# 2015 Environmental Performance Report

The City of Toronto (the "City") is the sole shareholder of Toronto Hydro Corporation (THC). THC owns two subsidiaries: Toronto Hydro-Electric System Limited (THESL), which owns and operates an electricity distribution system; and Toronto Hydro Energy Services Inc. (THESI), which provides street lighting services to the City of Toronto (THC, THESL and THESI on a consolidated basis are referred to as "Toronto Hydro" or the "Company").

The City requires the Company to uphold certain objectives and principles set out in the City's Amended and Restated Shareholder Direction relating to Toronto Hydro Corporation. This report focuses on two of the specified objectives, and demonstrates how the Company operates in an environmentally responsible manner, while supporting the City's energy, climate change, urban forestry, and utilization of emerging green technologies' objectives.

Toronto Hydro operates an integrated Environment, Health and Safety (EHS) Management System allowing significant efficiencies to be realized by building on synergies and eliminating duplication and redundant processes. In 2012, following an intensive audit of both its environmental and occupational health and safety management systems, Toronto Hydro certified to both the International Organization for Standardization's Environmental Management Systems Standard (ISO 14001:2004) and the Occupational Health and Safety Standard (OHSAS 18001:2007). Both certifications are internationally recognized standards established for effective and efficient management of an organization's environmental, health and safety activities.

In order to maintain these certifications, Toronto Hydro completes a variety of annual audits conducted by internal and external parties to verify conformance to these standards and compliance with both occupational safety and environmental legislation. Toronto Hydro also completes a full re-certification audit every 3 years. Findings and corresponding actions are tracked and reported at various levels of the organization up to and including the Board of Directors. In order to pass the recertification audits, Toronto Hydro must demonstrate how its management systems:

1. Continue to meet the certification requirements.
2. Ensure the standards are effectively implemented and understood by all employees.
3. Have permanently remediated prior non-compliance findings.
4. Demonstrate continual improvement.

In December 2015, Toronto Hydro underwent its first re-certification audit for the ISO 14001 and OHSAS 18001 certificates. The audit was conducted by an independent third-party auditor accredited by the Standards Council of Canada that verified that Toronto Hydro's EHS Management System met the requirements of the standards. The auditor identified only two minor findings that required action. The independent auditor commented on Toronto Hydro's tremendous improvements and recognized the maturity of its EHS Management System. Toronto Hydro is committed to continually meeting these

internationally recognized standards and verifying conformance through a third-party independent audit process.

Overall, Toronto Hydro continues to strive to achieve zero injuries and remain a sustainable electricity company. We regularly monitor and assess our energy consumption and waste streams in an effort to reduce our environmental footprint and improve organizational efficiency. Toronto Hydro also enables customers to be part of the shift to a sustainable economy by connecting renewable power and energy storage to the grid; encouraging the use of electrified transportation; and offering a variety of commercial and home energy efficiency programs.

## ENERGY USE AND GREENHOUSE GASES

Toronto Hydro operates in an environmentally responsible manner consistent with the City's Climate Change, Clean Air and Sustainable Energy Action Plan[1]. The City has established targets to reduce greenhouse gas (GHG) emissions by 30% by 2020 and 80% by 2050. Toronto Hydro is supporting these goals by reducing its own GHG emissions associated with its fleet, facilities, line losses, and releases of sulphur hexafluoride ($SF_6$) gases.

GHG emission reductions through Toronto Hydro's Conservation and Demand Management (CDM) activities are covered in the CDM section of this report.

### GHG Inventory

Toronto Hydro's GHG inventory includes Scope 1 and 2 emissions (explained below), quantified in accordance with national and provincial GHG reporting guidelines[2] and the GHG Protocol – Corporate Accounting and Reporting Standard[3]. The organizational boundary of this GHG inventory includes all Toronto Hydro-owned and controlled (i.e. leased) facilities.

Scope 1 emissions consist of direct emissions from stationary combustion (natural gas combustion for facilities), mobile combustion (fuel combustion for fleet) and fugitive sources (releases of $SF_6$ and refrigerant gases). Scope 2 emissions include indirect emissions from the use of purchased electricity (facilities and line losses) and chilled water (facilities). Scope 3 emissions are all indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions. Scope 3 emissions are not included in this GHG inventory.

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[1] City of Toronto's Climate Change, Clean Air and Sustainable Energy Action Plan: Moving from Framework to Action (June 13, 2007).
[2] Environment and Climate Change Canada, Technical Guidance on Reporting Greenhouse Gas Emissions, available at http://www.ec.gc.ca; Ontario Ministry of the Environment and Climate Change, Guideline for Greenhouse Gas Emissions Reporting, available at http://www.ontario.ca/ministry-environment-and-climate-change.
[3] The Greenhouse Gas Protocol - A Corporate Accounting and Reporting Standard (World Resources Institute and World Business Council for Sustainable Development), available at http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf.

The emission factors used to calculate the GHG emissions are the provincial values[4] representative of Ontario's energy supply mix and measured in tonnes of carbon dioxide equivalent emissions per gigawatt-hour ($tCO_2e$).

*Organizational Boundaries*

The following three changes are reflected in the modified organizational boundaries for 2015: (1) Toronto Hydro sold one of its facilities and as such, the electricity and natural gas use for this facility subsequent to the sale have not been included in this report; (2) one satellite work location was added; and (3) Toronto Hydro began to lease new office space.

*Data Sources and Assurance*[5]

Facilities Energy Data - The energy consumption data (electricity, natural gas and chilled water) is gathered from utility providers for all Toronto Hydro facilities included in the organizational boundary described above. This building-specific energy consumption data is used to populate the facilities energy management database. Facility energy billing data is comprised of digital files for electricity, paper bills from utility companies for natural gas, and consolidated billing files from third-parties for leased buildings. Additionally, the natural gas consumption for one of Toronto Hydro's leased buildings was not provided by the landlord, therefore the most recent complete data set available (2012) was used as a proxy.

GHG emissions from stationary air conditioning and refrigeration equipment (refrigerant leaks) are not included as they were deemed immaterial (0.05% of emissions).

Fleet Fuel Data - A similar process to the facilities energy data collection and assurance is used for the fuel consumption data of the motor vehicle fleet. The fuel management database is populated with data from various datasets acquired from fuel suppliers and through paper billing statements.

$SF_6$ Emissions Accounting Process - In 2014, Toronto Hydro developed a new process to track $SF_6$ gas inventory and equipment emissions consistent with the joint Canadian Electricity Association (CEA) - Environment Canada $SF_6$ Estimation and Reporting Protocol[6]. This process defines the procedures for acquisition of $SF_6$ gas (through the purchase of $SF_6$-filled equipment and gas cylinders for equipment "top-up"), inventory management (using Toronto Hydro's inventory management system and weigh scales to track gas use) and out-flow of gas from the system (through the decommissioning of old equipment). Starting January 2015, Toronto Hydro's methodology for tracking $SF_6$ emissions has consisted of weighing $SF_6$ cylinders against a baseline value on an inventory basis. Emissions from decommissioned and retired equipment were calculated by subtracting the mass (in kilograms) of $SF_6$

[4] 2013 Emission factors published in Environment Canada's National Inventory Report 1990-2013: Greenhouse Gas Sources and Sinks in Canada.

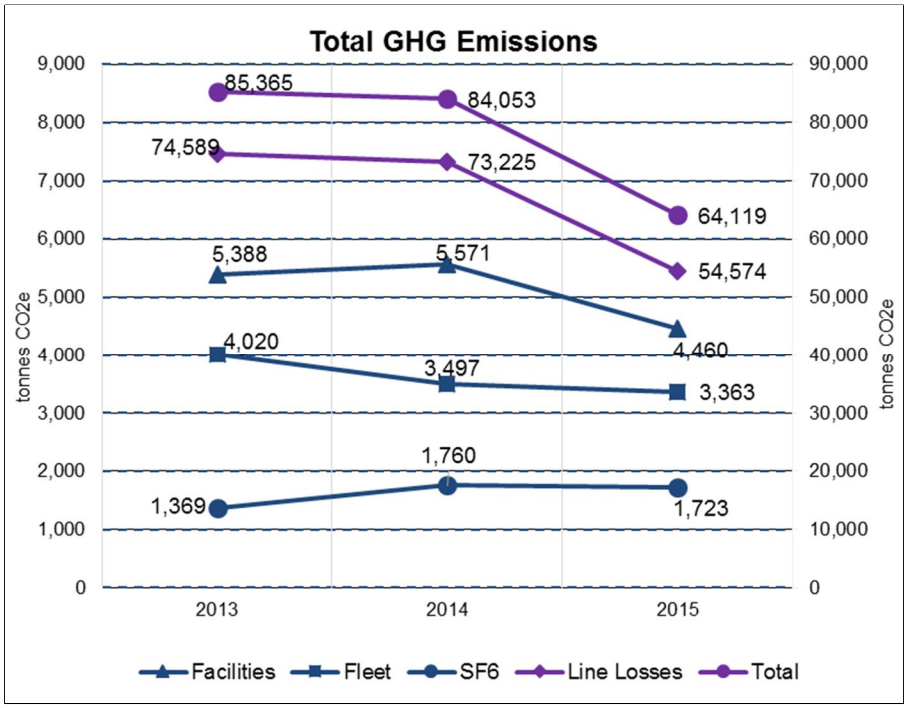
[5] Given that the internal assurance process entailed a sample audit of select bill entries, there is a small potential for data entry errors, as not all data entries have been verified.

[6] Annex A: $SF_6$ Emission Estimation and Reporting Protocol for Electric Utilities.

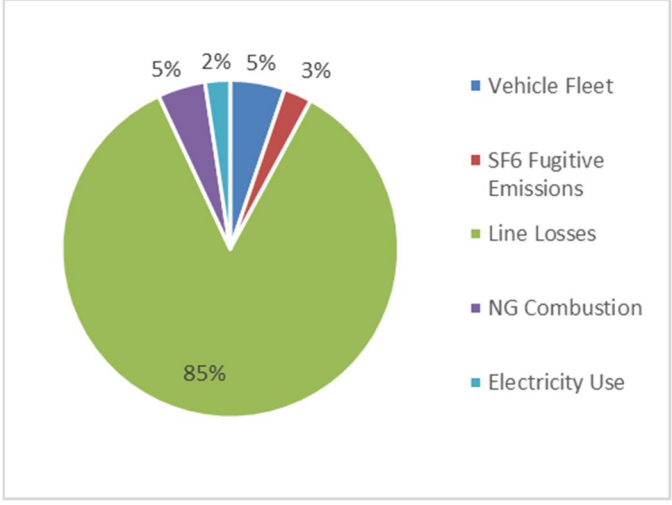
gas from approved recycling vendor reports and from the equipment nameplate capacity. Emissions from damaged but repairable equipment are included in the total equipment use emissions.

*Results and Analysis*

Toronto Hydro's 2015 total GHG emissions were 64,119 $tCO_2e$, a decrease of 24% relative to 2014. Below is the historical data on Toronto Hydro's GHG emissions by source (i.e., facilities, fleet, line losses and $SF_6$).




The make-up of the carbon footprint, shown in the following diagram, is similar to 2014 with 85% of the emissions attributed to line losses, while fleet and facilities (electricity and natural gas use) are responsible for 5% and 7%, respectively. The remaining 3% is associated with $SF_6$ emissions.



The fleet fuel consumption and associated emissions decreased by approximately 4% relative to 2014 and by 16% relative to 2013. This is the result of continued efforts to reduce the number of vehicles and optimize their use (see details in "Maximizing the efficiency of Toronto Hydro's fleet"), the implementation of a new Idle Management System (Governor to Reduce Idle and Pollution - GRIP), as well as through the creation of portable and satellite work sites in close proximity to new capital projects locations. For additional benefits, such as reduction in idling time, fuel use and kilometres travelled, please refer to the Environmental Initiatives section.

The total Facilities' electricity use (in kWh) and natural gas use (in $m^3$) decreased by 25% and 8%, respectively. Some of the factors contributing to these variances were the warmer winter conditions in 2015 (9% less heating degree days[7]) and the energy-efficiency initiatives described under "Facility Improvements".

The 20% and 25% decrease in total GHGs from facilities and line losses, respectively are largely attributed to the lower provincial emission factor (the electricity mix in Ontario was less GHG intensive in 2015 relative to 2014[8]).

The total $SF_6$ fugitive emissions decreased by 2% (37 kg) in 2015 compared to 2014.

In Toronto Hydro's 2014 Environmental Performance Report, a 100% leakage rate was assumed for $SF_6$ emissions from decommissioned equipment, since the recycling vendor reports were not available at the time the report was submitted. Toronto Hydro has now received the recycling vendor reports, and based on the accurate data from these reports, Toronto Hydro's 2014 $SF_6$ emissions were 13% lower (by approximately 10 kg of SF6 gas) than previously reported.

## Environmental Initiatives

*Facility Improvements*

In 2015, Toronto Hydro reduced its footprint by 122,000 square feet, by closing one facility and making better use of space at existing work centres.

Key 2015 projects targeting reduction in energy use and GHGs include:

- Roof replacement and the addition of better insulation at the 500 Commissioners Street location. This initiative resulted in improved insulation, reduced the heat loss and better utilized HVAC

[7] Degree days comparison obtained from http://www.weatherdatadepot.com/.

[8] National Inventory Report 1990-2013: Greenhouse Gas Sources and Sinks in Canada - Decreasing energy generation from coal and oil, accompanied by an increase in hydro, nuclear and wind generation, was the largest driver of decrease in emissions associated with Electricity Production between 2005 and 2013. The permanent closure, at the end of 2013, of all but one coal generating station in the province of Ontario was a determining factor.

equipment. The new roof reduced the load on the facility HVAC units and has contributed to a drop in the 2015 natural gas consumption by 10% relative to 2014 values.

- Installation of a Building Automation System (BAS) at Toronto Hydro work centres. When fully commissioned, the BAS will provide Facilities staff at each building with an automated, single-point of control for the HVAC and lighting systems. Moreover, by inputting the peak occupancy times into each building schedule, the HVAC and lighting equipment loads will closely match the building's occupancy levels. The end result will be a smart heating, cooling and lighting system that will help reduce energy consumption and costs along with associated GHGs.

Complementing the aforementioned initiatives, departmental metrics such as reduction of energy use, square footage and GHGs are monitored monthly as part of Toronto Hydro's internal scorecards.

*Fleet-Related Initiatives*

*GRIP Idle Management System*

The GRIP Idle Management System is designed to decrease the amount of time a vehicle spends idling while keeping all auxiliary functions of a vehicle in operation (i.e. GRIP keeps the cab environment comfortable for crews, maintaining operation of lighting bars, computer systems and safety features while the engine is off). This ultimately reduces engine use and wear, while simultaneously reducing fuel use and associated GHG emissions. In 2015, Toronto Hydro put eight new vehicles in service with GRIP Idling-reduction systems, for a total of 28 GRIP systems across its fleet.

*Sustaining a Green Fleet*

Since 2013, Toronto Hydro has maintained a steady fleet of approximately 60 hybrid and electric vehicles. By replacing traditionally-fueled vehicles with hybrid and electric alternatives, the company achieved a 2% and 1% annual reduction in both fuel consumption and GHG emissions, in 2014 and 2015, respectively[9].

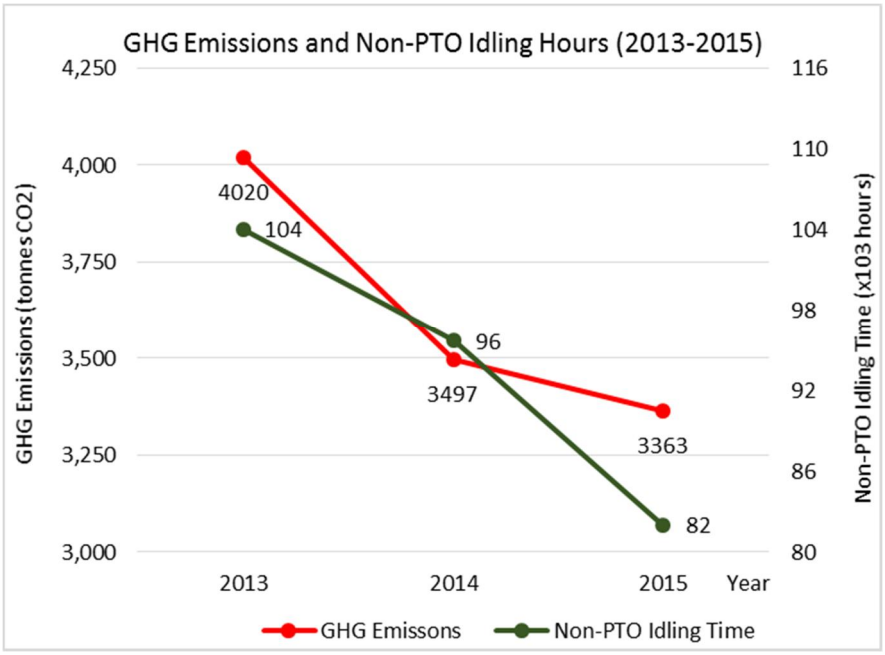
*Downsizing*

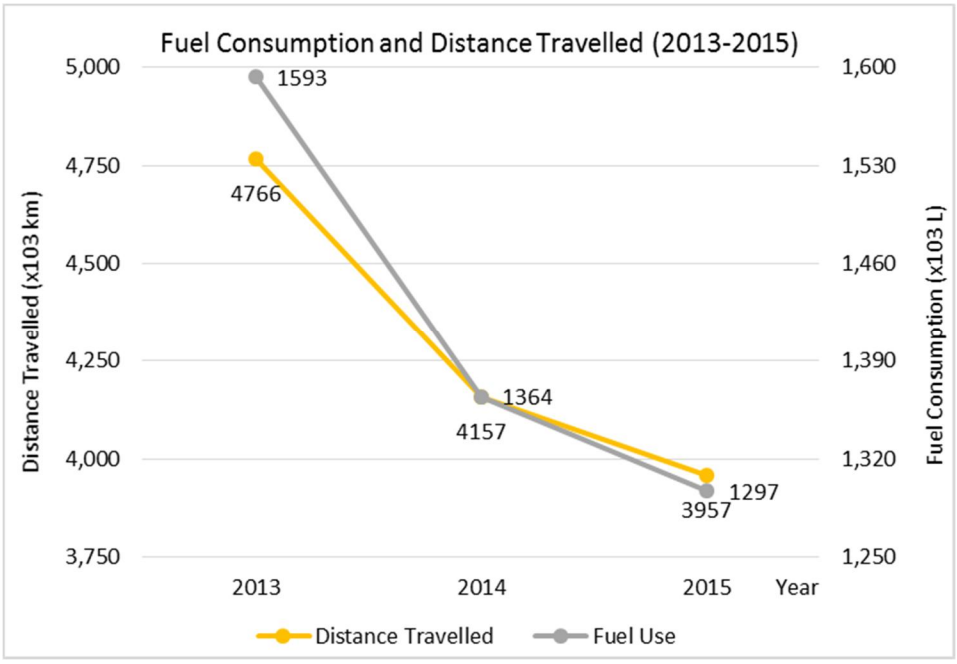
The most significant impact on reducing fuel consumption, idling hours, and GHG emissions is attributed to downsizing the fleet. In 2015, Toronto Hydro reduced its fleet by 24 vehicles.

The cumulative 2015 savings, relative to 2013, associated with the three fleet related initiatives mentioned above are: 19% reduction in total fuel consumed (approximately 296,000 L); 16% reduction in GHG emissions (657 $tCO_2e$); 17% reduction in kilometres travelled (approximately 809,000 km); and

[9] Calculations based on actual fuel consumption retrieved from Toronto Hydro's fuel management database.

21% reduction in total non-PTO[10] idling hours (approximately 22,000 hours)[11]. See the graphs below for additional details.

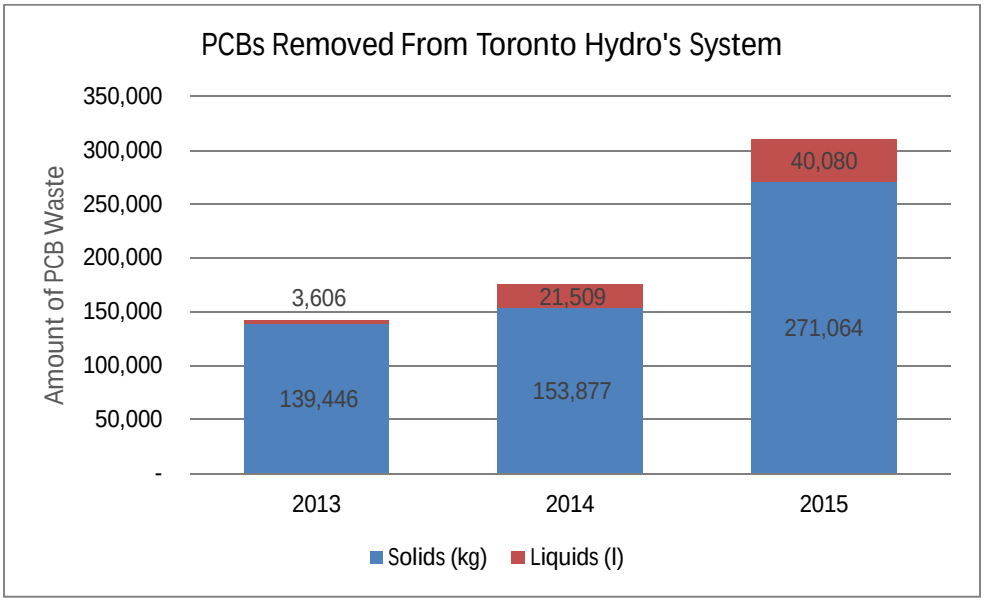



[10] Some of Toronto Hydro's vehicles (e.g. bucket trucks) require engines to be kept on (idling) in order to charge and operate the vehicle hydraulics. This is referred to as Power Take Off ("PTO") idling time.
[11] Supra note 10.

*Reducing Hazardous and Non-Hazardous Waste*

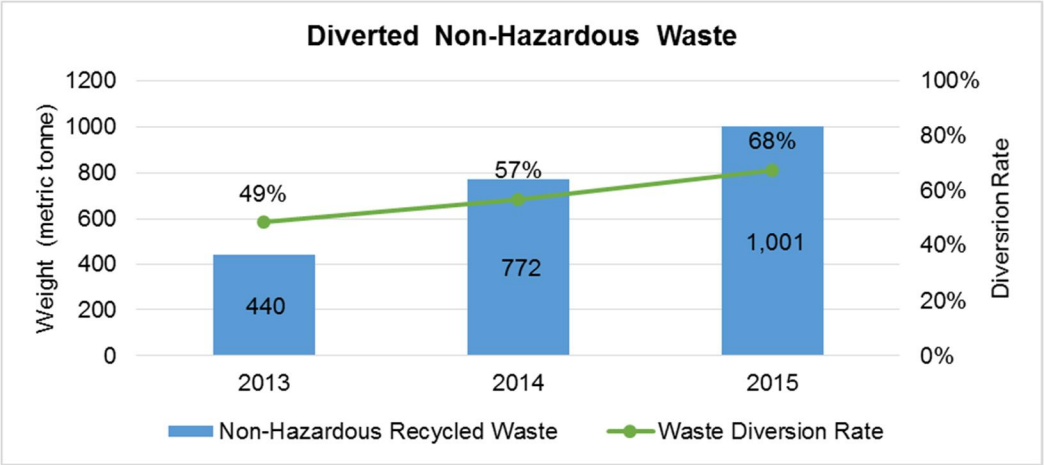
Similar to most electrical utilities in Canada, Toronto Hydro owns and operates equipment that contains polychlorinated biphenyls (PCBs). The operation of this equipment is compliant with the PCB Regulations under the *Canadian Environmental Protection Act, 1999*. In recognition of the persistent ecological effects of PCBs, Toronto Hydro is actively removing and safely disposing PCB-containing equipment as prescribed by federal and provincial laws. This removal and disposal has been accelerated in recent years. In 2015, approximately 271,000 kilograms of material[12] and 40,000 litres of liquids containing PCBs were sent for destruction – an increase of more than 40% over 2014. The graph below displays the increase in PCB waste removal and disposal since 2013.



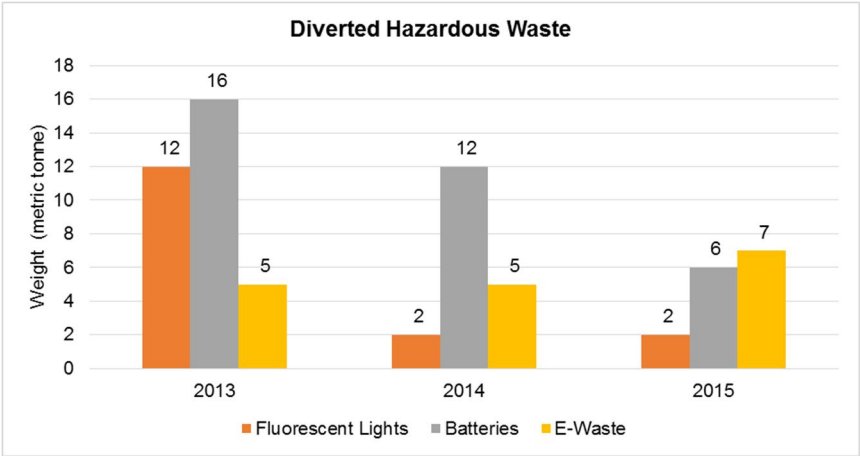

Beginning in January 2015, a waste reduction project entitled "Waste No More" was piloted. The ultimate objective of Waste No More is to increase the amount of waste that is diverted from landfill through effective source separation and reduction of materials entering waste streams.

The first phase of this pilot project was aimed at increasing the non-hazardous waste diversion rate by raising employees' awareness about which materials can be recycled at Toronto Hydro. This included various waste reduction strategies involving education, awareness, audits and feedback. Multiple forms of communications were used to explain what can and cannot be recycled at Toronto Hydro.
To date, changes in employees' behaviour related to effective source separation has led to an increase in the amount of waste diverted from landfill from 49% in 2013 to 68% in 2015.[13]

[12] The amount of PCB-containing equipment removed and sent for destruction is based on the monthly reports provided by Toronto Hydro's hazardous waste management company.
[13] The non-hazardous solid waste diversion rates have been provided by the waste management company performing annual waste audits for Toronto Hydro, as required by Ontario legislation. This waste diversion rate is calculated as the ratio of the amount of waste recycled to the total amount of waste generated, excluding electronic waste, wood poles, batteries and fluorescent lamps.




In addition to recycling solid non-hazardous waste from its facilities, Toronto Hydro has been recycling wood poles removed from service, fluorescent lights, batteries and electronic waste (e-waste) from the landfill. In 2015, Toronto Hydro diverted 876 metric tonnes of wood poles from landfill. [14] The graph below illustrates the respective amounts diverted from landfill between 2013 and 2015.




*Reduction of Paper Consumption*

The key to reducing waste is eliminating consumption of the materials that generate waste. In 2015, Toronto Hydro continued the initiative to automate and use electronic forms in place of paper. The four projects outlined below have reduced paper consumption by about 609,440 sheets of paper and have led to a reduction in life-cycle GHGs of approximately 7.8 $tCO_2e$[15]. When combined with similar

[14] 2015 data has been provided by the waste management company recycling wood poles. Data from previous years is not available for comparison.

[15] Estimation using a life cycle GHGs emission factor of 6.36 kg $CO_2e$/ream of 500 sheets 8.5 x11 (weighing 2.27 kg) based on Environmental Paper Network – Paper Calculator. Lifecycle emissions account for all emissions relating to the production, use and disposal of a product, including the extraction of raw materials, product manufacturing and intermediate transport steps. See: http://c.environmentalpaper.org/baseline.

initiatives carried out in earlier years, the annual savings increase to approximately 849,440 sheets of paper[16] and life-cycle GHG reduction of 10.8 $tCO_2e$. [17]

*Timekeeping Automation Project* – Prior to the introduction of MyTime, a platform that allows electronic submission of time sheets and leave requests, in April 2015, paper timesheets and leave requests were completed. MyTime, which operates online, eliminated the need for timesheets to be printed on paper. MyTime will be fully implemented across the organization by the end of 2016. The annual paper savings associated with the use of MyTime are estimated to be over 81,330 sheets of paper[18] along with the corresponding reduction in the ink used to print the timesheets.

*Online Project Change Request Application* (CRA) is a web-based solution which replaced the paper-based Change Request used by various employees and leaders at Toronto Hydro to process scope changes in a specific project. The online CRA enables electronic submission (initiation), processing, review and approval of a Change Request in a timely manner and eliminates paper consumption from this entire workflow. The application has been also integrated into Toronto Hydro's enterprise intranet interface (MS SharePoint) and email application (MS Outlook) for notification and reminder purposes. The direct paper savings associated with the use of CRA are estimated to be approximately 2,000 sheets of paper per year[19], along with the corresponding reduction in ink. Additional paper savings will be generated through the use of various multimedia materials that replaced the traditional paper-based job aids (including user manuals, templates, etc.).

*Electronic Submission for City Permit Applications* - In the past, in order to obtain a full stream road cut permit, the City required utility companies to submit two (2) sets of the civil drawings and all documentation (e.g., sign-offs from utilities, exemptions and notification letters, etc.). The City's comments were marked on one copy and sent back to the utility, which in turn (after addressing the comments) sent two more copies to the City for final approval. Lastly, the utility was required to submit six (6) copies of the approved drawings to the City.

In 2014, at Toronto Hydro's request, the City piloted an electronic submission process which is currently used by other public utility companies (e.g. Bell, Rogers, Enbridge). A similar electronic submission was also implemented for Toronto Hydro's third party auditor. The introduction of this electronic submission

[16] The additional 240,000 sheets of paper are saved annually as a result of the warehouse management system that allows purchase orders to be submitted automatically.
[17] Estimation using a life cycle GHGs emission factor of 6.36 kg $CO_2e$/ream of 500 sheets 8.5 x11 (weighing 2.27 kg) based on Environmental Paper Network – Paper Calculator. Lifecycle emissions account for all emissions relating to the production, use and disposal of a product, including the extraction of raw materials, product manufacturing and intermediate transport steps. See: http://c.environmentalpaper.org/baseline.
[18] Estimations based on the following assumptions: 1 daily timesheet for every 3 outside employees, 1 weekly timesheet for every inside employee and an average of 10 leave requests for all employees including contractors and students.
[19] Estimate based on historical data (previous years' paper-based requests).

process is estimated to have saved Toronto Hydro in 2015 approximately 70,000 sheets of paper[20], along with the corresponding reduction in ink.

*Paperless Billing* - Toronto Hydro has exceeded its paperless billing target by almost 33%, achieving more than 64,210 signups by customers. This amounts to savings of over 449,300 sheets of paper[21], along with the corresponding reduction in ink.

## ENERGY CONSERVATION AND DEMAND MANAGEMENT (CDM)

Toronto Hydro operates in a manner consistent with the City's Sustainable Energy Strategy[22], including targets to reduce electricity consumption by 550 MW and increase renewable generation by 550 MW by 2020. These targets are achieved through a variety of programs involving municipal and provincial partners, regulatory partners, industry partners and customers.

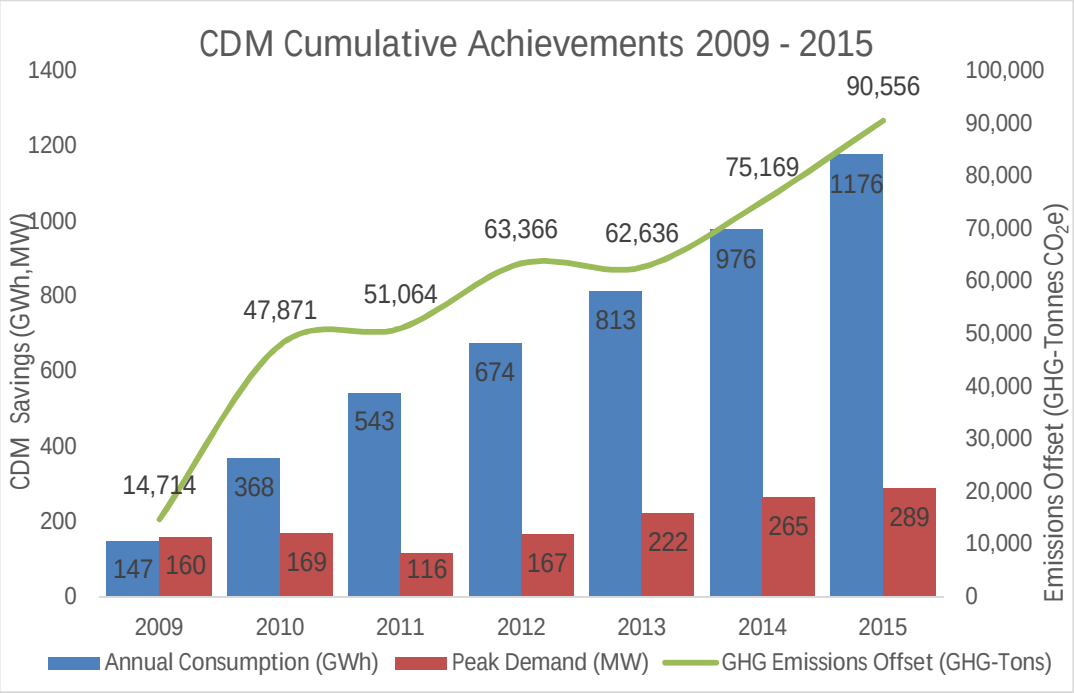
### Fostering Conservation Conversations with Customers

Toronto Hydro is one of the largest contributors to the Ministry of Energy's (the MOE) provincial CDM targets.

In 2015, Toronto Hydro continued to work with residential, small business, industrial and commercial customers to implement energy-efficiency projects. Toronto Hydro's 2015 CDM programs led to an estimated energy savings of 214,500 MWh and reduced summer peak demand by 32.5 MW. These initiatives helped to reduce GHG emissions in the city by 16,516 $tCO_2e$.[23]

Since 2009, through its CDM initiatives, Toronto Hydro has helped its customers reduce electricity consumption by 1,176 GWh[24] and reduce GHG emissions by 90,556 $tCO_2e$.[25] Furthermore, from 2009-2015, Toronto Hydro's CDM programs helped customers reduce energy demand by 289 MW, representing 53% of the City's 2020 goal. While Toronto Hydro has been the catalyst for these savings, the achievement is also attributed to the various programs offered by the municipal and provincial government, initiatives which have shaped a stronger culture of conservation among Torontonians.

[20] Estimation assumptions: number of City Permit Applications from 2014, which is equivalent to 9.25 letter size (8.5x11) sheets of paper per application; percentage of drawings for each phase described in this report by the City.
[21] Assumptions for paper savings: bills issued bi-monthly; 2 sheets of paper/bill.
[22] The Power to Live Green: Toronto's Sustainable Energy Strategy (October, 2009).
[23] Estimate using 2013 Ontario emission factors published in Environment Canada's National Inventory Report 1990-2013: Greenhouse Gas Sources and Sinks in Canada.
[24] These achievements were calculated to include the annual energy and peak demand savings that CDM initiatives continue to contribute in the years following implementation. 2015 CDM energy and peak demand savings have not yet been verified by the IESO.
[25] Supra note 24.



[26]

Shaping Provincial Conservation Directives

Toronto Hydro is a leading member of the Conservation First Implementation Committee (CFIC), serving as the co-chair with the Independent Electricity System Operator (IESO). This group of Local Distribution Companies (LDCs), the IESO and other related industry representatives has been guiding the implementation of the Conservation First Directive, issued by the MOE for the 2015 to 2020 period. Toronto Hydro also has a strong presence on all of the supporting working groups and committees aimed at satisfying the mandate to achieve the targeted savings.

The Conservation First framework supports the MOE's 2015-2020 "Conservation First" framework, an integral part of the province's Long-Term Energy Plan (LTEP). The LTEP includes a 7 TWh reduction in electricity consumption by 2020, resulting from conservation programs delivered by LDCs. Toronto Hydro has been allocated the largest electricity savings target in the province at 1.58 TWh.

In 2015, Toronto Hydro launched three new pilot programs under Ontario's new Conservation First framework:

- *OPsaver* – encourages continuous energy improvements through operational changes and incentives based on a "pay for performance" model. This pilot is targeted at owners or managers of commercial office buildings;

[26] These achievements were calculated to include the annual energy and peak demand savings that CDM initiatives continue to contribute in the years following implementation. 2015 CDM energy and peak demand savings have not yet been verified by the IESO.

- *RTUsaver* – tests the effectiveness of installing advanced control systems on air conditioning rooftop units ("RTUs"). This pilot was in collaboration with Enbridge Gas Distribution and is aimed at small to mid-size facilities with RTUs; and
- *PUMPsaver* – focuses on rebalancing hydronic systems and is targeted at multi-unit residential and commercial buildings with central distribution pumps.

These programs are tailored to the local and regional needs of customers and are designed to collect relevant information and customer feedback, determine their effectiveness, and inform decisions on whether they should be permanent programs that can be rolled out locally or across the province.

CDM Highlights

In 2015, Toronto Hydro's most successful program remained the Equipment Replacement Incentive Initiative (ERII). The program offered incentives to business customers to encourage investment in more energy-efficient equipment including lighting, space cooling, ventilation, controls and various other measures. Typical target segments for this initiative included commercial, retail, hospitality and entertainment, municipal, academic, health care, institutional and multi-residential customers. Toronto Hydro has a comprehensive team and related systems to support this initiative. As a result, in 2015, Toronto Hydro had completed 2,357 projects that resulted in 24.4 MW of net peak demand savings and 150,699 MWh of net energy savings. Verified results for 2015 will be available in September 2016 from the IESO. This initiative helped to reduce Toronto Hydro's customers' GHG emissions by 11,604 $tCO_2e$.[27]

*Combined Heat and Power*

In 2015, one of Toronto Hydro's industrial participants completed one of the largest single projects under the ERII framework. This project involved installing a new 4.5MW gas turbine with the heat being recovered for use in process heat loads.

*Educating Customers about Conservation*

Toronto Hydro executed a number of initiatives throughout the year to raise awareness and participation in its conservation programs and online services. Toronto Hydro participated in over 279 events including business tradeshows, Earth Week celebrations, the City's Environment Days, community festivals and in-store activities with Home Depot and Lowes generating 14,000 interactions.

One of the highlights in 2015 involved Toronto Hydro working with the Greater Toronto Hamilton Association (GTHA) of LDCs and natural gas distributors to promote conservation via the annual Energy Into Action (EIA) event. This event, which has been held annually since 2011, had over 400 attendees, marking it as the largest EIA event to date.

[27] Estimate using 2013 Ontario emission factors published in Environment Canada's National Inventory Report 1990-2013: Greenhouse Gas Sources and Sinks in Canada.

## Renewable Energy

Toronto Hydro has been supporting renewable generation across Toronto by enabling infrastructure and direct project investments. The initiatives described in the following section demonstrates Toronto Hydro's support of the City's renewable energy goal of installing 550 MW of renewable generation by 2020, including 166MW of solar photovoltaic (PV) generation.[28]

### *Enabling Infrastructure*

Toronto Hydro provides enabling infrastructure for connecting renewable generation resources consistent with the provincial *Green Energy and Economy Act, 2009* and the Ontario Energy Board's Distribution System Code. Generally, system improvements (e.g. short circuit capacity, protection and communication upgrades) are provided for renewable generation resources through regulated rates.

Toronto Hydro provides engineering support, pre-assessments and Connection Impact Assessments for renewable generation resources under a streamlined process. Between 2009 (the inception of the Feed-in Tariff (FIT) program) and 2015, Toronto Hydro enabled 834 microFIT interconnections (each under 10kW capacity). This totals more than 5.1 MW of generation. During the same period, Toronto Hydro enabled a total of 377 FIT interconnections (each greater than 10kW capacity) totalling more than 59.5 MW of generation.

### *Direct Investment and Development Projects*

In addition to installing enabling infrastructure for customers' renewable energy projects, Toronto Hydro is directly investing in renewable generation.

*Investment:* Toronto Hydro has jointly investing with the City in solar PV projects on City-owned facilities. The initial group of 10 projects, currently in operation, has an installed capacity totalling 1 MW. These projects generated 1,360 MWh and displaced 104 $tCO_2e$ in 2015. Toronto Hydro has previously invested in three other renewable generation projects (Exhibition Place Wind Turbine, Better Living Centre Solar and 500 Commissioners Street Solar) which have an installed capacity of 1.2MW, generated 1,740 MWh and displaced 134 $tCO_2e$ in 2015. Collectively, these projects displaced approximately 238 $tCO_2e$[29] in 2015. Under the FIT 3.0 program, Toronto Hydro and the City secured additional contracts and are moving forward with 10 additional projects with a total capacity of 1.5MW.

When net metered and Renewable Energy Standard Offer Program projects are included, Toronto Hydro has enabled over 1,280 renewable generation interconnections totalling approximately 66.9 MW between 2009 and 2015, representing 12% of the City's 2020 renewable energy generation goal.

[28] The Power to Live Green: Toronto's Sustainable Energy Strategy (October, 2009).

[29] Estimate using 2013 Ontario emission factors published in Environment Canada's National Inventory Report 1990-2013: Greenhouse Gas Sources and Sinks in Canada.

Assuming a specific yield of 1,100 kWh/kWp[30] and a GHG factor of 0.077 $tCO_2e$/MWh, these projects would produce 74.9 GWh and displace 5,770 $tCO_2e$[31] annually.

*HydroStor project* - Toronto Hydro has worked with the technology company, Hydrostor, as well as a consortium of government, academic and engineering organizations to develop the Underwater Compressed Air Energy Storage ("UWCAES"). Energy storage systems are designed to store electricity during off-peak hours when demand is low and electricity is cheapest. Electricity can be released when the grid needs a boost, such as during times of high demand or during short-term power outages. The Hydrostor system, located approximately three kilometres offshore from Toronto Island, efficiently converts electrical energy to compressed air. This air is then sent to a series of flexible accumulators located 55 metres below the surface of Lake Ontario. When the energy is required, the weight of the water pushes the air back to the surface where the system directs it through an expander driving a generator, thus supplying energy to the grid and completing the storage cycle. The system's mechanical plant and control centre are located on Toronto Island next to Toronto Hydro's municipal station (Island MS). This UWCAES technology offers storage with limited environmental impact and can be expanded with additional storage bags underwater as needed. The system will be evaluated over the next two years for demand response, price arbitrage and other applications. This system provides a peak capacity of 660 kW.

*Ryerson CUE/Electrovaya Project* - Toronto Hydro has worked with the technology company, Electrovaya, Ontario Centres of Excellence (OCE), Ryerson Centre for Urban Energy (CUE) and other government, academic and engineering organizations to develop an intelligent energy storage unit. This technology uses the latest in Lithium Ion battery technology to convert primarily surplus off-peak AC electrical energy to DC battery energy, and stores it for subsequent use during on-peak periods. The Electrovaya system is located in the heart of downtown Toronto on the Ryerson University campus and supports the CUE lab space. An intelligent inverter controller provides energy when required to manage peak loads at the building or provide emergency power. This modular Lithium Ion V2 technology offers cost-effectiveness and capacity of large-centralized systems while providing the site with the flexibility and scalability of the small-decentralized systems. The system will be evaluated over the next 12-18 months for demand response, price arbitrage, emergency power, power conditioning and other applications. This system provides peak capacity of approximately 300 kW for up to 4 hours.

[30] kWp represents kilowatt peak, the maximum output of the system.
[31] Estimate using 2013 Ontario emission factors published in Environment Canada's National Inventory Report 1990-2013: Greenhouse Gas Sources and Sinks in Canada.

The table below summarizes the reduction in GHG emissions associated with various projects and initiatives undertaken by Toronto Hydro in 2015.

| | Energy Saving | GHG Reduction[32] |
|---|---|---|
| CDM Projects 2009-2015 | 1,176 GWh | 90,556 $tCO_2e$ |
| CDM Projects 2015 | 214.5 GWh | 16,516 $tCO_2e$ |
| | Annual Energy Generated[33] | Annual GHG Reduction[34] |
| Renewable Energy Generation Projects 2009-2015 | 74.9 GWh | 5,770 $tCO_2e$ |
| Renewable Energy Generation Projects 2015 | 3.1 GWh | 238 $tCO_2e$ |
| | Annual Paper Saved | Annual Lifecycle GHG Reduction |
| Paperless Projects | 849,440 sheets | 10.8 $tCO_2e$[35] |
| | Energy Reduction | GHG Reduction[36] |
| Facilities Energy Efficiency Projects 2015 (Electricity) | 5 GWh | 244 $tCO_2e$ |
| Facilities Energy Efficiency Projects 2015 (Natural Gas) | 114,084 $m^3$ | 867 $tCO_2e$ |
| | Fuel Reduction | GHG Reduction |
| Fleet Fuel Efficiency Project 2015 | 67,449 L | 134 $tCO_2e$ |
| | | GHG Reduction |
| Line Losses 2015 | | 18,651 $tCO_2e$ |
| | | GHG Reduction |
| $SF_6$ Emissions 2015 | | 37.76 $tCO_2e$ |

## ENERGY SECURITY AND SUPPLY

Toronto Hydro is supporting the City in achieving its objectives of ensuring adequate distribution capacity and infrastructure resiliency. Toronto Hydro is mitigating high-risk events that could result from the unplanned loss of either Leaside or Manby transmission station (TS) supply points for the City. Manby and Leaside TS are critical transmission supply points for central Toronto, supporting the

[32] Estimate using 2013 Ontario emission factors published in Environment Canada's National Inventory Report 1990-2013: Greenhouse Gas Sources and Sinks in Canada.
[33] Based on renewable generation projects Toronto Hydro has provided interconnections and enabled infrastructure for connecting renewable generation resources.
[34] Supra note 33.
[35] Estimation using a life cycle GHGs emission factor of 6.36 kg $CO_2e$/ream of 500 sheets 8.5 x11 (weighing 2.27 kg) based on Environmental Paper Network – Paper Calculator. Lifecycle emissions account for all emissions relating to the production, use and disposal of a product, including the extraction of raw materials, product manufacturing and intermediate transport steps. See: http://c.environmentalpaper.org/baseline/
[36] Supra note 33.

key financial and hospital customers. Approximately 1,200 MW peak demand is provided through Leaside TS and approximately 800 MW peak demand is provided through Manby TS.

## Investing in the grid

In 2015, Toronto Hydro invested $537.2 million in the electricity distribution grid and the assets that support grid operation. Toronto Hydro delivered a large capital program, primarily to improve service reliability and address the need for additional distribution capacity. This program focused on four main investment categories: system access, system renewal, system service and general plant.

*Investments in the System Access category* are aimed at addressing Toronto Hydro's obligation to provide customers with access to power from Toronto Hydro's distribution system including connecting and metering customers, connecting renewable energy generation facilities, and relocating equipment to facilitate infrastructure projects undertaken by other agencies such as the TTC and Metrolinx.

*Investments in the System Renewal category* allow Toronto Hydro to target distribution system assets that are beyond their expected useful lives, in poor condition, or functionally obsolete through activities such as direct buried cable replacement and stations circuit breaker renewal.

*Investments in the System Service category* address critical system issues such as capacity and operational constraints, safety concerns, and system design deficiencies. Programs in this category include replacement of defective Polymer SMD-20 fuses and the installation of energy storage units to alleviate grid pressures, as well as the continuation of construction activities for the Copeland Transformer Station in downtown Toronto.

*Investments in the General Plant category* support the efficient and uninterrupted operation of Toronto Hydro's core business activities. Investments in this category include the renewal of the Company's fleet of vehicles and upgrading obsolete IT infrastructure.

## Preventive Asset Maintenance and Vegetation Management

Toronto Hydro conducts proactive inspection and maintenance work to mitigate a wide variety of risks. Each year, the company inspects over 8,000 underground transformers to gather information about their condition to mitigate equipment failures that may adversely impact the environment. Information gathered in 2015 is currently being utilized to plan transformer replacements in the coming years. In addition, inspections in 2015 allowed Toronto Hydro to identify and proactively replace transformers that were in very poor condition and posed an immediate environmental risk.

The specific maintenance and inspection tasks that Toronto Hydro conducts on its equipment and assets, along with their frequencies, have been established using an engineering analysis framework

called Reliability Centred Maintenance (RCM). At the heart of the framework is an emphasis on safe operations (both from the perspective of work crews and the public), environmental stewardship and compliance, and equipment reliability. Toronto Hydro initially adopted this framework in the mid-2000s and has periodically reviewed and updated its RCM analyses ever since then. In late 2015, Toronto Hydro began its next set of significant reviews and updates, which are expected to continue throughout 2016.

To help mitigate tree-related interference with Toronto Hydro wires, the Company employs modern arboriculture techniques to ensure proper care of the trees as part of its Vegetation Management program. For example, when trees adjacent to a distribution line are pruned, that distribution line experiences a 20% to 40% reduction in power outages due to tree-related events. On average, Toronto Hydro has been pruning approximately 47,000 trees annually that are adjacent to distribution lines in a manner which minimizes injury to the trees but helps improves system reliability. These vegetation management practices help protect the system against inclement weather by such means as removing vulnerable sections of the tree canopy that may break during high winds or from the accumulation of ice and snow.

## CLIMATE CHANGE ADAPTATION

In 2015, Toronto Hydro continued to participate in and lead important initiatives to study the effects of climate change and help improve the system's resiliency to severe weather, formalizing the climate change adaptation road map which is to be implemented in 2016 and beyond.

### *Climate Change Adaptation Road Map*

In 2015, Toronto Hydro completed a vulnerability assessment study following the Public Infrastructure Engineering Vulnerability Committee (PIEVC) protocol developed by Engineers Canada. Through this study, a risk assessment was conducted for the various components and areas of the distribution system that are expected to be impacted by projected climate change. The results of this study were used to develop a road map on climate adaptation initiatives which are now in progress. These initiatives include updating major equipment specifications, revising planning guidelines, investigating the load forecast impact, revising design practices, and enhancing maintenance programs.

### *Resilient City Working Group - Collaborating with the City on Climate Change*

The Resilient City Working Group is aimed at improving coordination with the City and other stakeholders to mitigate the impacts of widespread outages. Toronto Hydro has been working with participants to identify areas of the grid that are vulnerable to extreme weather events and to improve information sharing processes to better prepare for major weather events and mitigate their impact on the City. The working group has identified a number of working areas of which three themes have been identified as priority areas – water, utilities and transportation. Toronto Hydro has been participating in the Utilities Thematic Area Working Group, a subset of the Resilient City Working Group, along with

other utilities (e.g., natural gas, telecommunications, chilled water, steam, etc.) and city planning groups.

*Introducing New Products*

An illustration of Toronto Hydro's climate adaptation efforts can be seen in the introduction of new products into its distribution system that is better suited to withstand severe weather events:

- Stainless Steel Submersible Transformers - In 2015, Toronto Hydro installed these transformers on pilot projects and introduced a new standard which mandates their use in all new projects. The stainless steel transformers are less prone to failure due to their improved corrosion resistance, which leads to improved reliability and reduces the environmental risk of an oil spill.
- Generlink – In 2015, Toronto Hydro approved the use of this customer-owned device that can be installed behind the electricity meter for the safe connection of a generator in the event of an outage, including loss of power during extreme weather events.
- Storm-Safe – In 2015, Toronto Hydro has been testing the use of a breakaway link for overhead service connections. The link is designed to break at a specific load, thereby preventing damage to the customer's service mast due to falling trees or branches, allowing for quicker restoration time, and improving public safety by ensuring that service wires won't be energized if they fall to the ground during severe weather.

*Participation in Industry Discussions*

Toronto Hydro continues to participate in the Canadian Electricity Association (CEA) led industry discussions about the awareness of climate change impacts in the electricity generation, transmission and distribution sectors. The Company presented its climate adaptation plans at the Electricity, Distribution, Information Systems and Technology (EDIST) conference in January 2016 to bring awareness to this important issue to the electric utility industry.

Emergency Preparedness

Extreme weather, flooding and water level changes all have the potential to do costly damage not just to the electricity sector, but to other sectors which depend on it. To ensure a reliable and affordable power supply for decades to come, the electricity sector needs to become more resilient in the face of existing challenges, and also adapt to new and emerging risks.

Energy choices are an important part of the climate change adaptation solution: energy efficiency and renewable energy can diversify the electricity system and make it more resilient. But there is more to the picture. When customers lose power during extreme weather events, the costs associated with lost output and wages, spoiled inventory, and restarting industrial operations can be significant. This is why incorporating emergency preparedness in climate change management planning is critical.

Throughout 2015, Toronto Hydro continued to strengthen its corporate emergency management framework, including an executive policy commitment to emergency preparedness. In addition, the Company continues shifting towards proactive planning by supporting system resiliency and addressing

the recommendations identified by the Independent Review Panel that investigated Toronto Hydro's response to the December 2013 Ice Storm. The Company has updated its plans and procedures to reflect leading best practices in the United States and Canada and has completed an industry peer review with a major U.S. electrical utility.

*Mutual Aid*

In 2014, Toronto Hydro applied for membership to the North Atlantic Mutual Assistance Group (NAMAG) and was formally accepted in April 2015. Furthermore, in 2015 Toronto Hydro signed on to the CEA's National Mutual Assistance Agreement, which aims to improve effectiveness, enhance coordination and reduce response time efficiency during emergency situations. These agreements strengthen the relationships between member utilities and clarify the terms, conditions and availability of mutual assistance in advance of emergencies.

NAMAG is a consortium of 26 major utilities in the U.S. and Canada that have signed an agreement to share resources in the event of an emergency. On October 27 and 28, 2015, Toronto Hydro hosted utilities from Canada and the United Sates for the NAMAG 2015 Fall Conference. The topics at the conference included storm response reviews from National Grid, underground trades mutual aid assistance (addressed by ConEd) and Canadian border crossing (addressed by the Canadian Border Services Agency (CBSA)).

The importance of cultivating mutual aid relationships was demonstrated by the assistance Toronto Hydro received during the 2013 ice storm. Through these networks and alliances with utilities similar to Toronto Hydro's size and complexity, Toronto Hydro is not only enhancing emergency preparedness, but sharing and learning new ideas on how to better prepare the system for emergencies and serve customers.

*Improved Customer Restoration*

On August 5, 2015, Toronto Hydro and the Electrical Safety Authority (ESA) held a joint workshop to brainstorm ideas on how the organizations could streamline work processes in order to expedite customer restoration during declared emergencies. In the event of a wide scale emergency, such as the 2013 ice storm, Toronto Hydro's main objective is to safely restore power to customers as quickly as possible. Concurrently, the ESA is working to ensure customer-owned equipment is energized safely and public safety is maintained by adhering to Ontario Regulation 22/04. Under normal circumstances, both objectives can be achieved; however, wide scale emergencies can place a heavy strain on both organizations. The workshop reviewed scenarios that were experienced during the 2013 ice storm and identified steps to improve safe and expeditious restoration of customers.

While this project will require additional planning, discussion, and coordination, it demonstrates Toronto Hydro's commitment to serving customers irrespective of the type of emergency.