#	Request	BU	SME	PSP Lead	Ref#	Response
	Power System Planning					
1	[redacted]					
2						
3						
4						

	[redacted]					
5						
6						
7	Please clarify how the Fair Hydro Plan's refinancing of the Global Adjustment is treated in the above cost of service forecasts.	PAO	Andrew Pietrewicz	Joyce		Given that the Fair Hydro Plan was announced and developed after the release date of the OPO, the OPO forecast does not include this policy change. Nonetheless, the Cost of Electricity Service forecast would not have been impacted by the Fair Hydro Plan's refinancing plan. The various electricity cost components would still to be incurred; however, cost collected from ratepayers would be lower as they cover only a portion of the GA as the remaining short fall in the GA will be funded by the financing plan of the Fair Hydro Plan.
8	[redacted]					

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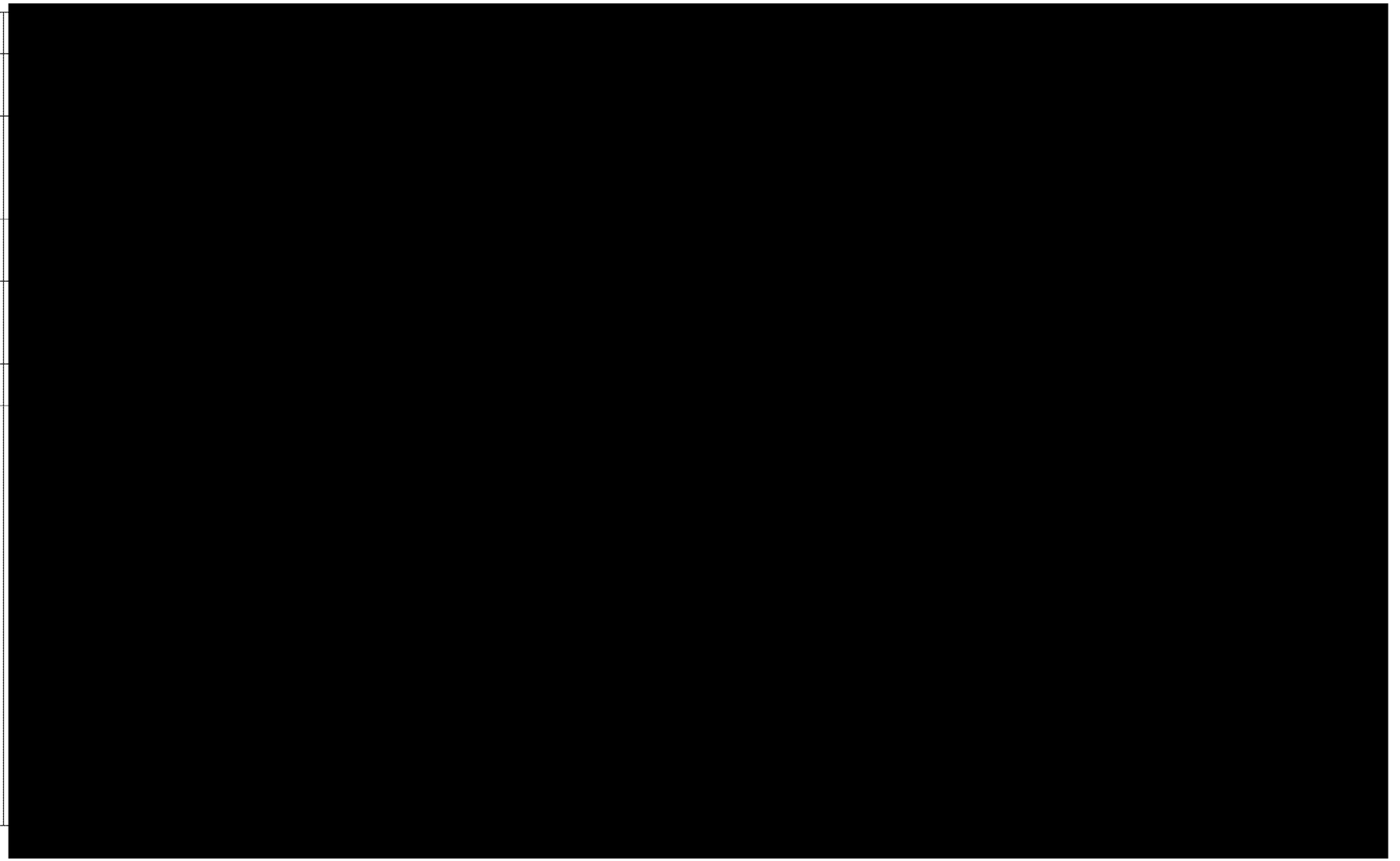

	b. if possible, please also include annual cost and "production" data for conservation/demand response.	PAO	Andrew Pietrewicz	Simon Z./ Joyce		See attached excel file No. 14 b.
	c. If similar modeling has been done for the 2017 LTEP to estimate expected cost and production by energy source in future years (out to 2035), please provide.	PAO	Andrew Pietrewicz	Joyce		This data will be available in the 2017 LTEP Modules to be released by the Ministry of Energy
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,	NA	NA			
	a. 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	GA	Jordan Penic			
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).	PAO	Andrew Pietrewicz	George		IESO's current estimate of the levelized unit electricity cost is found in the OPO Module 7: Electricity System Cost OPO, slide 33. http://www.ieso.ca/en/sector-participants/planning-and-forecasting/ontario-planning-outlook Module 7: Electricity System Cost Outlook Adobe pdf | PowerPoint file | Excel data file The LUEC table above does not include a range of the natural gas fired turbines. However, a simple cycle natural gas fired turbine capacity cost is provided ($/KW-year) since there is limited amount of energy from this resource.
	a. If LUECs do not include a cost of carbon, please also include a column with LUECs that incorporate a cost of carbon.	PAO	Andrew Pietrewicz	George		As noted above no natural gas LUEC's are readily available. The cost of carbon cost forecast in the OPO ranged from $16.75/Tonne in 2017 to $37.35/Tonne (in Real Cdn $2016). 2017 LTEP forecast cost of carbon, ranged from $17.40/Tonne in 2017 to $37.80/Tonne (in Real Cdn $2017)
	b. If possible, please also include estimates for the current cost of electricity storage per unit.	PEI	Darryl Yahoda	George		We may get this question.

#	Request	BU	SME	PSP Lead	Ref#	Response
	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:	PAO	David Short			
	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;	PAO	David Short			
	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.	PAO	David Short			
	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?).	PAO	David Short			
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?	PAO	David Short			

#	Request	BU	SME	PSP Lead	Ref#	Response
	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.	PAO	Andrew Pietrewicz David Short	Alan		As noted in OPO Module 1, slide 28. http://www.ieso.ca/en/sector-participants/planning-and-forecasting/ontario-planning-outlook Planning defines SBG to occur when the baseload generation is higher than the Ontario Demand plus net exports. SBG typically occurs during periods of low demand in Ontario and/or connected neighbouring systems. The expected baseload generation includes nuclear generation, baseload waterpower generation, and intermittent generation such as wind and solar. IESO does not breakdown generation capacity by baseload 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 flow conditions. When the flow is high, more hydroelectric would become baseload. When the flow is low, less hydroelectric would become baseload. As a result, IESO does not break the generation capacity by baseload vs. non-baseload. However, total generation capacity by fuel type is available in Response No. 13
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.	PAO	Andrew Pietrewicz	Bonnie		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 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. 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-

Commented [JP1]: Clarkson was going to take a kick of this question first and will share with us. Nonetheless, this is my shot at a response.

						20160901-pptx.pptx?la=en Capacity data based on the 2017 Long Term Energy Plan is expected to be available soon on Ministry of Energy's website.
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".	PAO	David Short			
22	It is the ECO's understanding that conservation in hours when hydro is the marginal resource may in some cases still deliver near-term electricity cost savings and greenhouse gas emissions reductions, if the hydro at the margin can be stored and used in other hours when it would reduce the use of natural gas-fired generation. Is this correct, and can the IESO estimate (qualitatively or quantitatively), the % of hours when such "peaking hydro" was the marginal resource in 2016 and 2017?	PAO	David Short			
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).	PAO	Andrew Pietrewicz	George		Still need to draft a response
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.)	PAO	David Short			
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.	PAO	David Short			
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.	PAO	David Short			
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.	PAO	Darryl Yahoda			
28	What were the results of the Industrial Electricity Incentive program (e.g. amount	PEI	Nik			

	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?		Schruder			
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)	PAO	Barbara Ellard			

#	Request	BU	SME	PSP Lead	Ref#	Response
	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.	PAO				
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.	PAO	Barbara Ellard			
32	Please provide projections of annual electricity exports (in $ of revenue expected and in TWh) until 2035.	PAO	Andrew Pietrewicz	Joyce		See attached excel file No. 32
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.	PAO	David Short			
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)?	PAO	Barbara Ellard			
35	Has the IESO considered an alternative to the current export pricing structure that includes the GA (or some portion of it)?	PAO	Barbara Ellard			

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

#	Request	BU	SME	Ref#	Response
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. [See Appendix Results of Renewable Energy Procurements]	PAO	Barbara Ellard		
40	What were the guiding principles that the IESO used to conduct price reviews for the FIT/microFIT program?	PAO	Barbara Ellard		
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.	PAO	Barbara Ellard		
42	Please clarify how the price reviews made use of information from previous IESO renewables procurements.	PAO	Barbara Ellard		
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?	PAO	Barbara Ellard		
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?	PAO	Barbara Ellard		
45	Over the lifetime of the FIT/microFIT program, what % of contracts submitted were rejected and not offered a contract?	PAO	Barbara Ellard		
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?	PAO	Barbara Ellard		
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.)?	PAO	Barbara Ellard		
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?	PAO	Barbara Ellard		
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?	LRCG	Michael Kileavy		
50	What have been the major "non compliance" issues with these contracts and how did the IESO resolve these?	LRCG	Michael Kileavy		

#	Request	BU	SME	Ref#	Response
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?	LRCG	Michael Kileavy		
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.).	LRCG	Michael Kileavy		
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. [Appendix renewable resources under contract]	LRCG	Michael Kileavy		

#	Request	BU	SME	Ref#		Response
	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?	PAO	David Short			
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?	PAO	David Short			
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.	PAO	David Short			
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.	PAO	Andrew Pietrewicz David Short	Andrew Pietrewicz		Andrew to draft

#	Request	BU	SME	PSP Lead	Ref#	Response
	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.	PAO	Andrew Pietrewicz	Brendan		Brendan to draft
59	Please explain why natural gas generation reduced substantially between 2015 and 2016? Does it appear that this trend will continue?	PAO	Andrew Pietrewicz	Brendan		Brendan to draft
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.	PAO	Andrew Pietrewicz	Brendan		Brendan to draft
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.	PAO	Andrew Pietrewicz David Short	Brendan		Brendan to draft
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?	PAO	Andrew Pietrewicz	Brendan		Brendan to draft

#	Request	BU	SME	PSP Lead	Ref#	Response
	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.	PEI	Nik Schruder	Brenda n		Conservation to draft – Planning will review
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).	PEI	Nik Schruder	Brenda n		Conservation to draft – Planning with review
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?	PEI	Nik Schruder	Brenda n		Brendan to draft
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.).	PEI	Nik Schruder			
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)?	PEI	Nik Schruder			
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?	PAO	Andrew Pietrewicz, Joe Tonegu zzo	Bob/Joe		Refer to excel file tab No. 68 for the map of the current information on the areas of transmission grid constraints. There are currently are no plans of improving the existing grid capability in these locations. However, we continue to monitor these areas in our planning process.
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.	PEI	Darryl Yahoda			

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.	PAO PEI	Barbara Ellard Darryl Yahoda			

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]
Illustrative FIT5	*IESO to complete…*	150	*IESO to complete…*	*IESO to complete…*	Fully subscribed – contract offers for 390 projects (382 solar, 7 on-farm biogas, 1 landfill biogas) representing 150 MW	*IESO to complete…*
FIT 3						
FIT 4						
FIT 5						

[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.

APPENDIX – RENEWABLE RESOURCES UNDER CONTRACT

wind, solar, biogas, hydroelectricity

Resource Type: Wind			
Tariff {example price ranges only}	**Contracted Capacity (MW)**	**Total Electricity Production (TWh, 2016)**	**Total Generation Cost ($, 2016)**
10-19 c/kWh			
20-29 c/kWh			
30-39 c/kWh			

Resource Type: Solar			
Tariff {example price ranges only}	**Contracted Capacity (MW)**	**Total Electricity Production (TWh, 2016)**	**Total Generation Cost ($, 2016)**
10-19 c/kWh			
20-29 c/kWh			
30-39 c/kWh			

Resource Type: biogas			
Tariff {example price ranges only}	**Contracted Capacity (MW)**	**Total Electricity Production (TWh, 2016)**	**Total Generation Cost ($, 2016)**
10-19 c/kWh			
20-29 c/kWh			
30-39 c/kWh			

Resource Type: Hydro			
Tariff {example price ranges only}	**Contracted Capacity (MW)**	**Total Electricity Production (TWh, 2016)**	**Total Generation Cost ($, 2016)**
10-19 c/kWh			

20-29 c/kWh			
30-39 c/kWh			