this type of analysis. However, the Market Surveillance Panel (MSP) created an econometric model for export trade between Ontario and New York described in the MSP report for the period May 2006 – October 2006 (https://www.oeb.ca/documents/msp/msp_report_final_20061222.pdf). The report indicates that among HOEP, there are other variables affecting the volume of exports. This model was created by the MSP over 10 years ago when Ontario had a much different supply mix and demand levels from today. This model would not be applicable for the electricity market conditions of today. In addition, given the changes to the designs of Ontario and neighbouring electricity markets over the last 10 years, the associated complexities of these changes would not permit the development of a current model for export price-sensitivity to be developed.	Public
35	Has the IESO considered an alternative to the current export pricing structure that includes the GA (or some portion of it)?	Ontario regulation 429/04 indicates how the GA is to be recovered from consumers. The IESO must settle the GA by this regulation. (https://www.ontario.ca/laws/regulation/040429#BK4)	Public

#	Request	Response	Public Source?
Market Renewal			
36	What does the IESO see as the biggest challenges as it moves over to a market renewal system?		Public
37	Please provide more details as to how the Market Renewal Initiative will ensure a "clean" energy system, e.g.	The IESO has created a subcommittee to help inform how non-emitting resources will participate in our future market design and explore how non-emitting resources might impact market outcomes, in light of Ontario's clean energy supply mix: http://www.ieso.ca/en/sector-participants/market-renewal/non-emitting-resources-subcommittee The IESO is also exploring near-term enhancements to its current electricity market to enhance the participation of new, emerging, and clean resources. For example: • Annual DR Auction; and • Enhancements to its Operating Reserve.	Public
37a	a. How will imports of coal- and gas-powered electricity from neighbouring jurisdictions be treated?	The IESO will continue to adhere to the current environmental policy frameworks (i.e., Cap and Trade) once the initiatives under Market Renewal are implemented.	Public
37b	b. How will conservation measures of various types be given fair valuation and opportunity to compete?	The IESO has created a subcommittee to help inform how non-emitting resources will participate in our future market design and explore how non-emitting resources might impact market outcomes, in light of Ontario's clean energy supply mix: http://www.ieso.ca/en/sector-participants/market-renewal/non-emitting-resources-subcommittee	Public

#	Request	Response	Public Source?
Market Renewal			
37c	c. Will customers (residential and/or business) with distributed energy resources or energy storage in their facility be able to bid into the market renewal initiative, perhaps under an aggregator?	The IESO has created a subcommittee to help inform how non-emitting resources will participate in our future market design and explore how non-emitting resources might impact market outcomes, in light of Ontario's clean energy supply mix: http://www.ieso.ca/en/sector-participants/market-renewal/non-emitting-resources-subcommittee	Public
37d	d. How will low-GHG imports (i.e. hydro from Quebec) be able to compete, if they may require additional investments in transmission?	The IESO has created a subcommittee to help inform how non-emitting resources will participate in our future market design and explore how non-emitting resources might impact market outcomes, in light of Ontario's clean energy supply mix: http://www.ieso.ca/en/sector-participants/market-renewal/non-emitting-resources-subcommittee	Public
38	Will the current export framework be revised under the market renewal process being implemented by the IESO?	Market Renewal will integrate with the existing approach to trading electricity to promote overall market efficiency.	Public

#	Request	Response	Public Source?
Renewable Energy Procurements			
39	Please provide the results of all renewable energy procurements completed by the OPA/IESO since 2005, by completing the following table. [Refer to Appendix Results of Renewable Energy Procurements]	Refer to Appendix 39- Results of Renewable Energy Procurements.	Public
40	What were the guiding principles that the IESO used to conduct price reviews for the FIT/microFIT program?	The April 5, 2012 direction from the Minister of Energy directed IESO to review FIT and microFIT prices on an annual basis, in consultation with the Ministry of Energy. As part of each annual price review, IESO distributed a public questionnaire, which noted the following in the introduction: "The IESO is required to regularly review the prices offered to generators under these programs to ensure both ratepayer value and a reasonable return on investment."	Public
41	Please provide documents or links to the IESO's final report detailing the conclusions of the FIT/microFIT price review and the rationale for the prices adopted, for each year the review was conducted.	All public FIT material, for each year, is available in the FIT Archive: http://www.ieso.ca/en/sector-participants/feed-in-tariff-program/fit-archive (see the "Communications" documents for each year). The results of the 2013 and 2014 price reviews (for 2014 and 2015 prices, respectively) were communicated solely through the posted 2014 and 2015 price schedules. For each of the 2015 and 2016 price reviews (for 2016 and 2017 prices, respectively), supplemental Background Information were posted: 2015 - http://www.ieso.ca/-/media/files/ieso/document-library/fit/archive/fit-newsroom-archive-2015.pdf?la=en (pages 12 – 39) 2016 - http://www.ieso.ca/en/sector-participants/feed-in-tariff-program/news-and-updates/price-schedule-available, see http://www.ieso.ca/-/media/files/ieso/document-library/fit/fit-5/stakeholder-engagement/2017-fit-price-review-background-deck-20160831.pdf?la=en	Public

#	Request	Response	Public Source?
Renewable Energy Procurements			
42	Please clarify how the price reviews made use of information from previous IESO renewables procurements.	The price reviews considered stakeholder, industry, community and government feedback collected primarily through the annual pricing questionnaires, information contained in publicly available costing data from other jurisdictions and information provided by 3rd-party technical consultants hired by IESO to provide costing data. As the price reviews were focused on establishing forward looking prices (i.e., prices applicable at the time a project reaches commercial operation – depending on technology, ~2 to 8 years after contract offer), historic pricing data was not as relevant as costing forecasts.	Public
43	What were the main factors identified by IESO in the price reviews as to why the cost of renewable energy projects in Ontario might differ from other jurisdictions?	The factors identified for the price reviews are in the 2015 and 2016 Background Information linked to in Item 41. These materials highlight some of the Ontario specific costs that were or were not considered in the price reviews.	Public
44	What conclusions, if any, did the FIT/microFIT price review draw regarding “soft costs” associated with renewable energy development (apart from the interconnection costs), e.g. costs of consultation, surveys, environmental approvals, etc.? Were these seen to be in-line with other jurisdictions and did they represent a significant portion of overall project cost?	The conclusions for the price reviews are in the 2015 and 2016 Background Information linked to in Item 41.	Public

#	Request	Response	Public Source?
Renewable Energy Procurements			
45	Over the lifetime of the FIT/microFIT program, what % of contracts submitted were rejected and not offered a contract?	[Note to ECO: The IESO assumes the question is intended to be: "Over the lifetime of the FIT/microFIT program, what % of *applications* submitted were rejected and not offered a contract."] Over the lifetime of the FIT/microFIT program 71% of FIT and 69% of microFIT applications we not offered a contract. There are various reasons that an application may be rejected: failure to comply with program/application requirements, no connection availability at proposed connection point, and the program target was reached. It is this last category which represents the majority of FIT application terminations as the program was consistently oversubscribed. In microFIT, terminations spanned all categories. It is also worth noting that in both programs, applications were sometimes made multiple times for the same project.	Not previously disclosed but OK to be disclosed
46	Over the lifetime of the FIT/microFIT program, what % of signed contracts (and what # of MW) were abandoned and failed to reach commercial operation? Were certain categories of projects (e.g. ground-mounted solar) more likely to fail to reach commercial operation?	Refer to "ECO Information Request – Supporting Tables.xlsx" tab 46 for the information on contracts that were abandoned and failed to reach commercial operation.	Public Can be derived from public information; not publically available in this form.

#	Request	Response	Public Source?
Renewable Energy Procurements			
47	What steps were taken to make the FIT/microFIT programs more accessible to individuals and community groups (e.g. co-operatives, non-profit organizations)? What were the results of these actions (e.g. number of contracts signed with individuals or co-ops, etc.)?	The FIT and microFIT programs were developed and subsequently revised in response to Minister of Energy directions to IESO. From the beginning in September 2009, the Minister directed that the FIT program include price adders for Indigenous participation projects. The April 5, 2012 direction instructed IESO to develop priority points and contract capacity set aside components for the FIT program to, among other things, encourage further participation from community participation projects (i.e., co-operatives) and Indigenous participation projects. The June 12, 2013 Minister's direction further expanded these aspects to include municipal or public-sector entity participation projects. Over the course of the FIT program, 648 contracts representing 494.547 MW were executed with community participation projects. The microFIT program has an Eligible Participant Schedule, in which one category is "Individual". Over the course of the microFIT program, 15,446 contracts representing 132.214 MW have been executed with Individuals. An additional 4,791 microFIT contracts, representing 39.795 MW, were executed in earlier versions of the program under the previous "homeowner" participant type category.	Not previously disclosed but OK to be disclosed
48	Has the IESO done any analysis as to whether the CLI soil classification system requirements unduly limited renewable energy deployment, given the scale of mapping it uses?	No. The agricultural land use restrictions were directed to be included in the program by the Minister of Energy and the Ministry of Energy provided the methodologies to be used for the soil investigations. CLI data is maintained by the Ministry of Agriculture, Food and Rural Affairs. It is noted that the FIT program has consistently been oversubscribed in every application period since it began in 2009.	Public
49	What is the IESO's administrative cost for managing the large number of different renewable energy contracts (and contract types), and what steps have been taken to reduce these costs?	See tab 49 in "ECO Information Request – Supporting Tables.xlsx" for the administrative cost for managing renewable energy contracts.	No

#	Request	Response	Public Source?
Renewable Energy Procurements			
50	What have been the major "non compliance" issues with these contracts and how did the IESO resolve these?	Over the 2012 to 2017 period, IESO audited (technical site visit and full document package review) a statistical sample of FIT projects in commercial operation for a total of ~400 projects. ~50 additional FIT projects were pre-selected in 2016-2017 (2017 is still draft) for site and document reviews. These audit findings were/will be presented to the Audit Committee of IESO Board of Directors. There have not been any major "non-compliance" issues identified since IESO audits started.	Public

#	Request	Response	Public Source?
Contribution of Renewable Energy to Supply Mix			
51	What are the average capacity factors (ratio of average electricity production/nameplate capacity) for wind and solar projects under contract? Does this change as a function of project size, and has it changed over time since the IESO began procuring wind and solar? ECO: looking for actual production to measure capacity factor, not design or planning assumptions		
52	The IESO's *Progress Report On Contracted Energy Supply* provides graphs showing the amount of renewable capacity brought into service each year, separately for bio-energy, hydroelectricity, solar, and wind, respectively. Please subdivide these capacity additions in each year, by contract type (e.g. FIT vs RESOP, etc.).	Refer to "ECO Information Request – Supporting Tables.xlsx" tab 52 for renewable capacity brought into service each year starting in 2005.	Public
53	Please provide a chart showing the renewable resources under contract (broken down by resource type – wind, solar, biogas, hydroelectricity), showing the amount of contracted capacity within different price ranges (see below for sample). Please use whatever price groupings make the most sense to IESO and address any concerns about confidentiality that IESO has. Please include microFIT within these tables.	Refer to "ECO Information Request - Supporting Tables.xlsx" tab 53 for the renewable resources under contract by resource type.	No

#	Request	Response	Public Source?
Integrating Intermittent Renewables Into Market Operations			
54	Please provide a general update on the IESO's efforts to integrate intermittent renewables into market operations (e.g., forecasting, visibility, need for flexibility in other resources, etc.). What are the current outstanding concerns in this area and how is IESO working to address them? ECO agreed a brief narrative on the history is fine, most interested in current efforts	The IESO's Renewables Integration Initiative (SE-91) completed in 2013 ensured that we can continue to reliably operate the electricity system with a large amount of wind and solar generation in the supply mix. This was achieved by improving the forecasts of wind and solar output (moved to a centralized forecast), improving our visibility of these resources (new control room tools) and giving us the capability to dispatch these resources. As the Ontario supply mix evolved with more renewable supply, the need for system flexibility has increased. System flexibility is the ability of the power system to respond to intra-hour differences between expected levels of supply/demand and actual resource output/load consumption. A stakeholder engagement was launched in June 2016 to explore potential options to enable and achieve system flexibility matching Ontario's evolving supply mix. Materials for this stakeholder engagement can be found at: http://www.ieso.ca/en/sector-participants/market-renewal/enabling-system-flexibility The IESO issued the *2016 IESO Operability Assessment Review of the Operability of the IESO-Controlled Grid to 2020 ("Operability Study")* in June 2016 which considers the changes expected on the power system and identified operating challenges, including continued integration of variable generation: http://www.ieso.ca/-/media/files/ieso/document-library/engage/esf/esf-20161208-2016-ieso-operability-assessment-summary.pdf?la=en The IESO is continuing to work on increasing flexibility to address changing resource mixes, like other electricity market operators (ISO/RTO's) in North America. The need for an additional 50 MW of regulation service was identified in IESO's 2016 Operability Study. Through a competitive procurement, IESO announced 55MW of regulation service was procured in November 2016: http://www.ieso.ca/en/sector-participants/ieso-news/2017/11/ieso-announces-results-of-regulation-service-rfp	Public

#	Request	Response	Public Source?
Integrating Intermittent Renewables Into Market Operations			
		The IESO has created a subcommittee to help inform how non-emitting resources will participate in our future market design and explore how non-emitting resources might impact market outcomes, in light of Ontario's clean energy supply mix: http://www.ieso.ca/en/sector-participants/market-renewal/non-emitting-resources-subcommittee	
55	As more renewable resources come on line, will the IESO need to take more actions that deviate from its dispatch algorithm (http://reports.ieso.ca/public/DispDeviation/PUB_DispDeviation.html)? If so, what are the consequences of these actions?	Refer to Appendix Item 55.	Public
56	Has the IESO done any analysis of whether dispatchable renewables (storage hydro, biomass, biogas) could play a larger role in balancing the intermittency of wind and solar, either by modifying the operating practices of resources already on the grid, or through procurement of new resources? Please provide any relevant details.	Having a dynamic and well-functioning market ensures that the right mechanisms and signals are in place to ensure that resources have the right incentives for their operation and participation within the market. The IESO issued the *2016 IESO Operability Assessment Review of the Operability of the IESO-Controlled Grid to 2020 ("Operability Study")* in June 2016 which considers the changes expected on the power system and identified operating challenges, including continued integration of variable generation: http://www.ieso.ca/-/media/files/ieso/document-library/engage/esf/esf-20161208-2016-ieso-operability-assessment-summary.pdf?la=en	Public

#	Request	Response	Public Source?
Integrating Intermittent Renewables Into Market Operations			
57	The LTEP mentions that "there is an opportunity to get more from existing waterpower assets, including increasing their operational flexibility" (page 44). Please provide more details as to what these opportunities are.	Opportunities to extract greater value from waterpower assets can include enhancements to the physical assets themselves as well as greater alignment between waterpower asset operations, water management/regulations, and power system/electricity market needs. Enhancements to physical assets can include things like refurbishments, upgrades and/or replacements. Candidates for enhancement include (but are not limited to) turbines, turbine components (such as runners), diffusor flaps, generators and generator components (such as coil windings). Enhancements in these and other areas can have the effect of increasing the amount of power delivered by a given asset for the same amount of water inflow. Waterpower assets can provide operational flexibility by quickly varying their output in response to changing electricity demands or other conditions such as line outages, contingencies, etc. They can also provide other services such as operating reserve, voltage support, regulation, black start capability and others. Opportunities to better align waterpower operations with power system/electricity market needs include working with asset owners, regulators, communities and others to ensure that legal/regulatory requirements and market designs do not unintentionally and/or unnecessarily constrain or discourage waterpower's ability to provide such flexibility services.	NA

#	Request	Response	Public Source?
Greenhouse Gas Emissions			
58	If possible, please provide a table with greenhouse gas emissions associated with each type of electricity generation resource (i.e., natural gas, coal, etc.) from 2000-2016. - If data this far back is not available, at least for 2005-2016.	Ontario's off-coal policy, completed in 2014 with the phase-out of all coal fired generation in Ontario, represents the single largest greenhouse gas emissions reduction program in Canada. For historical emission data for the electricity sector, IESO references the National Inventory Report from Environment and Climate Change Canada: https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html This Report also contains emissions and generation by fuel type, in Table 13-7: http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/can-2017-nir-13apr17.zip	Public
59	Please explain why natural gas generation reduced substantially between 2015 and 2016? Does it appear that this trend will continue?	Natural gas-fired generation is a flexible resource that is responsive to fluctuations in both demand and supply from baseload resources. It is usually the last resource that is turned on as needed, to deal with the fluctuations in net demand, reliability and operability. Demand was fairly stable between 2015 and 2016. Other supply resources contributed slightly higher amounts of energy in 2016 than in 2015, which meant less need for gas generation in 2016. A forecast of annual natural gas generation will be available in the 2017 LTEP Modules to be published by the Ministry of Energy.	Public

#	Request	Response	Public Source?
Greenhouse Gas Emissions			
60	Has the IESO done any analysis to disaggregate the GHG emissions reductions in Ontario's electricity sector since 2005 by contributing factor (e.g. coal replacement with natural gas, nuclear refurbishment, renewables, conservation), or to specifically estimate the GHG emissions reductions due to renewable electricity and/or utility conservation? If so, please provide.	The IESO has not completed a comprehensive back-casting analysis to disaggregate the impact of each of the many contributing factors on GHG emissions reductions in the electricity sector since 2005. Refer to "ECO Information Request – Supporting Tables.xlsx" tab 60 for the historical generation, demand, and emission data from 2005 to 2015. From 2005 to 2015: • Emissions reduce by 81%; • Grid demand decreased by 10% (due to conservation); • Generation increased by 3% (emitting generation decreased by 62% by phasing out coal, non-emitting generation increased by 26%); and • Emitting generation decreased by 26 TWh, and grid demand decreased by 16 TWh. Non-emitting generation increased by 30 TWh, net exports increased by 18 TWh. Emission intensity of the grid reduced from 0.21 t/MWh in 2005 to 0.04 t/MWh in 2015, as coal-fired generation was phased out.	Public

#	Request	Response	Public Source?
Greenhouse Gas Emissions			
61	Has the IESO noticed any impact of carbon pricing (cap and trade requirements) for electricity importers into Ontario to date, in terms of the volume (or the offer patterns) of electricity imports from different jurisdictions? If so, please describe.	Cap and Trade came into effect in Ontario January 1, 2017. With less than 12 months of data available and lower than anticipated need for either gas-fired generation or imports, it is difficult to distinguish an attributable impact of carbon pricing on electricity imports. Further, the energy sales agreement with Hydro-Quebec (HQ) has been in effect throughout 2017, which also impacts Quebec imports and exports. Also, because there have been changes in many of the underlying drivers such as fuel prices and demand, there has been no discernible impact noticed on marketers' offer patterns. The table in Appendix 61 shows imports and exports over the past 3 years. There is no obvious impact of Cap and Trade in Ontario that can be derived from this information because: • Different system conditions like nuclear power plant outages, transmission line outages, weather conditions etc. may impact the volume of imports/exports. • Different neighbouring jurisdiction prices may have impacts on intertie transactions. • HQ agreements that went into effect on January 1, 2017 may impact the volume of imports/exports. See Appendix Item 61	Public
62	Ontario's cap and trade program proposes including an anaerobic digestion offset protocol. Does the IESO have any (or know of any) forecasts about how much energy could be brought online as a result of this offset protocol?	IESO has not forecasted how much energy could be brought online as a result of a proposed anaerobic digestion offset protocol and is not aware of any energy forecasts relating to this proposal.	Public

#	Request	Response	Public Source?
Conservation/Net Metering/Future of Renewable Energy			
63	Please provide an update on the IESO's plans to update the "Avoided Costs" estimates used in conservation cost-effectiveness testing, in order to reflect the province's current supply/demand situation (as reflected in the 2017 LTEP), current cost of resources, and any other relevant factors.	The cost effectiveness analysis employs a range of avoided cost assumptions in its calculations. Many of these estimates are under review and may be updated where appropriate as part of the Long Term Energy Plan implementation and Conservation Mid-term Review process (http://www.ieso.ca/sector-participants/engagement-initiatives/engagements/conservation-framework-mid-term-review). All changes to IESO's avoided costs assumptions will be implemented in one revised cost-effectiveness tool, and will be used for cost-effectiveness screening and reporting of all conservation programs based on an effective date (currently estimated to be mid- to late-2018).	Public
64	Please clarify the rationale for the IESO's choice of carbon price ($43) that is proposed to be used for conservation programs going forward (referenced in DNV-GL, IESO Non-Energy Impacts, 2016 Results and Next Steps (19 October 2017), slide 15).	The 'carbon price' of $43 proposed by DNV-GL (http://www.ieso.ca/-/media/files/ieso/document-library/engage/cf/cf-20171019-nei-results.pdf?la=en is being reviewed by the IESO. The IESO will put forward a recommendation on an appropriate societal cost of carbon as part of the updated avoided cost assumptions currently review mentioned in IESO's response to ECO question #63.	Public
65	It is the ECO's understanding that the carbon price adder for conservation will be calculated based on the assumed average emissions factor of the electricity system (with emissions factors specific to each of the 8760 hours). Is this correct, and has IESO considered using a methodology based instead on the emissions intensity of the marginal generation source in each hour (similar to that proposed by the Toronto Atmospheric Fund: http://taf.ca/wp-content/uploads/2017/08/TAF_Guide_Ontario_Emissions_Factors_Digital_2017-08-03.pdf). Why or why not?	As noted in responses #63 and #64, IESO is currently reviewing the avoided costs, including the integration of a carbon price.	Public

#	Request	Response	Public Source?
Conservation/Net Metering/Future of Renewable Energy			
66	Can the IESO estimate the 8760 load shape of conservation savings achieved in 2016 (or previous years) from SaveONenergy programs? If this is not fully possible, please provide a partial answer (e.g. load shape of most popular programs/measures, energy savings recorded in the 9 time of use periods, etc.).	Refer to "ECO Information Request - Supporting Tables.xlsx" tab 66 which includes load shapes of province-wide conservation programs determined as part of the 2016 evaluation process, divided into the 8 time-of-use periods.	No load shapes were developed specifically to respond to ECO's question
67	Will the solar-specific achievable potential study that IESO is undertaking include all capacity sizes and will it take grid constraints into account (at the transmission and/or distribution levels)?	The rooftop solar potential study will assess the potential for solar PV systems across all residential and non-residential buildings in Ontario. The system capacities will be sized based on assumptions for available building roof space and building load. The study will not take system constraint into account at transmission or distribution level.	Public
68	Some areas of the Province's transmission grid are "full" and cannot take more renewable energy –does the IESO have current information on where these constraints are, and what plans if any exist to improve the grid capability in these locations?	Refer to Appendix 68 – Transmission Constraints Map for the map of the current information on the areas of transmission grid constraints. There are currently no plans for increasing the existing grid capability in these locations for the purpose of incorporating additional renewable generation because there is currently sufficient generation capacity in the province. The IESO will continue to monitor these areas through routine planning processes. As indicated in the 2017 Long-Term Energy Plan (2017 LTEP), the province's robust supply situation will be sufficient to meet Ontario's foreseeable electricity demand well into the next decade. Ontario's strong supply situation also means it is well-positioned to explore efficiencies that could be gained from market reforms.	Public

#	Request	Response	Public Source?
Conservation/Net Metering/Future of Renewable Energy			
69	The LTEP (p. 68) notes that "the government will work with the IESO to develop a program to support a select number of innovative renewable distributed generation demonstration projects strategically located and paired with other DERs and smart grid technologies, as well as virtual net metering demonstration projects." Is the IESO already funding any such pilots (e.g. through the Conservation Fund)? If so, please describe the project(s) and their scale.	The eligibility details for innovative renewable distributed generation demonstration projects through this 2017 LTEP initiative are in development. More information will be available when IESO submits its 2017 LTEP Implementation Plan to the Minister by January 31, 2018. The Conservation Fund and LDC [Program Innovation] Fund has supported a number of Distributed Energy Resources projects. The Conservation Fund does not support generation-focused projects with the exception of load displacement projects where electricity is generated by onsite behind-the-meter facilities driven by a primary energy source of process waste heat, waste power, waste by-product, or waste gas. To qualify as load displacement, projects must have a net efficiency benefit to the user and not be fueled by diesel, coal, or fuels previously eligible under IESO FIT or microFIT programs. However, we have supported a few demonstration projects that incorporate renewable generation as part of the larger project, such as PowerHOUSE and North Bay Community Energy Park.	Public
70	Please provide a list of existing and/or planned energy storage projects in the province that IESO has contracted with, including the technology of the facility and their storage capacity.	The names of the successful proponents to prior energy storage procurements, and related technologies, can be found here: http://www.ieso.ca/sector-participants/energy-procurement-programs-and-contracts/energy-storage. Please note that Dimplex North America LTD is no longer a contract counterparty. The IESO also recently concluded the 2017 RFP for Incremental Regulation Capacity, which has resulted in contract offers being extended to two new energy storage facilities: http://www.ieso.ca/RegulationRFP.	Public

APPENDIX 17b - Summary emergency operating procedures or other control actions to mitigate resource shortfalls in the operating timeframe

The table that follows covers the period starting January 1, 2013; the IESO does not have record of duration of events prior to 2013. All historical Public Appeals prior to 2013 are available here: http://www.ieso.ca/en/corporate-ieso/media/about-public-appeals

Control Action	# of Events	Comment
Public Appeals	4	On July 9, 2013 IESO appeals for reduced electricity consumption in Toronto
		On July 10, 2013 Need to reduce electricity consumption in Toronto continues
		On July 11, 2013 Continued energy conservation efforts still needed in Toronto
		On July 12, 2013 IESO Extends Public Appeal to Reduce Electricity Use in Toronto
5% voltage reductions [NOT PUBLIC INFORMATION]	3	On July 9, 2013 from 06:13 to 22:31 On July 10, 2013 from 10:54 to 13:18 On February 27, 2014 from 18:58 to 19:26
Energy Emergency Alert **(Note)**	6	Energy Emergency Alert 1 September 16, 2015 - EEA1 issued from 12:00 to 22:00,
		Energy Emergency Alert 1 September 17, 2015 - EEA1 issued from 12:30 to 22:00
		Energy Emergency Alert 1 August 10, 2016 - EEA1 issued from 16:00 to 21:00
		Energy Emergency Alert 1 August 11, 2016 - EEA1 issued from 12:14 to 20:00
		Energy Emergency Alert 1 September 25, 2017 - EEA1 issued from 11:06 to 21:06
		Energy Emergency Alert 1 September 26, 2017 - EEA1 issued from 11:00 to 21:05

Note:

NERC Definition of Energy Emergency Alert 1: All available generation resources in use. Circumstances:

- The Balancing Authority is experiencing conditions where all available generation resources are committed to meet firm Load, firm transactions, and reserve commitments, and is concerned about sustaining its required Contingency Reserves.
- Non-firm wholesale energy sales (other than those that are recallable to meet reserve requirements) have been curtailed.

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APPENDIX 21 - IESO Response:

Primary Resource Type	Marginal hours (2016)	Baseload Marginal (2016)	Marginal Hours (2017)	Baseload Marginal (2017)
Wind/Solar	2,282.9	2,282.9	2,677.3	2,676.9
Nuclear	380.2	380.2	574.1	574.1
Hydro	3,524.5	1,790.9	3,408.3	1,389.1
Gas	2,583.3	82.8	1,405.0	75.3
Other	98.8	90.7	38.3	35.3

Note:

- A marginal resource is considered "baseload" if its offer is less than $13 (The $13 threshold represents approximate minimum water rental fee). If a resource is marginal and its offer is less than $13, then it would be “Baseload Marginal”. For clarity, any resource, could be baseload as long as its offer is less than $13. If the Market Clearing Price reaches $2000, the variable generators (mostly solar) that offer at $2000 will become marginal and not be considered as baseload in this methodology. Baseload by this definition is different than used for Items 19 and 20 which are about capacity.
- The total number of hours in the table above might not add up to the total number of hours in one year as there might be data missing in our database due to tool issues.
- The end date of data for 2017 is November 30, 2017.

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Commented [DJB1]: Market Participant offer/bid information is used but individual MP’s offers/bids are not disclosed and not identifiable

APPENDIX Item 24

Year	Nuclear Reduction (TWh) (not including shutdown)	Hydro Reduction (Twh)	NUG Reduction (Twh)	Wind /Solar Reduction (Twh)
2011	0.20	0.70		
2012	0.16	0.81	0.18	
2013	0.59	2.01	0.40	
2014	1.22	2.46	0.39	0.38
2015	0.90	2.33	0.36	0.73
2016	0.67	3.08	0.14	2.24
2017(Nov 30, 2017)	0.92	1.80	0.04	3.06

Note:

The IESO started tracking SBG in 2011.

- Nuclear reduction is calculated by 300 MW blocks.
- Hydro reduction is calculated as the difference between the offered MW amount at $13 (assumed minimum water rental fee) or less and constrained dispatch MW of the hydroelectric unit.
- NUG reduction is from data sent by OEFC.
- Wind/Solar reduction is calculated as the difference between forecast and actual production.

NOTICE: CONFIDENTIAL - INFORMATION IN THIS APPENDIX IS NOT PUBLIC

Commented [DJB2]: Market Participant offer/bid information is used but individual MP's offers/bids are not disclosed and not identifiable

Appendix 39- Results of Renewable Energy Procurements.

Procurement	Enabling Ministerial Directive(s)[1]	Procurement Target (MW)	Rationale for Target[2]	Intake Period	Results Achieved	Comments[3]
Atikokan (ABESA)	August 26, 2010 directive	205	Directive	N/A	1 contract for 205.000 MW offered	Biomass Energy Supply Agreement
Thunder Bay (TBESA)	December 16, 2013 directive	150	Directive	N/A	1 contract for 135.000 MW offered	Biomass Energy Supply Agreement
CHP III	April 10, 2008/ November 23, 2010 directives	100	Directive	March 9, 2009 to May 28, 2009	85.000 MW offered	Combined Heat and Power Agreement (Tranche 3) – RFP issued on March 9, 2009
Tembec - Chapleau (Biomass NUG)	November 23, 2010/December 16, 2013 directives	5	Directive	N/A	5.000 MW offered	
RES III	August 27, 2006 directive	500	Directive	August 22, 2008 to October 28, 2008	492.100 MW offered	RES I and RES II procurements issued and conducted by the Ministry of Energy
RESOP	March 21, 2016	No target	Ontario Government's commitment to renewable and clean energy and renewable generation target	Launched November 2006 (open procurement window)	1,544.488 MW offered (70.419 MW as waterpower)	General government target of 2,700 MW of renewable generation by 2020
FIT 1 (Large FIT)	September 24, 2009 directive	No Target	Directive	October 1, 2009 to October 31, 2011	4,331.735 MW offered	

[1] Please list all relevant directives, if more than one apply
[2] Please clarify whether and how procurement target was derived from Ministerial directive(s), and whether IESO used its own judgement in setting target (e.g. setting a procurement target that was less than enabling authority in directive).
[3] Please include any observations about the procurement, e.g. comments as to why a procurement may have been undersubscribed, etc.

Procurement	Enabling Ministerial Directive(s)[1]	Procurement Target (MW)	Rationale for Target[2]	Intake Period	Results Achieved	Comments[3]
FIT 1 (Small FIT)	September 24, 2009 directive	No Target	Directive	October 1, 2009 to October 31, 2011	424.404 MW offered	
FIT 2	April 5, 2011/November 23, 2012 directives	200	Directive	December 14, 2012 to January 18, 2013	951 contracts or 146.484 MW offered (909 contracts for Solar Rooftop, 25 contracts for Solar Non-Rooftop, 1 contract for Waterpower, 15 contracts for Biogas, 1 contract for Biomass)	The 2 year program review resulted in FIT 2 launching a year after applications had been received under FIT 1. High application failure rate resulted in the target not being met.
FIT 3	June 12, 2013 directive	123.516	Directive	November 4, 2013 – December 13, 2013	500 contracts or 123.500 MW offered (403 contracts or 85.490 MW of Solar Rooftop, 87 contracts or 35.400 MW of Solar Non-Rooftop, 1 contract or 0.060 MW of Waterpower, 1 contract or 0.050 MW of Wind On-Shore, 6 contracts or 1.500 MW of Biogas On-Farm, 2 contracts or 1.000 MW of Renewable Biomass)	
Extended FIT 3	August 29, 2014 directive	100	Directive	October 2014	332 contracts or 99.996 MW offered (254 contracts or 65.798 MW of Solar Rooftop, 76 contracts or 33.198 MW of Solar Non-Rooftop, 2 contracts or 1.000 MW of Renewable Biomass)	An additional directed MW allocation for applications received under FIT 3
FIT Unconstructed Rooftop Solar Pilot	July 11, 2012 directive	15	Directive	November 4, 2013 – December 13, 2013	14.951 MW offered	A pilot program for FIT solar contracts on proposed new-construction buildings

Procurement	Enabling Ministerial Directive(s)[1]	Procurement Target (MW)	Rationale for Target[2]	Intake Period	Results Achieved	Comments[3]
FIT 4	June 12, 2013/August 29, 2014 directives	241.438	Directive	October 5, 2015 to October 23, 2015	936 contracts or 241.430 MW offered (662 contracts or 124.168 MW of Solar Rooftop, 245 contracts or 108.090 MW of Solar Non-Rooftop, 9 contracts or 2.722 MW of Waterpower, 6 contracts or 3.000 MW of Wind On-Shore, 1 contract or 0.500 MW of Biogas, 12 contracts or 2.700 MW of Biogas On-Farm, 1 contract or 0.250 MW of Renewable Biomass)	2013 directive of 150 MW, plus 50 MW from 2014 target, plus 41 MW of unallocated capacity from the 2014 procurement
FIT 5	April 5, 2016 directive	150	Directive	November 7, 2016 to November 25, 2016	390 contracts or 149.999 MW offered (99 contracts or 24.789 MW of Solar Rooftop, 283 contracts or 123.110 MW of Solar Non-Rooftop, 7 contracts or 1.600 MW of Biogas On-Farm, 1 contract or 0.500 MW of Landfill Gas)	
CPO - Combined Projects Option (constrained microFIT)	August 19, 2011	25.063	Based on the number of constrained microFIT projects which were eligible to participate in the CPO.		25.063 MW offered (all solar)	A program for certain eligible formerly connection-constrained microFIT 1 projects that were then amalgamated into larger FIT sized projects
GEIA - Phase I	April 1, 2010/ July 29, 2011 directives	500	Directive	N/A	520.000 MW offered	Procurement targets of 400 MW of Wind and 100 MW of Solar.
GEIA - Phase II	April 1, 2010/ July 29, 2011 directives	500	Directive	N/A	550.000 MW offered	Procurement targets of 400 MW of Wind and 100 MW of Solar

Procurement	Enabling Ministerial Directive(s)[1]	Procurement Target (MW)	Rationale for Target[2]	Intake Period	Results Achieved	Comments[3]
GEIA - Phase III	April 1, 2010/ July 29, 2011/April 30, 2014 directives	300	Directive	N/A	300.000 MW offered	Target not specified in a directive but in renegotiated GEIA
LRP I	December 16, 2013/April 24, 2014 directives	565	Directive	March 10, 2015 to September 1, 2015	16 contracts or 454.885 MW offered (7 contracts or 139.885 MW of Solar, 4 contracts or 15.500 MW of Waterpower, 5 contracts or 299.500 MW of Wind On-Shore)	
Whitesands FN	December 14, 2015 directive	4	N/A	N/A	TDB	3.6 MW Biomass cogeneration facility
microFIT 1	September 24, 2009 directive	130.997	Directive	December 10, 2009 to August 31, 2011	14,959 contracts or 130.885 MW offered (5,923 contracts or 47.777 MW of Solar Rooftop, 6,019 contracts or 58.812 MW of Solar Non-Rooftop, 3,013 contracts or 24.273 MW of Solar, 4 contracts or 0.023 MW of Wind On-Shore)	
microFIT 2	April 5, 2011 directive	50	Directive	July 12, 2012 to August 27, 2013	3,775 contracts or 31.875 MW offered (3,562 contracts or 29.797 MW of Solar Rooftop, 213 contracts or 2.078 MW of Solar Non-Rooftop)	
microFIT 2013	June 12, 2013 directive	30	Directive	August 28, 2013 to December 31, 2013	595 contracts or 4.982 MW offered (586 contracts or 4.893 MW of Solar Rooftop, 9 contracts or 0.089 MW of Solar Non-Rooftop)	

Procurement	Enabling Ministerial Directive(s)[1]	Procurement Target (MW)	Rationale for Target[2]	Intake Period	Results Achieved	Comments[3]
microFIT 2014	June 12, 2013 directive	50	Directive	January 1, 2014 to December 31, 2014	1,510 contracts or 13.385 MW offered (1,506 contracts or 13.346 MW of Solar Rooftop, 4 contracts or 0.039 MW of Solar Non-Rooftop)	
microFIT 2015	June 12, 2013 directive	50	Directive	January 1, 2015 to December 31, 2015	3,605 contracts or 34.009 MW offered (3,592 contracts or 33.891 MW of Solar Rooftop, 13 contracts or 0.118 MW of Solar Non-Rooftop)	
microFIT 2016	June 12, 2013 directive	50	Directive	January 1, 2016 to December 31, 2016	1,077 contracts or 8.855 MW offered (1,077 contracts or 8.855 MW of Solar Rooftop)	
microFIT 2017	June 12, 2013 directive	50	Directive	January 1, 2017 to December 1, 2017	TBD	Currently the 2017 50MW target has been reached, but total number of contracts and capacity will not be finalized until review and offering of contracts is complete.
HCI	May 7, 2009 directive	N/A	Directive	Open program	1,090.116 MW contracted	
HESA	December 20, 2007/April 24, 2014 directives		Ongoing contracting process		5 contracts or 1,063.800 MW offered	
HESOP Expansion	June 21, 2013/June 26, 2013/April 24, 2014 directives	40	Implemented by the OPA, pursuant to the directions issued by the Minister of Energy and in recognition of the unique characteristics associated with developing hydroelectric projects	October 1, 2014 to November 3, 2014	5 contracts for 12.322 MW offered	

Procurement	Enabling Ministerial Directive(s)[1]	Procurement Target (MW)	Rationale for Target[2]	Intake Period	Results Achieved	Comments[3]
HESOP Municipal	January 21, 2013/June 26, 2013 directives	60	Implemented by the OPA, pursuant to the directions issued by the Minister of Energy and in recognition of the unique characteristics associated with developing hydroelectric projects	November 4, 2013 to December 6, 2013	3 contracts for 35.250 MW offered	January 2013 directive set 10 MW target, plus additional 50 MW from June directive
Chaudière Falls	December 14, 2015 directive	39	Directive	N/A	1 contract for 39.000 MW offered	

APPENDIX Item 55:

1. The dispatch algorithm is the mathematical algorithm used by the IESO to determine the most economical (least cost) solution for meeting the system need. The outputs of the dispatch algorithm are used to determine the dispatch instructions, which guide the actual physical operations of the electricity system. However, the dispatch algorithm is an approximation of a complex physical reality as conditions of the electricity system can change constantly. Therefore, the IESO at times may be required to take action and modify or override the dispatch instructions to account for conditions that are not captured by the dispatch algorithm. These actions include issuing one-time-dispatch instructions and blocking dispatch instructions to resources, which are reported in the Dispatch Deviation Report.

   Notionally, a higher penetration of variable generation could result in an increase in actions taken that deviate from the results of the dispatch algorithm. However, the magnitude of the increase in actions could not be easily quantified since it is dependent on a variety of factors. For example:

   - The location of variable generation resources can affect the number of actions taken to respect an OSL, but is dependent on the system conditions;
   - The forecast accuracy of variable generation resources can contribute to the number of actions taken to correct an over or under generation condition, but the performance of other generation resources also contribute to over or under generation condition;
   - The reliability of equipment at any facility can impact the number of actions required to mitigate the effects of operational data input failures and dispatch algorithm input errors.

   When actions that deviate from the results of the dispatch algorithm are taken, the dispatch instructions diverge from the most economical solution. As a result, the cost to consumers could potentially increase. Nonetheless, the actions would be necessary to maintain system reliability as the dispatch algorithm may not have captured all the complexities of the electricity system.

2. Process for monitoring variable generation forecast error

   The IESO continuously monitors the performance of variable generation resources using the information available and various tools in its day-to-day operations. As part of the monitoring process, the IESO may decide to take one or multiple control actions to ensure system reliability should the performance of variable generation pose any concerns to reliability. The process is outlined in Market Manual 7.1 Section 2.4.2, titled *'Variable Generation Events'*.

3. In addition to the monitoring process, there is an active engagement to address the broader subject of system flexibility. This engagement looks to provide a market based solution to ensure reliability. More information could be found in Enabling System Flexibility.

   The IESO issued the *2016 IESO Operability Assessment Review of the Operability of the IESO-Controlled Grid to 2020 ("Operability Study")* in June 2016 which considers the changes expected on the power system and identified operating challenges, including continued integration of variable generation: http://www.ieso.ca/-/media/files/ieso/document-library/engage/esf/esf-20161208-2016-ieso-operability-assessment-summary.pdf?la=en

   The need for an additional 50 MW of regulation service was identified in the IESO's 2016 Operability Study. Through a competitive procurement, the IESO announced 55MW of regulation service was procured in November 2016: http://www.ieso.ca/en/sector-participants/ieso-news/2017/11/ieso-announces-results-of-regulation-service-rfp

APPENDIX Item 61

Year	Manitoba		Michigan		Minnesota		New York		Quebec	
	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export
2015	0.42	0.65	0.20	9.40	0.03	0.14	0.28	7.79	4.50	2.68
2016	0.60	0.99	0.06	9.74	0.09	0.32	0.28	7.24	6.24	1.61
2017	0.55	0.57	0.02	6.97	0.12	0.54	0.05	7.48	5.30	1.67

Note: The time frame is from January 1 to November 30 each year.

The impact of carbon pricing is not obvious from the data set for the following reasons:

- Different system conditions like nuclear power plant outages, transmission line outages, weather conditions etc. may impact the volume of imports/exports.
- Different neighbouring jurisdiction prices may have impacts on intertie transactions.
- HQ agreements that went into effect on January 1, 2017 may impact the volume of imports/exports.

APPENDIX Item 68 –Transmission Constraints Map