Power Workers' Union (PWU) INTERROGATORY #001

Reference:

EXHBIT B1: Transmission System Plan

Ref (a): Exhibit B1-2-6, Page 3 of 66:

> **Currently 28% of the transformer population is beyond its expected service life.**

Ref (b): Exhibit B1-2-6, Page 5 of 66:

> **Transformer forced outages are one of the leading causes of customer delivery point interruptions, and represent 18% of the equipment caused events impacting delivery point interruptions with multiple supplies over the past 10 years. To mitigate this risk, the proposed transformer replacements in the test years are focused on replacing transformers that may lead to delivery point interruptions and impacting system reliability, customer satisfaction and other adverse outcomes**

Ref (c): Exhibit B1-2-6, Page 7 of 66:

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

Ref (d): Exhibit B1-2-6, Page 9 of 66:

Table 3 shows that Hydro One is proposing to replace 27 transformers in 2017 and 22 transformers in 2018 – a total of about 50 transformers.

Interrogatory:

a) Confirm if the total number of Hydro One's transformers assumed in calculating the 15% high/very high risk transformers is 721?

b) Confirm that Hydro One identified the 15% high/very high risk transformers not based on demographic analysis but based on actual condition testing.

c) Please confirm that Hydro One's proposing to replace in the test years only about less than half of the 15% high/very high risk transformers.

Witness: Chong Kiat Ng

d) If confirmed, what is Hydro One's strategy to address the forced outage risk posed by the other more than half of transformers identified as high/very high risk but will not be replaced for at least the next 2 years?

e) What is the reason that more high/very high risk transformers are not being scheduled for replacement during the test period? Is the concern rate impact, or the availability of components/labour or other?

Response:

a) Confirmed.

b) Confirmed. The identification is done based on a fleet level condition assessment. Refer to Exhibit I, Tab 1, Schedule 31, part c).

c) Confirmed.

d) Forced outage risk can be measured by forced outage frequency and forced outage duration, where frequency refers to the number of occurrence while duration refers to the amount of time the asset is forced out. Historically, transformer failures only contribute a small percentage of forced outage occurrences. Hydro One managed the risk of a prolong outage by maintaining a certain level of spares across its population to respond to demand situations and minimizes the duration of which an asset is forced out of service.

e) Please refer to Exhibit I, Tab 1, Schedule 31.

Power Workers' Union (PWU) INTERROGATORY #002

Reference:

Ref (a): Exhibit B1- 2- 6, Page 16 of 66:

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

Interrogatory:

a) Confirm if the 11% figure above represents about 500 circuit breakers and that Hydro One is proposing to replace less than 200 breakers in the test years?

b) If confirmed, what is Hydro One's strategy to address the forced outage risk posed by the other more than half of circuit breakers identified as high/very high risk but will not be replaced for at least the next 2 years?

c) What is the reason that more high/very high risk circuit breakers are not being scheduled for replacement during the test period? Is the concern rate impact, or the availability of components/labour or other?

Response:

a) Yes, approximately 500 breakers.

b) Forced outage risk will be addressed by targeting maintenance spending on addressing "bad actors" within the population that are not expected to be replaced over the next two years and by targeting the primary root causes for the forced outage. A significant contributor to forced outages is the air blast circuit breakers. Based on outage constraints Hydro One is limited in how many replacements can be achieved in the test years. In order to address this situation the company is actively addressing known air system control component failure modes mitigate the forced outages.

c) In some cases the high/very high condition risk is indicative that the internals on the breakers require a major overhaul. Where a major overhaul is economical, it will be performed and the condition of the breaker will improve following maintenance. The criticality of the company's air blast circuit breakers within its system is very high and Hydro One is focusing on replacing these breakers due to reliability and obsolescence issues. All sustainment

planned replacements require coordination with development projects, customer's plans, regulatory requirements and other constraints such as outages.

Power Workers' Union (PWU) INTERROGATORY #003

Reference:

Ref (a): Exhibit B1-2-6, Page 22 of 66:

> **Currently 21% of the protection system population is beyond its expected service life. The existing replacement rate of approximately 450 units per year is required to maintain this level.**
>
> **The condition of the protection system fleet is such that 27% present high [16%] or very high [11%] condition risks that need to be mitigated.**

Ref (b): Exhibit B1-2-6, Page 29:

> **On average, Hydro One has replaced 438 protection systems over 2014 and 2015 and will replace an average of 448 per year, out of 12,100, in 2016 through 2018. [a total of 1344 protection systems]**

Interrogatory:

a) Given that Hydro One is proposing to replace 1344 over the 2016-2018 period, please confirm that this represents 11% of the 12,100 total number of protection systems, which is effectively equal to the number of protection systems identified as very high condition risk.

b) What is the reason that more protection systems are not being scheduled for replacement during the test period? Is the concern rate impact, or the availability of components/labour or other?

Response:

a) It is Hydro One's intent to replace about 1344 protection systems between 2016 and 2018. This value represents about 11% of the total protection fleet.

b) The vast majority of planned protection systems replacements are being undertaken as part of station centric work. Planning these capital expenditures requires striking a right balance between scheduling and securing requisite outages to carry out this work, availability of resources, and the impact of these expenditures on transmission rates. The proposed level of replacements (about 4% of fleet per year) allows Hydro One to attend to the most vulnerable protections in a timely and orderly fashion while maintaining the overall system reliability.

Witness: Chong Kiat Ng

Power Workers' Union (PWU) INTERROGATORY #004

Reference:

Ref (a): Exhibit B1-2-6, Page 35 of 66, Figure 24

Figure 24 (Conductor Fleet Condition Assessment) shows that 9% of conductor fleet is known to be high risk, 20% is fair risk, 40% is low risk, and 31% needs assessment [Emphasis added]

Interrogatory:

a) Given that the chart represents the result of condition assessment, please explain what "31% needs assessment" mean? …Does that mean Hydro One has no information (or complete information) on the state of 31% of its conductor fleet? If so, how reliable are the risk assessment results –high, fair and low risk – for the remaining 69% of the fleet indicated above?

Response:

a) Currently 31% of Hydro One's conductors require assessment. This means that they meet Hydro One assessment criteria, but have not been assessed. Based on Hydro One past experience, only a portion of these conductors will be under high risk category.

The remaining 69% of the conductor fleet either are too new (i.e., not requiring assessment) or they have been assessed to be in low, fair, or high risk. Conductor condition assessment has a high degree of reliability.

Power Workers' Union (PWU) INTERROGATORY #005

Reference:

Ref (a): Exhibit B1-2-6, Page 58

Figure 42 shows that total forced outage durations due to insulator failures increased from approximately 100 hours in 2013 to over 600 hrs in 2014 and approximately 500 hours in 2015.

Hydro one also states that:

> **There are approximately 34,000 circuit structures with defective COB or CP insulators and roughly 15,000 of these circuit structures have been identified as high risk....this translates to approximately 60,000 strings of defective insulators which will be replaced in the next four years. Furthermore, there are an additional 60,000 insulator strings containing these defective insulators which are outside of high risk areas, but will adversely affect system reliability should they fail and cause outages.**

Ref (b): Exhibit B1-2-6, Page 59, Table 12

Table 12 shows that Hydro One is proposing to replace 4,030 circuit structures in 2017 and 3,880 circuit structures in 2018 – a total of under 8,000.

Interrogatory:

a) Please confirm that Hydro One is proposing to replace in the test years only about half of the 15,000 defective circuit structures that are identified as high risk.

b) If confirmed, what is Hydro One's strategy to address the forced outage risk posed by the other half of circuit structures identified as high risk but will not be replaced for at least the next 2 years?

c) Assuming the work proposed in the application for the test years is in fact undertaken, how will it affect the total forced outage duration attributable to insulator failures in the test years? Will it be higher, lower or consistent with the 2014-15 statistics?

Witness: Chong Kiat Ng

d) Does Hydro One consider the continuation of total forced outage duration attributable to insulator failures consistent with the 2014-15 statistics to be an acceptable outcome from a customer perspective, and if so, why?

Response:

a) Yes, the defective insulators on 15,000 high risk circuit structures are planned to be replaced over the next 4 years. About half of these insulators are scheduled for replacement in the test years.

b) Hydro One plans to remove all of these defective insulators on high risk structures in the next 4 years and continue to assess risk and prioritize its insulator replacement program to minimize the safety and reliability risks. Due to system outage limitations, it is not feasible to replace all of defective insulators on 15,000 high risk circuit structures in shorter period of time.

c) It is expected that insulator failure frequency and duration will gradually improve as these insulators are being removed.

d) Insulator outage durations depend on the location and line configuration. It is expected that the total insulator outage duration will improve as these defective insulators are being removed from the system.

Power Workers' Union (PWU) INTERROGATORY #006

Reference:

Ref (a): Exhibit B2-1-1, Page 18 of 25:

> **…. for those parts of the business where unit costs are not currently available, Hydro One has selected productivity metrics to facilitate measurement of efficiency and productivity improvements. One of these measures is Reliability and Cost Efficiency (RCE), a metric that links reliability outcomes to maintenance spend. RCE enables measurement of productivity improvements over time for both lines and stations maintenance work.**

Interrogatory:

a) Hydro One indicates that the RCE is a 'new' measure. Please indicate if the RCE measure is developed and employed by Hydro One or if it is a measure that is being employed by other similar utilities as well.

b) What is Hydro One's understanding as to the number of years of RCE data that will be required in order for a trend in the data to be considered reliable?

Response:

a) Please refer to the response to Exhibit I, Tab 3, Schedule 61, part a).

b) Hydro One suggests that at least five years of data is required in order to consider the trend in the score reliable. The three year rolling average will smooth out the impact of individual events that cause major variations in the trend in a single year. For example in 2013, the ice storm caused an unusual number of unplanned outages and caused an increase in the RCE score. The three year rolling average also provides a better view of the long term trend. With five years of data available there are now three points available for the three year rolling average and the long term trend can be seen.

Witness: Michael Vels

Power Workers' Union (PWU) INTERROGATORY #007

Reference:

Ref (a): Exhibit B2-2-1, Attachment 1, Transmission Total Cost Benchmarking Study, Page 22-23:

> **The vehicular incident rate was good, although a specific performance target for preventable motor vehicle accidents should be established to drive continuous improvement**

Interrogatory:

a) Does Hydro One intend on setting a specific performance target for the vehicular incident rate as suggested in the Transmission Total Cost Benchmarking Study?

b) Is Hydro One considering specific performance targets on other scorecard measures as well, as is done in the LDC scorecard?

c) How often would a specific performance target for the vehicular incident rate, and other potential performance targets be reviewed?

Response:

a) Hydro One strives to improve its performance in all areas and particularly in the safety of its employees. As such, Hydro One will consider all of the recommendations in the report and then decide which of those will provide the greatest opportunity for performance improvement. Defensive driving and driver safety program training programs are being revised in 2016 and delivered to staff. The assignment of a target may be considered in the future when the effectiveness of the new safety program is realized.

b) See response to Exhibit I, Tab 1, Schedule 92, part b).

c) The frequency of review of any measure might vary based on the time needed to collect and communicate performance information. In the case of the vehicular incident rate, an annual review of the existing target would be reasonable once a baseline is determined for the new program.

Witness: Ben Grunfeld

Power Workers' Union (PWU) INTERROGATORY #008

Reference:

Ref (a): Exhibit B2-2-1, Attachment 1, Transmission Total Cost Benchmarking Study, Page 20:

> **The comparatively high number of project managers per capital project might positively influence the effectiveness of the company's project managers. However, the project managers must also complete the tasks normally assigned to support resources (cost analysts, schedulers, material coordinators, contract managers, etc.), which takes them away from the focused management of their projects and programs.**

Interrogatory:

a) Hydro One has a high number of project managers per value of capital additions relative to the peer group. Additionally, Hydro One has a relatively low number of support staff per project manager compared to the peer group. Navigant and First Quartile Consulting suggest this causes project managers to complete tasks normally assigned to support staff. Has Hydro One considered increasing the number of support staff?

Response:

Hydro One routinely evaluates the resources needed in each business area. If it is determined that additional resources are required in a particular area to support performance improvement, adjustments will be made within existing business guidelines. (e.g. budget and/or headcount restrictions) and within the confines of the Collective Agreements.

Power Workers' Union (PWU) INTERROGATORY #009

Reference:

Ref (a): Exhibit B2-1-1, Attachment 1, Proposed Transmission Regulatory Scorecard, Page 2 of 2 (Proposed scorecard)

Ref (b): Exhibit B2-1-1, Attachment 1, Proposed Transmission Regulatory Scorecard, Page 2 of 2

Note 3: In 2014 strategic decision made to increase sustainment capital.

Interrogatory:

a) Is Hydro One considering including a safety metric for general public incidents, as is done in the LDC scorecard?

b) The trend indicators on the proposed scorecard display only whether the measure is increasing or decreasing. Is Hydro One considering including indicators that reflect both the direction of the trend and whether the trend is improving?

c) If specific performance targets are included, would a clear indication of whether the target was met be incorporated?

d) The method used in the proposed scorecard of displaying sustainment capital per gross fixed asset value over time, as well as where it is situated on the scorecard, suggests that improvement is achieved as the percentage falls. The sustainment capital measure should be modified or removed since an upward trend may reflect a reasonable strategic decision rather than an indication of poor performance. Would it be more appropriate to measure the sustainment capital metric by efficiency in meeting its target level?

Response:

a) A safety metric for public incidents can be considered for the future. However, the Transmission System has fewer points of interaction with the public than the Distribution System, so the measure is expected to be less relevant for Transmission than Distribution.

b) The proposed scorecard currently shows trends as arrows on the right side of the scorecard. A green, upward arrow indicates and improving trend and a red, downward arrow denotes a deteriorating trend.

c) The assignment of performance targets, and other associated enhancements, may be considered in a future iteration of the Scorecard.

d) The measure is intended to demonstrate the efficient deployment of capital, but, as is the case for most metrics, the numerical results cannot be taken in isolation and without context, for the reasons cited in the question.

Power Workers' Union (PWU) INTERROGATORY #010

Reference:

Ref (a): Exhibit B2-2-1, Attachment 1, Transmission Total Cost Benchmarking Study, Page 16:

> **Using the TADS metrics, Hydro One's sustained outage frequency for the lower voltage lines (below 200kV) was the highest in the peer group (Figure 17). Even excluding worst performing circuits (Figure 18), Hydro One's sustained outage frequency for the lower voltage lines remains among the highest in the peer group.**

Ref (b): Exhibit B2-2-1, Attachment 1, Transmission Total Cost Benchmarking Study, Page 22 of 43:

> **Hydro One's momentary outage frequency was also among the highest in the peer group. "Power system condition" was the single largest cause of sustained transmission system outages. Power system condition causes include system instability, overload trip, out-of-step, abnormal voltage, abnormal frequency, or unique system configurations (e.g., an abnormal terminal configuration due to existing condition with one breaker already out of service). …In a recent study by the CEA for multi-circuit supplied delivery points, Hydro One was shown to be performing well when compared to other Canadian companies when it comes to frequency and duration of actual interruptions.**

Interrogatory:

a) In the Transmission Total Cost Benchmarking Study, Hydro One is among the lowest performing utilities for system outage frequency and duration rates in the peer group. A CEA report that is referred to in the benchmarking study suggests Hydro One is among the best performing utilities for system outage frequency and duration. Which benchmarking study does Hydro One rely on more in assessing its system outage rate performance?

b) Why are sustained outages caused by "Power system condition" considerably higher for Hydro One than its peers?

Response:

a) Hydro One relies on CEA report to assess its system outage rate performance, which is indicative of its delivery point performance.

Witness: Mike Penstone

b) Power system condition is an outage cause classification of the Transmission Availability Data System (TADS). It is a category that collects automatic outages attributable to unique system configurations, among other causes. Hydro One's system employs a unique design feature that provides redundancy but that renders portions of the system to be unavailable as a result of a disturbance. As such, this category is usually higher for Hydro One than for other companies.

Power Workers' Union (PWU) INTERROGATORY #011

Reference:

Ref (a): Exhibit B2-1-1, Page 23 of 25, Lines 4-6:

> **An effective preventive maintenance program would lead to less unplanned work, and reduce the ratio of unplanned to planned work.**

Ref (b): Exhibit B2-1-1, Page 23 of 25, Table 6:

Table 6: Performance of Productivity Metrics

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

Interrogatory:

a) What measures are being taken to ensure the preventative maintenance program is effective?

Response:

a) To The following measures are taken to ensure an effective Program:

- A preventative maintenance program is based on Reliability Centered Maintenance principles, as described in Exhibit C1, Tab 2, Schedule 2.
- Prior to releasing the work program for the coming year, equipment condition, criticality and performance data, compliance requirements, and outstanding corrective action plan information is assessed to prioritize maintenance orders.
- The prioritized maintenance orders are subjected to further optimization by considering outage requirements, work bundling options and the capital replacement plan to arrive at an optimum preventative maintenance program, which minimizes reliability and customer impact.

Witness: Michael Vels

- The full preventative program is released in the fall of the preceding year to allow for efficient program scheduling and resource allocation.
- Throughout the year, work program progress and effectiveness is tracked by a formal monthly reporting process between the execution group and asset management.
- Funding and resource redirection needed for demand corrective work, such as transformer or breaker failure, is closely monitored.

Power Workers' Union (PWU) INTERROGATORY #012

Reference:

Ref (a): Exhibit B2-1-1, Page 20 of 25, Table 4:

Table 4: Historical and Projected RCE Metrics

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

Interrogatory:

a) The Lines and Forestry RCE values for the years 2016-2018 appear inconsistent with the formulaic representation of the RCE. Please review/revise the values? Alternatively, explain the 0.8 values for the 2016-2018 period.

Response:

Please find below a corrected table with changes in red font. The overall score for the metric remains the same.

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Lines and Forestry	Outages/Assets	132.4	139.5	132.3	115.8	120.2	78.8	88.8	79.0	77.2	75.8
	Assets/Maintenance	86.0	98.4	94.8	109.4	100.3	92.9	101.7	97.7	98.6	98.6
	RCE	**1.5**	**1.4**	**1.4**	**1.1**	**1.2**	**0.8**	**0.9**	**0.8**	**0. 8**	**0.8**
	RCE (3 year avg)			**1.5**	**1.3**	**1.2**	**1.0**	**1.0**	**0.8**	**0.8**	**0.8**

Witness: Michael Vels

Power Workers' Union (PWU) INTERROGATORY #013

Reference:

Ref (a): Exhibit C1-2-1, Page 2 of 6, Table 1

Interrogatory:

a) Please explain the forecast decline in OM&A expenses in 2017 and 2018, despite, as Hydro One indicates "upwards pressure from inflation of approximately 2% per year, a growing asset base, and increasing compliance costs arising from new regulatory standards, such as the North American Electric Reliability Corporation's Critical Infrastructure Protection Cyber Security reliability standards."

Response:

A number of initiatives are being undertaken to contain increases in maintenance costs associated with the system and increased regulatory requirements, as described in section 6 of Exhibit B2, Tab 1, Schedule 1. Examples of specific initiatives include:

- optimized maintenance frequencies impacting overall costs and resource utilization, and additional moves to condition-based maintenance;
- increased bundling opportunities through alignment of maintenance activities and improved visibility of bundling opportunities, which provide efficiencies in the planning and execution of outages and staff mobilization; and
- increased replacement of assets mitigating higher corrective maintenance costs and equipment refurbishment activities by replacing the worst performing assets with new equipment that has lower lifecycle maintenance costs.

Power Workers' Union (PWU) INTERROGATORY #014

Reference:

Ref (a): Exhibit D1-1-2, Page 1 of 6, Table 1: In-Service Capital Additions 2014 – 2018 ($ Millions)

Interrogatory:

a) Please explain the $121 M variance between the 2015 board-approved and actual in-service additions identifying any project re-directions and/or delays behind the variance. Please describe the current status of projects that were delayed or cancelled.

b) Explain the $238 M variance between the 2016 projected in-service additions and the board-approved amount?

Response:

a) The explanation requested has been provided in Exhibit D1, Tab 1, Schedule 2, Section 2. Figure 1, Table 2 and Table 3 explain the shifts in timing for major projects and provide the rationale that it was prudent to perform work in order to address emergent needs, over the period of 2014 to 2016.

   The bridge year has not changed materially and has no material impact on the 2017 and 2018 test years.

b) Please see above.