ENVIRONMENTAL DEFENCE INTERROGATORY #1

Reference:
Exhibit B

Interrogatory:
Preamble:
The IESO has asked Hydro One to increase its import capability from Quebec by up to 1,650 megawatts (MW) by December 2022 at a cost of approximately $20 million. For further details see: http://www.ieso.ca/en/Sector-Participants/IESO-News/2019/02/IESO-increasing-reliability-of-the-electricity-system-in-the-Ottawa-area and http://www.ieso.ca/-/media/Files/IESO/Document-Library/regional-planning/Greater-Ottawa/IESO-Handoff-Letter-Hydro-One-Ottawa.pdf?la=en.

a) Is the IESO's request that Hydro One increase its import capability from Quebec by up to 1,650 megawatts (MW) by December 2022 included in Hydro One's Transmission System Plan?

b) What is the expected in-service date for this upgrade?

Response:
a) Yes; the project is included in Hydro One's Transmission System Plan, please refer ISD SS-06 in Exhibit B, Tab 1, Schedule 1.

b) The expected in-service date for the project is Q4 2022, as noted in ISD SS-06.

ENVIRONMENTAL DEFENCE INTERROGATORY #2

Reference:
TSP-01-08

Interrogatory:

a) Has Hydro One made improvements to its investment decision processes to better explore opportunities for economically reducing line losses since the Board's decision in EB-2016-0160? If not, please explain why not. If yes, please explain those improvements in detail. Please focus exclusively on improvements made since the decision in EB-2016-0160 and do not reiterate the information already on the record regarding investment decision processes.

b) To the extent that Hydro One has made improvements to its investment decision process with respect to transmission loss mitigation since the Board's decision in EB-2016-0160, please provide two examples of relevant investment decision-making documentation relating to projects considered before and after the improvements that would illustrate the improvements in question.

Response:

a) No, Hydro One has not made improvements to its investment decision processes with respect to line losses. Following the OEB Decision and Order in EB-2016-0160, Hydro One engaged EPRI to carry out a best practices review of the electric transmission industry with respect to line and transformer loss mitigation practices. EPRI was also requested to review Hydro One's practices on loss mitigation. The EPRI report (as presented in Attachment 1 to Exhibit B, Tab 1, Schedule 1, TSP Section 1.8) concluded that Hydro One's design practices are materially consistent with industry best practices for loss mitigation. Furthermore, as noted in Exhibit B, Tab 1, Schedule 1, TSP Section 1.8.6, Hydro One will continue to explore opportunities to economically reduce line losses.

b) Please refer to response in part (a), investment decision processes have not changed and therefore there is nothing to report.

Witness: Robert Reinmuller

ENVIRONMENTAL DEFENCE INTERROGATORY #3

Reference:

TSP-01-08

Interrogatory:

a) What cost effective opportunities for transmission loss reductions has Hydro One identified since the Board's decision in EB-2016-0160 that Hydro One would not have otherwise identified but for the Board's directive to explore said opportunities?

b) Please list and quantify the incremental transmission loss reductions (kWh and $) associated with each of the opportunities discussed in (a), if any.

Response:

a) No cost reduction opportunities have been identified that would not have been otherwise identified. As noted in Exhibit I, Tab 6, Schedule EnvironmentalDefence-2, EPRI concluded that Hydro One's design practices are materially consistent with industry best practices for loss mitigation.

b) Please see response to part (a) above.

Witness: Robert Reinmuller

ENVIRONMENTAL DEFENCE INTERROGATORY #4

Reference:

TSP-01-08

Interrogatory:

a) What cost effective opportunities for transmission loss mitigation has Hydro One identified since the Board's decision in EB-2016-0160 that Hydro One would not have otherwise implemented due to other drivers such as reliability, safety, and so on?

b) Please list and quantify the incremental transmission loss reductions (kWh and $) associated with each of the opportunities discussed in (a), if any.

Response:

a) No cost reduction opportunities have been identified that would not have been otherwise identified. As noted in Exhibit I, Tab 6, Schedule EnvironmentalDefence-2, EPRI concluded that Hydro One's design practices are materially consistent with industry best practices for loss mitigation.

b) Please see response to part (a) above.

ENVIRONMENTAL DEFENCE INTERROGATORY #5

Reference:

TSP-01-08

Interrogatory:

a) Please file Hydro One's internal documentation that describes its approach to evaluating line losses as part of its investment planning process.

b) Please file Hydro One's internal documentation describing how losses are taken into account where selection of new equipment is evaluated for procurement purposes.

Response:

a) There are no internal documents that describe an approach to line losses in Hydro One's investment planning process. As stated in TSP Section 1.8.5, Hydro One has incorporated development capital investments that resulted in line loss reduction benefits into Hydro One's proposed capital plan based on the outcomes of regional planning studies as part of the OEB's Regional Planning Process. As stated although loss reduction is one of the benefits, it was not the primary driver for any of these investments.

b) For documentation describing how losses are factored into the procurement of new transformers, please refer to proceeding EB-2016-0160 Exhibit J5.1 and Exhibit J5.1 Attachment 1.

ENVIRONMENTAL DEFENCE INTERROGATORY #6

Reference:

TSP-01-08

Interrogatory:

a) Please provide three examples of projects where transmission loss reductions were included in the cost-benefit analysis regarding the selection of equipment or project design.

b) For each of the three examples, please provide the cost-benefit analysis undertaken with respect to the relevant investment decision and identify the relevant sections.

c) For the three examples, please complete this cost/benefits analysis summary table:

	Project Name	Potential incremental cost to achieve loss reductions (e.g. incremental cost of more efficient transformer)	Forecast incremental lifetime loss reductions (lifetime)	Forecast incremental lifetime savings ($)
Ex 1				
Ex 2				
Ex 3				

Response:

a) Hydro One did not perform a cost-benefit analysis with respect to transmission line losses for any of the specific projects identified within Hydro One's capital plan; as transmission losses was not the primary driver for these transmission investments. As noted in Exhibit I, Tab 6, Schedule EnvironmentalDefence-5 part (a); the investments that resulted in line loss reduction benefits were based on the outcomes of regional planning studies as part of the Regional Planning Process. The need for these investments was primarily driven by need to support load thus the inclusion of the cost of losses would not have affected the outcome. For your reference, the reduction of peak losses of these investments is presented in Table 2 of Exhibit B, Tab 1, Schedule 1, TSP Section 1.8.

b) & c) Please refer to response in part (a) above.

ENVIRONMENTAL DEFENCE INTERROGATORY #7

Reference:

TSP-01-08

Interrogatory:

a) What methodologies does Hydro One use to assess the cost effectiveness of transmission loss reduction measures?

b) Please provide internal documentation describing these methodologies

c) Please provide two examples of cost effectiveness analysis undertaken with respect to actual projects.

Please focus on incremental measures within projects driven by other factors (e.g. selecting an incrementally more efficient transformer during replacement).

Response:

a) From a project perspective, as noted in Exhibit I, Tab 6, Schedule Environmental Defence-5 part (a), transmission losses are not the primary driver for investments identified in Hydro One's capital plan. The need for the investments noted in Table 2 of Exhibit B, Tab 1, Schedule 1, TSP Section 1.8, were primarily driven by need to support load thus the inclusion of the cost of losses would not have affected the outcome. The effectiveness of transmission loss reduction for these transmission investments is compared by looking at the reduction in MW of peak demand.

From an equipment perspective, Hydro One's selection process for new transformers and other equipment is based on comparing the effective equipment cost calculated as follows:

Effective Equipment Cost = Initial equipment cost + lifetime cost of losses

This methodology ensures that the equipment with the lowest cost is selected.

b) Please refer to response to Exhibit I, Tab 6, Schedule EnvironmentalDefence-5.

c) Please refer to response to part (a) above.

Witness: Robert Reinmuller

ENVIRONMENTAL DEFENCE INTERROGATORY #8

Reference:

TSP-01-08

Interrogatory:

a) How does Hydro One calculate the financial benefits ($) of transmission loss reductions as part of the investment decision-making process? Please provide details with respect to incremental investments (e.g. selecting more efficient equipment at the time of replacement) and investments where the financial benefit from loss reductions is included as one of many benefits compared to the overall cost of a project.

b) Please provide two examples from actual decision-making processes.

Response:

a) Hydro One did not calculate the financial benefits of transmission loss reductions. As noted in Exhibit I, Tab 6, Schedule EnvironmentalDefense-5 part (a), the investments that resulted in line loss reduction benefits were based on the outcomes of regional planning studies as part of the Regional Planning Process. The need for these investments was primarily driven by need to support load thus the inclusion of the cost of losses would not have affected the outcome.

b) Please refer to response in part (a) above.

ENVIRONMENTAL DEFENCE INTERROGATORY #9

Reference:

TSP-01-08

Interrogatory:

Preamble:

> *"The size of the conductor that can be considered is limited by the capability of the original tower structures and generally only conductors of the same size or one to two sizes larger can be accommodated."*

Approximately what percent of Hydro One's towers cannot accommodate a conductor that is one size larger?

Response:

Hydro One does not have this information. Each line would need to be assessed individually. However, generally towers can accommodate a slightly larger conductor, as noted in Exhibit B, Tab 1, Schedule 1, TSP Section 1.8.1.

ENVIRONMENTAL DEFENCE INTERROGATORY #10

Reference:
TSP-01-08

Interrogatory:
Preamble:
Hydro One states: *"There is typically little ability to cost effectively reduce line losses in line upgrade work where the existing conductor section is being replaced."*

In approximately what percentage of conductor replacement projects would it be possible to select a larger conductor or one with less resistance than would otherwise be selected while remaining within the capabilities of the original tower structures?

Response:
Please refer to response provided in Exhibit I, Tab 6, Schedule EnvironmentalDefence-9.

ENVIRONMENTAL DEFENCE INTERROGATORY #11

Reference:
TSP-01-08

Interrogatory:

a) Approximately how many metres of conductors does Hydro One plan to replace over (i) 2020 to 2024 and (ii) 2020 to 2030?

b) Approximately how many transformers does Hydro One plan to replace over (i) 2020 to 2024 and (ii) 2020 to 2030?

c) In EB-2016-0160, Hydro One stated that it planned to replace 500 km of its lines annually going forward (see Transcript Vol. 5, p. 64, lns. 26-27). Is that still the case? If not, please explain.

Response:

a) (i) Hydro One plans to replace 2,127 circuit-km of conductor over the 2020 to 2024 period as shown in Exhibit B, Tab 1, Schedule 1, TSP Section 3.3.5, Table 4.

(ii) Forecast replacements beyond 2024 are outside the scope of this Transmission System Plan. Planned replacements beyond 2024 will be included in a subsequent rebasing Application and Transmission System Plan.

b) (i) Hydro One plans to replace 108 transformers over the 2020 to 2024 period as shown in Exhibit B, Tab 1, Schedule 1, TSP Section 3.3.5, Table 3.

(ii) Forecast replacements beyond 2024 are outside the scope of this Transmission System Plan. Planned replacements beyond 2024 will be included in a subsequent rebasing Application and Transmission System Plan.

c) As noted in response to part (a) subpart (i) above, Hydro One is planning to replace 2,127 circuit-km of conductor over the 2020 to 2024 period; which is an average of 425 circuit-km of conductor per year. In comparison to the average replacement rate of 500 circuit-km per year discussed in EB-2016-0160, the slightly lower replacement rate in Hydro One's present rate filing is a result of continuous work re-prioritization

through the asset risk assessment ("ARA") process outlined in Exhibit B, Tab 1, Schedule 1, TSP Section 2.1.

ENVIRONMENTAL DEFENCE INTERROGATORY #12

Reference:

TSP-01-08 p.6

Interrogatory:

Preamble:

Hydro One states: "Transmission losses and their mitigation are not a focal point of transmitters, their independent system operators, or their regulatory bodies. At best, a few entities include the impact on losses that various design options may have in the selection of their project solutions."

Does Hydro One include the impact on losses that various design options may have in the selection of their project solutions?

Response:

Hydro One's current practices and strategy related to mitigating line losses are outlined in Exhibit B, Tab 1, Schedule 1, TSP Section 1.8.4.

ENVIRONMENTAL DEFENCE INTERROGATORY #13

Reference:

TSP-01-08 p.6, 11

Interrogatory:

Preamble:

Hydro One states that it "has incorporated line loss reduction benefits into Hydro One's proposed capital plan as demonstrated in Table 2."

a) Were any of the investments listed in Table 2, or a portion thereof, driven by transmission loss reduction benefits? In other words, would any of the investments, or a portion therefore, not have been made but for transmission loss reduction benefits?

b) If yes, please reproduce table 2 adding a columns to indicate: whether the project was driven by loss reductions in whole or in part, the cost of the portion driven by loss reductions (if any), and the net benefits of the incremental investment.

c) For those projects driven by loss reductions, if any, please provide the cost/benefit analysis underlying the forecast net benefits from the incremental loss reduction investments.

Response:

a) No, transmission losses are not a primary driver for any of the investments in Exhibit B, Tab 1, Schedule 1, TSP Section 1.8.5, Table 2.

b) Please refer to response in part (a) above.

c) Please refer to response in part (a) above.

ENVIRONMENTAL DEFENCE INTERROGATORY #14

Reference:

TSP-01-08-01 p.3-1

Interrogatory:

With respect to transmission losses, EPRI concludes that "efficiency must be considered in business cases" *and that* "transmission system expansion and refurbishment must incorporate efficiency considerations in the development of projects."

a) With respect to transmission losses, does Hydro One agree that "efficiency must be considered in business cases"?

b) Does Hydro One consider transmission loss efficiency in all business cases?

c) If yes, please file a copy of two business cases where this has been done and indicate the page(s) on which transmission loss efficiency has been considered.

d) Does Hydro One agree that "transmission system expansion and refurbishment must incorporate efficiency considerations in the development of projects."

e) Does Hydro One incorporate transmission loss efficiency considerations in the development of projects?

Response:

a) No. Hydro One does not agree that transmission loss efficiency must be considered in all business cases. It is overall efficiency that needs to be considered and not transmission loss efficiency. This is consistent with the EPRI report (Exhibit B, Tab 1, Schedule 1, TSP Section 1.8, Attachment 1, p3-1) that states: "*Efficiency is more than simply reducing losses*", and notes that "*A more economically efficient transmission system that fully utilizes existing assets and incorporates renewable energy sources and storage technologies may actually have higher losses*".

b) No, transmission losses are only considered in business cases where their impact is consequential to the project.

Witness: Robert Reinmuller

c) Please refer to response in part (b) above.

d) Yes, Hydro One agrees that efficiency must be considered in transmission expansion and refurbishment projects. However, it is overall efficiency and not transmission loss efficiency.

e) Please refer to Exhibit B, Tab 1, Schedule 1, TSP Section 1.8.4; which outlines Hydro One's current strategy and practices to incorporate transmission line loss considerations.

ENVIRONMENTAL DEFENCE INTERROGATORY #15

Reference:

TSP-01-08-01 p.4-6

Interrogatory:

EPRI concludes that "Loss mitigation costs and benefits should be considered in all project development and solution total cost analyses, such that the most cost-efficient solution is pursued that meets all reliability and safety criteria."

a) Does Hydro One agree that loss mitigation costs and benefits should be considered in all project development and solution total cost analyses, such that the most cost-efficient solution is pursued that meets all reliability and safety criteria?

b) Does Hydro One consider loss mitigation costs and benefits in all project development and solution total cost analyses, such that the most cost-efficient solution is pursued that meets all reliability and safety criteria?

c) If the answer to (b) is yes, please provide two examples of said total cost analyses conducted by Hydro One and indicate the page(s) on which the loss mitigation costs and benefits are considered.

Response:

a) Hydro One agrees with the EPRI recommendation to consider loss mitigation and benefits in conjunction with the overall efficiency. However the loss mitigation costs and benefits should be considered for alternative selection only when their impact is relevant and consequential to project economics.

b) No, please refer to response in part (a) above.

c) Please refer to response in part (b) above.

ENVIRONMENTAL DEFENCE INTERROGATORY #16

Reference:

TSP-01-08-01 Table 3-1, Table 5-3

Interrogatory:

Please ask EPRI to confirm that the lists of transmission loss reduction methods in Tables 3-1 and 5-3 were based on a survey of utilities conducted in 2008. If they survey was conducted prior to 2008 (the publication date), please indicate the year.

Response:

Hydro One received the following response from EPRI:

> *"The document in Table 3-1 was taken from, Transmission Efficiency Technology Assessment: Phase 1, EPRI, Palo Alto, CA: 2008. 1010692, was published in December 2008. The document does not reference a date for the actual survey, however, EPRI projects typically report on the findings carried out over the past year. Therefore the survey was conducted in late 2007 or 2008. Table 5-3 was based on Table 3-1 as far as establishing the topical loss mitigation methods that were reviewed with Hydro One staff. The information provided is based on discussions held with Hydro One."*

Witness: Robert Reinmuller

ENVIRONMENTAL DEFENCE INTERROGATORY #17

Reference:

TSP-01-08 p.9 Table 1

Interrogatory:

Please confirm that the list of transmission loss reduction methods listed in Table 1, page 9, is based on a survey of utilities conducted in 2008. If they survey was conducted prior to 2008 (the publication date), please indicate the year.

Response:

Please refer to response in Exhibit I, Tab 6, Schedule EnvironmentalDefence-16 related to Table 5-3; as Table 1 referenced above is a summary of Table 5-3 from EPRI's report (Exhibit B, Tab 1, Schedule 1, TSP Section 1.8, and Attachment 1).

Witness: Robert Reinmuller

ENVIRONMENTAL DEFENCE INTERROGATORY #18

Reference:

TSP-01-08-01, VII

Interrogatory:

Preamble:

EPRI concludes that: "Transmission Projects are initiated based on system need to ensure adequacy and reliability of supply or provide supply to customers. No utility is pursuing loss mitigation projects solely based on the potential mitigated loss savings over the life cycle of the asset."

a) Does EPRI agree that many energy efficiency measures involve incremental upgrades within wider projects (e.g. homeowners purchasing a more efficient equipment than they otherwise would at the time of replacement)?

b) Does EPRI agree that transmission owners generally do not replace wire or equipment in order to reduce transmission losses, but should consider the benefits of loss reduction when considering more efficient wires and equipment at the time of replacement driven by reliability, safety, or other factors?

Response:

a) & b) Hydro One received the following response from EPRI:

> *"EPRI is unable to respond, as the topic is outside the scope of EPRI's research."*

ENVIRONMENTAL DEFENCE INTERROGATORY #19

Reference:

TSP-01-08-01, VII

Interrogatory:

Does EPRI agree that the value of potential transmission loss reductions should be considered in the following circumstances?

a) In a cost/benefit analysis regarding operational measures which can mitigate losses;

b) In a cost/benefit analysis of equipment and design choices within wider capital projects;

c) In a cost/benefit analysis of capital projects driven primarily by other factors even though loss mitigation may only be a secondary factor that would not justify a project in isolation.

Response:

a) to c) Hydro One received the following response from EPRI:

> *"EPRI is unable to respond, as the topic is outside the scope of EPRI's research."*

ENVIRONMENTAL DEFENCE INTERROGATORY #20

Reference:

TSP-01-08-01

Interrogatory:

a) Please provide a list of all documentation Hydro One provided to EPRI for the purposes of its transmission losses report.

b) Please provide a copy of all documentation Hydro One provided to EPRI for the purposes of its transmission losses report.

Response:

a) Hydro One had preliminary discussions with EPRI related to transmission losses following the conclusion of the oral hearing in Hydro One's 2017-2018 Transmission Rate Application (EB-2016-0160). Based on these initial preliminary discussions, EPRI created a statement of work "Transmission Line Losses in Hydro One Networks System" for Hydro One to review. Upon Hydro One receiving the OEB's Decision and Order in EB-2016-0160, Hydro One had further discussions with EPRI outlining the OEB directive and provided confirmation to proceed with the report accordingly.

Hydro One subsequently provided the documentation listed below for the development of the report.

i. Losses Study_Circuits_Information.xlsx: Provided to EPRI December 11, 2017. Circuit flows and conductor data on a representative sample of circuits.
ii. Transformer Flows – EPRI.xlsx: Provided to EPRI January 24, 2018. A year's worth of typical transformer flows for units at two of Hydro One's stations as well as test data for comparable transformers.

b) The documentation noted in response to part (a) above, is provided herein. The initial statement of work from EPRI has been provided as an Appendix A to this response. The circuit and transformer data Hydro One provided to EPRI has been presented in excel format in Attachment 1 and Attachment 2 to this response, respectively.

Appendix A: EPRI Initial Statement of Work Proposal

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

FUNDING STATEMENT OF WORK

Funder Name: Hydro One Networks, Inc.
EPRI Contract ID: [Type Contract Number Here]
Contract Title: "Transmission Line Losses in Hydro One Networks System"
EPRI Project ID: New

Background and Objectives

Power losses are incurred in the generation, transmission and distribution of electricity. Power losses are considered in the design and selection of various components for a power system. In the design optimization process, certain assumptions are made to derive at the final decision to achieve the minimal life-cycle cost for a transmission line. Hydro One Networks is interested in verifying the energy losses in its transmission lines are consistent with the industry practice and that the actual system parameters are close to the original assumptions. As well, Hydro One Networks is interested to find out whether further improvements can be made to optimize losses in its transmission line system.

The objective of this study is to determine whether the existing transmission line system of Hydro One Neworks is optimal for line losses. If not, what are the practical and cost effective options to improve the transmission system.

New Learnings

The study will provide an approach to the industry for investigating and analyzing overhead line losses. Findings from the study will assist utlities in identifying potential line loss reductions. Improvements on line losses resulting in energy savings will ulitmately benefit the public in terms of electricity rates.

Tasks

1. **Investigate Electric Power System Efficiency**
   Information on the efficiency of various components of a power system will be collected. Typical energy losses will be provided on:
   - *1.1.* Generation
   - *1.2.* Substation
   - *1.3.* Transmission
   - *1.4.* Distribution
   - *1.5.* End-Use

2. **Reseach Line Loss Optimization Process**
   The common approach adopted by the industry to achieve optimal line losses will be investigated and described. The approach followed by Hydro One in the design process will be explained. An examples of Life-Cycle Cost Analysis will be provided. The following topics will be coverd:
   - *2.1.* Industry Practices
   - *2.2.* Hydro One Practice
   - *2.3.* Line Loss Calculation
     - 2.3.1. Loss Types
     - 2.3.2. Load Flow Pattern

2.3.3. Present Worth Approach
2.4. Life-Cycle Cost Analysis
2.4.1. Sizing of Conductors
2.4.2. Minimizing of Line Costs

3. **Study Hydro One Overhead Line Losses**
Working with Hydro One Networks staff, select typical transmission lines in the Hydro One Networks system to be evaluated for line losses. The study will cover overhead lines at various voltages. A summary of an overhead transmission line losses will be provided with an estimate of an overall % of line losses in the Hydro One system. Overhead line design parameters, load-flow data and other relevant information for the study shall be provided by Hydro One staff.

4. **Explore Transmission Line Loss Reductions**
From the results of line losses study, investigate and explore the potential of various transmission line loss reductions. Perform cost/benefit analysis of each of the options.

5. **Provide Observations, Conclusions and Recommendations**
From the study, provide observations made on the Hydro One Networks system as compared to the electric power industry, and make conclusion whether any improvement to the design practice and process is required to optimize line losses, and whether any lines have the potential for upgrades for loss reduction cost effectively, and provide and describe upgrade options, if required

Deliverables

The non-proprietary results of this work will be incorporated into EPRI R&D Program Program 35, and made available to the public, for purchase or otherwise.

1. Study results and data
2. Draft and Final Reports

Estimated Period of Performance/Estimated Schedule

Estimated Period of Performance

The estimated period of performance is 6 months.

Estimated Schedule

The study will be completed and the report prepared by the end of 2017.

Funder Obligations

Overhead line design parameters, power-flow data and other relevant information required for the study shall be provided by Hydro One Networks staff.

ENVIRONMENTAL DEFENCE INTERROGATORY #21

Reference:

TSP-01-08-01

Interrogatory:

a) Please provide a list of all documentation the IESO provided to EPRI for the purposes of its transmission losses report.

b) Please provide a copy of all documentation the IESO provided to EPRI for the purposes of its transmission losses report.

Response:

a) The IESO did not provide documentation to EPRI for the purpose of developing Exhibit B, Tab 1, Schedule 1, TSP Section 1.8, Attachment 1. Hydro One was the primary contact for EPRI and provided the supporting documentation required for the preparation of this report. Please refer to Hydro One's response in Exhibit I, Tab 6, Schedule EnvironmentalDefence-20.

b) Please refer to response in part (a) above.

ENVIRONMENTAL DEFENCE INTERROGATORY #22

Reference:

TSP-01-08-01, Chapter 5

Interrogatory:

a) Please provide a list of all the Hydro One documentation that EPRI reviewed in coming to its conclusions regarding Hydro One's loss mitigation efforts detailed in chapter five of its report. If not provided in response to interrogatory # 21, please also provide a copy of said documentation.

Response:

a) Hydro One received the following response from EPRI:

> *"The information provided is based on discussions held with Hydro*
> - *Description of eleven (11) different transmission lines, including line length, voltage, conductor type and sizing.*
> - *Description of two (2) transformer parameters.*
> - *Hourly transformer and line loading levels for each of the eleven lines for the calendar year of 2016."*

Note: The data referenced above with respect to Hydro One's transmission lines and transformers has been provided in response to Exhibit I, Tab 6, Schedule Environmental Defence-21.

ENVIRONMENTAL DEFENCE INTERROGATORY #23

Reference:

TSP-01-08-01

Interrogatory:

EPRI examined how other "transmitters, independent system operators, and regulatory bodies are addressing the loss mitigation concern."

a) Please confirm that EPRI conducted a jurisdictional scan and did not seek out and identify leading jurisdictions regarding loss mitigation.

b) How did EPRI decide which "transmitters, independent system operators, and regulatory bodies" to examine?

Response:

a) Hydro One received the following response from EPRI:

> *"EPRI first conducted a search within its own repository of reports and published documentation that addressed anything related to line or equipment losses. EPRI then used various internet search engines to scour the industry for documents related to line and equipment losses. The references identified in Chapter 7 of Exhibit B-1-1, TSP Section 1.8, Attachment 1 illustrate the breadth of the reference material reviewed. In addition to EPRI documents, a concerted search was made in published works of CIGRÉ, the International Council on Large Electric Systems and references to other independent transmission operators, e.g. PJM, SPP, ERCOT, IESO, and CAISO. In addition, DOE publications and state regulatory agencies, i.e., public utility commissions were researched for appropriate information."*

b) Hydro One received the following response from EPRI:

> *"EPRI did not target any specific entities, but cast as broad a global net as possible."*

Witness: Robert Reinmuller

ENVIRONMENTAL DEFENCE INTERROGATORY #24

Reference:

TSP-01-08-01

Interrogatory:

In EB-2018-0143, the Board accepted a settlement in which the IESO committed to "engage with stakeholders regarding the IESO's transmission losses work/report (similar to the 2017 engagement the IESO undertook on the development of its regulatory scorecard) including a discussion of the transmission losses processes used by National Grid UK, the recommendations of the Council of European Energy Regulators, and methodologies to assess the cost effectiveness of transmission loss reduction measures."

a) Please confirm that the IESO has agreed to conduct an engagement process that will include a discussion of the transmission loss mitigation processes used by National Grid UK and the recommendations of the Council of European Energy Regulators.

b) Please confirm that the EPRI transmission losses report does not include a discussion of the transmission loss mitigation processes used by National Grid UK and the recommendations of the Council of European Energy Regulators

c) Please confirm that the IESO has agreed to conduct an engagement process that will include a discussion of the methodologies to assess the cost effectiveness of transmission loss reduction measures.

d) Please confirm that the EPRI transmission losses report does not include a discussion of the methodologies to assess the cost effectiveness of transmission loss reduction measures.

Response:

a) Please refer to the IESO Settlement Proposal attached to Decision and Order EB-2018-0143 Section 5.4 (b) stating that the IESO will engage with stakeholders to discuss the transmission loss mitigation processes used by National Grid UK and the recommendations of the Council of European Energy Regulators.

b) EPRI has reviewed the European Practice on transmission investment as described in their report (Exhibit B, Tab 1, Schedule 1, TSP Section 1.8, Attachment 1 pages 4-3 to 4-6). However, they did not specifically discuss the loss mitigation processes used by National Grid and the recommendations of the Council of European Energy Regulators.

c) Please refer to the IESO Settlement Proposal attached to Decision and Order EB-2018-0143 Section 5.4 (b) stating that the IESO will engage with stakeholders to discuss the methodologies to assess the cost effectiveness of transmission loss reduction measures.

d) The EPRI transmission losses report (Exhibit B, Tab 1, Schedule 1, TSP Section 1.8 Attachment 1 page 4-5) refers to the use of life cycle costs for evaluating projects and suggests that these should include any losses.

ENVIRONMENTAL DEFENCE INTERROGATORY #25

Reference:

TSP-01-08-01

Interrogatory:

EPRI examined how other "transmitters, independent system operators, and regulatory bodies are addressing the loss mitigation concern." Attached are documents describing how the National Grid UK and the Council of European Energy Regulators are addressing loss mitigation.

Please list and describe the types loss mitigation efforts described in the attached documents which are not already described in the EPRI report. Please include a discussion of efforts by transmitters, independent system operators, and regulatory bodies.

Response:

Hydro One has reviewed the reports provided and Hydro One's specific discussion on each report are given below in the context of the EPRI report and Hydro One's practice.

In summary the EPRI report, prepared at the request of Hydro One, is a documentation of the industry's best practices on loss mitigation. There is nothing in any of four reports that is not already reflected in the EPRI report with respect to the aspects that are within Hydro One Transmission's purview.

There are areas of these reports not captured in the EPRI report, that relate to the operational practices or other aspects; however these are outside the accountability of Hydro One Transmission and have already been committed to be reviewed and stakeholdered by the IESO as part of the direction in its Settlement Agreement approved by the OEB in proceeding EB-2018-0143.

Hydro One's Discussion on Reports

1. Report 1 - European Regulators' Group for Electricity and Gas "Treatment of Losses by Network Operators - ERGEG Position Paper for public consultation", Ref: E08-ENM-04-03, dated 15 July 2008.

   This report, as it names states, relates to treatment of losses by the Network operators – primarily how Network Operators financially recover the cost of losses. The subject of this report is outside the scope of Hydro One's mandate as losses are recovered in Ontario by the IESO. Hydro One did not ask EPRI to study this aspect and it is not covered in the EPRI report.

2. Report 2 - National Grid's Strategy Paper to address Transmission Licence Special Condition 2K: Electricity Transmission Losses. Reporting Period: 1 April 2013 to 31 March 2021", Published: November 2013, Revised: September 2014

   This is the National Grid Strategy Paper on how they intended to address losses. Transmission losses are a well understood phenomena and both the National Grid Strategy Paper and the EPRI report describe known facts. All of the National Grid initiatives or methods for loss reduction are mentioned in the EPRI report. For example: Hydro One's practice for transformer and conductor selection (Exhibit B-1-1 TSP Section 1.8.4) is similar to the National Grid practice identified in their document, pages 5 to 8. Both Hydro One and National Grid include cost of losses when evaluating transformer purchases. Both look at using lower resistance conductors to decrease transmission line losses when building new lines or replacing conductors.

   National Grid and EPRI agree on the treatment of losses in economic evaluations. Both point out that transmission loss evaluation needs only to be done when including the cost of losses would change the ranking of the alternatives considered for any given investment. For example National Grid (See page 4) state that a detailed loss assessment is only carried out when:

   > *"An initial assessment concludes that the quantification of the cost of losses could realistically impact the option decision made by the investment team – i.e. where the capital cost of two options for investment are comparable on capital cost."*

EPRI Report (See page 5-3) expresses the same point as:

> *"Economic impact assessments of losses are conducted when such losses could reasonably be consequential to the selection of a least cost plan."*

National Grid and EPRI have the same view on loss reduction – that it is not economical to do work solely to reduce losses. National Grid states (See page 8)

> *"For most of the technical options, it is not economically justifiable to replace assets if the only driver is the reduction of transmission losses. Replacement is generally only considered in cases where there is a driver such as deterioration of asset conditions or a load related requirement to increase capacity."*

EPRI states in their report summary of best industry practices (See page 4-6)

> *"Loss mitigation projects are not self-supporting in that the projected loss savings do not exceed the cost of performing a mitigation project. As such projects with their primary objective being mitigation of transmission losses can seldom be justified based on lifetime savings alone."*

3. Report 3 - National Grid Electricity Plc Special Condition 2K.4 – Transmission Losses Report Reporting Period 1 April 2014 to 31 March 2015.

   This is a National Grid report detailing losses occurring on the National Grid transmission system in compliance with their license condition. The EPRI report is a review of loss mitigation practices so the two are not comparable. National Grid reported losses of 1.17% - 8.04% for different parts of their network (see Table 1 of report). EPRI reported transmission losses ranging from 1.5% - 5.8% (page 2-4 of EPRI report).

4. Report 4 - CEER Report on Power Losses – October 2017

   This is a Council of European Energy Regulators report on power losses detailing practices in European countries, and describes the levels of losses, how they are defined, calculated and valued. The report makes a number of recommendations.

As noted in the table below all the recommended practices that are in Hydro One Transmission's purview were mentioned by EPRI and are part of Hydro One's practices.

No.	CEER's Technical Losses Recommendations	Hydro One Practice
1	Increase voltage levels	Hydro One follows the same practice. There are a number of projects underway where the supply voltage is being upgraded.
2	Apply less transformational steps to deliver electricity to consumers	Hydro One follows the same practice. There is only one step transformation from 230kV or 115kV transmission voltages to 27.6kV or 13.8kV for electricity delivery to customers.
3	Utilize new and improved equipment	Hydro One follows the same practice. New transformers are purchased based on lifecycle cost to minimize losses.
4	Employ distributed generation in a more efficient manner, including combining it with local storage	This is not within Hydro One's control. Distribution generation location is decided by the generator proponent and the IESO.
5	Optimise network flows – reduce peaking	This is not within Hydro One's control. Flows depend on customer loads and available generation.
6	In general, pursue network architecture and management that promote the highest efficiency	Hydro One follows the same practice. This work is carried out jointly with LDCs and the IESO as part of Regional Planning Process.

ENVIRONMENTAL DEFENCE INTERROGATORY #26

Reference:
TSP-01-08-01

Interrogatory:
Does EPRI have the expertise to prepare a transmission losses report that:

a) Identifies and focuses on the leading jurisdictions with respect to assessment and optimization of transmission losses;

b) Includes the National Grid UK and the Council of European Energy Regulators in its review of best practices;

c) Describes methodologies to assess the cost effectiveness of transmission loss reduction measures and makes appropriate recommendations in that regard; and

d) Makes recommendations regarding Hydro One's and/or the IESO's assessment and optimization of transmission losses.

Assume that EPRI is appropriately retained and funded for such a report. If EPRI is able to study and report only on some of those four items, please indicate which.

Response:
Hydro One believes that EPRI has the necessary expertise to prepare a transmission losses report. However, Hydro One does not believe such a study is necessary for reasons detailed in the response to Exhibit I, Tab 6, Schedule EnvironmentalDefence-27.

Witness: Robert Reinmuller

ENVIRONMENTAL DEFENCE INTERROGATORY #27

Reference:
TSP-01-08-01

Interrogatory:
Is Hydro One willing to ask EPRI or another consultant to prepare a report that:

a) Identifies and focuses on the leading jurisdictions;

b) Includes the National Grid UK and the Council of European Energy Regulators in its review of best practices;

c) Describes methodologies to assess the cost effectiveness of transmission loss reduction measures and makes appropriate recommendations in that regard;

d) Makes recommendations regarding Hydro One's and optimization of transmission losses.

If Hydro One is willing to ask EPRI or another consultant to examine only some of those items, please indicate which.

Response:
EPRI has already provided Hydro One with a report on transmission losses; please see Exhibit B, Tab 1, Schedule 1, TSP Section 1.8, Attachment 1. Hydro One believes that the question of transmission loss mitigation measures has been well documented and that Hydro One is following the current best practices with respect to initiatives or methods for loss reduction.

Hydro One's practices are consistent with the National Grid UK practices in this regard as noted in Exhibit I, Tab 6, Schedule EnvironmentalDefence-25. Similarly the Council of European Energy Regulators recommendations are well known industry practices and documented in numerous previous industry studies as described in the EPRI Report (Exhibit B, Tab 1, Schedule 1, TSP Section 1.8, Attachments 1). Hydro One's practices include most of the technical recommendations of the Council of European Energy

Regulators, please refer to Exhibit I, Tab 6, Schedule EnvironmentalDefence-25 for a comparison of the Council recommendations with Hydro One's practices.

Furthermore, the methodology for assessing the cost effectiveness of transmission loss reduction measures is also well known and the EPRI report refers to the use of life cycle costs for evaluating projects, as noted in Exhibit I, Tab 6, Schedule Environmental Defence-24 part (d).

Areas of the National Grid and Council of European Energy Regulators reports not captured in the EPRI report, prepared at the request of Hydro One, relate to the operational practices or other aspects which are outside the accountability of Hydro One Transmission. Furthermore, these areas have already been committed to be reviewed and stakeholdered by the IESO as part of the direction in its Settlement Agreement approved by the OEB in proceeding EB-2018-0143.

Therefore, Hydro One sees little benefit in commissioning a new study to look at transmission loss mitigation measures.

ENVIRONMENTAL DEFENCE INTERROGATORY #28

Reference:
TSP-01-08

Interrogatory:
Preamble:
In EB-2018-0143, the Board accepted a settlement in which the IESO committed to "engage with stakeholders regarding the IESO's transmission losses work/report (similar to the 2017 engagement the IESO undertook on the development of its regulatory scorecard) including a discussion of the transmission losses processes used by National Grid UK, the recommendations of the Council of European Energy Regulators, and methodologies to assess the cost effectiveness of transmission loss reduction measures."

The IESO engagement is ongoing.

a) Does the Hydro One believe is has completely fulfilled the directions of the Board regarding transmission losses in EB-2016-0160?

b) What orders or relief are Hydro One seeking with respect to transmission losses in this proceeding?

c) Will Hydro One participate in the IESO's engagement process required by EB-2018-0143?

d) Will Hydro One commit to continue to "work jointly with the IESO to explore cost effective opportunities for line loss reduction" and to "explore, as part of its investment decision process, opportunities for economically reducing line losses" through the IESO's transmission losses engagement process and otherwise?

e) Will Hydro One commit to report on the initiatives described in (d) as part of its next rate application?

Response:
a) Hydro One understands the OEB direction to be a continuing requirement. As stated in Exhibit B, Tab 1, Schedule 1, TSP Section 1.8.6; Hydro One will continue to

consider the reduction of losses and will work collaboratively with the IESO to identify and investigate opportunities for economically reducing line losses.

b) Hydro One is not seeking any relief or orders with respect to transmission losses in this proceeding.

c) Yes, Hydro One intends on participating in the IESO engagement process.

d) Please see response to part (a) above.

e) Hydro One will commit to continue to report on the collaboration with the IESO to explore cost effective opportunities for line loss reduction, and document Hydro One's proposed capital plans that have line loss reduction benefit as part of its next rate application.