EB-2017-0049

Hydro One Networks Inc.

2018 Distribution Rate Application

OEB STAFF COMPENDIUM

Expert Panel: Work Programs

Oral Hearing

June 2018

Recommended Actions

In its request for proposals, Hydro One indicated that the study should produce recommendations that Hydro One could act upon to close gaps to best practice and improve the efficiency of its operations. Several recommendations were developed for each of the two areas under study.

Pole Replacement

The key recommended actions for pole replacement are outlined below.

1. Consider modifying the pole replacement program to include more complete pole inspections (sound, bore, excavation) and a longer (approximately 10-year) inspection cycle – the OEB would need to approve the change in inspection cycle.
2. Expand the existing centralized program management and pole selection approach to cover 90-95% of the replacement / refurbishment work on poles in a given year, leaving the remainder to be guided by the local staff while still meeting the centralized strategy and replacement criteria
3. Where geography and/or pole density permit, consider the use of dedicated pole replacement crews.
4. Consider modifying the program to include a rigorous pole refurbishment option, when appropriate.

Substation Refurbishment

The key recommended actions for substation refurbishment are outlined below.

1. Consider implementing a formal data governance process for equipment performance and maintenance data, and incorporating that information into the asset condition scoring and project planning process.
2. Enhance cost and work completion reporting for individual projects, and implement a formal change control process.
3. Develop and implement a more comprehensive set of key performance indicators including in-progress project cost performance measures and assessments of project/program impacts on substation reliability, maintenance costs and overall asset health.

OEB Staff Interrogatory # 126

Issue:

Issue 25: Does the Distribution System Plan adequately reflect productivity gains, benefit sharing and benchmarking?

Reference:

B1-01-01 Section 1.6 Page: 2004
(5.2.3) Benchmarking, Section 1.6.4 ATTACHMENTS: BENCHMARKING STUDIES, Attachment 1: Pole Replacement and Station Refurbishment Program Study – Navigant and First Quartile

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Substation Refurbishment

The key recommended actions for substation refurbishment are outlined below.

5. *Consider implementing a formal data governance process for equipment performance and maintenance data, and incorporating that information into the asset condition scoring and project planning process.*
6. *Enhance cost and work completion reporting for individual projects, and implement a formal change control process.*
7. *Develop and implement a more comprehensive set of key performance indicators including in progress project cost performance measures and assessments of project/program impacts on substation reliability, maintenance costs and overall asset health."*

Interrogatory:

Has Hydro One taken action to address these recommendations? Please provide details.

Response:

Please see details below for how Hydro One is addressing these recommendations.

Pole Replacement

1. Hydro One is considering including more quantitative pole testing methods within the existing line patrol program. The strategy currently being evaluated is to alternate detailed pole testing (for example: drilling and shell thickness measurements) with visual inspections. With this proposal the Distribution System Code Appendix C cycle length is maintained and detailed pole tests are obtained. Hydro One is continuously monitoring emerging technologies and will consider other non-destructive pole testing methods as they become available.

2. Please refer to Exhibit B1, Tab 1, Schedule 1, DSP Section 1.6.3.1 for the actions Hydro One has taken to address Recommendation 2.

3. As documented on page 15 in Exhibit Q, Tab 1, Schedule 1, Attachment 1, Hydro One did utilize dedicated crews in 2017 and intends to continue to use dedicated crews where appropriate.

4. Please refer to interrogatory response Exhibit I-25-Staff-122 for the actions Hydro One has taken to address Recommendation 4.

Substation Refurbishment

5. Hydro One has implemented a formal data governance project as noted in Exhibit A, Tab 3, Schedule 1, Attachment 3. This project is to provide data completeness improvements where missing data exists, review data requirement needs, and to clarify ongoing accountability, processes and communication to monitor and remedy data issues.

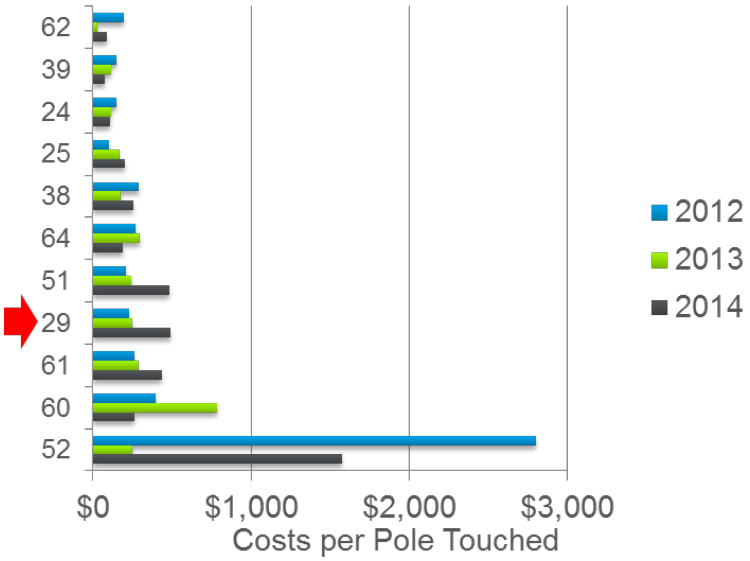
   Specifically for station refurbishment projects, Hydro One has made changes to aid in the improvement of data governance through identification of station equipment that is missing in the SAP system. Hydro One is also in the process of developing reports to identify incomplete data points.

6. Hydro One has enhanced the cost estimating for all new station refurbishment projects. Prior to releasing the project for execution, a detailed cost estimate will be requested rather than prior practice of releasing each project based upon a unit cost.

7. As mentioned in Item 6, Hydro One has implemented a new cost estimating and project release process for all new station refurbishment projects that will allow for improved project cost monitoring. Further as mentioned in Item 5, the implementation of the data governance project will ensure improved data quality and completeness on station assets condition, demographics and criticality.

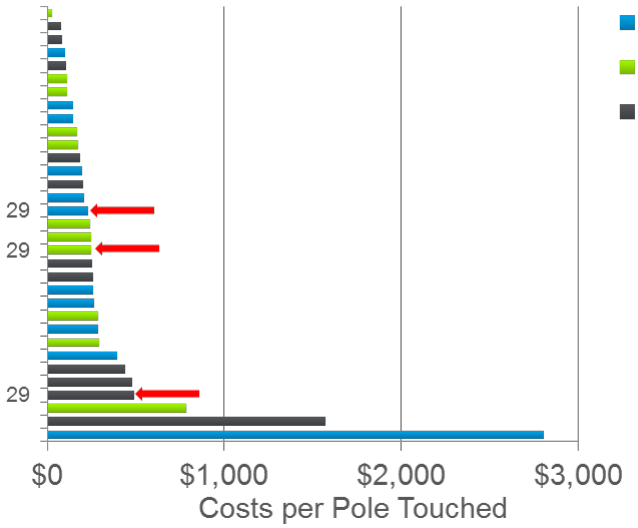
comparison, Hydro One again falls very near the mean of the comparison group.

Figure 8. Pole Program Costs Per Pole Touched Grouped by Company



Note: In this comparison, pole touched means the total number of poles inspected, replaced, and refurbished.

Figure 8. Pole Program Costs Ranked by Annual Spend



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3.2 Pole Inspection Costs and Frequency

Inspection costs are a function of what is done during the inspection. For example, is it a visual inspection, sound and bore, or other more complex physical inspection. Hydro One performs visual and light physical inspections on a shorter interval than most other companies (three to six years compared to 10 for the panel). Hydro One is the only company that does not use bore, excavation or ultrasonic methods on a dedicated schedule (seven to 20 years).

3.6 Refurbishment versus Replacement Costs

The cost of replacing a pole is substantially higher than the cost to refurbish a pole, with replacement being approximately 7x more expensive, where refurbishment is an option. Refurbishment is not an option in all cases. For example, it wouldn't make sense to refurbish a 50-year-old pole when its useful life is planned for 60 years. Refurbishment makes the most sense when a pole is found to be failing early in its planned life. Refurbishment has the possibility of extending the life of the pole by 20 to 40 years. In any scenario where a refurbishment can extend the life of the pole by over 20 years, then the economic benefit of refurbishment tends to be clear.

OEB Staff Interrogatory # 122

Issue:

Issue 25: Does the Distribution System Plan adequately reflect productivity gains, benefit sharing and benchmarking?

Reference:

B1-01-01 Section 1.1 Page: 29

Distribution System Plan Overview, Section 1.1.1 (5.2.1 A) KEY ELEMENTS OF THE DSP, pg 29 of 2930; **and**

DSP Section 1.6: (5.2.3) Benchmarking, Section 1.6.3.1 POLE REPLACEMENT PROGRAM STUDY, pg 1992 of 2930.

"The pole replacement program (ISD SR-09) is planned to be lower in 2018, to address customer rate sensitivities. The program will then increase until 2020 and level off in 2021 and 2022. There is a low reliability impact associated with this plan. Hydro One's goal is to sustain or modestly improve the condition of the pole fleet through the investment planning period."

"Recommendation 4: Pole Refurbishment Program

The study found that most of the peer group perform pole refurbishment. The study recommended refurbishing poles where possible. Hydro One will investigate the feasibility and cost benefit analysis of this option and its impact on work methods. The results of this analysis will determine if Hydro One will implement a pole refurbishment program."

Interrogatory:

a) It was recommended that Hydro One consider implementing a pole refurbishment program. Please provide details and the current status of this recommendation.

b) Could implementing a pole refurbishment program potentially take some pressure off the capital cost of pole replacements?

Response:

a) Hydro One is investigating different types of wood pole refurbishments. The two types being considered are structural refurbishment and chemical refurbishment. Structural

refurbishment involves attaching a steel member or wood pole stub to an existing pole in order to reinforce it. Chemical refurbishment involves applying a retreatment product to the pole during a drill test to restore the pole's chemical treatment at the ground line.

Chemical refurbishment is the currently preferred alternative. When combined with a drill testing program, this type of refurbishment has a low incremental cost. Preliminary discussions with vendors have occurred, and Hydro One is determining optimal cycle length, optimal candidates for refurbishment, and application licencing.

b) Chemical refurbishments have the potential to extend the life of the wood pole population which, in the long term, has the potential of reducing the annual capital investment in wood pole replacements. However, chemical refurbishments must be applied before any rot has started to develop within the pole otherwise it can be ineffective.

MR. OAKLEY: You do have such materials?

MR. JESUS: I believe so.

MR. OAKLEY: Would it be possible to provide those so we can just --

MR. JESUS: Sure [inaudible] --

MR. OAKLEY: -- get a flavour of what happens, because we don't know how material the calibration session is versus the other analyses that you do.

MR. JESUS: Sure.

MR. OAKLEY: Thanks.

MR. SIDLOFSKY: That will be Undertaking JT2.9.

UNDERTAKING NO. JT2.9: TO PROVIDE MATERIALS THAT WERE PRESENTED DURING THE CALIBRATION SESSION.

MR. OAKLEY: Can we move to Staff 115, please. And this is a bit of a discussion about business cases. And I take it from the response to D it means that as a rule intervenors and the OEB will not have the opportunity to review fully developed business cases for planned capital projects until after the projects, or perhaps even different projects with which they are replaced are completed?

MR. JESUS: That's correct. So business cases would be done for individual projects.

MR. OAKLEY: And those wouldn't typically be available prior to an application like this, a custom IR application?

MS. GARZOUZI: So it's the timing of the work execution. We would prepare the business case very shortly before execution, once we've completed our engineering and

our site assessment. And that is when we prepare the business case.

MR. OAKLEY: Okay, thanks. So is there any more comprehensive documentation of the proposed projects and programs that we would see in the ISDs. Clearly there's very little information. Typically, there is a one sentence scope. Typically, the alternatives considered are typically do this or don't do this, so there is no way to understand if there was more optimization done, if there were other alternatives considered. And in some cases, we're talking tens and hundreds of millions of dollars being spent based on a sort of one sentence scope, which doesn't give us a chance -- I mean, this is a custom IR. We're not trying to do a test year and then run it out for four years. We supposedly have a budget for every one of these years that is going to be approved in this process, and we can't really validate what's there.

Is there some more documentation than we've seen is all I'm really looking for, even if it's not a fulsome business case?

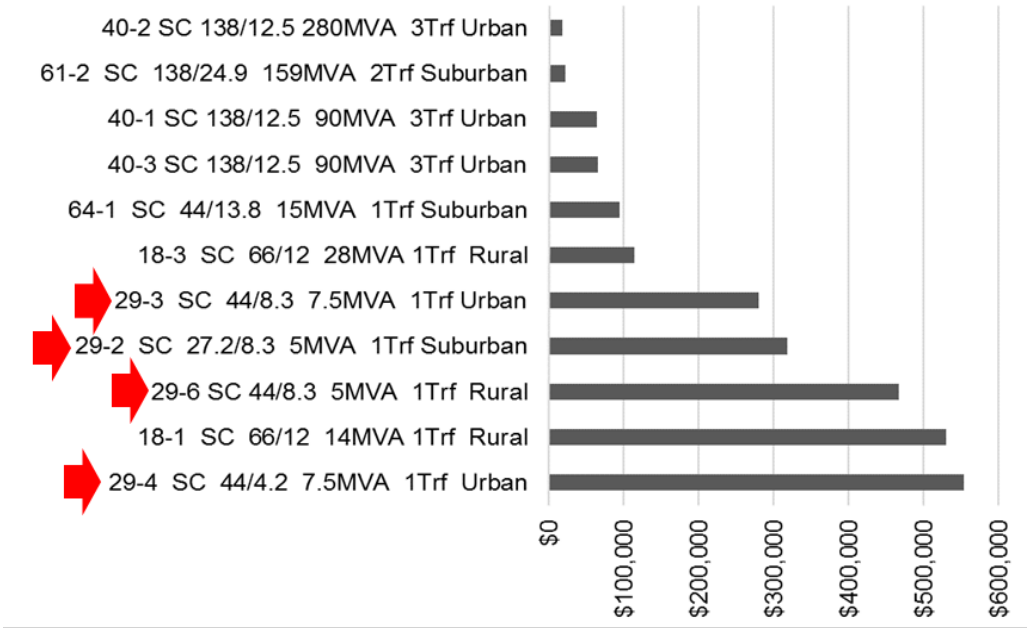
MS. GARZOUZI: That information that you're describing is usually found in the business case. For regional plans, for example, which have been filed, that would explain the need of those projects. So that would be background information for those specific business cases, for example, if we're developing feeders that are supplied from transmission stations.

MR. NETTLETON: Mr. Oakley, this was an issue that was

4.1.2 Substation-Centric Projects

A higher volume of substation-centric projects was available for analysis. As shown in Figure 22 and Figure 23, Hydro One's projects represent several of these, and they fall at different points within the comparative cost spectrum, whether measured on a per-transformer or a per-MVA basis. As before, all of the Hydro One stations in the comparison are single-transformer stations, typically at a distance from a work site.

Figure 22. Cost per Transformer Bank Refurbished for Substation-centric Projects



1.6 Key Findings

- **Maintenance Cycle** – The increase in the number of defects per km based on years since last worked found in the survey confirms a direct relationship between cycle intervals, defects, and reliability performance. Based on the survey data a 3 -year maintenance cycle is the optimal period before defects increase significantly which causes cost escalation and reduced reliability performance.
- **Work Scope** – The number of Off-ROW defects found in the survey confirms that the current work scope, in combination with the extended cycle, is the biggest contributor to less than desired reliability performance. It was evident that maintenance activities have been largely focused on areas within the ROW, leaving behind Off-ROW vegetation which is the major contributor to poor reliability performance.
- **Reliability Modeling** –By implementing an optimal maintenance cycle, modified work scope and an analytics based hazard tree program, it is reasonable to expect a 20% to 40% plus improvement in reliability by the end of 2020. An analytics based hazard tree program requires funding beyond the baseline maintenance levels.
- **Cost Modeling –** There is a reasonable probability, assuming that work scope is managed through a quality control effort, that the first 3-year maintenance cycle can be performed within existing funding levels. Cost for subsequent cycles may be significantly less as hazard trees and contact defects are controlled.
- **Feeder Prioritization** – The survey provides the data necessary to begin the transition to a shorter cycle interval with feeder prioritization based on voltage, defect volume, forecast cost and historical reliability results.

1.7 Recommendations

- Adopt an initial 3-year maintenance cycle first time through the system and re-evaluate prior to start of the second cycle. Alternative cycle intervals (2-5 years) may be introduced based on actual field conditions (3 years of data) matched to the desired outcome based on the intersection between defect, reliability, and cost.
- Revise work scope to focus on defects first (on and off ROW).
- Implement a Quality Control (QC) process to control scope and monitor work performance.
- Finalize and fully implement an outage investigation process to develop analytics for system awareness and continuous improvement.
- Implement a formal hazard tree program, part of which is incorporated into baseline cycle work and part of which is targeted work based on analytics.
- Implement work management and project management tools.
- Continue with workforce and work methods strategy.

Important Safety Observation

Recommendations contained in this report suggest a renewed emphasis on the identification and mitigation of hazard trees, with an estimated 1.1m trees needing work over the first cycle. Hazard trees, by definition, pose a risk not only to electric facilities but also to workers. Exposure to the dangers associated with climbing and/or felling hazard trees is likely to be greater than previously experienced. Additional precautions are advised.

	Field Investigations		Outage Reporting	
Outage Cause	# of Outages	% of Total	# of Outages	% of Total
Public Tree Cutting	5	2.00%		
Tree Branch	25	9.50%	1151	11.50%
Tree Fall In	209	79.70%	8,207	81.90%
Tree Grow In	17	6.50%	666	6.60%
Unable to find cause	2	0.70%		
Wildlife Tree Cutting	3	1.20%		

Table 5: Comparison of Field Investigation Results and Hydro One Outage Recording

4.4 Reliability Modeling

Using historical outage data and information on years since last worked, it is possible to create a model which forecasts the number of outages the system will incur moving to a modified cycle. Figures 10 and 11 (below) illustrate the number of outages and percent of outage reduction per year, after implementing a 3-year cycle with no changes to the current patrol standard. It is significant to note that the decrease in outages from only a cycle change flattens over time and additional reductions would require changes to the Dx standard and/or focused reliability efforts.

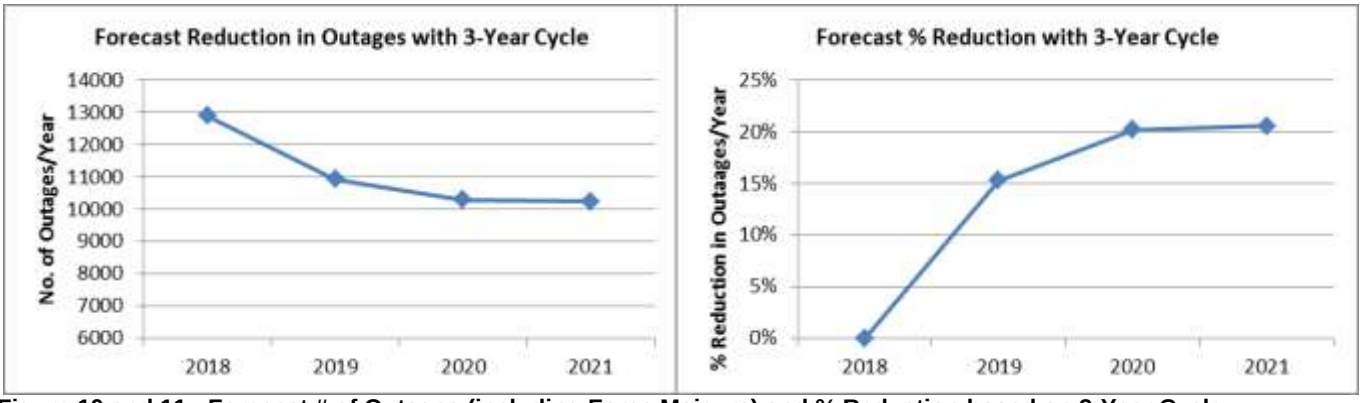


Figure 10 and 11: Forecast # of Outages (including Force Majeure) and % Reduction based on 3-Year Cycle

4.5 - Conclusion

Hydro One can reasonably expect a 20% to 40% (or better) reliability improvement moving to a shortened maintenance cycle, updating the patrol standard to match clearance requirements to cycle interval and implementing a more rigorous approach to hazard tree mitigation. As described above, modifying the cycle alone could produce a 20% improvement and based on field investigation results removal of dead trees could eliminate an additional 20% of the outages.

Improvements in tree-related reliability can lead to significant savings in other lines of business. A reduction in the number of outages results in less straight-time and overtime payroll for call center staff, trouble men and line crews. Additionally, there are avoided costs associated with a reduced number of damaged facilities.