



## Evaluation of 2018 Business Programs

Submitted to Independent Electricity System Operator

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# Foreword

This report provides an overall summary of the energy and demand savings achieved and cost effectiveness results by Independent Electricity System Operator (IESO) funded business energy efficiency programs in 2018 within the Conservation First Framework (CFF). It is intended for all parties interested in understanding the achievements of the 2018 business energy efficiency programs in Ontario. Note, only projects completed by December 31, 2018 have been included in this report. Given that projects pre-approved prior to May 1, 2019 have until December 31, 2020 to complete, the IESO will be providing addendums to this 2018 report over the next two years as 2018 initiated projects which have not been included in this report are completed.

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## List of Acronyms

BRI	= Business Refrigeration Incentive Program
CDM	= Conservation Demand Management
CFF	= Conservation First Framework
EBCx	= Existing Building Commissioning Program
FCR	= Full Cost Recovery
FR	= Free ridership
GWh	= Gigawatt-hour
HP	= Horsepower
HPNC	= High Performance New Construction Program
HVAC	= Heating, ventilation, and air conditioning
kW	= Kilowatt
kWh	= Kilowatt-hour
IESO	= Independent Electricity System Operator
LDC	= Local Distribution Company
LUEC	= Levelized Unit Energy Cost
MW	= Megawatt
MWh	= Megawatt-hour
NTG	= Net-to-gross
NTGR	= Net-to-gross ratio
P4P	= Pay for Performance
PAC	= Program administrator cost
SBL	= Small Business Lighting Program
SO	= Spillover
TRC	= Total resource cost
VFD	= Variable frequency drive

# 1 Executive Summary

The Independent Electricity System Operator (IESO) retained Nexant, Inc., to conduct a simplified evaluation approach of its business energy conservation programs for Program Year 2018 (PY 2018) as part of an orderly and cost effective wind down of the Conservation First Framework<sup>1</sup>. The evaluation team also includes NMR Group, Inc. This section provides a high-level summary of results of the impact and process evaluation of IESO's province-wide and local business programs for PY 2018.

## 1.1 Evaluation Goals and Objectives

The following are goals and objectives of the 2018 evaluation of the Business Programs:

- Determine net adjusted results based on a simplified evaluation approach of the following province-wide Save on Energy Programs: Retrofit Full Cost Recovery, Retrofit Pay for Performance, Small Business Lighting, Business Refrigeration Initiative, Audit Funding, High Performance New Construction, and Existing Building Commissioning Programs
- Determine net adjusted results based on a simplified evaluation approach of the following local and regional programs: PUMPSaver, RTUsaver, OPSaver, and High Efficiency Agricultural Pumping
- Determine the cost effectiveness of each program using the Total Resource Cost (TRC) test, Program Administrator's Cost (PAC) test and Levelized Unit Energy Costs (LUEC).

A summary of the impact evaluation methodology is presented in Section 2 with the net adjusted results presented and discussed in Section 3.

## 1.2 Business Program Results

The total 2018 first-year net adjusted energy and summer peak demand savings across all business programs was 549.9 GWh and 81.8 MW, respectively. The contribution of each program to the net adjusted energy savings is presented in Table 1-1.

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<sup>1</sup> The Conservation First Framework (CFF) was discontinued last March 21, 2019 (<http://ieso.ca/Sector-Participants/Conservation-Delivery-and-Tools/Interim-Framework>).

Table 1-1: 2018 Program and Portfolio Savings

Program Availability	Program	Net Energy Savings (GWh)	Net Summer Demand Savings (MW)
Province Wide	Retrofit Full Cost Recovery (FCR)	405.6	54.8
	Retrofit Pay-for-Performance (P4P)	43.6	7.0
	Small Business Lighting	40.4	7.8
	High Performance New Construction	20.9	8.1
	Audit Funding	17.0	0.9
	Business Refrigeration	12.0	0.9
	Existing Building Commissioning	0.1	0.0
	<b>Province Wide Program Savings</b>	<b>539.6</b>	<b>79.7</b>
Regional and Local	PUMPSaver	7.3	0.9
	RTUsaver	2.7	1.2
	Opsaver	0.2	0.0
	High Efficiency Agricultural Pumping	0.03	0.0
	<b>Regional and Local Program Savings</b>	<b>10.3</b>	<b>2.1</b>

Table 1-2 summarizes the TRC and PAC cost effective results for each program where programs with a result of 1.0 or greater are considered to pass the test. Levelized Unit Energy Costs (\$/kWh and \$/kW) represent the cost paid by the program for each unit of energy and demand saved.

**Table 1-2: 2018 Business Programs Cost Effectiveness Results**

Program Availability	Program	TRC Ratio	PAC Ratio	\$/kWh	\$/kW
Province Wide	Retrofit FCR	1.14	3.38	\$0.022	\$166.62
	Retrofit P4P	1.92	3.27	\$0.024	\$144.49
	Small Business Lighting	1.43	1.45	\$0.061	\$622.03
	High Performance New Construction	0.67	5.27	\$0.024	\$160.29
	Audit Funding	1.49	3.52	\$0.016	\$60.11
	Business Refrigeration	1.50	1.32	\$0.046	\$293.46
	Existing Building Commissioning	0.25	0.21	\$0.721	\$1,323.55
Regional and Local	PUMPSaver	4.19	3.65	\$0.021	\$83.45
	RTUsaver	5.08	3.66	\$0.038	\$287.42
	OPsaver	0.36	0.20	\$0.237	n/a
	High Efficiency Agricultural Pumping	0.03	0.03	\$4.194	\$12,570.98



## 2 Evaluation Methodology

### 2.1 Impact Evaluation Methodology

Following receipt of a directive from the Ministry of Energy, Northern Development and Mines on March 21, 2019, the IESO took necessary steps to immediately discontinue the Conservation First Framework (CFF) and used all reasonable efforts to minimize costs associated with the CFF. As part of this orderly wind-down the IESO applied a simplified PY 2018 evaluation and reporting approach.

Projects across all programs, except for Retrofit P4P<sup>1</sup>, were reviewed for energy and summer peak demand savings using the historical samples of verified projects from previous evaluation years. Savings from these previously verified projects were estimated using impact evaluation techniques including population sampling, project audits, verification of site specific energy and summer peak demand savings, comparison of verified savings to reported savings to calculate realization rates, and estimation of net-to-gross ratios through participant attribution surveys.

The realization rates and net-to-gross adjustment factors applied to PY 2018 programs were calculated using a savings-weighted average of the most relevant previous program year's adjustment factors. Most provincial programs applied values from the PY 2015 through PY 2017 evaluations. BRI and PUMPSaver programs started in PY 2016 and took their first (PY 2016) and second year (PY 2017) results into account for the adjustment factors, and results for RTUSaver and OPSaver are based on PY 2016 which was the only year with historical evaluated results. Calculated adjustment factors for each program, and the data source for these adjustment factors, are shown in Table 2-1.

**Table 2-1: 2018 Program Level Adjustment Factors**

Program Availability	Program	Realization Rate		Net-to-Gross		Source
		Energy	Demand	Energy	Demand	
Province Wide	Retrofit FCR	98.4%	93.4%	81.6%	84.0%	PY2015 to PY2017
	Small Business Lighting	79.2%	62.4%	91.6%	90.2%	
	High Performance New Construction	108.0%	104.0%	58.0%	108.0%	
	Audit Funding	n/a	n/a	90.0%	87.0%	
	Existing Building Commissioning	100.0%	117.0%	78.0%	100.0%	PY2016 to PY2017
	Business Refrigeration	67.0%	63.0%	98.0%	67.0%	

<sup>1</sup> As per the Electricity Conservation Agreement (ECA) the IESO is required to continue to fund Eligible Expenses that have been paid, are payable or have accrued under the CDM Plan to the date of termination and will fund Participant Incentives and pay pay-for-performance incentives of the Programs under existing Participant Agreements that continue in effect following termination.

Regional and Local	PUMPSaver	114.0%	102.0%	101.0%	114.0%	PY2016
	RTUsaver	103.0%	148.0%	71.0%	103.0%	
	Opsaver	104.0%	0.0%	100.0%	0.0%	
	High Efficiency Agricultural Pumping	100.0%	100.0%	100.0%	100.0%	No historical performance

### 2.1.1 Retrofit P4P Quarterly Evaluation Methodology

In contrast to the rest of the programs offered through CFF and evaluated on an annual basis, the Retrofit P4P Program evaluation reviewed projects on quarterly time-frame. LDCs who opted into this program forego set incentive levels dependent on ex-ante equipment installed or reported energy savings, and instead were provided set payments based on net verified ex-post savings. Quarterly evaluations of these projects provided a consistent accounting of program savings and expected payments to the LDCs. Realization rates were calculated for each quarter through the use of a four-quarter rolling sample based on savings verification of sample projects, with program specific quarterly NTG rates determined independently for each quarter through participant attribution surveys<sup>2</sup>.

LDCs that opt into the Retrofit P4P Program are required to submit their projects to IESO in two different ways:

1. Quarterly: Allowing the evaluation team to verify the projects and provide net verified energy savings estimates that are used to calculate incentive payments; and
2. Annually: Through the use of the LDC Reports projects are submitted to IESO for inclusion in the annual accounting of savings that are attributable to the energy efficiency portfolio.

In 2018 the Retrofit P4P Program submitted 2,039 projects for review through the quarterly reporting process, but only 749 of these projects were provided through the LDC Reports and included in the Retrofit P4P Impact Evaluation (Section 3.2). The evaluation team expects the remaining projects will be included in the PY2019 evaluation as true-ups.

### 2.1.2 Gross Reported Savings

Gross reported savings are the energy and summer peak demand savings that are provided by program participants on their applications.

### 2.1.3 Gross Adjusted Savings

The adjustment factors in Table 2-1 include realization rates that model the historical levels of gross energy and demand savings that are achieved based on program reported energy and demand savings. For PY 2018, a weighted average of past program realization rates was applied to create adjustment factor for 2018 projects. The calculation of this weighted average realization rate for the Retrofit Program is shown in Equation 2-1.

<sup>2</sup> If quarterly NTG results fail to meet the 90/10 target responses from the previous quarter are rolled into the current results.

### Equation 2-1: Weighted Average Realization Rate Calculation

$$2018 \text{ Energy Realization Rate}_{\text{Retrofit}} = \frac{\sum_{2015}^{2017} \text{Energy Savings}_{\text{Retrofit},i} \times \text{Energy Realization Rate}_{\text{Retrofit},i}}{\sum_{2015}^{2017} \text{Energy Savings}_{\text{Retrofit},i}}$$

Weighted average realization rates were developed for each program based on past performance. Total program gross adjusted savings for all projects in the program are then calculated as the product of program reported savings and the program's weighted average realization rate. **Error! Reference source not found.** shows the basic formula for calculating the gross adjusted savings for each program.

### Equation 2-2: Gross Adjusted Savings

$$\text{Gross Adjusted Savings}_{\text{Program}} = \text{Reported Savings}_{\text{Program}} \times \text{Realization Rate}_{\text{Program}}$$

Where:

*Reported Savings*<sub>Program</sub> = Sum of all savings reported for a given program

*Realization Rate*<sub>Program</sub> = Adjustment factor based on past program performance

These total program-level gross adjusted savings reflect the direct energy and demand impact of the program's operations. However, these program-level gross savings do not account for customer or market behaviour impact that may have been added to or subtracted from the program's direct results—these market effects are accounted for through the net impact analysis.

## 2.1.4 Lifetime Savings

The total amount of savings that occur over the lifetime of the retrofitted equipment is an important consideration in the impact evaluation since energy savings, demand savings, avoided energy costs, avoided capacity costs, and other benefits continue to accrue each year the equipment is in service. The evaluation team created savings persistence load profiles for each program that model performance of past programs over time to create annual persistence factors between 0% and 100%. This value represents the portion of first-year savings that remain in place for each year between 2018 and 2050 and the product of the first-year savings and persistence factor is the annual savings for a given year (Equation 2-3). Lifetime savings are calculated as the sum of all program savings between 2018 and 2050 (Equation 2-4).

### Equation 2-3: Annual Savings

$$\text{Annual Savings}_{\text{Program},i} = \text{Evaluated Savings}_{\text{Program}} \times \text{Persistence Factor}_{\text{Program},i}$$

### Equation 2-4: Lifetime Savings

$$\text{Lifetime Savings}_{\text{Program}} = \sum_{i=2018}^{2050} \text{Annual Savings}_{\text{Program},i}$$

Where:

*Annual Savings* = Program level savings for a given year

### 2.1.5 Net Adjusted Savings

Net adjusted savings represent the portion of gross adjusted savings that are attributable to each program. This accounts for the influence of free-riders, program participants who would have implemented a program measure or practice in the absence of the program, and spillover, additional reductions in energy consumption and demand that are due to program influences beyond those directly associated with program participation. Using a process similar to the estimation of energy and demand realization rates, adjustment factors for program level net-to-gross were based on a weighted average of past program performance (Equation 2-5).

#### Equation 2-5: Weighted Average Net-to-Gross Calculation

$$2018 \text{ Energy Net-to-Gross}_{\text{Retrofit}} = \frac{\sum_{2015}^{2017} \text{Energy Savings}_{\text{Retrofit},i} \times \text{Energy Net-to-Gross Ratio}_{\text{Retrofit},i}}{\sum_{2015}^{2017} \text{Energy Savings}_{\text{Retrofit},i}}$$

Net adjusted savings were determined by multiplying the gross adjusted savings by the net-to-gross (NTG) ratio as shown in and Equation 2-6.

#### Equation 2-6: Net Adjusted Savings

$$\text{Net Savings}_{\text{Program}} = \text{Gross Adjusted Savings}_{\text{Program}} \times \text{NTG}_{\text{Program}}$$

Where:

Gross Adjusted Savings<sub>Program</sub> = Gross adjusted savings for a given program

NTG<sub>Program</sub> = Net-to-gross ratio for a given program

## 2.2 Cost Effectiveness

The IESO CDM Energy Efficiency Cost Effectiveness Tool was used to calculate various measures of cost effectiveness, including the Total Resource Cost (TRC) Test, the Program Administrator Cost (PAC) Test, and the Levelized Unit Energy Cost (LUEC). Tool inputs included program level benefits and costs stated in present value terms with appropriate discount and inflation rates applied to estimate the future values. Program useful life was estimated using past program performance. The IESO CDM Energy Efficiency Cost Effectiveness Tool conforms to IESO requirements set forth in the IESO CDM Cost-Effectiveness Test Guide.

## 3 Impact Results

### 3.1 Retrofit Full Cost Recovery

The Retrofit Program provides incentives to businesses in the industrial, commercial, institutional and multi-family residential sectors for the purchase and operation of energy efficient equipment. Incentives are based on a per unit basis for the prescriptive track and on a per-kWh or per-kW basis for custom track measures. LDCs are provided the option of two payment methods to re-coup costs associated with the program; Full Cost Recovery (FCR) or Pay for Performance (P4P). Nearly all LDCs choose the Retrofit FCR Program and receive set incentive levels based on the type of equipment installed (prescriptive track) during a project or the reported energy savings (custom track) estimated on the project application.

#### 3.1.1 Retrofit Impact Results

Table 3-1 shows the province-wide results of the 2018 Retrofit Full Cost Recovery (FCR) Program impact evaluation.

**Table 3-1: 2018 Retrofit Program Impact Results**

Measurement	Project Count	Reported Savings	Realization Rate	Gross Adjusted Savings	Net-to-Gross Ratio	Net Savings	Lifetime Net Savings	Net Savings at 2020
Energy (GWh)	8,102	505.2	98.4%	497.1	81.6%	405.6	4,896.2	404.1
Summer Peak Demand (MW)		69.9	93.4%	65.3	84.0%	54.8	671.4	55.0

#### 3.1.2 Retrofit Cost Effectiveness

Cost effectiveness (CE) for the 2018 Retrofit FCR Program achieved a TRC ratio of 1.10 and PAC ratio of 3.10 (Table 3-2). Each of these tests exceeded the set threshold of 1.00 to determine if a program is cost effective.

Table 3-2: 2018 Retrofit FCR Cost Effectiveness Results

Cost Effectiveness Test	Value
<b>Total Resource Cost (TRC)</b>	
TRC Costs (\$)	\$280,709,868
TRC Benefits (\$)	\$247,102,982
TRC Net Benefits (\$)	\$33,606,886
TRC Net Benefit (Ratio)	1.14
<b>Program Administrator Cost (PAC)</b>	
PAC Costs (\$)	\$261,175,579
PAC Benefits (\$)	\$77,202,549
PAC Net Benefits (\$)	\$183,973,030
PAC Net Benefit (Ratio)	3.38
<b>Levelized Unit Energy Cost (LUEC)</b>	
\$/kWh	\$0.022
\$/kW	\$166.62

## 3.2 Retrofit Pay for Performance

The Retrofit P4P Program, offered by Alectra Utilities, provided incentives for equipment installed at industrial, commercial, institutional, and residential multi-family sectors. Under the P4P payment mechanism the utility is reimbursed based on the net-verified energy savings evaluated quarterly instead of a set payment dependent on equipment installed or savings reported.

### 3.2.1 Retrofit Pay for Performance Impact Results

Table 3-3 shows the results of the 2018 Retrofit P4P Program impact evaluation. Interactive effects were added to the program realization rates to account for the influence of lighting savings on heating and cooling loads at the project site.

Table 3-3: 2018 Retrofit P4P Program Impact Results

Measurement	Project Count	Reported Savings	Realization Rate	Gross Adjusted Savings	Net-to-Gross Ratio	Net Savings	Lifetime Net Savings	Net Savings at 2020
Energy (GWh)	749	52.9	108.6%	57.4	75.9%	43.6	555.8	43.6
Summer Peak Demand (MW)		8.6	107.2%	9.2	76.2%	7.0	91.6	7.0

### 3.2.2 Retrofit Pay for Performance Cost Effectiveness

Cost effectiveness for the 2018 Retrofit P4P Program achieved a TRC ratio of 1.92 and PAC ratio of 3.27 (Table 3-4). Each of these tests exceeded the set threshold of 1.00 to determine if a program is cost effective.

**Table 3-4: 2018 Retrofit P4P Program Cost Effectiveness Results**

Cost Effectiveness Test	Value
<b>Total Resource Cost (TRC)</b>	
TRC Costs (\$)	\$35,920,160
TRC Benefits (\$)	\$18,725,361
TRC Net Benefits (\$)	\$17,194,799
TRC Net Benefit (Ratio)	1.92
<b>Program Administrator Cost (PAC)</b>	
PAC Costs (\$)	\$33,554,652
PAC Benefits (\$)	\$10,269,423
PAC Net Benefits (\$)	\$23,285,229
PAC Net Benefit (Ratio)	3.27
<b>Levelized Unit Energy Cost (LUEC)</b>	
\$/kWh	\$0.024
\$/kW	\$144.49

## 3.3 Small Business Lighting

The Small Business Lighting (SBL) Program provides small business owners and tenants of commercial, institutional, agricultural facilities, and multifamily buildings who are not residential distribution customers the opportunity to receive up to \$2,000 in free lighting upgrades.

### 3.3.1 Small Business Lighting Impact Results

Table 3-5 shows the province-wide results of the 2018 SBL Program impact evaluation.

**Table 3-5: 2018 SBL Program Impact Results**

Measurement	Project Count	Reported Savings	Realization Rate	Gross Adjusted Savings	Net-to-Gross Ratio	Net Savings	Lifetime Net Savings	Net Savings at 2020
Energy (GWh)	7,233	55.7	79.2%	44.1	91.6%	40.4	304.9	32.9
Summer Peak Demand (MW)		13.8	62.4%	8.6	90.2%	7.8	63.4	6.3

### 3.3.2 Small Business Lighting Cost Effectiveness

Cost effectiveness (CE) for the 2018 SBL Program achieved a TRC ratio of 1.29 and PAC ratio of 1.30 (Table 3-6). Each of these tests exceeded the set threshold of 1.00 to determine if a program is cost effective.

**Table 3-6: 2018 SBL Program Cost Effectiveness Results**

Cost Effectiveness Test	Value
<b>Total Resource Cost (TRC)</b>	
TRC Costs (\$)	\$20,026,402
TRC Benefits (\$)	\$14,001,621
TRC Net Benefits (\$)	\$6,024,781
TRC Net Benefit (Ratio)	1.43
<b>Program Administrator Cost (PAC)</b>	
PAC Costs (\$)	\$19,812,150
PAC Benefits (\$)	\$13,640,191
PAC Net Benefits (\$)	\$6,171,959
PAC Net Benefit (Ratio)	1.45
<b>Levelized Unit Energy Cost (LUEC)</b>	
\$/kWh	\$0.061
\$/kW	\$622.03

## 3.4 High Performance New Construction

The High Performance New Construction (HPNC) Program provides design assistance and incentives for building owners and planners who design and implement energy efficient equipment within commercial, institutional, industrial, or multi-residential occupancy new construction or major renovation projects. Incentives are offered for measures or designs that exceed the current Ontario Building Code requirements.

### 3.4.1 HPNC Impact Results

Table 3-7 shows the province-wide results of the 2018 HPNC Program impact evaluation.



Table 3-7: 2018 HPNC Program Impact Results

Measurement	Project Count	Reported Savings	Realization Rate	Gross Adjusted Savings	Net-to-Gross Ratio	Net Savings	Lifetime Net Savings	Net Savings at 2020
Energy (GWh)	124	33.3	108.0%	36.0	58.0%	20.9	438.3	20.9
Summer Peak Demand (MW)		7.2	104.0%	7.5	108.0%	8.1	174.7	8.1

### 3.4.2 HPNC Cost Effectiveness

Cost effectiveness (CE) for the 2018 HPNC Program achieved a TRC ratio of 0.66 and a PAC ratio of 4.88 (Table 3-8). The PAC result exceeds the set threshold of 1.00 to determine if a program is cost effective.

Table 3-8: 2018 HPNC Program Cost Effectiveness Results

Cost Effectiveness Test	Value
<b>Total Resource Cost (TRC)</b>	
TRC Costs (\$)	\$41,258,675
TRC Benefits (\$)	\$61,547,864
TRC Net Benefits (\$)	(\$20,289,189)
TRC Net Benefit (Ratio)	0.67
<b>Program Administrator Cost (PAC)</b>	
PAC Costs (\$)	\$35,877,108
PAC Benefits (\$)	\$6,807,166
PAC Net Benefits (\$)	\$29,069,943
PAC Net Benefit (Ratio)	5.27
<b>Levelized Unit Energy Cost (LUEC)</b>	
\$/kWh	\$0.024
\$/kW	\$160.29

## 3.5 Business Refrigeration

The Business Refrigeration Incentive (BRI) Program provides small business owners and tenants of commercial, institutional, agricultural facilities, and multifamily buildings who are not residential distribution customers the opportunity to receive up to \$2,500 in free refrigeration equipment upgrades.

### 3.5.1 Business Refrigeration Impact Results

Table 3-9 shows the province-wide results of the 2018 BRI impact evaluation.

Table 3-9: 2018 BRI Program Impact Results

Measurement	Project Count	Reported Savings	Realization Rate	Gross Adjusted Savings	Net-to-Gross Ratio	Net Savings	Lifetime Net Savings	Net Savings at 2020
Energy (GWh)	2,980	18.3	67.0%	12.3	98.0%	12.0	147.5	12.0
Summer Peak Demand (MW)		2.2	63.0%	1.4	67.0%	0.9	10.9	0.9

### 3.5.2 Business Refrigeration Cost Effectiveness

Cost effectiveness (CE) for the 2018 BRI achieved a TRC ratio of 1.36 and PAC ratio of 1.19 (Table 3-10). Each of these tests exceeded the set threshold of 1.00 to determine if a program is cost effective.

Table 3-10: 2018 BRI Program Cost Effectiveness Results

Cost Effectiveness Test	Value
<b>Total Resource Cost (TRC)</b>	
TRC Costs (\$)	\$8,347,413
TRC Benefits (\$)	\$5,561,372
TRC Net Benefits (\$)	\$2,786,042
TRC Net Benefit (Ratio)	1.50
<b>Program Administrator Cost (PAC)</b>	
PAC Costs (\$)	\$7,258,620
PAC Benefits (\$)	\$5,509,178
PAC Net Benefits (\$)	\$1,749,443
PAC Net Benefit (Ratio)	1.32
<b>Levelized Unit Energy Cost (LUEC)</b>	
\$/kWh	\$0.046
\$/kW	\$293.46

## 3.6 Audit Funding

The Audit Funding Program provides funding of up to half of the cost of certain energy audits that are undertaken to identify opportunities to reduce electricity consumption at industrial, commercial, institutional, and multi-family residential buildings; this program also acts as a feeder for the Retrofit Program.

### 3.6.1 Audit Funding Impact Results

Table 3-11 shows the province-wide results of the 2018 Audit Funding Program impact evaluation.

Table 3-11: 2018 Audit Funding Program Impact Results

Measurement	Project Count	Reported Savings	Realization Rate	Gross Adjusted Savings	Net-to-Gross Ratio	Net Savings	Lifetime Net Savings	Net Savings at 2020
Energy (GWh)	374	18.9	100.0%	18.9	90.0%	17.0	168.0	17.0
Summer Peak Demand (MW)		1.1	100.0%	1.1	87.0%	0.9	9.4	0.9

### 3.6.2 Audit Funding Cost Effectiveness

Cost effectiveness (CE) for the 2018 Audit Funding Program achieved a TRC ratio of 1.36 and PAC ratio of 1.19 (Table 3-2). Each of these tests exceeded the set threshold of 1.00 to determine if a program is cost effective.

Table 3-12: 2018 Audit Funding Program Cost Effectiveness Results

Cost Effectiveness Test	Value
<b>Total Resource Cost (TRC)</b>	
TRC Costs (\$)	\$9,126,784
TRC Benefits (\$)	\$6,110,572
TRC Net Benefits (\$)	\$3,016,212
TRC Net Benefit (Ratio)	1.49
<b>Program Administrator Cost (PAC)</b>	
PAC Costs (\$)	\$7,936,334
PAC Benefits (\$)	\$2,255,828
PAC Net Benefits (\$)	\$5,680,506
PAC Net Benefit (Ratio)	3.52
<b>Levelized Unit Energy Cost (LUEC)</b>	
\$/kWh	\$0.016
\$/kW	\$60.11

## 3.7 Existing Building Commissioning

The Existing Building Commissioning (EBCx) Program provides funding for projects comprised of commissioning phases and the installation of measures to reduce electricity consumption associated with chilled water systems in existing industrial, commercial, institutional, and multifamily residential buildings.

### 3.7.1 Existing Building Commissioning Impact Results

Table 3-13 shows the province-wide results of the 2018 EBCx impact evaluation.

Table 3-13: 2018 EBCx Program Impact Results

Measurement	Project Count	Reported Savings	Realization Rate	Gross Adjusted Savings	Net-to-Gross Ratio	Net Savings	Lifetime Net Savings	Net Savings at 2020
Energy (MWh)	1	97.2	100.0%	97.2	78.0%	75.9	379.2	75.9
Summer Peak Demand (kW)		35.3	117.0%	41.3	100.0%	41.3	206.5	41.3

### 3.7.2 Existing Building Commissioning Cost Effectiveness

Cost effectiveness (CE) for the 2018 EBCx achieved a TRC ratio of 0.20 and PAC ratio of 0.17 which reflect negative TRC and PAC net benefit for this program (Table 3-14). Neither the TRC nor PAC test exceeded the set threshold of 1.00 to determine if a program is cost effective.

Table 3-14: 2018 EBCx Program Cost Effectiveness Results

Cost Effectiveness Test	Value
<b>Total Resource Cost (TRC)</b>	
TRC Costs (\$)	\$55,895
TRC Benefits (\$)	\$221,981
TRC Net Benefits (\$)	(\$166,086)
TRC Net Benefit (Ratio)	0.25
<b>Program Administrator Cost (PAC)</b>	
PAC Costs (\$)	\$48,604
PAC Benefits (\$)	\$236,768
PAC Net Benefits (\$)	(\$188,164)
PAC Net Benefit (Ratio)	0.21
<b>Levelized Unit Energy Cost (LUEC)</b>	
\$/kWh	\$0.721
\$/kW	\$1,323.55

## 3.8 PUMPSaver

The PUMPSaver local program delivered by Toronto Hydro Electric System Ltd (THESL) was created to save electricity consumption through improving the efficiency of cooling and heating distribution systems. Specifically, the program's objective is to re-engineer and re-balance inefficient closed loop heating and cooling distribution systems, typically found in mid to high-rise buildings, with the application of variable frequency drives (VFDs). Typically, valves are used to restrict the flow of liquid which creates back-pressure on the motor and increases energy consumption. With a variable frequency drive valves can be

opened and systems can be configured to move liquid at the desired rate of flow, reducing work required of the motor.

### 3.8.1 PUMPSaver Impact Results

Table 3-15 shows the results of the 2018 PUMPSaver Program impact evaluation.

**Table 3-15: 2018 PUMPSaver Program Impact Results**

Measurement	Project Count	Reported Savings	Realization Rate	Gross Adjusted Savings	Net-to-Gross Ratio	Net Savings	Lifetime Net Savings	Net Savings at 2020
Energy (GWh)	12	6.3	114.0%	7.2	101.0%	7.3	109.6	7.3
Summer Peak Demand (MW)		0.8	102.0%	0.8	114.0%	0.9	13.6	0.9

### 3.8.2 PUMPSaver Cost Effectiveness

Cost effectiveness (CE) for the 2018 PUMPSaver Program achieved a TRC ratio of 4.01 and PAC ratio of 3.50 (Table 3-16). Each of these tests exceeded the set threshold of 1.00 to determine if a program is cost effective.

**Table 3-16: 2018 PUMPSaver Program Cost Effectiveness Results**

Cost Effectiveness Test	Value
<b>Total Resource Cost (TRC)</b>	
TRC Costs (\$)	\$6,316,015
TRC Benefits (\$)	\$1,508,625
TRC Net Benefits (\$)	\$4,807,391
TRC Net Benefit (Ratio)	4.19
<b>Program Administrator Cost (PAC)</b>	
PAC Costs (\$)	\$5,492,187
PAC Benefits (\$)	\$1,503,133
PAC Net Benefits (\$)	\$3,989,054
PAC Net Benefit (Ratio)	3.65
<b>Levelized Unit Energy Cost (LUEC)</b>	
\$/kWh	\$0.021
\$/kW	\$83.45

## 3.9 RTUsaver

The RTUsaver local program delivered by Toronto Hydro helps non-residential customers to reduce the use of their packaged HVAC units through providing or incentivizing smart thermostats, occupancy sensor controls, and demand controlled ventilation (CO<sub>2</sub> sensors and fan controller).

The program includes an initial assessment of the HVAC equipment and provides the customer with a choice of controls. This initial assessment is also used to identify any repairs needed, which must be completed by the customer prior to receiving the offered measures.

### 3.9.1 RTUsaver Impact Results

Table 3-17 shows the results of the 2018 RTUsaver Program impact evaluation.

**Table 3-17: 2018 RTUsaver Program Impact Results**

Measurement	Project Count	Reported Savings	Realization Rate	Gross Adjusted Savings	Net-to-Gross Ratio	Net Savings	Lifetime Net Savings	Net Savings at 2020
Energy (GWh)	432	3.7	103.0%	3.8	71.0%	2.7	27.2	2.7
Summer Peak Demand (MW)		0.8	148.0%	1.2	103.0%	1.2	12.3	1.2

### 3.9.2 RTUsaver Cost Effectiveness

Cost effectiveness (CE) for the 2018 RTUsaver Program achieved a TRC ratio of 4.59 and PAC ratio of 3.36 (Table 3-18). Each of these tests exceeded the set threshold of 1.00 to determine if a program is cost effective.

**Table 3-18: 2018 RTUsaver Cost Effectiveness Results**

Cost Effectiveness Test	Value
<b>Total Resource Cost (TRC)</b>	
TRC Costs (\$)	\$3,254,911
TRC Benefits (\$)	\$641,282
TRC Net Benefits (\$)	\$2,613,628
TRC Net Benefit (Ratio)	5.08
<b>Program Administrator Cost (PAC)</b>	
PAC Costs (\$)	\$2,830,357
PAC Benefits (\$)	\$773,270
PAC Net Benefits (\$)	\$2,057,087
PAC Net Benefit (Ratio)	3.66

Cost Effectiveness Test	Value
<b>Levelized Unit Energy Cost (LUEC)</b>	
\$/kWh	\$0.038
\$/kW	\$287.42

## 3.10 OPSaver

OPSaver is a 'Continuous Energy Improvement' (CEI) program that provided Toronto Hydro's medium to large sized commercial, institutional, and industrial customers with the opportunity to work with energy experts who guide them towards continuous building operations improvements. OPSaver motivates organizations to achieve and maintain operational maintenance and behaviour energy savings.

Through year-over-year engagement, the program provides 'coaching' for building operators and employees to encourage energy conservation activities with the intention that these practices persist over time. Participants work with the OPSaver Consultants to identify, implement and evaluate operational and behavioural energy efficiency measures and establish continuous energy improvement processes to ensure the energy savings are realized over the long-term.

### 3.10.1 OPSaver Impact Results

Table 3-19 shows the results of the 2018 OPSaver Program impact evaluation.

**Table 3-19: 2018 OPSaver Program Impact**

Measurement	Project Count	Reported Savings	Realization Rate	Gross Adjusted Savings	Net-to-Gross Ratio	Net Savings	Lifetime Net Savings	Net Savings at 2020
Energy (MWh)	1	239.8	104.0%	249.3	100.0%	249.3	2,721.8	249.3
Summer Peak Demand (kW)		0.0	100%	0.0	100%	0.0	0.0	0.0

### 3.10.2 OPSaver Program Cost Effectiveness

Cost effectiveness (CE) for the 2018 OPSaver Program achieved a TRC ratio of 0.31 and PAC ratio of 0.18 (Table 3-20). Neither the TRC nor PAC test exceeded the set threshold of 1.00 to determine if a program is cost effective.

**Table 3-20: 2018 OPSaver Program Cost Effectiveness Results**

Cost Effectiveness Test	Value
<b>Total Resource Cost (TRC)</b>	
TRC Costs (\$)	\$117,499
TRC Benefits (\$)	\$324,656
TRC Net Benefits (\$)	(\$207,157)

Cost Effectiveness Test	Value
TRC Net Benefit (Ratio)	0.36
<b>Program Administrator Cost (PAC)</b>	
PAC Costs (\$)	\$102,173
PAC Benefits (\$)	\$522,540
PAC Net Benefits (\$)	(\$420,367)
PAC Net Benefit (Ratio)	0.20
<b>Levelized Unit Energy Cost (LUEC)</b>	
\$/kWh	\$0.237
\$/kW	n/a

## 3.11 High Efficiency Agricultural Pumping Program

The High Efficiency Agricultural Pumping (HEAP) program is a regional program covering the service territories of Hydro One Network Inc. (HONI) and Niagara Peninsula Energy Inc. (NPEI). The program involves the delivery of incentives for high efficiency pump measures sold by pump distributors or wholesalers; and education targeting contractors and end users through the same pump system distributors. HEAP included only Integrated High Performance Pumping Systems (IHPPS or "smart pumps") between 0.5 horsepower (hp) and 10 hp.

### 3.11.1 High Efficiency Agricultural Pumping Impact Results

Table 3-21 shows the results of the 2018 HEAP Program impact evaluation.

**Table 3-21: 2018 HEAP Program Impact Results**

Measurement	Project Count	Reported Savings	Realization Rate	Gross Adjusted Savings	Net-to-Gross Ratio	Net Savings	Lifetime Net Savings	Net Savings at 2020
Energy (MWh)	12	27.2	100.0%	27.2	100.0%	27.2	408.3	27.2
Summer Peak Demand (kW)		9.1	100.0%	9.1	100.0%	9.1	136.2	9.1

### 3.11.2 High Efficiency Agricultural Pumping Cost Effectiveness

Cost effectiveness (CE) for the 2018 HEAP Program achieved a TRC ratio of 0.03 and PAC ratio of 0.02 (Table 3-22). Neither the TRC nor PAC test exceeded the set threshold of 1.00 to determine if a program is cost effective.

**Table 3-22: 2018 HEAP Cost Effectiveness Results**

Cost Effectiveness Test	Value
<b>Total Resource Cost (TRC)</b>	



Cost Effectiveness Test	Value
TRC Costs (\$)	\$36,490
TRC Benefits (\$)	\$1,195,673
TRC Net Benefits (\$)	(\$1,159,182)
TRC Net Benefit (Ratio)	0.03
<b>Program Administrator Cost (PAC)</b>	
PAC Costs (\$)	\$31,731
PAC Benefits (\$)	\$1,136,400
PAC Net Benefits (\$)	(\$1,104,669)
PAC Net Benefit (Ratio)	0.03
<b>Levelized Unit Energy Cost (LUEC)</b>	
\$/kWh	\$4.194
\$/kW	\$12,570.98

## Appendix A Business Program Impact Results

Table 3-23: Business Program Energy Savings

Program	Project Count	Reported Energy Savings (GWh)	Realization Rate	Gross Adjusted Energy Savings (GWh)	Net-to-Gross Ratio	Net Energy Savings (GWh)	Lifetime Net Energy Savings (GWh)	Net Energy Savings at 2020 (GWh)
Retrofit FCR	8,102	505.2	98.4%	497.1	81.6%	405.6	4,896.2	404.1
Retrofit P4P	749	52.9	108.6%	57.4	75.9%	43.6	555.8	43.6
Small Business Lighting	7,233	55.7	79.2%	44.1	91.6%	40.4	304.9	32.9
High Performance New Construction	124	33.3	108.0%	36.0	58.0%	20.9	438.3	20.9
Audit Funding	374	18.9	100.0%	18.9	90.0%	17.0	168.0	17.0
Business Refrigeration	2,980	18.3	67.0%	12.3	98.0%	12.0	147.5	12.0
PUMPSaver	12	6.3	114.0%	7.2	101.0%	7.3	109.6	7.3
RTUsaver	432	3.7	103.0%	3.8	71.0%	2.7	27.2	2.7
OPsaver	1	0.2	104.0%	0.2	100.0%	0.2	2.7	0.2
Existing Building Commissioning	1	0.1	100.0%	0.1	78.0%	0.1	0.4	0.1
High Efficiency Agricultural Pumping	12	0.03	100.0%	0.03	100.0%	0.03	0.4	0.03

<sup>1</sup>Table values may not sum to Full Portfolio values due to rounding errors

Table 3-24: Business Program Summer Peak Demand Savings

Program	Reported Demand Savings (MW)	Realization Rate	Gross Adjusted Demand Savings (MW)	Net-to-Gross Ratio	Net Demand Savings (MW)	Lifetime Net Demand Savings (MW)	Net Energy Demand at 2020 (MW)
Retrofit FCR	69.9	93.4%	65.3	84.0%	54.8	671.4	55.0
Retrofit P4P	8.6	107.2%	9.2	76.2%	7.0	91.6	7.0
Small Business Lighting	13.8	62.4%	8.6	90.2%	7.8	63.4	6.3
High Performance New Construction	7.2	104.0%	7.5	108.0%	8.1	174.7	8.1
Audit Funding	1.1	100.0%	1.1	87.0%	0.9	9.4	0.9
Business Refrigeration	2.2	63.0%	1.4	67.0%	0.9	10.9	0.9
PUMPSaver	0.8	102.0%	0.8	114.0%	0.9	13.6	0.9
RTUsaver	0.8	148.0%	1.2	103.0%	1.2	12.3	1.2
OPsaver	0.0	0.0%	0.0	0.0%	0.0	0.0	0.0
Existing Building Commissioning	0.04	117.0%	0.04	100.0%	0.04	0.21	0.04
High Efficiency Agricultural Pumping	0.01	100.0%	0.01	100.0%	0.01	0.14	0.01

<sup>1</sup>Table values may not sum to Full Portfolio values due to rounding errors

## Appendix B Business Program Cost Effectiveness Results

Table 3-25: Business Program Total Resource Cost (TRC) Effectiveness

Program	TRC Benefits	TRC Costs	TRC Net Benefits	TRC Ratio
Retrofit FCR	\$280,709,868	\$247,102,982	\$33,606,886	1.14
Retrofit P4P	\$35,920,160	\$18,725,361	\$17,194,799	1.92
Small Business Lighting	\$20,026,402	\$14,001,621	\$6,024,781	1.43
High Performance New Construction	\$41,258,675	\$61,547,864	(\$20,289,189)	0.67
Audit Funding	\$9,126,784	\$6,110,572	\$3,016,212	1.49
Business Refrigeration	\$8,347,413	\$5,561,372	\$2,786,042	1.50
PUMPSaver	\$6,316,015	\$1,508,625	\$4,807,391	4.19
RTUsaver	\$3,254,911	\$641,282	\$2,613,628	5.08
OPsaver	\$117,499	\$324,656	(\$207,157)	0.36
Existing Building Commissioning	\$55,895	\$221,981	(\$166,086)	0.25
High Efficiency Agricultural Pumping	\$36,490	\$1,195,673	(\$1,159,182)	0.03

**Table 3-26: Business Program Program Administrator (PAC) Cost Effectiveness**

Program	PAC Benefits	PAC Costs	PAC Net Benefits	PAC Ratio
Retrofit FCR	\$261,175,579	\$77,202,549	\$183,973,030	3.38
Retrofit P4P	\$33,554,652	\$10,269,423	\$23,285,229	3.27
Small Business Lighting	\$19,812,150	\$13,640,191	\$6,171,959	1.45
High Performance New Construction	\$35,877,108	\$6,807,166	\$29,069,943	5.27
Audit Funding	\$7,936,334	\$2,255,828	\$5,680,506	3.52
Business Refrigeration	\$7,258,620	\$5,509,178	\$1,749,443	1.32
PUMPSaver	\$5,492,187	\$1,503,133	\$3,989,054	3.65
RTUsaver	\$2,830,357	\$773,270	\$2,057,087	3.66
OPsaver	\$102,173	\$522,540	(\$420,367)	0.20
Existing Building Commissioning	\$48,604	\$236,768	(\$188,164)	0.21
High Efficiency Agricultural Pumping	\$31,731	\$1,136,400	(\$1,104,669)	0.03

**Table 3-27: Business Program Levelized Unit Energy Cost (LUEC)**

Program	\$/kWh	\$/kW
Retrofit FCR	\$0.022	\$166.62
Retrofit P4P	\$0.024	\$144.49
Small Business Lighting	\$0.061	\$622.03
High Performance New Construction	\$0.024	\$160.29
Audit Funding	\$0.016	\$60.11
Business Refrigeration	\$0.046	\$293.46
PUMPSaver	\$0.021	\$83.45
RTUsaver	\$0.038	\$287.42
OPsaver	\$0.237	n/a
Existing Building Commissioning	\$0.721	\$1,323.55
High Efficiency Agricultural Pumping	\$4.194	\$12,570.98



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