2016 Toronto Hydro Environmental Performance Report

Environment, Health and Safety

3/3/17

Contents

Toronto Hydro Corporation

The City of Toronto (the "City") is the sole shareholder of Toronto Hydro Corporation (THC). THC wholly 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 and expressway lighting services in 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 efficiencies to be realized by building on synergies and eliminating duplication and redundant processes. In December 2015, Toronto Hydro underwent and passed its first re-certification audit for the International Organization for Standardization's Environmental Management Systems Standard (ISO 14001:2004) and the Occupational Health and Safety Assessment Series Standard for Occupational Health and Safety Management Systems (OHSAS 18001:2007) certificates.

This marks the fourth consecutive year that Toronto Hydro has been certified to these stringent internationally recognized standards for environmental and occupational management systems. Toronto Hydro is committed to continually meeting these internationally recognized standards and verifying conformance through a third-party independent audit process. In addition, Toronto Hydro is only one of five electrical utilities in Canada to be awarded the prestigious Sustainable Electricity Seal by the Canadian Electricity Association (CEA).

Overall, Toronto Hydro continues to strive to achieve zero injuries and remain a sustainable electricity company. The Company regularly monitors and assesses its energy consumption and waste streams in an effort to reduce its 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.

As a testimony of its long-standing commitment to sustainability, Toronto Hydro was awarded the CEA 2016 Integrated Approach to Sustainability Award in November, 2016. The Company was given this distinction as a result of having sustainability integrated into its corporate culture and business strategy, and undertaking and prioritizing multiple strategic projects and initiatives that demonstrate a commitment to the goals and objectives of sustainability. Furthermore, Toronto Hydro's president was honoured by Delta Management Group in 2017 as one of Canada's Clean50 sustainability leaders for accomplishments including: delivering 24% of the province's conservation and demand management (CDM) focused savings, connecting 11,000 solar projects, partnering with the City to install 8,800 panels on City owned buildings producing 2,600 MWh of electricity, and investing in pilot projects for emerging technologies such as compressed air and pole top energy storage and community energy storage. The organization has also moved to cut its own energy use, install solar panels, and implement conservation programs for its fleet and buildings.

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, releases of sulphur hexafluoride (SF_6) gases, and facilitating the transformation to a carbon-free city through the electrification of activities and equipment currently powered by fossil fuels.

GHG emission reductions through Toronto Hydro's CDM activities are covered in the CDM section of this report. GHG emission reductions associated with Toronto Hydro's solar PV project investments are covered in the Development Projects 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 and propane combustion used for tools and heating the aggregate shed), 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 consist of 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.

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 (tCO_2e) per gigawatt-hour.

Organizational Boundaries

The following changes are reflected in the modified organizational boundaries for 2016: (1) Toronto Hydro moved out of one of its leased buildings and as such, the electricity and natural gas use for this facility subsequent to the move have not been included in this report; (2) one satellite work location was added.

[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.
[4] Emission factors published in Environment Canada's National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada.

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 boundaries described above. This building-specific energy consumption data is used to populate the Sustainability Performance Indicators 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 two of Toronto Hydro's leased buildings was not provided by the landlord, therefore the most recent complete data sets available (2012 and 2015) were used as a proxy.

GHG emissions from stationary air conditioning and refrigeration equipment (refrigerant leaks), and emissions from propane combustion[6] 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 Sustainability Performance Indicators database is populated with data from various datasets acquired from fuel suppliers and through paper billing statements.

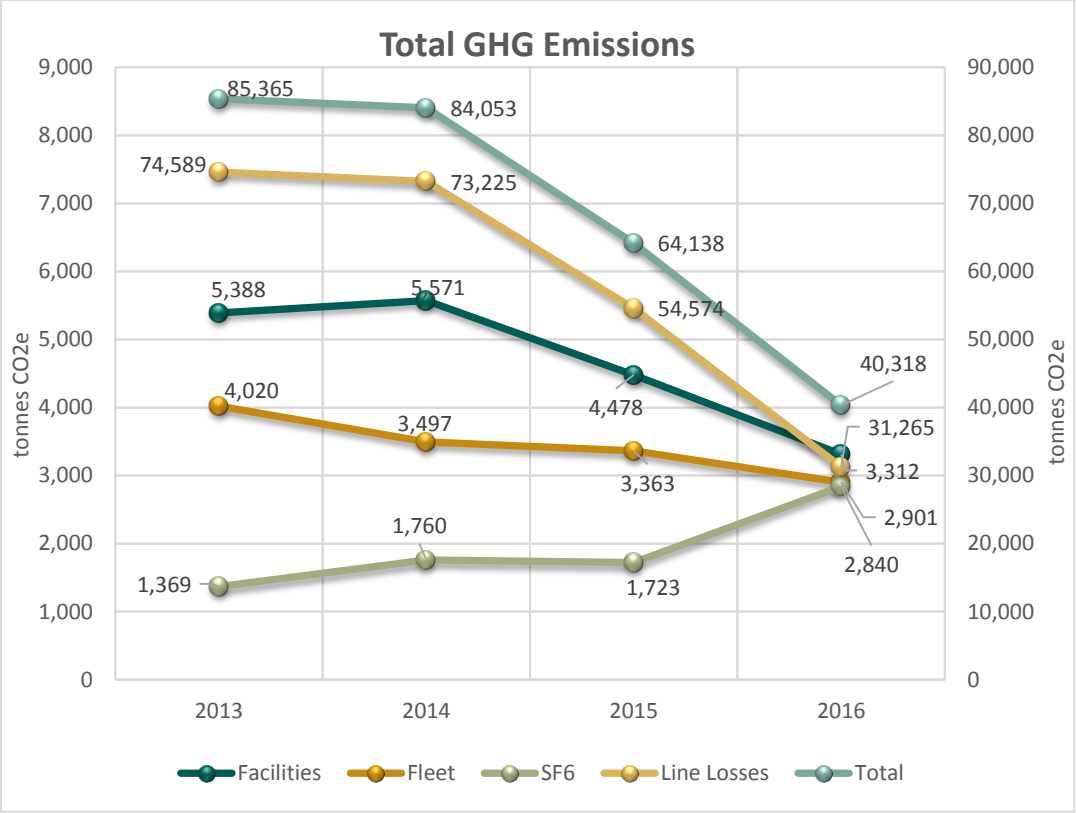
SF6 Emissions Accounting Process – In 2015, Toronto Hydro successfully implemented its revised SF_6 Inventory and Emissions Management Procedure, consisting of weighing SF_6 cylinders against a baseline value on an inventory basis. Emissions from decommissioned and retired equipment were calculated by subtracting the mass (in kilograms) of SF_6 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. This methodology for tracking SF_6 inventory and reporting SF_6 equipment emissions has improved the accuracy and consistency of the information reported.

Results and Analysis

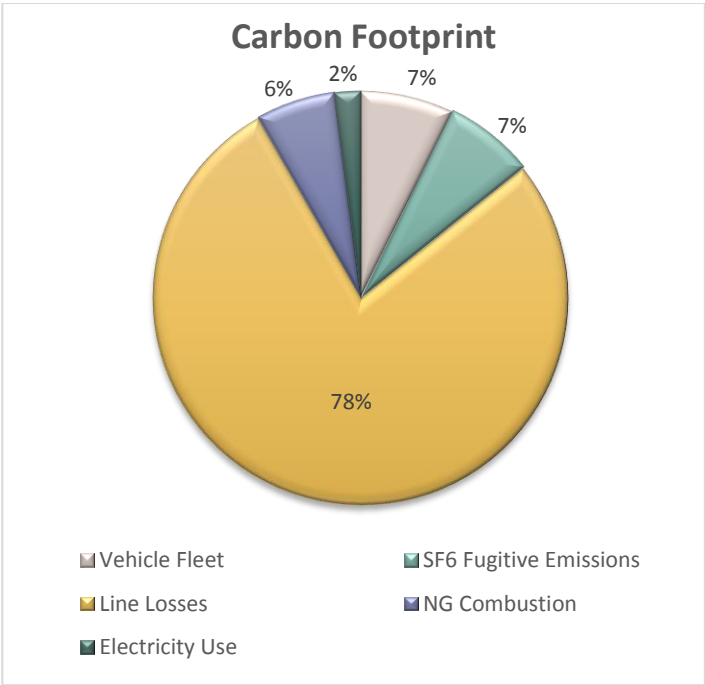
Toronto Hydro's 2016 total GHG emissions were 40,318 tCO_2e, a decrease of 37% relative to 2015. Below is the historical data on Toronto Hydro's GHG emissions by source (i.e., facilities, fleet, line losses and SF_6).

[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] Propane is used in the Training Center in tools and for heating the aggregate shed at 500 Commissioners.



The make-up of the carbon footprint, shown in the following diagram, is as follows: 78% of the emissions attributed to line losses, 7% is attributed to fleet emissions, while facilities (electricity and natural gas use) are responsible for 8%. The remaining 7% is associated with SF_6 emissions.



The fleet fuel consumption and associated emissions decreased by approximately 14% relative to 2015 and by approximately 28% relative to 2013. This is the result of continued efforts to reduce the number of vehicles and optimize their use (see details in "Fleet Related Initiatives" section below), the implementation of the 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 capital project 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 9.5% and 15%, respectively from 2015. Some of the factors contributing to these variances were the warmer winter conditions (9% less heating degree days[7]), warmer summers (37% more cooling degree days[8]) in 2016 compared with 2015, as well as the energy efficiency projects implemented in 2015.

The 26% and 43% 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 2016 relative to 2015 and 2014[9]).

The total SF_6 fugitive emissions increased by 65% in 2016 compared to 2015. This increase is believed to be due to a more accurate and comprehensive measurement methodology introduced in 2016.

[7] Degree days comparison obtained from http://www.weatherdatadepot.com/.
[8] Supranote 7
[9] National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada - Decreasing energy generation from coal and oil, accompanied by an increase in hydro, nuclear, solar and wind generation, was the largest driver of decrease in emissions associated with Electricity Production between 2005 and 2014.

Environmental Initiatives

Facility Improvements

As part of its Facilities Consolidation program, aimed at making better use of space at existing work centres, in 2016, Toronto Hydro completed the construction of the David M. Williams Centre. As a result, the Company moved out of one of its leased buildings. The new facility, located at 71 Rexdale Boulevard, is built on a former industrial brown-field site utilizing much of the original building's structural steel and concrete. This new building has incorporated Toronto Hydro's new building and facility standards, including the elimination of desk side waste bins, use of energy efficient lighting and Information Technology (IT) equipment, low volatile organic compound (VOC) paints and carpets, and standardized office furniture. More effective use of office space has resulted in approximately a 40% reduction in Toronto Hydro' space utilization per employee relative to 2012.

Key facts related to the David M. Williams Centre construction project:

- Over 2,500 tonnes of concrete and 400 tonnes of steel were salvaged, reused and diverted from landfill.
- Re-used existing furniture: 171 filing cabinets; 13 manager office furniture sets (including, desks and storage cabinets); 75 training room tables; approximately 340 employees desk chairs; cafeteria furniture (20 tables and 55 chairs); security office welcome furniture (4 chairs and 2 tables); warehouse furniture (racking and shelving, 10 workstations and 2 supervisor office furniture sets); and 230 lockers. The company assisting Toronto Hydro with this office move, diverted from landfill 62% of its waste furniture (recycled 66.3 tonnes of furniture and sold 19 tonnes);
- A variable air volume air handling system combined with multi-staged direct expansion cooling and perimeter radiant heating ceiling panels provide optimal comfort conditions for occupants;
- A demand control ventilation system is used to maximize indoor air quality and air handling system efficiency;
- A Building Automation System that controls and monitors core building systems (HVAC, lighting, water supply, life safety systems & security etc.) help ensure safe working conditions and prevents business interruptions by identifying and addressing building related issues proactively.
- Dedicated parking spaces have been assigned for carpool vehicles.

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 Operational Support Services scorecard.

Fleet-Related Initiatives

Anti-Idling Technologies

The installation of Governor to Reduce Idle and Pollution (GRIP) technology on 24 of Toronto Hydro's cube vans (starting in late 2014), has led to a 27% decrease in average annual idling hours in its GRIP-equipped vehicles (compared to non-GRIP equipped cube vans).

In November 2015, Toronto Hydro began GRIP trials in four of its new heavy duty bucket trucks, which has resulted in a 26% decrease in idling amongst those trucks (compared to non-GRIP equipped trucks). In July 2016, the Company trialed the GRIP units in five of its highest idling pick-up trucks.

Since installing the GRIP system in pick-up vehicles , Toronto Hydro has realized a 22% reduction in idling hours across this pool of vehicles compared to the same period, in 2015 (July-November, inclusive).

The GRIP system has delivered proven idling reductions and, as such, is currently Toronto Hydro's preferred anti-idling technology. GRIP functions by shutting the engine off after 1 minute of idling and deferring to the auxiliary battery power source requiring long-lasting batteries in order to fully optimize the GRIP system's use. In 2016, Toronto Hydro's Fleet department explored various means of extending auxiliary battery longevity. Solutions currently being trialed are: (1) decreasing load on the auxiliary battery by swapping out the existing inverter for a high-efficiency generator; (2) swapping existing auxiliary battery for a high-efficiency lithium ion battery; (3) reactive reporting on vehicles not plugged into shore power nightly. Preliminary results on the expected benefits of these solutions are anticipated by end of the second quarter of 2017.

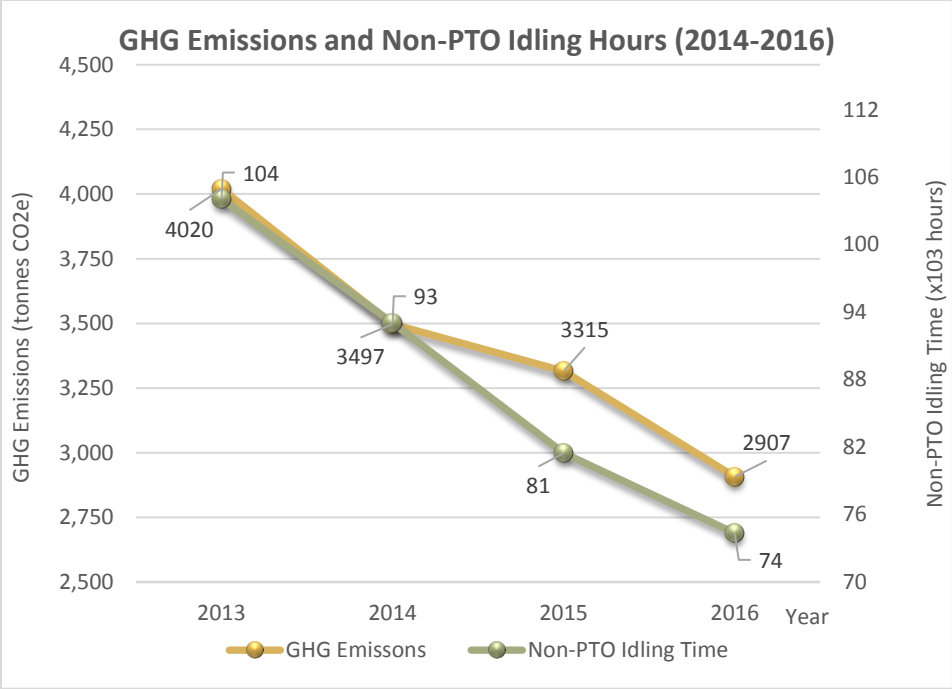
As a result of the idling reduction initiatives, in 2016, Toronto Hydro saw a 23% reduction in fuel consumption amongst cube vans - a 6% reduction in fuel consumption amongst bucket trucks - and a 13% reduction in fuel consumption amongst pickup trucks. This led to fuel savings of 16,331 L and reduction in GHGs of 45 tCO_2e, in 2016 relative to 2015.

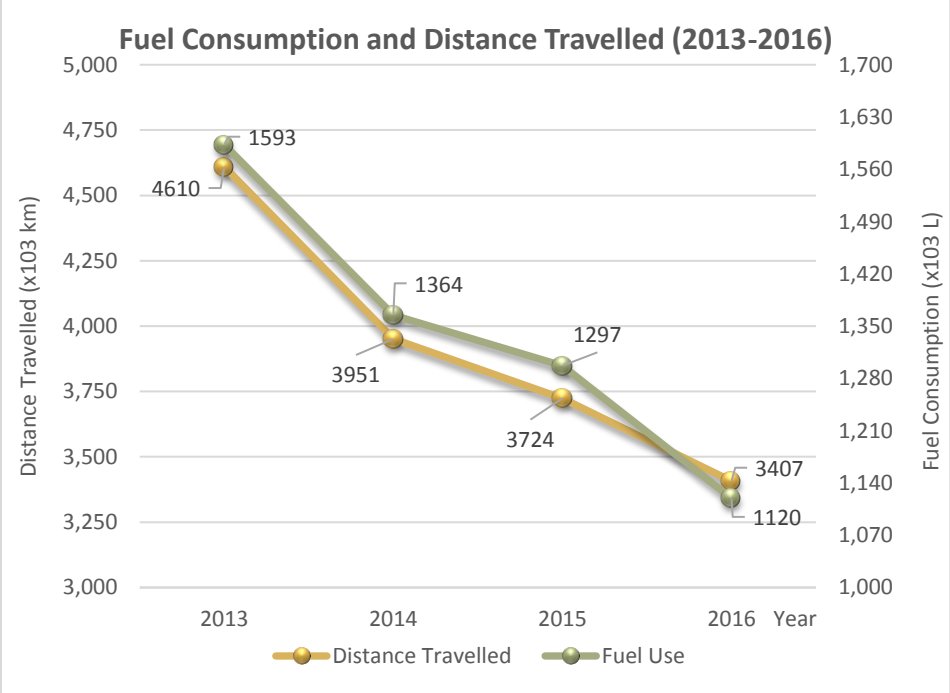
Downsizing

The most significant impact on reducing fuel consumption, idling hours, and GHG emissions is attributed to downsizing the fleet. In 2016, Toronto Hydro reduced its fleet by 17 vehicles.

The cumulative 2016 savings, relative to 2013, associated with the two fleet related initiatives mentioned above are: 30% reduction in total fuel consumed (approximately 473,320 L); 28% reduction in GHG emissions (1,119 tCO_2e); 26% reduction in kilometres travelled (approximately 1,202,590 km); and 29% reduction in total non-PTO[10] idling hours (approximately 29,700 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 9.





Reducing Hazardous and Non-Hazardous Waste

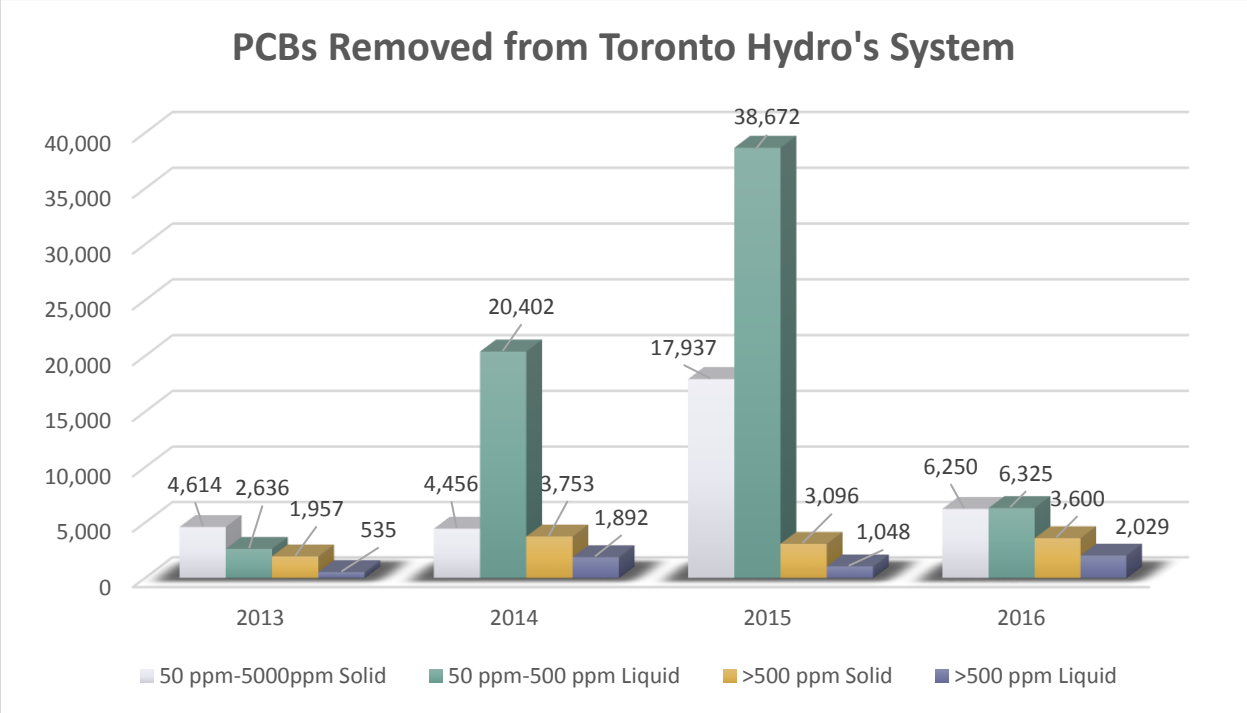
Similar to most electrical utilities in Canada, Toronto Hydro owns and operates equipment that has oil containing polychlorinated biphenyls (PCBs). The operation of this equipment is compliant with the PCB Regulations under the *Canadian Environmental Protection Act, 1999*. In recognition of the persistent ecological effects of PCBs, Toronto Hydro is actively removing and safely destroying equipment and oil containing PCB's in excess of the standards prescribed by federal and provincial laws.

This removal and destruction has been accelerated in recent years and has been enabled by proactive inspections of equipment suspected of having oil containing PCBs and testing of oil in equipment for the presence of PCBs. In 2016, Toronto Hydro conducted inspections and oil sampling for over 3,000 transformers.

In addition, Toronto Hydro initiated a capital replacement program in 2016 to replace all submersible transformers in the distribution system that were manufactured prior to 1986. Most submersible transformers of this vintage, which at the beginning of 2016 amounted to approximately 900 units, are suspected of having oil containing PCBs. By the end of 2016, approximately 500 of these units were replaced. The objective of this program is to eliminate the risk of submersible transformers from leaking oil containing PCBs into the natural environment. Toronto Hydro expects that the program will continue into 2017.

In 2016, approximately 10,000 kilograms of material[12] and 8,500 litres of liquids containing PCBs were sent for destruction. The amount of solid waste containing PCBs decreased by approximately 53% from 2015. The liquid waste containing PCBs decreased by approximately 80% from 2015. The majority of contaminated liquid in 2015 came from a single location. Approximately 27,600 L of contaminated water was identified at the location as a result of Toronto Hydro's diligence in testing suspect contaminated water. The water was contained at the location and shipped for disposal. The source of the contamination was identified and subsequently removed and sent for destruction.

The graph below displays the trend in removal and destruction of equipment and oil containing PCBs since 2013 and reflects the accelerated effort to remove this substance from the city.



[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.

In 2016, Toronto Hydro added Recycling Rate as a Key Performance Indicator. The recycling rate is the percentage of the total waste generated by Toronto Hydro that is sent for recycling.

Signs have been installed throughout buildings and in the yards to indicate where different types of waste should be placed. In August 2016, mixed recycling bins were added to Toronto Hydro yards for employees who work in the field to dispose of recyclable waste generated while working outside of Toronto Hydro work centres. The same waste that goes in the mixed recycling bins in the offices can go in the larger mixed recycling bins. This includes coffee cups, plastic bottles, metal cans, milk cartons and plastic shopping bags. Additionally, other wastes generated in the field such as plastic guy guards, plastic caution tape, and termination/splice plastic scrap can be placed in these bins for recycling. Toronto Hydro and its waste disposal provider have also worked to find a solution to minimize waste created by the use of paper towels by diverting the paper towels to recycling. This has been facilitated through the introduction of new dedicated collection bins in washrooms and allowing paper towels into the mixed recycling stream of recycling containers.

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 64% in 2016.[13]

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). In 2016, Toronto Hydro diverted 490 metric tonnes of wood poles from landfill[14].

Reduction of Paper Consumption

The key to reducing waste is eliminating consumption of the materials that generate waste. In 2016, Toronto Hydro continued the initiative to automate and use electronic forms in place of paper, and set duplex printing as default for most of its printers. The five projects outlined below reduced paper consumption, in 2016, by approximately 2,415,480 sheets of paper and led to a reduction in life-cycle GHGs of approximately 8 tCO_2e[15]. When combined with similar initiatives carried out in earlier years the annual savings increase, relative to 2015, to approximately 2,655,480 sheets of paper[16] and life-cycle GHG reduction of over 28 tCO_2e[17].

[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.

[14] 2016 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.

[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.

Timekeeping Automation Project – The online web based application "MyTime" was implemented throughout the organization in 2016, and has eliminated the need for timesheets and leave requests printed on paper. Annually, this is estimated to save over 82,000 sheets of paper[18].

Online Project Change Request Application (CRA) – This is a web-based solution which replaced the paper-based Change Request process used by various employees and leaders at Toronto Hydro to process program and project changes. The online CRA enables electronic submission/initiation, processing, review and approval of a Change Request in a timely manner and eliminates paper consumption over the course of the entire workflow. The application is integrated into Toronto Hydro's enterprise intranet via the MS SharePoint interface 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 2,500-3,000 sheets of paper per year along with the corresponding reduction in printer ink. Additional paper savings are realized through the use of various multimedia options that replaced the traditional paper-based materials such as job aids, procedure documents, manuals, and templates.

Electronic Submission for City Permit Applications – In 2014, at Toronto Hydro's request, the City piloted an electronic submission process which was also trialed by other public utility companies (e.g. Bell, Rogers, Enbridge). A similar electronic submission was also implemented for Toronto Hydro's third party auditor. Previously, in order to obtain a full stream road cut permit, the City required utility companies to submit two sets of civil drawings and all documentation on paper. Once approved the utility was required to submit six paper copies of the approved drawings to the City, which will no longer be required under the new electronic submission system. Overall, Toronto Hydro estimates that the electronic submission process for City Permit Applications will save the Company approximately 80,000 sheets of paper per year[19] along with the corresponding reduction in ink.

Paperless Billing – Toronto Hydro has increased the number of customers that signed up for paperless billing by 50% since last year (2015: 64,211 and 2016: 96,220). This amounts to savings of approximately 865,980 sheets of paper[20] , along with the corresponding reduction in ink. These results were achieved through a multi-pronged approach including targeted campaigns directed to our residential and commercial customers including in-field kiosks, prizing, blasts and a simplified registration process.

Duplex printing – In May 2016, Toronto Hydro set duplex printing as the default setting for all printers. As a result the Company saved approximately 1,385,000 sheets of paper (May – December 2016).

Major Equipment Re-Use

In an effort to reduce material consumption, Toronto Hydro developed a Quality Standard Practice in compliance with the guidelines set out in Ontario Regulation 22/04, for the re-use of major equipment that has been decommissioned and returned from service.

[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] 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.

[20] Average of 6.9 sheets of paper in 2015 vs 9 sheets in 2016 to account for monthly billing implementation.

Major equipment, such as transformers, switches, switchgear, and network protectors, that has been decommissioned due to a failure can be evaluated and sent to a third party for repair or refurbishment. All returned major equipment eligible for re-use undergoes routine testing and evaluation by a competent person prior to being returned into stock. The estimated cost savings facilitated by this program in 2016 is approximately $2 million. Furthermore, as a result of this initiative, in 2016 Toronto Hydro re-used a total of 286,803 kg of major equipment.

Energy Conservation and Demand Management (CDM)

Toronto Hydro operates in a manner consistent with the City's Sustainable Energy Strategy[21], including targets to reduce electricity system demand 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.

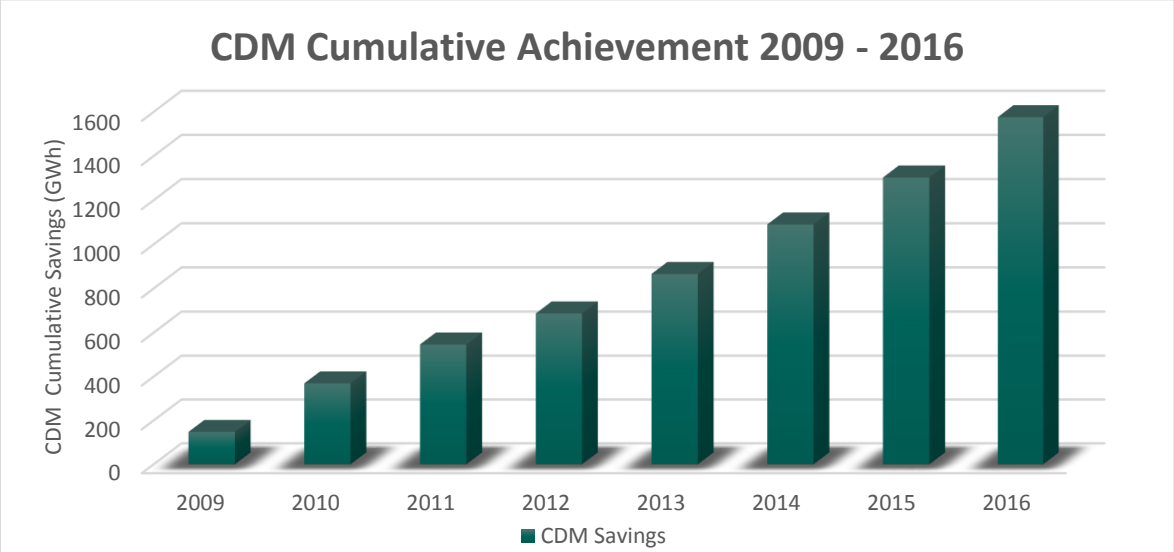
Fostering Conservation Conversations with Customers

Toronto Hydro is one of the largest contributors to the Ontario Ministry of Energy's (MOE) provincial Conservation and Demand Management (CDM) mandate.

In 2016, Toronto Hydro continued to work with residential, small business, industrial and commercial customers to implement energy-efficiency projects. Toronto Hydro's 2016 CDM programs led to an estimated energy savings of 273,200 MWh[22] and reduced summer peak demand by 32.5 MW. These initiatives also helped to reduce GHG emissions in the city by 11,200 tCO_2e.[23]

Since 2009, through its CDM initiatives, Toronto Hydro has helped its customers reduce annual electricity consumption by 1,576 GWh[24] and reduce GHG emissions by 64,600 tCO_2e.[25] During the same period (since 2009), Toronto Hydro's CDM programs helped customers reduce their peak demand by 276 MW[26], representing 50% of the City's 2020 goal.

While Toronto Hydro has been the catalyst for these savings, the achievement is also attributed to various programs offered by the municipal and provincial government, initiatives which have shaped a stronger culture of conservation among Torontonians.



[21] The Power to Live Green: Toronto's Sustainable Energy Strategy (October, 2009).
[22] 2016 CDM energy and peak demand savings have not yet been verified by the IESO.
[23] Estimate using 2014 Ontario emission factors published in Environment Canada's National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada.
[24] The energy and peak demand savings represent cumulative totals but do not account for savings persistence.
[25] Supra note 22.
[26] The peak demand savings do not include achievement from demand response programs.

Shaping Provincial Conservation Directives

Toronto Hydro is also 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 2015-2020 Conservation First Directive, issued by the MOE in 2014 as an extension to the 2011-2014 SaveONenergy CDM framework. 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 is an integral part of the province's Long-Term Energy Plan (LTEP). The LTEP includes a 7 TWh reduction in electricity consumption in Ontario 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 response to this significant challenge, Toronto Hydro has worked to develop many new local CDM programs in 2016. The following new initiatives are designed to drive deeper energy savings, with specialized delivery models targeting harder to reach sub-sectors and electricity end-uses.

- OPsaver – a program designed for larger commercial, institutional, and industrial customers, which encourages continuous energy improvement through operational and behavioural change. Approved OPsaver consultants are assigned to work with building owners, managers, and operators to help strengthen corporate commitment to energy management, while participants are rewarded with incentives on a multi-year, "pay for performance" basis.

- RTUsaver – a full-service program which begins with a maintenance assessment of participating rooftop HVAC units. If there are no maintenance needs, or if maintenance issues are identified and repaired, customers are provided with a free and installed web-enabled thermostat. Qualifying participants may also receive incentives for occupancy sensors and advanced rooftop controls to enhance savings.

- PUMPsaver – an initiative which focuses on the rebalancing of hydronic systems and is targeted at multi-unit residential, commercial, and institutional buildings with central distribution pumps. This program is delivered as a direct install service, with no cost to the qualifying participants.

- Business Refrigeration Incentive Program – a program which is intended to overcome established market barriers associated with promoting energy efficient refrigeration equipment in small businesses markets. Delivered as a direct install program, this offering includes a facility audit, a personalized energy action plan, and the supply and installation of energy efficient refrigeration equipment. In addition to reducing the energy used by refrigeration equipment, this initiative is also expected to reduce the amount of ozone depleting substances released into the atmosphere – when new energy efficient equipment is selected, refrigerant leaks will also be addressed.

- Residential Engagement Platform – a residential conservation initiative which employs both Home Energy Reports and a web portal to provide homeowners with a detailed assessment of their electricity use, and a strategy to tailor energy consumption targets to their lifestyle and needs. The reports will include "Self-Benchmarking" and "Social-Benchmarking", while the web portal will provide rewards, and direct them to other energy efficiency programs and marketplaces to promote continuous improvement.

- Adaptive Thermostats Program – a program which offers residential customers a rebate towards the purchase of an eligible "smart" thermostat. These devices are mobile-enabled, provide more intuitive scheduling interfaces, and leverage a 'learning' engine which attempts to understand behaviour and user preferences over time. The program is being delivered together with Enbridge Gas.

- POOLsaver – a unique "midstream" offering which provides swimming pool equipment vendors incentives to reduce the point-of-sale cost of energy-efficient pool pump technology. Pilots and programs in other jurisdictions have demonstrated substantial energy savings opportunities resulting from the replacement of constant speed pool pumps with variable speed alternatives.

- In April 2016, Toronto Hydro conducted the E-Waste Exchange Pilot at the Green Living Show. The initiative targeted residential customers and encouraged the decommissioning of older, working-condition electronics in exchange for Tier 1 or Tier 2 advanced power strips; participants meeting certain additional eligibility requirements also received a coupon for $100 off the cost of an "ENERGY STAR® Most Efficient" Samsung television. The pilot successfully delivered 10,000 power strips while collecting and decommissioning over 9,000 lbs of electronic waste.

- In September, Toronto Hydro also collaborated with Enersource, Hydro One Brampton, and Oakville Hydro to pilot the delivery of instant discounts on LED lightbulbs. The LED Truckload events were initiated at 22 Home Depot locations over two weekends in September, and offered participants point of sale discounts on 15 Phillips LED products rather than requiring the current paper coupons. While final results are pending, the pilot was considered a success and the results were the basis for provincial Coupon Program design improvements which will take effect in the fall of 2017.

CDM Highlights

In 2016, Toronto Hydro's most successful initiative remained the Retrofit program. 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, and multi-residential customers. Toronto Hydro has a comprehensive team and related systems to support this initiative. As a result, in 2016, Toronto Hydro approved 3,220 projects resulting in 31.8 MW of peak demand savings and 207,156 MWh in annual energy savings.

Final verification of these achievements will be available in June 2017 from the IESO. In 2016, this initiative helped to reduce Toronto Hydro's customers' GHG emissions by 8,493 tCO_2e[27].

High Performance New Construction (HPNC)

HPNC is a program that offers incentives to building owners and design decision-makers (architects, engineers, consultants, etc.) to build beyond Ontario Building Code requirements. Due to the considerable construction timelines associated with larger buildings, the early applicants in the HPNC program had produced limited results between 2011 and 2015. However, with a number of new facilities finally entering the construction completion and building commissioning phases in the past year, Toronto Hydro settled a total of 21.5 GWh in energy savings in 2016, resulting in 882 tCO_2e in GHG emissions.

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 280 events including business tradeshows, Earth Week celebrations, the City's Environment Days, community festivals and in-store activities with Home Depot, Canadian Tire and Lowes generating 57,000 interactions.

One of the highlights in 2016 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 950 attendees, marking it as the largest EIA event to date.

[27] Estimate using 2014 Ontario emission factors published in Environment Canada's National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada.

Renewable Energy

Toronto Hydro has been supporting renewable generation across Toronto through 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.

Toronto Hydro provides support including pre-assessments, Connection Impact Assessment and Commissioning and Engineering support for renewable generation resources under a streamlined process. Between 2009 (the inception of the Feed- in Tariff (FIT) program) and 2016, Toronto Hydro enabled 955 microFIT interconnections (each under 10kW capacity). This totals more than 6.1 MW of generation. During the same period, Toronto Hydro enabled a total of 529 FIT interconnections (each greater than 10kW capacity) totalling more than 73MW of generation.

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 invested 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 1,520 MWh and displaced 62 tCO_2e in 2016. The second group of 10 projects, which has an installed capacity of 1.5MW, generated 1,950 MWh and displaced 80 tCO_2e in 2016. 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, together, have an installed capacity of 1.2MW, generated 1,800 MWh and displaced 74tCO_2e in 2016. Collectively, these projects displaced approximately 216tCO_2e in 2016.

When net-metered and Renewable Energy Standard Offer Program projects are included, Toronto Hydro has enabled over 1,572 renewable generation interconnections totalling approximately 81.9 MW between 2009 and 2016, representing 15% of the City's 2020 renewable energy generation goal, and approximately 50% of the City's 2020 goal for solar PV generation.
Assuming a specific yield of 1,100 kWh/kWp[29], these projects would produce 90.1 GWh and displace approximately 3,695 tCO_2e[30] 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

[28] The Power to Live Green: Toronto's Sustainable Energy Strategy (October, 2009).
[29] kWp represents kilowatt peak, the maximum output of the system.
[30] Estimate using 2014 Ontario emission factors published in Environment Canada's National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada.

during off-peak hours when demand is low and electricity is cheapest. Electricity can be generated 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 energy is required, weight of the water pushes 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). The UWCAES technology offers storage with minimal environmental impact and can be expanded with additional accumulators underwater as needed. The system provides a peak capacity of 660 kW for approximately 1 hour. The system is undergoing upgrades and will be evaluated through 2017 for demand response, price arbitrage and other applications.

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. The technology uses lithium ion battery technology to convert primarily surplus off-peak electrical energy to 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. The modular lithium ion battery technology offers cost-effectiveness and capacity of large-centralized systems while providing the site with flexibility and scalability of small-decentralized systems. The system provides peak capacity of approximately 300 kW for up to four hours. The system has been evaluated over 2016 for demand response, price arbitrage, emergency power and power conditioning. Integration with building systems and loads was completed successfully and control algorithms were developed. The project faced over heating issues in the summer months and was derated to 150kW. The project has very high density lithium-ion battery architecture and will require higher capacity cooling and control features.

Community Energy Storage Project – Toronto Hydro is constructing a battery energy storage system with the technology company, eCamion, Canada's Sustainable Development Technology Corporation program and Ontario's Smart Grid Fund. The project uses lithium ion battery technology to store off-peak electrical energy for subsequent use during on-peak periods. The system is located at Toronto Hydro's 500 Commissioners facility and will provide demand response, price arbitrage, emergency power and power conditioning. The system provides peak capacity of approximately 500kW for up to 1 hour and supports business continuity.

GHG Reductions Summary

As illustrated in the summary table below, in 2016, Toronto Hydro achieved a reduction in GHG emissions of 13,361 tCO_2e as a result of its CDM projects, renewable energy generation and operational initiatives (related to fleet and facilities).

	Energy Saving	GHG Reduction[31]
CDM Projects 2009-2016	1,583 GWh	64,916 tCO_2e
CDM Projects 2016	280.9 GWh	11,516 tCO_2e
	Annual Energy Generated[32]	Annual GHG Reduction[33]
Renewable Energy Generation Projects 2009-2016	90.1 GWh	3,695 tCO_2e
Renewable Energy Generation Projects 2016	5.27 GWh	216 tCO_2e
	Energy Reduction	GHG Reduction[34]
Facilities Energy Efficiency Projects 2016 (Electricity)	2,100 MWh	723 tCO_2e
Facilities Energy Efficiency Projects 2016 (Natural Gas)	233,516 m^3	444 tCO_2e
	Fuel Reduction	GHG Reduction
Fleet Fuel Efficiency Projects 2016	217,000 L	462 tCO_2e
		GHG Reduction
Line Losses 2016		23,308 tCO_2e
	Annual Paper Saved	Annual Lifecycle GHG Reduction
Paperless Projects	2,655,480 sheets	28 tCO_2e[35]

[31] Estimate using 2014 Ontario emission factors published in Environment Canada's National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada.
[32] Based on renewable generation projects Toronto Hydro has provided interconnections and enabled infrastructure for connecting renewable generation resources.
[33] Supra note 31.
[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/

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 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 - Capital Expenditure Plan

Toronto Hydro's 2015-2019 capital program is designed to improve service reliability and address the need for additional distribution capacity. The program consists of four main investment categories: system access, system renewal, system service and general plant.

- Investments in the System Access category are driven by statutory, regulatory or other obligations to provide customers with access to Toronto Hydro's distribution system. This category includes investments to connect renewable energy generation facilities, and metering-related investments to maintain compliance with Measurement Canada regulations and the IESO Market Rules.
- Investments in the System Renewal category target the renewal and reconfiguration of distribution assets that are no longer performing at an acceptable standard. These programs focus on remediating assets that are at, near or exceeding the end of their useful lives, and assets that no longer align to current operating practices. This includes assets with accessibility or serviceability conflicts (e.g. assets located in ravines, rear lots, highway crossings, etc.), which pose increased reliability and safety-related risks.
- Investments in the System Service category target system-wide critical issues such as capacity and operational constraints, security-of-supply, safety, system reliability and other considerations for the effective operation of the distribution grid.
- Investments in the General Plant category are essential to Toronto Hydro's 24/7 day-to-day operational activities. These investments include the upgrade and renewal of critical software and hardware systems, vehicles and associated equipment, and facilities.

Preventive Asset Maintenance and Vegetation Management

Toronto Hydro conducts proactive inspection and maintenance work to help mitigate a wide variety of risks. Each year, the Company inspects over 8,000 underground transformers to gather information about their condition and mitigate equipment failures that may adversely impact the environment. Information gathered in 2016 is currently being utilized to plan transformer replacements in the coming years. In addition, inspections in 2016 allowed Toronto Hydro to identify and proactively replace approximately 600 transformers that were in very poor condition and posed an environmental risk.

The specific maintenance and inspection tasks that Toronto Hydro conducts on its equipment and assets, and 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, 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. In late 2015, Toronto Hydro began its next set of significant reviews and updates and this work continued through 2016 and will continue throughout 2017.

To help mitigate tree-related interference with Toronto Hydro wires, the Company employs modern arboriculture techniques to ensure proper care of trees as part of its Vegetation Management program. For example, when trees adjacent to a distribution line are pruned, adjacent distribution lines 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 and Adaptation

In 2016, Toronto Hydro undertook a number of initiatives aimed at improving the system's resiliency to extreme weather events caused by climate change. Toronto Hydro expects some of these initiatives to continue throughout 2017, in addition to continued collaboration with the City of Toronto and other agencies.

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. The study conducted a risk assessment for the various components and areas of the distribution system that would be affected by climate change, and the results were used to develop a road map on climate adaptation initiatives.

Pursuant to this road map, a number of initiatives were undertaken in 2016.

Load Forecast Sensitivity Study – The Station Load Forecast is prepared every year to provide a ten year peak load forecast for each transformer station. This forecast is used for planning purposes to evaluate station bus capacity adequacy. Ambient air temperatures can affect the load forecast. By using projected future temperature data rather than historical data, a more accurate load forecast was developed to be used for planning purposes.

Lightning Maps – Lightning strikes are a significant source of outages. To analyze the effect of lightning strikes on the system, Toronto Hydro mapped data relating to historical lightning strikes across the City of Toronto and correlated this data with system outage information. In the future, this information may be used for planning purposes to enhance resiliency in areas that are more prone to lightning activity.

Major Equipment Technical Specifications – Toronto Hydro completed a review of Technical Specifications used for the purchase of major equipment in order to assess whether there are any opportunities to enhance the Technical Specification to provide additional resiliency.

Asset Impact Study – Assets can be affected by climate change in different ways and at different magnitudes. To understand these differences, the Company assessed how different asset types are affected by different aspects of climate change, and considered the measures that can be taken with respect to technical specifications and maintenance procedures to mitigate these climate-related risks.

Industry Review – Toronto Hydro reviewed the climate adaptation plans of other utilities in Ontario, Canada and the United States to gain insight into best practices and policies.

Reliability Monitoring Review – The Company reviewed its reliability measures against various types of extreme weather events in an effort to continue to monitor the effect of its resiliency initiatives on system performance.

Climate Data – Toronto Hydro reviewed various sources of climate data to verify that the projections used for planning purposes continue to be valid and widely accepted, particularly as government policy and economic factors continue to influence the direction of future climate.

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

Throughout 2016, the Resilient City Working Group met on a regular basis to improve coordination with the City and other stakeholders to help 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 the impact on the City. The working group prepared a report of work completed and delivered it to City Council on December 13, 2016.

Participation in Industry Discussions

Toronto Hydro continues to participate in the 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 conference in January 2016 to bring awareness to this important issue to the electric utility industry.

Grid Emergency Management

In recent years there have been a number of major events that have drawn attention to the emergency preparedness and response practices of electricity distribution utilities. Occurrences include both unplanned incidents (such as Hurricane Sandy in October 2012, the July 2013 flash flood in west Toronto and the December 2013 ice storm) and planned events (such as the 2015 Pan Am Games and the 2010 G20 Summit). Utility performance during these circumstances has been examined and scrutinized by a wide range of stakeholders including customers, governments, regulators, shareholders and the media.

In response to these concerns, Toronto Hydro developed a formal Grid Emergency Management program in 2014. The aim of this program is to address previously identified gaps in emergency readiness and emergency response.

In 2016, the Grid Emergency Management program achieved the following:

- published new emergency management plans
- rostered staff into key emergency roles
- conducted seminars, training and table-top exercises with Senior Management to familiarize them with their roles and the organizations approach to emergency management
- engaged front line staff to inform them of the new plans and processes
- developed new tools to support incident management teams

In addition, Toronto Hydro remains committed to maintaining a strong corporate governance structure at the executive and senior management levels through an all-hazard emergency management system that includes detailed policies, plans, training and exercises. In 2016, Toronto Hydro focused on developing its business continuity program with a focus on IT and disaster recovery planning in response to increasing cyber and data breach threats. This included the participation of over 25 subject matter experts throughout the organization and is aligned with Canadian and US best practice.

Mutual Aid

Through membership in the CEA Mutual Aid Working Group (CanMAG) and the North Atlantic Mutual Assistance Group (NAMAG), Toronto Hydro has cultivated relationships with a large number of utilities from across Canada and the northeastern United States in order to help ensure additional resources can be brought in from other areas to support restoration efforts during a major storm. In CanMAG, Toronto Hydro has taken a leadership role in developing the capabilities of the working group, including organizing and hosting a meeting in Toronto in the fall of 2016.

Ultimately, through a long-term sustained effort, Toronto Hydro aims to improve our ability to efficiently and effectively respond to and recover from major grid disruption events, and to do so while providing our customers and the community with timely and accurate information.

Emergency Preparedness for Customers

Emergency preparedness is a top priority for customers. In 2016, Toronto Hydro focused on encouraging customers to create an emergency preparedness kit. These activities took place through direct outreach campaigns via newsletters, brochures and community events, and public relations campaigns such as the Emergency Preparedness Week, which attracted multiple media stories and live coverage on the Weather Network.