

Chapter 1

Section 1.06

Hydro One—Management of Electricity Transmission and Distribution Assets

Follow-Up on VFM Section 3.06, 2015 Annual Report

RECOMMENDATION STATUS OVERVIEW						
	# of Actions Recommended	Status of Actions Recommended				
		Fully Implemented	In Process of Being Implemented	Little or No Progress	Will Not Be Implemented	No Longer Applicable
Recommendation 1	3					3
Recommendation 2	2					2
Recommendation 3	3				2	1
Recommendation 4	1					1
Recommendation 5	5		2			3
Recommendation 6	1					1
Recommendation 7	3	2				1
Recommendation 8	1					1
Recommendation 9	2	1				1
Recommendation 10	2				1	1
Recommendation 11	1					1
Recommendation 12	2				1	1
Recommendation 13	2	1				1
Recommendation 14	1					1
Recommendation 15	2					2
Recommendation 16	1					1
Recommendation 17	4					4
Total	36	4	2	0	4	26
%	100	11	6	0	11	72

Overall Conclusion

As of July 26, 2017, for about 72% of our recommendations, Hydro One did not provide enough information and/or supporting documents for us to follow up with review-level assurance. As a result of the *Building Ontario Up Act, 2015* (Act), our Office no longer has the ability to conduct value-for-money audits at Hydro One or to follow up on the implementation status of recommendations from our audits conducted prior to the tabling of the Act on December 4, 2015. Since Hydro One was not required to participate in our follow-up work, we categorized these recommendations as no longer applicable.

For about 11% of our recommendations, we were able to obtain sufficient additional information ourselves to state with review-level assurance that these recommendations had been fully implemented. These were in the areas of Hydro One conducting benchmarking studies with other similar utilities relating to cost and performance, and developing strategies to improve its reliability.

For a further 6% of our recommendations, we were able to obtain sufficient additional information ourselves to state with review-level assurance that the recommendations were in the process of being implemented. These were mainly in the areas of Hydro One improving the quality of its data and enhancing the functions of an asset investment planning system called Asset Analytics.

Hydro One will not implement 11% of our recommendations, specifically those dealing with reassessing its practice of replacing assets that were rated as being in good condition before replacing assets in very poor condition, replacing assets that exceeded their planned useful service life, and shortening the vegetation-management cycle from 9.5 years to four years.

We encouraged the Ontario Energy Board (OEB) to follow up on the status of 72% of our recommendations that we previously mentioned.

The status of each of our recommendations is summarized in this report.

Background

Hydro One Inc. (Hydro One) owns one of the largest electricity delivery systems in North America, operating in three main areas that involve:

- moving electricity from power generators to large industrial customers and to most of Ontario's local distribution companies through an extensive high-voltage transmission network;
- operating, through wholly owned subsidiaries, its own distribution system that serves about 1.4 million residential and business customers; and
- managing a telecommunications system that monitors and remotely operates its transmission equipment.

Hydro One's total revenues were \$6.548 billion in the year ending December 31, 2014, while operating and other costs were \$5.801 billion, for a net income of \$747 million. Hydro One's transmission, distribution and telecommunication net assets were valued at about \$16.2 billion.

Hydro One's mandate is to be a safe, reliable and cost-effective transmitter and distributor of electricity. However, our audit found that Hydro One's transmission and distribution system reliability was worsening, while costs to maintain and improve the system were increasing and customers were experiencing more frequent power outages. Hydro One spent over \$1 billion annually from 2012 to 2014 on capital projects to sustain its transmission and distribution systems.

Some of the more significant issues we noted relating to Hydro One's transmission system included the following:

- Overall, Hydro One's transmission system reliability worsened in the five years from 2010 to 2014, with outages lasting 30% longer

and occurring 24% more often. In the same time period, Hydro One's spending to operate the transmission system and replace assets that were old or in poor condition increased by 31%. It should be noted that Hydro One's overall transmission system reliability still compared favourably to other Canadian transmitters, but had worsened in comparison to U.S. transmitters.

- Hydro One's backlog of preventive maintenance orders on its transmission system equipment increased 47% between 2012 and 2014, which contributed to equipment failures.
- Hydro One failed to replace 14 of the 18 transmission transformers it reported to be in very poor condition in its 2013–14 rate application to the Ontario Energy Board (OEB). Over the same two-year period, it replaced 37 other transformers reported in better condition. We found that two of the transformers rated in very poor condition in the OEB rate application, but not replaced, failed and resulted in outages to customers lasting 200 minutes in 2013 and 220 minutes in 2015.
- The risk of power failures can increase without an effective program for replacing transmission assets that have exceeded their planned useful service life. The number of key transmission assets, such as transformers, circuit breakers and wood poles, in service beyond their normal replacement date ranged from 8% to 26%. Replacing these assets would eventually cost Hydro One an estimated \$4.472 billion, or over 600% more than its \$621-million capital sustainment expenditure for 2014.

Some of the more significant issues we noted relating to Hydro One's distribution system included the following:

- Hydro One's distribution system had consistently been one of the least reliable among large Canadian electricity distributors between 2010 and 2014. The average duration of outages reported by members of the Canadian Electricity Association (CEA) between

2010 and 2014 was about 59% less than the duration of Hydro One's outages over the same period, while the average frequency of outages among CEA members was 30% lower.

- The principal cause of Hydro One's distribution system outages from 2010 to 2014 was broken power lines caused by fallen trees or tree limbs. Hydro One operates on a 9.5-year vegetation-management cycle, while 14 of its peer utilities operate on an average 3.8-year cycle. Hydro One's own analysis indicated that the vegetation-management work it did in 2014 cost \$84 million more than it would have under a four-year cycle, and customers would have experienced fewer outages caused by trees.
- Hydro One installed 1.2 million smart meters on its distribution system at a cost of \$660 million, but it had not used the related software and capabilities to improve its response times to power outages. At the time of our audit, smart meters were being used mainly for billing, and not to remotely identify the location of power outages before a customer called to report the outage. Such information from smart meters would have made dispatching of work crews timelier and more efficient, leading to improved customer service and cost savings.

We recommended that Hydro One should set multi-year targets and timetables for its transmission system to reduce the frequency and duration of power outages and thus improve transmission system reliability and availability; eliminate its growing preventive maintenance backlog; target assets for replacement that have the highest risk of failure, especially those rated as being in very poor condition and that have exceeded their planned useful service life; and provide accurate information to the OEB on its asset replacement activities.

For its distribution system, we recommended that Hydro One establish more ambitious goals, targets and benchmarks for system reliability performance; and lower its costs and improve reliability by shortening its vegetation-management cycle.

Our 2015 audit contained 17 recommendations, consisting of 36 actions, to address our audit findings.

Standing Committee on Public Accounts

In March 2016, the Standing Committee on Public Accounts (Committee) held a public hearing on our 2015 Hydro One—Management of Electricity Transmission and Distribution Assets audit. In December 2016, the Committee tabled a report in the Legislature resulting from this hearing. The Committee endorsed our findings and recommendations. The Committee made 10 additional recommendations and asked Hydro One to report back by April 2017. The Committee's recommendations and our follow-up on them are found in Chapter 3.

Important Events Following Our 2015 Audit

Sales of Hydro One Shares

The government passed the *Building Ontario Up Act* (Act) in June 2015 to permit the sale of up to 60% of the Province's common shares in Hydro One (the Province was the sole shareholder), with no other single shareholder allowed to hold more than 10% of the total equity. The Province then released an initial public offering of about 15% of the common shares in November 2015.

In May 2017, the Province sold another 120 million Hydro One shares. As a result, Ontario now holds just 49.9% of Hydro One's shares. In addition, as announced in July 2016, the Province agreed to sell up to 2.5% of its Hydro One shares to First Nations, depending on the level of First Nation participation. Assuming full participation, this would bring the Province's ownership to 47.4% of Hydro One.

By law, the government of Ontario is required to remain the largest shareholder, keeping at least 40% of Hydro One's shares. No other shareholder,

or group of shareholders, is permitted to own more than 10% of Hydro One.

Hydro One No Longer Subject to Scrutiny of Our Office

Effective December 4, 2015, the Act also removed the authority of our Office to conduct and report on value-for-money audits and follow-ups on Hydro One. As a result, our audit of Hydro One's management of electricity transmission and distribution assets, which commenced prior to the tabling of the Act, was our Office's last value-for-money audit of Hydro One.

Since Hydro One ceased to be an agency of the Crown following passage of the Act, it was not required to participate in this follow-up. As an act of good faith and courtesy, Hydro One nevertheless sent us a document on April 26, 2017, presenting actions it had taken to respond to our recommendations (following our formal request in late January 2017 for it to report back to us). However, as explained in more detail in the following section, it declined to provide us with any more details beside this document.

Given that our Office ceased having jurisdiction over Hydro One as of December 4, 2015, we requested that the Ontario Energy Board take the observations we made in our audit into consideration during its regulatory processes.

Status of Actions Taken on Recommendations

We conducted assurance work between April 1, 2017, and July 26, 2017. To meet new Canadian auditing standards, we requested Hydro One's CEO and/or Vice President to sign a management representation letter, dated September 1, 2017, at the completion of our work. The purpose of the letter was to obtain written representation from Hydro One that it had provided us with a complete

update of the status of the recommendations made in the original audit two years ago. On August 29, 2017, Hydro One responded that it declined to sign this letter or any similar document. Hydro One indicated that since it ceased to be an agency of the Crown following passage of the *Building Ontario Up Act, 2015*, it was not required to participate in this follow-up, and it was not appropriate for it to sign the letter.

Hydro One's update was sent to us on April 26, 2017. Normally, after receiving such an update, we have questions that need to be answered, and we request supporting documents so we can verify the information our auditee has provided. We presented our first round of questions and our request for supporting documents in early May 2017. Hydro One responded that the information it had already provided was given in good faith and as a courtesy, since it was not required to participate in our follow-up. It declined to participate any further in our follow-up process.

Since we no longer have the authority to follow up with Hydro One, we have classified all of our recommendations as no longer applicable. And since we did not have the support to verify or confirm the information Hydro One provided in April, we were unable for most recommendations to assign any other status but “no longer applicable”—with the following exceptions:

- When Hydro One clearly stated that it will not implement a recommended action, we assigned the status “Will not be implemented.”
- When we were able to obtain supporting documents ourselves to verify the information that Hydro One provided (since they were included in Hydro One's applications to the Ontario Energy Board (OEB) for rate increases, which we obtained from the OEB), we assigned either the status “Fully implemented” or “In the process of being implemented by [a specific date].”

We also determined whether the OEB had taken the observations we made in our 2015 audit

into consideration in its regulation of Hydro One's transmission and distribution rates. At the time of our follow-up, Hydro One's transmission and distribution rate applications were under review by the OEB. We noted that the OEB conducted oral hearings to examine the evidence provided by Hydro One for its rate applications and submitted over 100 questions to Hydro One in order to clarify how Hydro One had addressed the specific areas of concern cited in our 2015 report in its rate applications.

Transmission System

Recommendation 1

To ensure the reliable operation of the transmission system and to reduce the number of power outages experienced by customers, Hydro One should:

- *set multi-year targets and timetables for reducing the frequency and duration of power outages that would lead to it having a system reliability and availability that compares favourably to other utilities in North America, establish an action plan and strategy for achieving these targets, and regularly report publicly on its efforts to achieve these targets;*

Status: No longer applicable.

Details

In our 2015 audit, we found that Hydro One's transmission system had become less reliable, with longer and more frequent outages. While Hydro One's system reliability and availability were generally better than that of other Canadian electricity transmitters, reliability and availability had deteriorated over time and were worse than that of U.S. transmitters.

The document Hydro One sent us in April 2017 as a courtesy did indicate that it had done the following to improve its transmission system reliability and reduce outages:

- developed multi-year transmission reliability targets;

- implemented Transmission Strategies, which include combining planned maintenance activities into a single work-stream, to reduce planned outages and reduce the risk of delivery point interruptions to customers;
- made organizational changes that have established a Planning Analytics team to work closely with asset planners to improve performance analysis on its transmission system and to integrate this analysis into the investment planning process; and
- reviewed the outstanding defects and deficiency reports across all asset groups, which include transmission stations and lines, to ensure that all critical defects have been addressed and to mitigate the impact of equipment failures.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

- *set targets and timetables, and cost-effective action plans, to improve the poor performance of its single-circuit transmission system;*

Status: No longer applicable.

Details

Hydro One measures its transmission system reliability for areas serviced by a single-circuit system (where a customer has only one line delivering electricity) separately from areas serviced by a multi-circuit system (where a customer has multiple towers and lines delivering electricity). Our 2015 audit found that 47% of transmission outages from 2010 to 2014 occurred in Northern Ontario, where 86% of the delivery points were supplied by a single circuit.

The document Hydro One sent us in April 2017 as a courtesy did indicate that it had done and was doing the following to improve its transmission delivery point performance:

- developed multi-year transmission reliability targets;

- annually conducting an analysis of transmission delivery point performance to determine remedial options for affected customers and to provide data that can be integrated into its future business plans to improve system reliability;
- annually conducting an analysis of five-year and 10-year transmission reliability performance to further investigate system reliability issues and to identify remedial options for affected customers in accordance with the Customer Delivery Point Performance Standards;
- annually reviewing customer delivery point performance; and
- annually communicating its plans for improvement activities to affected customers.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

- *more thoroughly analyze outage data on both its single- and multi-circuit systems to correct the main issues that are contributing to the system's declining reliability.*

Status: No longer applicable.

Details

Our 2015 audit found that the difference in transmission reliability for areas serviced by a single-circuit system and those serviced by a multi-circuit system was significant. Outages mainly occurred in Northern Ontario, where the majority of the delivery points are supplied by a single circuit. But Hydro One's reliability also deteriorated significantly in multi-circuit areas, with longer and more frequent outages.

The document Hydro One sent us in April 2017 as a courtesy did indicate that it had done and was doing the following to improve its transmission delivery point performance:

- annually conducting an analysis of transmission delivery point performance to determine

remedial options for affected customers and to provide data that can be integrated into its future business plans to improve system reliability;

- annually conducting an analysis of five-year and 10-year transmission reliability performance to further investigate system reliability issues and to identify remedial options for affected customers in accordance with the Customer Delivery Point Performance Standards;
- completed a high-level analysis comparing five-year historic transmission reliability performance to maintenance program spending to identify opportunities for shifting program funding to those asset classes contributing to long outages; and
- supplemented its analyses with a model to quantify reliability risk in order to improve its ability to measure the effect of investment on transmission reliability.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

Recommendation 2

To ensure that Hydro One has an effective preventive maintenance program for all its critical transmission system assets to ensure they operate reliably and their expected service life is not shortened, Hydro One should:

- *establish a timetable that eliminates its growing preventive maintenance backlog as soon as possible;*

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One had a growing backlog of preventive maintenance on transmission system equipment, and this lack of maintenance led to equipment failures. From 2012 to 2014, the backlog of preventive maintenance

increased by 47%, and the total number of equipment failures increased by 7%.

The document Hydro One sent us in April 2017 as a courtesy did indicate that the backlog we reported in our 2015 audit was partially due to one-time testing to ascertain the level of polychlorinated biphenyls (PCBs) in oil-filled equipment older than 1985. The testing is not expected to be completed until 2021. The test results will help Hydro One determine whether the equipment needs to be replaced to comply with federal regulations to phase out PCBs.

Our research found that PCBs are chemicals once used mainly for electrical equipment. Canada prohibited the manufacture, process, import and sale of PCBs in the 1970s because of their toxicity. To further reduce the release of PCBs into the environment, the federal government amended the PCB regulations in 2015 by setting an end-of-use deadline of December 31, 2025, for specific equipment located at electrical generation, transmission and distribution facilities.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying Hydro One's information about the one-time testing and its role in the maintenance backlog.

- *improve its oversight of preventive maintenance programs to ensure maintenance is completed as required and on time.*

Status: No longer applicable.

Details

Our 2015 audit noted that the preventive maintenance backlog existed because Hydro One did not have sufficient staff available to perform all scheduled maintenance. The situation had worsened since 2012, as maintenance staff had been assigned to complete capital projects to repair or refurbish Hydro One's aging transmission system.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had developed accountabilities and processes for

maintenance order generation, prioritization, redirection, scheduling, cancellation and deferral. This includes a control whereby no critical preventive maintenance orders can be deferred without approval from Asset Management.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

Recommendation 3

To reduce the risk of equipment failures that can cause major power outages on the transmission system, Hydro One should:

- *ensure that its asset replacement program targets assets that have the highest risk of failure, especially those rated as being in very poor condition;*

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One did not replace assets in very poor condition and at very high risk of failing. During 2013 and 2014, Hydro One replaced only four of the 18 power transformers it deemed to be in very poor condition. Two of these transformers failed and resulted in outages. Hydro One planned to replace in 2015 and 2016 only eight of the 34 power transformers that were rated at very high risk for failure.

The document Hydro One sent us in April 2017 as a courtesy did indicate that it has implemented investment planning processes and trained planning engineers to develop asset renewal plans based on multiple risk factors. The document also stated that to support its choice of which transformers to replace in 2017 and 2018, Hydro One conducted assessments and prepared engineering reports based on an Asset Risk Assessment (ARA) process outlined in its 2017/18 rate application to the OEB.

Since Hydro One did not provide further details on the ARA process, we reviewed Hydro One's 2017/18 rate application to find out more. We

noted that the ARA process takes into account each asset's condition, demographics, performance, criticality, economics and utilization based on data analyses and engineering studies. Hydro One collects this data during routine maintenance, inspections and testing done for planning purposes. In assessing asset needs, asset planners also consider other factors such as obsolescence, environmental risks and requirements, compliance obligations, equipment defects, health and safety considerations, and customer needs and preferences. Asset planners then make recommendations regarding what investments should be made. The ARA process is only one step in the asset planning process and does not replace decisions made by engineers who physically inspect the assets.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying whether and how well Hydro One actually implemented the ARA process.

- *reassess its practice of replacing assets that are rated as being in good condition before replacing assets in very poor condition;*

Status: Will not be implemented. The Office of the Auditor General continues to support the implementation of this recommendation.

Details

In our 2015 audit, we found that Hydro One's transmission assets in very poor condition were not replaced while others in reportedly better condition were. We questioned how Hydro One asset management staff prioritized transmission assets for replacement when assets known to be in very poor condition were not replaced. We also found that Hydro One's asset investment planning system—Asset Analytics—did not record and consider key factors that affected asset investment decisions, including those related to technological/manufacturer obsolescence, known defects, environmental impact and health and safety.

Hydro One informed us that it had considered our recommendation but decided not to implement it.

Hydro One indicated that the findings in our 2015 audit regarding asset replacement were based solely on asset condition information without considering other factors that Hydro One uses in making asset replacement decisions. For example, Hydro One may decide to replace assets in good condition based on other factors such as environmental impact, health and safety issues, and customer needs and preferences, while assets that have deteriorated but have no significant impact on the system may not need immediate replacement.

- *replace assets that have exceeded their planned useful service life.*

Status: Will not be implemented. The Office of the Auditor General continues to support the implementation of this recommendation.

Details

Our 2015 audit found that Hydro One did not have an effective program for replacing transmission assets beyond their planned useful service life. This increases the risk of power failures.

Hydro One informed us that it had considered our recommendation but decided not to implement it.

Hydro One explained to us that an asset's expected or planned useful service life is the average time in years that an asset can be expected to operate under normal conditions. But Hydro One does not believe that an asset older than that expected age necessarily needs immediate replacement. Hydro One acknowledged that it has such older assets; however, its asset management objective is to maintain asset performance while minimizing costs, to the benefit of ratepayers. It therefore does not replace assets that, while old, are in good working condition. The aim is to maximize the life expectancy of an asset and optimize work efficiency.

Recommendation 4

Hydro One should ensure that its applications for rate increases to the Ontario Energy Board provide accurate

information on its asset replacement activities, including whether it actually replaced assets in poor condition that were cited in previous applications and whether the same assets in poor condition are being resubmitted to obtain further or duplicate rate increases in current applications.

Status: No longer applicable.

Details

In our 2015 audit, we found that Hydro One did not follow through on the information it provided the Ontario Energy Board (OEB). For example, Hydro One's 2015/16 rate application indicated it would replace 43 transformers. They included 13 that had been rated in very poor condition in Hydro One's 2013/14 rate application and had been funded for replacement then but were not replaced. For the second year in a row, the OEB approved rate increases to fund replacing these transformers.

The document Hydro One sent us in April 2017 as a courtesy did indicate that it had done the following to ensure that its rate increase applications give an accurate picture of asset replacement:

- engaged a third-party expert, Electric Power Research Institute, to review its transformer fleet health (condition) assessment, which supported Hydro One's assessment methodology and verified that Hydro One's rate applications have accurately reflected its asset replacement activities;
- aligned its asset replacement rates and pacing of investments with customer needs and preferences, which have been reflected in its rate applications; and
- outlined in its rate applications its replacement strategies for transformers and breakers, its selection process and its execution methodology, thus providing the OEB with the rationale behind its asset replacement activities.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

Recommendation 5

To ensure Hydro One is replacing assets that are at the highest risk of failure as determined through accurate asset condition ratings, Hydro One should:

- enhance its Asset Analytics system to include information on all key factors that affect asset investment decisions, including those related to technological/manufacturer obsolescence, known defects, environmental impact and health and safety;

Status: In the process of being implemented by the fourth quarter of 2020.

Details

Our 2015 audit found that Hydro One's asset investment planning system—Asset Analytics—did not record and consider a number of key factors, including technological or manufacturer obsolescence information, known defects in the assets, environmental impact, and health and safety concerns. As a result, assets that needed replacing were not always being identified.

Hydro One informed us that the Asset Analytics system is one tool used to help it make asset investment decisions, but its results are not the only factor considered in making these decisions. The purpose of the system is to provide asset planners with convenient access to asset data to assess emerging risk factors in an efficient manner. Asset planners then make asset replacement decisions based on not only data from the system but also other factors—demographics, criticality, economics, obsolescence, environmental risks and requirements, compliance obligations, equipment defects, health and safety considerations, and customer needs and preferences.

Since Hydro One would not provide further details on the Asset Analytics system, we obtained its 2017/18 application to the OEB for rate increases, in which Hydro One indicated that the system requires remediation because the existing risk factors have remained unchanged since the initial deployment of the system (asset planners use

risk factors to support maintenance programs and plan future investments). Hydro One was planning to implement a project to update the system's risk factors. The project will refine the existing risk factors to improve the quality of asset-planning data and decisions. Key elements of the project will include:

- adding two new risk factors, including an obsolescence risk factor and a health, safety and environmental-impact risk factor;
- modifying the existing risk factors by adding new supporting factors and adjusting the weighting of such factors to improve the prioritization of assets for work and replacement; and
- training end-users on the changes to the system.

The planned completion of the project is by the fourth quarter of 2020.

- review and adjust current weighting assigned to risk factors in Asset Analytics to more accurately reflect their impact of asset condition and risk of failure;

Status: In the process of being implemented by the fourth quarter of 2020.

Details

Our 2015 audit noted that the Asset Analytics system applies six factors to evaluate asset condition: the age of the asset; the asset's condition; the amount spent on repairs to the asset; how much the asset is used relative to its capacity; its performance reliability (assessed using unplanned outages data); and its importance (based on the number of customers it serves). The system weighs all six factors for each asset type to generate a risk score for making asset replacement decisions. However, our audit found that the system did not properly weigh the risk posed by certain conditions that may shorten asset life.

As previously noted, Hydro One's 2017/18 application to the OEB for rate increases outlined a project to update Asset Analytics risk factors.

The project will refine the existing risk factors to improve the quality of asset-planning data and decisions. The planned completion of the project is by the fourth quarter of 2020.

- *make changes to its Asset Analytics system and procedures so that updates to its data are complete, timely and accurate;*

Status: No longer applicable.

Details

Our 2015 audit found that the Asset Analytics system did not provide complete and accurate information. Key information was often not included, or incorrectly weighted, in the system.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had initiated a data remediation project to address data quality, collection and functionality issues relating to the Asset Analytics system. Hydro One told us it had completed the following data and functionality improvements to the system in 2015 and 2016:

- Data from transmission stations had increased from 35% to 85%, and data from transmission lines had increased from 50% to 70%.
- Data from distribution stations had increased from 35% to 60%; work was ongoing to increase data from distribution lines data from 69% to 85% by the end of 2017.
- Work to improve distribution data, such as the number of poles and pole-top transformers, and to develop a dashboard for distribution lines, was ongoing, with a targeted completion date of the end of 2017.
- Dashboards to show population levels, missing data reports and the effectiveness of new assets were established for all transmission and distribution asset classes.
- About 30% to 40% of asset characteristics being collected in the Asset Analytics system that were not required were deleted.
- More than 250 data templates in the Asset Analytics system were revised to improve the quality of data entry and provide clear direction to staff.

In addition, Hydro One told us it had updated its Transmission Lines Geographical Information System (TLGIS), which stores images, photographs and videos of transmission line assets. Asset planners can now use the Asset Analytics tool to view the transmission network in the TLGIS environment. The details stored in the TLGIS will be updated each year and as assets change.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

- *conduct a comprehensive review of the data quality in Asset Analytics to update any incomplete or erroneous information on its assets and to ensure the information can support its asset replacement decision-making process;*

Status: No longer applicable.

Details

Our 2015 audit found that the Asset Analytics system did not provide complete and accurate information to support Hydro One's asset replacement decision-making process. As a result, not all of the assets that needed replacing were being identified. For example, oil leaks are one of the leading reasons for replacing a transformer; however, the presence of oil leaks has very little impact on Asset Analytics's scoring of the risk of the asset failing and the need to replace it.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had initiated a data remediation project to address data quality, collection and functionality issues relating to the Asset Analytics system. The document stated that Hydro One had completed data and functionality improvements in 2015 and 2016.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

- *investigate why known deficiencies in the reliability of the Asset Analytics system, such as those found two years earlier by internal audits, have not been corrected by management in a timely manner.*

Status: No longer applicable.

Details

In our 2015 audit, we noted that in 2013, Hydro One's internal auditors found that 21% of defective equipment notifications recorded by maintenance staff did not accurately identify the transmission asset that was defective. As a result, the defective asset was not entered into Hydro One's database. Our testing found that this problem still existed in 2015.

The document Hydro One sent us in April 2017 as a courtesy did not have any information on this finding and recommendation.

Hydro One also would not provide us with any more information, so this follow-up has no information to report on this recommendation.

Recommendation 6

Hydro One should ensure that its applications to the Ontario Energy Board for rate increases include accurate assessments of the condition of its assets.

Status: No longer applicable.

Details

Our 2015 audit noted that Hydro One included inaccurate condition ratings for some of its assets in its applications to the OEB for rate increases. Specifically, some of the assets that Hydro One replaced or planned to replace from 2013 to 2016 were inaccurately rated as being in good or very good condition. The main reason for these inaccuracies was the unreliable data in Hydro One's information systems.

The document Hydro One sent us in April 2017 as a courtesy did state that Hydro One has endeavoured to ensure the data submitted to the OEB for rate setting accurately reflects asset conditions. Hydro One said that our 2015 report focused on the information about investments that appeared

in successive applications to the OEB and that, in practice, investments might be delayed because of work delays and changing circumstances leading to changes in priority. Hydro One said that it used the best information available at the time concerning its capital spending plans to file its 2017/18 application. Hydro One also indicated that it is prepared to explain variations from its previous plans and/or OEB-approved spending amounts, compared to actual work completed.

The document also stated that Hydro One had initiated a data remediation project to address data quality, collection and functionality issues relating to the Asset Analytics system, ensuring that its rate applications to the OEB have accurate information on the condition of its assets.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

Recommendation 7

To ensure that its maintenance expenditures on the transmission system are cost-effective, and activities produce more timely improvements to the reliability of the transmission system, Hydro One should conduct:

- *an assessment of its past maintenance expenditures and activities to determine what changes and improvements can be made to more effectively focus its efforts on the critical factors that improve system reliability and how its planned maintenance and capital improvements work can be completed with less risk of service disruption;*

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One's overall increased spending to maintain and operate the transmission system from 2010 to 2014 did not result in improved system reliability. The average frequency of outages of Hydro One's multi-circuit transmission system increased 24% over this period, primarily due to an increase in the number of

unplanned outages, such as those caused by equipment failure or weather.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One has conducted a high-level analysis of transmission reliability relative to spending on maintenance to identify opportunities for shifting program funding to those asset classes that have contributed to significant outage duration, in addition to:

- annually conducting an analysis of transmission delivery point performance to determine remedial options for affected customers and to provide data that can be integrated into its future business plans to improve system reliability;
- annually conducting an analysis of five-year and 10-year transmission reliability performance to further investigate system reliability issues and to identify remedial options for affected customers in accordance with the Customer Delivery Point Performance Standards; and
- supplementing its analyses with a model to quantify reliability risk in order to improve its ability to measure the effect of investment on transmission reliability.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

- *benchmark cost assessments with other similar North American transmitters to compare its results with those that have reasonable expenditures and that maintain reliability;*

Status: Fully implemented.

Details

In our 2015 audit, Hydro One acknowledged that its transmission cost measures could be benchmarked against those of other utilities, but it had not attempted to do so since the Canadian Electricity Association stopped annually comparing costs of all major Canadian transmitters in 2009.

The document Hydro One sent us in April 2017 as a courtesy indicated that Hydro One had engaged a third party to conduct a cost and reliability performance benchmarking study—the “Total Cost Benchmarking Study”—which Hydro One submitted as part of its 2017/18 application for rate increases to the OEB.

We reviewed the study as it appeared in the rate application. The study was completed in May 2016 and included a set of benchmarks comparing Hydro One’s total transmission cost and performance against peer utilities in Canada and the United States. The study focused on five key areas: cost, reliability, project management, safety and staffing. In most areas, Hydro One’s transmission business benchmarked well relative to the peer group. The study reported the following:

- Hydro One’s total spending on transmission lines and stations was among the lowest in the peer group.
- Hydro One’s sustained outage frequency for the lower voltage lines was the highest in the peer group. Momentary outage frequency was also among the highest in the peer group.
- Hydro One put significant project management resources in place to manage its large annual capital investment plan. The number of project managers on staff exceeded the peer group average. Its project estimates were relatively accurate.
- Hydro One’s lost time severity rate (the time lost as a result of work-related injuries or illnesses) was low compared to the peer group. Its vehicular incident rate (the frequency rate of both preventable and non-preventable motor vehicle accidents) was also lower than the peer group average.
- Hydro One’s wage rates were close to the peer group average. Hydro One’s hourly cost of overtime was higher than the peer group average, but overtime usage was consistent with the group average.

- a study of other leading cost-effective transmitters and consider implementing their best practices to quickly improve Hydro One's reliability and improve its costs.

Status: Fully implemented.

Details

In our 2015 audit, we noted that the OEB recognized the need for Hydro One to compare its costs with those of Hydro One's costs with other similar transmitters. As part of the OEB's January 2015 decision to award Hydro One a transmission system rate increase for 2015/16, Hydro One agreed to complete an independent transmission cost benchmarking comparison study, and to provide it to the OEB in spring 2016 as part of its next rate application for 2017/18.

As previously mentioned, Hydro One did have a third party conduct this study and we had access to it as it appeared in Hydro One's 2017/18 application to the OEB. In addition to the key findings listed in the previous section, the study identified industry best practices and made the following recommendations to Hydro One based on these best practices:

- Reassess and adjust performance indicators across all levels of the organization.
- Target a corrective maintenance spending that is about 25% of total corrective and preventative spending.
- Assess opportunities to reduce administrative costs.
- Continue building on the use of external resources for engineering to create a pipeline of construction-ready projects.
- Manage contingency budgets at the corporate level.
- Allocate project management resources to improve effectiveness.
- Formalize a rolling two-year capital budget and project portfolio and reporting framework.
- Refresh the formal driver training program.

Recommendation 8

To ensure a robust and high level of security for the transmission system to mitigate the risk of service disruptions due to sabotage, vandalism, software viruses, and unauthorized or unintentional changes to device software or controls, Hydro One should develop a comprehensive security framework to cover all its electronic devices. The framework should include best practices for security over electronic devices, including establishing standards similar to those set by the North American Electricity Reliability Corporation, performing security vulnerability risk assessments on all electronic devices, establishing appropriate actions and controls to mitigate security risks to an acceptable level, and conducting regular audits to validate that the security framework has been adhered to.

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One had weak security for most of the electronic devices on its transmission system. The North American Electricity Reliability Corporation (NERC) has security standards for North American transmitters' electronic devices that are critical for the whole continent's electricity system and that could have an impact on other jurisdictions. Only 18% of Hydro One's transmission stations fall under the NERC security standards, and only 17% of Hydro One's electronic devices fall under NERC's definition of critical devices. Hydro One's security policies are less rigorous for those of its electronic devices not required to comply with NERC standards. There was also no requirement for Hydro One's security policies to be tested periodically to ensure compliance.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had developed a comprehensive security framework called the Security Code of Practice, which includes Hydro One's Security Policy and Security Operating Standards and had been implemented in compliance with version 5 of NERC's Critical Infrastructure Protection Standards.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

Distribution System

Recommendation 9

In order to improve the reliability ratings for its distribution system, Hydro One should:

- *establish more ambitious performance goals, targets and benchmarks for system performance;*

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One's distribution system was one of the least reliable among large Canadian electricity distributors between 2010 and 2014, with no improvement over this time period. The total number of distribution-side power outages increased by 11%, primarily due to equipment failures.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One was planning to have set multi-year distribution reliability targets by the end of April 2017.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

- *develop short- and long-term strategies for new and enhanced activities and cost-effective investments that will improve its overall reliability record.*

Status: Fully implemented.

Details

Our 2015 audit found that Hydro One was among the worst-performing large Canadian electricity distributors from 2010 to 2014. In a scorecard published by the OEB in 2014, Hydro One was ranked the worst distributor in Ontario for the duration of its outages

in 2013 and the second-worst distributors in Ontario for the frequency of its outages in 2013.

The document Hydro One sent us in April 2017 indicated that Hydro One had done the following to improve its distribution reliability record:

- implemented distribution strategies, which include expanding renewal programs for distribution lines and stations, improving control-room visibility and the control-ability of devices, and focusing vegetation-management programs on large commercial/industrial customers;
- updated its distribution investment prioritization matrix, including giving greater weight to reliability and increasing priority categories to give field crews more direction in their work and to cut lower-priority work if funding constraints are encountered;
- required monthly monitoring and reporting of distribution work accomplishments "on a more granular level (including program completions)" (in the absence of clarification from Hydro One, we interpret this to mean requiring more detailed reporting);
- required annual monitoring of the scope of work in station refurbishments; and
- developed a Distribution System Plan (DSP) for 2018–2022 that incorporates strategic updates based on feedback from consultations with customers, along with adjusted investments in programs to improve the reliability of specific underperforming distribution assets.

We were able to review this DSP because it was included in Hydro One's most recent rate application to the OEB, which we obtained. Our review noted that the DSP has reflected customer needs and preferences, and that Hydro One had taken or was planning to take actions to address customer feedback. For example:

- Residential and small-business customers requested that Hydro One maintain its existing level of reliability. In response, Hydro One assessed the condition of its key assets and developed an investment plan to sustain

reliability performance through system renewal projects and programs such as the Pole Replacement Program, Distribution Station Refurbishment Projects and Line Renewal Projects.

- Large industrial customers ranked improved power quality as their top priority. In response, Hydro One created a program that will install power quality meters and surge arresters to help customers figure out the source of any power quality issue. Hydro One also increased funding for reliability enhancement projects targeted to mid-size industrial customers.

Recommendation 10

To lower costs and ensure Hydro One’s vegetation-management program is effectively reducing the number of tree-related outages experienced by its distribution system customers, Hydro One should:

- *shorten its current 9.5-year vegetation-management cycle to a more cost-effective cycle of less than four years, in line with other similar local distribution companies;*

Status: Will not be implemented. The Office of the Auditor General continues to support the implementation of this recommendation.

Details

Our 2015 audit found that Hydro One experienced more outages caused by fallen trees or tree limbs because Hydro One did not trim back trees as often as other utilities did. Hydro One was operating on a 9.5-year vegetation-management cycle—over double the length of the cycles in use by similar local distribution companies. Hydro One’s vegetation-management costs in 2014 were \$84 million higher than they would have been under a four-year cycle.

Hydro One informed us that it had considered our recommendation but decided not to implement it.

Hydro One also told us that it introduced a new On-Cycle Maintenance Program in 2016 and adjusted the 9.5-year vegetation-management cycle

to an eight-year cycle. Hydro One believes that any shorter of a cycle (such as a four-year cycle as we recommended) is not economically feasible.

- *change the way it prioritizes lines that need clearing so that lines with more frequent tree-related outages are given higher priority and work crews are dispatched sooner.*

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One’s system for designating distribution lines for vegetation management did not prioritize areas where trees caused outages. Instead, as the examples we found attested, Hydro One did vegetation management for distribution lines that had few tree-caused outages. The result of poor prioritizing was a 5% increase in tree-caused outages between 2010 and 2014.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had reviewed the vegetation-management program and would review it annually going forward. It also stated that Hydro One had improved its prioritization model by giving greater weight to reliability, thus making reliability a major driver of prioritization. It further stated that Hydro One had improved its deployment of work crews and implemented flexible locational work to focus on areas with more tree-related outages.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

Recommendation 11

To ensure that management decisions on replacing distribution system assets are made using reliable and complete information, Hydro One should take the actions needed to ensure its Asset Analytics system provides timely, reliable, accurate and complete information on the condition of assets.

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One's Asset Analytics system, a key tool for making replacement decisions, had incomplete and unreliable data on distribution assets. For example, there was limited data available to evaluate all 152 distribution-station breakers; and 14 distribution-station power transformers that were under 10 years old were mistakenly assigned age scores of 100, well past the 40-year expected service life of such transformers.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had initiated a data remediation project to address data quality, collection and functionality issues relating to the Asset Analytics system. It also said that Hydro One had completed improvements for the system's data and functionality in 2015 and 2016.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

Recommendation 12

To reduce the risk of equipment failures that can cause power outages on the distribution system, Hydro One should:

- *replace assets that have exceeded their planned useful service life;*

Status: Will not be implemented. The Office of the Auditor General continues to support the implementation of this recommendation.

Details

Our 2015 audit found that Hydro One did not replace distribution system assets that had exceeded their planned useful service life, increasing the risk of power failures. For example, of Hydro One's 1.6 million wood poles, 202,000 (or 13%) had exceeded their 62-year expected service life and only about 12,000 poles were replaced each year. From 2010 to 2014, there were 47 outages caused by fallen wood poles.

Hydro One informed us that it had considered our recommendation but decided not to implement it.

Hydro One explained to us that an asset's expected or planned useful service life is the average time in years that an asset can be expected to operate under normal conditions. But Hydro One does not believe that an asset older than that expected age necessarily needs immediate replacement. Hydro One acknowledged that it has such older assets; however, its asset management objective is to maintain asset performance while minimizing costs, to the benefit of ratepayers. It therefore does not replace assets that, while old, are in good working condition. The aim is to maximize the life expectancy of an asset and optimize work efficiency.

- *reassess its planned expected service life for assets and justify any variances in the years used by Hydro One compared to other similar local distribution companies.*

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One set the planned useful life for its distribution system assets longer than other comparable local distribution companies (LDCs). For wood poles, Hydro One expected a 62-year service life, while other LDCs expected a service life of only 44 years. For station transformers, Hydro One's expected service life was 50 years, whereas that of other LDCs was 45 years.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had reviewed the expected or planned service life values for key asset classes, which it found were valid and in line with other utilities.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

Recommendation 13

To ensure that its capital sustainment and maintenance expenditures on the distribution system are cost effective and produce more immediate improvements to the reliability of the distribution system, Hydro One should:

- *conduct an assessment of its past maintenance expenditures and activities to determine how to focus efforts on more critical factors that affect the system;*

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One's increased spending on capital sustainment and on operations, maintenance and administration (OM&A) for its distribution system did not result in improved system reliability. While Hydro One's 18% overall increase in spending in these two areas from 2010 to 2014 would have been expected to improve system reliability and result in fewer equipment failures, outages had actually increased by 11% over this period.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had assessed its past maintenance expenditures and activities, with a focus on critical factors and contributors to distribution reliability. It also said Hydro One had undertaken strategic updates to its distribution programs and projects based on customer feedback during the third quarter of 2016. Hydro One told us it included these updates in the Investment Summary Documents as part of its Distribution System Plan.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

- *benchmark cost assessments with other similar local distribution companies (LDCs) in Ontario and Canada, and consider implementing the best practices of the leading cost-effective LDCs.*

Status: Fully implemented.

Details

Our 2015 audit noted that, according to a 2013 study, Hydro One's operations, maintenance and administration (OM&A) and capital sustainment costs were higher than other similar LDCs. The Canadian Electricity Association also found that Hydro One had higher costs than the average of its members from 2006 to 2010. As well, in 2014, the OEB gave Hydro One its lowest cost-efficiency ranking among distributors. Hydro One's actual costs were more than 25% higher than what the OEB expected.

The document Hydro One sent us in April 2017 as a courtesy indicated that Hydro One had participated in benchmarking studies to support its approaches to the investment, maintenance and sustainment activities included in its 2017/18 distribution rate application. These studies included vegetation management, the pole replacement program, and the station refurbishment program. The document also indicated that in 2016, Hydro One arranged for an independent third-party review of its Distribution System Plan (DSP), providing unit-cost validation for its forestry, pole replacement and station refurbishment programs.

We obtained Hydro One's 2017/18 rate application from the OEB. This enabled us to verify that Hydro One had engaged third parties to conduct benchmarking studies to assess its distribution system performance and examine best practices. The key findings from each major study were as follows:

- The Pole Replacement Program Study found that Hydro One's costs are in line with the average of the comparison group, with low unit costs for inspections and average costs for replacement of poles; Hydro One inspects its poles more frequently than most utilities, but Hydro One replaces its poles less frequently than do the comparison utilities.
- The Distribution Station Refurbishment Program Study noted that utilities' refurbishment activities vary widely, limiting the ability to make comparisons; it nevertheless could observe that Hydro One's costs for individual station refurbishments are within the range observed across the comparison utilities.

- The Vegetation Management Program Study found that Hydro One has high unit costs compared to the peer group due to heavy workloads associated with long cycle lengths and higher costs for labour and equipment, and that Hydro One is below the peer group average for tree-related outages per system kilometre.
- The Total Compensation Study showed that on an overall weighted basis, Hydro One's compensation amounts are 14% higher than the market median at industry comparator organizations.

Recommendation 14

To lower its repair costs and improve customer service relating to power outages through more accurate and timely dispatches of its repair crews, Hydro One should develop a plan and timetable for using its existing smart meter capability to pinpoint the location of customers with power outages.

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One installed 1.2 million smart meters on its distribution system at a cost of \$660 million, yet it did not implement the related software and capabilities to improve its response times to power outages. Hydro One used smart meters predominantly for billing purposes, but not for the purpose of remotely identifying the location of power outages in the distribution system before a customer calls to report the outage.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had approved a pilot project called the Advanced Metering Infrastructure for Operations and the Advanced Metering Infrastructure for Analytics. The project is to integrate smart meter outage data to the outage management system, enabling Hydro One to monitor asset loading information in order to avoid premature and possible unplanned asset failures due to overloaded equipment. In addition to being able to ping meters to determine whether

customers have power at their premises and avoid re-dispatching crews for further repair work, the project is to deliver further value by consolidating multiple meters without power and showing the scope of a power outage to the control room operators. Hydro One indicated that it had confirmed the project's requirements and scope and selected vendors. Hydro One's document to us stated that the project was expected to be completed by the end of 2017.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

Spare Transformers in Storage Not Aligned with Hydro One's Needs

Recommendation 15

To reduce its excess inventory of spare transmission and distribution system transformers to an appropriate cost-effective level, and to lower costs while still being able to replace failed transformers in a timely manner, Hydro One should:

- *improve the forecasting model it uses for predicting transformer failures, and maintain its inventory levels of spare transformers in accordance with the forecasts;*

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One did not have a cost-effective strategy for ensuring it had an appropriate number of spare transformers on hand, resulting in an excessive number of spare transformers in storage. Hydro One used a model to help forecast the number of transformers it would need to keep in storage, but it did not apply the model to the vast majority of types of distribution system transformers and did not follow the model to determine the number of spares to stock.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had updated its forecasting model (called the Markov Model) to predict its need for spare transformers. The document stated that the model uses industry-proven strategic spares risk-analysis methodology to determine the appropriate quantity of operating spares. Hydro One also indicated that it had implemented Transmission and Distribution Spares Strategies to address key issues, including reducing existing inventory, reinforcing a “first-in-first-out” policy and establishing the shelf life of spare transformers to trigger mandatory deployment.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

- *develop a plan to standardize in-service transformers as much as possible, and set targets and timelines for achieving savings from better managing both spare and in-service transformers.*

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One had already saved \$50 million to \$60 million since 2009 by standardizing transmission system transformers; however, no similar plans were in place for standardizing distribution system transformers. We estimated that another \$25 million in savings over 10 years could be forgone if no changes were made to standardize distribution system transformers. We also estimated that this savings could be much higher, ranging from \$50 million to \$70 million, by not buying more spare transformers over the next 10 years.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had taken the following actions to standardize and manage its power transformers:

- reviewed its transmission power transformer fleet for further standardization and determined that its existing 14 procurement stan-

dards are sufficient, so adopting additional standards would have limited value;

- reviewed its distribution power transformer fleet, revised its procurement standards (reducing them from 60 to 45) and documented its calculation of savings and timelines for achieving such savings;
- reviewed and documented its power transformer inventory at the Central Maintenance Shop storage area to ensure that the required level of inventory is maintained (with plans to continue to do this annually); and
- reviewed and updated the asset data in its system to improve the tracking of available spares and their deployment status (with plans to continue to do this annually).

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

Data from Power Quality Meters Not Used to Help Customers Avoid Disruptions

Recommendation 16

To minimize the number and impact of power quality events for its large customers, Hydro One should proactively use the data collected by its power meters to help assess the frequency and location of power quality events on its transmission and distribution systems and thereby improve the reliability of the power supply.

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One did not proactively correct power quality issues, such as fluctuations in voltage levels, on its transmission and distribution systems. Hydro One had installed 138 power quality meters since 2010; however, it did not monitor and analyze the data from these meters to improve system reliability for its customers. Instead, Hydro One addressed the issues only if customers complained.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had completed system studies to estimate the magnitude, frequency and duration of sags in voltage levels. The document stated that the information provided by the studies will enable Hydro One to identify and undertake initiatives to minimize the impacts of power quality events on customers. Hydro One also indicated that it had been working with its customers to enable their power meters to serve as power quality meters, which will allow Hydro One to assess power quality events and their impacts on customers. As well, Hydro One said it had engaged third-party experts to assess customers' premises and recommend measures to increase customers' resilience to minor or moderate power quality events.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

Weak Management Oversight Processes over Capital Project Costs

Recommendation 17

To ensure that management can better manage and monitor capital projects that use its own workforce, as well as lower project costs, Hydro One should:

- *use industry benchmarks to assess the reasonableness of capital construction project costs, and whether using internal services and work crews is more economical than contracting out capital projects;*

Status: No longer applicable.

Details

Our 2015 audit found that Hydro One did not assess whether its spending on capital construction projects was reasonable or competitive with industry standards. While Hydro One spent over \$1 billion annually from 2012 to 2014 on capital projects to sustain its transmission and distribution systems,

it had weak oversight processes to minimize project costs, and it did not regularly analyze or benchmark its internal costs to industry standards.

We were able to obtain details on Hydro One's Total Cost Benchmarking Study (see the second action of Recommendation 7) by reviewing Hydro One's 2017/18 rate application to the OEB. This study noted that Hydro One's overall direct capital expenditures between 2010 and 2014 were generally below those of its peer group.

The document Hydro One sent us in April 2017 as a courtesy indicated that Hydro One had refined its internal work breakdown structure to enable a more efficient, consistent and accurate process for capturing actual project costs and comparisons. In addition, Hydro One indicated that it had been working with peer Canadian utilities to establish a consistent approach to benchmarking capital project work. The initial focus has been on transmission lines projects, with plans to move on later to substation projects.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information on Hydro One's use of industry benchmarks to assess the reasonableness of capital construction project costs.

Furthermore, neither the Total Cost Benchmarking Study nor information provided in Hydro One's April 2017 courtesy document have any details on whether using internal services and work crews is more economical than contracting out capital projects.

- *use and adhere to contingency and escalation allowances that are more in line with industry norms for capital construction projects;*

Status: No longer applicable.

Details

Our 2015 audit found that all Hydro One's capital project cost estimates included, on average, a 20% contingency allowance and an 8% escalation allowance over and above the original estimates. Such large allowances gave Hydro One staff little

incentive to complete a project at its original cost estimate or develop more accurate cost estimates for projects.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had reviewed and adjusted the contingency and escalation allowances, and that escalation allowances are in line and consistent with its business plan.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

- *improve its management reporting and oversight of project costs by regularly producing reports that show actual project costs and actual completion dates compared to original project cost estimates, cost allowances used, original approved costs, subsequent approvals for cost increases, and planned completion dates;*

Status: No longer applicable.

Details

Our 2015 audit found that the reports received by Hydro One's senior management on the progress of capital projects did not include enough detail about costs and timelines to allow them to effectively assess how well a project was being managed. The project management reporting system was not designed to compare original cost estimates and completion dates with the final costs and dates.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had implemented a quantitative project risk management methodology and a formalized project clos-

ure reporting process, which includes all project stakeholders, to analyze the project plan and the effectiveness of its execution.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.

- *regularly analyze its success in preparing project estimates by comparing them with final project costs.*

Status: No longer applicable.

Details

In our 2015 audit, we found that several completed projects had cost overruns. We noted the following common causes for the overruns: the complexity and magnitude of the work was significantly underestimated at the planning stages; in-depth site visits either were not conducted or were insufficient for understanding the magnitude and complexity of the project; and unit costs used in the estimation process were not current.

The document Hydro One sent us in April 2017 as a courtesy did indicate that Hydro One had implemented a quantitative project risk management methodology and a formalized project closure report process, which includes all project stakeholders, to analyze the project plan and the effectiveness of its execution.

However, Hydro One would not provide us with any more details or supporting documents, which prevented us from verifying this information from Hydro One.