

#	Request	Response
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?	
2	Please provide an update with 2016 data for the cost of service tables on slides 42 and 43 of OPO Module 1.	
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).	
4	Please explain why the cost of electricity service decreased between 2005 and 2006 (OPO Module 1, Slide 42).	
	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. NTD: 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.	
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).	
7	Please clarify how the Fair Hydro Plan’s refinancing of the Global Adjustment is treated in the above cost of service forecasts.	
8	Please provide any additional relevant assumptions incorporated into the residential bill forecast (LTEP 2017, Figure 5)	
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.	

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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.	
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.	
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?	
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).	
14	Please provide a table with electricity generation costs (including both HOEP and GA) as well as electricity production data for each generation source	

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	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 <table><tr><th>Technology</th><th>Cost (\$ million)</th><th>Total Production (TWh)</th></tr><tr><td>Nuclear</td><td>5,900</td><td>94.9</td></tr><tr><td>Hydro</td><td>1,835</td><td>37.9</td></tr><tr><td>Gas/Oil</td><td>2,287</td><td>14.9</td></tr><tr><td>Wind</td><td>935</td><td>7.8</td></tr><tr><td>Solar</td><td>884</td><td>1.8</td></tr><tr><td>Bioenergy</td><td>100</td><td>0.5</td></tr><tr><td>Coal</td><td>7</td><td>0.1</td></tr><tr><td>Other*</td><td>186</td><td>1.6</td></tr><tr><td>Imports</td><td>251</td><td>4.9</td></tr><tr><td>Export (Revenue)</td><td>(636)</td><td>(19.1)</td></tr><tr><td>Total Generation Cost</td><td>11,749</td><td></td></tr></table> * 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	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		
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	b. if possible, please also include annual cost and “production” data for conservation/demand response.																																					
	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.																																					
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																																					

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	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	
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).	
	a. If LUECs do not include a cost of carbon, please also include a column with LUECs that incorporate a cost of carbon.	
	b. If possible, please also include estimates for the current cost of electricity storage per unit.	

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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:	
	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;	
	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.	
	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?).	
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?	

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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.	
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.	
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”.	
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).	
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	
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.)	
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.	

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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.	
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.	
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?	
29	Has the IESO considered restructuring electricity prices for uses other than storage (which was discussed in the 2017 LTEP)?	
	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)	

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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.	
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.	
32	Please provide projections of annual electricity exports (in \$ of revenue expected and in TWh) until 2035.	
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.	
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)?	
35	Has the IESO considered an alternative to the current export pricing structure that includes the GA (or some portion of it)?	

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Market Renewal		
36	What does the IESO see as the biggest challenges as it moves over to a market renewal system?	
37	Please provide more details as to how the Market Renewal Initiative will ensure a “clean” energy system, e.g.	
	a. How will imports of coal- and gas-powered electricity from neighbouring jurisdictions be treated?	
	b. How will conservation measures of various types be given fair valuation and opportunity to compete?	
	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?	
	d. How will low-GHG imports (i.e. hydro from Quebec) be able to compete, if they may require additional investments in transmission?	
38	Will the current export framework be revised under the market renewal process being implemented by the IESO?	

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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]	
40	What were the guiding principles that the IESO used to conduct price reviews for the FIT/microFIT program?	
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.	
42	Please clarify how the price reviews made use of information from previous IESO renewables procurements.	
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?	
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?	
45	Over the lifetime of the FIT/microFIT program, what % of contracts submitted were rejected and not offered a contract?	
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?	
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.)?	

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Renewable Energy Procurements		
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?	
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?	
50	What have been the major "non compliance" issues with these contracts and how did the IESO resolve these?	

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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? NTD: ECO wants to use actual production to measure capacity factor	
52	The IESO’s <i>Progress Report On Contracted Energy Supply</i> 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.).	
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.	

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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? NTD: ECO agreed a brief narrative on the history is fine, most interested in current efforts	
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?	
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.	
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. NTD: Ministry of Energy best suited to respond	

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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.	
59	Please explain why natural gas generation reduced substantially between 2015 and 2016? Does it appear that this trend will continue?	
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.	
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.	
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?	

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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.	
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).	
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?	
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.).	
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)?	
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?	

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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.	
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.	

Appendix - Results of Renewable Energy Procurements.

Procurement	Enabling Ministerial Directive(s) ¹	Procurement Target (MW)	Rationale for Target ²	Intake Period	Results Achieved	Comments ³

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.