

Evaluation of PY2019 Residential Programs

ADDENDUM TO EVALUATION OF 2018 RESIDENTIAL PROGRAMS REPORT

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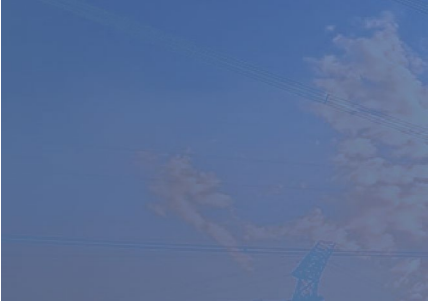
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Foreword

This report is an addendum to the Evaluation of 2018 Residential Programs Report and provides an overall summary of the energy and demand savings achieved by the Independent Electricity System Operator (IESO) – funded residential energy efficiency programs in program year 2019 within the Conservation First Framework (CFF). This report is intended for all parties interested in residential energy efficiency programs in Ontario. During the next two (2) years, energy and demand savings achieved by the residential CFF programs will be provided as an addendum to the 2018 report. All projects pre-approved by the local distribution companies before May 1, 2019 are given until December 31, 2020 to be completed except for the Residential New Construction Program which was given until June 30, 2021 to complete all projects.

Acronyms and Abbreviations

Acronym/Abbreviation	Definition
EUL	Effective useful life
FNCP	First Nations Conservation program
HAP	Home Assistance program
HVAC program	Heating and Cooling program
IESO	Independent Electricity System Operator
Clothesline ISP	Clothesline Instant Savings program
LDC	Local distribution company
NTG ratio	Net-to-gross ratio
PY	Program year
RNC program	Residential New Construction program



Executive Summary

As part of the orderly and cost-effective wind down of the Independent Electricity System Operator's (IESO) Conservation First Framework, the Cadmus team (Cadmus, Econoler and Apex Analytics) evaluated program year (PY) 2019 province-wide and local residential programs using a simplified approach. This report describes the impact results for PY2019 for nine programs:

- **Province-wide programs**
 - Heating and Cooling (HVAC) program
 - Residential New Construction (RNC) program
 - Home Assistance program (HAP)
- **Local programs**
 - Adaptive Thermostat Rebate program
 - First Nations Conservation program (FNCP)
 - Clothesline Instant Savings program (Clothesline ISP)
 - SuiteSaver program
 - Social Benchmarking program
 - Swimming Pool Efficiency program

For these evaluations, the Cadmus team determined the annual estimated net and gross energy savings and demand reduction at the program level using historical adjustment factors and other parameters.

CADMUS



As shown in Table 1, the PY2019 portfolio achieved a total of 48.5 GWh in net first-year estimated energy savings and 12.3 MW in net first-year estimated summer peak demand savings. Net estimated 2020 savings were 33.2 GWh and 12.3 MW.

Table 1. PY2019 Portfolio Results

Program	Net Estimated Energy Savings (GWh)	Net Estimated Summer Peak Demand Savings (MW)	Net Estimated 2020 Energy Savings (GWh)	Net Estimated 2020 Summer Peak Demand Savings (MW)
Province-Wide Programs	24.0	7.104	24.0	7.104
HVAC	14.7	5.120	14.7	5.120
RNC	1.2	0.237	1.2	0.237
HAP	8.1	1.747	8.1	1.747
Local Programs	24.6	5.255	9.2	5.255
Adaptive Thermostat Rebate	0.2	-	0.2	-
FNCP	2.1	0.410	2.1	0.410
Clothesline ISP	0.030	0.001	0.030	0.001
SuiteSaver	6.7	4.800	6.7	4.800
Social Benchmarking	15.4	-	-	-
Swimming Pool Efficiency	0.2	0.044	0.2	0.044
Total	48.6	12.359	33.2	12.359

Impact Evaluation Approach

This section describes the Cadmus team’s overall approach to calculate program-level energy savings, demand savings, incremental costs and effective useful life (EUL). In PY2019, the Cadmus team continued the simplified evaluation approach as part of the orderly and cost effective CFF wind down using program-level realization rates and net-to-gross (NTG) ratios based on past program performance. These realization rates and NTG ratios are shown in Table 2.

The IESO provided the Cadmus team with raw PY2019 participation data for each program, which we reviewed for erroneous or missing values and removed duplicate data. The Cadmus team reviewed projects across all programs for energy savings and summer peak demand reduction using the historical samples of estimated projects from previous evaluation years.

For most programs, to estimate program-level gross savings, the Cadmus team multiplied aggregated measure-level reported savings by program-level historical realization rates using up to three years of historical results. Consistent with PY2018 for HAP but new for FNCP, the Cadmus team used the historical program-level energy to demand ratios since the demand reduction was often reported as “connected demand” instead of “peak demand” (and was therefore multiple orders of magnitude too large). Using a realization rate in these cases would also produce estimated demand reduction that was orders of magnitude too large. The program-level energy to demand ratios are not dependent on reported demand reduction, and thus are aligned with past program performance.

To estimate net savings, the Cadmus team multiplied the program-level gross savings by historical NTG ratios, averaging up to three years of results, consistent with PY2018 program design and measures.

Also consistent with PY2018, the Social Benchmarking program did not claim reported savings in PY2019. For this program, the Cadmus team calculated the average per-home annual energy and demand savings across all treated homes in PY2017 and applied this average to all treated homes in PY2019, pro-rated for the number of months homes were treated (for example, homes treated for three months received one-quarter of annual per-home savings).

Table 2. Assumptions for Program Realization Rates

Program	Energy Realization Rate	Demand Realization Rate	Energy Net-to-Gross	Demand Net-to-Gross	Assumptions
HVAC	107.3%	71.9%	78.1%	81.1%	Applied PY2017 adjustment factors (the first year with a new mix of measures).
RNC	21.0%	114.0%	80.8%	78.7%	Applied weighted average of PY2016 and PY2017 results due to updated baseline between PY2015 and PY2016.
HAP	65.2%	N/A ^a	100.0%	100.0%	Applied PY2015 through PY2017 weighted average for realization rates to energy savings, as no major program design changes have occurred since PY2015. For demand reduction, multiplied the PY2015 through PY2017 average ratio of demand-to-energy savings by the PY2018 realized energy savings. NTG assumed as 100% for low-income programs.
Adaptive Thermostat Rebate	100.0%	100.0%	100.0%	100.0%	Applied 100% adjustment factors since this is a new program with no historical data.
FNCP	47.6%	N/A ^a	100.0%	100.0%	Applied PY2016 and PY2017 weighted average. NTG assumed as 100% for indigenous programs.
Clothesline ISP	35.4%	5.8%	170.8%	170.8%	Applied PY2017 adjustment factors since program was initiated in PY2017.
SuiteSaver	100.0%	100.0%	100.0%	100.0%	Applied 100% adjustment factors since this is a new program with no historical data.
Social Benchmarking	N/A	N/A	85.4%	93.2%	Applied PY2016 and PY2017 weighted average of NTG (program uplift).
Swimming Pool Efficiency	99.7%	83.4%	100.2%	100.2%	Applied PY2017 adjustment factors since program was initiated in PY2017.
Adaptive Thermostat Rebate	100.0%	100.0%	100.0%	100.0%	Applied 100% adjustment factors since this is a new program with no historical data.

^a The Cadmus team used the historical program-level energy to demand ratios since the demand reduction was often reported as “connected demand” instead of “peak demand” (and was therefore multiple orders of magnitude too large). Using a realization rate in these cases would also produce estimated demand reduction that was orders of magnitude too large. The program-level energy to demand ratios are not dependent on reported demand reduction, and thus are aligned with past program performance. Also note that the reported energy savings were similar in magnitude (on a per-project basis) to previous program years.



Consistent with the approach used for calculating realization rates and NTG ratios in PY2018, the Cadmus team estimated the incremental costs and EUL at the program level. For HAP and FNCP, where incentives equal incremental costs, the Cadmus team applied the weighted average incremental costs per project from PY2017. For all other existing programs, the Cadmus team calculated PY2019 incremental costs by weighting the PY2017 incremental costs by measure counts.

The Cadmus team calculated lifetime savings using program-level EUL and savings persistence factors. The savings persistence factors represent the percentage of first-year savings that continue to accrue for each year of the program's EUL. To estimate the savings persistence factors, the Cadmus team divided the total annual savings in each year of the program's EUL by the program's first-year savings.

Cost Effectiveness

No cost effectiveness evaluation was performed for PY2019. As CFF is winding down and fewer projects are expected to be completed, the cost effectiveness results of PY2019 CFF programs may not accurately be representative of the program's performance. Instead, the overall cost effectiveness of each of the residential province wide and local programs covering all program years in CFF will be presented in the final evaluation report.

Heating and Cooling Program

Launched in PY2006, the IESO marketed the HVAC program as Save on Energy’s Heating and Cooling Incentive program to promote electronically commutated motors (ECMs) when purchased with a high-efficiency furnace, high-efficiency central air conditioners and (new in PY2017) high-efficiency air-source heat pumps. Residents (and businesses with residential-sized systems) received an incentive toward the purchase of qualifying new or replacement equipment through a participating contractor. Operated province-wide, program fulfilment was managed by Summerhill, which processed program data, applications and rebates and reported to the IESO. The Heating, Refrigeration and Air Conditioning Institute of Canada managed the program’s contractor network.

Table 3 shows the participation, gross and net program savings, realization rates and NTG ratios for PY2019 and PY2018.

Table 3. PY2018 and PY2019 Heating and Cooling Program Performance

Item	Units	PY2019	PY2018
Participation	Projects	22,911	47,261
Gross Estimated Savings	MWh	18,760.9	76,673.0
Gross Estimated Savings	MW	6.313	26.186
Gross Realization Rate	% (MWh)	107.3%	107.3%
Gross Realization Rate	% (MW)	71.9%	71.9%
Net Estimated Annual Savings (First Year)	MWh	14,652.2	59,881.6
Net Estimated Annual Savings (First Year)	MW	5.120	21.237
Net Estimated Annual Savings (PY2020)	MWh	14,652.2	59,881.6
Net Estimated Annual Savings (PY2020)	MW	5.120	21.237
Net-to-Gross Ratio (MWh)	%	78.1%	78.1%

Residential New Construction Program

Launched in PY2011, the RNC program encouraged homebuilders to include energy-efficient design and technologies in new and substantially renovated homes. Residential homebuilders received incentives to participate in three program tracks—prescriptive, performance and custom:

- Through the prescriptive track, the IESO offered incentives for installing individual measures including dimmer switches, ENERGY STAR® lighting, motion sensors and central air conditioners.
- Through the performance track, the IESO provided incentives for homes receiving an ENERGY STAR certification, an EnerGuide rating of 83 or 84 or an EnerGuide rating of 85 or more from a Natural Resources Canada auditor.
- Through the custom track, the IESO provided incentives based on savings from improvements exceeding the Ontario Building Code.

Table 4 shows the participation, gross and net program savings, realization rates and NTG ratio for PY2019 and PY2018.

Table 4. PY2019 and PY2018 Residential New Construction Program Performance

Item	Units	PY2019	PY2018
Participation	Homes	80	344
Gross Estimated Savings	MWh	1,450.7	3,046.1
Gross Estimated Savings	MW	0.302	0.643
Gross Realization Rate	% (MWh)	21.0%	21.0%
Gross Realization Rate	% (MW)	114.0%	114.0%
Net Estimated Annual Savings (First Year)	MWh	1,172.2	2,461.2
Net Estimated Annual Savings (First Year)	MW	0.237	0.506
Net Estimated Annual Savings (PY2020)	MWh	1,172.2	2,461.2
Net Estimated Annual Savings (PY2020)	MW	0.237	0.506
Net-to-Gross Ratio (MWh)	%	80.8%	80.8%

Home Assistance Program

Launched in PY2011 and managed by the IESO and local distribution companies (LDCs)¹, HAP helped income-qualified homeowners and tenants in nonprofit housing and private rentals improve the energy efficiency of their home and manage their energy use more effectively at no cost to the resident or owner. Program representatives (delivery agents or LDC staff) first conducted an energy audit to identify appropriate program measures. With participant or property owner consent, the representative installed these measures, either through the initial audit visit or during a follow-up visit. Measures included showerheads, aerators, LEDs, power bars, window air conditioners, dehumidifiers, clothes drying racks, draft proofing and attic insulation. During the audit, participants also received education about electricity conservation, time-of-use rates and the new energy efficiency equipment they receive.

Participants in single-family homes that are heated by electricity may have received a more extensive weatherization audit to determine eligibility for additional air sealing and insulation upgrades. To receive weatherization or domestic hot water measures (or both), the residence must have been heated by or produce hot water using electricity.

Table 5 shows the participation, gross and net program savings, realization rates and NTG ratio for PY2019 and PY2018. Note that for demand, Cadmus used the program-level energy to demand ratio (0.0140%) because the reported demand savings were orders of magnitude too high relative to what was expected in previous years. The demand realization reported represents the estimated demand savings divided by the reported demand savings and not the applied the realization rate.

Table 5. PY2019 and PY2018 Home Assistance Program Performance

Item	Units	PY2019	PY2018
Participation	Projects	8,379	4,609
Gross Estimated Savings	MWh	8,139.9	7,047.3
Gross Estimated Savings	MW	1.747	0.986
Gross Realization Rate	% (MWh)	65.2%	65.2%
Gross Realization Rate	% (MW)	2.2%	0.6%
Net Estimated Annual Savings (First Year)	MWh	8,139.9	7,047.3
Net Estimated Annual Savings (First Year)	MW	1.747	0.986
Net Estimated Annual Savings (PY2020)	MWh	8,139.9	7,047.3
Net Estimated Annual Savings (PY2020)	MW	1.747	0.986
Net-to-Gross Ratio (MWh)	%	100.0%	100.0%

¹ In PY2019, about 75% of measures were delivered by the LDCs and 25% were centrally delivered.

Adaptive Thermostat Rebate Program

Through the Adaptive Thermostat program, launched in PY2018, Toronto Hydro and Enbridge Gas Distribution provided incentives to residential customers who upgraded from standard (non-learning) thermostats to Nest, Ecobee or Honeywell smart thermostats, also known as adaptive thermostats.

Customer could purchase qualifying thermostats from participating Home Depot and Best Buy retailers. To be eligible, participants had to register their thermostat online after installation, be served by Toronto Hydro and Enbridge Gas and own a single-family home with central air conditioning and natural gas heating. All participants received a \$100 rebate in the form of bill credits from Enbridge Gas.

Each month, Enbridge Gas invoiced Toronto Hydro for half the total incentives disbursed to customers.

Table 6 shows the participation, gross and net program savings, realization rates and NTG ratio for PY2019 and PY2018.

Table 6. PY2019 and PY2018 Adaptive Thermostat Rebate Program Performance

Item	Units	PY2019	PY2018
Participation	Measures	651	4,326
Gross Estimated Savings	MWh	151.7	1,008.3
Gross Estimated Savings	MW	0	0
Gross Realization Rate	% (MWh)	100.0%	100.0%
Gross Realization Rate	% (MW)	N/A	N/A
Net Estimated Annual Savings (First Year)	MWh	151.7	1,008.3
Net Estimated Annual Savings (First Year)	MW	0	0
Net Estimated Annual Savings (PY2020)	MWh	151.7	1,008.3
Net Estimated Annual Savings (PY2020)	MW	0	0
Net-to-Gross Ratio (MWh)	%	100.0%	100.0%

First Nations Conservation Program

From PY2011 to PY2014, the IESO offered the Aboriginal Conservation program to help on-reserve First Nation customers improve the energy efficiency of their homes. Starting in PY2015, the IESO transferred delivery of the Aboriginal Conservation program to the LDCs.

Consequently, Hydro One created the FNCP to directly serve its First Nation communities. The program, managed by Hydro One, helped homeowners and tenants in band-owned and private housing improve the energy efficiency of their homes and manage their energy use more effectively at no cost to the resident or owner. A program representative directly installed eligible efficiency measures, as determined through an in-home energy audit, and provided conservation education to participants. The program measures included LEDs, power bars, blocker heater timers, aerators, dehumidifiers, refrigerator or freezer replacements, programmable thermostats and attic, basement and hot water tank insulation. In addition, the LDC could make repairs to the residence, installing eligible measures and making health and safety upgrades where necessary.

Table 7 shows the participation, gross and net program savings, realization rates and NTG ratio for PY2019 and PY2018. Note that for demand, Cadmus used the program-level energy to demand ratio (0.0094%) because the reported demand savings were orders of magnitude too high relative to what was expected in previous years. The demand realization reported represents the estimated demand savings divided by the reported demand savings and not the applied the realization rate

Table 7. PY2019 and PY2018 First Nations Conservation Program Performance

Item	Units	PY2019	PY2018
Participation	Projects	2,442	1,742
Gross Estimated Savings	MWh	2,070.6	2,245.0
Gross Estimated Savings	MW	0.410	0.131
Gross Realization Rate	% (MWh)	47.6%	47.6%
Gross Realization Rate	% (MW)	1.3%	8.6%
Net Estimated Annual Savings (First Year)	MWh	2,070.6	2,245.0
Net Estimated Annual Savings (First Year)	MW	0.410	0.131
Net Estimated Annual Savings (PY2020)	MWh	2,070.6	2,245.0
Net Estimated Annual Savings (PY2020)	MW	0.410	0.131
Net-to-Gross Ratio (MWh)	%	100.0%	100.0%

Clothesline Instant Savings Program

Through the Clothesline ISP, launched in PY2017, five LDCs sponsored events in the community and at their offices to provide free retractable clotheslines directly to customers. In PY2019 and² consistent with PY2018, to receive a clothesline, customers had to have a residential account with the LDC and not have previously participated in the program. Along with the clothesline, the LDC provided additional information on energy-savings opportunities, other efficiency programs and energy-savings tips.

Table 8 shows the participation, gross and net program savings, realization rates and NTG ratio for PY2019 and PY2018.

Table 8. PY2019 and PY2018 Clothesline Instant Savings Program Performance

Item	Units	PY2019	PY2018
Participation	Measures	311	10,768
Gross Estimated Savings	MWh	17.7	865.9
Gross Estimated Savings	MW	0.001	0.049
Gross Realization Rate	% (MWh)	35.4%	35.4%
Gross Realization Rate	% (MW)	5.8%	5.8%
Net Estimated Annual Savings (First Year)	MWh	30.2	1,479.0
Net Estimated Annual Savings (First Year)	MW	0.001	0.083
Net Estimated Annual Savings (PY2020)	MWh	30.2	1,479.0
Net Estimated Annual Savings (PY2020)	MW	0.001	0.083
Net-to-Gross Ratio (MWh)	%	170.8%	170.8%

² These LDCs were Canadian Niagara Power Inc., Essex Powerlines Corporation, Greater Sudbury Hydro Inc., Newmarket-Tay Power Distribution Ltd. and North Bay Hydro Distribution Limited.

SuiteSaver Program

Through the SuiteSaver program, Toronto Hydro offered building owners and managers of high-rise multi-unit residential buildings free smart power bars and in-suite lighting retrofits for installation in residential units. The program was implemented from September 2018 to March 2019.

Toronto Hydro designed the SuiteSaver program to overcome barriers to improving energy efficiency in the multifamily sector, especially in multi-unit residential building with all-inclusive rents or administration fees. In this segment, residents (tenants or unit owners) often pay a fixed cost for electricity as part of their rent or maintenance fees, and building operators are responsible for maintenance. Through the SuiteSaver program, building owners and managers may have received a direct reduction in electricity costs from efficiency upgrades and may have been able to install in-suite upgrades throughout the entire building.

Table 9 shows the participation, gross and net program savings, realization rates and NTG ratio for PY2019 and PY2018.

Table 9. PY2019 and PY2018 SuiteSaver Program Performance

Item	Units	PY2019	PY2018
Participation	Projects	202	63
Gross Estimated Savings	MWh	6,697.5	1,428.6
Gross Estimated Savings	MW	4.800	1.076
Gross Realization Rate	% (MWh)	100.0%	100.0%
Gross Realization Rate	% (MW)	100.0%	100.0%
Net Estimated Annual Savings (First Year)	MWh	6,697.5	1,428.6
Net Estimated Annual Savings (First Year)	MW	4.800	1.076
Net Estimated Annual Savings (PY2020)	MWh	6,697.5	1,428.6
Net Estimated Annual Savings (PY2020)	MW	4.800	1.076
Net-to-Gross Ratio (MWh)	%	100.0%	100.0%

Social Benchmarking Program

In PY2019, the Social Benchmarking local program was offered by four LDCs³. All the programs shared a common tool—home energy reports—which were mailed or emailed to a large proportion of customers who were randomly selected to receive behavioural treatment. The reports stimulated customer interest in energy efficiency and attempted to change their behaviours by putting the customer’s energy use in context and benchmarking against similar homes and by providing personalized actionable recommendations to reduce energy use.

Each LDC implemented a uniquely designed program that included features such as web portals, email reports or opt-in opportunities and components based in behavioural science, which sought to reduce residential electrical demand and consumption, enhance customer experience and encourage participation in other energy efficiency programs.

The Social Benchmarking programs were designed to enable measurement of resulting effects through two primary experimental research designs. These experimental designs allowed for measurement control and rely on statistical power to determine if a treatment was effective:

- Randomized control trial design for opt-out programs
- Randomized encouragement design for programs that encourage customers to opt-in

Table 10 summarizes the program designs for each LDC and details the treatment customer counts provided to the Cadmus team for evaluation.

Table 10. Local Distribution Company Behaviour Program Design

LDC	Design ^a	Measure	Treatment Size
Alectra Utilities (PowerStream, Horizon)	RCT	<ul style="list-style-type: none"> • Customer Engagement Platform • Electronic reports • Direct mail 	93,282
Hydro Ottawa	RCT and RED	<ul style="list-style-type: none"> • Email home energy reports 	246,703
Collus PowerStream	RCT	<ul style="list-style-type: none"> • Direct mail • Web portal 	2,288
Toronto Hydro	RCT	<ul style="list-style-type: none"> • Direct mail • Email home energy reports 	209,163

a RCT = randomized control trial; RED = randomized encouragement design

³ These LDCs were Alectra Utilities Corporation, Hydro Ottawa, Collus PowerStream and Toronto Hydro.

Table 11 shows the participation, gross and net program savings, realization rates and NTG ratio for PY2019 and PY2018.

Table 11. PY2019 and PY2018 Social Benchmarking Program Performance

Item	Units	PY2019	PY2018
Participation	Home Energy Reports	551,436	544,769
Gross Estimated Savings	MWh	18,070.5	71,414.5
Gross Estimated Savings	MW	0	13.368
Gross Realization Rate	% (MWh)	N/A	N/A
Gross Realization Rate	% (MW)	N/A	N/A
Net Estimated Annual Savings (First Year)	MWh	15,432.2	60,988.0
Net Estimated Annual Savings (First Year)	MW	0	12.459
Net Estimated Annual Savings (PY2020)	MWh	0	0
Net Estimated Annual Savings (PY2020)	MW	0	0
Net-to-Gross Ratio (MWh)	%	85.4%	85.4%

Swimming Pool Efficiency Program

Launched in PY2017, the Swimming Pool Efficiency program was offered by four LDCs⁴. The program was designed to replace constant speed swimming pool pumps with variable speed pumps for existing in ground pools. Constant speed pumps are sized to provide a continuous flow rate regardless of usage, whereas variable speed pumps adjust flow rates by use (filtering and sanitation, heating and cleaning), resulting in energy savings.

All single-family residential customers of participating LDCs who owned an in-ground pool with a constant speed pump, with or without existing controls, were eligible for the program. The LDCs provided an instant \$400 discount at the point of sale toward an ENERGY STAR variable-speed pool pump. The pool pump had to be installed by a participating pool pump vendor or a participating vendor's contracted installer. The program design used a midstream approach, in which vendors were responsible for recruiting participants, providing the discounted equipment to customers and claiming incentives from the LDCs.

Table 12 shows the participation, gross and net program savings, realization rates and NTG ratio for PY2019 and PY2018.

Table 12. PY2019 and PY2018 Swimming Pool Efficiency Program Performance

Item	Units	PY2019	PY2018
Participation	Homes	61	1,969
Gross Estimated Savings	MWh	185.8	6,123.9
Gross Estimated Savings	MW	0.044	1.365
Gross Realization Rate	% (MWh)	99.7%	99.7%
Gross Realization Rate	% (MW)	83.4%	83.4%
Net Estimated Annual Savings (First Year)	MWh	186.2	6,136.1
Net Estimated Annual Savings (First Year)	MW	0.044	1.367
Net Estimated Annual Savings (PY2020)	MWh	186.2	6,136.1
Net Estimated Annual Savings (PY2020)	MW	0.044	1.367
Net-to-Gross Ratio (MWh)	%	100.2%	100.2%

⁴ These LDCs were Hydro One Networks Inc., Hydro Ottawa Limited, Kitchener-Wilmot Hydro Inc. and Toronto Hydro-Electric System Limited.