DEMARCO
ALLAN
LLP

5 Hazelton Avenue, Suite 200
Toronto, ON M5R 2E1
TEL +1.888.389.5798
FAX +1.888.734.9459
www.demarcoallan.com

Lisa (Elisabeth) DeMarco
Senior Partner
CEL +1.647.991.1190
lisa@demarcoallan.com

August 12, 2016

Filed on RESS and Sent via Courier

Kirsten Walli
Board Secretary
Ontario Energy Board
P.O. Box 2319, 27th Floor
2300 Yonge Street
Toronto ON M4P 1E4

Dear Ms. Walli:

Re: Hydro One Networks Inc. – Application for approval to increase transmission rates (2017 and 2018)
Board File No. EB-2016-0160

We are counsel to Anwaatin Inc. (**Anwaatin**). Anwaatin respectfully submits the enclosed written interrogatories in the above-mentioned matter, pursuant to Procedural Order No. 1, dated July 29, 2016.

Please do not hesitate to contact me should you have any questions.

Yours very truly,

Lisa (Elisabeth) DeMarco

Encl.

ONTARIO ENERGY BOARD

IN THE MATTER OF the *Ontario Energy Board Act, 1998*, S.O. 1998, c.15 (Sched. B);

AND IN THE MATTER OF an Application by Hydro One Networks Inc. Transmission for electricity transmission revenue requirement and related changes to the Uniform Transmission Rates beginning January 1, 2017, and January 1, 2018.

EB-2016-0160

Interrogatories From

Anwaatin Inc. (Anwaatin)

August 12, 2016

Question: 1

Reference:
- Exhibit A, Tab 9, Schedule 1
- Exhibit A, Tab 5, Schedule 1, page 7 of 8
- Exhibit B1, Tab 1, Schedule 2, page 10 of 13
- Exhibit B2, Tab 1, Schedule 1, page 1 of 25
- Exhibit B2, Tab 1, Schedule 1, page 2 of 25
- Exhibit B2, Tab 2, Schedule 1, Attachment 2
- Exhibit B2, Tab 2, Schedule 1, Attachment 3
- Exhibit B2, Tab 2, Schedule 1, Attachment 4
- Toronto Star, August 15, 2015, "Ontario failed duty to consult First Nations on Hydro One sale, chief says" (Attachment 1)

Preamble: Hydro One Networks Inc. (**Hydro One**) has committed to business objectives including customer focus, operational effectiveness, public policy responsiveness and financial performance. The establishment of a scorecard is one of the key elements of performance measurement under the OEB's new Filing Requirements for Electricity Transmission Applications. Hydro One's evidence lists various "stakeholder sessions" in 2015 and 2016, including a session on April 27, 2016, to discuss a proposed transmission scorecard and cost efficiencies, productivity improvements and key performance indicators (**KPIs**).

Hydro One is aware that Chiefs of Ontario leader Isadore Day has stated publicly that the Ontario government should have engaged in "extensive consultation" with First Nations governments about the semi-privatization of the company, which has numerous transmission and distribution lines running through First Nations' territory.

In its century-long history, Hydro One (previously Ontario Hydro) projects have caused serious disruption on First Nations' territories, and Hydro One has sought to address these "legacy issues" by implementing a strict consultation and grievance process for First Nations.

Hydro One has established partnerships with aboriginal communities for infrastructure projects, such as B2M Limited Partnership with the Saugeen Ojibway Nation. B2M Limited Partnership owns most of the assets relating to specific Bruce-to-Milton transmission line assets, and is a significant source of economic development and wealth-building for First Nations people.

First Nations have constitutionally recognized legal status within Ontario, and they and their members are important Hydro One customers who have unique insights on the performance of Hydro One's transmission business, the proposed transmission scorecard, cost efficiencies, productivity improvements and KPIs. Transmission reliability and delivery performance are very important to First Nations.

a) Please describe all measures undertaken by Hydro One to ensure First Nations inclusion in the stakeholder sessions that took place on February 11, 2015, August 6, 2015, and January 11, 2016, and the stakeholder session held on April 27, 2016, on Hydro One's proposed transmission scorecard and cost efficiencies, productivity improvements and KPIs.

b) Please list which, if any, First Nation governments and First Nation organizations Hydro One invited to the stakeholder sessions listed in Question 1(a).

c) Please describe any and all assistance Hydro One made available to First Nation entities to facilitate their attendance at the stakeholder sessions listed in Question 1(a).

d) Please provide all input that Hydro One has sought and received from First Nations governments, groups and businesses with respect to its proposed transmission scorecard and cost efficiencies, productivity improvements and KPIs, and specifically from First Nations governments and organizations in the regions of Northwest Ontario and North/East of Sudbury.

Question: 2

Reference:
- Exhibit H1, Tab 5, Schedule 1
- Hydro One Notice of Application

Preamble: Given the unique energy supply mix and the nature of heating, ventilation and cooling options and equipment used by non-remote First Nations in northern and southern Ontario, especially the many First Nations lacking access to low-cost natural gas for home and water heating, many First Nations households are not similar to the “typical residential customer” identified in Hydro One's Notice of Application.

a) Please confirm that Hydro One has all relevant data to be able to calculate the expected increase in a typical residential customer's bill in 2017 and 2018, and provide the related bill impacts.

b) Please confirm that Hydro One has the data to calculate the expected increase for remote First Nations and rural communities in northern Ontario and southern Ontario and provide the related bill impacts.

c) Please confirm that Hydro One has the data to calculate the expected increase for non-remote First Nations and rural communities in northern Ontario and southern Ontario and provide the related bill impacts.

d) Assuming that the rate application is approved as requested in the application, please describe (in $ and %) how the proposed rate increase will impact the customer bill in 2017 and 2018 for a typical First Nation (non-remote) household without access to low-cost natural gas for home and water heating in the planning regions of Northwest Ontario and North/East of Sudbury. Please provide the same calculations for the average customer in the more densely-populated planning regions of southern Ontario.

Question: 3

Reference:
- Exhibit B1, Tab 1, Schedule 3, pages 22-29 of 29
- Exhibit B1, Tab 1, Schedule 3, Attachment 1

Preamble: Regional and customer-specific data on reliability and related price is relevant to establishing the value of the services that Hydro One provides relative to the price/bills that customers pay.

a) Given the importance Hydro One has attached to reliability measures in this application (including frequency of momentary interruptions, frequency of sustained interruptions, overall frequency of interruptions, duration of sustained interruptions, delivery point unreliability, delivery point unreliability and customer delivery point performance outliers, and customer delivery point performance standards (**CDPP**)), Hydro One's focus on customers, and that Hydro One conducts a detailed annual assessment of the performance measures described above, please provide detailed data and calculations for (i) all Hydro One service territory, (ii) northern and remote communities, and (iii) First Nation communities, including Aroland First Nation, Moose Factory and Moosonee, Rocky Bay First Nation, and Red Rock Indian Band, Geraldton and Beardmore in the planning regions of Northwest Ontario and North/East of Sudbury, on the following:

   (i) the frequency of momentary interruptions;

   (ii) the frequency of sustained interruptions;

   (iii) overall frequency of interruptions, including both momentary and sustained interruptions;

   (iv) the duration of sustained interruptions;

   (v) delivery point unreliability;

   (vi) delivery point unreliability outliers; and

   (vii) CDPP outliers.

b) Please provide Hydro One's CDPP standards.

c) Please provide a description of how Hydro One measures customer focus and any and all related data and results pertaining to customer focus.

Question: 4

Reference:
- Exhibit B1, Tab 1, Schedule 3, Attachment 1
- Exhibit B1, Tab 1, Schedule 2, pages 9-10 of 13

Preamble: Hydro One has committed to business objectives including customer focus, operational effectiveness, public policy responsiveness and financial performance. Transparency with respect to delivery charges is essential for ratepayers to understand whether these objectives have been met.

The First Nations community members affiliated with Anwaatin’s

intervention experience significant delivery charges that may not be transparent.

a) Please provide a detailed explanation and calculations for each and all of the delivery charges on a typical bill sent to ratepayers located in each of the Aroland First Nation, Moose Factory and Moosonee, Rocky Bay First Nation, Red Rock Indian Band, Geraldton, Nipigon and Beardmore in the planning regions of Northwest Ontario and North/East of Sudbury (Please ensure that the calculations are accurate to the penny and clearly show the fixed and variable rates for time-of-use pricing and tiered pricing and winter versus summer rates).

b) Please compare the calculations provided in response to Question 4(a) to delivery charges in bills sent to ratepayers in more densely-populated areas of southern Ontario.

Question: 5

Reference:
- Exhibit B1, Tab 1, Schedule 3, page 25 of 29
- Exhibit B1, Tab 1, Schedule 3, Attachment 1
- Office of the Auditor General of Ontario, 2015 Annual Report, Chapter 3: Reports on Value-for-money Audits, section 3.06 "Hydro One—Management of Electricity Transmission and Distribution Assets", pages 248-261 (Attachment 2)

Preamble: Ontario's Auditor General (**AG**) found that Hydro One was not replacing assets it had determined were in very poor condition and at very high risk of failing and that it used these assets in successive rate applications to the Ontario Energy Board to justify and receive rate increases.

The AG further found that significant transmission assets beyond their expected service life were still in use and that Hydro One's distribution system was consistently one of the least reliable among large Canadian electricity distributors between 2010 and 2014 (pages 249; 260-261). The AG also found that 47% of Hydro One's transmission outages between 2010 and 2014 occurred in northern Ontario, even though fewer than 20% of Hydro One's delivery points are located there (page page 254). The AG further noted that:

"In Northern Ontario, 86% of the delivery points are single circuit supplied. As it is costly to build additional towers and lines,

> *Hydro One does not attempt to convert rural single-circuit delivery points that serve fewer, or smaller, customers to multi-circuit delivery points because it does not consider it cost effective to do so, even if it would improve system reliability for these customers."* (Page 254)

In EB-2013-0416, the Board also concluded that Hydro One's distribution investment planning does not yet appear to be properly aligned with the actual condition of its assets; that its vegetation management does not show sufficient efficiencies or productivity improvements; and that its productivity commitments do not show the company to have a strong enough orientation toward continuous improvement.

a) Please provide the following information for customers in the territory of Aroland First Nation, Moose Factory and Moosonee, Rocky Bay First Nation, Red Rock Indian Band, Geraldton, Nipigon and Beardmore areas:

(i) transmission system reliability trends plotted on a graph showing each of the last 10 years;
(ii) the annual backlog, if any, of preventative maintenance for transmission lines, including vegetation management, plotted on a graph, showing each of the last 10 years;
(iii) please provide a list of any high risk assets in sub-optimal condition; and
(iv) a table showing a list of all of Hydro One's transmission assets, their age, their originally-anticipated replacement date and their actual or anticipated replacement date.

Question: 6

Reference:
- Exhibit B1, Tab 1, Schedule 1, page 1 of 9
- Exhibit B1, Tab 1, Schedule 2, pages 10 of 13
- Exhibit D1, Tab 1, Schedule 3
- Manitoba Hydro, "Residential Earth Power Loan", <https://www.hydro.mb.ca/your_home/power_smart/earth_power_loan/index.shtml> (Attachment 3)
- Manitoba Hydro, "Power Smart and First Nations", <https://www.hydro.mb.ca/your_home/first_nations/index.shtml> (Attachment 4)

Preamble: Hydro One is committed to supporting the sustainable development of the Ontario economy and sustainably manage its environmental footprint.

In Ontario, combined heat and power (**CHP**) and micro CHP (**MCHP**) adoption, energy efficiency, and other alternative HVAC options may be hindered by regulatory rules and the lack of programs.

In Manitoba, Manitoba Hydro provides ratepayers with financing options to access affordable financing for energy efficiency upgrades and energy-efficient heating systems to reduce electricity costs through its Residential Earth Power Loan program (with special programs for First Nation households and communities). This program includes financing for geothermal heat pump systems, air source heat pumps and solar thermal water heaters that can lower annual heating costs by 50 to 70%. Loans may include a term of up to 15 years, no down payment, and payments transferrable to future tenants through the billing system.

a) Please describe any and all measures that Hydro One is undertaking to facilitate affordable financing options for energy efficiency, CHP and alternative HVAC options.

b) Please describe any and all initiatives that Hydro One is undertaking to promote energy efficiency, CHP, and alternative HVAC options to enable First Nations households and communities to access affordable financing for energy efficiency upgrades and energy-efficient heating systems.

Question: 7

Reference:
- Exhibit B1, Tab 2, Schedule 3, page 6 of 20

Preamble: As part of the regional planning process, Hydro One undertakes extensive consultation with local distribution companies and the Independent Electricity System Operator to identify needs and develop plans as envisioned by the Board in its Renewed Regulatory Framework. Hydro One also reaches out to its large transmission-connected customers to obtain and update their future plans and electricity load forecasts.

In the Northwest Ontario region, the working group established by Hydro One includes stakeholder groups such as the Northwestern

Ontario Municipal Association, Common Voice, Ontario Mining Association and municipalities.

a) Please describe what measures, if any, Hydro One is undertaking to include First Nations governments and ratepayers as part of its Regional Planning Customer Consultation Process and Needs Assessments. Please provide any and all information on specific inclusion efforts with First Nations governments and ratepayers in the regions of Northwest Ontario and North/East of Sudbury.

Question: 8

Reference:
- Exhibit H1, Tab 5, Schedule 1, page 2 of 3

Preamble: In Quebec, distribution rates are uniform, regardless of population density.

Hydro One's delivery charges are postage stamp based on service territory.

a) Please describe any and all measures or initiatives that Hydro One has undertaken to assess the value of its current delivery rate model and any exploration of alternate rate recovery models, such as that in Quebec.

ALL OF WHICH IS RESPECTFULLY SUBMITTED THIS

12th day of August, 2016

Lisa (Elisabeth) DeMarco
DeMarco Allan LLP
Counsel for Anwaatin

ATTACHMENT 1

thestar.com

Ontario failed duty to consult First Nations on Hydro One sale, chief says

Publicly owned company a “main vehicle” for economic development on First Nations territory, and a potential source of wealth and jobs.

Chiefs of Ontario leader Isadore Day said he believes the Ontario government should have engaged in “extensive consultation” with First Nations governments about the semi-privatization of Hydro One. (SEAN KILPATRICK / THE CANADIAN PRESS FILE PHOTO)

By **SARA MOJTEHEDZADEH** Work and Wealth reporter
Tues., Aug. 18, 2015

First Nations have been almost completely excluded from the decision to sell Hydro One — even though the sale directly affects aboriginal territories and could dramatically affect their economic and environmental fortunes, according to Chiefs of Ontario leader Isadore Day.

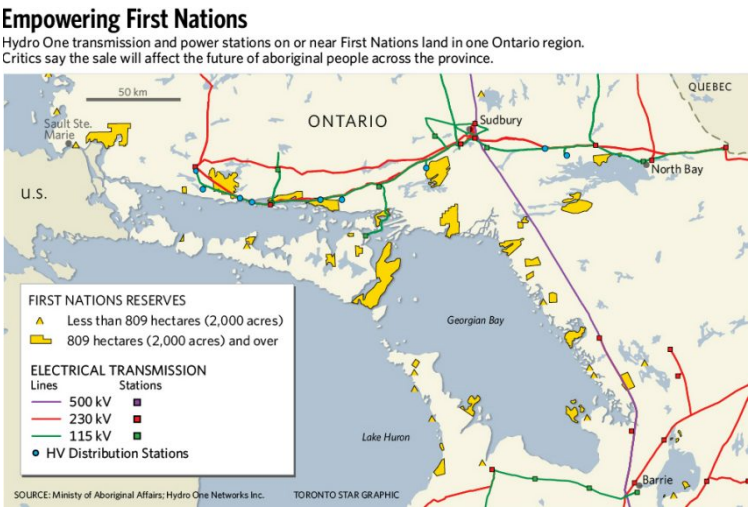
In an exclusive interview with the Star, Chief Day said he believes the Ontario government should have engaged in “extensive consultation” with First Nations governments about the semi-privatization of the company, which has numerous transmission and distribution lines running through First Nations’ territory.

“There was virtually nothing leading up to (the sale), and we know the transmittal of that sale has begun through legislation,” he said, referring to the June 3 budget bill that approved the sale of 60 per cent of Hydro One.

“There was a very big opportunity and responsibility from the Ontario government that just didn’t occur.”

Governments in Canada have a constitutional duty to consult with First Nations communities when they believe a decision will affect aboriginal land and rights.

“The law is relatively clear on this. If government plans to take any action that impacts rights or claims it knows about, the duty (to consult) is triggered,” said Alex Monem, a partner at Pape Salter Teillet LLP, which represents numerous First Nations affected by the decision.



In its century-long history, Hydro One (previously Ontario Hydro) projects have caused serious disruption on First Nations territories, according to Monem. But more recently, the government-owned corporation has sought to tackle those "legacy issues" by implementing a strict consultation and grievance process for First Nations communities.

It has also formed groundbreaking partnerships with aboriginal communities for infrastructure projects, which are a significant source of economic development and wealth-building for First Nations people. One example is the Saugeen Ojibway Nation's 2013 acquisition of a 30 per cent stake in the power line running from the Bruce nuclear power station to Milton.

"The Ontario government has used its wholly owned corporations as the main vehicle for reconciling its bad history with First Nations," Monem said. "Now they're going to divest themselves of that vehicle."

Without meaningful consultation with aboriginal leadership going forward, legal experts also say the Wynne government could face serious problems in selling off Hydro One assets.

Paul Seaman, an associate with the prominent law firm Gowlings, said First Nations communities could challenge the decision in court — possibly demanding an injunction to halt proceedings until aboriginal concerns are addressed.

A spokesperson for Hydro One said queries related to its impending sale should be directed to the government. In an emailed statement, Minister of Energy Bob Chiarelli's spokesperson Dan Moulton said that "engaging in meaningful discussions with First Nations leaders is a top priority for our government."

"Minister Chiarelli has regularly met with various representatives of Ontario's First Nations and Metis communities," he said.

In response to subsequent questions from the Star asking whether the ministry believed the Hydro One sale triggered its duty to consult, a spokesperson said that the government "considers (First Nations') inclusion in this conversation a vital part of the process."

The government's final report on the semi-privatization of Hydro One, published in April, makes no mention of the impact on aboriginal rights.

But according to lawyer Seaman there is both a moral and strategic imperative driving the duty to consult — reducing the risk of protest or legal action scuttling major decisions.

"It's the modern reality, and it's good practice in government and industry to embrace it," he said. "It helps achieve certainty in what you're about to do."

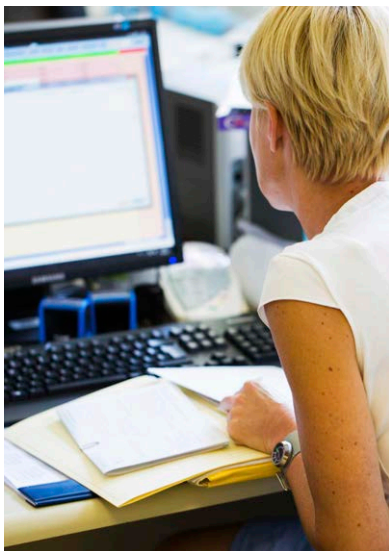
The Ministry of Energy's Moulton said he expected Hydro One's partial sale to be raised at an economic development meeting between government officials and the Union of Ontario Indians in Thunder Bay, scheduled for the end of August.

Read more about: Hydro One

ATTACHMENT 2

Office of the Auditor General of Ontario

Annual Report 2015



Office of the Auditor General of Ontario

To the Honourable Speaker
of the Legislative Assembly

In my capacity as the Auditor General, I am pleased to submit to you the *2015 Annual Report* of the Office of the Auditor General of Ontario to lay before the Assembly in accordance with the provisions of section 12 of the *Auditor General Act*.

Bonnie Lysyk
Auditor General

Fall 2015

Copies of this report are available from ServiceOntario: (416) 326-5300 or toll-free at 1-800-668-9938.
An electronic version of this report is available at **www.auditor.on.ca**

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3.06

Hydro One—Management of Electricity Transmission and Distribution Assets

1.0 Background

1.1 Overview

Hydro One Inc., one of the largest electricity delivery systems in North America, has three key reportable segments:

- **Transmission**: Hydro One Networks Inc. transmits electricity through its 29,000-kilometre high-voltage transmission network that sends electricity from power generators to approximately 90 large industrial customers and 47 of the 71 local distribution companies (LDCs), or utilities, in Ontario, as well as to Hydro One's local distribution business;
- **Distribution**: Hydro One Networks Inc. also delivers and sells electricity to residential and industrial customers through its 123,000-kilometre low-voltage distribution system that serves as the LDC for about 1.4 million customers mostly in smaller municipalities and rural areas throughout the province and serving 28% of all customers in Ontario. (This is different than most other distributors, which typically service larger urban and surrounding areas. Hydro One has an average of 11 customers for each kilometre of distribution line, whereas the average for the four largest LDCs in Ontario is 51.) It also sends electricity to the remaining 24 smaller LDCs not directly serviced by the transmission network; and
- **Telecommunications**: Hydro One Telecom Inc. manages a telecommunications system that allows Hydro One to monitor and remotely operate its transmission system equipment. Telecommunications services are also sold to large resellers and corporate users.

The Ontario electricity grid is a network of power generators and consumers connected by high-voltage transmission towers and lines and low-voltage distribution lines. Hydro One owns and operates 96% of the province's electricity transmission system, with the remaining 4% being owned by four private-sector corporations. The transmission system collects electricity from generators and sends it via high-voltage transmission towers and lines to transformer stations, where the electricity is converted to a lower voltage and then travels from the transformer station to an LDC or a large industrial client.

LDCs own and operate the low-voltage lines that distribute or deliver power to homes and businesses. As of December 31, 2014, there were 71 LDCs across the province that were mainly owned by the municipalities they service, in addition to Hydro One Networks distribution system operations (for

the rest of this report, we refer to 72 LDCs because we include Hydro One Networks as an LDC). This includes Hydro One Brampton Networks Inc., a wholly owned subsidiary of Hydro One Inc., which operates as a standalone LDC serving the City of Brampton area. In addition, Hydro One Remote Communities Inc. operates standalone generation and distribution systems for 21 remote northern Ontario communities serving 3,500 customers.

Figure 1 shows the organization and the roles and responsibilities of key entities, including Hydro One, involved in the electricity system in Ontario, covering policy formulation, planning, generation, pricing, regulation, transmission and distribution. (See **Section 3.05** of this year's Annual Report for our audit of the Ministry of Energy's Electricity Power System Planning.)

Hydro One's mandate is to be a safe, reliable and cost-effective transmitter and distributor of electricity. The corporation is subject to direction from its sole shareholder, the government of Ontario, and operates in accordance with governing legislation and regulations, particularly the *Electricity Act, 1998*. The board of directors is responsible for the stewardship of the company and supervision of management.

Hydro One's transmission and distribution businesses are licensed and regulated by the Ontario Energy Board (OEB) under the authority of the *Ontario Energy Board Act, 1998*. The OEB sets transmission and distribution rates and issues licences to Hydro One for both systems.

Hydro One is bound by the terms of its transmission and distribution licences, as well as the requirements of the Transmission System Code and Distribution System Code, both issued by the OEB. The codes provide the minimum conditions a transmitter or distributor must meet in carrying out its obligation to operate and maintain each system.

Hydro One's earnings are principally generated from its regulated transmission and distribution businesses. For the year ending December 31, 2014, Hydro One's total revenues were $6.548 billion, and its operating and other costs were $5.801 billion, resulting in a net income of $747 million. Hydro One's transmission, distribution and telecommunication net fixed assets were valued at about $16.2 billion. At the end of 2014, Hydro One had 5,500 permanent staff and had employed 2,100 temporary workers during the year. The temporary workers are mainly seasonal, working from April to October on construction projects and to supplement Hydro One lines and forestry groups.

1.2 Transmission System

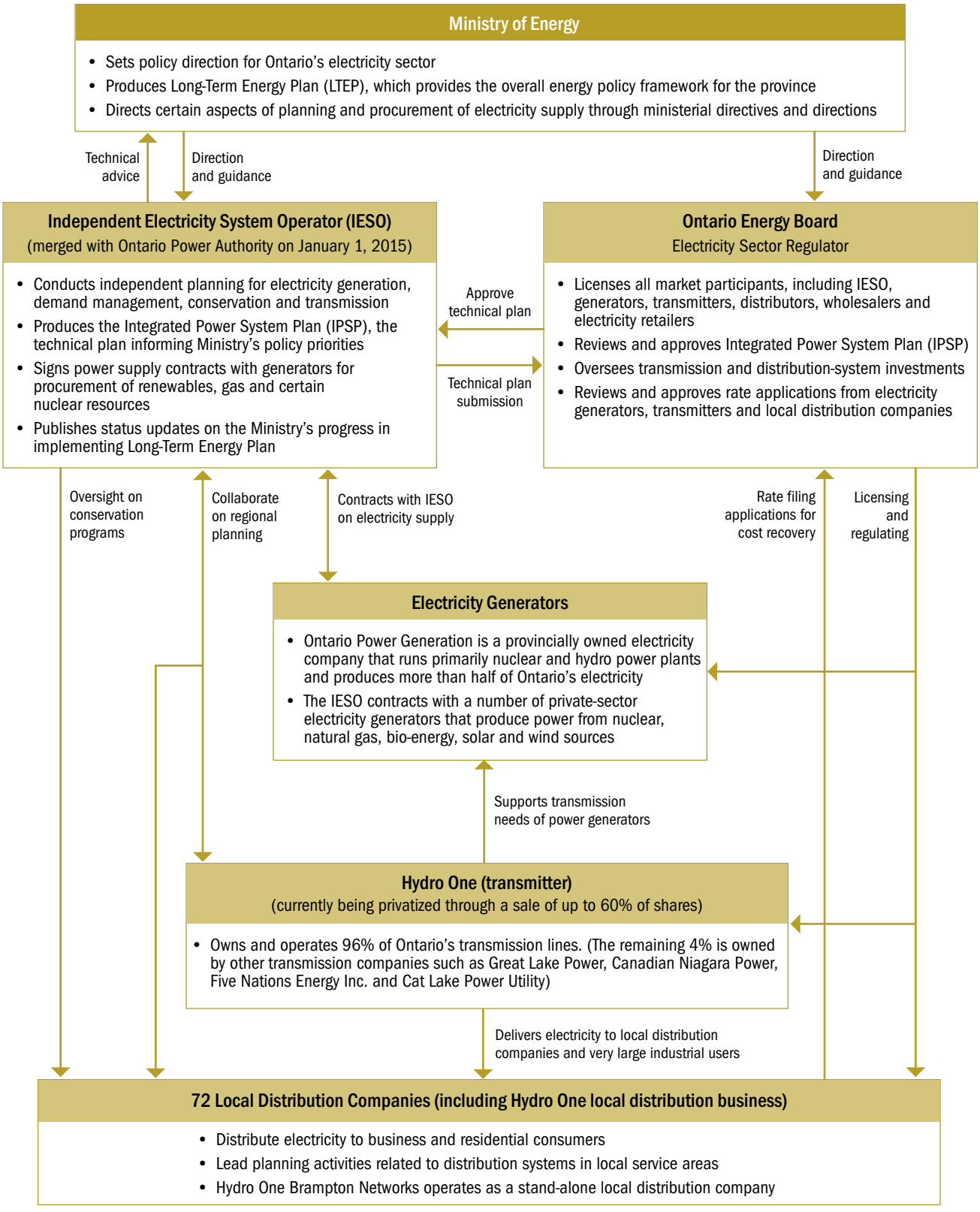
Hydro One's transmission system had net tangible capital assets (for example, lines, towers and transformer stations) valued at $9.3 billion as of December 31, 2014. The transmission system operates over long distances and links electricity generating facilities to LDCs and end-user transmission customers, such as mines, automobile manufacturing facilities and petro-chemical plants via transmission towers and lines connected to transformer stations. The transmission system is linked to five adjoining jurisdictions: Quebec, Manitoba, New York, Michigan and Minnesota. These interconnections are designed to facilitate the transfer of electricity between Ontario and other jurisdictions.

High-voltage transmission towers and lines operate at 500,000 volts, 230,000 volts and 115,000 volts. Almost all lines are overhead, as opposed to underground. Key components of high-voltage transmission lines include the lines, overhead conductors, steel support structures (towers) and grounding systems. Hydro One owns and operates 299 transformer stations that contain 722 power transformers, 4,604 power circuit breakers and 14,000 switches, along with protection and control equipment. There is also physical infrastructure, such as buildings, roads and security fences within a station's boundaries.

Unplanned power outages on the transmission system are primarily caused by weather, particularly lightning strikes, and by equipment failures. Approximately 70% of the delivery points (which receive over 85% of all electricity) on Hydro One's

Figure 1: Roles and Responsibilities of Key Entities Involved in the Electricity System in Ontario

Prepared by the Office of the Auditor General of Ontario



transmission system are multi-circuit delivery points, meaning they have more than one line available to provide power to customers along that line. The remainder of the transmission system features single-circuit delivery points. Where there are multiple transmission towers and lines connected to a customer, a power outage on one line will not disrupt the power supply to a customer because the other operational line still provides electricity.

(Please see the **Appendix** at the end of this report for a glossary of terms we have used.)

Hydro One must adhere to reliability standards established by the North American Electricity Reliability Corporation (NERC). NERC's mission is to ensure the overall reliability of the bulk electricity system in North America. As the North American transmission system is interconnected, its utilities share a common set of standards that govern the reliability of their operations. Working with the continent's approximately 1,400 bulk electricity transmitters, including Hydro One, NERC establishes and monitors these standards.

The transmission system is monitored, controlled and managed centrally by the Ontario Grid Control Centre (Control Centre) in Barrie. The Control Centre monitors the system around the clock electronically, responds to alarms caused by equipment, and can restore, divert and interrupt power transmission remotely. The Control Centre also authorizes all planned outages (such as when maintenance needs to be performed on transmission system equipment), and it dispatches repair crews to deal with unplanned outages.

Total transmission revenues for Hydro One in 2014 were $1.6 billion. Transmission revenue is based on the transmission tariffs set by the OEB, for which Hydro One makes rate applications every two years. The tariff is designed to recover from large industrial customers and LDCs enough revenue to support Hydro One's costs to operate and maintain the transmission system.

1.3 Distribution System

Hydro One's distribution system spans 75% of Ontario geographically and serves 28% of the province's customers. It serves approximately 1.4 million retail customers, 44 large industrial users and 24 smaller LDCs. Hydro One is the largest LDC in Ontario by both number of customers served and geographic area covered.

The distribution system's net tangible capital assets are valued at $5.9 billion. The system is composed of 123,000 kilometres of distribution lines that operate below 50,000 volts, 1.6 million wooden poles, 500,000 pole-top transformers and approximately 1,200 distribution stations. Distribution stations typically include equipment such as transformers, switches and protection and control equipment, and may include buildings, roads and security fences. From 2012 to 2014, Hydro One installed at a cost of $660 million approximately 1.2 million smart meters, which allows it to remotely receive individual customers' usage data over its telecommunications system.

The Control Centre is also responsible for overseeing the distribution system. However, the system is generally not equipped to monitor service electronically for outages. When a power outage occurs, the Control Centre receives service disruption calls from its customers, and it dispatches local work crews throughout the province to repair service. Unplanned power outages on the distribution system are often due to fallen trees and branches (31%), equipment failure (25%)and miscellaneous incidents such as accidents involving motor vehicles or wildlife (27%). On the other hand, outages on the transmission system, which feeds electricity to the distribution system, cause less than 1% of outages on the distribution system. In addition, planned outages for maintenance work account for 17% of outages.

Total revenue for the distribution business was approximately $4.9 billion in 2014. Similar to the transmission system, distribution revenue is based on distribution tariffs set by the OEB, which are

based on separate rate applications that Hydro One submits, typically covering periods of one to three years.

1.4 Telecommunications System

Hydro One's high-speed telecommunications system throughout its transmission and distribution networks had net tangible capital assets of $541 million. The system is used to provide telecommunications for the monitoring, protection and control equipment of Hydro One's transmission system, as well as for corporate data and voice networks and smart meter operations for its distribution system. The system allows the Control Centre to receive real-time data on the performance of the transmission system and operate transmission protection equipment remotely. Use of the telecommunications system is also sold to telecommunications carriers and commercial customers, which in 2014 generated revenues of $57 million.

1.5 Privatization of Hydro One Inc. and Sale of Hydro One Brampton Networks Inc.

The government passed the *Building Ontario Up Act* in June 2015 to permit the sale of up to 60% of the province's common shares in Hydro One. The government announced plans for the fiscal year ending March 31, 2016, to release an initial public offering of approximately 15% of the common shares in Hydro One. The legislation requires the province to retain at least 40% the common shares in Hydro One, and no other single shareholder would be allowed to hold more than 10% of the total equity. In April 2015, the Premier's Advisory Council on Government Assets estimated Hydro One's valuation at $13.5 to $15 billion; using this estimate, selling 60% of Hydro One could bring up to $9 billion to the province, the sole shareholder.

Effective December 4, 2015, the *Building Ontario Up Act* also removed the ability of the Office of the Auditor General to conduct and report on value-for-money audits on the operations of Hydro One Inc. As a result, this audit of Hydro One's management of electricity transmission and distribution assets, which commenced prior to the tabling of the *Building Ontario Up Act*, will be the last value-for-money audit released by the Office.

The government is also proceeding with the sale of Hydro One Brampton Networks, expected to bring the province about $607 million, net of any price adjustments. In April 2015, the government announced that it had agreed to an unsolicited offer by three other LDCs, Enersource Corporation, Powerstream Holdings Inc. and Horizon Holdings Inc., to form a merger with Hydro One Brampton Networks.

On August 31, 2015, Hydro One declared a dividend transferring all its shares in Hydro One Brampton Networks to the province. The sale was still in progress as of September 2015 and subject to approval of the local municipalities that own the other LDCs and the Ontario Energy Board.

2.0 Audit Objective and Scope

Our audit objective was to assess whether Hydro One had adequate systems and procedures in place to manage and maintain its transmission and distribution assets efficiently and cost-effectively in accordance with relevant Hydro One policies and regulatory requirements, and to ensure the system was reliable for its customers.

Senior Hydro One management reviewed and agreed to our audit objective and criteria.

Our audit work included interviews with Hydro One management and staff, as well as review and analysis of relevant files, asset databases and other IT systems, policies and procedures, and Hydro One's transmission and distribution regulatory filings to the Ontario Energy Board.

Our work was primarily conducted at Hydro One's head office in Toronto. However, we also visited several transmission and distribution stations,

the Ontario Grid Control Centre in Barrie and the Central Maintenance Shop in Pickering. During our visits we interviewed operations staff and we also held discussions with several key staff responsible for vegetation management throughout the province. We also met with representatives from the Association of Major Power Consumers in Ontario, the Canadian Electricity Association, and the Ontario Society of Professional Engineers. We reviewed past Hydro One Internal Audit reports, which also contained findings consistent with our own report.

The scope of our work did not include Hydro One Brampton Networks, which is managed and operated as a standalone LDC and is separate from Hydro One Networks, its distribution system. This audit also did not cover the government's recent decisions to privatize Hydro One Inc. and sell Hydro One Brampton Networks; both of these transactions had not been fully executed at the time our field work was completed in July 2015. We also did not cover Hydro One Remote Communities because its communities are not connected to Ontario's electricity grid.

Our audit fieldwork was conducted from January to July 2015, and we primarily focused on Hydro One activities over the three calendar years from 2012 to 2014.

3.0 Summary

Hydro One's mandate is to be a safe, reliable and cost-effective transmitter and distributor of electricity. Hydro One's customers instead have a power system for which reliability is worsening while costs are increasing. Customers are experiencing more frequent power outages, largely due to an asset management program that is not effective or timely in maintaining assets or replacing aging equipment, and an untimely vegetation-management program that has not been effectively reducing the number of outages caused by trees.

Some of the more significant areas we noted for improvement in transmission reliability included:

- **Transmission system reliability has deteriorated**: Hydro One's transmission system reliability has worsened for the five years from 2010 to 2014. Outages are lasting 30% longer and occurring 24% more frequently. In the same period, Hydro One's spending to operate the transmission system and replace assets that are old or in poor condition increased by 31%. While Hydro One's overall transmission system reliability compares favourably to other Canadian electricity transmitters, it has worsened in comparison to U.S. transmitters.
- **Equipment outages increasing, backlog of preventive maintenance growing**: Hydro One has a growing backlog of preventive maintenance orders to be performed on its transmission system equipment, and this lack of maintenance led to equipment failures. The backlog of preventive maintenance orders for transmission station equipment increased by 47%, from 3,211 orders as of 2012 to 4,730 orders as of 2014. At the same time, the number of equipment outages on the transmission system increased by 7%, from 2,010 in 2012 to 2,147 in 2014. The cost to clear the backlog of preventive maintenance work orders has grown 36%, from $6.1 million as of December 31, 2012, to $8.3 million as of December 31, 2014.
- **Hydro One not replacing very high-risk assets, contrary to its rate applications**: We found Hydro One was not replacing assets it determined were in very poor condition and at very high risk of failing, and it used these assets in successive rate applications to the Ontario Energy Board to justify and receive rate increases. Power transformers that are identified as being in very poor condition should be replaced at the earliest time possible; however, Hydro One replaced only four of the 18 power transformers it deemed to be in very poor condition in its 2013-2014

application used to obtain rate increases, and instead replaced other old transformers rated in better condition. These transformers are at a higher risk to fail, and we found two power transformers rated as being in very poor condition that failed and resulted in outages to customers lasting 200 minutes in 2013 and 220 minutes in 2015. Hydro One's transmission system rate application for the two-year period 2015-2016 listed 34 power transformers as rated "very high risk" for failure; however, the application did not indicate that Hydro One was planning to replace only eight of these over this period. In choosing not to use the additional funds from rate increases approved by the OEB to replace 26 transformers in very poor condition, Hydro One will have to seek $148 million again in the future to carry out the overdue replacement.

- **Significant transmission assets that are beyond their expected service life still in use**: Hydro One's risk of power failures can increase if it does not have 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% for all types of assets in service. Replacing these assets will eventually cost Hydro One an estimated $4.472 billion, or over 600% more than its $621-million capital sustainment expenditure for 2014.
- **Funding requests made to Ontario Energy Board not supported by reliable data**: The asset condition ratings provided by Hydro One in its 2013-2014 and 2015-2016 rate applications to the OEB were inaccurate and contained errors because of unreliable internal systems for reporting on the condition of assets. We found that 27 of the 41 transformers replaced in 2013 or 2014 had been wrongly identified in the rate applications as being in good or very good condition, yet Hydro One had plans at the time to replace several of these transformers due to their old age or poor condition. Similarly, we noted that 24 of the 43 transformers inaccurately reported in the 2015-2016 rate application as having a low or very low risk of failure were already scheduled to be replaced during this period.
- **Asset Analytics System not accurately considering all factors related to asset replacement decisions**: Key information is often not included, or incorrectly weighted, in the Asset Analytics system, Hydro One's new asset investment planning IT system implemented in 2012 to replace older systems. As a result, assets that need replacing are not being accurately identified. We found that the Asset Analytics database does not incorporate qualitative factors, such as technological or manufacturer obsolescence information, known asset defects and health and safety concerns. For example, oil leaks are one of the leading reasons for replacing a transformer. However, this information has only a minor impact in Asset Analytics for determining the risk of the asset failing and the need to replace it. In its reporting to OEB, Hydro One assigns oil leaks an impact on a transformer's condition rating of only 15% in determining whether an asset is classified as being in very good to very poor condition overall.
- **Limited security for electronic devices increases risk of power outages**: Hydro One's approach to ensuring proper security over transmission system electronic devices did not ensure a robust, high level of security for all of its electronic devices. Only certain devices in its transmission system receive higher levels of security in order for it to meet North American Electricity Reliability Corporation (NERC) standards for the bulk electricity system, which includes those major transmission lines and transformer stations that are linked to other states and provinces.

Hydro One is required to apply NERC standards related to electronic devices to only 18% of its transmission stations, and only to critical devices, which make up less than 17% of the electronic devices at these stations. All other electronic devices that are used for transmission within Ontario and don't impact the bulk electricity system are covered by Hydro One's weaker security policy, which was not applied consistently to devices. This increases the risk of service disruptions for Ontario customers due to sabotage, vandalism, software viruses and unauthorized or unintentional changes to device software or controls.

Some of the more significant areas we noted for improvement in distribution reliability are as follows:

- **Distribution reliability poor and costs have increased**: Hydro One's distribution system has 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 Hydro One over the same period, while average frequency of outages among CEA members was 30% lower. In a scorecard published by the Ontario Energy Board in 2014, Hydro One was ranked worst and second worst of all distributors in Ontario for duration and frequency of outages in 2013. Over the same period, spending increased by 18% to operate and maintain the distribution system or replace assets that were old or in poor condition.
- **Hydro One not clearing vegetation (forestry) around distribution system in timely way, thus increasing the risk of outages and system reliability**: The top reason for distribution system outages from 2010 to 2014 was broken lines caused by fallen trees or tree limbs. A key factor in this was that Hydro One operates on a 9.5-year vegetation-management cycle, while the average such cycle for 14 of Hydro One's peer utilities was 3.8 years. Hydro One's own analysis indicates that by not operating on a vegetation-management cycle similar to its peers, the vegetation-management work it did in 2014 cost $84 million more than it would have under a four-year vegetation management cycle and customers would have experienced fewer outages caused by trees, and, therefore, had 36 minutes less in total outage time for the year.
- **Improper prioritization of vegetation-management work resulted in more tree-caused outages**: The system used by Hydro One to designate distribution lines for vegetation management does not put priority on those areas where tree-related outages have caused disruptions. We found examples where vegetation management was performed on distribution lines that had had few tree-caused outages, at the expense of distribution lines that had had significantly more tree-caused outages. This resulted in the number of tree-caused outages increasing by 5% from 2010 to 2014 (from 7,747 in 2010 to 8,129 in 2014), while vegetation management spending increased by 14% over the same period ($161 million in 2010 to $183 million in 2014).
- **Asset Analytics ratings information for distribution assets is incomplete and unreliable**: As of July 2015, Hydro One's Asset Analytics system, a key tool in making replacement decisions, had incomplete and unreliable data for distribution assets. We found that three years after the implementation of the Asset Analytics database, it contained incomplete or erroneous data for distribution system assets. For example:
  - there was limited data available to evaluate all 152 distribution station breakers; and
  - 14 distribution station power transformers that are under 10 years old were mistakenly

assigned age scores of 100, which would be past the 40-year expected service life of such transformers.

- **Significant distribution assets that are beyond their expected service life still in use**: Hydro One increases the risk of power failures by not replacing distribution system assets that have exceeded their planned useful service life. Hydro One's planned service life for wood poles is 62 years, but 202,000 poles, or 13% of the total, were older than that. Replacing these poles will eventually cost $1.76 billion. Only about 12,000 poles are replaced each year, much less than the number needed to address the risk of poles falling and much less than the number that are in service beyond their expected service life. In addition, it will eventually cost another $158 million to replace the 243 station transformers beyond their 50-year expected service life.
- **Smart meters not used to proactively identify power outages**: Hydro One installed 1.2 million smart meters on its distribution system at a cost of $660 million, yet it has not implemented the related software and capabilities to improve its response times to power outages. Currently, smart meters are used by Hydro One predominantly for billing purposes and not to remotely identify the location of power outages in the distribution system before a customer calls to report an outage. Such information from smart meters would make dispatching of work crews timelier and more efficient, leading to improved customer service and cost savings.

Some of the other significant areas we noted for improvement pertaining to both the transmission and distribution systems are as follows:

- **Excessive number of spare transformers in storage**: Hydro One did not have a cost-effective strategy for ensuring it had an appropriate number of spare transformers on hand, resulting in it having too many spare transformers in storage. While typically only about 10 transformers fail annually, Hydro One had 200 spare transformers—60 transmission transformers and 140 distribution transformers—valued at around $80 million in storage at the Central Maintenance Shop in Pickering. Thirty-five of these transformers had been in storage for at least 10 years. Hydro One itself estimates that by standardizing transformers and improving forecasting, it could reduce the number of spare transformers by up to 35% and save up to $20 million over the next 10 years. We estimate this savings could be much higher with better management, ranging from $50-$70 million.
- **Power quality issues are not corrected proactively**: Major transmission and distribution customers are concerned about the quality of their power, such as having stable voltage levels, but Hydro One addresses power quality issues only if customers complain. Hydro One has received 150 power quality complaints from 90 large industrial transmission customers alone since 2009. To measure fluctuations and assess the frequency and location of power quality events, Hydro One has installed 138 power quality meters across its transmission and distribution systems since 2010. However, Hydro One is not monitoring and analyzing the data from these meters to improve system reliability for its customers unless a customer first calls to complain.
- **Weak management oversight processes over capital project costs**: While Hydro One spent over $1 billion annually from 2012 to 2014 on capital projects to sustain its transmission and distribution systems, we noted it had weak oversight processes to minimize projects costs. For instance, up to 55% of projects costs are internal charges, since Hydro One primarily uses its own employees to carry out construction projects; however, it does not regularly analyze or benchmark its internal costs to industry standards to assess whether they are reasonable.

We also found that all capital project estimates used for approving projects included on average a 20% contingency charge allowance and an 8% escalation charge allowance, which gave Hydro One staff little incentive to complete a project at its original project cost estimate, or develop more accurate cost estimates for projects. We asked Hydro One management to prepare a report that compared the original project approval, including allowances, with the actual project costs for all projects completed for the years 2013 to 2015. The report we received in June 2015 was incomplete, and only included 61 of the 105 projects approved for over $1 million. Using the incomplete report, we estimate Hydro One spent on average 22% more than the original project cost estimates and used the allowances to complete these projects. This amounted to a total of $150 million more spent on the projects than the original project cost estimates.

Given that the Office of the Auditor General will no longer have jurisdiction over Hydro One as of December 4, 2015, we have made the following recommendation, requesting that the Ontario Energy Board take the observations we have made in this report into consideration during its regulatory processes:

- That the Ontario Energy Board, on behalf of electricity ratepayers in Ontario, as part of its regulatory oversight of Hydro One, review this report, the recommendations, and future actions taken by Hydro One to improve the reliability and cost-effectiveness of its transmission and distribution systems.

This report contains 17 recommendations to Hydro One, consisting of 37 actions, to address the findings noted during this audit.

OVERALL ONTARIO ENERGY BOARD RESPONSE

As part of its regulatory regime, the Ontario Energy Board (OEB) uses processes to hold all utilities, including Hydro One, to a high standard of efficiency and effectiveness. The recommendations made by the Auditor General in this report are useful in further supporting our efforts and in holding Hydro One accountable for prudently managing its resources and improving its service.

The OEB is committed to using all key information available for its deliberations and decision-making processes, and will, as appropriate, consider the areas of improvement identified by the Auditor General in future as it exercises its regulatory functions to ensure that Hydro One undertakes appropriate planning and investing, and optimal maintenance of its systems, and that it benchmarks itself against external comparators.

The report highlights a number of areas where Hydro One can improve the quality of its planning and the cost-effectiveness of its execution of those plans. The OEB likewise places a high priority on delivering value to electricity customers for the rates they pay. In 2012, the OEB developed the renewed regulatory framework for electricity (RRFE) distributors, which places a focus on rigorous asset management and capital planning in support of cost-efficient operations. The framework prescribes use of industry benchmarking to ensure improvement in cost performance and contains high expectations of continuous improvement to increase the productivity of operations. Utilities are expected to engage with their customers to understand their needs and preferences and to focus on the achievement of outcomes that take their priorities into account.

In its evaluation of Hydro One's most recent rate-rebasing application (EB-2013-0416), the first such application that it filed under the OEB's

renewed framework, the OEB identified certain deficits: among other things, it concluded that Hydro One Networks Inc.'s distribution investment planning does not yet appear to be properly aligned with the actual condition of its assets; that its vegetation management does not show sufficient efficiencies or productivity improvements; and that its productivity commitments do not show the company to have a strong enough orientation toward continuous improvement.

Consequently, the OEB has already secured Hydro One's commitment to measure and report on many of the areas that the Auditor General's report has highlighted in its audit recommendations. In fact, in light of its concerns as to whether Hydro One's distribution investment priorities had been optimized, in Hydro One's last rate application, the OEB approved only three years of a proposed capital spending plan rather than the five years Hydro One requested, and indicated that further approvals will be contingent on the quality of Hydro One's supporting evidence.

The OEB decision in this application took further steps to ensure that Hydro One addresses shortcomings in its planning and benchmarking, many of which intersect directly with the recommendations of the Auditor General. Specifically, the OEB has ordered or otherwise secured Hydro One's commitment, among other things, to:

- conduct external benchmarking on the unit costs of its distribution pole replacement and station refurbishment plans;
- consider external review of its distribution system planning;
- report on achieved in-service investments relative to plan;
- undertake a total factor productivity study of Hydro One's own productivity, including data from 2002 and following years at a minimum; and
- explore best practices in vegetation management, considering changes in labour mix and innovation opportunities, as well as conduct a trend analysis of the vegetation management program showing year-over-year variations in unit costs.

Similar focus has also fallen on Hydro One's transmission business. As part of its most recent transmission rate application (EB-2014-0140), Hydro One has committed to benchmark its transmission cost performance relative to similar companies. The OEB is also working toward the implementation of the RRFE framework for transmission in Ontario as part of its continued commitment to ensure that the owners and operators of electricity networks in Ontario provide reliable, cost-effective service at rates that represent good value to customers.

OVERALL HYDRO ONE RESPONSE

Managing Hydro One's massive and complex transmission and distribution system requires considerable engineering expertise and dynamic asset management strategies that result in timely and disciplined investments to maintain or improve reliability and optimize equipment performance and cost. The Company recognizes there is always room to do better in this regard, so it makes continuous improvement a primary consideration in all of its asset plans and strategies.

Hydro One has strengthened the oversight of the Company and its operations. Internal Audit, reporting directly to the Audit Committee of the independent Board of Directors, will review this report and will oversee the Company's implementation of the recommendations where Hydro One believes they enhance reliability while balancing service and cost.

Hydro One's transmission and distribution businesses are regulated by the Ontario Energy Board (OEB), and the Company must comply with the conditions of service within the transmission and distribution system codes as part of its license. Hydro One places a high priority on

its obligation to provide the OEB with complete, accurate and supportable evidence in its rate applications. Additionally, the Company acts on the recommendations and direction of the OEB as outlined in successive rate decisions.

Going forward, Hydro One is focused on delivering improved business performance and superior customer service as the Company prudently invests in Ontario's electricity transmission and distribution infrastructure. The Company will continue to do so while balancing service with cost.

Hydro One appreciates the work of the Auditor General and her staff, and the opportunity to respond to the findings within the audit. The recommendations provided as a result of this audit are being carefully considered as the Company moves forward.

4.0 Detailed Audit Observations

4.1 Transmission System

4.1.1 System Reliability Worsened from 2010 to 2014

Hydro One's transmission system customers expect their system to be reliable. However, we found that the system became less reliable from 2010 to 2014, with longer and more frequent outages. Hydro One's overall transmission system reliability compares favourably to other Canadian electricity transmitters; however, its reliability has worsened compared to U.S. transmitters.

Transmission system reliability is measured by two main metrics: the duration of outages and the frequency of outages. The System Average Interruption Duration Index (SAIDI) (average duration of outages) measures the average number of minutes per year each delivery point on the transmission system has experienced an outage, while the System Average Interruption Frequency Index (SAIFI) (average frequency of outages) measures the average number of outages per delivery point per year.

Hydro One measures system reliability separately for areas that are serviced by single-circuit delivery points, where a customer has only one line delivering electricity, and multi-circuit delivery points, where a customer has multiple towers and lines delivering electricity. Transmission outages are less likely to occur in areas that have multiple towers and lines since electricity can be supplied uninterrupted using an alternative line should one become out of service. Hydro One publicly reports on the performance of its transmission system based only on its areas serviced by multi-circuit delivery points, which cover over 85% of the electricity it delivers.

The difference in reliability between areas serviced by single or multiple lines was significant. As shown in **Figure 2**, single-circuit areas averaged 217.5 minutes in outages per year from 2010 to 2014, and the number of minutes varied significantly between years. In comparison, multi-circuit areas averaged 9.9 minutes in outages per year. Similarly, the number of outages averaged 3.22 per year per delivery point for the single-circuit transmission system compared to only 0.31 per year for the multi-circuit transmission system.

We found 47% of transmission outages from 2010 to 2014 occurred in Northern Ontario, even though this is where fewer than 20% of Hydro One's delivery points are located. In Northern Ontario, 86% of the delivery points are single circuit supplied. As it is costly to build additional towers and lines, Hydro One does not attempt to convert rural single-circuit delivery points that serve fewer, or smaller, customers to multi-circuit delivery points because it does not consider it cost effective to do so, even if it would improve system reliability for these customers.

For multi-circuit areas of the transmission system, Hydro One's reliability performance has deteriorated significantly since 2010. **Figure 2** shows that average duration of outages and average frequency of outages worsened (increased) by

Figure 2: Hydro One Transmission System Outages, 2010–2014
Source of data: Hydro One

	2010	2011[1]	2012	2013	2014[2]	Five-year Average	% Change Between 2010 and 2014
Multi-circuit Delivery Points							
SAIDI (minutes per delivery point)	9.1	8.9	6.8	12.9	11.8	9.9	30
SAIFI (outages per delivery point)	0.29	0.33	0.28	0.30	0.36	0.31	24
Unplanned outages	176	203	175	189	228	194	30
Single-circuit Delivery Points							
SAIDI (minutes per delivery point)	165.2	410.0	224.9	192.4	95.2	217.5	-42
SAIFI (outages per delivery point)	2.99	3.25	3.59	3.55	2.73	3.22	-9
Unplanned outages	820	851	947	945	737	860	-10

1. Hydro One indicated that 2011 was an extraordinary year for power outages for areas serviced by single-circuit delivery points because of forest fires in northern Ontario. Forest-fire-triggered outages accounted for 234 minutes out of the total 410 minutes incurred during that year.
2. Hydro One indicated that 2014 performance improved significantly for power outages for areas serviced by single-circuit delivery points primarily because of relatively less adverse weather during the year.

approximately 30% and 24% respectively from 2010 to 2014, and unplanned outages increased by 30%. Hydro One's records indicate this deterioration in reliability is primarily due to an increase in the number of unplanned outages, such as those caused by equipment failure or weather, that occurred at the same time as planned outages for such work as refurbishing or replacing aging transmission system assets, which temporarily rendered the alternate lines inoperative. If the alternate lines had been in operation at the time, those customers would likely not have experienced outages. These types of outages increased by 27% from 2010 to 2014 (from 74 outages in 2010 to 94 outages in 2014).

Despite the fact that Hydro One's recent transmission system reliability has worsened, it still compares favourably to other Canadian transmitters. The Canadian Electricity Association (CEA) collects information on the system reliability of Canadian electrical transmitters. Annually from 2010 to 2014, Hydro One's average duration and frequency of outages were generally better than the CEA average each year.

4.1.2 Transmission System Reliability is Poor Compared to the U.S.

As part of the bulk electricity system in North America, Hydro One's transmission system is integrated with transmitters in the United States. Hydro One participates in an annual transmission system reliability benchmarking study with transmitters in the United States, and the results indicate the reliability of Hydro One's system was generally worse than other transmitters. Other provinces' transmitters that are also on the bulk electricity system do not participate in these studies.

The study compares various metrics, including the average frequency and duration of outages, of a transmitter's entire system. In the 2011 report, based on outage data from 2006 to 2010, Hydro One's average duration and frequency of outages ranked only 21st and 22nd respectively out of the 25 participants. Similarly, in the 2015 study, based on outage data from 2010 to 2014, Hydro One was ranked only 10th and 13th for the average duration and frequency of outages out of 14 participants, and both averages were higher (worse) than the scores from the 2011 report.

The study also compares the reliability of only the portion of each transmitter's system that is part

of the bulk electricity system. In the 2011 report, Hydro One's average duration of outages for its bulk electricity system was ranked 21st out of 24, and in the 2015 report, it ranked only 12th out of 14. In the 2011 report, Hydro One's average frequency of outages for its bulk electricity system was ranked only 21st out of 24, and in the 2015 report, it ranked only 13th out of 14.

4.1.3 Transmission System Availability Has Worsened from 2006 to 2014 Compared to Other Provincial and U.S. Transmitters

Comparison to Other Provincial Utilities

The Canadian Electricity Association (CEA) collects data from and reports to its provincial utility members on an availability metric for their transmission systems. The metric identifies how often electricity was unavailable, in system minutes, on the transmission system.

The CEA's data shows that Hydro One's availability is generally better than the CEA average of other provincial transmitters, with Hydro One unavailability at 16.4 system minutes compared to the CEA's average of 19.5 minutes using the average unavailability during the period 2010-2014.

Nevertheless, Hydro One's availability has worsened over time. While the CEA's 2011 report found that from 2006 to 2010, Hydro One's unavailability was 14.6 system minutes on average per year, this increased to 16.4 system minutes on average per year in the 2015 report, which reports on data from 2010 to 2014. While Hydro One's unavailability increased by 12% between the 2011 and 2015 reports, the CEA average unavailability decreased slightly during the same period, from 20.2 system minutes to 19.5 system minutes.

Transmission system availability is impacted by both planned and unplanned outages. It appears that Hydro One may have had more scheduled outages due to increased spending for maintenance, repairs and improvements, and therefore availability was negatively impacted when primary or back-up lines were shut down.

Comparison to U.S. Transmitters

The transmission system reliability benchmarking study Hydro One participates in with transmitters in the United States indicates that the unavailability of Hydro One's system is higher than other participating transmitters.

The study compares an overall Transmission Availability Composite Score (TACS), which measures the availability of electricity (how often transmission customers had electricity available for their use compared to how often they desired electricity). In the 2011 report, based on outage data from 2006 to 2010, Hydro One's TACS ranked it 23rd out of 25 participants. Similarly, in the 2015 study, based on outage data from 2010 to 2014 from 14 participants, Hydro One scored worse than it had in 2011 and placed last, including being behind the two transmitters that had a worse TACS than Hydro One in 2011.

On the other hand, Hydro One's availability for only the portion of each transmitter's system that is part of the bulk electricity system has improved compared to others U.S. transmitters surveyed. While Hydro One's system availability decreased (worsened) between the 2011 and 2015 reports, Hydro One's overall ranking improved from 13th of 24 in the 2011 report to fourth of 14 in the 2015.

We asked Hydro One management why U.S. transmitters generally have more reliable systems, and were advised that they typically have shorter distances to deliver electricity than Hydro One, and that Ontario's geography is larger and more challenging to service. However, no detailed analysis was available that studied these reasons or how to overcome the differences.

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;

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

HYDRO ONE RESPONSE

Hydro One agrees with the Auditor General's recommendation and has started setting multi-year reliability targets in its 2015 Corporate Scorecard. The 2015 Corporate Scorecard included both 2015 and 2019 targets to signal the Company's drive to continuous improvement.

Hydro One will continue to make reliability a key priority by reducing the number of planned outages. It will do so by combining planned maintenance activities undertaken during the outage. This will reduce the risk of customer interruptions.

Hydro One's single circuit delivery points, by design, are not as reliable as delivery points served by multiple circuits. Single-circuit delivery point reliability has increased over the 2010–14 time horizon, as shown by the improved SAIDI and SAIFI results and lower unplanned outages.

Hydro One does respond to customer requests to improve reliability, providing the customer is prepared to pay the costs of the necessary investments in accordance with the Ontario Energy Board's (OEB's) Transmission System Code (TSC). The TSC requires affected customers to consent to pay their respective shares of the cost of the additional circuit. Customers have generally not provided such consent in Ontario, where such costs tend to be high due to low customer density and long lines.

Hydro One will continue to analyze outage data to identify issues relating to reliability. Hydro One carries out investments to improve customer reliability in accordance with the Customer Delivery Point Performance Standard issued by the OEB. This standard sets out thresholds for inadequate performance and appropriate funding levels based on minimum improvement levels and size of the customer load. The investments balance costs and benefits, and consider the degree of the improvement and the size of the load that is impacted.

Hydro One will undertake network expansions to provide redundant supplies and improve reliability to electrical areas that serve multiple customers when electricity demand in the area meets the criteria established by the Independent Electricity System Operator's Ontario Resource Transmission Assessment Criteria standard. The objective of the standard is to balance cost, customer benefit and ratepayer impacts.

4.1.4 Growing Backlog of Preventive Maintenance on Equipment Reduced System Reliability

A lack of preventive maintenance can lead to a shorter expected service life of equipment and premature equipment failure, which is the second-most common cause of outages (16% of all outages from 2010 to 2014). We found that the growth in the backlog of preventive maintenance on transmission system equipment from 2012 to 2014 likely contributed to an increase in the number of equipment outages on the transmission system. The backlog increased by 47%, from 3,211 orders as of 2012 to 4,730 orders as of 2014. During the same period, the total number of equipment outages on the transmission system increased by 7%, from 2,010 instances in 2012 to 2,147 instances in 2014.

Almost half (48%) of the preventive maintenance backlog in 2014 relates to the two most critical assets within a transmission station—transformers and circuit breakers. The backlog of preventive maintenance for these assets increased by 320% and 393%, respectively, from 2012 to 2014. During the same period, the increase in the number of transformer and circuit breaker outages on the transmission system increased by approximately 14% and 36%, respectively. We identified instances where a key piece of equipment for the transmission system failed that had backlogged preventive maintenance work.

Hydro One advised us that the backlog exists because it does not have sufficient staff available to perform all scheduled maintenance. The situation has worsened since 2012 as maintenance staff have been assigned to complete capital projects to repair or refurbish Hydro One's aging transmission system. We estimate from the preventive maintenance work orders in the backlog that the cost to clear the backlog has grown 36%, from $6.1 million as of December 31, 2012, to $8.3 million as of December 31, 2014. We believe that an $8.3-million backlog should have been manageable and eliminated long ago by Hydro One, given their multi-billion dollar annual operating budgets; instead, it is growing and impacting system reliability.

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

HYDRO ONE RESPONSE

Hydro One agrees that more diligence is required to ensure that the records contained in its management information system are reflective of actual outstanding maintenance. Consistent with industry practice, Hydro One maintains a catalogue of planned maintenance work that may have completion dates that extend well into the future. These maintenance orders are released well in advance of required completion dates to allow Hydro One to bundle work effectively (thus avoiding the need for multiple planned outages). Reducing the number and duration of planned outages reduces the risk of customer interruptions.

All critical preventative maintenance is completed when required. Maintenance activities that need to comply with industry standards are confirmed through Hydro One's Internal Compliance Program.

Hydro One will continue to prioritize work to enhance reliability and optimize work efficiency, while at the same time balancing service and cost.

4.1.5 Hydro One Not Replacing Transmission Assets that Are at Very High Risk of Failure

We found that the assets that Hydro One replaced or planned to replace from 2013 to 2016 were not the ones that it reported to be in very poor condition and at very high risk of failure in its bi-annual transmission rate applications to the Ontario Energy Board (OEB). In its rate application for 2013-2014, Hydro One stated that it had a program to replace power transformers and circuit breakers that had reached the end of their useful service lives, which was determined by evidence including the condition and age of the asset and its operating history. The rate application noted that the condition of an asset is the main indicator of its risk of failing, and that replacing assets that are in poor

condition as soon as possible is key to maintaining the reliability of the system.

Based on Hydro One's report of its aging and deteriorating transmission transformers, as presented in its rate applications, the OEB approved increased capital sustainment funding for the period 2013 to 2016. As a result, Hydro One's transmission transformer replacement spending increased to more than $280 million over the two years 2013 and 2014 from $180 million over 2011 and 2012. Hydro One also planned to spend about $225 million on transformer replacements over 2015 and 2016.

In its 2013-2014 transmission rate application filed in May 2012, Hydro One reported that 18 of its 719 power transformers as of December 2011 were rated as being in very poor condition and at a very high risk of failure. Most of these 18 power transformers were at or past their expected service life of 40 to 60 years, with their average age being over 60 years.

However, as **Figure 3** shows, Hydro One replaced only four of the 18 power transformers deemed to be in very poor condition in 2013 and 2014, and replaced 37 other old power transformers, including 14 rated as being in very good condition and 13 in good condition. Of the four power transformers in very poor condition that were replaced, one failed prior to its replacement in 2013, causing a major power outage of 200 minutes on September 12, 2013, in an eastern Ontario town. One of the remaining 14 power transformers rated as being in very poor condition that was not replaced also failed in 2015, causing a major outage of 220 minutes on February 13, 2015, affecting customers in Toronto.

In its 2015-2016 transmission rates application filed in June 2014, indicating it wanted to replace 43 transformers, Hydro One informed the OEB that it now had 34 power transformers deemed as being at very high risk of failure. The application did not state that the 34 transformers included 13 that had been identified in the previous rate application as being in very poor condition, but had not yet been replaced. However, information for 2015-2016 provided to us by Hydro One indicated that of the 43 transformers it indicated it wanted to replace, it planned to replace only eight of the 34 in very poor condition. By not replacing 26 transformers in very poor condition, even though the OEB approved rate increases to fund these replacements, Hydro One will have to seek $148 million again in the future for their eventual overdue replacement.

Similarly, as **Figure 3** shows, Hydro One did not replace circuit breakers during 2013 and 2014 in accordance with the condition ratings it submitted to the OEB. While 153 circuit breakers were replaced at a cost of $123 million, only one of the 16 circuit breakers reported as being in very poor condition was replaced, and 63% of breakers replaced were in fair, good or very good condition. In addition, Hydro One's planned replacement lists for 2015-2016 indicate that the 85 circuit breakers

Figure 3: Condition Ratings and Replacements of Transformers and Circuit Breakers
Source of data: Hydro One

	Condition Rating					
	Very Good	**Good**	**Fair**	**Poor**	**Very Poor**	**Total**
Transformers						
# as of December 2011*	374	203	68	56	18	**719**
# replaced in 2013–2014	14	13	6	4	4	**41**
Circuit Breakers						
# as of December 2011*	908	1,715	975	648	16	**4,262**
# replaced in 2013–2014	12	50	34	56	1	**153**

* This is the number reported in Hydro One's transmission rate application for 2013/14 filed with the Ontario Energy Board in May 2012.

ATTACHMENT 3

Residential Earth Power Loan

Our Residential Earth Power Loan is an option if you would like to make energy efficiency upgrades to your home.

The loan covers qualifying upgrades for:

- geothermal (ground source) heat pumps;
- cold climate air source heat pumps;
- solar thermal water heaters;
- solar photovoltaic systems.

Calculate your payments.

Benefits

- Your monthly payment will be added to your energy bill.
- Your home will be more energy efficient and comfortable.
- No down payment is required.

Financing information

- The minimum allowable loan amount is $500.
- The maximum allowable loan is:
  - Up to $20,000 for geothermal ground source heat pumps;
  - Up to $10,000 for air source heat pumps;
  - Up to $7,500 for solar thermal water heaters;
  - Up to $30,000 for solar photovoltaic panels.
- Solar PV financing is calculated based on $3,000 per kW installed;
- The maximum term is 15 years.
- No down payment is required.
- The loan becomes due and payable when the house is sold. The loan is not transferrable.
- Annual interest rate is fixed at 4.9 per cent (O.A.C.) for the first 5 years.
- Monthly installments will be included on your energy bill. Loan billing and the responsibility for loan payment will be up to the owner and not to a tenant.
- You must be the owner of the home in which energy improvements are made and have an active Manitoba Hydro account in good standing.
- Additional or complete payments may be made after 6 months from the first finance charge on your account. A $20 administration fee will apply for any additional or complete payments prior to 6 months.
- You cannot combine Residential Earth Power Loan financing with any other Power Smart financing option for the same upgrade.

Financing is **not available** for:

- unoccupied homes, seasonal homes (cottages), apartment buildings, garages, commercial properties, and homes under construction;
- projects that have been started prior to or during the application process;
- used equipment or materials;
- natural gas and electrical materials that are not installed by an allied gas fitter/electrician, licensed by the province of Manitoba.

How to apply

Your contractor or retailer will work with you to determine if your project is eligible for financing and will help you complete the loan application.

Contractors and retailers can find more information on the Residential Earth Power Loan by contacting us.

Read more about heating

- Residential Propane and Oil Furnace/Boiler Replacement Program
- Calculate heating costs
- Geothermal heat pump systems
- Installation costs
- Ventilation systems
- Thermostats
- Power Smart heating & cooling tips

ATTACHMENT 4

Power Smart and First Nations

We are partnering with First Nations communities to help them be Power Smart.

Power Smart First Nations Program

Each First Nations community is matched with an energy efficiency specialist to select qualifying homes and recommend energy efficient measures.

Energy saving measures may include insulation and basic energy efficiency upgrades:

- compact fluorescent light bulbs;
- insulated pipe wrap;
- draft proofing;
- faucet aerators;
- low-flow showerheads.

We can provide community members with training to do the upgrades. Energy saving seminars can be arranged to provide community members with information and tips on what they can do to make their communities more energy efficient.

Community Geothermal Program

Through the Community Geothermal Program First Nations community members are engaged in being active participants in reducing their energy consumption. This is achieved through training local businesses on how to install and maintain geothermal heat pump systems while providing homeowners with convenient and affordable financing through Pay As You Save (PAYS) Financing.

Aki Energy, a non-profit social enterprise group, is the main contact point for First Nation Communities seeking to use the Community Geothermal Program. In addition to helping the communities identify opportunities for geothermal technology use, Aki Energy also trains community members on how to install and maintain these systems.

Benefits

- local economic benefits through job and business creation;
- little to no upfront capital costs are required to install the geothermal heat pump systems by using PAYS Financing;
- increased customer support as local businesses are trained to install and maintain the equipment;
- lower energy consumption for homeowners.

For more information about the program, call 204-480-5900, 1-888-MBHYDRO (outside of Winnipeg), or email us.