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Ontario

BY E-MAIL

August 9, 2016

Kirsten Walli
Board Secretary
Ontario Energy Board
2300 Yonge Street, 27th Floor
Toronto, ON M4P 1E4

Dear Ms. Walli:

Re: Hydro One Networks Inc. (Transmission)
2017 and 2018 Transmission Revenue Requirement and Rates Application
OEB Staff Interrogatories
Board File No. EB-2016-0160

In accordance with Procedural Order No. 1, please find attached OEB staff's interrogatories in the above noted proceeding. Hydro One and all intervenors have been copied on this filing.

Hydro One's responses to interrogatories are due by August 31, 2016.

Yours truly,

Original Signed By

Harold Thiessen
Ontario Energy Board staff
Case Manager, EB-2016-0160

Attach.

OEB Staff Interrogatories
Hydro One Networks Inc. (Hydro One)
2017 and 2018 Transmission Revenue Requirement
and Rates Application
EB-2016-0160
August 9, 2016

Exhibit A 1.0 ADMINISTRATION

1.0 – Staff 1
Ref: Exhibit A/Tab5/Sch1
In 2015, Hydro One underwent a change in corporate structure which included the issuance of ownership shares to outside investors.

a) Please provide a summary of the impacts of this change with regard to this application with particular regard to financial impacts that would affect customers.

b) Please advise what impact, if any, the change in corporate structure will have on Hydro One's governance.

1.0 – Staff 2
Ref: Exhibit A and Auditor General's Report, Fall 2015
The 2015 Ontario Auditor General's report identified a number of areas of concern for Hydro One and in particular, the transmission system. The most significant concerns cited by the auditor general were:

- Deterioration of system reliability
- Backlogs of preventative maintenance
- High risk assets not being replaced
- Significant assets beyond expected life still in use
- Asset analytics not considering all factors for asset replacement decisions.
- Inaccurate data in OEB funding requests
- Limited security for electronic devices.

Please provide a summary of how the areas of concern cited by the Auditor General were addressed in this application.

Customer Engagement

1.0 – Staff 3
Ref: Responses to Letters of Comment
Following publication of the Notice of Application, the OEB has, so far, received 9 letters of comment. Section 2.3.2 of the Transmission Filing Requirements indicates, "Transmitters are expected to file with the OEB their response to the matters raised in any letters of comment sent to the OEB related to the transmitter's application."

Please file a response to the matters raised in the letters of comment referenced above. Going forward, please ensure that responses are filed to any subsequent letters that may be submitted in this proceeding.

1.0 - Staff 4
Ref: Exhibit A/Tab3/Sch 1/p. 5
Hydro One specifies that customers indicated that the customer consultations were valuable to them in understanding Hydro One's operations and investment process.

Please provide a list of the specific indications from customers regarding the value of the customer consultations.

1.0 – Staff 5
Ref: Exhibit A/Tab3/Sch 1/p. 4
Chapter 2 of the Transmission Filing Requirements indicate the importance of enhanced customer engagement and reporting on future planned customer engagement activities.

Please describe the differences between customer engagement conducted in preparation for the current application and previous customer engagement. Please explain how customer engagement has been enhanced and summarize Hydro One's future plans regarding customer engagement.

1.0 – Staff 6
Ref: Exhibit A/Tab9/Sch 1/p. 3
Hydro One indicates that it incorporated feedback given at the stakeholder session into the application and provides an example citing T-SAIFI-S and T-SAIFI-M metrics.

Please provide a list and description of any other feedback that was given and incorporated in the application.

1.0 – Staff 7
Ref: Exhibit A/Tab3/Sch 3/pp. 5 & 6
Table 2 shows the 'Fees Payable to Hydro One Networks for Services Provided' for 2017 and 2018. Table 3 shows 'Fees Payable by Hydro One Networks for Services Received'.

Please provide similar historical information from 2012 to 2016 for both tables.

Exhibit B 2.0 TRANSMISSION SYSTEM PLAN/COST EFFICIENCIES and PRODUCTIVITY

2.0 – Staff 8
Ref: Exhibit B1
In the Hydro One Distribution rates decision (EB-2013-0416) the OEB indicated at page 35, that it "….also expects that Hydro One will consider the merits of having its DSP reviewed by an independent third party and, if done, to file that review in its next rates application. If not done, an explanation of that choice must be filed with the DSP."

a) Did Hydro One consider the merits of a third party review for its Transmission System Plan?

b) If any review was completed, what was the extent of the review and what were the results?

2.0 – Staff 9
Ref: Exhibit B1/Tab1/Sch 1/p. 2
"Hydro One has gained additional knowledge through the ongoing testing of critical assets and expansion of the scope of condition assessments, combined with information collected about the actual performance (including failures) of individual assets. Hydro One has also been developing a greater understanding of how equipment unavailability due to condition and demographics are a leading indicator of future reliability issues, contributing to higher reliability risk. As a result of these efforts, Hydro One is continuing to prioritize replacement of assets with a goal of maintaining top quartile reliability and reducing reliability risk on the system."

a) Please define "top quartile reliability" as used in the quoted paragraph and please confirm that Hydro One uses the term "top quartile reliability" consistently throughout the filing.

b) Please confirm the following.

i. That Hydro One uses the term "reliability risk" consistently throughout the filing.
ii. Whether or not this represents the common interpretation of "reliability risk" as that term is used by electric industry organizations such as NERC or CEA.

2.0 – Staff 10
Ref: Exhibit B1/Tab1/Sch 3/p. 23 - External Comparisons of Reliability, Figure 8a – Comparison of Hydro One Frequency of Momentary Interruptions to CEA composite, Figure 8b – Comparison of Hydro One to Frequency of Sustained Interruptions to CEA Composite.
Please compare Hydro One's performance in the momentary and sustained delivery point interruptions categories with the Peer Group against which Hydro One's capital expenditure performance was benchmarked in the Navigant report.

2.0 – Staff 11
Ref: Exhibit B1/Tab1/Sch 3/p. 25 - External Comparisons of Reliability, Figure 11 – Comparison of Hydro One Delivery Point Unreliability Index to CEA Composite.

a) Please explain the reason for the apparent correlation in Figure 11 between the CEA Composite and Hydro One delivery point unreliability index results.

b) Do the Hydro One results influence the CEA composite index? If yes, is it possible to compare the Hydro One results with CEA results that exclude Hydro One, to enable a comparison with other Canadian utilities that is not influenced by Hydro One results? If so, please provide this comparison.

2.0 – Staff 12
Ref: Exhibit B1/Tab1/Sch 3/p. 26 - External Comparisons of Reliability, Figure 12 – Unavailability of Transmission Lines, Figure 13 – Unavailability of Major Transmission Station Equipment.

a) Figures 12 and 13 above compare Hydro One's annual unavailability results with 5-year rolling averages of the CEA composite results. Please provide revised figures comparing annual Hydro One results with annual CEA results.

b) Do the Hydro One results influence the CEA results? If yes, is it possible to show annual CEA results excluding Hydro One results to enable a more meaningful comparison? If so, please provide this comparison

c) Please explain in detail the causes of the unavailability spikes that occurred in 2015 for both transmission lines and major transmission station equipment.

2.0 – Staff 13
Ref: Exhibit B1/Tab1/Sch 3/p. 27 - External Comparisons of Reliability.
"Hydro One undertakes an annual detailed assessment of the cited performance measures. This assessment is taken into account along with other factors (such as asset condition) when establishing and prioritizing operating, maintenance and capital programs."

Please confirm if Hydro One assesses equipment performance independently of condition assessment. If yes, please provide examples of assets with highly rated condition assessment with simultaneously poor assessed performance.

2.0 – Staff 14
Ref: Exhibit B1/Tab2/Sch 4/p. 7 - Section 3.2: Reliability Risk Modeling Approach.

"Reliability risk is modelled using the relationship between asset demographics, historical asset failures and the impact that equipment has on reliability. Hydro One's risk model focuses on lines, transformers and breakers, due to their large contribution to reliability risk and criticality to the system. Calculating reliability risk based on the interruption durations attributable to these asset classes creates a measure of the substantial portion of the reliability risk on the transmission system.

The output of the risk model is a measure of the system reliability risk resulting from planned investments relative to a baseline. The model considers both the expected impact of asset replacement and the continued aging and deterioration of existing assets."

a) Please confirm that Hydro One's risk model only takes into account lines, transformers and breakers and that no other asset classes are considered by Hydro One when calculating reliability risk.

b) Please identify if this is Hydro One's first Transmission Cost-of-Service Application and Evidence Filing to employ this risk modeling approach.

c) Has Hydro One back-tested or "back-cast" its reliability risk model to validate modeled risk projections against actual reliability and outage performance? If yes, please provide the results of these back-tests.

d) Does Hydro One use the risk model output to develop capital investment budgets? If yes, please explain in detail how the risk model output is used and at what stage of the capital planning process.

e) Please provide Hydro One's methodology and quantified model outputs that were used to assess the system reliability risk impacts of the capital investments proposed in this filing.

f) If the risk model output does not identify individual capital projects, how does it provide a meaningful indication of the reliability risk mitigation effectiveness of different levels of capital investment? Please explain in detail and include quantified examples.

g) Has Hydro One used asset demographics to determine which assets need to be replaced in the absence of asset condition assessment and/or performance data? If yes, please identify which of the projects identified in this application are driven primarily by asset demographics and provide Hydro One's rationale for not field-verifying the condition/performance of these assets prior to including these projects in the present filing.

2.0 – Staff 15
Ref: Exhibit B1/Tab2/Sch 4/p. 8 - Section 3.2: Reliability Risk Modeling Approach, Table 1 – Relative Change in Reliability Risk

"Table 1 below summarizes the expected relative decrease in risk, for each critical asset class and for the system as a whole, as a result of the 2017 and 2018 investment plan. For comparison the table also provides the relative increase in risk which will occur if no assets were replaced in the two year period."

Table 1: Relative Change in Reliability Risk

	Relative Change in Risk from Jan 1, 2017 to Dec 31, 2018, as per proposed investment	Relative Change in Risk from Jan 1, 2017 to Dec 31, 2018, without investment	% of Interruption Duration*
Lines	-2%	11%	69%
Transformers	-9%	14%	9%
Breakers	1%	17%	6%
Other[1]	-	-	16%
Total*	**-2%**	**10%**	

* Total is calculated by weighting the change in risk by the asset class' contribution to interruption duration.

a) Please provide a description of the methodology, the detailed calculations and the supporting data used to populate Table 1 above.

b) Does Table 1 above show the overall probability of asset failures in each asset class contributing to SAIDI, CAIDI or some other metric?

c) Is the relationship between level of capital investment and the Relative Change in Risk values shown in Table 1 linear, or are there inflection points driven by different individual investments or overall levels of investment?

d) Did Hydro One evaluate any alternative investment plans other than the "proposed investment" and "without investment" cases shown in Table 1?
   i. If yes, please provide the investment level and projected reliability risk performance of these alternative investment portfolios.
   ii. If no, please explain how the proposed plan optimizes capital investment costs against reliability risk.

e) Has Hydro One ranked its capital investments to facilitate forced prioritization of the most effective reliability risk mitigation projects if the approved level of capital investment is less than Hydro One has requested?
   i. If yes, please provide the prioritized project list.
   ii. If no, please explain how the most effective risk mitigation projects will be prioritized if the approved capital investment level is less than requested.

2.0 – Staff 16
Ref: Exhibit B1/Tab2/Sch 4/p. 9 - Section 4.1: Relationship between Maintenance Expenditures and Capital Investment.

"Hydro One has relied on maintenance programs to extend the lifespan of assets by continually addressing asset condition deficiencies, where practical, as a means of deferring large capital expenditures. As a result assets are being operated beyond their expected service life ("ESL"). Although this approach defers capital investments, it increases maintenance costs and the risk that assets will fail, deteriorate significantly or become obsolete as spare parts and manufacturer support is becomes unavailable.

The following examples illustrate situations where these risks were manifest:

- *Elgin TS and Horning TS were constructed in Hamilton in 1968 and 1967 respectively. Although the equipment at both stations was in a deteriorated condition, Hydro One continued to keep them operating through continual corrective maintenance. Capital investments to refurbish these stations were planned in 2015 and 2016 respectively.*
- *In 2015, significant equipment failures also occurred with Bridgman TS (Toronto), built in 1952, and Frontenac TS (Kingston), built in 1938, due to deteriorating assets. These failures caused reliability and public safety concerns due to their locations. In the case of the Frontenac failure, Kingston and surrounding areas lost power for over 12 hours."*

a) Please explain how Hydro One decides whether to replace or to extend the lifespan of deteriorated assets.
   i. Did Hydro One decide to refurbish Elgin TS and Horning TS in 2015 and 2016 because Hydro One's capital investment decision-making process indicated that it was better to refurbish these assets rather than replace them? Please explain.
   ii. Did Hydro One decide to defer refurbishing or replacing Bridgman TS and Frontenac TS because Hydro One's capital investment decision-making process indicated that replacement or refurbishment was not necessary? Please explain.
   iii. Does Hydro One perform cost-benefit analysis before making each such decision?
   iv. If yes, please provide the cost-benefit analyses for Elgin TS, Horning TS, Bridgman TS, and Frontenac TS.
   v. If no, please explain how Hydro Once made its evaluations and decisions for Elgin TS, Horning TS, Bridgman TS, and Frontenac TS.

b) Please define the activities represented by the terms "continual corrective maintenance" and "refurbish" as used in the above reference.

c) Please identify if Hydro One has made any changes to its capital investment process as a result of its experiences with Elgin TS, Horning TS, Bridgman TS and Frontenac TS.
   i. If any changes were made, are those changes quantifiable, i.e.: has the risk weighting calculation algorithm been modified? Please provide the algorithm and details of any algorithm changes.

2.0 – Staff 17
Ref: Exhibit B1/Tab2/Sch 4/p. 12 – Section 6: Sustainment Forecast and External Constraints

"The ESL profile of Hydro One's asset base suggests that significant sustainment capital will be needed between 2016 and 2030 in order to prevent an increase in reliability risk. A sizable portion of each critical asset class is operating beyond expected service life, contributing to an increase in reliability risk. Specifically, 28% of transformers, 9% of breakers and 19% of conductors are currently operating beyond their normal expected service lives."

a) Please describe in detail how Hydro One assesses and tracks the age of its assets (i.e.: is the asset age determined solely by the original asset commissioning date, or does Hydro One use an adjusted age based upon the results of condition assessments?)

b) Did Hydro One utilize actuarial values of expected service lives when deciding which sustainment projects to include in its filed sustaining capital plan?

c) Please provide details of the methodology Hydro One uses to calculate "Expected Service Life" for different asset classes.

d) Does Hydro One adjust the expected service lives of assets based upon the results of its asset condition assessment procedure?

e) How often does Hydro One update its "Expected Service Life" calculations?

f) Do "Expected Service Life" updates incorporate updated actual Hydro One asset performance data?

g) Please confirm that Hydro One has performed recent asset condition assessments for all major assets scheduled to be replaced as part of the sustaining capital projects included in this filing. If not confirmed, please identify which filed sustainment projects involve replacing major assets that have not had a recent asset condition assessment.

2.0 – Staff 18
Ref: Exhibit B1/Tab2/Sch 4/p. 15 – Section 6: Sustainment Forecast and External Constraints, Figure 5 – Anticipated Sustainment Work Volume

a) Please confirm that the anticipated sustainment work volume post-2016 shown in Figure 5 replicates Hydro One's original annual asset installation counts by asset class starting in 1949, effectively implying a fixed 68-year asset replacement cycle across all asset classes.

b) Please confirm that Hydro One is not proposing to follow the implied 68-year asset replacement cycle shown in Figure 5.

c) Please provide an updated Figure 5 with an asset replacement cycle that reflects the expected service lives of different asset classes and Hydro One's current asset base.

2.0 – Staff 19
Ref: Exhibit B1/Tab2/Sch 4/ Attachment 1 – Reliability Risk Model, pg. 1

"Hydro One's reliability risk model relies on three key inputs, which are detailed below: asset-specific hazard curves, the asset demographic of Hydro One's current fleet, and the total units of each asset class that are planned to be replaced. The reliability risk model is used to help inform the level of investment required to manage system reliability risk."

Does the increased amount of intermittent generation on the Hydro One system, relative to the historic period from which reliability / hazard curves were developed, change the expected useful life of any of Hydro one's key assets?

2.0 – Staff 20
Ref: Exhibit B1/Tab2/Sch 4/ Attachment 1 – Section 1: Hazard Rates, pp. 1-2

"The Hazard Rate represents the conditional probability of failure, including retirements, in a year given that the asset has survived through the previous years.

Hydro One's hazard curves were developed based on the results from a report commissioned from Foster Associates entitled, "2014 Asset Failure Analysis." Foster Associates determined the hazard curves for each asset class based on Hydro One's actual asset demographic data (including vintage and in-service dates) and Hydro One's actual asset failures and retirements caused by asset condition deterioration, performance, wear and tear, actions of the elements, accidents and functional and technical obsolescence.

Foster Associates determined the hazard curves that describe the expected risk profiles for each of Hydro One's major asset groups, including transformers, circuit breakers, and conductors. These curves serve as the basis for estimating asset failure risks in the reliability risk model."

a) The above reference includes "retirements" as a Hazard Rate constituent component.

   i. Please define the term "retirements" as used in this reference.
   ii. Please describe the conditional failure mechanism associated with "retirements".

b) Please provide a copy of Foster Associates' 2014 Asset Failure Analysis report.

c) Are transformers, circuit breakers and conductors the only asset classes for which hazard curves were developed?

d) Has Hydro One historically retired individual assets or classes of assets at specified ages, regardless of asset condition, wear and tear, performance, etc.?
   i. If yes, how have Hydro One's retirement practices influenced the cited Hazard Rate curves?

ii. If yes, how have Hydro One or Foster Associates adjusted the Hazard Rate curves to compensate for the different replacement methodologies that are applied to different assets?

e) In the determination of Hazard Rate curves, how are major failures differentiated from smaller or partial failures that can be easily repaired? For example, would the curves treat failure of a transformer bushing NEMA-pad connector differently than a transformer winding failure? Please explain.

f) For conductor failures, does the Hazard Rate curve differentiate failures caused by acts of God (e.g.: wind storm, ice storm) from failures caused by normal wear & tear or corrosion? Please explain.

g) Are the Hazard Rate curves consistent across all regions, or are different categories modified depending upon regional characteristics, e.g.: heavy ice loading areas, or high corrosion zones.

2.0 – Staff 21
Ref: Exhibit B1/Tab2/Sch 4/ Attachment 1 – Section 5: Summary of Risk Model Assumptions, pg. 6

5. SUMMARY OF RISK MODEL ASSUMPTIONS

Asset	Critical Inputs and Assumptions		
	Demographics	Hazard Curves	Units of activity under investment plan
Transformers	Hydro One's transformer demographics as of Jan. 2016	• Hazard curves for each type of transformer (e.g. auto-transformer, step down transformer) were applied to the asset demographics of that type of transformer; calculated a weighted average to arrive at an asset-class level metric	• Oldest transformers were assumed to be prioritized for replacement according to proportion of total transformers beyond expected service life for each transformer type

a) Please confirm that the transformers proposed for replacement in this filing are actually the oldest transformers in the Hydro One fleet.

b) If not, please confirm that the calculation of reliability risk change is based upon the actual capital investment plans for replacing transformers rather than the assumption that the oldest transformers are being replaced. Please provide detailed calculations showing how the reliability risk calculations were modified to accommodate the actual replacement list.

c) Please identify which of the oldest transformers identified in Hydro One's Jan 2016 transformer demographics per the above reference are not proposed for replacement in this filing. Explain how Hydro One determined that these transformers did not require replacement.

2.0 – Staff 22
Ref: Exhibit B1/Tab2/Sch 4/ Attachment 1 – Section 5: Summary of Risk Model Assumptions, pg. 6

5. SUMMARY OF RISK MODEL ASSUMPTIONS

Asset	Critical Inputs and Assumptions		
	Demographics	Hazard Curves	Units of activity under investment plan
Conductors	All asset demographics in circuit kilometers Conductor asset demographics as of Jan 2016	• Hydro One's lines demographics extended beyond the age (90) at which the hazard curve for conductors reached a limit of 4.6%. • Assumption built into model of 1% increase in risk for every year of aging past 90 in order to more realistically represent the risk facing aging conductors	• Oldest conductors assumed to be replaced first

a) Has Hydro One quantified the relationship between conductor failures and asset age?

b) Does “risk" as used in the table above mean "annual probability of failure"?

c) Please show the calculations used by Hydro One to support the assumed 1% increase in "risk" (or annual probability of failure) for each year of aging past 90.

d) Please show the quantified relationship between Hydro One's conductor fleet demographics and annual conductor failures over the last 10 years.

e) Does Hydro One include failures caused by hardware such as sleeves, saddles, dead-ends and spacer-dampers in its count of conductor failures?
   i. If yes, is Hydro One able to separate hardware failures from actual conductor failures? Please provide the relevant data for the past 10 years.
   ii. Is conductor replacement the most economically efficient approach to reducing the frequency of hardware failures?

f) Please confirm that Hydro One’s calculation of reliability risk change is based upon actual capital investment plans (for replacing conductors) rather than the assumption that the oldest conductors will be replaced. Please explain in detail.

g) Please confirm that the actual list of conductors being proposed for replacement comprises the oldest conductors, and if not, please identify how the actual list was developed.

2.0 – Staff 23
Ref: Exhibit B1/Tab2/Sch 5/ – Section 2.1: Asset Risk Assessment Methodology, pg. 2

"In assessing asset needs, planners also consider other factors such as environmental risks and requirements, compliance obligations, equipment defects, health and safety considerations and customer needs and preferences. Planners then make recommendations regarding what investments should be made within an identified timeframe. To clarify, the ARA is one step in the asset planning process; it does not replace decisions made by qualified engineers in conjunction with physical inspections."

a) Is the ARA a screening tool used by Hydro One to determine the overall portfolio of potential sustainment projects considered for inclusion in the capital budget, with the final selection made by qualified engineers?

b) Were all the projects included in the present filing initially identified using the ARA?

c) Were any projects initially identified using a different methodology? If yes, please specify which projects and which methodology was used.

d) Were any projects in the present filing directly selected using only the ARA methodology?

e) Please explain why the asset information is not consolidated into one system in order to enable decisions based upon a comprehensive algorithm (e.g.: why aren't the physical inspection results incorporated into the ARA to evaluate and compare the risks per asset)?

2.0 – Staff 24
Ref: Exhibit B1/Tab2/Sch 5/ – Section 2.1.2: Asset Demographic Risk, pg. 3

"Asset demographic risk relates to the increased probability of failure exhibited by assets of a particular make, manufacturer, and/or vintage, which is based on empirical data. Typically, the probability of asset failure increases with age. Thus, the asset demographic risk increases as an asset ages. Assets with relatively high demographic risk are candidates for refurbishment or replacement."

a) Does "asset demographic risk" as used above mean the correlation between the probability of failure and the "make, manufacturer, and/or vintage" of different classes of assets?

b) Has Hydro One developed annual probabilities of failure for different asset classes based upon asset make, manufacturer and age? If yes, please provide details of the methodology used to develop these probabilities and the resulting annual failure probabilities for all asset classes based on make, manufacturer and age.

c) Was "asset demographic risk" the primary criterion used to select any of the projects listed in this filing? If yes, please identify those capital projects and provide details of how this methodology was used in their selection.

2.0 – Staff 25
Ref: Exhibit B1/Tab2/Sch 5/ – Section 2.1.3: Asset Criticality, pg. 3

"Asset criticality represents the impact that the failure of a specific asset would have on the transmission system. Primarily, it is used to show relative importance of an asset compared to other assets of the same type."

a) How does Hydro One evaluate Asset Criticality for individual assets? Please explain in detail, including discussion of the role that probability of failure and consequence of failure play in determining Asset Criticality.

b) How does Hydro One quantify Asset Criticality (i.e.: is it represented as a number, such as 1 to 10, or is it assigned a subjective description, like very important and less important)?

c) Please confirm that Asset Criticality is used by Hydro One to evaluate the consequence of failure of specific assets.

d) Please provide a listing of the 10 highest criticality assets in Hydro One's fleet as evaluated using this methodology, and provide details of how criticality was determined for each asset.

2.0 – Staff 26
Ref: Exhibit B1/Tab2/Sch 5/ – Section 2.1.4: Asset Performance Risk, pg. 3

"Asset performance risk reflects the historical performance of an asset, which is based on empirical data. Performance is defined by any power interruptions that have been caused by failure of the asset. This risk factor considers the frequency and duration of these interruptions, as well as whether the interruptions are occurring more or less frequently over time."

a) Does Hydro One examine the correlation between its Asset Condition Assessments and subsequent Asset Performance? In other words, how often do assets that initially receive a positive Asset Condition Assessment subsequently perform poorly, and vice versa?

b) Please identify any asset replacement projects listed in this filing for which "Asset Performance Risk" was the primary driver for the asset replacement decision?

c) Does Hydro One track Asset Performance Risk by individual asset or by groups or classes of assets?

2.0 – Staff 27
Ref: Exhibit B1/Tab2/Sch 5/ – Section 2.1.5: Asset Utilization Risk, pg. 4

"Asset utilization risk represents the increased rate of deterioration exhibited by an asset that is highly utilized, which is based on empirical data. The relative deterioration of some assets is highly dependent on the loading placed upon them or the number of operations they experience. For example, transformers that are heavily loaded relative to their nameplate rating deteriorate more quickly than those that are lightly loaded."

a) Please identify any asset replacement projects listed in this filing for which "Asset Utilization Risk" was the primary driver for the asset replacement decision.

b) Please show how Hydro One evaluated asset utilization risk for a specific representative project.

c) Does Hydro One track asset utilization for all its assets or only for assets of specific sizes and classes?

d) Please provide a listing of the 10 most heavily utilized assets for each of the following classes:
- Autotransformers;
- Transformers;
- Air-blast Circuit Breakers;
- Oil Circuit Breakers;
- 500 kV Transmission Lines;
- 230 kV Transmission Lines; and
- 115 kV Transmission Lines.

e) Please identify which, if any, of the assets listed in d) are scheduled for replacement in Test Years 2017 & 2018.

f) Does Hydro One track the historic loadings of its transformers? If yes, please explain how this information is incorporated into the asset utilization risk evaluation and provide concrete examples of how the information is utilized.

2.0 – Staff 28
Ref: Exhibit B1/Tab2/Sch 5/ – Section 2.1.6: Asset Economic Risk, pg. 4
"Asset economic risk is based on the economic evaluation of the ongoing costs associated with the operation of an asset. Depending on the asset type, this evaluation may be as simple as determining the replacement cost of the asset, or as complex as comparing the present value of ongoing maintenance to that of complete refurbishment or replacement.

While an economic evaluation can identify assets that are candidates for replacement, more typically, the evaluation assists in selecting the best form of remediation for assets already deemed to be candidates for refurbishment or replacement."

a) Does Hydro One develop business cases to evaluate the all-in economic risk of individual assets or groups of assets (such as integrated substation investment projects) when preparing its capital budgets, and when determining if the economic risk of an asset or group of assets would be most economically addressed by replacement or refurbishment?
   i. If yes, does the business case evaluation criteria change in accordance with a certain materiality threshold? Please provide details.
   ii. If yes, please provide the business cases for all projects listed in this filing with total costs of over $20M.
   iii. If no, please explain why Hydro One does not develop business cases to evaluate capital investments of this magnitude, and describe the cost materiality threshold at which developing a business case would be considered appropriate.
   iv. If no, please provide details of how the all-in economic risk is measured and analyzed.

b) How does Hydro One evaluate the economic risk of a refurbished asset prematurely failing when deciding between replacement and refurbishment for a particular asset?

2.0 – Staff 29
Ref: Exhibit B1/Tab2/Sch 5/ – Section 2.2: ARA Data, p. 5
"Asset condition data is collected during routine maintenance, inspections and testing. For each specific asset, information on condition, performance history, utilization, criticality and other non-condition characteristics is compiled into a database for planning purposes. Improving the quality and quantity of this data is an ongoing objective for Hydro One."

a) What steps does Hydro One take to ensure the consistency of the asset condition data? In other words, how does Hydro One ensure that the assessment of "asset condition" is consistent across the system, and across the spectrum of employees making the assessments?

b) Does Hydro One track the predictive accuracy of the results produced by its ARA process? If yes, please provide details.
c) Is the existing ARA database complete enough and the evaluation methodology robust enough that it appropriately prioritizes capital expenditures without human intervention post-processing?

   i. If not, when does Hydro One expect that ongoing investments in this system will produce reliable project prioritization results?
   ii. Please provide the expected schedule and costs of the ARA implementation plan for achieving this outcome.

d) What are the historical and forecast annual OM&A and capital costs of developing, operating and maintaining Hydro One's Reliability Risk Model from its initiation to 2021?

2.0 – Staff 30
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.1.1: Transformers - Asset Overview, pg. 3

"The forced outage frequency of transformers has been relatively stable over the last decade. However, transformer failures can have a significant impact to local and system reliability. Transformers failures also have a negative impact on the environment in the event of oil spills."

a) Does Hydro One correlate its transformer failures against the results of its diagnostic testing and/or its transformer fleet demographics?

b) If yes, please provide the results of this analysis covering the past 10 years.

c) If no, please explain how Hydro One utilizes fleet demographics and diagnostic testing results in evaluating reliability risk and initiating asset replacement projects for its transformers.

2.0 – Staff 31
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.1.1: Transformers - Asset Overview, pp. 2-3

"Hydro One has 721 large transmission class transformers in service.
- *Currently 28% of the transformer population is beyond its expected service life.*
- *The condition of the transformer fleet, determined through industry standard diagnostic testing, is such that 15% present high or very high condition risks that need to be mitigated.*

Given the demographics of the transformer population, the condition trend and the risks associated with transformer failures including reliability impact, environmental and safety concerns, Hydro One plans to replace 27 transformers in 2017 and 22 in 2018. Regulatory requirements related to oil leaks, noise levels and PCB contaminated oil in equipment also contribute to the need to replace some of the transformer fleet."

a) Please provide a list of all 49 transformers selected for replacement in 2017 and 2018.

b) Please categorize each of the selected transformers by the primary driver for replacement: e.g.: high probability of failure, severe consequence of failure, noise levels, leaks, PCB contamination or other (if "other", please specify).

c) Hydro One has stated that 15% of its transformer fleet (i.e.: 108/721) exhibits "high or very high condition risks".
   i. Are all "high or very high condition risks" best addressed with transformer replacement?
   ii. Can any of the "high or very high condition risks" associated with transformers be successfully mitigated through refurbishment?

d) Please separately quantify the number of Hydro One transformers classified as exhibiting "high condition risks" and "very high condition risks".

e) Please identify which of the 49 transformers scheduled for replacement in 2017 & 2018 have been classified as exhibiting "high or very high condition risks".

f) Does Hydro One intend to replace all 108 transformers classified as exhibiting "high or very high condition risks" over the period 2017 to 2021?

g) Are all transformers classified as exhibiting "high or very high condition risks" included in the 28% of transformers categorized as being beyond expected service life? Please identify all exceptions.

2.0 – Staff 32
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.1.3: Transformers - Asset Assessment Details, Demographics, pp. 4-5

"The average age of the transformer fleet is currently 34 years of age and 28% of the in service transformers are currently beyond their expected service life. The demographics of the transformer population are outlined in Figure 2.
The potential risks to system and customer reliability as a result of this long-term demographic pressure needs to be managed through continued capital replacement programs."

a) Does "expected service life" as used in the above statement mean that 28% of the transformer population is above a nominal average expected service life developed for actuarial purposes?
   i. If yes, please provide the probability distribution associated with this service life expectation, and identify the maximum age by which 90% of the assets in this class can be expected to have failed.
   ii. If not, please explain in detail what "expected service life" means in this statement.

b) Is there a high probability that the 28% of the transformer population identified as being beyond the "expected service life" will fail in the near future? If yes, please quantify the probability of failure over the next 5 years for each asset and show the calculations used to evaluate those probabilities.

c) Are the expected service life values used to evaluate the assets shown in Figure 2 derived from standard industry values (if so, please provide reference) or Hydro One empirical results (if so, please provide the methodology and calculations)?

d) A large percentage of Hydro One's transformer assets are classified as exceeding "expected service life". Are these assets still providing adequate service in most cases?
   i. If yes, how is "expected service life" useful in determining the timing of these sustaining capital investments?

ii. If no, what has changed since Hydro One's previous application to prompt the decision to invest now, versus the decision not to invest previously? Please show the associated cost-benefit analysis.

e) Please provide details of the long-term project planning and prioritization process Hydro One intends to use to smooth the demographic bulges shown in Figure 2 to maintain the annual rate impacts of future sustaining capital investments at manageable and predictable levels.

f) Given the number of transformer assets shown as being "Beyond ESL" in Figure 2, please explain how Hydro One's proposed planning approach will avoid putting the system or customers at risk.

2.0 – Staff 33
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.1.3: Transformers - Asset Assessment Details, Condition, Figure 5 – Transformer Fleet Condition Assessment, pg. 7

"Based on the latest analysis, 15% of Hydro One's transformer population is rated high or very high risk, as outlined in Figure 5."

a) Does Hydro One quantitatively calculate the probability of failure for individual transformers, or is the probability of asset failure based upon a qualitative assessment by experienced personnel?
   i. If calculated quantitatively, please provide the calculation methodology utilized and the quantitative calculation results of risk (Probability x Consequence = Risk) for the 49 transformers planned for replacement in 2017 and 2018**.**

b) Figure 5 shows that very high-risk transformers comprise 2% or about 14 out of the fleet of 721 transformers. Does the designation Very High Risk in this figure indicate an actual Risk (i.e.: Probability x Consequence = Risk) or simply the probability of an imminent failure?
   i. If actual Risk, please quantify both the probability of failure and the consequence of failure for the Very High Risk assets identified in Figure 5.

c) Please quantify the probability of failure range and the timeframe of assessment for each category shown in Figure 5 (e.g.: Category A implies an X% probability of asset failure over the next Y years.)

d) Please explain in detail how Hydro One prioritizes and ultimately selects the high and very high risk assets to be replaced.

2.0 – Staff 34
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.1.3: Transformers - Asset Assessment Details, Other Influencing Factors, p. 8

"Safety - Power transformers can experience catastrophic explosions and fire if their condition is deteriorated. Power transformer outages can represent a concern for employee and public safety as individuals may be exposed to unneeded risks and harmed from the results of transformer failure as well as through prolonged power outages."

a) Please provide the total number of Hydro One transformers that have failed catastrophically over the past 10 years, by voltage class.

b) Please provide the number of transformers in Hydro One's fleet that are materially susceptible to imminent catastrophic failure, and quantify the probability of catastrophic failure and the period of evaluation for each transformer identified in this response.

c) To which transformers does Hydro One apply real-time gas alarm monitoring to reduce the risk of catastrophic transformer failure by enabling de-energization of transformers prior to imminent failure?

2.0 – Staff 35
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.2.1: Circuit Breakers - Asset Overview, p.11

"Currently 9% of the circuit breaker population is beyond its expected service life."

a) Is there a high probability that the 9% of the circuit breaker population beyond its "expected service life" will fail in the near future?
   i. If yes, please quantify the probability of failure by asset and show the basis of calculation.
   ii. If yes, please quantify the consequence of failure by asset and show the basis of calculation.

b) Are these assets still providing adequate service in most cases?
   i. If yes, please explain how Hydro One uses "expected service life" in selecting Circuit Breaker sustaining capital investments.
   ii. If no, please explain what has changed since Hydro One's previous filing to prompt the decision to invest now versus the decision not to invest previously, and provide the associated cost-benefit analysis.

2.0 – Staff 36
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.2.1: Circuit Breakers - Asset Assessment Details, Demographics, pg. 12

"Hydro One uses an expected service life ("ESL") of 40 years for all circuit breakers with the exception of oil circuit breakers, where an ESL of 55 years is used."

Are these ESLs based upon industry standard values or an empirical evaluation of the historical performance of Hydro One assets?

i. If the former, please provide a reference.
ii. If the latter, please provide quantified calculations of these ESLs.

2.0 – Staff 37
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.2.3: Circuit Breakers - Asset Assessment Details, Performance, Figure 8 – Forced Outages Frequency of Circuit Breakers, pp. 14-15

"As displayed in Figures 8 and 9, the number of forced outages due to circuit breakers and the duration of those outages both increased beginning in 2013. This was primarily the result of increased outages among the Air Blast Circuit Breakers (ABCB) compared to previous years."

a) Please define "forced outages" as used above, and categorize the different types of circuit breaker failure modes by frequency of occurrence.

b) What are the failure rates for system circuit breakers versus customer supply circuit breakers?

c) What is the root cause of the step increase in forced outage frequency starting in 2013? Is the root cause linked to changes in Hydro One operational or maintenance practices? Please explain.

2.0 – Staff 38
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.2.3: Circuit Breakers - Asset Assessment Details, Performance, Figure 10 – Forced Outage Frequency of Circuit Breaker by Type, pg. 15

"In 2014 and 2015 the number of outages has been declining modestly from 2013 as ABCBs have been replaced throughout the system. This trend is notable in Figure 10, where the performance data for the different breakers in Hydro One system is depicted. Oil and SF6 breakers have steady trend whereas ABCBs have a significant increase."

a) Please quantify the annual circuit breaker failure rate for each type of circuit breaker, identified in Figure 10, by voltage class.

b) What are the primary causes of circuit breaker failures for each type and voltage class?

c) In Figure 10, what caused the 50% increase in oil breaker failures in 2015 versus 2014?

d) What caused ABCB outages to triple in frequency from 2012 to 2013 and to continue performing poorly in 2014 and 2015? Please explain in detail.

2.0 – Staff 39
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.2.3: Asset Assessment Details, pg. 16

"Circuit breaker condition is primarily based on assessment from preventive maintenance and corrective maintenance programs through diagnostic testing such as breaker timing, breaker oil analysis, history of deficiencies, and other tests. The components generally degrade over time based on the amount of usage. In some cases the degradation can be addressed through replacement of worn components during maintenance, but in many cases replacement of the circuit breaker is the only viable solution."

a) Please define "history of deficiencies" as used in the above paragraph.

b) Please provide quantified results showing the history of deficiencies of critical system circuit breakers.

c) It is stated above that "in many cases replacement of the circuit breaker is the only viable solution". Is viability in this statement based upon the economic trade-off of maintenance versus replacement? If not, please explain.

d) Has Hydro One conducted individual asset or overall fleet business case evaluations in developing its circuit breaker replacement plans? If yes, please provide the business case evaluations.

2.0 – Staff 40
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.2.3: Circuit Breakers - Asset Assessment Details, Figure 11 – Circuit Breaker Fleet Condition Assessment, pg. 16

"Currently 11% of Hydro One's circuit breakers rated high or very high risk based on asset condition, as outlined in Figure 11."

a) Does the designation high or very high condition risk indicate an actual Risk (i.e.: Probability x Consequence = Risk) or simply the probability of an imminent failure? If actual Risk, please quantify both the probability of failure and the consequence of failure for the 11% of circuit breakers at high or very high risk.

b) How many of Hydro One's ABCBs are rated as high or very high risk?

c) Please provide details of effective mitigation techniques that Hydro One has implemented to extend the service life of its circuit breaker fleet.

d) How does Hydro One evaluate life cycle costs when deciding between breaker refurbishment and replacement?

2.0 – Staff 41
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.2.3: Circuit Breakers - Asset Assessment Details, Other Influencing Factors, pg. 17

"Equipment Operations - Breakers that have exceeded their expected service life in terms of number of operations, have parts that are significantly worn, and are considered for replacement. Due to their frequent operation, this is most typical of capacitor and reactor breaker positions."

a) Please quantify the annual failure rates for capacitor and reactor breakers.

b) Is the system performance consequence of capacitor and reactor breaker failures typically very significant?

c) In what cases does Hydro One implement Point on Wave operation as standardized practice for capacitor and reactor breaker switching?

2.0 – Staff 42
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.2.3: Circuit Breakers - Asset Assessment Details, Other Influencing Factors, pg. 17

"Environmental Impact – Minimizing SF6 emissions and their resultant impact as a greenhouse gas to the environment is considered in the replacement or refurbishment plans for SF6 breakers."

a) Please quantify the number of occurrences of Hydro One SF6 circuit breaker failures leading to gas release for the last 10 years, by year.

b) Please describe how Hydro One considers greenhouse gas impacts in its replacement and refurbishment plans for SF6 breakers?

2.0 – Staff 43
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.2.3: Circuit Breakers - Asset Assessment Details, Other Influencing Factors, pg. 17

"System Evolution – Load growth and renewable generation connections may lead to increase in short-circuit requirement that is beyond the functional capability of existing breakers."

How does Hydro One ensure timely replacement of circuit breakers prior to their short circuit interruption capabilities being exceeded? Please describe in detail.

2.0 – Staff 44
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.2.3: Circuit Breakers - Asset Assessment Details, Table 5 – Circuit Breaker Replacement Rate, pg. 17

Table 5: Circuit Breaker Replacement Rate

Circuit Breaker Portfolio	Historic			Bridge	Test	
	2013	2014	2015	2016	2017	2018
# of Replacements	57	83	31	43	66	132
% of Fleet	1.2%	1.8%	0.7%	0.9%	1.5%	2.9%

a) What is Hydro One's rationale for doubling the circuit breaker replacement rate from 2017 to 2018?
   i. Does Hydro One currently have the capacity to implement this increased rate of replacement?
   ii. Does Hydro One anticipate that the planned 2018 rate of breaker replacement will carry over into the next cost of service or IRM period that will begin in future Test Year 2019?

b) Given an average expected life of between 40 and 60 years (implied 2.5% to 1.7% average replacement rate), the projected replacement of 3% of circuit breakers in 2018 represents a significantly accelerated rate of replacement. If continued going forward, a 3% annual replacement would be anticipated for assets with an average expected life of 33 years. What are the forecast annual rates of breaker replacement through the years 2019-2021?

2.0 – Staff 45
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.3.3: Protection and Automation - Asset Assessment Details, Performance, pg. 25

"The forced outage frequency of equipment caused by protection systems has been declining for lines equipment and a relatively stable trend for station equipment over the past 10 years."

What percentage of Hydro One forced outages due to protection system mis-operation is caused by incorrect protection settings or applications, and what percentage is caused by protection system equipment or hardware failure?

2.0 – Staff 46
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.3.3: Protection and Automation - Asset Assessment Details, Performance, pg. 26

"Programmable Auxiliary Logic Controller (PALC) relays, one type of solid state protection system, have shown an increase in recorded defects and trouble calls over the years. Hydro One has been actively replacing PALC relays and approximately 200 PALCs have been replaced in 2014 and 2015."

Are the PALC relays affected by manufacturer "type faults" or is the increase in defects due to thermal cycling or some other deterioration factor? If other, please specify.

2.0 – Staff 47
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.3.3: Protection and Automation - Asset Assessment Details, Table 7 – Protection Systems Expected Service Life, pg. 24 (PDF 925); Section 2.3.3: Protection and Automation - Asset Assessment Details, Condition, pg. 27

Table 7: Protection Systems Expected Service Life

Protection Technology	*Expected Service Life*
Electromechanical	45 years
Solid State	25 years
Microprocessor	20 years

"Protection system condition is an important indicator of equipment reliability. Condition is primarily based on age and findings from the preventive and corrective maintenance programs. The internal components degrade as a function of time, which can alter the performance of the relay. This is primarily a concern with electromechanical systems, but component aging or defects and thermal cycling can also affect solid state and microprocessor based protection systems. Microprocessor based protections are a relatively new technology, detailed condition metrics and indicators are not as well established."

a) Please reconcile the claim in Table 7 that electromechanical systems have a significantly longer expected service life than solid state or microprocessor systems with the statement that they are the systems most affected by degradation over time.

b) Given that Microprocessor relays are relatively new technology, are not as affected by time degradation as electromechanical relays, and generally require less operational intervention, how did Hydro One determine the 20 year expected life value?

c) What is the likelihood that these relays may ultimately demonstrate effective service lives equivalent to or longer than electromechanical or solid state relay systems?

2.0 – Staff 48
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.3.3: Protection and Automation - Asset Assessment Details, Other Influencing Factors, pp. 28-29
"Technology Obsolescence – Many protection systems are no longer available, limiting the availability of spares and support; which can adversely impact outage planning and overall system reliability. This is a significant factor for electromechanical and solid state systems."

Why is this a significant factor for electromechanical and solid state systems, but not for microprocessor based protection systems as well?

2.0 – Staff 49
Ref: Exhibit B1/Tab2/Sch 6/ – Section 2.3.3: Protection and Automation - Asset Assessment Details, Other Influencing Factors, pg. 29

"Innovation – New microprocessor based protection systems have advanced monitoring and diagnostic capabilities which can provide insight into station equipment performance and early detection of problems, potentially avoiding equipment damage. Modern microprocessor protection systems can be deployed with pre-tested configuration settings to facilitate fast and efficient system protection changes to accommodate dynamic changes to the configuration of the transmission system. Extended maintenance intervals for microprocessor based systems help contain OM&A expenditures and reduce life cycle costs."

Please reconcile the above statement with Hydro One's claim on page 27 that microprocessor based protections are a relatively new technology, and that detailed condition metrics and indicators are not as well established. In addition, it appears that that the expected life of microprocessor based protection systems is much shorter than the other two protection technology types.

2.0 – Staff 50
Ref: Exhibit B1/Tab2/Sch 6/ – Section 3.1.1: Transmission Overhead Conductor and Hardware - Asset Overview, pg. 31; Section 3.1.3: Transmission Overhead Conductor and Hardware – Asset Assessment Details, Demographics, pg. 33

"9% of the conductor population falls within the high risk category. Hydro One expects population of this category to increase as additional condition assessment programs are carried out during the test years.
The number of forced outage from conductors has declined slightly in recent years while the duration of outages has remained flat."
"Although there have been recent increases in replacement rates to deal with immediate risks, Figure 21 demonstrates that by 2025 the number of conductors beyond their expected service life will increase by over 90%. Hence an increase in future replacements is required to maintain acceptable fleet demographics."

a) Please reconcile the two statements cited in the excerpts from Section 3.1.1 above; if 9% of the conductor population falls within the high-risk category and that percentage is continually increasing, why is performance improving?

b) Has Hydro One tracked conductor failures by age of asset? If so, please provide this information.

c) What are the primary modes and relative frequencies of actual conductor failure, in comparison with the failure modes and frequencies of items such as conductor suspension and splicing hardware?

2.0 – Staff 51
Ref: Exhibit B1/Tab2/Sch 6/ – Section 3.1.2: Transmission Overhead Conductor and Hardware – Asset Strategy, pg. 31

"Hydro One intends to replace approximately 0.6% of conductor in 2017 and 1.5% in 2018, in order to manage risks associated with the declining condition of the conductor population."

Exhibit B1, Tab 2, Schedule 4, Figure 5 shows approximately 3000 circuit kms of anticipated conductor sustainment work volume in 2018. Please reconcile the anticipated conductor work volumes shown in Figure 5 with the replacement values provided in the cited excerpt from Section 3.1.2.

2.0 – Staff 52
Ref: Exhibit B1/Tab2/Sch 6/ – Section 3.1.3: Transmission Overhead Conductor and Hardware – Asset Assessment Details, Demographics, pg. 32

"Hydro One uses an expected service life ("ESL") of 70 years for conductors; although this can vary based on several factors, with environmental conditions being the primary factor."

a) Please quantify the relationship between the different environmental conditions evaluated by Hydro One and the impact on conductor ESL.

b) Please provide any analysis conducted by Hydro One that correlates conductor age in regions exhibiting these different environmental conditions with the frequency of outages caused by conductor failure.

2.0 – Staff 53
Ref: Exhibit B1/Tab2/Sch 6/ – Section 3.1.3: Transmission Overhead Conductor and Hardware – Asset Assessment Details, Performance, Figure 22 – Forced Outage due to Conductor & related Hardware Failures, pp. 33-35

"The number of forced outages due to conductor failures has improved over the past 10 years, as outlined in Figure 22.Outage frequency and duration performance is anticipated to deteriorate based on the results of condition assessment derived from actual aged conductor sample testing."

a) Please reconcile the above statement that forced outages due to conductor failures have improved over the past 10 years with Hydro One's claim that an aggressive conductor replacement program (e.g.: 3000 circuit kms of anticipated conductor sustainment work volume in 2018) must be implemented in the Test Years and forecast years to mitigate material future increases in conductor failure frequency.

b) Please explain the results shown in Figure 22 given Hydro One's aging conductor fleet demographics.

2.0 – Staff 54
Ref: Exhibit B1/Tab2/Sch6/ – Section 3.1.3: Transmission Overhead Conductor and Hardware – Asset Assessment Details, Performance, Figure 23 – Forced Outage Duration due to Conductor Failure, pg. 34

"The forced outage duration due to conductor failure, displayed in Figure 23, demonstrates that conductor outage duration has been relatively stable over the last 10 years with the exception of the abnormality in 2009 and 2015."

Please explain in detail the causes of the apparently abnormal conductor outage durations in 2009 and 2015.

2.0 – Staff 55
Ref: Exhibit B1/Tab2/Sch6/ – Section 3.1.3: Transmission Overhead Conductor and Hardware – Asset Assessment Details, Demographics, Figure 35 – Projection of Steel Structures Requiring Coating, pp. 49-50; Exhibit B1/Tab3/Sch2 – Section 5.2.2: Investment Plan, Table 16 – Overhead Lines Component Replacement Programs ($ Millions), pg. 35

"Based on the historical data, the average rate for structure renewal is about 200 towers per year. As outlined in Figure 35, at historic tower coating rates, the steel structures requiring coating in high corrosion zones will increase by 34% in 10 years. However, with planned coating plan, all structures requiring coating will be coated in the next 10 years."

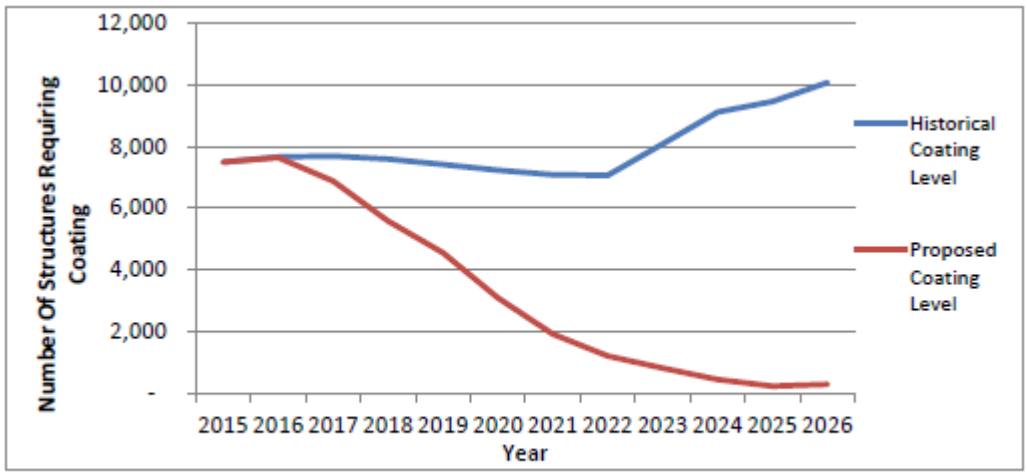

Figure 35: Projection of Steel Structures requiring Coating

Table 16: Overhead Lines Component Replacement Programs ($ Millions)

Description	Historic Years				Bridge Year	Test Years	
	2012	2013	2014	2015	2016	2017	2018
Wood Pole Replacements	26.9	32.7	43.6	38.5	38.3	35.3	35.3
Steel Structure Coating	1.6	5.7	5.1	4.6	8.8	42.5	54.4
Steel Structure Foundation Refurbishments	3.3	4.5	3.6	1.6	3.9	7.8	7.8
Shieldwire Replacements	4.4	2.9	8.2	4.3	5.2	7.0	7.1
Insulator Replacements	3.3	6.9	3.8	2.8	26.1	63.9	61.4
Transmission Lines Emergency Restoration	8.0	8.2	8.7	8.8	8.3	8.7	8.8
Other Line Component Replacements	3.4	5.6	5.7	6.0	3.2	5.0	5.2
Total	**50.9**	**66.5**	**78.7**	**66.6**	**93.8**	**170.2**	**180.0**

a) Please show the expected rate of failure if the steel structure re-coating rate is maintained at the present rate rather than being increased by 34%.

b) Please provide a quantified rationale for the increase in Steel Structure Coating program investments in 2017 and 2018 relative to historic years. What, if any, change does this increased level of investment indicate in Hydro One's Steel Structure Coating sustaining capital investment philosophy?

c) Please provide a quantified rationale for doubling Steel Structure Foundation Refurbishment investments in 2017 and 2018 relative to historic years? What, if any, change does this increased level of investment indicate in Hydro One's Steel Structure Foundation sustaining capital investment philosophy?

d) Please provide a quantified rationale for the increased Insulator Replacements in 2017 and 2018 relative to historic years. What, if any, change does this increased level of investment indicate in Hydro One's Insulator Replacement sustaining capital investment philosophy?

e) Regarding "Other Line Component Replacements" investments, if the potential costs associated with emergency restoration are unpredictable, please explain how Hydro One selected investment values of $3.2M in 2016, $5.0M in 2017, and $5.2M in 2018?

2.0 – Staff 56
Ref: Exhibit B1/Tab2/Sch 7 – Section 1: Introduction, pg. 1

"The investment planning process draws upon the previous year's efforts to identify investment needs, evaluating and prioritizing proposed individual investments that address these needs, based on the business objectives. The end product is a fully prioritized investment plan."

a) Please confirm that the list of "investment needs" projects carries over from year to year until all identified projects are refurbished or replaced.

b) Have Hydro One's business objectives changed from year to year or from filing to filing? Is it accurate to say that the prioritization of projects taken from the investment needs list would be very similar regardless of Hydro One's business objectives?

2.0 – Staff 57
Ref: Exhibit B1/Tab2/Sch 7 – Section 2: Strategic Context, pg. 2

"The business drivers are assigned weights by Hydro One's investment management group, based on their relative importance to the company."

Please provide concrete examples of the set of risk-based and outcome-based factors that Hydro One employed in assigning weights to the business drivers.

2.0 – Staff 58
Ref: Exhibit B1/Tab2/Sch 7 – Section 3: Economic Assumptions, pg. 3

"An economic outlook and customer load forecast are developed and used as basic assumptions in developing the investments. The load forecast is discussed in Exhibit E1, Tab 3, Schedule 1."

a) How does economic outlook impact decisions on sustaining capital, operations, and common corporate costs? Specifically, why does economic outlook, customer load forecasts and business objectives alter forecasts of non-discretionary items such as sustaining capital and operations which are based primarily on assets already in the ground?

b) Are the assumptions within the economic outlook identical to the assumptions that are taken into account when undertaking the various Regional Plans?

c) How does Hydro One differentiate between non-discretionary investments and discretionary investments to ensure that only those projects that represent truly non-discretionary investments are identified before prioritizing discretionary spending? Please provide examples of the most common investment types that Hydro One categorizes as discretionary and non-discretionary.

2.0 – Staff 59
Ref: Exhibit B1/Tab2/Sch 7 – Section 4.4: Risk Treatment and Options Analysis, pg. 14

"These identified options and flexible timing arrangements are, at least in the short term, considered to be viable candidate investments, and are included in the optimization process for potential selection."

Are the risk ratings given for the various scenarios based upon subjective judgment?

a) If yes, how does Hydro One guard against judgment bias that may be contrary to objective evidence?

b) If no, please provide the methodology for determining the quantitative risk ratings based on objective evidence.

2.0 – Staff 60
Ref: Exhibit B1/Tab2/Sch 7 – Section 6.2: Re-direction of Funds, pg. 17

"The re-direction of funds allows appropriate and prudent adjustments to be made to the work originally identified in the investment plan. As an example, the emergency restoration work needed to repair equipment failures or storm damage to a transmission line can be significant. Such events may necessitate the re-direction of funds and field resources from other investment areas."

a) What percentage of overall capital funds have been redirected from the investment plans in each year, from 2012 to 2015? Please identify the recipient and donor investment categories to and from which the funds were transferred, respectively, along with the rationale for the transfer.

b) For each project originally identified in the original investment plan but not executed as planned, please identify the rationale for re-directing funds to another project.

2.0 – Staff 61
Ref: Exhibit B1/Tab3/Sch 1 – Section 2.4: Common Corporate Capital, pg. 5

"Common Corporate capital spending levels in the test years are forecast to be higher than historical levels due to: (a) higher capital spending on information technology development projects, which aim to improve productivity in Hydro One's operations; (b) increased facility needs for expanding Sustainment, Development and Operations work programs; and (c) incremental capital investments in transport and work equipment, primarily, a new helicopter. The capital spending levels are forecast to be relatively stable through the test years."

Please provide the business case for the decision to acquire a new helicopter rather than pursue other alternative options (e.g.: drones, subcontracting, etc.)

2.0 – Staff 62
Ref: Exhibit B1/Tab3/Sch 1/ Attachment 1 – Comparison of Net Capital Expenditures by Major Category – Historic, Bridge and Test Years, pg. 1-3

a) What is the benefit to ratepayers of Hydro One's decision to change practice between 2012-2013 and 2017-2018 and group most substation spending into Integrated Station Investments? Please provide quantified evidence of the benefit to ratepayers.

b) Hydro One claims in Exhibit B1/Tab3/Sch2 – Section 3.3 that one of the benefits of Integrated Capital Investments is cost avoidance, thereby resulting in reduced overall capital expenditures. Please reconcile this claim with the forecast investment increase in Transmission Stations Capital from $322.5 million in 2012 to an annual average in excess of $500 million for the years 2014 to 2018.

c) What is the rationale for increasing the level of overhead lines investments by a factor of 5 from 2012 to 2018 despite acceptable line performance statistics? Please explain in detail.

d) What is the rationale for the order of magnitude step increase in underground cable refurbishment and replacement investment levels from 2017 to 2018?

e) Overall Sustaining Capital investments are forecast to increase from less than $400 million per year in 2012 to over $800 million per year in 2018. Please provide a cost-benefit analysis to justify more than doubling the level of Sustaining Capital Investments over this period.

2.0 – Staff 63
Ref: Exhibit B1/Tab3/Sch 2/– Section 3.2: Fundamentals of Integrated Investments, pg. 5

"The three year window aligns with the typical three to five year project execution duration required for scope development, design, construction and commissioning of integrated investments projects. This approach minimizes the potential for repeated mobilization of work crews to replace individual assets. Assets that are not in need of replacement or refurbishment are maintained until the next investment cycle when they are reassessed.
This approach provides opportunities to reduce the number of assets through reconfiguration, utilize modern technology and implement safety by design, to improve reliability, safety and productivity."

Please provide quantitative evidence to demonstrate that Hydro One's incremental asset replacements are incrementally improving reliability and/or incrementally lowering O&M costs.

2.0 – Staff 64
Ref: Exhibit B1/Tab3/Sch 2/ – Section 3.3: Benefits from Integrated Capital Investments, pg. 7

"Cost Avoidance – An integrated capital investment approach enables the system to be reconfigured and standardized, thereby reducing the number of assets within the system. For example, in the 2017 and 2018 test years, Hydro One plans to eliminate 10 transformers and 24 breakers from the system through reconfiguration. This results in avoided capital expenditures of $57 million during the test years."

a) Please reconcile the claim that the methodology described above avoided capital expenditures of $57 million in the Test Years when sustaining capital costs have more than doubled over the past 5 years.

b) Please provide detailed explanations of the $57 million savings and the base case against which those savings were calculated.

2.0 – Staff 65
Ref: Exhibit B1/Tab3/Sch 2/ – Section 3.3: Benefits from Integrated Capital Investments, pg. 7

"Operation & Maintenance Cost Reduction – The reduction of assets through the reconfiguration and standardization of design described above results in less equipment to maintain in the system, reducing maintenance expenses. For example the transformers and breakers eliminated in the test years will result in savings of approximately $2 million in operating and maintenance expenses that would have been required over the life of the assets."

a) Please provide detailed explanations of the actual O&M savings resulting from the eliminated transformers and breakers, and the base operational costs against which those savings were calculated.

b) Are there other examples of reconfiguration and standardization of design that have resulted in O&M savings? If yes, please provide detailed explanations of the actual O&M savings for these examples and the base operational cost against which those savings were calculated.

2.0 – Staff 66
Ref: Exhibit B1/Tab3/Sch 2/ – Section 4.1.1: Integrated Station Investments – Introduction, pg. 11

"As noted in Section 3.0 above, efficiency gains are achieved in many cases by replacing all end of life (EOL) components within the station as part of the same project."

a) Please explain how Hydro One balances the advantages of early replacement against the additional costs involved in this approach when initiating integrated station projects.

b) Please confirm that the business cases for integrated station projects filed with this application with total costs over $20M include a Present Value analysis of the full-life cycle capital and operating costs of each alternative being considered, and quantify the performance consequence costs attributable to implementing each of the different alternatives evaluated.

c) If detailed business cases have not been prepared for all integrated station projects with total costs over $20M, please provide quantified details of the evaluation methodology that was used to select each of these projects for this application.

2.0 – Staff 67
Ref: Exhibit B1/Tab3/Sch 2/ – Section 4.1.3: Summary of Expenditures, pg. 16

"In general, Hydro One's fleet of stations has deteriorated to the point of requiring significant investment to maintain and operate a safe and reliable transmission system."

a) Please explain if the situation described above has arisen unexpectedly, or if this situation was expected, please provide the justification for allowing the situation to develop.

b) Did Hydro One conduct cost-benefit analysis in past years to evaluate the long-term rate impact of deferring required Sustaining Capital Investments versus increased operational costs? If yes, please provide documentation of this analysis.

2.0 – Staff 68
Ref: Exhibit B1/Tab3/Sch 2/ – Section 4.1.3: Summary of Expenditures, pg. 17

"A reduction in this program will result in an increase in the length of time required to address degrading performance of air blast circuit breakers at critical network stations, and the integrated rebuild of these stations delivering load to customers. Negative impacts to both system and customer reliability would be a result."

Please quantify the claims made in the cited reference, showing the relevant performance history and the calculations used to develop the forecast system and customer reliability degradation that would be caused by reduced levels of capital investment in each major investment category.

2.0 – Staff 69
Ref: Exhibit B1/Tab3/Sch 2/ – Section 4.2.3: Investment Plan, pg. 19

"The purchase of operating spare transformers is in line with Hydro One's probabilistic approach to determine the number of spare requirements. The analysis considers performance trends and supply chain considerations of Hydro One's various power transformer types, and groups them into optimized spare cohorts to adequately cover the in-service population. The transmission operating spares requirement is intended to replenish inventory that is expected to be drawn down for future failures."

Please provide a table showing historic in-stock spares, annual draw-down and annual replenishment for 2012-2016, broken down into the following components:

- Autotransformers (>125 MVA);
- Large Transformers (>42MVA);
- Mid-size Transformers (15 to 42 MVA);
- 500 kV Breakers;
- 345 kV Breakers;
- 230 kV Breakers; and
- 115 kV Breakers.

2.0 – Staff 70
Ref: Exhibit B1/Tab3/Sch 2/ – Section 5: Lines, pp. 31-32

"The overall Lines Sustaining Capital spending requirement for the 2017 and 2018 test years are considerably higher than historic years. These spending increases are required to address the overhead lines refurbishment, tower coating needs and insulator replacement needs as described in the Asset Needs Overview found in Exhibit B1, Tab 2, Schedule 6."

In Hydro One's risk assessment for projects falling under Lines Sustaining Capital, how much flexibility does Hydro One have in terms of the timing of implementation? Please provide quantified calculations showing the impact of investment timing changes.

2.0 – Staff 71
Ref: Exhibit B1/Tab3/Sch 3 – Section 2: Development Capital Investments, Table 1 – Development Capital, pg. 4

With regard to this table, please explain what drove the increased spending levels for Inter Area Network Transfer Capability, Local Area Supply Adequacy, and Load Customer Connection investments in 2012.

2.0 – Staff 72
Ref: Exhibit B1/Tab3/Sch 3 – Section 2.1.1: Description of Inter-Area Network Transfer Capability Investments, Table 2 – Inter-Area Network Transfer Capability: Summary of Development Capital Projects in Excess of $3 Million, pg. 7

Table 2: Inter-Area Network Transfer Capability:

Summary of Development Capital Projects in Excess of $3 Million

ISD #	Investment Description	Capital Project Category[1]	Gross Capital Expenditures ($ Millions)										In-Service Years
			Historic				Bridge	Test		Gross Total Cost[2]	Capital Contribution[3]	Net Total Cost[4]	
			2012	2013	2014	2015	2016	2017	2018				
D01	Clarington TS: Build new 500/230kV Station	2	6.8	4.5	30.1	79.3	76.7	68.6	14.8	280.7	0.0	280.7	Q4 2018
D02	Nanticoke TS: Connect HVDC Lake Erie Circuit	3	0.0	0.0	0.0	0.0	1.0	5.0	13.0	36.0	36.0	0.0	Q4 2019
D03	Merivale TS to Hawthorne TS: 230 kV Conductor Upgrade	4	0.0	0.0	0.0	0.0	0.3	2.5	8.0	20.0	0.0	20.0	Q1 2020
D04	East-West Tie Expansion: Station Work	3	0.0	0.0	1.0	0.1	0.0	3.0	30.0	166.1	0.0	166.1	Q4 2020
D05	Milton SS: Station Expansion and Connect 230kV Circuits	4	0.0	0.0	0.0	0.0	0.1	2.0	5.0	250.0	0.0	250.0	Q2 2022
	Other Projects <$3M (2017-18 Cash flows)[5]		0.0	0.1	0.1	6.9	16.9	3.7	2.0				
	Other Historical Projects (pre-2017)[6]		111.0	37.1	15.2	0.0	0.0	0.0	0.0				
	Total Gross		**117.8**	**41.7**	**46.4**	**86.3**	**94.9**	**84.8**	**72.8**				
	Capital Contribution		*0.0*	*0.0*	*(0.5)*	*0.0*	*(1.0)*	*(5.0)*	*(13.0)*				
	Total Net		**117.8**	**41.7**	**45.9**	**86.3**	**93.9**	**79.8**	**59.8**				

a) Please provide the forecast spending trend to project completion for the projects listed in Table 2 that have in-service years that extend past 2018.

b) Does Hydro One consider that the scope, schedule and cost of all projects shown in Table 2 above are non-discretionary? If yes, please provide a detailed explanation showing why each project is considered to be non-discretionary during the test years.

c) Does Hydro One or ratepayers face any cost overrun risk if the Nanticoke TS project final costs exceed the customer contribution amount of $36 million?

2.0 – Staff 73
Ref: Exhibit B1/Tab3/Sch 3 – Section 2.2.1: Description of Local Area Supply Investments, Table 3 – Local Area Supply Adequacy: Summary of Development Capital Projects in Excess of $3 Million, pg. 14

Table 3: Local Area Supply Adequacy: Summary of Development Capital Projects in Excess of $3 Million

ISD #	Investment Description	Capital Project Category	Gross Capital Expenditures ($ Millions)										In-Service Years
			Historic				Bridge	Test		Gross Total Cost[1]	Capital Contri-bution[2]	Net Total Cost[3]	
			2012	2013	2014	2015	2016	2017	2018				
D06	Galt Junction: Install In-Line Switches on M20D/M21D Circuits	2	0.0	0.0	0.0	0.2	0.7	3.6	0.1	4.5	0.0	4.5	Q2 2017
D07	York Region: Increase Transmission Capability for B82V/B83V Circuits	2	0.0	0.0	0.2	1.2	7.5	22.6	0.2	31.8	0.0	31.8	Q4 2017
D08	Hawthorne TS: Autotransformer Upgrades	2	0.0	0.0	0.0	0.2	2.0	8.0	5.8	16.0	0.0	16.0	Q2 2018
D09	Brant TS: Install 115kV Switching Facilities	3	0.0	0.0	0.0	0.0	0.2	5.0	6.0	12.0	12.0	0.0	Q1 2019
D10	Riverdale Junction to Overbrook TS: Reconfiguration of 115kV Circuits	3	0.0	0.0	0.0	0.0	1.0	2.4	4.2	8.7	4.3	4.4	Q2 2019
D11	Southwest GTA Transmission Reinforcement	4	0.0	0.0	0.0	0.0	0.1	0.9	5.0	30.0	0.0	30.0	Q2 2020
D12	Barrie TS: Upgrade Station and Reconductor E3B/E4B Circuits	4	0.0	0.0	0.0	0.0	1.0	4.0	20.0	80.0	0.0	80.0	Q4 2020
	Other Projects <$3M (2017-18 Cash flows)[4]		0.5	1.1	13.3	42.1	18.8	3.9	13.0				
	Other Historical Projects (pre-2017)[5]		95.2	60.8	47.7	52.1	27.3	0.0	0.0				
	Total Gross		**95.7**	**61.9**	**61.2**	**95.8**	**58.5**	**50.5**	**54.3**				
	Capital Contribution		*(9.2)*	*(7.9)*	*(12.1)*	*(30.9)*	*(10.3)*	*(6.7)*	*(8.6)*				
	Total Net		**86.4**	**54.0**	**49.1**	**64.9**	**48.2**	**43.8**	**45.7**				

Are any of the "Other Projects < $3M" discretionary? If yes, please identify those projects.

2.0 – Staff 74
Ref: Exhibit B1/Tab3/Sch 3 – Section 2.3.1: Description of Load Customer Connection Investments, Table 4 – Load Customer Connection: Summary of Development Capital Projects in Excess of $3 Million, pg. 21

Table 4: Load Customer Connection: Summary of Development Capital Projects in Excess of $3 Million

ISD #	Investment Description	Capital Project Category	Gross Capital Expenditures ($ Millions)										In-Service Years
			Historic				Bridge	Test		Gross Total Cost[1]	Capital Contribution[2]	Net Total Cost[3]	
			2012	2013	2014	2015	2016	2017	2018				
D13	Ear Falls TS to Dryden TS: Upgrade 115kV Circuit E4D	2	0.0	0.0	0.1	1.1	0.4	10.0	5.9	17.5	14.0	3.5	Q1 2018
D14	Supply to Essex County Transmission Reinforcement	1	0.2	0.3	0.2	0.8	3.7	33.0	31.4	72.3	21.0	51.3	Q2 2018
D15	Horner TS: Build 230/27.6kV Transformer Station	2	0.0	0.0	0.0	0.0	3.0	16.0	13.0	32.0	26.9	5.1	Q2 2018
D16	Lisgar TS: Transformer Upgrades	2	0.0	0.0	0.0	0.1	1.0	10.3	2.5	13.9	3.9	10.0	Q2 2018
D17	Seaton MTS: Provide 230kV Line Connection	4	0.0	0.1	0.0	0.0	0.7	3.3	3.0	7.1	4.8	2.3	Q2 2018
D18	Hanmer TS: Build 230/44kV Transformer Station	3	0.0	0.0	0.0	0.0	0.2	9.5	18.5	30.0	5.6	24.4	Q1 2019
D19	Runnymede TS: Build 115/27.6kV Transformer Station and Reconductor 115kV Circuits	4	0.0	0.0	0.0	0.0	5.0	23.0	17.0	47.0	21.8	25.2	Q1 2019
D20	Toyota Woodstock: Upgrade Station	4	0.0	0.0	0.0	0.0	0.5	3.0	2.5	6.0	6.0	0.0	Q1 2019
D21	Enfield TS: Build 230/44kV Transformer Station	3	0.0	0.0	0.0	0.0	0.5	10.0	15.0	33.1	22.4	10.7	Q2 2019
D22	TransCanada: Energy East Pipeline Conversion	3	0.0	0.0	0.8	0.6	1.0	1.9	10.2	175.6	175.6	0.0	Q4 2021
	Other Projects <$3M (2017-18 Cash flows)[4]		0.3	3.4	16.9	5.9	12.6	6.0	2.5				
	Other Historical Projects (pre-2017)[5]		75.3	38.5	32.2	11.6	9.1	0.0	0.0				
	Total Gross		**75.8**	**42.3**	**50.2**	**20.1**	**37.7**	**126.0**	**121.5**				
	Capital Contribution		*(15.2)*	*(17.6)*	*(35.6)*	*(12.4)*	*(21.6)*	*(67.9)*	*(64.1)*				
	Total Net		**60.6**	**24.7**	**14.6**	**7.7**	**16.0**	**58.1**	**57.4**				

a) Please provide Capital Contribution calculations for all projects with Net Total Cost above $10 million.

b) Please compare these customer contribution calculations with the customer contribution calculations for the planned transformer station additions at Milton and Halton Hills.

<u>Overhead Capitalization</u>

2.0 – Staff 75
Ref: Exhibit B1/Tab3/ Sch 10 p. 1

This section of the application acknowledges that in April 2010 the OEB had accepted a methodology proposed by Black & Vetch (BV) that derived an overhead capitalization rate for Hydro One Distribution's common corporate costs. This accepted methodology was used in the 2013-14 and 2015-16 transmission rate applications. Hydro One indicates that this methodology continues to be a reasonable method of distributing common corporate costs to capital projects for transmission rates in 2017-2018.

a) Please file a copy of the review of capitalization filed in the EB-2012-0031 proceeding.

b) Please outline the analysis that Hydro One undertook to support its statement of the continued reasonableness of the BV methodology?

c) How would the nature and quantum of the costs being capitalized under the current methodology be impacted if the capitalization guidance prescribed by IAS 16 was followed?

2.0 – Staff 76
Ref: Exhibit B1/Tab3/ Sch 10 – Attachment 1 – Review of Overhead Capitalization Rates (Transmission) – 2017-2018
In Section D of the Overview, Hydro One indicates that a time study, in this case the four-week period ending June 12, 2015, was used as the basis to determine the portion of costs to be capitalized.

a) Could the period in which the time study is conducted potentially impact its results? For example, if the study was conducted during a period of abnormally high or low capital spending activity, could the results be skewed?
b) If so, what is done to ensure that the period selected for the time study is indicative of normal operations so as to ensure that any estimates or assumptions derived from the results are accurate and reasonable?

2.0 – Staff 77
Ref: Exhibit B1/Tab3/ Sch 10 – Attachment 1 – Appendix A – Transmission Overhead Capitalization Rates – BP 2017-2018 – Review
The Overhead Capitalization Rates are developed based on Business Plan numbers and estimates.

Please provide a retrospective analysis that compares the amounts capitalized in previous rate applications for test years 2011 to 2015 to the actual amounts capitalized during each of the given years.

2.0 – Staff 78
Ref: Exhibit B1/Tab3/ Sch 11 – Hydro One Networks – Investment Summary Document, Reference #: S06 – Air Blast Circuit Breaker Replacements – Lennox TS

"Need: To address Air Blast Circuit Breakers ("ABCBs") and associated auxiliary systems at Lennox TS that are in need of replacement due to deteriorated condition, asset demographics, and equipment obsolescence, which directly impacts the operability and reliability of the transmission system. Not proceeding with this investment would result in a significant risk of further equipment deterioration and declining system reliability."

a) Is the need to replace any of these breakers contingent upon ongoing operation of OPG's Lennox Generating Station?

b) If yes, please identify how many breakers are contingent upon ongoing Lennox GS operation and provide confirmation that the Lennox GS will either continue to operate for the expected service life of the new breakers or will backstop cost responsibility for the unused lifespan.

2.0 – Staff 79
Ref: Exhibit B1/Tab3/ Sch 11 – Hydro One Networks – Investment Summary Document, Reference #: S08 – Station Reinvestment – Beach TS

Project No.	Investment Summary	Total Cost
S08	*The project entails:* • *Extensive refurbishment and reconfiguration of Beach TS which will result in the replacement of two transformers, seven 230 kV oil circuit breakers, one 115 kV oil circuit breaker, associated disconnect switches, and protection, control and telecom equipment;* • *Upgrading of oil spill containment facilities to comply with the Ministry of Environment and Climate Change requirements.*	*$76.5 M*

Please provide a detailed breakdown of the $76.5M investment, highlighting any exceptional requirements and justifications for those requirements that contribute to the capital costs.

2.0 – Staff 80
Ref: Exhibit B1/Tab3/ Sch 11 – Hydro One Networks – Investment Summary Document, Reference #: S11 – Station Reinvestment – Elgin TS

Project No.	Investment Summary	Total Cost
S11	*The project entails:* • *Reconfiguration of Elgin TS by replacing and upgrading existing facilities with new equipment built to current standards including: the 115/13.8kV transformers, the low voltage switching facilities (including thirty-eight low voltage breakers) with a new medium voltage gas-insulated switchgear building installation, protection and control facilities, and other associated ancillary equipment; as well as the oil spill containment facilities will be upgraded in compliance with the Ministry of Environment and Climate Change ("MOECC") requirements; and* • *Replacement of four transformers with two standard units; the other two transformers will no longer be required as a result of the reconfiguration to a standardized design.*	*$58.2 M*

Please provide a detailed breakdown of the $58.2 million investment, highlighting any exceptional requirements and justifications for those requirements that contribute to the capital costs.

2.0 – Staff 81
Ref: Exhibit B1/Tab3/ Sch 11 – Hydro One Networks – Investment Summary Document, Reference #: S11 – Station Reinvestment – Elgin TS

*"**Need:** To address multiple assets at Elgin TS that are in need of replacement due to poor condition, obsolescence and high maintenance costs, which directly impact the operability and reliability of the transmission system. Not proceeding with this investment would result in a significant risk of further equipment deterioration and declining reliability to the customers in the area."*

The statement: "are in need of replacement due to poor (or degraded) condition, obsolescence and high maintenance costs" or similar wording has been used in many of the integrated substation project need descriptions. Has Hydro One conducted business case evaluations or cost/benefit analyses for all of the integrated substation projects included in this filing?

a) If yes, please provide the business case evaluation or cost/benefit analysis conducted for each project

b) If no, please explain if the copied text (or similar wording) should be considered an appropriate level of business justification for such a diverse range of large investments.

2.0 – Staff 82
Ref: Exhibit B1/Tab3/ Sch 11 – Hydro One Networks – Investment Summary Document, Reference #: S01 – Air Blast Circuit Breaker Replacement – Beck #1 SS, S02 – Air Blast Circuit Breaker Replacement – Beck #2 TS, S03 – Air Blast Circuit Breaker Replacement – Bruce A TS, and S07 – Air Blast Circuit Breaker Replacement – Richview TS

Project No.	Original Station ISD	Station Age (as of 2016)	Investment Summary	ABCB Age
S01	*1947*	*69 years*	*Replacement of two ABCBs*	*44 years*
S02	*1955*	*61 years*	*Replacement of twenty ABCBs*	*48 years*
S03	*1976*	*40 years*	*Replacement of sixteen ABCBs*	*44 years*
S07	*1957*	*59 years*	*Replacement of twenty-four ABCBs*	*50 years*

a) Some of the above listed ABCBs were either first installed or replaced soon after the original station ISD;

- S01: ABCBs were first installed or replaced starting in 1972, only 25 years after the facility was originally built in 1947.
- S02: ABCBs were first installed or replaced starting in 1968, only 13 years after the facility was originally built in 1955.

- S07: ABCBs were first installed or replaced starting in 1966, only 9 years after the facility was originally built in 1957.

Please explain why the above listed additions (or replacements) occurred so soon after initial station commissioning.

b) The sixteen ABCBs being replaced under S03 are 44 years old, but the station is only 40 years old. Please explain this discrepancy.

2.0 – Staff 83
Ref: Exhibit B1/Tab3/ Sch 11 – Hydro One Networks – Investment Summary Document, Reference #: S08 – Station Reinvestment – Beach TS; S11 – Station Reinvestment – Elgin TS; S13 – Station Reinvestment – Gage TS S14 – Station Reinvestment – Kenilworth TS

Project No.	*Station*	*Original ISD*	*Approximate Age*	*Need*
S08	*Beach TS*	*Late 1940's*	*65+ Years*	*Replacement due to poor condition, obsolescence and high maintenance costs*
S11	*Elgin TS*	*Late 1960's*	*48 Years*	*Replacement due to poor condition, obsolescence and high maintenance costs*
S13	*Gage TS*	*1940, with additional capacity in 1960's*	*75+ Years (from original ISD)*	*Replacement due to degraded condition and asset demographics*
S14	*Kenilworth TS*	*Early 1950's*	*65 Years*	*Replacement due to degraded condition and asset demographics*

a) Please explain why 4 critical transformer stations in the City of Hamilton (Beach TS, Elgin TS, Gage TS and Kenilworth TS) were allowed to fall into the described state of disrepair and obsolescence simultaneously.

b) Please explain how the 4 stations listed above have all reached end of life simultaneously despite having a wide range of station vintages and initial in-service dates.

2.0 – Staff 84
Ref: Exhibit B1/Tab3/ Sch 11 – Hydro One Networks – Investment Summary Document, Reference #: S57 – CIP V6 Transient Cyber Assets & Removable Media

Project No.	Investment Summary	Total Cost
S57	*The new version requirement of NERC's Critical Infrastructure Protection for Transient Cyber Assets and Removable Media has a compliance date of April 1, 2017. This investment is for the deployment of a compliant solution for Hydro One.*	*$12 M*

a) Please explain how Hydro One intends to ensure that the project will be implemented price-competitively.

b) Please provide the cost benefit analysis explaining why the proposed investment is the cost-effective solution to achieve compliance with the new NERC requirements.

c) Please explain the interaction between this expenditure and the $68.6 million project O01 (Back Up Centre).

2.0 – Staff 85
Ref: Exhibit B1/Tab3/ Sch 11 – Hydro One Networks – Investment Summary Document, Reference #: S61 – Transmission Site and Facilities Infrastructure

Project No.	Investment Summary	Total Cost
S61	*This program includes HVAC system replacements and general building renovations, including building roof and water supply upgrades.*	*$13.4 M*

Please provide historical comparison levels of spending associated with the Transmission Site and Facilities Infrastructure program.

2.0 – Staff 86
Ref: Exhibit B1/Tab3/ Sch 11 – Hydro One Networks – Investment Summary Document, Reference #: S67 – D2L (Upper Notch x Martin River) Line Refurbishment, S71 – K1/K2 Line Refurbishment, and S74 – D2H/D3H Line Refurbishment

Project No.	Line Voltage	Equipment to be Replaced	Length of Rebuild	Total Cost
S67	*115 kV*	*Existing ACSR with new similar size conductor; and shieldwire, insulators and all associated hardware. All structures will be refurbished as required.*	*58 km*	*$43.2 M*
S71	*115 kV*	*Existing copper conductor with equivalent ACSR conductor; and shieldwire, insulators and all associated hardware.*	*59 km*	*$15.7 M*
S74	*115 kV*	*Existing ACSR with new similar size conductor; and shieldwire, insulators and all associated hardware. All structures will be refurbished as required.*	*59 km*	*$25.9 M*

The three Sustaining Capital Lines projects S67, S71 and S74 listed in the above table have the same line voltage, and have similar rebuild lengths and equipment to be replaced. Please explain in detail the cost discrepancies between these three projects.

2.0 – Staff 87
Ref: Exhibit B1/Tab3/ Sch 11 – Hydro One Networks – Investment Summary Document, Reference #: S76 – Steel Structure Coating

Project No.	*Investment Summary*	*Total Cost*
S76	*The proposed plan will be to reinstate the protective coating on 1,250 and 1,600 steel structures in the 2017 and 2018 test years respectively.*	*$96.9 M*

Please quantify the projected future capital and operational cost savings stemming from this program, and show how Hydro One intends to track and validate the expected savings.

2.0 – Staff 88
Ref: Exhibit B1/Tab3/ Sch 11 – Hydro One Networks – Investment Summary Document, Reference #: S80 – Transmission Lines Emergency Restoration

Project No.	*Investment Summary*	*Total Cost*
S80	*The proposed funding for the transmission lines emergency restoration during the test years are based on recent historic levels of spending associated with emergency repairs.*	*$17.5 M*

Please provide historic annual levels of spending associated with emergency transmission line repairs for the years 2012 to 2015.

2.0 – Staff 89
Ref: Exhibit B1/Tab3/ Sch 11 – Hydro One Networks – Investment Summary Document, Reference #: O01 – Integrated System Operations Centre (ISOC)

Project No.	*Need Summary*	*Total Cost*
O01	*It is essential to proceed with this investment to ensure continued compliance with regulatory requirements regarding having an operable Backup control facility with fully functional monitoring and operation control of the Hydro One Transmission system.*	*$68.6 M*

a) When was Hydro One's existing Backup Control Centre commissioned?

b) When and how did Hydro One become aware that its existing Backup Control Centre was not compliant with NERC requirements? Please list all deficiencies at the existing site that cannot be mitigated at the existing site.

c) Please explain which regulatory requirements Hydro One would risk not being compliant with in the event that this project did not proceed or were to be delayed.

d) Please provide a business case or cost/benefit analysis that supports Hydro One's proposal to develop a new integrated System Operations Centre combining its Backup Control Centre, Backup Integrated Telecommunications Management Centre, Telecom Security Events Monitoring and Security Operations functions.

e) Please explain how Hydro One intends to ensure that the project will be implemented price-competitively.

f) Did Hydro One evaluate any alternative lower-cost solutions that would enable it to achieve backup control centre compliance? If yes, provide detailed descriptions of the alternative solutions and explain why they were rejected.

2.0 – Staff 90
Ref: Exhibit B2/Tab 1/Sch1 – Section 2: Proposed Transmission Scorecard, pg. 2

"The incentives that are embedded in the Company's compensation plans also support continuous improvement and improvements in these critical metrics and are designed to both increase efficiency and deliver value to customers."

Hydro One's primary role is the delivery of electricity transmission services to Ontario customers. Does "increase efficiency" in the above statement mean reduced costs per unit delivery?

a) If yes, how will "increased efficiency" be measured in specific quantifiable terms?

b) If not, what does "increase efficiency" mean and how will it be measured?

2.0 – Staff 91
Ref: Exhibit B2/Tab 1/Sch1 – Section 4: Process to Develop Scorecard Metrics, Table 1 – Proposed Transmission Scorecard, pg. 5-6

As one of the paramount concerns of customers is the cost of receiving electricity service, please explain why the proposed scorecard doesn't include a cost per unit, either in $/MWh of energy delivered or $/MW-year of capacity billed to customers or a measure of total costs to be borne by rate payers over the years.

2.0 – Staff 92
Ref: Exhibit B2/Tab 1/Sch1 – Section 5: KPI Selection, pg. 7

"While many of these metrics are tracked today, others have not been previously measured and will be tracked going forward."

a) Please describe how the metrics referenced in the above statement are tracked (e.g.: frequency of reporting, etc.).

b) Has Hydro One considered establishing stretch targets for the test years on the KPIs that are proposed?

2.0 – Staff 93
Ref: Exhibit B2/Tab 1/Sch1 – Section 5: KPI Selection, Table 2 – Tier 2 and Tier 3 Metrics, pg. 10

Performance Categories	***% Satisfaction with Outage Planning Procedures***	***Preliminary Tier 2 Metrics***
Cost Control	*Sustainment Capital/Gross Fixed Assets*	*Actual cost versus estimated costs for completed capital projects (%)*

a) Please explain in detail how Hydro One evaluates the quality of its project cost estimates when measured against actual project cost performance.

b) Is it considered good industry practice for project actual costs to consistently fall significantly below estimated costs?

i. If yes, please provide references from established estimating industry groups such as the Association of the Advancement of Cost Engineering ("AACE").

ii. What does an ongoing pattern of actual project costs consistently falling significantly short of estimated costs potentially indicate (e.g.: that contingency allowances are excessive)?

2.0 – Staff 94
Ref: Exhibit B2/Tab 1/Sch1 – Section 6: Commitment to Productivity Improvement, pg. 12

"Furthermore, as part of recent activities commissioned by the Company's new board and management, a number of initiatives have been identified that are expected to drive greater efficiency and productivity in Hydro One's programs, leading to lower projected OM&A costs. The initiatives include:

- *Savings identified through a full evaluation of Hydro One's procurement program and investments in new processes and tools;*
- *Reductions in administrative expenditures through improved processes and optimization of internal staff skills;*
- *Rationalization of Hydro One's IT spending; and*
- *Improved field efficiency through additional work planning improvements, including several opportunities to improve scheduling and labour efficiency."*

a) Please provide additional details for each initiative listed above.

b) Which of the above initiatives are set up to address potential labour shortages or changes in the productivity/experience level of Hydro One staff?

c) Please describe the technologies (e.g.: drones or hand held cameras) being used to lower the cost, time requirement, accuracy/consistency of evaluation, and safety risks for dangerous inspection, conduction inspections and other asset condition assessment activities.

2.0 – Staff 95
Ref: Exhibit B2/Tab 1/Sch1 – Section 7: Productivity Metric Selection, pg. 13

"In the [Transmission Total Cost Benchmarking Study], the median levels amongst the peer set for these metrics were found to be:

- *Total Capital Expenditures + OM&A/Gross Fixed Asset Value = 13.9%*
- *Total Capital Expenditures/Gross Fixed Assets = 6.6%*
- *Total O&M/Gross Fixed Asset Value = 4.3%"*

a) Please confirm that the median expenditure levels presented in the citation above are derived from a different set of peers than the CEA Composite Group against which Hydro One has compared its reliability performance in Exhibit B1/Tab1/Schedule 3 of this filing.

b) Please compare Hydro One's cost metrics against the cost metrics of the CEA peer group members.

2.0 – Staff 96
Ref: Exhibit B2/Tab 1/Sch1 – Section 7.2: Total Capital Expenditures, pg. 15

"Navigant Consulting and First Quartile Consulting cited in the study that Direct CapEx was noticeably lower than the median and has been for several years. Given the relative age of the Hydro One's assets, expectation is that CapEx will need to increase in order to maintain reliability."

a) Does Hydro One agree that it makes trade-offs between the planned level of Sustaining Capital Investments and operating costs?

b) How does Hydro One ensure that its capital plan appropriately balances increases in Sustaining Capital Investments against reduced operating costs?

c) Has Hydro One calculated the O&M savings it expects to realize as a consequence of the proposed significant increases in Sustaining Capital Expenditures? If yes, please provide detailed results.

2.0 – Staff 97
Ref: Exhibit B2/Tab 1/Sch1 – Section 8: Unit Cost Metrics, pg. 17

"In new construction, the asset or station configuration is designed to address the unique local load profile requirements of the station, again making it difficult to compare costs across construction sites."

a) Has Hydro One attempted to compare costs across construction sites for these "heterogeneous" activities? If yes, please provide examples.

b) Has Hydro One attempted to break down project costs into major sub-components that are comparable from site to site? If yes, please provide examples.

c) Has Hydro One attempted to implement standardized station configurations and equipment sizes for different load supply ranges?

2.0 – Staff 98
Ref: Exhibit B2/Tab 1/Sch1 – Section 10.2: Procurement, Table 5 – Historical Performance Productivity Metrics, pg. 22

"The Planning Index measures material ordering according to manufacturer contracted lead time and gauges the efficiency of the ordering process. The Supply Chain Services Value Realization metric relates the value generated by the procurement organization (through discounts and strategic sourcing) as a percentage of the costs incurred to run the procurement organization."

Table 5: Historical Performance Productivity Metrics

	Metric	2011	2012	2013	2014	2015
Administrative Costs	Administrative costs as % of Net OM&A & Capital Expenditures	N/A	11.4%	13.3%	11.9%	10.5%
	Overhead as % of Net Capital Expenditures	13%	14%	15%	15%	12%
Supply Chain	Planning Index (material ordering per lead time)	89%	93%	94%	89%	85%
	Supply Chain Services value realization (Value generated/cost)	0.46	0.70	0.78	0.62	0.93

Please provide detailed examples of the calculation of the Planning Index and Supply Chain Services Value Realization metric figures shown in Table 5 above.

2.0 – Staff 99
Ref: Exhibit B2/Tab 1/Sch1 – Section 10.3.1: Stations, pg. 23

"Hydro One selected the ratio of unplanned work to planned work as a complement to the stations RCE metric. This metric provides insight into the effectiveness of maintenance work planning and of unplanned outage prevention. An effective preventive maintenance program would lead to less unplanned work, and reduce the ratio of unplanned to planned work."

Please provide definitions of unplanned work and planned work.

a) Is unplanned work any activity related to addressing an unplanned outage?

b) Is the measure in dollars or in hours? If other, please specify.

2.0 – Staff 100
Ref: Exhibit B2/Tab 1/Sch1 – Section 9: Reliability and Cost Efficiency Metrics, Table 4 – Historical and Projected RCE Metrics, pg. 20; Exhibit B2/ Tab 1/Schedule 1 – Section 10.3.2: Project Delivery and Construction, pg. 23; Exhibit B1/Tab 2/Schedule 3 – Section 5.3: External Comparisons of Reliability, Figure 13 – Unavailability of Major Transmission Station Equipment, pg. 26

Table 4: Historical and Projected RCE Metrics

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Stations	Outages/Assets	117.0	105.7	103.9	85.6	98.0	87.7	80.8	74.8	70.0	63.7
	Assets/Maintenance	42.6	47.2	46.0	58.2	56.9	62.3	66.8	76.6	72.1	81.4
	RCE	**2.7**	**2.2**	**2.3**	**1.5**	**1.7**	**1.4**	**1.2**	**1.0**	**1.0**	**0.8**
	RCE (3 year average)			**2.4**	**2.0**	**1.8**	**1.5**	**1.4**	**1.2**	**1.0**	**0.9**
Lines & Forestry	Outages/Assets	132.4	139.5	132.3	115.8	120.2	78.8	88.8	108.4	101.0	94.7
	Assets/Maintenance	86.0	98.4	94.8	109.4	100.3	92.9	101.7	71.2	75.4	79.0
	RCE	**1.5**	**1.4**	**1.4**	**1.1**	**1.2**	**0.8**	**0.9**	**0.8**	**0.8**	**0.8**
	RCE (3 year average)			**1.5**	**1.3**	**1.2**	**1.0**	**1.0**	**0.8**	**0.8**	**0.8**

Table 6: Performance of Productivity Metrics

	Metric	2011	2012	2013	2014	2015
Work Execution	ISA as % of the OEB approved budget	95%	75%	90%	106%	85%
	% of budgeted work completed on or ahead of schedule	N/A	N/A	50%	85%	67%
	Engineering costs/ ECS Capital $	N/A	9.15%	9.14%	7.96%	8.23%
	Ratio of Stations unplanned work to planned work	36%	35%	38%	42%	41%

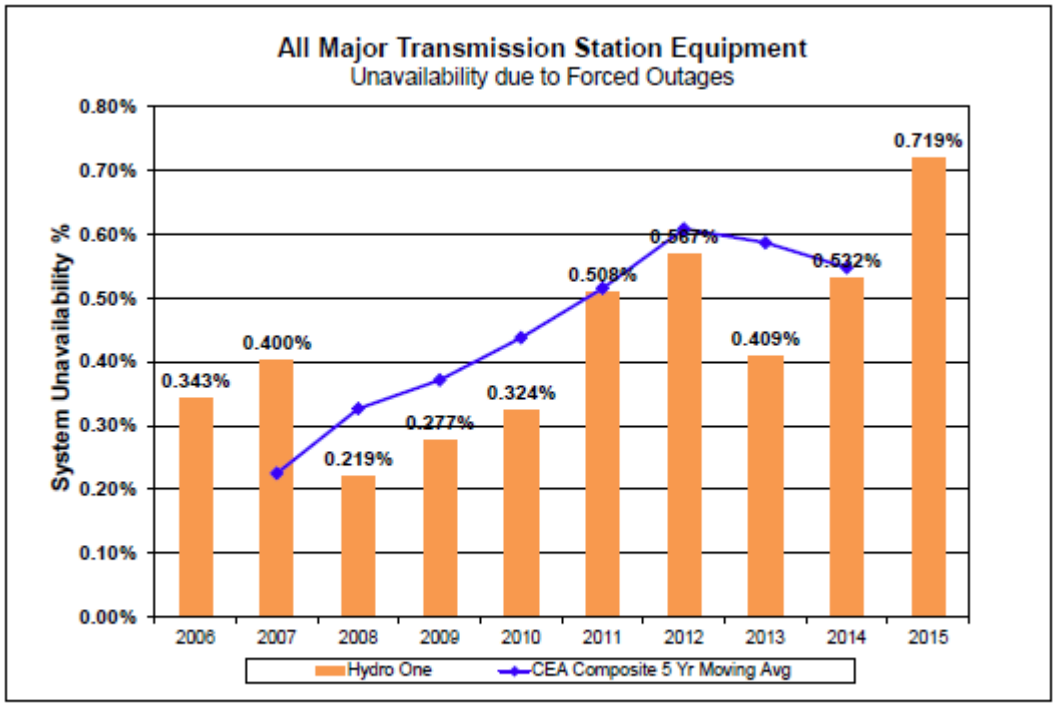

Figure 13: Unavailability of Major Transmission Station Equipment

a) Please comment on why RCE measures (Table 4, page 20 of B2-T1-S1) are declining (improving) from 2011-2015, while at the same time the ratio of unplanned station work to planned station work is increasing (worsening) (Table 6, page 23 of B2-T1-S1), and the Unavailability of Major Station Equipment due to forced outages (Figure 13, page 26 of B1-T1-S3) is increasing (worsening)?

b) Are these metrics pointing to different conclusions? Please explain in detail.

2.0 – Staff 101
Ref: Exhibit B2/Tab 1/Sch1 – Section 10.3.2: Project Delivery and Construction, pg. 23

"In Service Additions as a % of OEB approved budget: Selected to measure whether capital placed in service aligns with estimates developed during the planning process."

Table 6: Performance of Productivity Metrics

	Metric	2011	2012	2013	2014	2015
Work Execution	ISA as % of the OEB approved budget	95%	75%	90%	106%	85%
	% of budgeted work completed on or ahead of schedule	N/A	N/A	50%	85%	67%
	Engineering costs/ ECS Capital $	N/A	9.15%	9.14%	7.96%	8.23%
	Ratio of Stations unplanned work to planned work	36%	35%	38%	42%	41%

a) Please explain what happens to the capital projects that are not placed in service within the specified test period. Does the associated rate base addition roll over to the next filing?

b) Please explain in detail how Hydro One dealt with the 6% ISA spent in excess of the OEB approved budget in Year 2014 of Table 6.

c) Please explain the discrepancy between the values for ISA as % of the OEB approved budget and the % of budgeted work completed on or ahead of schedule in 2013, 2014 & 2015. What do these results indicate regarding project schedule management performance, given that a significant portion of forecast total annual expenditures were spent before capital year-end in each of these years?

2.0 – Staff 102
Ref: Exhibit B2/Tab 1/Sch1 Attachment 2 – Proposed Transmission Scorecard – Glossary of Measure Description, pg. 2

Performance Category	Metric	Description
Asset Management	1. In-Service Capital Additions as % of OEB-Approved Plan	1. *The measure is consistent with regulatory requirements of the Transmission Business, measuring the % of Capital In-Serviced relative to plan. The measure is not benchmarkable.*
	2. Capital Expenditures as % of Budget	2. *Progress is measured as the ratio of actual total capital expenditures to the total amount of planned capital expenditures. The measure is benchmarkable.*

Could the metric highlighted in the above table be achieved by overspending on individual projects while other planned projects were deferred or eliminated?

If yes, please explain how Hydro One could modify this metric to show actual costs incurred per unit of budgeted project value delivered for a specific item (e.g.: actual cost per budgeted cost per transformer MVA, actual cost per budgeted cost per breaker by voltage class, actual cost per budgeted cost per km of new transmission by voltage class).

2.0 – Staff 103
Ref: Exhibit B2/Tab 1/Sch1 Attachment 2 – Proposed Transmission Scorecard – Glossary of Measure Description, pg. 2

Performance Category	Metric	Description
Cost Control	1. Total OM&A and CAPEX/Gross Fixed Asset Value (%)	*1. Demonstrates Transmission cost effectiveness by comparing the ratio Total Capital and OM&A to Gross Fixed Asset costs. The measure is benchmarkable.*
	2. Sustainment Capital/Gross Fixed Asset Value (%)	*2. Demonstrates Transmission cost effectiveness by comparing the ratio Sustainment Capital to Gross Fixed Asset costs. The measure is benchmarkable.*
	3. OM&A/Gross Fixed Asset Value (%)	*3. Demonstrates Transmission cost effectiveness by comparing the ratio OM&A to Gross Fixed Asset costs. The measure is benchmarkable.*

a) For item 2. why was Sustainment OM&A not also included as a separate measure in addition to the Sustainment capital?

b) Did Hydro One consider how these cost control metrics could be used to show an impact on how revenue requirement or rates were reduced?

c) Did Hydro One consider a metric of OM&A per kWh transmitted? Why or why not?

2.0 – Staff 104
Ref: Exhibit B2/Tab 2/Sch1, p. 4
Table 1 provides the 8 best practice recommendations from the Transmission Cost Benchmarking Study and indicates the section of the evidence where the recommendations are addressed.

Please provide an expanded table which includes the specific actions taken by Hydro One in addressing each best practice, the specific evidence reference (exhibit/tab/schedule/page) and an estimate or target of the $ impact of the action taken.

2.0 – Staff 105
Ref: Exhibit A/Tab 3/Sch1– Section 2.3: Asset Needs Assessment, pg. 6

"Reliability risk is a metric that is derived using a probabilistic calculation based on asset demographics and the historical relationship between asset age and the occurrence of failure or replacement. Reliability risk is used by Hydro One in its asset management process to gauge the impact of its investments on future transmission system reliability. It also provides a directional indicator to inform the appropriate level and pacing of sustainment investments. The reliability risk model is not used to identify specific asset needs and investments. Instead, these are determined by condition assessments and other asset-specific information, as described in Exhibit B1, Tab 2, Schedule 5."

Are failures of assets across all types, categories and voltage classes expected to impose similar consequence?

a) If no, does Hydro One consider the consequence of asset failure when evaluating Reliability Risk?

b) If yes, please provide details of the methodology and examples of quantitative evaluations that have been used in identifying specific projects in this application.

2.0 – Staff 106
Ref: Exhibit A/Tab 3/Sch1– Section 4: Transmission System Plan, pg. 13

Investment Category	EB-2014-0140		EB-2016-0160		Comparison between Filings	
	2017	2018	2017	2018	2017 Increase	2018 Increase
Sustaining	597.4	636.7	776.8	842.1	30.0%	32.3%
Development	148	116.4	196.4	170.2	32.7%	46.2%
Operations	44.4	25.2	25.4	30.8	-42.8%	22.2%
Common Corp Costs	58	60.4	77.6	79.1	33.8%	31.0%
Total Capital	**847.8**	**838.7**	**1076.1**	**1122.2**	**26.9%**	**33.8%**

a) Please confirm the following:

i) that the forecast sustaining capital expenditures in Test Years 2017 & 2018 are 30% and 32.3% higher than the corresponding Hydro One forecasts for sustaining capital expenditures in those years in the 2014 EB-2014-0140 filing.

ii) that the forecast development capital expenditures in Test Years 2017 & 2018 are 32.7% and 46.2% higher than the corresponding Hydro One forecasts for development capital expenditures in those years in the 2014 EB-2014-0140 filing.

iii) that the forecast operations capital expenditures in Test Years 2017 & 2018 are 42.8% lower and 32.3% higher respectively than the corresponding Hydro One forecasts for operations capital expenditures in those years in the 2014 EB-2014-0140 filing.

iv) that the forecast common corporate capital expenditures in Test Years 2017 & 2018 are 33.8% and 31% higher than the corresponding Hydro One forecasts for development capital expenditures in those years in the 2014 EB-2014-0140 filing.

b) Given the magnitude of these changes, please explain if Hydro One has obtained sources of material new information or changed evaluation methodologies between preparation of the 2014 application and this application.

i) If a result of new information, please explain why this information was not available to Hydro One at its last application.

ii) If as a result of new methodology, please explain what benefits this new methodology will produce to justify the additional costs.

2.0 – Staff 107
Ref: Exhibit B1/Tab3/Sch1
Has any information come forward, since the application was submitted (particularly for the 2016 Bridge year), to indicate that 2015 or 2016 capital expenditure forecasts require amendment? Are all projects expected to be in rate base for the test years, still expected to be in rate base?

If some of the projects that are listed in Table 2-27 are not expected to be in-service in 2016 and as a result will not be added to the 2016 Rate Base, please identify all such projects, the associated capital expenditure and the expected in-service date.

Exhibit C 3.0 COST OF SERVICE

3.0-Staff --108
Ref: Exhibit C1/Tab 2/Sch 1
a) Please identify what improvements in services and outcomes Hydro One's customers will experience in 2016 and during the subsequent 2017- 2018 term as a result of OM&A spending in 2016, 2017 and 2018?

b) How has Hydro One communicated these benefits and the associated costs to its customers, and how did customers respond? Please provide some examples, including a synopsis of any customer feedback. If no communications took place, please explain why not.

3.0 – Staff 109
Ref: Exhibit C1
Has any information come forward, since the application was submitted, particularly as the Bridge year evolves, to indicate that 2016, 2017 or 2018 OM&A forecasts require amendment? If so please provide an update with any rationales for changes.

3.0 – Staff 110
Ref: Exhibit C1/Tab 2/Sch1 pp. 6-7

Tables 2 and 3 show the $20.0 million reduction negotiated in the EB-2014-0140 settlement agreement for 2015 and 2016 respectively.

Did the $20 million OM&A settlement reduction in each of those years cause any negative system performance or service reliability results?

a) If yes, please provide quantified details and explain how Hydro One was able to reduce the budgets by a further $4.6 million in 2016 without exacerbating those negative results.

b) If no, please describe and quantify any negative system performance or service reliability impacts that would result from a similar proportional reduction in OM&A budgets for Test Years 2017 & 2018.

3.0 – Staff 111
Ref: Exhibit C1/Tab2/Sch2/p.10
Table 10 shows spending plans for environmental management with substantial increases in PCB and Transformer Oil Leak Reduction areas:

a) Please explain why PCB Retirement and Waste Management and Transformer Oil Leak Reduction costs are projected to increase significantly in the test years, while Hydro One is simultaneously accelerating the rate of capital expenditures for transformer replacements, with the notional benefit of reducing operating costs.

b) Please confirm that Hydro One prioritizes transformer replacements to ensure that those transformers that are in the worst condition are replaced first. Please identify all exceptions and provide reasons for prioritizing the replacement of transformers that are not in the worst condition.

c) Hydro One indicates that it will be increasing spending in the test years on PCB Retirement and Waste Management in order to ensure meeting the 2025 Environment Canada deadline for PCB retirement in advance. Why is Hydro One spending at levels to achieve compliance before the deadline?

3.0 – Staff 112
Ref: Exhibit C1/Tab2/Sch2/p.17
Hydro One indicates that its system continues to age which correlates to an increase in maintenance requirements, yet the corrective maintenance spending is declining from 2014 and 2015 levels (in the two test years). Why are these budgeted levels not increasing as the system ages?

3.0 – Staff 113
Ref: Exhibit C1/Tab2/Sch2/p.25
Table 7 shows that Protection, Control, Monitoring and Metering equipment OM&A increases from $19.5 million in 2015 to $23.3 million by 2018, an increase of 10.5% over 3 years. Please provide more detail on the work programs that contribute to this increase and why those programs require such funding increases.

3.0 – Staff 114
Ref: Exhibit C1/Tab2/Sch2/p.41 and Exhibit B2/Tab1/Sch1 p.18
Table 11 shows Vegetation Management costs over the test year period. Brush Control costs grow from $17.8 million in 2015 to $21.5 million in 2018, an increase of 21% over 3 years. At page 44, Hydro One indicates that the increase is due to the requirement to perform additional necessary brush control.

a) What are the specific reasons for the increase in brush control costs over this period?

b) At the second reference in Table 3, Hydro One provides unit cost metrics for forestry and lines work, covering 2012 to 2015. Please provide Hydro One's forecast or targets for the metrics on this table for 2016, 2017 and 2018.

c) What are the clearing cycles employed by Hydro One that it considers are appropriate for its system and how it has determined that these cycles provide a cost-effective and sustainable level of reliability? Please provide examples to illustrate the varying cycle times.

3.0 – Staff 115
Ref: Exhibit C1/Tab2/Sch2/p.45
Table 12 shows Overhead Line Maintenance costs over the test year period showing an increase from 2015 to 2018 of over 30%. It appears this increase is driven by Preventative Maintenance and Asset Assessment activities (increasing 97% over the 3 year period). On page 50 Hydro One indicates that costs are higher as it needs to conduct more condition assessments on deteriorating assets.

Please provide further specific rationale for the increase in costs using specific examples for illustration.

3.0 – Staff 116
Ref: Exhibit C1/Tab2/Sch6/pp. 5 - 17
Hydro One lists a number of productivity improvements and business practices that are intended to increase efficiency. Has Hydro One quantified these improvements in terms of OM&A savings over the 2016 to 2018 period? Please provide a forecast of the savings that may be expected through each of these process improvements.

3.0-Staff-117
Ref: Exhibit C1/Tab 3/Sch2, p. 3
Hydro One indicates that "The Inergi Agreement provides for optional benchmarking reviews of fees by an independent third party, the costs of which are borne equally by Hydro One and Inergi."

Has Hydro One or Inergi called for a benchmarking review since the contract was initiated on March 15, 2015? Is Hydro One planning any such reviews it the near

future? If not, is Hydro One satisfied that the contract is achieving its cost effectiveness and operational goals?

3.0-Staff-118
Ref: Exhibit C1/Tab 3/Sch2, p. 3
Hydro One discusses Performance Indicators (PIs), how they are regularly measured and how they are adjusted upwards annually to drive continuous improvement. In addition Hydro One indicates that the Inergi contract life-to-date as of February 2016 met or exceeded 94% for all SOWs with regard to the PIs.

Please provide a report of actual performance for the PIs, the monthly, quarterly and yearly measures, and an indication of the actual upward adjustments initiated.

3.0-Staff-119
Ref: Exhibit C1/Tab 3/Sch2, p. 12, Appendix B
This table of total Inergi contract fees over the 2013 to 2014 period, shows a marked drop in fees from 2015 to the 2016 Bridge year. What are the primary reasons for this significant 21% reduction in fees?

3.0-Staff-120
Ref: Exhibit C1/Tab 3/Sch2, p. 5
Regarding the BGIS services agreement which was effective February 19, 2015:

Please provide Hydro One's rationale for entering into such an agreement with an emphasis on the expected cost savings over the 10 year period. In addition, please provide a report of client satisfaction and the regular reviews as indicated on page 7 of the schedule.

3.0-Staff-121
Ref: Exhibit C1/Tab 3/Sch3, p. 2 (Table 1)
Table 1 provides the Tx allocation for the CCFS costs for the 2017 and 2018 test years only.

a) Please provide the Tx allocation for the 2012 to 2016 period as well.
b) Please provide similar breakdown for Exhibit C1/Tab3/Sch4 pg. 2 Table 1.
c) Please provide similar breakdown for Exhibit C1/Tab3/Sch5 pg. 1 Tables 1-7.
d) Please provide similar breakdown for Exhibit C1/Tab3/Sch7 pg. 1 Tables 1-2.

3.0 – Staff 122
Ref: Exhibit C1/Tab3/Sch3/p. 2
Hydro One shows an increase of over 300% in Corporate Management Costs from 2015 to 2018, from $5.4 million to $22.1 million. Hydro One indicates that higher corporate management costs are due to increases in compensation.

a) Please provide additional detail on the components of this compensation increase.

b) Please justify the reasoning for the necessity for the magnitude of these increases.

3.0 – Staff 123
Ref: Exhibit C1/Tab3/Sch3/p. 20
Hydro One shows an increase in Internal Audit and Risk Management costs in the range of 50% from 2015 to 2018. The rationale provided is that rotational resources were made permanent and increased need for Internal Audit capabilities.

a) Which originating departments reduced costs as resources were transferred to Internal Audit and what were the reductions in cost?

b) Why did Internal Audit capabilities need to be increased? Please provide specific examples.

Corporate Staffing and Compensation

3.0-Staff-124
Ref: Exhibit C1/Tab 4/Sch1, p. 4 and Figure 2
Hydro One indicates that from 2011 to 2015 about 20 to 25% of those employees that are eligible to retire; actually retire. Please provide a forecast for 2016 to 2018 to show projected retirements over that period. Is there any reason for Hydro One to expect a higher retirement uptake in future years?

3.0-Staff-125
Ref: Exhibit C1/Tab 4/Sch1, p. 7 and Figure 4
Please provide a similar graph which expands to include separate lines for regular, temporary and casual employees. In addition, please defined the term, "Total Spend".

3.0-Staff-126
Ref: Exhibit C1/Tab 4/Sch1, p. 11 and Table 1
Why, in 2016, is Hydro One reducing the levels of apprentice hiring for both Lines and Stations from 2010 levels? Please provide a justification in light of the concerns cited with retirements and expanded work program. What is Hydro One's forecast of this apprentice hiring in 2017 and 2018?

3.0-Staff-127
Ref: Exhibit C1/Tab 4/Sch1, p. 22
Hydro One indicates that in 2015, approximately 57% of the total transmission capital work was performed by casual, unionized employees.

a) Can Hydro One provide an estimate of the savings that are generated by this level of casual labour?
b) What are the additional costs, if any, to Hydro One for employing this level of casual labour (both financial and operational)?

c) Will Hydro One continue to increase this percentage in the 2017 and 2018 test years?

3.0-Staff-128
Ref: Exhibit C1/Tab 4/Sch1, p. 24
Hydro One indicates that collective bargaining has resulted in share grants as part of total compensation packages for the PWU and the Society. These share grants were offset by below average base wage increases. Please specifically define the 'below average' wage increases and indicate what the total increase in compensation would be when share grants are accounted for on April 1, 2017 for the PWU and April 1, 2018 for the Society.

3.0-Staff-129
Ref: Exhibit C1/Tab 4/Sch1, p. 25
Hydro One indicates that total compensation for regular employees increased by 1.27% per year over the 2013 to 2018 period.

a) What was the increase over the same period for temp staff and casual staff over the same period?

b) Please explain the statement, "The attachment does not reflect the revenue requirement for compensation for this Application". Are the figures that appears under 2017 and 2018 not indicative of compensation related to this application?

3.0-Staff-130
Ref: Exhibit C1/Tab 4/Sch1, p. 26
Why did Hydro One not complete an update of the Mercer Compensation Benchmarking study for this application? If the study was not updated, can Hydro One provide similar information on how its compensation levels compares with others in the industry?

Pension and OPEB Costs

3.0-Staff-131
Ref: Exhibit C1/Tab 4/Sch2, p. 2 – Table 1 Cash Pension Cost

a) Please reconcile the total cash pension cost for the test years to the annual funding requirements outlined in the June 9, 2016 Willis Towers Watson actuarial valuation provided in Exhibit C1/Tab 4/Sch 2, Attachment 1 (p.19).

b) Hydro One Transmission has historically recovered OPEBs in rates on an accrual basis:

i) Please complete the table below to illustrate the delta between recovering on an accrual basis compared to the actual cash benefit payments made in the given years.

OPEBs	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**Total**
Amounts included in rates							
OM&A							
Capital							
Sub-total							
Paid benefit amounts							
Net excess amount included in rates greater than amounts actually paid							

ii) Please describe what Hydro One Transmission has done with any recoveries in excess of cash benefit payments.

iii) How are OPEB costs allocated between the Transmission and Distribution operations?

iv) How are OPEB costs allocated between OM&A and Capital?

v) Please provide the actuarial valuation to support the amounts being claimed in the test years as noted in above graph.

3.0-Staff-132
Ref: Exhibit C1/Tab 4/Sch2, p. 4
Please provide more detailed information on the Pension Funds target benchmark. What is this benchmark comprised of and why is it an appropriate benchmark for the Pension Plan?

3.0-Staff-133
Ref: Exhibit C1/Tab 5/Sch1, p. 13
Hydro One indicates that its equipment utilization averages have increased from 65% in 2001 to 81% in 2015.

Will Hydro One continue to be able to increase utilization rates in 2016, 2017 and 2018? Does Hydro One have a target for equipment utilization? What is a comparable industry standard rate?

Payments in Lieu of Taxes

3.0-Staff-134
Ref: Exhibit C1/Tab 8/Sch1 – Departure from PILs Regime
Hydro One Limited realized a deferred tax recovery of $2,619 million that was triggered by the deemed disposition of its assets upon exiting the PILs regime in 2015 (see page 28 of the Hydro One Limited 2015 Annual Report). The impact of this deferred tax recovery has been excluded from the test year PILs calculations filed with this application.

a) In RP-2004-0188, *Report of the Board on the 2006 Electricity Distribution Rate Handbook*, the OEB reviewed a similar matter related to a deferred tax recovery that utilities realized upon first entering the PILs regime in 2001 (RP-2004-0188, pp. 55-57). Given the similar circumstances, has this conclusion been considered in determining the regulatory treatment of the $2,619 million deferred tax recovery in the current application?

b) What portion, if any, of the $2,619 million deferred tax recovery would be allocated to the Transmission business?

c) How would the test period PILs calculations in Exhibit C2/Tab 4/Sch 1, Attachment 1 be impacted if the deferred tax recovery was applied to the estimate?

3.0-Staff-135
Ref: Exhibit C2/Tab 4/Sch1 Attachment 1 – Calculation of Utility Income Taxes
The OEB approved PILs Model requires that a utility's return on deemed equity be used as the starting point (i.e. Net Income Before Tax) when computing Regulatory Taxable Income for the test year.

a) What value is being presented as the “Regulatory Net Income (before tax)” in the test year calculations for PILs?

b) Why hasn’t the test year return on deemed equity, as calculated in Table 1 of Exhibit D1/Tab 4/Sch 1, been used as the Regulatory Net Income (before tax)?

c) How would the test year PILs calculations be impacted had the return on deemed equity been used as the starting point?

3.0-Staff-136
Ref: Exhibit C2/Tab 4/Sch1 Attachment 1 – Calculation of Utility Income Taxes
Based on the PILs calculations provided for historical years in Exhibit C2/ Tab4/Sch 1, Attachment 3, it appears that interest capitalized for accounting purposes, but deductible for tax purposes, has typically been approximately $32-35 million per year. An estimate for this deduction does not appear to be incorporated within the test year PILs calculation, please explain why. If this is an oversight, please update the test year calculation to incorporate the impact of this item.

3.0-Staff-137
Ref: Exhibit C2/Tab 4/Sch1 Attachment 1 – Calculation of Utility Income Taxes
How does the deduction for Capitalized Pension Costs in the test year PILs calculations reconcile to the capitalized pension cost amounts presented in Table 1 of Exhibit C1/Tab 4/Sch 2?

3.0-Staff-138
Ref: Exhibit C1/Tab 8/Sch1 Attachment 1 – Integrity Checks
This section indicates that the December 31, 2015 federal T2 tax return was not prepared at the time of this application and therefore estimated December 31, 2015 UCC balances were used in preparing the UCC/CCA continuity for the bridge year (opening balances).

a) Please provide a copy of December 31, 2015 federal T2 tax return that was filed as of June 30, 2016.

b) Please update the UCC/CCA continuity schedules for the bridge and test years in Exhibit C2/Tab 4/Sch 1, Attachment 2 based on the actual Schedule 8 UCC balances filed in the December 31, 2015 tax return.

c) Has there been any correspondence from the related tax authorities since filing the December 31, 2015 T2 return that impact the UCC/CCA balances

presented in Schedule 8? If so, please ensure that these are factored into the updated numbers provided in (b) above.

3.0-Staff-139
Ref: Exhibit C1/Tab 8/Sch1 Attachment 1 – Integrity Checks
A statement is made that "The 2015 CCA deductions in the PILs tax model do not agree with the numbers in the UCC schedules because Hydro One received a significant amount (approximately $55 million) of capital contribution true-ups from customers. These amounts are treated as taxable income by the tax authorities rather than reduction of UCC balances for 2015 tax purposes".

Currently the CCA deductions used in the PILs model filed in Exhibit C2/Tab 4/Sch 1, Attachment 1 and Attachment 3 agree to the detailed CCA calculations provided in Exhibit C2/Tab 4/Schedule 1, Attachment 2 and Attachment 4.
Please explain what this statement is referring to.

3.0-Staff-140
Ref: Exhibit C1/Tab 3/Sch7 – Section 2.1 Transmission Stations and Buildings
This section states that a province wide reassessment was due to take place in 2016 by MPAC to refresh property values for property tax calculation purposes. Has this reassessment been received and how does it impact the values shown in Table 2?

Exhibit D 4.0 RATE BASE and COST OF CAPITAL

4.0 – Staff-141
Ref: Exhibit D/Tab1/Sch4

The evidence shows that Working Capital increases in 2017 to $14.7 million, an increase of over 70% from the 2016 level, with a subsequent increase of 6% in 2018.

Please provide an itemized list of the primary factors that contribute to the increase in working capital from 2016 to 2017 and from 2017 to 2018.

Exhibit E 5.0 REVENUE REQUIREMENT and LOAD FORECAST

5.0 – Staff 142
Ref: Exhibit E1/Tab 2/Sch1, p. 2
Table 1 shows that External Revenues fall significantly from 2015 to 2016 in all 3 major categories of external revenues.

a) Regarding Secondary Land Use, Hydro One cites previously high levels of unbudgeted transactions involving easement grants and land sales. What is the reason for the precipitous drop in these revenues in 2016, 2017 and 2018?

b) For Station Maintenance, Hydro One cites a lower volume of work from major customers. Why is there a lower volume of work for this revenue source?

c) For Other External Revenues, why do levels fall from 2016 to 2018?

5.0 – Staff 143
Ref: Exhibit E1/Tab 3/Sch. 1, pp. 3–8
In section 3 of Exhibit E1/Tab 3/Sch. 1, Hydro One summarizes some of the key economic assumptions that influence its load forecasts.

a) Please provide the source(s) of the economic data that is provided in section 3 of Exhibit E1/Tab 3/Sch. 1.

b) If any of the forecast economic assumptions are calculated by Hydro One, please explain the methodology used to forecast those quantities.

5.0 – Staff 144
Ref: Exhibit E1/Tab 3/Sch. 1, pg. 50
In Appendix G, Hydro One states that its comparison of load forecast results with the IESO is "consistent with the latest Hydro One consultation with IESO in February 2016."

Please summarize the activities/consultations Hydro One undertakes with the IESO to ensure consistency between the results of the IESO's 18-month forecast and Hydro One's forecast of transmission charge determinants.

Exhibit F 6.0 REGULATORY ASSETS

6.0 – Staff 145
Ref: Exhibit F1/Tab 1/Sch2 – Regulatory Accounts Requested: Section 2.6
Section 2.6 is proposing to continue to use this account to record the difference between the actual pension cost based on the May 2012 Towers Willis Watson actuarial valuation and what will be approved by the Board as part of the 2017 and 2018 Transmission Rates.

Shouldn't the May 2012 report referenced in this section be replaced with the latest valuation from Towers Willis Watson received on June 9, 2016? Please explain.

6.0 – Staff 146
Ref: Exhibit F1
Certain filing information does not appear to be present in this section of the Application (Exhibit F1), including the following:

a) Section 2.10 of the Chapter 2 Filing Requirements states that the applicant must provide the interest rates used to calculate the carrying charges by month or by quarter for each year. Please provide.

b) Section 2.10 also requires that the applicant makes a statement as to whether adjustments had been made to deferral and variance account balances that were previously approved by the OEB on a final basis. Please provide accordingly.

Exhibit G 7.0 COST ALLOCATION

7.0 – Staff 147
Ref: Exhibit G/Tab 1/Sch1
Hydro One is proposing to simplify the allocation process by eliminating the Wholesale Meter rate pool and allocating the related revenue requirement into the three remaining rate pools.

Please provide the Wholesale Meter rate pool revenue requirement amounts each year from 2012 to 2016 and the forecast amounts for 2017 and 2018.

Exhibit H 8.0 RATE DESIGN

No Questions.

---End---