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BY EMAIL AND RESS

February 26, 2021

Ms. Christine E. Long
Registrar
Ontario Energy Board
Suite 2700, 2300 Yonge Street
P.O. Box 2319
Toronto, ON M4P 1E4

Dear Ms. Long:

EB-2020-0265 – Hydro One Networks Inc. Leave to Construct Application – Hawthorne to Merivale Reconductoring Project – Interrogatory Responses

Hydro One Networks Inc. (Hydro One) is submitting written responses to the Ontario Energy Board ("OEB") staff and Environmental Defence ("ED") interrogatories on Hydro One's Hawthorne to Merivale Reconductoring Project, consistent with the timing outlined in the OEB's Procedural Order No. 1. ED was the only registered intervenor that posed interrogatories, additional to Board Staff.

In responding to the interrogatories, Hydro One is providing certain informational data separately on a confidential basis, consistent with the OEB's rules. An electronic copy of the confidential information will be provided to the OEB (via email) and shall not be used by any party for any purpose other than the matters at hand.

An electronic copy of the interrogatory responses has been submitted using the Board's Regulatory Electronic Submission System.

Sincerely,

Joanne Richardson

c/ EB-2020-0265 Intervenors (Electronic only)

OEB STAFF INTERROGATORY #1

Reference:

(1) Exhibit B, Tab 2, Schedule 1, page 1

Preamble:

The reference above states that the IESO:

> *"has identified the need for an increased power transfer limit across the two M30A and M31A circuits to address the need to facilitate bulk power flows from eastern Ontario, including eastern Ontario generation, towards the GTA."*

Interrogatory:

a) What criteria stipulate the capability required to facilitate bulk power flows from eastern Ontario, including eastern Ontario generation, towards the GTA across circuits M30A and M31A?

b) What is the statistical frequency and magnitude of power transfer capability insufficiency across circuits M30A and M31A with respect to bulk power flows from eastern Ontario, including eastern Ontario generation, towards the GTA and how does it compare to applicable criteria?

c) If the Hawthorne to Merivale reconductoring project is implemented, what will the expected statistical frequency and magnitude be? (i.e., of power transfer capability insufficiency across circuits M30A and M31A with respect to bulk power flows from eastern Ontario, including eastern Ontario generation, towards the GTA).

d) Please identify the specific areas within or around the GTA that will benefit from the bulk power flows enabled by the Hawthorne to Merivale reconductoring project and indicate what those benefits will be

Response:

This response was provided by the IESO.

a) The IESO controlled grid is planned in accordance to the following reliability standards and criteria where applicable:

- NPCC Directory #1 – "Design and Operation of the Bulk Power System"[1]
- NERC Standard TPL-001-4 – "Transmission System Planning Performance Requirements"[2]
- IESO Ontario Resource and Transmission Assessment Criteria[3]

The reliability standards and criteria listed above stipulate the planning events required to be assessed (e.g., system's initial condition and system contingencies) and the system performance required to be met. The IESO's planning studies indicate that the power flows across the existing 230 kV circuits M30A and M31A exceed their transfer capability (e.g., exceed their long-term emergency ampacity ratings after a contingency) today based on extreme weather forecasts. Generation located in eastern Ontario was dispatched as the IESO would expect it to be dispatched to help meet demand during peak hours, which is typically how the IESO carries out its planning studies.

b) As described in the response to part a) above, applicable reliability standards and criteria stipulate the planning events required to be assessed and the system performance required to be met. The reliability standards and criteria take a deterministic rather than a probabilistic approach to planning the transmission system. For this reason, the statistical frequency and or magnitude of power transfer capability insufficiency across circuits M30A and M31A is only meaningful when assessing the economic benefits of the Hawthorne to Merivale Reconductoring (HMR) project and not for assessing the reliability of the transmission system and hence was not determined.

[1] https://www.npcc.org/content/docs/public/program-areas/standards-and-criteria/directories/directory1-design-and-oper-20200305.pdf
[2] https://www.nerc.com/files/TPL-001-4.pdf
[3] https://www.ieso.ca/-/media/Files/IESO/Document-Library/Market-Rules-and-Manuals-Library/market-manuals/connecting/IMO-REQ-0041-TransmissionAssessmentCriteria.pdf

c) After implementing the HMR Project, flows across circuits M30A and M31A are expected to remain within their capability based on current long-term forecasts (i.e., 20 years).

d) After implementing the HMR Project, the increased capability of circuits M30A and M31A will ensure generation located in eastern Ontario can reliably contribute to meeting Ontario's forecast peak system demand and will benefit all of Ontario.

OEB STAFF INTERROGATORY #2

Reference:

(1) Exhibit B, Tab 2, Schedule 1, page 1

Interrogatory:

a) Has the IESO developed a business case to show the costs and benefits of upgrading circuits M30A and M31A to facilitate bulk power flows from eastern Ontario, including eastern Ontario generation, towards the GTA? If so, please summarize and provide the business case.

b) Based on the IESO's analysis, please indicate how much power flow would be facilitated by the proposed upgrade and what value the additional power flow would provide Ontario ratepayers annually (e.g. compared to a status quo scenario).

c) Did the IESO compare the suitability, costs and benefits on non-wires alternatives or distribution system alternatives for achieving similar outcomes? If so, please comment.

d) If applicable, why was a transmission wires alternative recommended?

Response:

Hydro One and the IESO contributed to this response.

a) The upgrade of circuits M30A and M31A are needed to meet reliability standards and criteria and, as such a cost-benefit analysis is not needed here.

b) After completing the HMR Project, the power flow that can be facilitated across the circuits M30A and M31A will increase from approximately 648MW to approximately 1080 MW. As indicated in part a), the upgrade of circuits M30A and M31A are needed to meet reliability standards and criteria and, as such, additional value analysis (e.g. economic analysis) is not needed here.

c) When considering non-wires alternatives, the IESO looks at a number of factors that can include but are not limited to: timing of need, size of need, community support and siting. Considering these factors and the relatively low cost of the transmission wires solution, a transmission wires solution was recommended to address the reliability need. There are no distribution alternatives.

d) Please refer to the responses above in part c).

OEB STAFF INTERROGATORY #3

Reference:

(1) Exhibit B, Tab 2, Schedule 1, page 1

Interrogatory:

a) When were circuits M30A/M31A between Hawthorne TS and Merivale TS placed into service?

b) If not for the Hawthorne to Merivale reconductoring project, when would circuits M30A/M31A between Hawthorne TS and Merivale TS be expected to reach their end-of-life?

c) Please estimate the remaining depreciation cost of existing circuits M30A/M31A between Hawthorne TS and Merivale TS between:
   i. the time they are decommissioned as part of the Hawthorne to Merivale reconductoring project; and
   ii. the time they are expected to reach end of life.

d) How has the cost of depreciation/remaining value of existing circuits M30A and M31A been factored into the IESO's cost benefit analysis of upgrading circuits M30A and M31A to facilitate bulk power flows from eastern Ontario, including eastern Ontario generation, towards the GTA?

e) Please comment on whether and how Hydro One proposes to recover any remaining depreciation amount through rates.

Response:

a) The M31A circuit was placed in-service in 1988. The M30A circuit was placed in-service in 1991.

b) Steel tower transmission lines have a number of components that have expected service lives of between 60 to 90 years. In the absence of the IESO's request for more capacity on the M30A and M31A circuits, between Hawthorne TS and Merivale TS, those circuits were not expected to require major refurbishment before 2050.

c) Circuits M30A and M31A are one of three circuits that are each carried on separate tower series spanning between Hawthorne TS and Merivale TS. Each series of towers carries three different voltage circuits, a 500 kV, a 230 kV, and a 115 kV circuit. The only component that is changing as part of the HMR project is the conductor for the 230 kV circuits, known as M30A and M31A. At the time of decommissioning, as part of the Hawthorne to Merivale reconductoring project, the undepreciated cost (i.e. the Net Book Value) of the existing circuits M30A and M31A, spanning between Hawthorne TS and Merivale TS, is approximately $1.5M.

d) As mentioned in Exhibit I, Tab 1, Schedules 1 part a) and 2, the line reconductoring is required to meet reliability standards, as directed by the IESO. Accordingly, the IESO did not complete a cost-benefit analysis in order to inform their decision, nor was one performed by Hydro One.

e) The remaining undepreciated cost on the existing conductor will be recovered via depreciation rates as determined by the company's depreciation consultant (Foster and Associates), consistent with Hydro One's accounting treatment for these types of scenarios, and Hydro One's OEB-approved pooled depreciation methodology.

OEB STAFF INTERROGATORY #4

Reference:

(1) Exhibit B, Tab 3, Schedule 1, Attachment 1, pages 1 & 2

Preamble:

The IESO states at the above reference that circuits M30A and M31A are:

> *"critical for supplying customers in the western half of the City of Ottawa and providing a transmission path for a* ***portion*** *of the power transfers between Eastern Ontario and the Greater Toronto Area" and that limitations on circuits M30A and M31A will have an "impact" on "utilization of resources in Eastern Ontario for regional or system needs". [****emphasis added****]*

Interrogatory:

a) Please specify the portion of power transfers between Eastern Ontario and the GTA served by circuits M30A and M31A.

b) Please indicate which specific resources in eastern Ontario are being referred to in the above reference.

c) Please comment on and quantify, how frequently, and by how much the utilization of the resources referenced above is impacted by limitations on circuits M30A and M31A.

d) Please describe, and if possible quantify, the implications to Ontario customers of impacts on the utilization of the resources referenced above caused by limitations on circuits M30A and M31A.

e) How is the impact of existing limitations (i.e. in the absence of the proposed upgrade) on circuits M30A and M31A on the utilization of resources in eastern Ontario for regional or system needs forecast to change over the next 15 years?

f) Please comment on the timing of the proposed upgrade relative to the information provided in response to part d).

Response:

This response was provided by the IESO.

a) The circuits M30A and M31A are "network facilities"[1]. When combined with all other "network facilities" in the province they collectively serve Ontario demand. The portion of power transfers between Eastern Ontario and the GTA served by the M30A and M31A circuits will vary considerably throughout a day and seasonally as Ontario demand varies. For the purpose of determining the need, load and generation assumptions were based off expected levels at the time of peak demand and to align with relevant planning criteria.

b) Eastern resources refer to transmission connected generators which are tabulated below.

Name	Fuel Type
Amherst	Wind
Arnprior	Water
Barrett Chute	Water
Cardinal Power	Gas
Chats Falls	Water
Chenaux	Water
Healey	Water
Kingston Solar	Solar
Lennox	Gas & Oil
Loyalist	Solar
Mountain Chute	Water
Napanee	Gas
Kingston Cogen	Gas
Nation Rise	Wind
Saunders	Water
Stewartville	Water
Wolf Island	Wind
Ottawa Health Science	Gas

[1] Sections 3.0.14 and 3.0.15b of the Transmission System Code. Link to the code; https://www.oeb.ca/oeb/_Documents/Regulatory/Transmission_System_Code.pdf.

c) Please see response to Exhibit I, Tab 1, Schedule 1, part b). For this reason, additional studies to examine the statistical frequency and or magnitude of power transfer capability insufficiency across circuits M30A and M31A were not identified.

d) The implications on Ontario rate payers is that generation in eastern Ontario may not be able to be relied on to help supply Ontario's demand for electricity during peak periods.

e) The 2020 APO[2] signaled a need for capacity. Generation in eastern Ontario is expected to be increasingly relied upon to help meet system needs and satisfy adequacy needs in eastern Ontario. However, during peak periods, load in the Ottawa area can place restrictions on the dispatch of resources in eastern Ontario, limiting the ability of these resources to contribute to meeting adequacy needs.

f) The upgrade will be in place to meet the identified existing transmission reliability need before a forecast need for system capacity emerges in 2026, where there may be a need for further reliance on existing and potential new resources in eastern Ontario.

[2] www.ieso.ca/-/media/Files/IESO/Document-Library/planning-forecasts/apo/Annual-Planning-Outlook-Dec2020.ashx

OEB STAFF INTERROGATORY #5

Reference:

(1) Exhibit B, Tab 3, Schedule 1, page 2

Preamble:

The reference above notes that reinforcement of the M30A and M31A circuits would enable capacity imports from Quebec.

Interrogatory:

a) Please confirm that in this context, capacity imports from Quebec refer to contract-based or capacity market-based capacity imports.

b) Please clarify how capacity imports differ from the energy imports from Quebec that are currently scheduled in the real-time market.

c) Does Ontario currently hold a contract with Quebec for capacity imports?

d) Does Ontario currently have a capacity market that could source capacity imports from Quebec?

e) Are there firm plans to secure a contract with Quebec for capacity imports within the next five years?

f) If the answer to part (d) above is “no”, are there firm plans to establish a capacity market within the next five years that could source capacity imports from Quebec?

g) Is the reinforcement of the M30A and M31A circuits the only investment that would be required to enable capacity imports from Quebec, or are there other upstream or downstream investments that would also be required?

h) If additional investments are required, please describe the nature of the limitations to be addressed (e.g. thermal, voltage).

i) Is the Hawthorne to Merivale Reconductoring project the only feasible way of enabling capacity imports from Quebec? If no, has the IESO considered alternative ways? Please describe any alternatives that have been considered.

Response:

This response was provided by the IESO.

a) Confirmed.

b) Capacity imports differ from the energy imports from Quebec that are currently scheduled in the real-time market in that capacity imports are accounted as firm capacity towards satisfying resource adequacy needs for Ontario, like domestic generation, and cannot be accounted for by the source jurisdictions to meet their resource adequacy needs. Given this, in Ontario's Capacity Auction, imports are paid capacity payments to be available during pre-defined peak demand hours and are subject to non-performance charges and claw-backs if they fail to meet their capacity obligation.

c) Confirmed.

d) Confirmed. The Capacity Auction allows system backed capacity imports. Hydro Quebec is committed to provide 80 MW of system-backed imports through the December 2020 Capacity Auction for delivery to Ontario during the 2021 summer.

e) All existing firm commitments are described in part d), above.

f) Not applicable.

g) As described in the IESO's hand off letter to Hydro One[1], the upgrades to the M30A and M31A circuits are recommended to meet reliability needs. As such, studies to evaluate what system upgrades are needed for Quebec imports were not required. However, for reference, in 2014, the IESO conducted a review of Ontario's interconnections with its neighbors, including those with Quebec. Subsequently in 2017, the IESO conducted a follow-up technical review focused in more detail on the Ontario-Quebec interconnections. Both reviews identified that the main impediment to enabling capacity imports from Quebec is the limitation of the Hawthorne to Merivale path and reinforcement of this path would be necessary to mitigate this restriction. The follow-up technical review of the Ontario-Quebec interconnections identified incremental investments that can further enable additional capacity imports from Quebec. Those investments identified in the report are copied in the table below. As stated in the report, upgrading the 230 kV circuits between Hawthorne and Merivale (HMR project) will enable 1,250 MW of capacity imports. No additional improvements are expected to be required to enable 1,250 MW of capacity imports.

[1] Exhibit B, Tab 3, Schedule 1, Attachment 1.

Case	System Change	Total Transmission Cost and Timing Requirements	Total Resulting Firm Import Capability (MW)
1	Existing System		**0 MW firm import** • Non-firm energy imports are feasible, depending on system conditions, such as demand, and eastern Ontario hydroelectric generation levels
2	After replacing two 230 kV line disconnect switches at Hawthorne TS	Approx. $ 500,000; 1-2 years of lead time	**500 MW firm import on HVDC intertie** • In conjunction with Ottawa demand growth up to mid-2020s • Energy import may be able to exceed 500 MW for some hours
3	After replacing two 230 kV line disconnect switches and reconductoring two 230 kV circuits between Hawthorne TS and Merivale TS (approx. 12 km)	Approx. $20 M 3 years of lead time Note: scheduling outages for this work will require significant timing coordination	**1,250 MW firm import – Full capability of HVDC intertie** • Energy import would be limited to approximately 1,250 MW at any given time • In addition to enabling increased use of the intertie capability, reconductoring the Hawthorne-Merivale circuits would allow Ontario to further optimize the targeting of the 2.3 TWh import agreement
Cases 4 and 5 are alternative options that build on Case 3 to enable two levels of incremental import capability from the dedicated generators at the Beauharnois intertie			
4	Operating the Beauharnois intertie in bus-split mode – directing 400 MW of intertie capability to the Hawthorne TS hub	Operational change – no significant incremental cost or timing requirements above the $20 M required for Case 3	**1,650 MW firm import (1,250 MW from HVDC + 400 MW from Beauharnois)** • Energy import would be limited to approximately 1,650 MW at any given time, also dependent on availability of specific Quebec generators • Change of configuration would result in a lower level of supply reliability for some eastern Ontario customers
5	After reinforcing the eastern Ontario network by rebuilding 115 kV circuit L2M between St. Lawrence and Merivale TS as a double-circuit 230 kV transmission line (approx. 86 km)	Approx. $220 M Plus the cost of additional upgrades in the Ottawa area that may be required. 5-7 years of lead time	**2,050 MW firm import (1,250 MW from HVDC + 800 MW from Beauharnois)** • Energy import would be limited to approximately 2,050 MW at any given time, also dependent on availability of specific Quebec generators

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h) Please see response to part g) above.

i) As stated in the IESO's project hand-off letter[2] to Hydro One, in 2014, the IESO conducted a review of Ontario's interconnections with its neighbors, including those with Quebec. Subsequently in 2017, the IESO conducted a follow-up technical review focused in more detail on the Ontario-Quebec interconnections. During those reviews, the IESO identified incremental investments required to enable capacity imports from 0 MW to 2,050 MW. Upgrading the 230 kV circuits between Hawthorne and Merivale (the HMR Project) enables up to 1,250 MW of import capacity. Considering the relatively low cost for this investment, no other alternatives were considered to achieve this level of import capacity because import capacity is not in the scope of this review and upgrade proposal.

[2] Exhibit B, Tab 3, Schedule 1, Attachment 1.

OEB STAFF INTERROGATORY #6

Reference:

(1) Exhibit B, Tab 3, Schedule 1, Attachment 1, page 2

Preamble:

The IESO states at the above reference that circuits M30A and M31A:

> *"are inadequate today to supply the demand in west Ottawa" and that the "overload will become more severe in the longer term as the demand in west Ottawa is forecast to increase by about 150 MW in the next 10 years".*

Interrogatory:

a) The IESO letter indicates that it supports Hydro One's targeted in-service date for the Hawthorne to Merivale reconductoring project of December 2022. However, the application indicates that the project will not be in-service until December 2023.
   i. Why did Hydro One change the in-service date to 2023?
   ii. Does this delay create service reliability concerns/issues for consumers in west Ottawa and/or the IESO from a system management perspective?

b) Please define "west Ottawa" (e.g. show regional boundaries). Which transformer stations or other customer connections are included in this area?

c) Please provide five years of historical demand and 15 years of demand forecast information for west Ottawa. With respect to the provided information, please specify:
   i. When the forecast was produced; and
   ii. How this forecast compares to the forecast described in the above reference

d) How much of west Ottawa's demand are existing circuits M30A and M31A capable of supplying? What year did, or will, the above forecast exceed that capability? Please identify the basis/source of your response.

e) Please describe the existing inadequacy of circuits M30A and M31A to supply the demand in west Ottawa. When responding, please specify the drivers of the inadequacy, how frequently the circuits are inadequate, and the degree/magnitude of the inadequacy as it relates to demand in west Ottawa.

f) What criteria stipulate the capability required on circuits M30A and M31A to supply the demand in west Ottawa? How would the IESO or Hydro One characterize the extent to which the criteria are currently exceeded?
   i. How does the IESO or Hydro One forecast this characterization to change over the next 5, 10, and 15-years? What is the basis for this forecast?

g) How would the Hawthorne to Merivale reconductoring project help satisfy applicable criteria related to the reliability of supply to west Ottawa?

h) Please comment on whether the Hawthorne to Merivale reconductoring project was recommended in a regional plan and how the supply to west Ottawa figured into that recommendation. If yes, please provide the regional plan and indicate whether its findings remain valid.

Response:

Both Hydro One and the IESO contributed to providing this response.

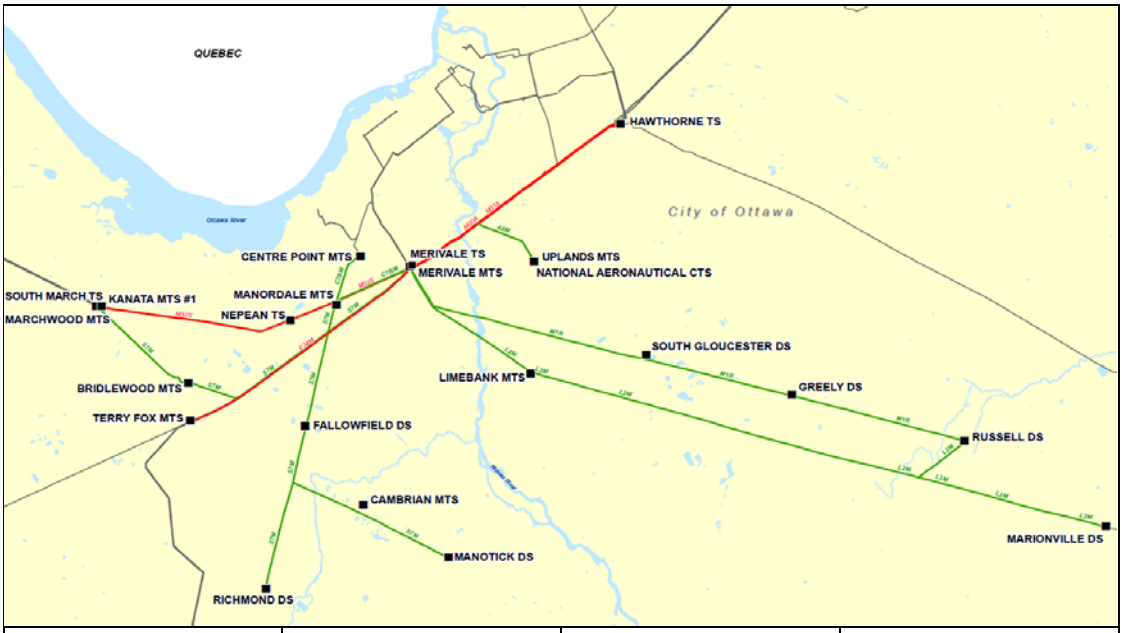
a)

i. The Project's schedule is driven by outage availability. A number of projects are underway at Hydro One's Hawthorne TS which were delayed due to extensive repair work required at Merivale TS, due to the devastation caused by a Tornado in the Ottawa area on September 21, 2018.

ii. No, neither Hydro One nor the IESO anticipate that the 12-month delay will create any service reliability concerns in terms of a system management perspective. During the construction and reconductoring project, flows will continue to be managed to minimize impact on customers in the local area, and on the overall bulk energy system.

b) The term “west Ottawa” refers to an area electrically supplied from Merivale TS. The transformer stations included in this area are shown in Figure 1 below.

Figure 1 - Transformer Station Facilities within the West Ottawa Area



Bridlewood MTS	Marchwood MTS	Fallowfield DS	Manotick DS
Richmond DS	Manordale MTS	Limebank MTS	Marionville DS
Uplands MTS	South Gloucester DS	Greely DS	Russell DS
Centre Point MTS	Merivale MTS	NAE CTS	Kanata MTS
South March TS	Nepean TS	Terry Fox MTS	South Nepean MTS

c) The table below provide five years of historical demand for the west Ottawa Stations. The 15 years of demand forecast information for west Ottawa is given in the Ottawa Area IRRP[1].

Table 1 – Historical Demand in West Ottawa Area

	Historical Actuals (Regional Coincidence)					
Station	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Bridlewood MTS	18.4	22.3	5.7	17.8	15.1	16.2
Marchwood MTS	45.3	37.8	39.2	23.7	41.6	44.0
Fallowfield DS	42.1	46.0	44.7	44.3	39.3	44.9
Manotick DS	6.5	6.5	5.6	7.0	7.0	9.0
Richmond DS	4.5	4.6	4.5	4.7	4.5	5.5
Manordale MTS	9.7	8.2	8.5	12.7	9.3	10.8
Limebank MTS	39.2	55.6	46.8	51.8	37.7	58.2
Marionville DS	11.4	11.5	10.3	12.8	12.1	12.3
Uplands MTS	20.5	20.9	19.8	24.1	27.8	21.2
South Gloucester DS	4.2	4.2	3.8	4.5	4.1	4.7
Greely DS	16.1	16.8	16.0	18.2	17.3	20.8
Russell DS	3.4	3.3	3.4	2.7	3.2	4.3
Centerpoint MTS	14.6	14.4	13.8	15.7	14.4	14.7
Merivale TS	13.0	13.5	9.5	0.0	0.0	8.9
National Aeronautical CTS	0.5	0.5	0.4	0.4		
Kanata MTS	57.7	53.0	51.6	66.3	52.8	47.7
South March TS	72.6	66.7	81.1	80.0	81.7	86.8
Nepean TS	136.7	122.3	131.9	142.1	134.7	151.3
Terry Fox MTS	32.2	47.1	49.7	58.5	49.1	56.5
South Nepean TS	0.0	0.0	0.0	0.0	0.0	0.0

i. The demand forecast shown above was produced in 2019 as part of the most recent Ottawa Area Sub-region IRRP 2.

ii. The forecast described in the IESO's hand-off letter3 was an "in-progress" version of the Ottawa Area Sub-region IRRP demand forecast that was finalized

[1] Ottawa Sub-Region: Integrated Regional Resource Plan – Appendices. March 4, 2020. https://www.ieso.ca/-/media/Files/IESO/Document-Library/engage/ottawa/Ottawa-Sub-Region-IRRP-Appendices.ashx.
The information appears in Appendix B, Table B5 to that report.
[2] Ottawa Sub-Region: Integrated Regional Resource Plan – Appendices. March 4, 2020. https://www.ieso.ca/-/media/Files/IESO/Document-Library/engage/ottawa/Ottawa-Sub-Region-IRRP-Appendices.ashx. The information appears in Appendix B, Table B5 to that report.
[3] IESO's hand-off letter is provided at Exhibit B, Tab 3, Schedule 1, Attachment 1.

later in 2019. The two forecasts are close, with the final version of the forecast showing west Ottawa demand increasing by about 170 MW over a 10 year period from 2019 to 2029.

d) The circuits M30A and M31A are "Network Facilities" since they form a physical path between two network stations, Hawthorne TS and Merivale TS[4]. Combined with other "Network Facilities" in the province they form part of the transmission system shared by, and providing benefits to, all electricity users in the province. "Network Facilities" function to transmit bulk power from large generators and interconnected neighbors to supply Ontario demand. West Ottawa loads form part of the total Ontario demand and for this reason cannot be separated out.

e) The M30A and M31A circuits are inadequate **today** based on existing system load and generation utilization during peak demand. This was determined by conducting load flow analysis in accordance with the planning standards identified in Exhibit I, Tab 1, Schedule 1, Question 1 part a).

f) Please see response to Exhibit I, Tab 1, Schedule 1, Question 1, for the criteria that stipulate the capability required on circuits M30A and M31A to supply Ontario demand. Based on these required planning criteria load flow studies have confirmed the capability of the path is already exceeded.
   i. Load in Ottawa and in the province overall is forecast2,5 to continue to increase over the next 5-through-15-year timeframe, which will increase the need for the HMR.

g) See response to Exhibit I, Tab 1, Schedule 1, Question 1 part c).

h) While need for the work was previously identified in Hydro One's 2015 Regional Infrastructure Plan Report (EB-2019-0082, TSP 01-02-03), the project was not recommended through the regional plan. The need to upgrade the circuits M30A and

[4] Sections 3.0.14 and 3.0.15b of the Transmission System Code.
https://www.oeb.ca/oeb/_Documents/Regulatory/Transmission_System_Code.pdf.
[5]IESO's Annual Planning Outlook: Ontario's electricity system needs: 2022-2040, Dec. 2020
https://www.ieso.ca/-/media/Files/IESO/Document-Library/planning-forecasts/apo/Annual-Planning-Outlook-Dec2020.ashx

M31A, which are "network facilities", is driven by bulk system flows comprising of Ontario demand (which includes west Ottawa) and transfer of electricity from resources located in eastern Ontario to supply the Ontario demand. A bulk system study was carried out to assess this need, and a recommendation to upgrade these facilities was identified through the IESO's hand-off letter[6].

[6] IESO's hand-off letter is provided at Exhibit B, Tab 3, Schedule 1, Attachment 1.

OEB STAFF INTERROGATORY #7

Reference:
(1) Exhibit B, Tab 6, Schedule 1, page 2

Preamble:
The above reference notes that limitations on circuits M30A and M31A may cause the need for *"operational measures that have the potential to reduce the reliability of supply to Ottawa customers"*.

Interrogatory:
a) Please describe the types of operational measures referred to above and comment on the conditions and drivers causing their need.
    i. If applicable, please indicate how frequently these operational measures are taken.

b) Please specify why these operational measures have the potential to reduce the reliability of supply to Ottawa customers.
    i. To-date, has reliability been jeopardized as a result of these operational measures being enacted?

c) Please confirm that such operational measures, if enacted, would belong to a set of measures that are currently permitted by applicable reliability standards and operating practices.

d) Please confirm that the Hawthorne to Merivale reconductoring project would reduce (and by how much) or eliminate the likelihood that such operational measures would be required.

Response:
This response was provided by the IESO.

a) During hot summer days, the flows across the circuits M30A and M31A can exceed their thermal capability as system demand during this period is at its highest, and the ratings of the equipment are most limiting. The IESO has to take control actions such as opening breakers at Merivale TS, Albion TS and Ellwood TS to shed load by

configuration or shift power flows to prevent exceeding the capability of the circuits after a recognized contingency. Prior to taking these control actions, if at the time the IESO was importing energy from Quebec on the Outaouais and Beauharnois interfaces, the IESO would first reduce those imports. This implicitly would affect the ability to meet demand needs in Ontario and require re-dispatch measures elsewhere in the province.

b) The operational measures described in part a) above increase the risk of shedding load in the Ottawa area automatically following a contingency.
    i. The operating measures described above have historically been used, and as such have increased the risk of shedding load in the Ottawa area automatically following a contingency.

c) The operational measures identified above are acceptable in the operating time frame, but not in the planning time frame. Planning criteria is designed to be more conservative than operating criteria to ensure that the power system is robust enough to handle many different operating conditions.

d) Upon completion of the HMR Project the flows are expected to remain at acceptable levels based on the current 20-year demand forecast. As such, the control actions described above will no longer be required with all elements in service.

OEB STAFF INTERROGATORY #8

Reference:

(1) Exhibit B / Tab 3 / Schedule 1 / Attachment 1
(2) Exhibit B / Tab 5 / Schedule 1

Interrogatory:

a) Are circuits M30A and M31A the only sources of supply to west Ottawa? If no, please identify and describe the other sources.

b) Is the Hawthorne to Merivale reconductoring project the only feasible way of increasing supply to west Ottawa?
   i. Please identify the source/basis of your response.

c) If the answer to b) is 'no', please describe the feasible alternatives, including distribution and/or non-wires alternatives. Please explain why the Hawthorne to Merivale reconductoring project is the preferred means of increasing supply to west Ottawa.

d) Please describe the benefits of dual bundled conductors generally, as well as in the context of the Hawthorne to Merivale reconductoring project.

e) Was a non-bundled conductor option(s) investigated as an alternative? If not, why not? If applicable:
   i. Did Hydro One identify the non-bundled option(s) investigated as capable or incapable of meeting the objectives of the Hawthorne to Merivale reconductoring project as described in the IESO letter? Please fully explain the rationale supporting Hydro One's determination.
   ii. What was the cost of the non-bundled option(s)?
   iii. Would the non-bundled option(s) require the tower arm reinforcement as proposed for the Hawthorne to Merivale reconductoring project?
   iv. Please provide a cost/benefit analysis of the non-bundled option(s) considered.

Response:

Both Hydro One and the IESO contributed to this response.

a) No. Please refer to the table below which lists the "network facilities" that supply Ottawa zone including west Ottawa load, in addition to Ontario load.

Table 1
Network Facilities Contributing to Ottawa and Provincial Load Supply

500 kV Circuits	X522A (from Lennox TS)
	X523A (from Lennox TS)
230 kV Circuits	M32S/C3S (from Chats Falls TS)
	E34M/T33E (from Clarington TS)
	M30A (from Hawthorne TS)
	M31A (from Hawthorne TS)
	L24A (from St Lawrence TS)
115 kV Circuits	S7M/W6CS (from Chats Falls SS)
	C7BM (from Chats Falls SS)
	A8M (from Hawthorne TS)
	A3RM (from Hawthorne TS)
500-230 kV Autotransformers	Hawthorne T1/T2/T3
230-115 kV Autotransformers	Merivale T21/T22
	Hawthorne T4/T5/T6/T9

b) No. There are other ways to address the circuit M30A and M31A need, however, the proposed HMR Project is the most cost-effective way forward. Further reinforcements may be needed (both locally and at the bulk level) to supply Ottawa area load, but the HMR Project is a required part of those solutions as well.

c) As mentioned in part b) above, the HMR Project is the most cost-effective alternative. Please see the response to Exhibit I, Tab 1, Schedule 2, part c), with respect to distribution and non-wire alternatives.

d) Bundled conductors increase the effective conductor diameter, resulting in higher capacity. In this Application, the primary benefit of dual bundled conductors is to increase line capacity without the need to construct a new circuit. A new circuit would also require additional land rights and/or the acquisition of additional Rights-of-Way.

In the context of the HMR Project, the bundling of dual conductors is far more affordable, efficient and an appropriate use of resources than the other far costlier and landowner/ stakeholder invasive alternatives provided in Exhibit B, Tab 5, Schedule 1, and labeled as Alternatives 1 and 2.

e) Hydro One investigated the capacity of non-bundled conductors and concluded that technically acceptable single conductors cannot satisfy the ampacity requirements.

OEB STAFF INTERROGATORY #9

Reference:

(1) Exhibit B, Tab 6, Schedule 1, page 1

Preamble:

The Hawthorne to Merivale reconductoring project includes the replacement of the M31A sky-wire (non-OPGW capable) with OPGW. The reference above states that the OPGW *"will provide redundancy to the teleprotection system required by NERC and NPCC"*.

Interrogatory:

a) Please clarify the purpose and function of the new OPGW proposed for the M31A skywire and, more broadly, of the teleprotection system it would be part of.
   i. Why has Hydro One only proposed to replace the skywire on M31A?
   ii. If there is currently a skywire on M30A, why has Hydro One decided against replacing it?

b) Please clarify whether the NERC and NPCC requirement at the above reference relates to the existence of a teleprotection system (i.e., that there should be a teleprotection system) or to the redundancy of an existing teleprotection system (i.e., that where there is a teleprotection system, it must be redundant).

c) If not required by NERC and NPCC, please comment on why Hydro One proposes to replace the M31A skywire with a new OPGW and what the benefit would be.

d) Was the M31A skywire replacement previously identified in a Hydro One transmission plan or in a regional plan or planning study? If yes, please provide the applicable regional plan(s)/planning study(ies) and indicate whether its/their findings remain valid.

e) If Hydro One did not reconductor circuits M30A and M31A, when, if at all, would it otherwise replace the M31A skywire with OPGW?

f) How much remaining life does the existing M31A skywire have? What is the approximate cost of a like-for-like (non-OPGW) replacement? What is the

approximate cost that remains to be recovered for the existing M31A skywire as of the time of construction start on the Hawthorne to Merivale reconductoring project?

i. If existing non-OPGW costs have yet to be recovered, how does Hydro One plan to recover these costs?

Response:

a) The OPGW (optical ground wire) is a replacement of the traditional skywire used on transmission lines. It incorporates a tubular structure carrying multiple optical fibres surrounded by steel and aluminum conductors. It serves the purpose of the traditional skywire in that it shields the line conductors from lightning strikes. The optical fibres (found in the OPGW) are used for telecommunication and data transmission.

Hydro One has proposed replacing the skywire with OPGW on only the tower line carrying circuit M31A. OPGW is already installed on the tower line carrying circuit M30A. Installation of the OPGW on the M31A tower line provides a second redundant communication and teleprotection path between Hawthorne and Merivale TS, thereby improving reliability and eliminating dependence on the external communication path for providing redundancy for these NERC BES classified circuits.

The OPGW on the M30A tower line is in good condition, and therefore its replacement is not considered necessary.

b) The mandatory NERC and NPCC requirements at the above reference relates to the redundancy of an existing teleprotection system.

c) Please refer to the responses in parts a) and b), above.

d) The M31A skywire replacement was previously specifically identified in Hydro One Transmission's 2020-2022 Transmission Rate Filing. (EB-2019-0082, Investment Summary Document - *SR28 - Fibre Optic Infrastructure Development Projects*) and was included in its Transmission System Plan ("TSP").

e) Yes. As identified in EB-2019-0082, Exhibit TSP, ISD-SR28, the plan was to replace the skywire with OPGW by 2021.

f) As per the response provided in Exhibit I, Tab 1, Schedule 3, the M31A circuit went in-service in 1988. Based on a life expectancy of 60 years for the skywire, there is approximately 25 years of remaining useful life.

The cost for a like-for-like (i.e., non-OPGW) replacement was not estimated as it would not provide functionality to address the need, as described above.

The cost of the existing skywire that remains to be recovered is approximately $24,000.

i. Cost recovery of the undepreciated skywire is consistent with the methodology used by Hydro One for recovery of the undepreciated conductor. Please refer to the response at Exhibit I, Tab 1, Schedule 3, part e).

OEB STAFF INTERROGATORY #10

Reference:

(1) Exhibit B, Tab 9, Schedule 1, page 3

Preamble:

The table at the above noted reference estimates the impact of the Hawthorne to Merivale reconductoring project on the typical residential customer. The estimate assumes a residential consumption of 1,000 kWh per month.

Interrogatory:

a) Please provide a second table showing impacts assuming a residential consumption of 700 kWh per month.

Response:

a) Below is a table provides the impacts assuming residential consumption of 700 kWh per month.

A. Typical monthly bill (Residential R1 in a high density zone)	$147.17 per month
B. Transmission component of monthly bill	$11.65 per month
C. Line Connection Pool share of Transmission component	$1.61 per month
D. Transformation Connection Pool share of Transmission component	$3.86 per month
E. Network Pool share of Transmission component	$6.19 per month
F. Impact on Network Connection Pool Provincial Uniform Rates	0.26%
G. Net impact on typical residential customer bill (E * F)	$0.02 per month or $0.19 per year
H. Percentage increase on typical residential customer bill (G / A)	0.01%[1]

Note: Values are rounded to two significant digits.

[1] The actual percentage value, as discussed in Section 3.0 above, is 0.0026% and rounded to two decimal places is 0.00%.

OEB STAFF INTERROGATORY #11

Reference:

(1) Exhibit E, Tab 1, Schedule 1, page 4
(2) Exhibit E, Tab 1, Schedule 1, Attachment 3
(3) Exhibit E, Tab 1, Schedule 1, Attachment 4
(4) EB-2018-0117, Exhibit E, Tab 1, Schedule 1, Attachment 3
(5) EB-2018-0117, Exhibit E, Tab 1, Schedule 1, Attachment 7
(6) EB-2019-0077, Exhibit E, Tab 1, Schedule 1, Attachment 2
(7) EB-2019-0077, Exhibit E, Tab 1, Schedule 1, Attachment 8

Preamble:

Hydro One has applied for approval of the forms of the agreement offered or to be offered to affected landowners pursuant to s.97 of the OEB Act. Hydro One states that two of its proposed land agreements were approved by the OEB under files EB-2018-0117 and EB-2019-0077.

Interrogatory:

a) Please confirm that the forms of agreement Hydro One seeks approval of at references 2 and 3 correspond, respectively, to the forms of agreement approved under EB-2018-0117 at references 4 and 5 above and to forms approved under EB-2019-0077 at references 6 and 7 above.

b) Please advise whether there are any substantive differences between the previously approved forms of agreement referenced above and the forms of agreement that Hydro One requests approval of as part of the Hawthorne to Merivale reconductoring project, and explain any such differences.

Response:

a) The Hydro One form agreements included in this Application have been previously approved by the OEB in EB-2018-0117 and EB-2019-0077.

b) There are no substantive differences between the form agreements included in this application, to the corresponding form agreements included in Hydro One's OEB-approved leave to construct applications EB-2018-0117 and EB-2019-0077.

The form agreement referenced in Reference 6, i.e. EB-2019-0077, Exhibit E, Tab 1, Schedule 1, Attachment 2 (Early Access Agreement), is not included in this Application. The form agreements included in this Application that were approved by the OEB in EB-2019-0077 are:

- Exhibit E, Tab 1, Schedule 1, Attachment 7 (Temporary Land Use Agreement) and,
- Exhibit E, Tab 1, Schedule 1, Attachment 8 (Damage Claim Agreement) (as per Reference (7) above).

OEB STAFF INTERROGATORY #12

Reference:

(1) Exhibit E, Tab 1, Schedule 1

Preamble:

The reference above identifies the land right agreements that Hydro One proposes to use to obtain any identified land rights for the Hawthorne to Merivale reconductoring project.

Interrogatory:

a) Please confirm that all impacted landowners will have the option to receive independent legal advice regarding the proposed land agreements.

b) Please clarify whether Hydro One has committed to or will commit to reimbursing landowners for reasonably incurred legal fees associated with the review and execution of the necessary land rights agreements.

Response:

a) Confirmed.

b) Yes, Hydro One commits to reimbursing private landowners for reasonably incurred legal fees associated with the review and completion of the necessary land rights.

OEB STAFF INTERROGATORY #13

Reference:

(1) Exhibit B, Tab 1, Schedule 1

Preamble:

Hydro One has applied for leave to construct approval pursuant to s.92 of the OEB Act.

Interrogatory:

a) Please comment on the following draft conditions of approval proposed by OEB staff. If Hydro One does not agree with any of the draft conditions of approval noted below, please identify the specific conditions that Hydro One disagrees with and explain why. For conditions in respect of which Hydro One would like to recommend changes, please provide the proposed changes.

1. Hydro One shall fulfill any requirements of the SIA and the CIA, and shall obtain all necessary approvals, permits, licences, certificates, agreements and rights required to construct, operate and maintain the project.

2. Unless otherwise ordered by the OEB, authorization for leave to construct shall terminate 12 months from the date of the Decision and Order, unless construction has commenced prior to that date.

3. Hydro One shall advise the OEB of any proposed material change in the project, including but not limited to changes in: the proposed route, construction schedule, necessary environmental assessment approvals, and all other approvals, permits, licences, certificates and rights required to construct the project.

4. Hydro One shall submit to the OEB written confirmation of the completion of the project construction. This written confirmation shall be provided within one month of the completion of construction.

5. Hydro One shall designate one of their employees as project manager who will be the point of contact for these conditions, and shall provide the employee's name and contact information to the OEB and to all affected landowners, and shall clearly

post the project manager's contact information in a prominent place at the construction site.

Response:

Hydro One has no concerns with the above proposed Conditions of Approval being included in the OEB's final Decision and Order.

OEB STAFF INTERROGATORY #14

Reference:

(1) Exhibit B, Tab 9, Schedule 1, pages 1 and 2
(2) Exhibit B, Tab 3, Schedule 1, Attachment 1

Preamble:

At the above reference, Hydro One states that:

> *Hydro One's M30A and M31A 230 kV circuits are network circuits linking the electrical system between two main transformer stations (Hawthorne TS and Merivale TS) located in Ottawa. The circuits are used primarily to transfer bulk power from eastern Ontario to the GTA, including eastern Ontario generation. The Project will address the IESO identified capacity need for Ontario, facilitating current and future load requirements of the network.* ***This is a system project that is not tied to any particular load increase or customer load application and is intended to relieve the current bulk power transfer limitation. As such, the proposed line upgrade is included in the Network Pool and no customer capital contributions are required, consistent with the provisions of Section 6.3.5 of the Transmission System Code****. [emphasis added]*

Interrogatory:

a) The IESO letter, provided at Exhibit B, Tab 3, Schedule 1, Attachment 1, identified that the proposed project would serve several purposes, including a "critical" role in supplying customers in the western half of the City of Ottawa. Specifically, the IESO letter states that "Upgrading the M30/31A circuits will allow the load in west Ottawa to be supplied reliably with sufficient capacity to meet forecast demand growth…".
   i. Please explain the seeming inconsistency between the IESO letter and Hydro One's referenced statement with respect to the need for the project not being tied to customer load growth in west Ottawa. When responding, please identify the degree to which Hydro One considers load growth in west Ottawa as a driver for the project.

b) Hydro One states that the proposed project requires no customer capital contributions on the basis that it is not tied to any particular load increase or customer load

application. In light of the IESO letter that identified a primary driver of the project to be its ability to serve increasing demand in west Ottawa, please justify this statement.

Response:

Both Hydro One and the IESO contributed to providing this response.

a) Please refer to Exhibit I, Tab 1, Schedule 1, part a), and Exhibit I, Tab 1, Schedule 8, part b). The IESO's project hand-off letter mentioned several benefits from this Project. There is no evident inconsistency, however, these circuits are network facilities and as inherent to their purpose they provide multiple benefits, such as bulk transfers, reliability and security of bulk electric system by designing them to NERC standards. Furthermore, as 'Network Pool' assets these circuits ultimately provide benefits to the 'pool', or, all provincial ratepayers, not just in the local geographic area where they are physically located.

b) Please refer to the response above in part a), and to Exhibit I, Tab 1, Schedule 1, part a). It is important to note that not requiring a capital contribution for this project from any one load customer is consistent with the OEB's Transmission System Code ("TSC")[1].

[1] Section 6.3.5 of the OEB's TSC, states that no capital contributions are required from a load customer(s) for a network classified facility. There are no exceptional circumstances that exist with the HMR project so as to reasonably require a customer/s to make a capital contribution for the network construction/modification.

OEB STAFF INTERROGATORY #15

Reference:

(1) Exhibit B, Tab 7, Schedule 1, page 6
(2) Exhibit B, Tab 2, Schedule 1, page 6
(3) Exhibit C, Tab 1, Schedule 1, page 1
(4) EB-2016-0325: Exhibit B, Tab 7, Schedule 1

Preamble:

Table 2 presented at the above reference (1) has been extracted and shown below.

Table 1: Extract from Exhibit B, Tab 7, Schedule 1, page 6

Project	HMR Project	WTTE Project	D6V/D7V Project	DxS Project
Technical	Reconductor of double circuit 230 kV dual-bundled conductor (on two separate towers)	Reconductor of mostly quad 115kV circuit line	Reconductor of double circuit 230 kV line	Reconductor of double circuit 115kV line
Length (km)	11.9	10.0	9.4	9.0
Circuit km length (km)[4]	23.8	40.0	18.8	18.0
Project Surroundings	Mostly urban: residential & commercial Multiple road crossings	Urban	Mostly rural	Mostly urban
In-Service Date	Dec-23	Nov-18	Dec-20	Dec-15
Years for escalation	-	5 yrs, 1 mth	3 yrs	8 yrs
Total Project Cost ($M)[5]	21.3	21.4	8.6	6.3
Less: Bypass ($M)	0.2	-	-	0.2
Less: OPGW termination work ($M)	1.0	-	-	-
Less: OPGW/Skywire ($M) [6]	1.6	0.3	0.3	0.8
Total Project Costs Before escalation ($M)	**18.7**	**21.1**	**8.3**	**5.3**
Add: Escalation Adjustment (2%/year)	-	2.2	0.5	0.9
Total Comparable Project Costs ($M)	**18.7**	**23.3**	**8.8**	**6.2**
Total Cost/Circuit km ($M)	**0.8**	**0.6**	**0.5**	**0.3**

Interrogatory:

a) Column 3 of the referenced table indicates an actual total project cost of $21.4 million for the West Toronto Transmission Enhancement (WTTE) project. At Exhibit B, Tab 7, Schedule 1 of Hydro One's WTTE application (EB-2016-0325), Hydro One estimated that the total capital cost of the line work component of the WTTE project, including overheads and capitalized interest, would be $29.3 million. Please describe the reasons for the difference between the actual costs shown in the above referenced table and the estimate provided in the WTTE application.

b) At reference (b), Hydro One indicates that the project will require minor work at the Hawthorne and Merivale transmission stations which connect the lines being reconductored.
   i. Please indicate if the Hawthorne to Merivale reconductoring project costs shown in the table above include the costs of the required transmission station work.
   ii. Please indicate if the project costs shown in the table above for each comparator project are inclusive or exclusive of required transmission station work.

c) At reference (c), Hydro One states that the current 230 kV supporting tower arms will require replacement with stronger arms capable of safely carrying the new dual-conductor bundled 230 kV per phase configuration.
   i. Please confirm if the costs of the replacement tower arms are reflected in the Hawthorne to Merivale reconductoring project costs shown in the above table.
   ii. Please confirm if the costs of any of the comparator projects shown in the above table include the costs associated with tower reinforcement work that is the same/similar to that required for the Hawthorne to Merivale reconductoring project.
   iii. Please remove the costs of the replacement tower arms if the comparator projects did not incur such costs.
   iv. Please confirm that, as part of the project, only the arm on one side of each tower requires upgrading and that no other upgrades are necessary, including to the towers themselves. If tower upgrades (or other in addition to the tower arms) are necessary, please confirm if their costs are represented in the current total project cost estimate of $21.3 million. If not represented, please provide an updated project cost estimate inclusive of all necessary tower upgrades.

d) The referenced table indicates that the Hawthorne to Merivale reconductoring project will incur a cost of $1 million and $1.6 million for OPGW termination work and OPGW/Skywire, respectively.
   i. Please briefly describe the work and/or equipment associated with the "OPGW termination work" and "OPGW/Skywire" line items.
   ii. Please describe the reasons for the difference between the amounts shown in the "OPGW termination work" and OPGW/Skywire" line items between the Hawthorne to Merivale reconductoring project and all comparator projects.

e) For comparison purposes, please provide the per kilometre costs of a dual bundled 230 kV conductor (such as that proposed for the Hawthorne Merivale project) and the costs of a quad bundled 115 kV conductor (such as that installed for the WTTE project).

Response:

a) The actual cost of the WTTE Project came in under the estimate provided in the OEB-approved leave to construct application. The WTTE Project cost included both contingency, based on the assessment of the project's risks at the time, and interest on capital expenditures during construction. The project cost variance, were primarily due to four elements:
   1. lower than estimated material and construction costs;
   2. reduction in removal costs;
   3. the removal of the interest cost component, as the project was funded by Toronto Hydro-Electric System Limited ("Toronto Hydro"), and;
   4. the contingency budgeted cost element was also not required.

b)
   i. The station work includes two parts: protection and control ("P&C") setting revision and commissioning, and connection of the OPGW to teleprotection equipment. The P&C part is minor work and was not specifically identified in the above referenced table. As such its cost is included in the total project cost for comparison with the other project. The cost of the connection of the OPGW was specifically identified and is not included in the cost comparison. Additionally, please refer to the response below in part d), sub-section i).

   ii. For the comparator line projects in the table, the project costs shown are inclusive of transmission station work and covered P&C setting revisions except for the WTTE Project. The WTTE Project costs reported above were

only for the line portion of the project and did not include the station component.

c)

i. Confirmed, the cost of replacement tower arms is included in the total project cost.

ii. The comparator projects presented in the Table 1 of Exhibit B, Tab 7, Schedule 1, are, in Hydro One's view, the most appropriate projects to compare the overall HMR Project scope of work. However, given the unique nature of large transmission infrastructure projects, not all work on these types of projects are the same in terms of circuit/tower/conductor configurations. For example, of the four projects shown in the Table, the tower arm replacement is exclusive to the HMR Project. The comparator projects did have some minor tower reinforcement work, however, not all arms, or tower bodies required steel structural replacement or reinforcement. With reference to the comparator projects, reinforcement of tower body or arms was done more in terms of refurbishment work, i.e. returning the tower structure back to its original strength, rather than upgrading a specific component on each structure to carry the additional weight, etc.

For the comparator projects steel reinforcement was done on an as needed basis, and was performed only after an in-field site inspection had been completed and determined it was required. These costs can be considered minor from an overall project cost perspective. They were not specifically tracked as not all towers, on the comparator projects required the same reinforcement strategy.

iii. As mentioned above in part ii), the costs of the comparator project's structural reinforcement was generally restorative in nature, and was not tracked separately. For the HMR Project the estimated cost of reinforcement of the tower arms is approximately $1.2M. For comparison purposes the cost of the project after removing the cost of the tower arms reinforcement reduces from $18.7M to $17.5M.

iv. All tower reinforcement cost are included in the project total, as provided in Exhibit B, Tab 7, Schedule 1, of $21.3M. The extent of the tower reinforcement

work for HMR Project is limited to only the tower arms carrying the new bundled 230 kV conductor phases.

d)

i. The scope of work can be described as the following a) OPGW Termination Work: which consists of the installation of fiber optic cables in trenches and termination to telecommunication equipment within protection building (i.e., termination blocks and fiber racks) and b) Skywire/OPGW: which consists of the removal of existing non-OPGW skywire and its replacement with an OPGW capable component.

ii. The other comparator projects used in Table 2, consisted of a scope of work that replaced either skywire, or OPGW on a like-for-like basis. This project is proposing to replace a non-OPGW skywire, with an OPGW capable skywire that has built in optical fibre for telecommunication purposes. As such, for the comparator projects, there was no change in the nature/type of skywire being used, and therefore no station related work to accommodate a change. The installation of OPGW for the HMR project has added complexity. The skywire is being carried on towers that also carry 500 kV circuits, and as such installing skywire and related equipment on a 500kV tower, adjacent to live 500 kV operating circuits requires additional safety measures and larger equipment that go along with higher towers, which together increase the cost of this installation scope of work[1]. Additionally, installing new OPGW skywire requires the installation of splice boxes at the 'dead-end' tower to connect the OPGW section together[2].

e) The WTTE Project was a reconductor project for four circuits which were all carried on the one set of towers. As such this was labeled, or referred to as a "quad 115 kV line". Each of these circuits have three conductors per phase, each phase consisting of only one conductor. The HMR Project by comparison will have two conductors for each phase. Please refer to Exhibit C, Tab 1, Schedule 1 for a description and photos that depict the two types of configurations described above. The cost per km for each project is shown in Exhibit B, Tab 7, Schedule 1, Table 2.

[1] As discussed in Exhibit B, Tab 7, Schedule 1.

[2] Please note, that consistent with the response to Exhibit I, Tab 1, Schedule 9, only one skywire is being replaced with OPGW in the HMR Project's scope of work.

ENVIRONMENTAL DEFENCE INTERROGATORY #1

Reference:

Exhibit B, Tab 5, Schedule 1

Interrogatory:

a) Please provide all documentation and calculations underlying Hydro One's assessment of alternative 4 on page 3, including its comment that after reviewing the anticipated line losses savings over the life of the asset, Hydro One decided that the incremental increase in cost (approximately $4.5 million) would not be offset by the additional incremental reduction in line losses." Please provide any live excel spreadsheets that were used so that the data can be easily used by our consultant.

b) Hydro One stated "equipment limitation at the terminal stations would not allow loading the circuit beyond the capability of that proposed in Alternative 3". Further, Hydro One has stated "the extra capacity of the circuits over Alternative 3 would also require station upgrades to be completed". Please provide a detailed description of equipment limitations at the terminal stations. Please describe, if available, operating parameters and associated costs, that would allow the larger conductor in Alternative 4 to be installed but not exceed equipment limitations at the terminal stations. Please describe the station upgrades that must be installed to utilize the extra capacity of the circuits over Alternative 3. Please provide a cost estimate of the station upgrades by major cost components (e.g., protection & contract, civil infrastructure, etc.).

c) With respect to the assessment of alternative 4 please explain the assumptions and provide any associated data relating to: (i) the cost-benefit analysis time horizon used, (ii) the forecast annual demand (kWh) broken down by season (i.e., summer, winter, shoulder), (iii) the forecast annual incremental loss reductions from upsizing the conductor (kWh) broken down by season, (iv) the forecast incremental loss reduction from upsizing the conductor at the peak hour (kWh), (v) the value of loss reductions (total and per kWh), (vi) the value of any incremental capacity benefits to both the Ottawa region and the Ontario bulk power system.

Response:

Hydro One and the IESO contributed to this response.

a) Initial screening of the alternatives for losses was performed using flows for the last seven years (2014 through 2020) for which data was available. The 2016 year was selected as the 'base case' for further analysis because it had the highest losses of any one year in that above mentioned range.

The data that Hydro One used in the analysis provided in this response pertains to flows on the Bulk Electrical System. For these reasons, Hydro One is providing this data separately on a confidential basis consistent with the OEB's rules. This data is used to determine the losses that are shown in the table below. Hydro One submits that providing this data will not assist the OEB in making a determination regarding the approval of the subject matter of this Application, as the results are summarized below in Table 1 - Evaluations of Alternatives.

Case 1, in Table 1, is using the 2019 Average HOEP of $18.62/MWh. The annual cost of losses is obtained and the difference between Alternatives 3 and 4 is compared with the additional revenue recovered from ratepayers based on the $4.5M additional cost of Alternative 4. Extra revenue required from ratepayers is about $328k per year and the break-even period is over 400 years. Cases 2 and 3 repeat the analysis assuming a HOEP price of $50/MWh and $100/MWh. In this case the extra revenue required from ratepayers is $309k and $280k annually and the break-even period is approximately 152 years and 76 years respectively.

Table 1 – Evaluation of Alternatives

		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Average annual HOEP Price $/MWh	A	$18.62	$50.00	$100.00	$18.62	$50.00	$100.00
Losses Alt 3 (MWh)	B	3650	3650	3650	7731	7731	7731
Losses Alt 4 (MWh)	C	3052	3052	3052	6463	6463	6463
Incremental Losses (MWh)	D=B-C	598	598	598	1268	1268	1268
Incremental Loss Savings	E=A*D	$11,135	$29,900	$59,800	$23,610	$63,400	$126,800
Additional Capital cost of Alternative #4	F	$4,530,000	$4,530,000	$4,530,000	$4,530,000	$4,530,000	$4,530,000
Annual Revenue Requirement	G	$339,313	$339,313	$339,313	$339,313	$339,313	$339,313
Additional cost to ratepayers	H=G-E	$328,179	$309,413	$279,513	$315,703	$275,913	$212,513
Breakeven Period (Years)	I=F/E	407	152	76	192	71	36

A sensitivity analysis was carried out with the lines loaded to the maximum allowable line rating of 3000A and the results are shown as Cases 4, 5 and 6 above. Even with these higher flows, the savings in losses are not enough to pay for the additional costs. The annual additional cost to ratepayers varies from $316k to $212k annually, and the breakeven period varies from 192 to 36 years.

In all cases the incremental loss savings are not enough to pay for the additional capital costs of Alternative 4.

b) The terminal station equipment that requires upgrade are the 230 kV switchyard main buses, the diameter breakers and disconnect switches at both Hawthorne TS and Merivale TS. There are no operating parameters that would allow the larger conductor to be effectively utilized without upgrading both stations. The cost of the station upgrade would be far more than the cost difference of $4.5M between Alternatives 3 and 4, as discussed above.

c)

i. Please refer to answer in part a) above.
ii. Please refer to answer in part a) above.
iii. Please refer to answer in part a) above.
iv. Please refer to answer in part a) above.
v. Please refer to answer in part a) above.
vi. The Alternative 4 conductor does not provide any additional benefit over the conductor recommended in Alternative 3. Please refer to the response in part b) above.

ENVIRONMENTAL DEFENCE INTERROGATORY #2

Reference:

Exhibit B, Tab 5, Schedule 1

Interrogatory:

a) Please calculate the value of the loss reductions from alternative 4 (incremental to alternative 3) based on the following scenario: (i) avoided losses are valued at HOEP plus the GA (Class B $/MWh), (ii) evaluation horizon of 50 years, (iii) load assumed to increase 1% annually, (iv) the fact that loss reductions are highest at the peak when costs are highest is accounted for and (v) the announced carbon price increases are accounted for.

b) Please recomplete the analysis in (a) for a scenario where the avoided losses are valued at HOEP plus the avoided cost of generation per the latest Annual Planning Outlook supplemental data.[1]

c) Please recomplete the analysis in (a) for a scenario where the lines are used to their capacity for imports and exports with Quebec.

For all of the above, please provide all underlying figures and calculations in a live excel spreadsheet. Please complete this on a best efforts basis. If one of the items cannot be completed, please explain why and complete the remainder of the scenario analysis. Please make and state assumptions for years beyond which there are existing forecasts based on professional judgement (e.g. the variable could increase at the level of the historic rate of change or be held static).

[1] https://www.ieso.ca/en/Sector-Participants/Planning-and-Forecasting/Annual-Planning-Outlook

Response:

a) Please see to Exhibit I, Tab 2, Schedule 1, part a). The analysis in that response is adequate as a sensitivity analysis with various values of HOEP. Alternative 3 is the most economical option. Further analysis is not required for this project.

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

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

ENVIRONMENTAL DEFENCE INTERROGATORY #3

Reference:

Exhibit B, Tab 5, Schedule 1

Interrogatory:

a) Please provide a breakdown of the $4.5 million incremental increase in cost between alternative 3 and 4.

b) Please reproduce table 1 in Exhibit B, Tab 7, Schedule 1, Page 1 with an added column detailing the cost of alternative 4 broken into the categories in that table.

Response:

a) The cost breakdown and incremental difference between Alternative 3 and Alternative 4 is given in Table 1 below:

Table 1: Estimated Cost of Line Work

	Alternative #3	**Alternative #4**	**Difference**
	$000's	**$000's**	**$000's**
Materials	6,520	8,049	1,529
Labour	4,796	5,921	1,124
Equipment Rental & Contractor Costs	2,683	3,312	629
Sundry	296	365	69
Contingencies	1,797	2,219	422
Overhead	1,716	2,119	403
Capitalized Interest	1,498	1,849	351
Real Estate	387	387	-
Total Line Capital Work	**19,693**	**24,221**	**4,528**

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

ENVIRONMENTAL DEFENCE INTERROGATORY #4

Reference:

Exhibit B, Tab 5, Schedule 1

Preamble:

With respect to Alternative 4 (an upsized conductor), Hydro One notes: *"the extra capacity of the circuits over Alternative 3 would also require station upgrades to be completed."*

Interrogatory:

a) Are we correct in understanding that upsized conductor would still reduce losses by approximately 10% even if the above-referenced station upgrades did not occur?

b) Please describe any operating parameters and associated costs that would allow the larger conductor in Alternative 4 to be installed but not exceed equipment limitations at the terminal stations.

c) Please describe the above-mentioned station upgrades that must be installed to utilize the extra capacity of the circuits over Alternative 3.

d) Please estimate the cost of the above-referenced station upgrades incremental to the expenditures in alternative 3.

e) Could the above-referenced station upgrades be undertaken in the future if the IESO sought additional capacity along these lines?

f) How much additional capacity would the above-referenced station upgrades and upsized conductor achieve?

g) Would the above-referenced station upgrade enable incremental capacity imports from Quebec beyond the 1250-1650 MW outlined in Exhibit B, Tab 3, Schedule 1, Page 2? If yes, please detail by how much (MW). If Hydro One needs to consult with the IESO on this or any other question, please do so. Please also indicate whether this has occurred in the answer.

Response:

a) Confirmed.

b) Please refer to Exhibit I, Tab 2, Schedule 1, part b).

c) Please refer to Exhibit I, Tab 2, Schedule 1, part b).

d) Please refer to Exhibit I, Tab 2, Schedule 1, part b).

e) The IESO has not identified any additional capacity along these lines. Detailed estimates would be required to determine whether the upgrades are feasible within the current station footprint.

f) Please refer to the response in part e) above.

g) The Alternative 3 line upgrade, as proposed in this Application, would enable the maximum imports from Quebec as described in Exhibit I, Tab 1, Schedule 5 part g). No additional station upgrades are necessary.

ENVIRONMENTAL DEFENCE INTERROGATORY #5

Reference:

Exhibit B, Tab 3, Schedule 1, Page 2

Preamble:

Hydro One states:

> *"The 2017 Quebec interconnection study identified that 1250-1650 MW of capacity imports from Quebec would be enabled following the reinforcement of the M30A and M31A circuits. Having this non-domestic capacity to participate in Ontario's electricity markets may improve market competition resulting in lower costs for capacity overall."*

Interrogatory:

a) Please make a best efforts attempt to calculate the cost reductions that may arise via increased import capacity from Quebec as described in the preamble. Please make and state assumptions as necessary. To address the uncertainty around the quantity of likely imports, please address scenarios including where 50% of this capacity is used and where 100% of this capacity is used.

b) Please file the 2017 Quebec interconnection study so it can be easily and cleanly referred to through an exhibit number in this proceeding.

c) The quote in the preamble discusses an increase in import capacity between 1250 and 1650 MW. Please explain why a range was provided and discuss whether the actual capacity increase is more likely to be 1250 or 1650 MW based on the best current information. If the additional 400 MW required for the full 1650 MW increase requires other infrastructure projects, please discuss those and whether they are being planned and implemented.

d) On June 22, 2017 Hydro Quebec offered to sell Ontario 8 billion kWh per year, for 20 years, at a price of 6.12 cents per kWh.[1] If Hydro One has a different understanding or believes the figure is inaccurate, please explain and provide Hydro One's best estimate.

[1] Letter from Steve Demers, Vice President, Hydro Quebec to Peter Gregg, CEO, Independent Electricity System Operator, (June 22, 2017).

e) According to news reports, in August of 2017 Hydro Quebec offered to sell Ontario 8 billion kWh per year, for 20 years, at an average price of 5 cents per kWh.[2] If Hydro One has a different understanding or believes the figure is inaccurate, please explain and provide Hydro One's best estimate.

f) Please confirm that according to the Hydro Quebec 2019 Annual Report, in 2019 the average price of Hydro Quebec electricity exports was 4.3 cents per kWh as determined by dividing its export revenue by export volumes.[3] If Hydro One has a different understanding or believes the figure is inaccurate, please explain and provide Hydro One's best estimate.

[2] Pierre Couture, "Hydro Quebec l'Ontario en ligne de mire", Journal de Montreal, (August 16, 2017), https://www.tvanouvelles.ca/2017/08/16/lontario-en-ligne-de-mire.
[3] Hydro Quebec, 2019 Annual Report, https://www.hydroquebec.com/data/documents-donnees/pdf/annual-report-2019-hydro-quebec.pdf.

Response:

Hydro One and the IESO contributed to this response.

a) The HMR Project is needed to address reliability requirements. Increased capacity imports are only a secondary benefit. As such, potential benefits arising from increased capacity imports from Quebec have not been quantified and are not required for the Project.

b) A link to the IESO study is provided in the below footnote.[4]

c) Please refer to response provided in Exhibit I, Tab 1, Schedule 5 part i).

d) It is not clear to the IESO or Hydro One that this information is relevant to this proceeding. The HMR Project is needed to address reliability requirements. The increased capacity imports are only a secondary benefit.

e) Please refer to response in part d) above.

f) Please refer to response in part d) above. Clarification of information in Hydro-Quebec's Annual Reports should be directed to Hydro-Quebec.

[4] https://www.ieso.ca/-/media/Files/IESO/Document-Library/power-data/supply/IntertieReport-20170508.ash

ENVIRONMENTAL DEFENCE INTERROGATORY #6

Reference:

Exhibit B, Tab 3, Schedule 1, Page 2

Preamble:

See the following excerpt from Financial Accountability Office of Ontario, *Electricity Trade Agreement: An Assessment of the Ontario-Quebec Electricity Trade Agreement*, (Spring 2018), page 7:

> *"Currently, Quebec buys electricity from Ontario when demand and prices in Ontario are low and sells electricity back into the Ontario market when demand and prices are high. In 2017, Quebec purchased 2.0 TWh of electricity from Ontario at an average price of $9.4/MWh and sold 5.8 TWh of electricity into the Ontario market at an average price of $21.5/MWh.1"*[1]

Interrogatory:

a) Please confirm that this report indicates that the average price of Ontario's spot market electricity purchases from Quebec was 2.2 cents per kWh in 2017. If Hydro One has a different understanding or believes the figure is inaccurate, please explain and provide Hydro One's best estimate.

b) Does Hydro One have better or newer figures indicating the average price of Ontario's spot market electricity purchases from Quebec?

c) Please file a copy of this report so it can be easily and cleanly referred to through an exhibit number in this proceeding.

[1] https://www.fao-on.org/web/default/files/publications/Electricity%20April%202018/ElectricityTrade0418.pdf.

Response:

Hydro One and the IESO contributed to this response.

a) The requested information is not relevant to the HMR Project. The Project is needed to address reliability needs and increase transfer capability.

b) Please refer to part a) above.

c) The report requested can be found in the footnote provided below[2].

[2] www.fao-on.org/web/default/files/publications/Electricity%20April%202018/ElectricityTrade0418.pdf

ENVIRONMENTAL DEFENCE INTERROGATORY #7

Reference:

Exhibit B, Tab 5, Schedule 1

Interrogatory:

a) What time horizons does Hydro One generally use for economic evaluations of reconductoring projects?

b) How long will the depreciation period be for the costs incurred for the proposed project?

c) Please estimate how long the lines and towers in question in this proceeding will continue to operate before needing replacement due to age/reliability.

d) Generally speaking, how long do hydro towers of the type at issue in this proceeding continue to remain in good working order before needing to be replaced?

e) When were the hydro towers in question first built?

f) Will the replacement of portions of the hydro towers as part of this project (as required for the heavier conductors) likely extend their useful life or defer the need for replacement?

Response:

a) For M30A/ M31A reconductoring project, Hydro One's economic evaluation approach is described in Exhibit I, Tab 2, Schedule 1, part a).

b) The depreciation period for the costs incurred for the proposed project is 65 years.

c) Please refer to the response provided in Exhibit I, Tab 1, Schedule 3, part b).

d) Please refer to the response provided in part c) above.

e) Please refer to the response provided in Exhibit I, Tab 1, Schedule 3, part a).

f) No, the work is not expected to extend the life of the towers along the circuit's route.

ENVIRONMENTAL DEFENCE INTERROGATORY #8

Reference:

Exhibit B, Tab 5, Schedule 1

Interrogatory:

a) Please provide the best available forecast flow (in MWh) for the lines in question in hourly increments over as long of a period as possible. If hourly data is not available, please provide the data in as granular of a format as possible (i.e. daily, monthly, seasonal). Please provide this in a live excel spreadsheet so it can be used by Environmental Defence's consultant.

b) Please provide the annual flow for the lines in question over (i) the past 10 years [historical] and (ii) the next 10 years [forecast].

c) Please provide the historic throughput over these lines in hourly increments for the three most recent years. Please provide this in a live excel spreadsheet so it can be used by Environmental Defence's consultant. If hourly data is not available, please provide the data in as granular of a format as possible (i.e. daily, monthly, seasonal).

d) Please provide the capacity (in MW) of (i) the lines in question currently, (ii) the lines in question if the proposed alternative (#3) is implemented, (iii) the lines in question if a larger conductor is used (alternative #4), and (iv) the lines in question if a larger conductor is used (alternative #4) and station upgrades are made to enable the additional capacity made possible by the larger conductors. For all of the above, please indicate if the capacity is different by season (i.e., winter, summer, and shoulder).

e) Please provide the forecast flows for the lines in question for a scenario where Ontario enters into a firm electricity import contract with Quebec that would utilize the full 1250 or 1650 MW import capacity increase enabled by this project. Please provide this on an (i) hourly basis, (ii) seasonal basis and (iii) annual basis.

f) Please complete the following table mapping the throughput over these lines for the most recent year data is available based on the loading of the lines at the time.

Loading	Annual kWh at loading level
Up to 10 MW	
10 MW to 20 MW	
…	

Response:

a) Hydro One does not have this information. However, please see response to Exhibit I, Tab 2, Schedule 1, part a), which illustrates that even if the line is loaded up to its limit, the incremental savings in losses are not sufficient enough to cover the additional cost of the incremental scope of work involved with Alternative 4.

b) Please refer to Exhibit I, Tab 2, Schedule 1 part a). Prior years are not relevant based on current system configuration and conditions.

c) Please refer to the response to part b) above.

d) The capacity by season is provided in Table 1, below. It is important to note that the rating provided in the table is the lower of that of the conductor and the station.

Table 1 - MW ratings of the M30A and M31A circuits

MW Ratings	Today	Alt 3	Alt 4	Station as of Today	Station Uprated
Summer (35ºC)	648	1102	1224	1080	1440
Shoulder (20ºC)	698	1184	1318	1080	1440
Winter (10ºC)	727	1235	1372	1080	1440

e) Hydro One does not have forecast flows for this scenario.

f) Please refer to the response provided to part b), above.

ENVIRONMENTAL DEFENCE INTERROGATORY #9

Reference:

Exhibit B, Tab 5, Schedule 1

Interrogatory:

a) Please estimate the incremental loss reductions (%) as between alternative 3 and 4 based on the loading of the lines. Please do so by completing the below table. If Hydro One believes another format for this information would be helpful, please also provide the information in that alternative format.

Loading	Losses (%) – Status Quo	Losses (%) – Alt 3	Losses (%) – Alt 4
10 MW			
20 MW			
30 MW			
…			

b) Please provide the historic transmission losses over these lines in hourly increments for the three most recent years. Please provide this in a live excel spreadsheet so it can be used by Environmental Defence's consultant. If hourly data is not available, please provide the data in as granular of a format as possible (i.e. daily, monthly, seasonal).

c) Please reproduce the response to (b) with the transmission losses that would have occurred if alternative 3 had been in place. Please provide this in a live excel spreadsheet so it can be used by Environmental Defence's consultant.

d) Please reproduce the response to (b) with the transmission losses that would have occurred if alternative 4 had been in place. Please provide this in a live excel spreadsheet so it can be used by Environmental Defence's consultant.

e) Please estimate the losses that would arise in the scenario outlined in Interrogatory 6(e) [full utilization of the lines] on an hourly and annual basis. If hourly data is not available, please provide the data in as granular of a format as possible (i.e. daily, monthly, seasonal).

f) Please provide the equations necessary to calculate the losses per hour based on the loading (MW) with the (i) status quo, (ii) alternative 3, and (iii) alternative 4 (i.e. equations that will output the losses (kWh) based on a given loading (MW).

g) To the extent that it is different from the answer to (f), please provide the equation(s) Hydro One used to calculate losses for alternatives 3 and 4.

Response:

a) Please refer to Exhibit I, Tab 2, Schedule 1. The losses are proportional to the resistance. The resistances and percentages loss reductions are provided in Table 1, below.

Table 1 - Resistances and Percentages Loss Reductions

Alternative No.	Existing Conductor	Alternative #3	Alternative #4
Ohm/km	0.037531	0.023227	0.019418
Ratio	100%	62%	52%
Loss reduction	-----	38%	48%

The loss reductions in percentage will be the same at any flow level.

b) Please refer to response at Exhibit I, Tab 2, Schedule 1 part a).

c) Please refer to response at Exhibit I, Tab 2, Schedule 1 part a).

d) Please refer to response at Exhibit I, Tab 2, Schedule 1 part a).

e) Please refer to response at Exhibit I, Tab 2, Schedule 1 part a).

f) Transmission line losses are represented by the following equation:

$$\text{Transmission Line Losses} = 3 \times I^2 \times R$$

Where,

I = Line current

R = Line Resistance

The same equation is true for; (i) status quo, (ii) Alternative 3, and (iii) Alternative 4.

g) No. Hydro One used the same equation.

ENVIRONMENTAL DEFENCE INTERROGATORY #10

Reference:

Exhibit B, Tab 5, Schedule 1

Interrogatory:

a) Please provide the forecast carbon intensity of electricity (t CO2e / kWh) forecast over as long of a period as is available and based on the latest available information, which we assume to the data tables published along with the IESO's latest Annual Planning Outlook.

b) Please provide the forecast carbon intensity of electricity (t CO2e / kWh) forecast over as long of a period as is available at the provincial peak hour.

c) Please comment on whether carbon pricing applies to power generation in Ontario.

d) Please comment on whether carbon pricing will apply to power generation in Ontario in the future under the federal governments announced increases to the carbon price up to 2030.

e) Please provide the annual carbon price announced by the federal government recently for each year up to 2030.

f) Please estimate the cost of carbon based on (e) per kWh in Ontario up to 2030.

Response:

These questions are better directed to the IESO outside of this proceeding. Hydro One submits that these questions are outside the scope of this Application.

ENVIRONMENTAL DEFENCE INTERROGATORY #11

Reference:

Exhibit B, Tab 5, Schedule 1

Interrogatory:

a) Please file the three most recent versions of the IESO's CDM Cost-Effectiveness Test Guides, including the appendices on avoided costs.

b) Please file a copy of the avoided cost data published by the IESO in its latest Annual Planning Outlook.[1] Please discuss in detail whether this could be used to economically evaluate transmission loss reductions.

c) Please provide a figure illustrating the latest information on when Ontario will face an electricity capacity deficit and the size of that deficit.

d) Please confirm that provincial generation capacity is built to meet the electricity demand at its peak. If not, please explain. Please describe whether the relevant peak is hourly or a 5-minute interval.

e) Please confirm that transmission losses are greatest at the time of peak electricity demand. If not, please explain.

f) Please provide the losses on the lines in question over each of the past 5 years (both % and kWh) at (i) the province's coincident peak demand hour, (ii) the province's coincident peak demand 5-minute interval, (iii) the peak hour for the lines in question, and (iv) the peak 5-minute interval for the lines in question. Please complete this table:

[1] https://www.ieso.ca/-/media/Files/IESO/Document-Library/planning-forecasts/apo/APO-Avoided-Costs.ashx.

Losses on the Hawthorne to Merivale Line at the Provincial and Local Peaks			
	Throughput (kWh)	**Losses (%)**	**Losses (kWh)**
2015			
Ontario's coincident peak demand hour			
Ontario's coincident peak demand 5-minute interval			
Hawthorne to Merivale peak demand hour			
Hawthorne to Merivale peak demand 5-minute interval			
…			
2019			
Ontario's coincident peak demand hour			
Ontario's coincident peak demand 5-minute interval			
Hawthorne to Merivale peak demand hour			
Hawthorne to Merivale peak demand 5-minute interval			

g) Please estimate the losses on the Hawthorne to Merivale line (% and kWh) with demand of 648MW (the current capacity) for an hour with (i) the status quo, (ii) alternative 3, and (iii) alternative 4 (larger conductor).

h) Please estimate the losses on the Hawthorne to Merivale line (% and kWh) with demand of 1080MW (the capacity for alternative 3) for an hour with (i) alternative 3, and (ii) alternative 4 (larger conductor).

Response:

Hydro One and the IESO contributed to this response.

a) Transmission line loss reductions have a different load profile compared to the load reduction from the energy efficiency portfolio. As a result, the avoided cost for a transmission measure may materially differ from the avoided costs developed for the specific energy efficiency portfolio.

This question should be directed to the IESO outside of this Application.

b) Please refer to the response in part a), above.

c) Please refer to the response in part a), above.

d) Provincial generation capacity is built to meet the electricity demand at its peak, which is an hourly peak.

e) Confirmed, for system normal conditions and configuration.

f) Please refer to Exhibit I, Tab 2, Schedule 1 part a), regarding the provision of sensitive and confidential data.

Table 1 below provides the peak hour for the past 5 years.

Table 1 – The Ontario Peak Demand Hour for 2016 through 2020

Year	The Ontario Peak Demand Hour
2016	September 7 at 5pm
2017	September 25 at 5pm
2018	September 5 at 6pm
2019	July 29 at 5pm
2020	July 7 at 5pm

i. Please see Exhibit I, Tab 2, Schedule 1 part a)
ii. 5-minute interval not available.
iii. Please see Exhibit I, Tab 2, Schedule 1 part a)
iv. 5 minute interval not available

g) Please refer to the response provided at Exhibit I, Tab 2, Schedule 9 part a).

h) Please refer to the response provided at Exhibit I, Tab 2, Schedule 9 part a).

ENVIRONMENTAL DEFENCE INTERROGATORY #12

Reference:

Exhibit B-3-1, Attachment 1

Preamble:

The IESO's letter states:

> *"As reported in the 2017 Interconnection report, detailed engineering studies done by Hydro One indicated that the overhead M30/31A circuits are capable of being uprated by replacing the existing conductors with twin conductors at a cost of about $20 million."*

Interrogatory:

a) Please file the studies referred to above which resulted in the $20 million cost estimate.

b) What kind and capacity of twin conductors where proposed in the studies referred to above. Please compare those to the conductors cited under alternative 3 and 4.

Response:

a) Detailed engineering studies refer to the design and engineering that were involved in the development of the cost estimate. That estimate was updated, and the details and results are provided in Exhibit B, Tab 7, Schedule 1.

b) The previous study was based on using the conductor in Alternative 4.

ENVIRONMENTAL DEFENCE INTERROGATORY #13

Reference:

Exhibit B, Tab 1, Schedule 1, Page 3; Exhibit B-3-1, Attachment 1

Preamble:

Hydro One states:

> *"The proposed in-service date for the Project is December 2023, assuming construction commencement in October 2021."*

The IESO letter states:

> *"Hydro One has indicated that a target in-service date of December 2022 is feasible. The IESO supports targeting for this in-service date and will provide assistance, as required, to Hydro One in implementing this project."*

Interrogatory:

a) Please explain in detail why the in-service date has moved from December 2022 to December 2023.

b) Please reproduce the project schedule at Exhibit B, Tab 11, Schedule 1 with the most expedited schedule that Hydro One believes is possible. Please include an explanation indicating where Hydro One thinks it may or may not be able to expedite the steps.

Response:

a) Please refer to the response provide in Exhibit I, Tab 1, Schedule 6.

b) The Project schedule provided in Exhibit B, Tab 11, Schedule 1 is the most expedited schedule possible.

ENVIRONMENTAL DEFENCE INTERROGATORY #14

Reference:

Exhibit B, Tab 5, Schedule 1

Interrogatory:

a) Please confirm whether utilities include the cost of avoided generation capacity when valuing transmission loss reductions in (i) New York, (ii) Vermont, and (ii) California. Please provide underlying documentation.

b) Please confirm whether National Grid UK includes the cost of avoided generation capacity when valuing transmission loss reductions. Please provide underlying documentation.

c) Please provide a figure indicating the forecast electricity capacity surplus/deficit over as long of a period as such a forecast is available.

d) What is the average price of nuclear power as included in the HOEP in the most recent year available?

e) What is the average price of hydro power as included in the HOEP in the most recent year available?

f) Please describe how OPG's regulated generation revenue requirement is charged to customers through the HOEP and GA, and the proportion in each.

g) When Hydro One was most recently delivering energy efficiency programs, what values did it assign to the avoided cost of generation capacity for each kWh saved.

h) Please provide all the avoided cost figures and methodologies that Hydro One has used in the past five years to value the avoided costs associated with energy efficiency programs (e.g. the relevant CDM guidelines or internal evaluation guidelines).

Response:

Hydro One and the IESO contributed to this response.

a) The IESO and Hydro One have not conducted any further research on other jurisdictions beyond the comparison of our current practices to the information in National Grid UK's Strategy Paper, the Council of European Energy Regulator's ("CEER") report on power losses, and the report the Electric Power Research Institute ("EPRI") completed on behalf of Hydro One on industry best practices. This comparison was documented in the September 30, 2020, stakeholder engagement on transmission losses. None of the products reviewed as part of this work indicated that the avoided cost of generation capacity was used when valuing transmission losses.

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

c) This question should be directed to the IESO outside of this Application.

d) This is outside the scope of the proposed investment and outside the scope of this Application.

e) Please refer to the response in part d) above.

f) Please refer to the response in part d) above.

g) Please refer to the response in part d) above.

h) Please refer to the response in part d) above.