Interim Framework Retrofit PY2022 Evaluation Results

Submitted to IESO

in partnership with NMR Group

Date: 09.14.2023

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Acknowledgements

The evaluation team would like to thank Alice Herrera, Cass Heide, and Gavin Zheng at the Independent Electricity System Operator (IESO) for their assistance in coordinating this evaluation effort. With their support and guidance, the evaluation team was able to complete their activities as efficiently and successfully as possible.

Additionally, the evaluation team would like to thank the hundreds of participants that supported the evaluation team's impact telephone and web-based surveys, and site visits. Their cooperation with the evaluation team's efforts has produced high quality data that will serve Ontario conservation efforts for years to come.

Acronyms and Abbreviations

CDM	Conservation and Demand Management
DCKV	Demand control kitchen ventilation
EM&V	Evaluation, measurement, and verification
EUL	Effective useful life
FR	Free-ridership
GW or GWh	Measurement of demand (GW) or energy (GWh) equivalent to 1,000,000,000 W or Whr
HVAC	Heating, ventilation, and air conditioning
IDI	In-depth interview
IESO	Independent Electricity System Operator
IF	Interim Framework
kW or kWh	Measurement of demand (kW) or energy (kWh) equivalent to 1,000 W or Whr
LED	Light emitting diode
MW or MWh	Measurement of demand (MW) or energy (MWh) equivalent to 1,000,000 W or Whr
NTG	Net-to-gross
PY	Program year
SO	Spillover
VFD	Variable frequency drive

1. Executive Summary

The Independent Electricity System Operator (IESO) retained Resource Innovations (formerly Nexant Inc.) and their sub-contractor, NMR Group, Inc., to conduct an impact evaluation of the Interim Framework (IF) Retrofit Program. The IF program operated from 2019 through 2022 to offer energy-efficiency incentives and rebates to Ontario electricity customers through a suite of Save on Energy programs. Commercial, industrial, and residential market segments, as well as indigenous and low-income communities, have all been served through the IF programs. This Executive Summary provides an overview of the impact evaluation results for the IF Retrofit Program during the January 1 through December 31, 2022, evaluation period.

1.1. Program Description

The Retrofit Program enables owners and operators of industrial, commercial, institutional, and multi-family residential buildings to install and benefit from newer, more energy-efficient solutions. Such solutions allow owners and operators to reduce their energy consumption, operate their businesses more efficiently, and improve their bottom line. The IF Retrofit program offers a variety of prescriptive energy-efficient measures. The program also features a custom track that offers customers the flexibility to incorporate measures not covered by the prescriptive track and suggest modifications that best suit their facility's needs.

1.2. Evaluation Objectives

The following are goals and objectives of the PY2022 evaluation of the IF Retrofit Program:

- Conduct audits of completed projects to evaluate, measure and verify completion and operating parameters through desk reviews, and on-site inspections and metering.
- Annually verify gross and net energy and summer peak demand savings at the delivery zone-level for the IF Retrofit program at a 90% confidence level and 10% precision.
- Perform a cost-effectiveness assessment, greenhouse gas reduction estimate and job impact quantification.

1.3. Summary of Results

An impact evaluation was performed to analyze the impact of the program's improvements and quantify the savings realized as an outcome of implementing energy efficiency measures under the IF Retrofit program in the province of Ontario during PY2022. During the evaluation period, 1,173 evaluation projects were completed across Ontario. The net verified impact results of the PY2022 Retrofit Program are presented in Table 1-1. The net verified energy and summer peak demand savings were 240,771 MWh and 22.3 MW, respectively.

Table 1-1: Impact Results

Region	Gross Reported Savings	Realization Rate	Gross Verified Savings	Net-to-Gross Ratio	Net Verified Savings	Net Verified Savings at 2022
Energy (MWh)	266,765	100.5%	268,171	89.8%	240,771	240,771
Summer Peak Demand (MW)	27.0	90.6%	24.5	91.2%	22.3	22.3

The PY2022 IF Retrofit program achieved a Program Administrator Cost (PAC) ratio of 4.55, exceeding the 1.00 target threshold. The PY2022 IF Retrofit program CE results is consistent with the PY2021 IF Retrofit program which achieved a PAC ratio of 4.03. Additional detail can be found in Section 0. First-year avoided GHG emissions from electricity savings in PY2022 were reduced by the increase in GHG consumption due to the gas-heating penalty, resulting in 25,576.75 Tonnes of CO2 reduced in the first year. The PY2022 IF Retrofit program projects are expected to achieve a total of 437,125 Tonnes of avoided GHG throughout the EUL of the installed measures. Additional detail can be found in the Appendix.

Table 1-2. Cost Effectiveness Results

Program Administrator Cost (PAC)	PY2022 Results
PAC Costs ($)	$26,994,401
PAC Benefits ($)	$122,837,292
PAC Net Benefits ($)	$95,842,892
PAC Net Benefit (Ratio)	4.55
Levelized Unit Energy Cost (LUEC)	**PY2022 Results**
$/kWh	$0.01
$/kW	$133.31

2. Introduction

This report summarizes the evaluation results of the Retrofit Program and includes projects that were completed and reported to the IESO during PY2022. During the IF, the Retrofit Program was divided into four regions (Toronto, Greater Toronto Area (GTA), South-West, and North-East) served by three unique vendors. During the evaluation period, impact evaluations, net-to-gross analyses, and participant surveys were completed for all regions. This report provides an annual summary of the results from these four independent evaluations.

2.1. Program Description

The Retrofit program offers incentives to industrial, commercial, institutional, and multi-family residential facilities interested in upgrading existing equipment with energy-efficient alternatives. The IF Retrofit Program Requirements, found on the Save on Energy website, provides criteria for eligible participants, facilities, and projects. The program offered two application streams, as outlined below:

> **Prescriptive Track** applications offer a program-defined list of approved equipment and fixed incentives available for installation. This track encourages lighting and non-lighting building improvements. Limited documentation is required for this track to ensure a simplified experience for program participants.
>
> **Custom Track** applicants are provided with the flexibility to propose upgrades that best meet their facility's needs. Incentives are estimated from the project's energy or summer peak demand savings, with incentives of $0.05/kWh or $400/kW for lighting measures or $0.10/kWh or $800/kW for non-lighting measures and capped at 50% of project costs. This track provides an opportunity to install equipment that is unavailable in the prescriptive track and allows the implementation of measures outside the scope of the pre-approved equipment list.

2.2. Evaluation Objectives

The following are the goals and objectives of the PY2022 evaluation of the Retrofit Program:

- Conduct audits of completed projects to evaluate, measure and verify completion and operating parameters through desk reviews, and on-site inspections and metering.
- Annually verify gross energy and summer peak demand savings at the delivery zone-level for the IF Retrofit program at a 90% confidence level and 10% precision.
- Assess free-ridership and participant spillover to determine an appropriate net-to-gross (NTG) ratio.

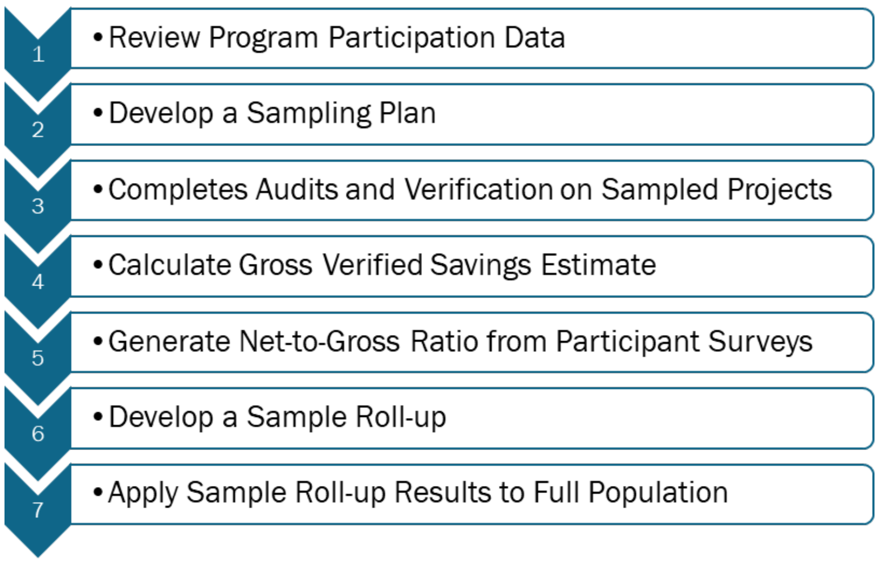
- Perform a cost-effectiveness assessment, greenhouse gas reduction estimate and job impact quantification.
- Deliver annual reports, memos, impact results template, and a final report that meets the IESO's requirements and timelines.

3. Methodology

3.1. Impact Evaluation Methodology

The impact evaluation methodology, comprised of distinct components, is presented in Figure 3-1 Additional detail can be found in Appendix A.

Figure 3-1:Impact Evaluation Methodology



3.2. Net-to-Gross Evaluation Methodology

The NTG evaluation assessed free-ridership and spillover through surveys with program participants. A customized survey instrument was developed to ensure the responses produced comparable data and allowed for the inference of meaningful conclusions. Table 3-1 presents the survey methodology, the total population invited to participate in the surveys, the total number of completed surveys, the response rate, and the sampling error at the 90% confidence level. Additional detail regarding the NTG evaluation methodology can be found in Appendix B.

Table 3-1: NTG Evaluation Primary Data Sources

Respondent Type	Methodology	Population	Completed	Response Rate	90% CI Error Margin
Participants	Web and Phone Survey	793	126	16%	6.7%

4. Impact Evaluation

An impact evaluation was performed to assess energy and summer peak demand savings attributable to the program and quantify savings generated as a result of implementing energy efficiency projects in the province of Ontario during PY2022. The impact evaluation section presents the combined results from the evaluation cycle across the full province of Ontario.

4.1. Project Participation and Sampling

Program participant is defined as an individual or company who completed a project through the Retrofit Program during the evaluation period. The evaluation sample for PY2022 was drawn from the list of post-approved and paid projects between January 1st and December 31st, 2022. The impact evaluation reviewed a total of 1,389 evaluation projects (672 prescriptive and 717 custom) as part of the PY2022 IF Retrofit program. This project count exceeds the total number of unique applications approved through the program during this evaluation period due to the evaluator's choice to stratify projects by track to increase the accuracy of the evaluation results. This may result in application IDs that include measures from both prescriptive and custom tracks that are split into distinct evaluation projects to adhere to the evaluation design.

The previous evaluation cycle (PY2021) followed a rolling sample approach while PY2022 does not use a rolling sample. A total of 232 random sample projects were selected between the Lighting, and Non-lighting tracks in the province of Ontario, as shown in Table 4-1. The number of projects selected in the Ontario province targeted results that achieved a 90% confidence level at a 10% precision level, assuming a coefficient of variation of 0.5. The evaluation team exceeded the intended sample size to achieve a 90% confidence level at a 10% precision level.

Table 4-1: PY2022 Project and Sample counts*

Track/Type	PY2022 Target Sample	PY2022 Achieved Sample	Project Count
Prescriptive Lighting	47	85	614
Prescriptive Non-lighting	5	11	58
Custom Lighting	89	79	456
Custom Non-lighting	91	72	261
Total	**232**	**247**	**1,389**

***PY2022 Sampling process includes 2021-2024 CDM Framework IF carry over projects**

4.2. Impact Evaluation Results and Findings

The energy and summer peak demand sample realization rates for the PY2022 IF Retrofit program are presented in Table 4-2. Interactive effects[1] have been considered for applicable lighting measures.

Table 4-2: PY2022 Samples Realization Rates

Measurement	Realization Rate
Energy	100.5%
Summer Peak Demand	90.6%

During PY2022, the IF Retrofit program generated 240,771 MWh first-year net verified energy savings and 22.3 MW net verified summer peak demand savings. These savings are consistent with PY2020 results however, during PY2021, the program had the highest amount of savings at 360,885 MWh of first-year net verified energy savings and 52.6 MW net verified summer peak demand savings. All energy and summer peak demand savings discussions in this report are in reference to the first-year net verified energy savings or the first-year net verified peak demand savings unless otherwise noted. PY2019 through PY2022 IF Retrofit net impact results, including the PY2019 true-up projects, are provided in Table 4-3 for comparison.

Table 4-3: 2019-2022 IF Retrofit Net Results Comparison

Measurement	Metric	2019	2020	2021	2022
Project Count		966	3,157	4,421	1,389
Energy	Gross Reported Savings (MWh)	46,683	210,152	439,096	266,765
	Realization Rate	118.5%	107.9%	104.8%	100.5%
	Gross Verified Savings (MWh)	55,297	226,727	460,168	268,171
	Net-to-gross Ratio	91.6%	75.7%	78.4%	89.8%
	Net Verified Savings (MWh)	**50,652**	**171,680**	**360,856**	**240,771**
Summer Peak Demand	Gross Reported Savings (kW)	7,631	35,575	63,377	27,027
	Realization Rate	133.9%	111.0%	105.7%	90.6%
	Gross Verified Savings (kW)	10,223	39,492	66,982	24,490
	Net-to-gross Ratio	99.1%	75.4%	78.6%	91.2%
	Net Verified Savings (kW)	**10,131**	**29,791**	**52,667**	**22,325**

[1] The effective realization rates for lighting projects include the influence of HVAC interactive effects as calculated in the evaluation sample.

Table 4-4 and Table 4-5 present the province-wide track-level results of the PY2022 IF Retrofit program impact evaluation. Interactive effects have been considered for applicable lighting measures.

Table 4-4: PY2022 IF Retrofit Energy Impacts

Track	Measure Type	Reported Energy Savings (MWh)	Realization Rate	Gross Verified Energy Savings (MWh)	Net-to-Gross Ratio	Net Verified Energy Savings (MWh)	Net Verified Energy Savings at 2022 (MWh)
Prescriptive	Lighting	29,823.5	100.8%	30,074.0	89.9%	26,915.5	26,915.5
Prescriptive	Non-Lighting	1,244.9	99.6%	1,240.1	89.9%	1,120.7	1,120.7
Custom	Lighting	84,191.5	99.0%	83,381.5	89.9%	76,414.8	76,414.8
Custom	Non-Lighting	151,505.1	101.3%	153,475.8	89.9%	136,320.5	136,320.5
Total		**266,765.0**	**100.5%**	**268,171.5**	**89.9%**	**240,771.4**	**240,771.4**

Table 4-5: PY2022 IF Retrofit Summer Peak Demand Impacts

Track	Measure Type	Reported Summer Peak Demand Savings (MW)	Realization Rate	Gross Verified Summer Peak Demand Savings (MW)	Net-to-Gross Ratio	Net Verified Summer Peak Demand Savings (MW)	Net Verified Summer Peak Demand Savings at 2022 (MW)
Prescriptive	Lighting	4.7	93.5%	4.4	91.2%	4.0	4.0
Prescriptive	Non-Lighting	0.3	87.1%	0.3	91.2%	0.2	0.2
Custom	Lighting	11.9	94.2%	11.2	91.2%	10.5	10.5
Custom	Non-Lighting	10.1	85.2%	8.6	91.2%	7.7	7.7
Total		**27.0**	**90.6%**	**24.5**	**91.2%**	**22.3**	**22.3**

The prescriptive track accounted for 48.4% of all projects in the PY2022 population and, 11.6% of the first-year net verified energy savings. The custom track contained a higher portion of program projects (51.6%) and represented 88.4% of the first-year net verified energy savings. The average net verified energy savings per project within the custom track (296.7 MWh) is close to seven times that of the prescriptive track (41.7 MWh). A similar trend is exhibited for the average net verified summer peak demand savings per project under the custom track (25.2 kW), which is four times larger than that of the prescriptive track (6.2 kW). Additional detail is provided in the remainder of this section.

The PY2022 IF Retrofit program is expected to achieve 3,292.2 GWh of lifetime net verified savings based on the installed measures and their respective effective useful lives (EULs). The lifetime savings of the Retrofit program depend mainly on the EULs of the implemented measures, which describe how long the savings associated with the measure will persist. Equipment installed as part of the Retrofit program must be operated and maintained for a minimum continuous period of four years. Therefore, savings claimed in the first year will persist annually and be attributable to the program until the equipment's EUL is depleted. As measures reach their EUL, the incremental savings claimed by the Retrofit program in the province of Ontario will progressively decrease. Figure 4-1 illustrates the annual net verified energy savings of the 2022 Retrofit program over time.

Figure 4-1: 2022 Retrofit Net Verified Savings Over Time

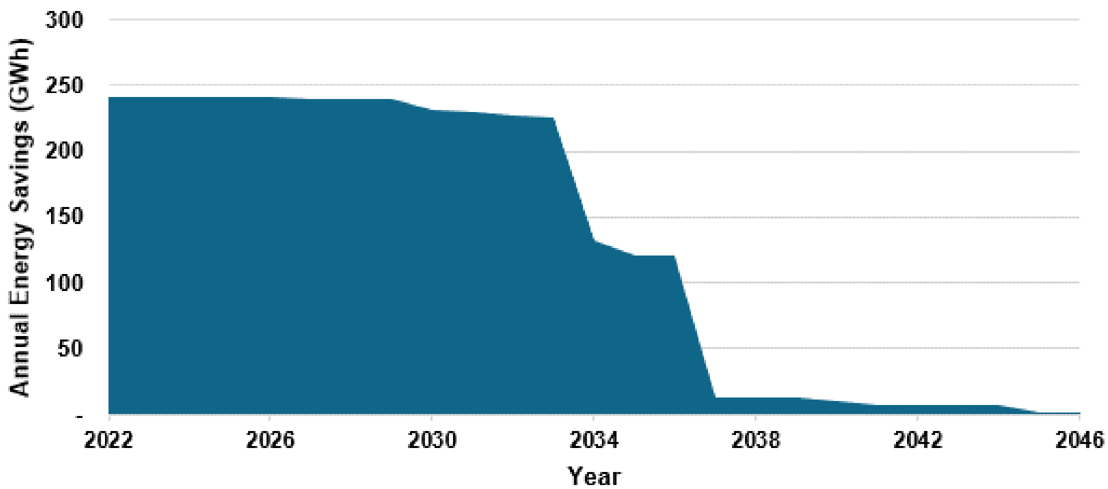


Figure 4-2 and Figure 4-3 present the distribution of the first-year net verified energy and summer peak demand savings by building type during PY2022 across the province of Ontario. Industrial/Manufacturing and commercial other account for the majority (81%) of the first-year net verified energy and (76%) of summer peak demand savings. This is higher than their PY2021 contributions where the same sectors accounted for only 34% of the first-year net verified energy and summer peak demand savings. Industrial/Manufacturing, retail facilities, and government and public facilities accounted for the majority (54%) of the first-year net verified energy and (53%) of the summer peak demand savings during PY2021.

Figure 4-2: PY2022 First-Year Net Energy Savings by Building Type

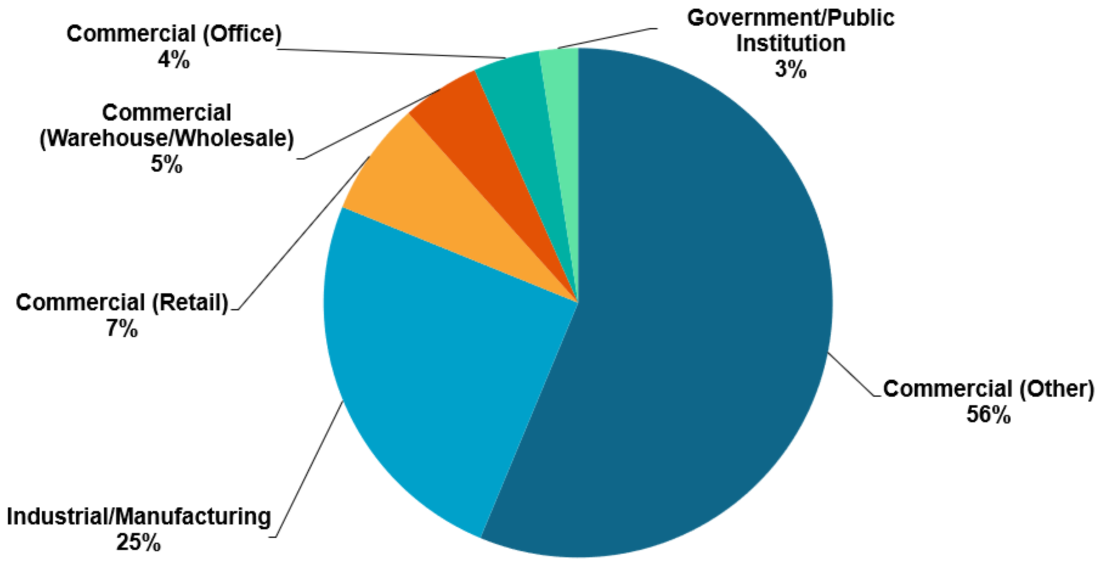


Figure 4-3: PY2022 First-Year Net Summer Peak Demand Savings by Building Type

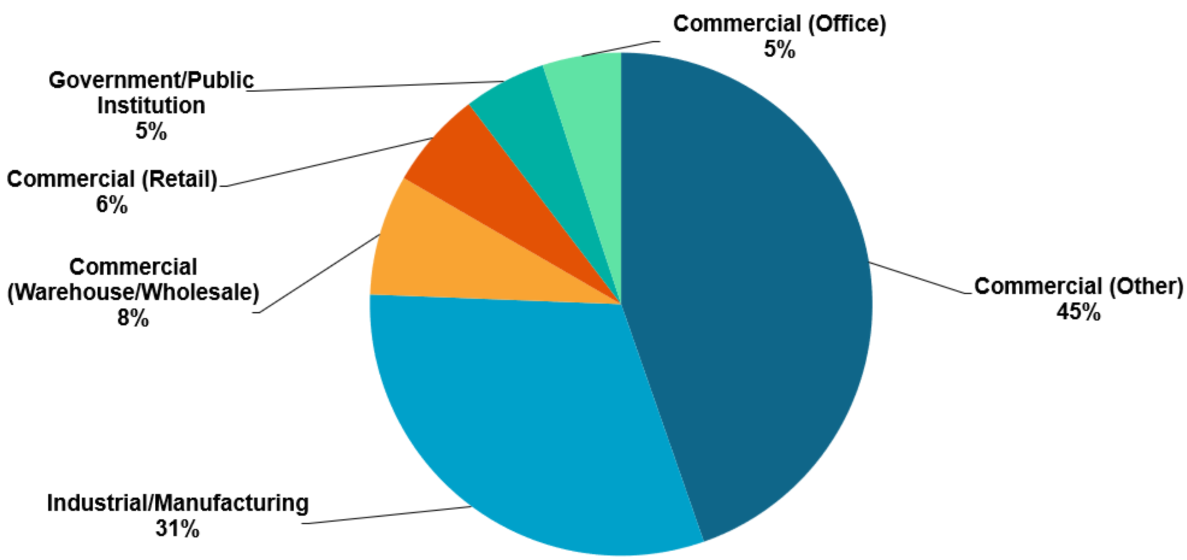


Figure 4-4 and Figure 4-5 depict the first-year net verified energy and summer peak demand savings distribution across program tracks and measure types (lighting/non-lighting) for the PY2022 IF Retrofit program across the province. Non-lighting projects generated the majority of the program's net verified savings, accounting for 57% of the total first-year net verified energy savings but only 35% of the first-year net verified summer peak demand savings. Most of the non-lighting projects' net verified savings are derived from the custom track, accounting for 99% and 97% of the total non-lighting first-year net verified energy and summer peak demand savings, respectively. Lighting projects generated a lower portion of the program's net verified savings, accounting for 43% of the total first-year net verified energy savings but accounted for 65% of the first-year net verified summer peak demand savings. During PY2021 lighting measures contributed to 68% and 78% of the first-year net verified energy and summer peak demand savings, respectively. Non-Lighting measures contributed to 32% and 22% of the first-year net verified energy and summer peak demand savings during PY2021, respectively.

Figure 4-4: 2022 Net verified Energy Savings by Track and Technology

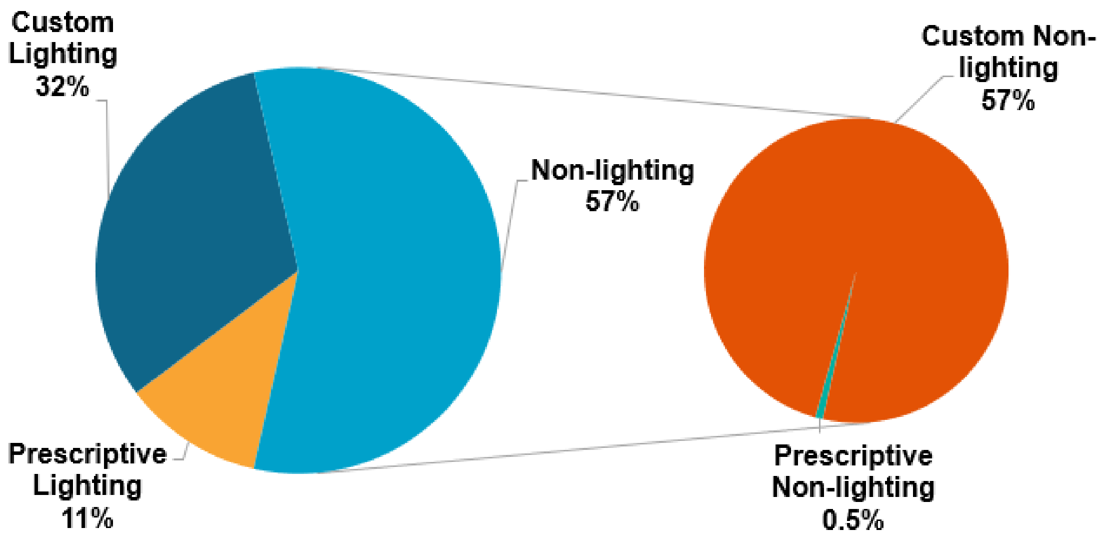
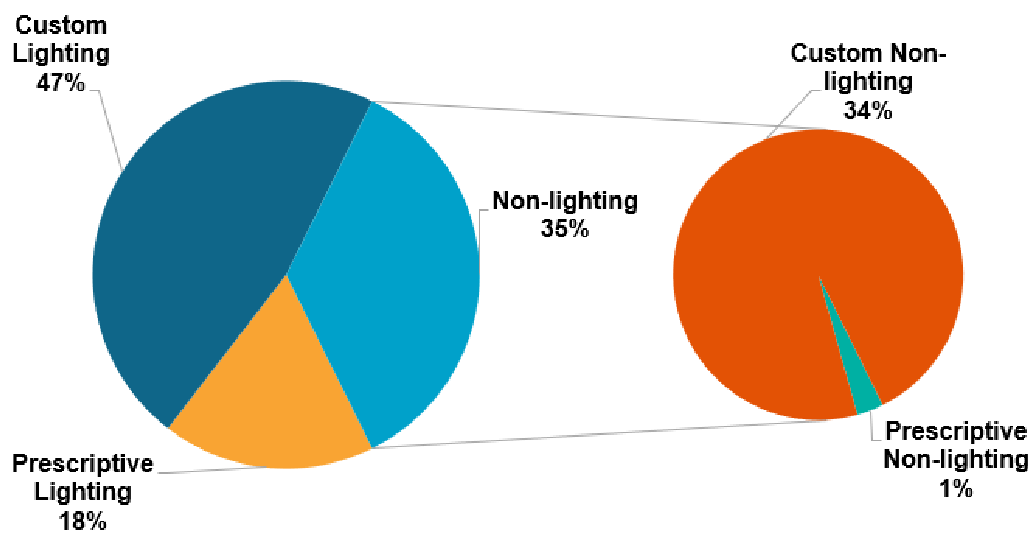


Figure 4-5: 2022 Net verified Summer Peak Demand Savings by Track and Technology



4.2.1. Prescriptive Lighting Measure

The prescriptive lighting track accounted for 44% of all completed Retrofit projects in the PY2022 and generated 11% of the region's total net verified energy savings. Prescriptive lighting provided 26.9 GWh of the first-year net verified energy savings and 4.0 MW of the first-year net verified summer peak demand savings. The average first-year net verified energy savings per project in this stratum is 43.8 MWh.

In PY2021, the prescriptive lighting track accounted for 53% of all completed Retrofit projects and generated 21% of the region's total net verified energy savings. Prescriptive lighting provided 75.4 GWh of the first-year net verified energy savings and 11.9 MW of the first-year net verified summer peak demand savings. The average first-year net verified energy savings per project in this stratum was 33.8 MWh.

The most common lighting measures installed within the prescriptive track are exterior lights (37% of net energy savings), LED troffers (37%) and high bay lighting (10%). Collectively, these three measures accounted for 84% of the prescriptive lighting stratum's first-year net verified energy savings. Additional savings are derived from controls (6%), LED tube re-lamping (2%), reflectors (2%), and omni-directional A-shape lamps (2%).

The main contributors to the net verified summer peak demand savings are LED troffers (66%) and high bays (19%). Additional demand savings were generated by omni-directional A-shape lamps (4%), LED tube re-lamps (4%), reflectors (3%), downlights (3%), and exit lighting (1%). Exterior lighting does not contribute to the summer peak demand savings, notably for its night-time operation, which occurs outside the IESO summer peak demand hours[2].

Figure 4-6 and Figure 4-7 depict the full distribution of prescriptive measures' net verified energy and summer peak demand savings for the PY2022 IF Retrofit program, respectively.

[2] June 1st to Aug 31st from 1:00 PM to 7:00 PM

Figure 4-6: Prescriptive Lighting Measures Net Verified Energy Savings

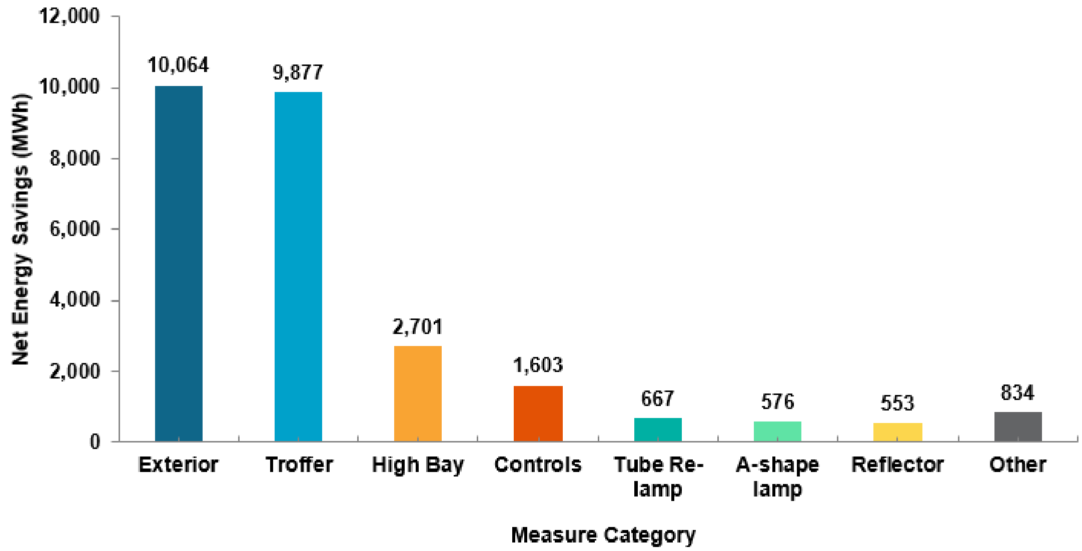
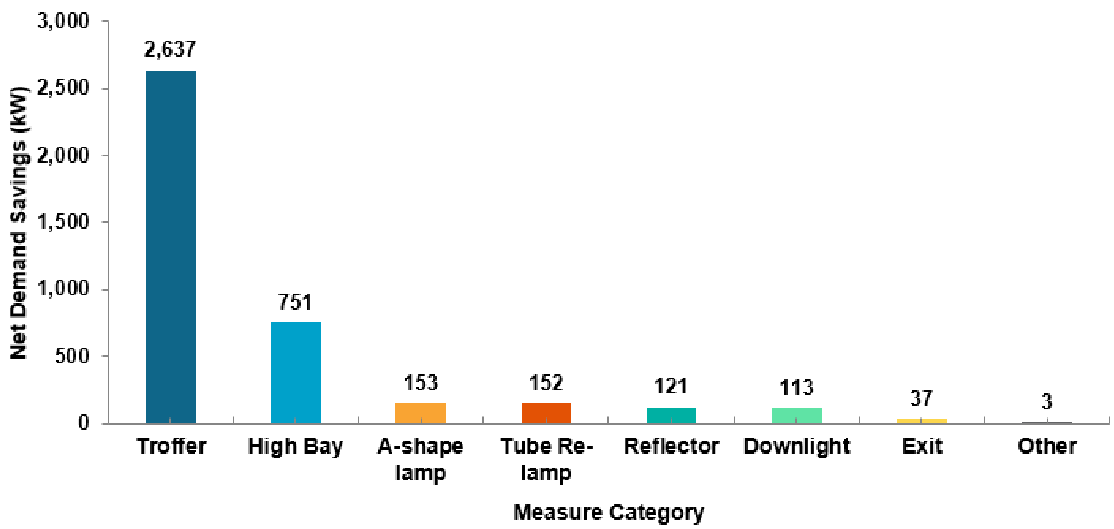


Figure 4-7: Prescriptive Lighting Measure Net Verified Summer Peak Demand Savings



4.2.2. Prescriptive Non-Lighting Measure

Prescriptive non-lighting measures achieved 1.1 GWh of first-year net verified energy savings and 0.2 MW of the first-year net verified summer peak demand savings, accounting for 0.5% and 1% of the PY2022 IF Retrofit program energy and summer peak demand savings, respectively. The average first-year net verified energy and summer peak demand savings in this stratum are 19.3 MWh and 4.0 kW per project.

In PY2021, prescriptive non-lighting measures achieved 6.8 GWh of first-year net verified energy savings and 1.1 MW of the first-year net verified summer peak demand savings, accounting for 2% of the IF Retrofit program energy and summer peak demand savings. The average first-year net verified energy and summer peak demand savings in this stratum are 54.6 MWh and 8.6 kW per project.

Variable Frequency Drives (VFDs) account for 89% of the prescriptive non-lighting measures' total first-year net verified energy savings. Unitary AC (6%), motors (5%) and Demand Control Ventilation (DCV) (0.3%) account for the remaining net verified energy savings in this stratum (Figure 4-8 and Figure 4-9). Similarly, VFDs account for 60% of the prescriptive non-lighting measures' total first-year net verified summer peak demand savings with Unitary AC's contributing to 38%. Motors (2%) and DCKV (0.2%) account for the remaining net verified summer peak demand savings in this stratum.

Figure 4-8: Prescriptive Non-Lighting Measures Net Verified Energy Savings

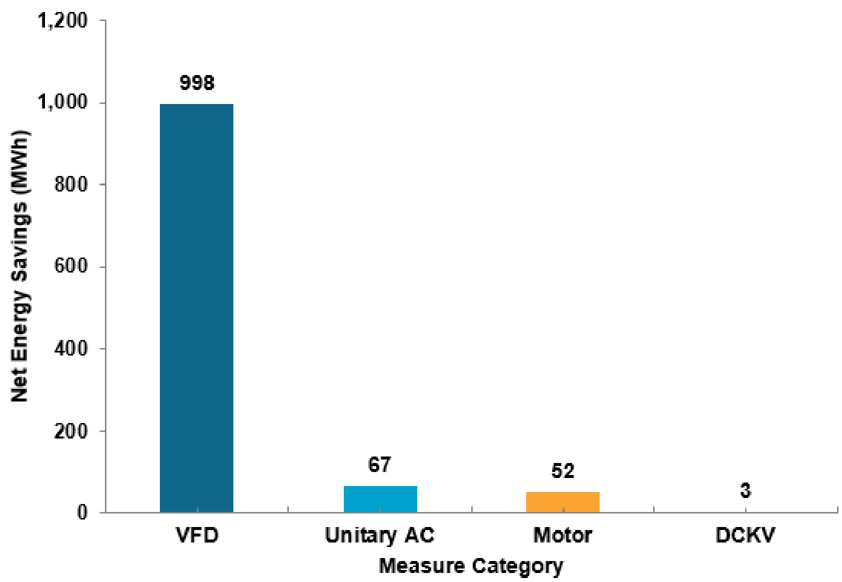
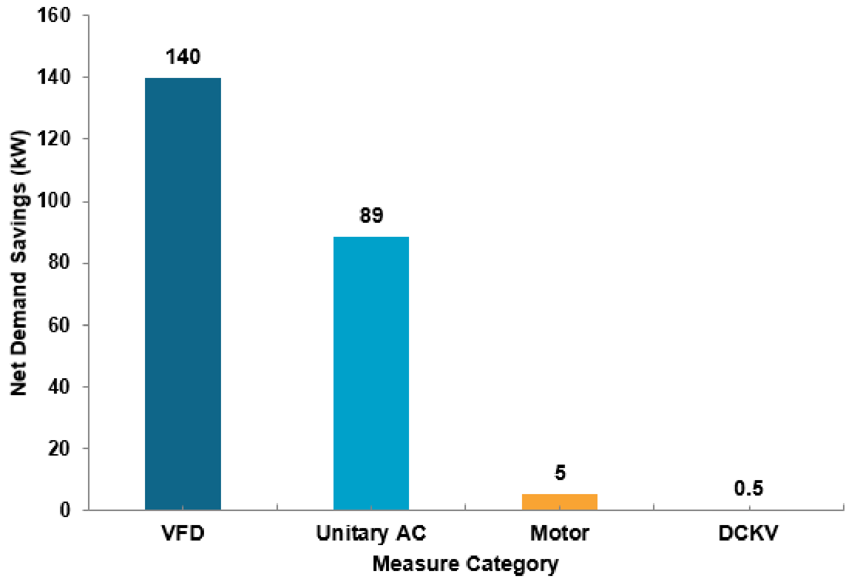


Figure 4-9: Prescriptive Non-Lighting Measures Net Verified Summer Peak Demand Savings



4.2.3. Custom Lighting Measures

Custom lighting projects comprise 33% of the total completed projects in the PY2022 IF Retrofit program and comprise 32% of the province's net verified energy savings. The first-year net verified energy and summer peak demand savings for this stratum are 76.4 GWh and 10.5 MW, respectively. The average net verified energy savings per project in the custom lighting stratum (167.6 MWh) is over three times the average prescriptive lighting project size (43.8 MWh).

In PY2021, custom lighting projects comprised of 35% of the total completed projects in the IF Retrofit program and comprised of 47% of the province's net verified energy savings. The first-year net verified energy and summer peak demand savings for this stratum were 169.5 GWh and 28.9 MW, respectively. The average net verified energy savings per project in the custom lighting stratum (110.9 MWh) was over three times the average prescriptive lighting project size (33.8 MWh).

4.2.4. Custom Non-Lighting Measures

Custom non-lighting measures typically cover the implementation of a wide range of non-lighting equipment upgrades and/or replacements. Custom non-lighting projects comprise 19% of the total completed projects and comprise of 57% of the province's net verified energy savings. The first-year net verified energy and demand savings for this stratum are 136.3 GWh and 7.7 MW, respectively. The average net verified energy savings per project in the custom non-lighting stratum (522.3 MWh) is over 25 times higher than the average prescriptive non-lighting project size (19.3 MWh).

In PY2021, custom non-lighting projects comprised of 12% of the total completed projects and comprised of 30% of the province's net verified energy savings. The first-year net verified energy and demand savings for this stratum were 109.1 GWh and 10.8 MW, respectively. The average net verified energy savings per project in the custom non-lighting stratum (202.4 MWh) was nearly four times higher than the average prescriptive non-lighting project size (54.6 MWh).

Some of the non-lighting measures installed within the custom track in the Ontario region include horticultural lighting, controls, HVAC upgrades, HVAC controls, DCV upgrades, refrigeration system and control upgrades, and VFD installations.

4.3. Net-to-Gross Evaluation

Table 4-6 presents the results of the PY2022 IF Retrofit Program NTG evaluation. The evaluation team targeted and achieved 90% confidence and 10% precision levels in the savings results. Participant feedback indicates moderate levels of FR at 14.9%.

Over one-fifth (21%) of participants stated they would have done the "exact same upgrade" in the program's absence, which is indicative of higher FR for these participants. Close to two-fifths (39%) of participants showed no indication of free-ridership since they stated they would have put off the upgrade for at least one year (26%) or cancelled their upgrade altogether (13%) if the program had not been available to them. Other participants were considered partial free riders if they reported that they would have scaled back on the size, efficiency, or scope of their project (31%) or if they did not know what they would have done in the absence of the program (10%).

Participants' decisions to participate in the program were most commonly influenced by the availability of the incentive (81%) and information or recommendations provided by contractors, vendors, or suppliers (60%). Participation in the program resulted in moderate SO at 2.3%. SO energy savings were primarily driven by the installation of motor/pump upgrades. Additional analyses performed to assist in interpreting these values can be found in Appendix D.

Table 4-6: PY2022 Retrofit Program Net-to-Gross Results

Unique Participants	NTG Responses	Savings Weighted Free-Ridership	Spillover – Energy	Spillover – Summer Demand	Weighted NTG – Energy	Weighted NTG – Summer Demand	Energy NTG Precision at 90% Confidence
793	126	14.9%	2.3%	3.3%	87.4%	88.3%	± 7.2%

5. Cost-Effectiveness Evaluation

A cost-effectiveness (CE) analysis for the IF Retrofit program was conducted using the IESO's CE Tool V7.1. The PY2022 program passed the Program Administrator Cost (PAC) test, with benefits exceeding their respective costs and a PAC ratio of 4.55 and a levelized unit energy cost of $0.01 per kWh and $133.31 per kW. The PY2022 IF Retrofit results are consistent with results from the PY2021 evaluation, where the IF Retrofit Program achieved a PAC ratio of 4.03 and a levelized unit energy cost of $0.01 per kWh and $98.1 per kW. In line with the program's maturity and a decrease in administrative expenditures, the PY2022 IF Retrofit program CE is stronger than it was in 2019, 2020, and 2021. The cost-effectiveness results are presented in Table 5-1.

Table 5-1: 2019-2022 IF Retrofit Program Cost Effectiveness Results

Cost Effectiveness Test	Program Year				
Program Administrator Cost (PAC)	2019	2020	2021	2022	2019-2022
PAC Costs ($)	$12,180,857	$41,313,073	$46,158,808	$26,994,401	**$126,647,139**
PAC Benefits ($)	$27,715,992	$90,933,185	$185,819,779	$122,837,292	**$427,306,249**
PAC Net Benefits ($)	$15,535,135	$49,620,112	$139,660,971	$95,842,892	**$300,659,110**
PAC Net Benefit (Ratio)	2.28	2.20	4.03	4.55	**3.37**
Levelized Unit Energy Cost (LUEC)	2019	2020	2021	2022	2019-2022
$/kWh	$0.02	$0.03	$0.01	$0.01	**$0.02**
$/kW	$119.4	$151.5	$98.1	$133.31	**$120.85**

The prescriptive lighting stratum has a PAC Net Benefit Ratio of 4.53[3]. This stratum contributed 13.4% to the PAC benefits, and 17.4% to the PAC costs. The prescriptive non-lighting measures have a PAC Net Benefit Ratio of 3.28[3], while contributing 0.7% to the PAC benefits and 1.2% to its costs.

Aligned with its strong contribution to the IF Retrofit program energy and summer peak demand savings, the custom track contributed the most the program's benefits and costs and has a net benefits ratio of 6.2[3]. In total, the custom track contributed 85.9% to the PAC benefits, and 81.3% to the PAC costs. The custom lighting stratum is the only stratum that contributed more the PAC benefits (32.9%) than it did to the PAC costs (26.4%).

[3] Track-level benefit to cost ratios do not include program admin costs. Admin costs are included in the program level CE results presented in Table 5-1, track-level CE results are directional in nature and to be used for comparison purposes.

6. Other Energy Efficiency Benefits

6.1. Avoided Greenhouse Gas Emissions

The evaluation team used the IESO's CE Tool V7.1 to calculate the avoided GHG emissions. Avoided GHG emissions were calculated for the first years of PY 2019, 2020, 2021, and 2022 and the lifetime of the measures. Table 6-1 below represents the results of the avoided GHG emissions calculations. First-year avoided GHG emissions from electricity savings were reduced by the increase in GHG consumption resulting from the gas-heating penalty, resulting in 25,576.75 Tonnes of CO_2 reduced in the first year for PY2022 project. PY2022 IF Retrofit program projects are expected to achieve a total of 437,125 Tonnes of avoided GHG throughout the EUL of the installed measures. All GHG emissions shown are in Tonnes of CO_2 equivalent, unless otherwise noted.

Table 6-1: IF Retrofit Avoided Greenhouse Gas Emissions

Program Year	First Year GHG Avoided (Tonnes CO_2 equivalent)			Lifetime GHG Avoided (Tonnes CO_2 equivalent)		
	Electric	Gas*	Total	Electric	Gas*	Total
2019	4,364.79	(4,551.07)	(186.28)	100,138.17	(55,728.43)	42,755.31
2020	18,995.06	(11,812.32)	7,182.76	329,456.76	(146,337.92)	183,118.85
2021	41,142.50	(19,818.08)	21,324.42	688,534.56	(243,541.63)	444,992.94
2022	32,648.76	(7,072.01)	25,576.75	523,979.92	(86,854.93)	437,125.00
2019 - 2022	**97,151.12**	**(43,253.48)**	**53,897.65**	**1,642,109.41**	**(534,117.33)**	**1,107,992.09**

*Interactive gas penalty

6.2. Jobs Impact Results

6.2.1. Key Findings

Key findings from the PY22 Jobs Impacts approach include the following:

- The analysis used an input-output model which estimated that Retrofit will create 2,688 total jobs in Canada, of which 2,370 will be in Ontario.
- $1M of program investment resulted in the creation of 97.8 jobs, compared to 93.3 jobs in PY21.
- 197 out of 2,688 (7.3%) of jobs impacts were realized in the first year – 123 of the 197 first year jobs impacts were due to first year savings.

6.2.2. Input Values

The model was used to estimate the impacts of three economic shocks:

- The demand shock, representing the demand for energy-efficient products and services from Retrofit
- The business reinvestment shock, representing the increased business reinvestment due to bill savings (and net of project funding)
- The household expenditure shock, representing decreases in household spending on goods and services due to increases in the residential portion of program funding.

Table 6-2 below displays the input values for the demand shock representing the products and services related to Retrofit. Each measure installed as part of the program was categorized according to the StatCan IO Supply and Use Product Classifications (SUPCs).

Table 6-2: Summary of Input Values for Demand Shock

Lighting fixtures	19,917	11,339	31,256
Electric light bulbs and tubes	17,246	9,931	27,177
Heating and cooling equipment (except household refrigerators and freezers)	14,936	8,042	22,978
Switchgear, switchboards, relays and industrial control apparatus	9,877	5,363	15,239
Industrial and commercial fans, blowers and air purification equipment	8,143	4,385	12,527
Pumps and compressors (except fluid power)	7,088	3,817	10,905
Electric motors and generators	2,919	1,572	4,491
Glass (including automotive), glass products and glass containers	2,305	1,241	3,546
Metalworking machinery and industrial moulds	792	427	1,219
Other industry-specific machinery	660	356	1,016
Other miscellaneous manufactured products	436	235	671
Measuring, control and scientific instruments	380	206	586
Other commercial buildings	145	78	224

Electric power engineering construction	61	33	95
Other professional, technical and scientific services	4	2	7
Subtotal	**84,910**	**47,025**	**131,935**
Office Administrative Services	-	-	6,636
Total			**138,571**

The second shock modelled by the IO Model was the business reinvestment shock. This shock represented the amount that businesses would reinvest and thus inject back into the economy. This amount was split over various industries in order to properly model the demand shock. The business reinvestment shock totaled $256.1 million over 29 different industries. More detail on the business reinvestment shock, along with the reinvestment values by industry, can be found in Appendix F.

The third model input is the household expenditure shock.[4] This shock represents the incremental increase in electricity bills to the residential sector from funding the program. The assumption is that the IESO programs are funded by all customers in proportion to the overall consumption of electricity. Thus, the residential funding portion was 35% of the $27.5M program budget or $9.6M.

6.2.3. Model Results

Impacts from the StatCan I-O model are generated separately for each shock and added together to calculate overall program job impacts. In the case of Retrofit, this means that three different sets of job impacts are combined into the overall jobs impacts. Table 6-3 shows the total estimated job impacts by type – combining the impacts from the demand, business reinvestment and household expenditure shocks. The majority (2,370 out of the 2,689 estimated total jobs) were in Ontario. Of the 1,307 direct jobs created across Canada, 1,256 were created in Ontario. A slightly smaller proportion of the indirect and induced jobs were in Ontario; 554 of 690 indirect and 560 out of 692 induced jobs were estimated to be created within the province. The FTE estimates were slightly lower overall than the total jobs, with a total of 1,956 FTEs (of all types) created in Ontario and 2,218 FTEs added nationwide. A large portion of direct FTEs (1,082 of 1,128) were added in Ontario, with this number representing approximately 55% of the total FTEs added in Ontario and 49% of all FTEs created across Canada. In 2022, each $1M of program spend resulted in the creation of 97.8 total jobs compared to 93.3 jobs per $1M in 2021.

[4] The model is actually run with a normalized value of $1 million in extra household expenditures, and the job results can be scaled by the actual demand shock.

Table 6-3: Total Job Impacts by Type

Job Impact	FTE	*(in person-years)*	Total Jobs	*(in person-years)*	Total Jobs per $1M Investment
Type	Ontario	Total	Ontario	Total	*(in person-years)*
Direct	1,082	1,128	1,256	1,307	47.5
Indirect	460	577	554	690	25.1
Induced	414	513	560	692	25.2
Total[1]	**1,956**	**2,218**	**2,370**	**2,689**	**97.8**

[1] Columns may not add to totals due to rounding. Real values are rounded to the nearest whole number and the whole numbers do not sum exactly to the whole number total in every column.

A more detailed write up of the model impacts – including a breakout of impacts by industry, impacts due to first year savings and verbatims from program contractors – can be found in Appendix F.

Appendix A Impact Evaluation Methodology

A.1 Sample Plan

Independently verifying the energy and demand savings and attributing these savings first requires selecting sample projects representing the program's population. The goal of a representative sample ensures results can be applied to the population's reported savings to verify gross and net impacts with minimal uncertainty. A random sampling of projects was completed by studying the population and developing a sampling plan based on the following factors:

- Participation levels provided in the program database extract.
- Overall confidence/precision targets of 90/10 for the program, assuming a coefficient of variation (CV) of 0.5

A.2 Project Counts

Due to the broad range of measures incentivized through the Retrofit program, several variables are considered when defining a unique project, and include:

- Application identification (ID)
- Track (prescriptive/custom)
- Measure type (lighting/non-lighting)

As a result, a number of IESO-defined projects were split into various evaluation projects, often due to different tracks within the same application or different measure types installed within the same track. This sorting process resulted in a greater count of evaluation projects, thus exceeding the count of projects reported by the IESO.

A.3 Project Audits

Subsequent to the sampling process, the evaluation team completed project audits representing the entire Retrofit population. Sampled projects received Level 1 audits, consisting of desk reviews of project documentation from the program delivery vendor. These documents included project applications, equipment specification sheets, notes on equipment installed, invoices for equipment, and any other documentation submitted to the program.

Evaluation of the Retrofit program often included Level 2 audits with on-site visits. A subset of sampled projects received Level 2 audits, where a Resource Innovations engineer visited the facility to confirm equipment installation, gathered metering/trend data, and interviewed participants to confirm key details of the project, operating patterns, and schedules.

A.4 Reported Savings

Gross reported savings are the energy and summer peak demand savings derived from information submitted on participant applications. They reflect the equipment installed throughout the program. This information was provided to the evaluation team through the program participation data extract provided by the IESO.

A.5 Verified Savings

Energy and demand savings are verified for all sampled projects and rely on data collected and verified during the project audit. This information is evaluated utilizing analytical tools to determine the savings attributable to each project. The verified savings are compared to the reported savings for a specific stratum to define the stratum realization rate. This realization rate is then applied to all projects' gross reported savings in a stratum's population to estimate the stratum verified savings. Equation A-1 presents the formula for calculating a stratum's realization rate.

Equation A-1: Realization Rate

$$Realization\ Rate = \frac{\sum_i^n Savings_{verified}}{\sum_i^n Savings_{reported}}$$

Where:

$Savings_{verified}$ = Energy (kWh) or demand (kW) savings verified for each project in the sample

$Savings_{reported}$ = Energy (kWh) or demand (kW) savings reported by the program for each project in the sample

The total verified savings reflect the direct energy and demand impact of the program's operations. However, these savings do not account for customer or market behaviour impacts 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.

A.6 Interactive Effects for Lighting Equipment

The Retrofit program incentivizes installing lighting equipment with higher efficiency levels compared to commonly installed lamps and fixtures. Ideally, this high-efficiency equipment should consume less energy. However, it is understood that the equipment's energy consumption in an enclosed space cannot be viewed in isolation. Building systems interact with one another, and a change in one system can affect a separate system's energy consumption. This interaction should be considered when calculating the benefits provided by the program. Examining cross-system interactions provides a comprehensive view of building-level energy changes, rather than limiting the analysis to solely the energy change that directly relates to the modified equipment. The IESO Evaluation Measurement and Verification (EM&V)

Protocols state that interactive energy changes should be quantified and accounted for whenever possible. Based on this guidance, interactive effects were calculated for all energy-efficient lighting measures installed through the program to capture the changes in the operation of heating, ventilation, and air-conditioning (HVAC) equipment due to lower heat loss from energy-efficient lighting equipment.

A.7 Lifetime Savings

When performing the impact evaluation, it is important to consider the total amount of savings over the lifetime of retrofitted equipment. This consideration is necessary given that energy savings, demand savings, avoided energy costs, and other benefits continue to accrue each year the equipment is in service. The method of calculating the lifetime energy savings of a measure level is presented in Equation A-2.

Equation A-2: Lifetime Energy Savings

$$Lifetime\ Energy\ Savings = EUL \times Annual\ Energy\ Savings$$

Where:

EUL = Estimated useful life of the retrofitted equipment

Appendix B Net-to-Gross Methodology

This appendix provides detail on the sampling plans for collecting NTG data, the instruments used to assess FR and SO, the implementation of the data collection, and the analysis methods. An effective questionnaire was developed to assess FR and SO. The approach has been used successfully in many previous evaluations. The NTG ratio presented in Equation B-1 is defined as follows:

Equation B-1: Net-to-gross Ratio

$$NTG = 100\% - FR + SO$$

Where FR is free-ridership, and SO is spillover.

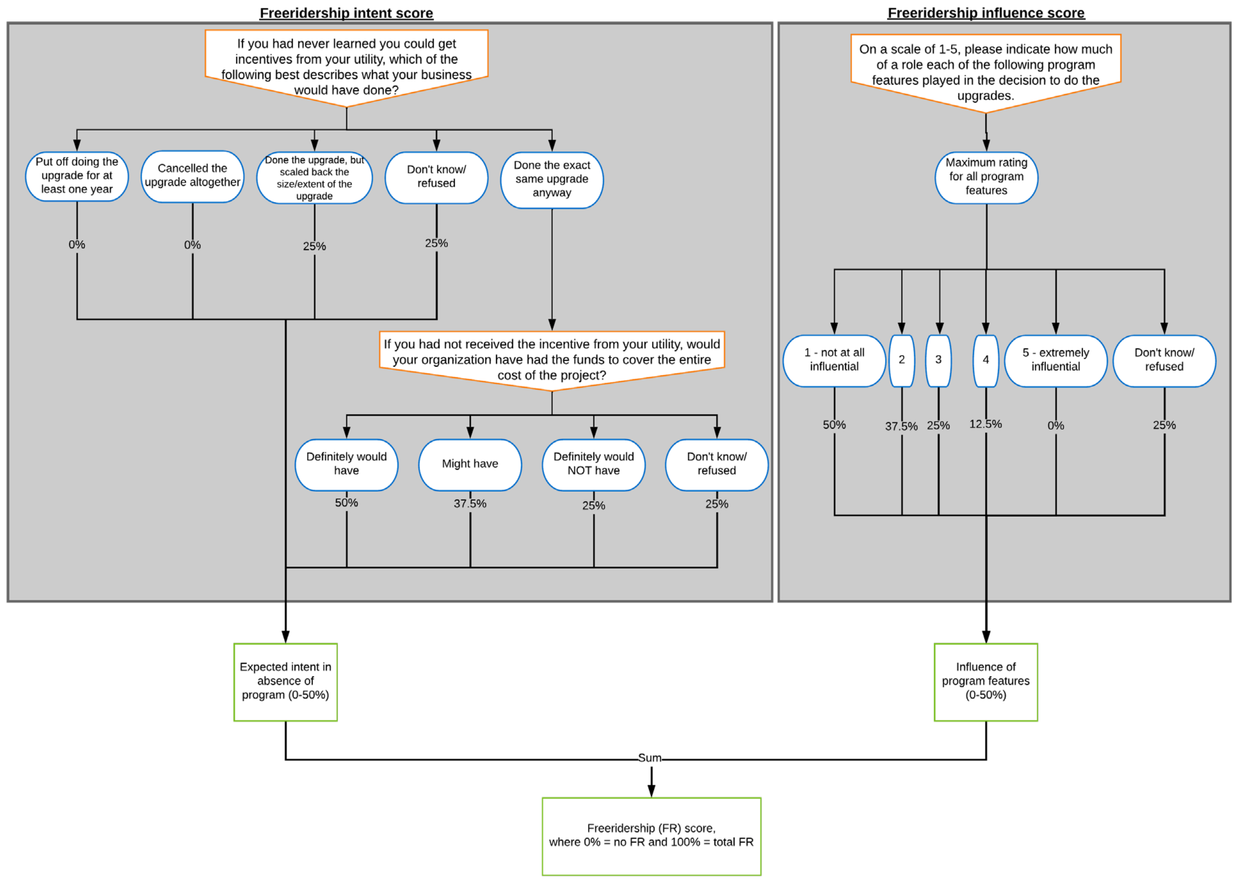
B.1 Free-Ridership Methodology

The survey addressed the attribution of savings for each sampled project or type of equipment through two main components:

- Intention of the expected behaviour in the program's absence; and
- Influence of various program features, such as the incentive, program marketing and outreach, and any technical assistance received.

Each component produces scores ranging from 0 to 50. The two components are summed to produce a total FR score ranging from 0 (not a free-rider) to 100 (complete free-rider). The total score is interpreted as a percentage (0% to 100%) to calculate the mean FR level for a given program. Figure B-1 illustrates the FR methodology.

Figure B-1: Free-Ridership Methodology



Intention Component

The FR score's intention component asks participants how the evaluated project would have differed in the program's absence. The two key questions that determine the intention score are as follows:

Question 1: If you had never learned you could get incentives/upgrades at no cost through the program, which of the following best describes what your business would have done? Your business would have…

1. Put off doing the upgrade for at least one year.
2. Cancelled the upgrade altogether.
3. Done the upgrade but scaled back the size, equipment efficiency, or scope of the upgrade.
4. Done the exact same upgrade anyway

98. Don't know
99. Refused

[ASK ONLY IF RESPONSE TO QUESTION 1=4: Done the exact same upgrade anyway]
Question 2: If you had not received the incentive/upgrades at no cost from the program, would you say your organization definitely would have, might have, or definitely would not have had the funds to cover the entire cost of the project?

1. Definitely would have
2. Might have
3. Definitely would NOT have
98. Don't know
99. Refused

Table B-1 indicates the possible intention scores a respondent could have received depending on their responses to these two questions.

Table B-1: Key to Free-Ridership Intention Score

Question 1 Response	Question 2 Response	Intention Score (%)
1 or 2	Not asked	0 (no FR for intention score)
3, 98 (Don't Know), or 99 (Refused)	Not asked	25
4	3, 98 (Don't Know), or 99 (Refused)	25
4	2	37.5
4	1	50 (high FR for intention score)

If a respondent provided an answer of 1 or 2 (would postpone or cancel the upgrade) to the first question, the respondent would receive an FR intention score of 0% (on a scale from 0% to 50%, where 0% is associated with no FR and 50% is associated with high FR). If a respondent answered 3 (would have done the project but scaled back the size, equipment efficiency, or scope) or stated they did not know or refused the question, the respondent would receive an FR intention score of 25% (associated with moderate FR). If the respondent answered 4 (would have done the exact same upgrade anyway), they are asked the second question before an FR intention score can be assigned.

The second question asks the participants who stated they would have done the exact same upgrade, regardless of whether their organization would have had the funds available to cover the entire project cost. If the respondent answered 1 (definitely would have had the funds), the respondent would receive a score of 50% (associated with high FR). If the respondent answered 2 (might have had the funds), they would receive a slightly lower FR score of 37.5%. If the respondent answered 3 (definitely would not have had the funds) or did not know or refused the question, the respondent would receive a FR intention score of 25% (associated with moderate FR).

The bullet points below display the same FR intention scoring approach in a list form. As mentioned above, for each respondent, an intention score was calculated, ranging from 0% to 50%, based on the respondent's report of how the project would have changed had there been no program:

- Project postponement or cancellation = 0%
- Reduction in size or scope or use of less energy-efficient equipment = 25%
- Respondent does not know what they would have done in the absence of the program = 25%
- No change and respondent states firm would not have made funds available = 25%
- No change but respondent is not sure whether firm would have made funds available = 37.5%
- No change and respondent confirms firm would have made funds available = 50%

Influence Component

The influence component of the FR score asks each respondent to rate how influential various potential program-related factors were on their company's decision to do the upgrade(s) in question. Influence is reported using a scale from one (1) to five (5), where one indicates it was "not at all influential" and five indicates it was "extremely influential." The potential influence includes the following:

- Availability of the incentives
- Information or recommendations provided to you by an IESO representative
- The results of any audits or technical studies done through this or another program provided by the IESO
- Information or recommendations provided from contractors or vendors, or suppliers associated with the program
- Information from Enbridge Gas
- Information from another government entity
- Marketing materials or information provided by the IESO about the program (email, direct mail, etc.)
- Information or resources from the IESO website
- Information or resources from social media
- Previous experience with any energy-saving program

- Others (identified by the respondent)

Table B-2 indicates the possible influence scores a respondent could receive depending on how they rated the influence factors above. For each respondent, the program influence is set equal to the maximum influence rating a respondent reports across the various influence factors. For example, suppose the respondent provided a score of 5 (extremely influential) to at least one of the influence factors. In that case, the program is considered to have had a great role in their decision to do the upgrade, and the influence component of FR is set to 0% (not a free rider).

Table B-2: Key to Free-Ridership Influence Score

Maximum Influence Rating	Influence Score (%)
5 - program factor(s) extremely influential	0
4	12.5
3	25
2	37.5
1 - program factor(s) not at all influential	50
98 – Don't know	25
99 - Refused	25

The bullet points below display the same FR Influence scoring approach in a list form. As mentioned above, for each project, a program influence score was calculated, also ranging from 0% to 50%, based on the highest influence rating given among the potential influence factors:

- Maximum rating of 1 (no influencing factor had a role in the decision to do the project) = 50%
- Maximum rating of 2 = 37.5%
- Maximum rating of 3 = 25%
- Maximum rating of 4 = 12.5%
- Maximum rating of 5 (at least one influence factor had a great role) = 0%
- Respondent does not know how much influence any factor had = 25%

The intention and program influence scores were summed for each project to generate an FR score ranging from 0 to 100. The scores are interpreted as % FR: a score of 0 indicates 0% FR (the participant was not at all a free rider), a score of 100 indicates 100% FR (the participant was a complete free rider), and a score between 0 and 100 indicates the participant was a partial free rider.

B.2 Spillover Methodology

To assess the SO, respondents were asked about installing energy-efficient equipment or services that were done without a program incentive following their participation in the program. The equipment-specific details assessed are as follows:

- ENERGY STAR Appliance: type and quantity
- Fan: size, quantity
- HVAC: air conditioner replacement, above code minimum: tonnage and quantity
- Lighting: type, quantity, wattage, location, and fixture length
- Lighting – controls: type of control, and type and quantity of lights connected to control
- Motor/Pump Upgrade: end-use, horsepower, quantity, and efficiency
- Motor/Pump Drive Improvement (VSD and Sync Belt): type, horsepower, and quantity
- Others (identified by the respondent): description of the upgrade, size, quantity, hours of operation

For each equipment type, the respondent reports installing without a program incentive the survey asks about the extent of influence that earlier involvement in the program had on the decision to carry out the upgrades. Influence is reported using a scale from one (1) to five (5), where one indicates it was "not at all influential" and five indicates it was "extremely influential." Suppose the influence score is between 3 and 5 for a particular equipment type. In that case, the survey instrument solicits details about the upgrades to estimate the quantity of energy savings that the upgrade produced.

For each upgrade, the program influence rating was converted to an influence score ranging from 0% to 100%, as follows:

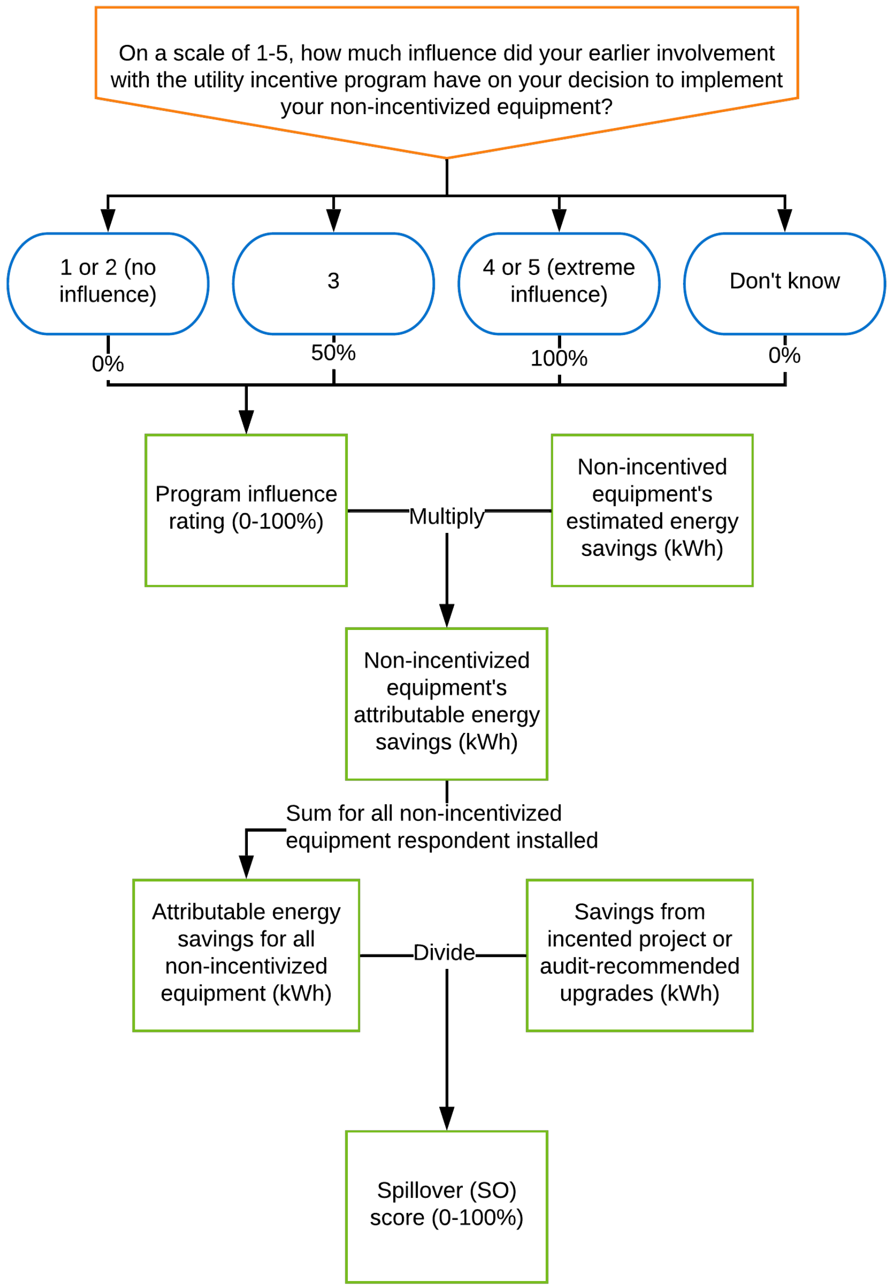
- Maximum rating of 1 or 2 (no influence) = 0%
- Maximum rating of 3 = 50%
- Maximum rating of 4 or 5 (great influence) = 100%
- Respondent does not know how much influence any factor had = 0%

The following procedure was used to calculate an SO percentage for each respondent:

- Multiplying the estimated energy savings for each upgrade by the influence percentage to calculate the upgrade's program-attributable energy savings.
- Summing program-attributable energy savings from all identified upgrades for each respondent to calculate the respondent's total SO savings.
- Dividing each respondent's total SO savings by the savings from the incented project.

Figure B-2 illustrates the SO methodology.

Figure B-2: Spillover Methodology



B.3 Identification of Project or Upgrade for NTG Assessment

Participants were asked to consider all their completed projects during the program year through the particular program in question. This approach allowed for the respondent's NTG value across all the projects they completed in the program year to be applied rather than just one.

B.4 Other Survey Questions

In addition to the questions addressing FR and SO, the survey included the following topics to provide additional context:

- Whether the respondent is the person primarily involved in decisions about upgrading equipment at their company. Suppose the respondent is not the appropriate contact. In that case, they are asked by the interviewer to be transferred to or be provided contact information for the appropriate person in the case of a phone survey. In the case of a web survey, the web link will be forwarded to the appropriate contact.
- Whether the respondent had primary or shared responsibility for the budget or expenditure decisions for the program-incentivized work completed at their company.
- The respondent's job title.
- When the respondent first learned about the program incentives relative to the upgrade in question (before planning, after planning but before implementation, after implementation began but before project completion, or after project completion).
- When the respondent submitted their application to the program, and their reasons for submitting it after the work was started or completed, if applicable.
- How the respondent learned about the program.

The responses to these questions are not included in the algorithms for calculating FR or SO but provide additional context. The first question ensures that the appropriate person responded to the survey. The other questions provide feedback about responsibility for budget and expenditure decisions, the respondent's job title, application submission process details, and how and when program influence occurs.

B.5 Net-to-Gross Survey Implementation

The survey was implemented over the web and by phone. The survey lab was instructed to avoid collecting duplicate responses by no longer calling on respondents if they had responded to the web survey or deactivating the respondent's survey web link if they had responded to the phone survey.

For each of the phone surveys, the survey lab called participants in a randomized order. After reaching the identified contact for a given participant, the interviewer explained the survey's purpose and identified the IESO as the sponsor. The interviewer asked if the contact was involved in decisions about upgrading equipment at that organization. If the contact was not involved in decisions about upgrading equipment, the interviewer asked to be transferred to or for the contact information of the appropriate decision-maker. The interviewer then attempted to reach the identified decision-maker to complete the survey.

It was assumed that all contacts who responded to the web version of the survey were the appropriate contacts to answer the questions. The introductory text in the survey asked the respondent to forward the survey web link to the appropriate contact to fill it out if they were not the appropriate contact to do so.

Appendix C Participant Net-to-Gross Survey Methodology

This appendix provides additional detail about the Participant NTG survey methodology. The NTG evaluation collected primary data from program participants to develop NTG estimates. A total of 128 participants were surveyed from a sample of 793 unique contacts (Table C-1). The purpose of the survey was to better understand the participants' feedback related to FR and SO.

The sample was developed from program records provided by the IESO EM&V staff. A census-based approach was employed to reach the largest number of respondents possible, given the small number of unique contacts.

The survey was delivered both over the phone and over the web in partnership with the Resource Innovations survey lab using Qualtrics survey software. The NMR staff worked closely with the Resource Innovations survey lab to test the programming of the surveys and to perform quality checks on all data collected.

The survey was delivered over the phone and on the web in partnership with the Resource Innovations survey lab using Qualtrics survey software. Survey implementation was conducted between February 27 and April 4, 2023. The survey took an average of 12 minutes to complete after removing outliers.[5] Weekly e-mail reminders were sent to non-responsive contacts throughout web survey fielding.

[5] Note that the survey was designed to allow the respondent to come back to it at a later time to complete it if they preferred. The average survey time was calculated with this in mind and assumed that any survey that took 40 minutes or more to complete was likely completed by a respondent who took a break before completing the survey.

Table C-1: Participant NTG Survey Disposition

Disposition Report	Web	Phone
Completes	122	6
Emails bounced	32	-
Bad Contact Info (No Replacement Found)	-	-
Unsubscribed	-	-
Partial Complete	51	-
Screened Out	14	-
Busy	-	3
Callback	-	6
Soft Refusal	-	2
Hard Refusal	-	-
Picked up but no response	-	-
Emailed new contact	-	3
No Eligible Respondent	-	1
Non-working #	-	2
Left message with operator	-	-
Call did not connect	-	-
Bad Signal	-	-
Voicemail	-	27
Agreed to Complete Online	-	3
Wrong Number	-	-
Language Barriers	-	-
No longer with company	-	2
Out of business	-	-
No Response	574	2
Total Invited to Participate	793	57

Appendix D Additional Net-to-Gross Evaluation Results

This appendix provides additional results in support of the NTG evaluation.

D.1 Additional Participant Net-to-Gross Results

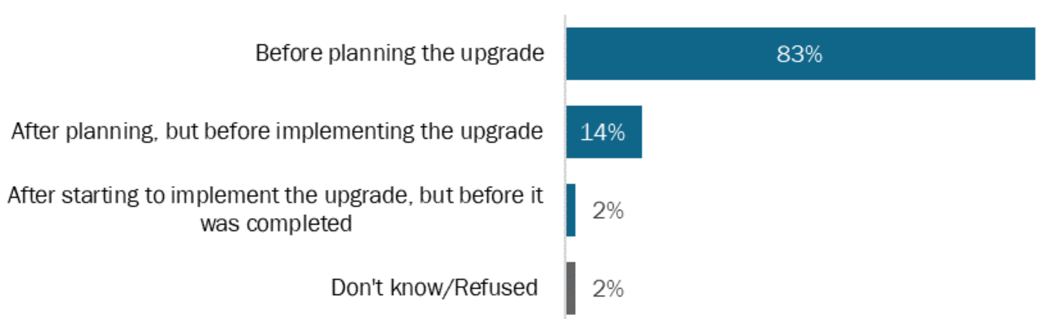
This section includes detailed FR and SO results associated with the NTG results for Retrofit participants. In the sections below, if the number of respondents to a question is under 20, counts are shown rather than percentages and results should be considered as directional given the small number of respondents.

Free-Ridership (FR)

The extent of FR within the program was assessed through surveys of Retrofit Program participants that explored their experiences and plans before learning about the program, what they would have done in the program's absence, and how influential the program was on their decision to implement the energy-efficient upgrades.

Over four-fifths (83%) of respondents stated they first learned they could receive energy-efficiency incentives through the Retrofit Program before starting to plan their upgrades (Figure D-1). This may suggest the program was influential in many of these respondents' decisions to begin the project. Over one-tenth (14%) of respondents learned about the program after planning had started but before implementing the project. The remaining respondents learned after implementing but before completing their projects (2%) or did not know or preferred not to answer (2%). While responses to this question did not directly impact the FR score, they provided additional context for understanding the participants' decision-making processes.

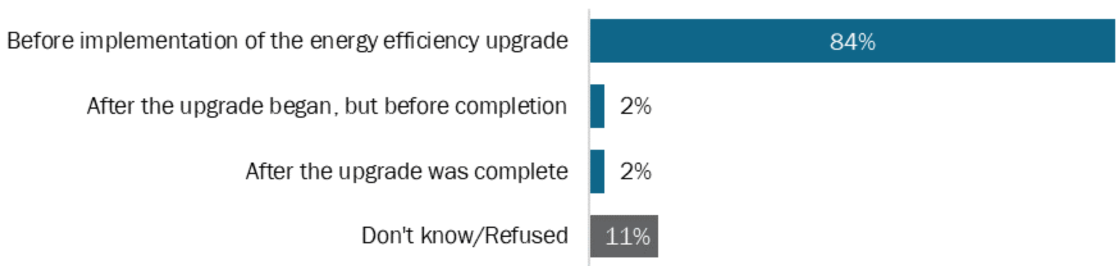
Figure D-1: When Participants First Learned About the Program (n=126)*



*Does not sum to 100% due to rounding.

Next, participants were asked about the timing of their application to the program in relation to the start of their energy-efficient upgrades (Figure D-2). More than four-fifths (84%) of respondents said they applied before their company began implementing the upgrade, suggesting that most participants applied to the program as intended. Three respondents each applied after the upgrade began but before it was completed (2%) or after the upgrade was complete (2%). Over one-tenth did not know or preferred not to answer (11%) Similar to the previous question, this question was not used to calculate the FR score, yet it provides additional context regarding participant intentions.

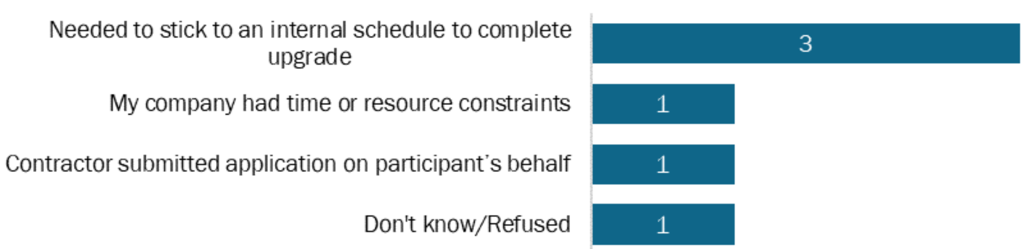
Figure D-2: Timing of Program Application (n=126)*



*Does not sum to 100% due to rounding.

Respondents who moved forward with the project before submitting their application were asked their reasoning for doing so (Figure D-3). The most common reason was the need to stick to an internal schedule to complete the upgrade (3 respondents). While responses to this question did not directly impact the FR score, they provide additional context for understanding the participants' decision-making processes.

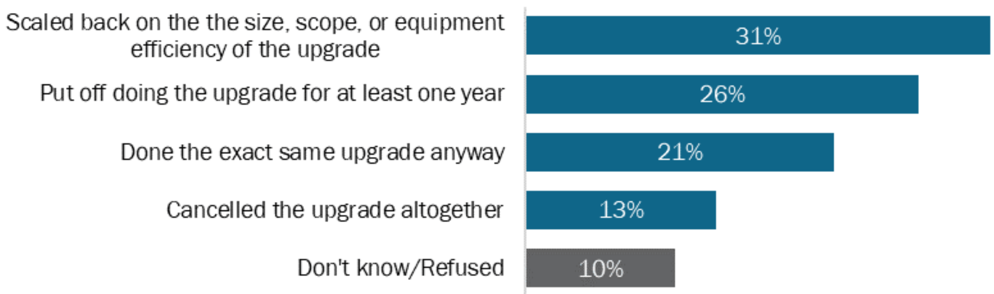
Figure D-3: Reason for Submitting After Starting Upgrade (n=5)*



*Does not sum to five due to multiple response.

The survey then asked respondents what they would have done in the absence of the program (Figure D-4). Over one-fifth (21%) of respondents would have done the "exact same upgrade" anyway, which is indicative of higher FR for these respondents. Close to two-fifths (39%) of respondents showed no indication of FR since they stated they would have put off the upgrade for at least one year (26%) or cancelled their upgrade altogether (13%) if the program had not been available to them. Other respondents were considered partial free riders if they reported that they would have scaled back on the size, efficiency, or scope of their project (31%) or if they did not know what they would have done in the absence of the program (10%). The evaluation team factored responses from this participant intent question into the FR analysis.

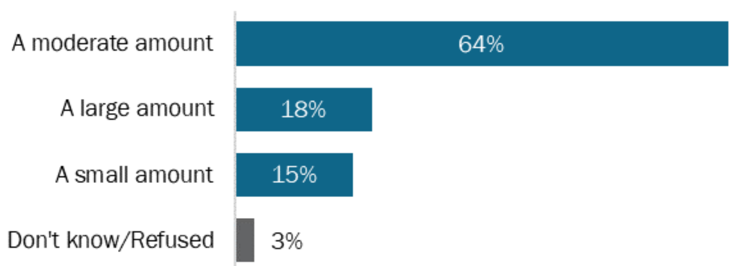
Figure D-4: Actions in the Absence of Program (n=126)*



*Does not sum to 100% due to rounding.

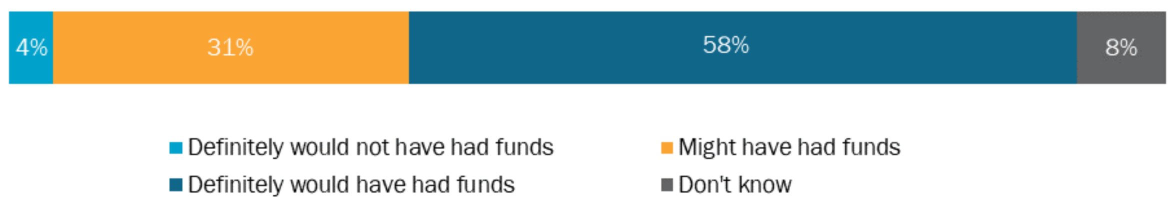
Respondents who indicated they would have reduced the size, equipment efficiency, or scope of their energy-efficient upgrade in the absence of the program were asked to describe the impact on their projects (Figure D-5). Over three-fifths (64%) of these respondents estimated they would have reduced the size, scope, or equipment efficiency of their upgrade by "a moderate amount," indicating that the program allowed these participants to increase their project's size and/or scope beyond what they would have achieved on their own. The remaining participants were split between those who would have scaled back their projects by a small amount (15%), those who would have scaled it back by a large amount (18%), and those who did not know how their project scope would have changed (3%). This question was not used to calculate the FR score, though it provided additional context around participant intentions.

Figure D-5: Scaled Back Size or Extent of Upgrade in Absence of Program Incentives (n=39)



Respondents who indicated their company would have done the exact same upgrade in the absence of the program were asked whether their company would have had the funds to cover the entire cost of the upgrade (Figure D-6). Nearly three-fifths (58%) of respondents indicated that their company definitely would have had the funds to cover all project costs, nearly twice as many as the respondents who stated they might have had the funds (31%). The evaluation team factored responses to this participant intent question into the FR analysis.

Figure D-6: Availability of Funds in Absence of Program Incentives (n=26)*



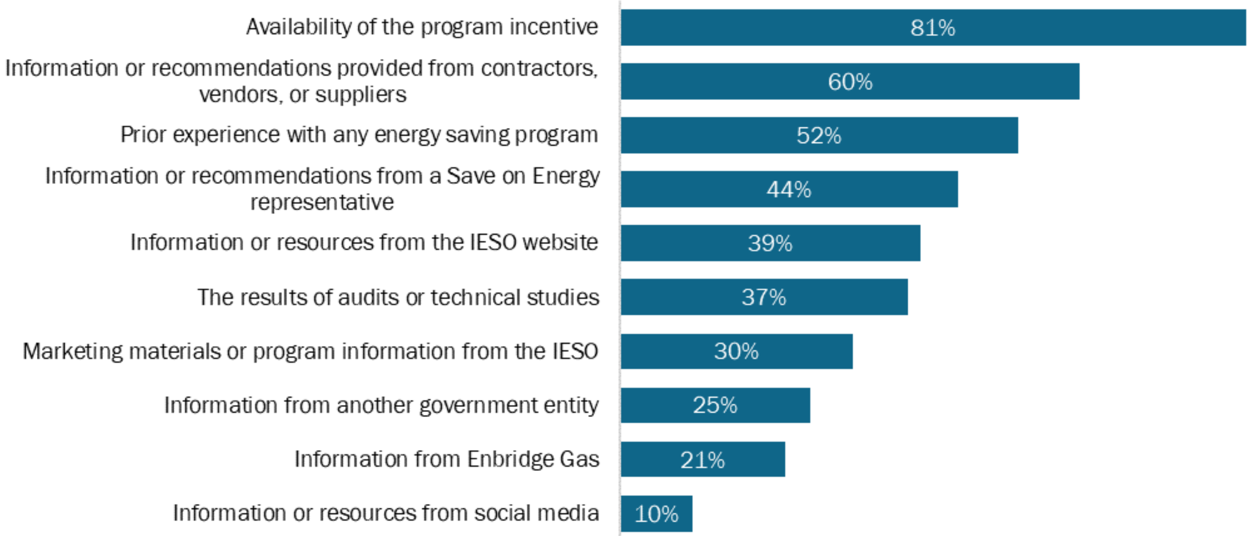
*Does not sum to 100% due to rounding.

The survey next asked respondents how influential various program features were on their decision to install energy-efficient equipment (Figure D-7 Participants rated the influence of each feature on a scale from one to five, where one meant it was "not at all influential" and five meant it was "extremely influential." Respondents gave the highest influence rating to the availability of incentives (81% with a rating of 4 or 5). Respondents gave the lowest influence rating to information or resources from social media (10% with a rating of 4 or 5). The evaluation team used this question, which focuses on the influence of the program, along with the prior questions about customer intentions to estimate the FR score.

The findings from this question emphasize the contractor, vendor, and supplier networks' strength in driving Retrofit Program engagement. Their interactions with customers are valuable on their own but more generally help familiarize customers with energy-saving programs and influence future participation beyond the Retrofit Program.

Figure D-7: Influence of Program Features on Participation (n=126)*

(Rating of 4 or 5 on a scale from 1 to 5)



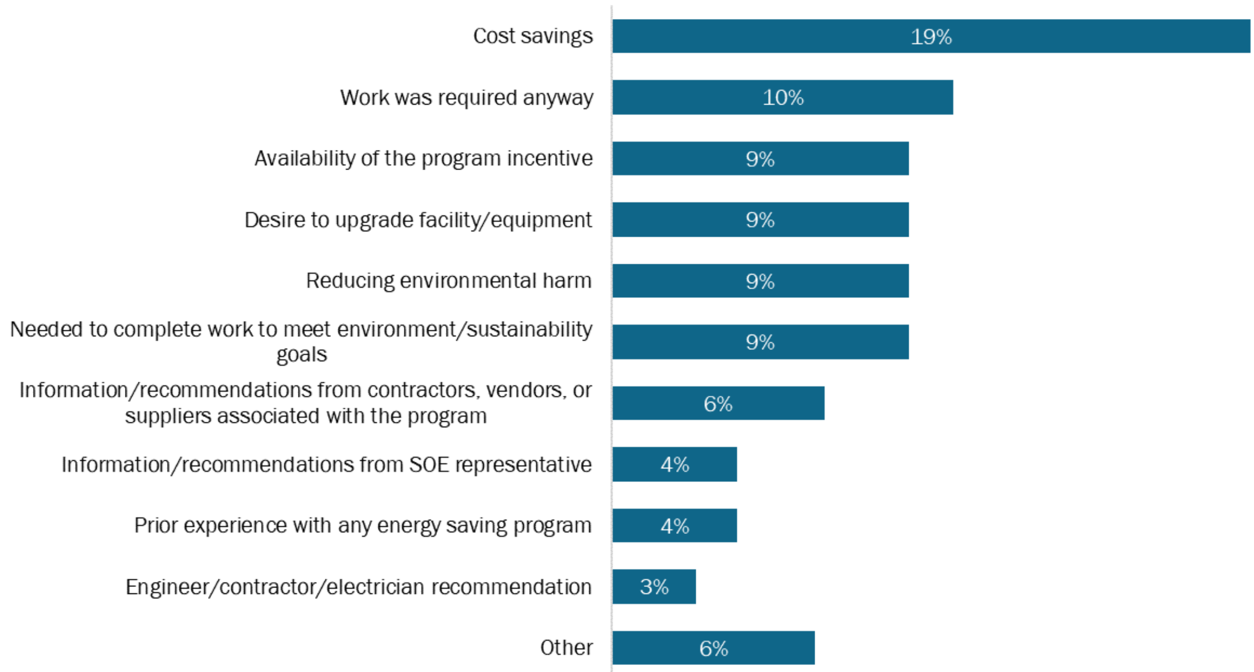
*Does not sum to 100% due to multiple response.

When respondents were asked whether any other factors played “a great role” in influencing their organization to install energy-efficient equipment, the answers varied widely (Figure D-8). Respondents most commonly indicated that cost savings influenced their decision (19%). The “other” responses included:

- Available capital
- Desire to improve comfort
- Information from another government entity
- Information from Enbridge Gas
- Results of audits/technical studies done through IESO

Figure D-8: Other Influential Factors on Upgrade Decision

(Open-ended and multiple responses allowed; n=79)*

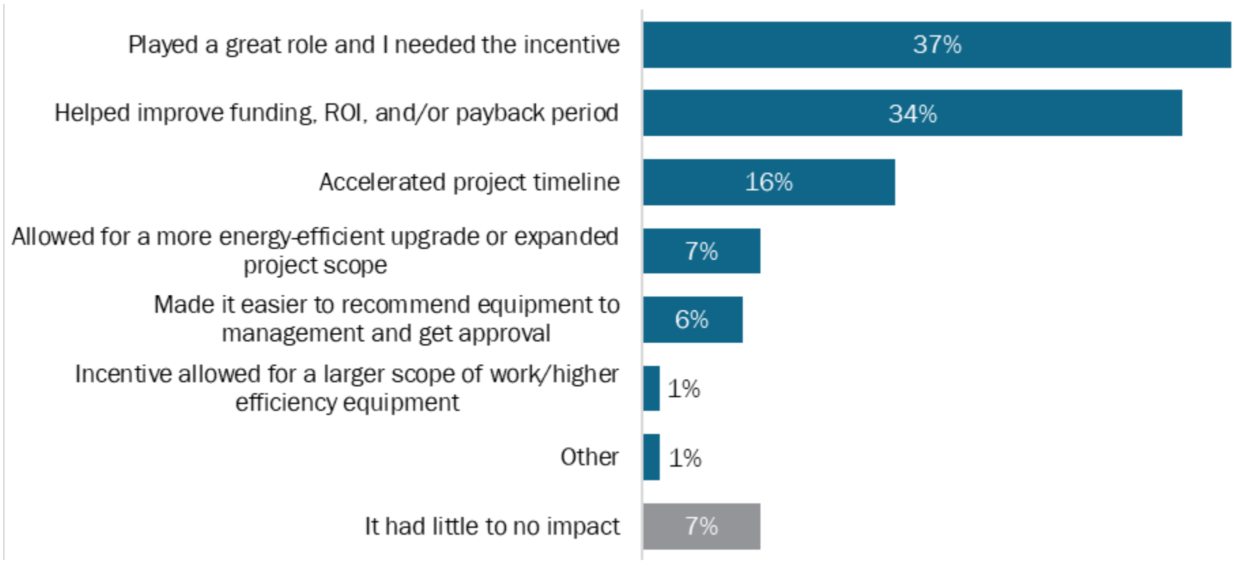


*Does not sum to 100% due to multiple responses.

The survey asked respondents to explain what impact, if any, the financial support or technical assistance they received from the program had on their decision to install the program incentivized equipment at the time that they did (Figure D-9). The most common responses were that the program played a great role and the respondent needed the incentive (37%) and the incentive helped improve funding, ROI, and/or payback period (34%).

Figure D-9: Program Impact on Decision to Install Equipment

(Open-ended and multiple responses allowed; n=95)*

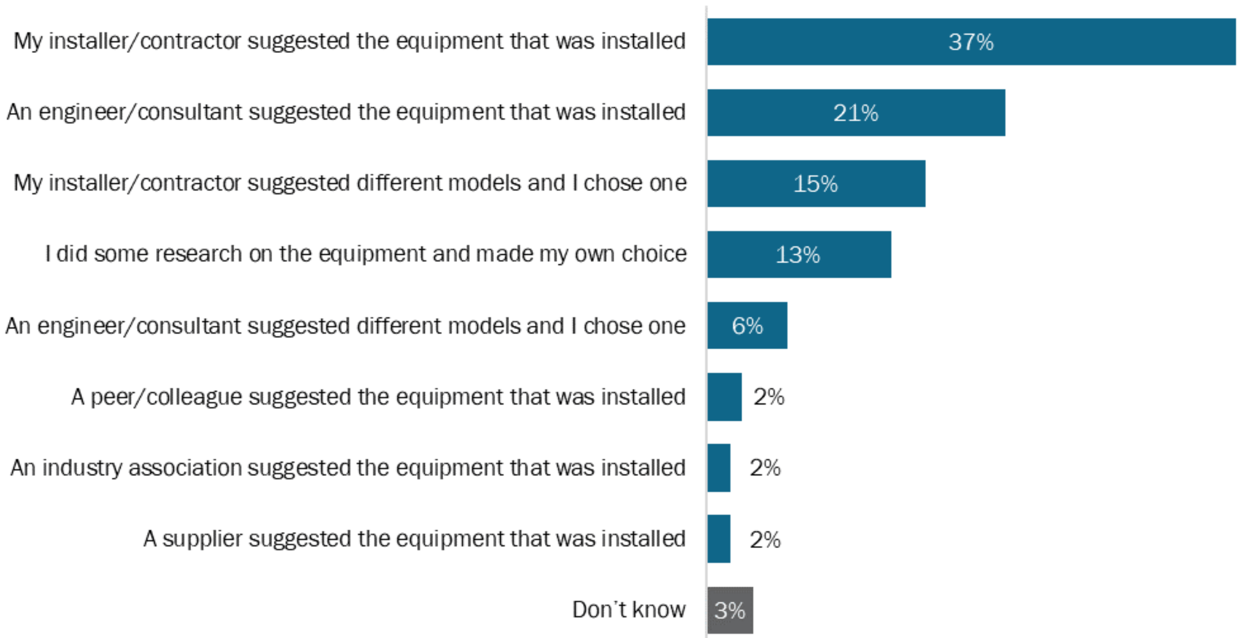


*Does not sum to 100% due to multiple responses.

The survey asked respondents how they selected equipment to install or upgrade (Figure D-10). Close to two-fifths (37%) of respondents selected equipment based on suggestions from an installer or contractor and over one-fifth (21%) of respondents selected equipment based on suggestions from an engineer or consultant. This indicates that contractors, engineers, and consultants serve an important role in helping customers make decisions about what equipment to install or upgrade.

Figure D-10: Equipment Selection Process

(Open-ended and multiple responses allowed; n=123)*



*Does not sum to 100% due to multiple responses.

Spillover (SO)

To estimate the SO rate, participants were asked if they installed any energy-efficient equipment for which they did not receive an incentive following their participation in the Retrofit Program. Over one-tenth (14%) reported installing new equipment.

Table D-1 displays the types of non-incentivized equipment installed by companies after their Retrofit project was completed. Respondents most commonly reported installing lighting (13 respondents), more than twice the number that mentioned any other equipment type.

Table D-1: Types of Upgrades Installed after Program Participation

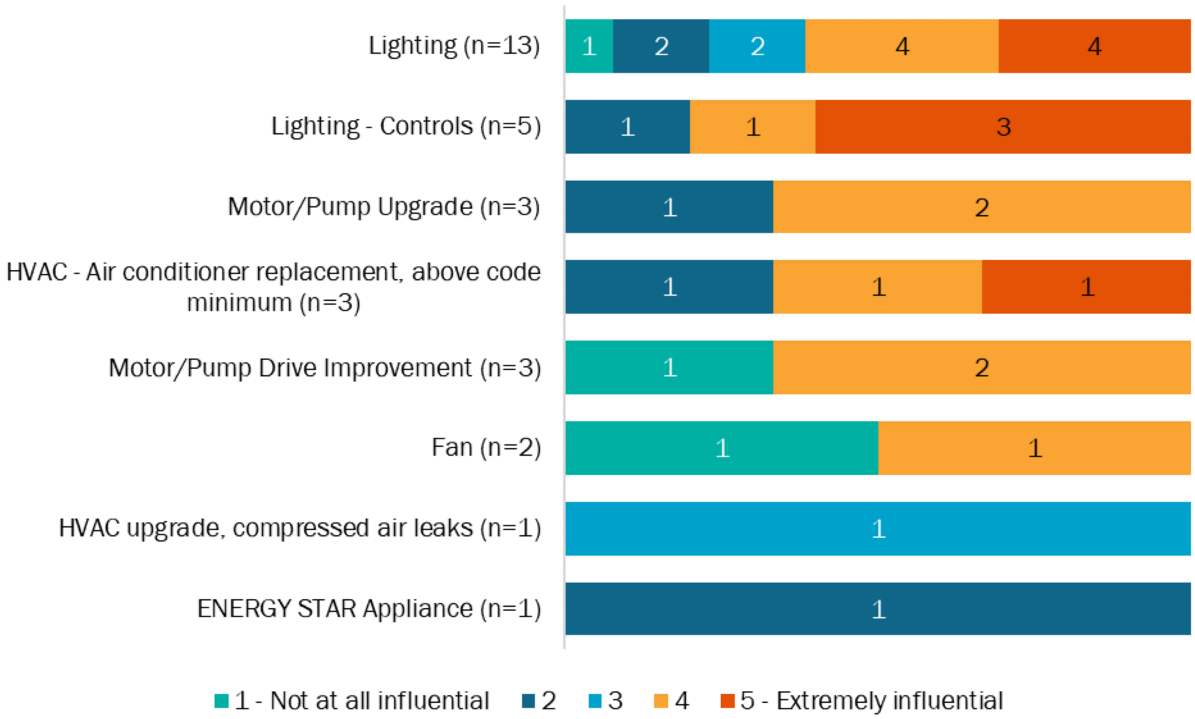
(Open-ended and multiple responses allowed; n=18)*

Upgrade	Respondents
Lighting	13
Lighting Controls	5
HVAC - Air conditioner replacement, above code minimum	3
Motor Pump Drive Improvement	3
Motor/Pump Upgrade	3
Fan	2
ENERGY STAR Appliance	1
HVAC, compressed air leaks	1

*Does not sum to 18 due to multiple responses.

The survey asked respondents what level of influence their prior participation in the Retrofit Program had on their decision to install this additional energy-efficient equipment. Respondents rated the influence of the program on a scale from one to five, where one meant the program was "not at all influential" and five meant the program was "extremely influential" (Figure D-11). Responses varied, with some respondents indicating the program was influential in their decision to install the additional energy-efficient equipment (ratings of 3.0 and above). Responses varied, with many respondents reporting the program was influential in their decision to install the additional energy-efficient equipment (ratings of 3.0 and above).

Figure D-11: Program Influence on Equipment Installed Outside the Program*



*May not sum to 100% due to rounding.

Participants who indicated they installed program-influenced non-incentivized equipment were then asked a series of follow-up questions (for example, capacity, efficiency, annual hours of operation). The results of these questions are displayed in Table D-2 through Table D-11 and were used within the NTG algorithm to attribute SO savings to each equipment installation. SO, savings were primarily driven by 85 motor/pump drive improvements.

Table D-2: Lighting Installed*
(Multiple responses allowed; n=10)

Spillover Lighting	Respondents	Quantity
LED linear or troffer	7	3,249
LED exterior	6	922
LED screw base	1	353

*Respondent count does not sum to 10 due to multiple responses.

Table D-3: LED Exterior Lighting Mounts (n=6)

Location	Respondents	Quantity
Pole mount	3	740
Against building	3	182

Table D-4: LED Linear Fixtures (n=7)

Respondents	Quantity
7	3,249

Table D-5: LED Screw Base Bulbs (n=1)

Wattage	Respondents	Quantity
< 10	1	353

Table D-6: Lighting Controls (n=4)

Control Type	Respondents
Occupancy Sensor	4

Table D-7: Motor/Pump Upgrades (n=2)

Motor/Pump End Use	Efficiency	Size (hp)	Respondents	Quantity
HVAC fan	Premium	15.1 – 30.0	1	83
HVAC Water Pump	Premium	5.1 – 15.0	1	2

Table D-8: Air Conditioners Installed

Size (tons)	Respondents	Quantity
Less than 5.4	1	80
5.4 – 11.40	1	4

Table D-9: Motor/Pump Drive Improvements (n=2)

Motor Improvement	Size (hp)	Respondents	Quantity
Variable speed drive	5.1 – 15.0	1	2
Variable speed drive	15.1 – 30.0	1	83

Table D-10: Fan Installed (n=1)

Diameter (ft)	Respondents	Quantity
3	1	19

Table D-11: HVAC Upgrade, Compressed Air Leaks (n=1)*

Respondents	Size (tons)	Efficiency	Hours of Use per Day	Quantity
1	Different sizes 5-20	High Efficiency	24	>10

*Other response written in by respondent.

Appendix E Job Impacts Methodology

This appendix provides a detailed breakdown of the Jobs Impact Evaluation methodology.

E.1 Developed Specific Research Questions

The first step in modelling the job impacts from the Retrofit program was to determine which specific research questions (RQs) the model would answer. In a scenario without the existence of the Retrofit program, customers receive electricity from the IESO and pay for it via the monthly billing process. Implementing the Retrofit program introduces a set of economic supply and demand shocks to different sectors of the economy. The four research questions below illustrate these shocks:

1) **What are the job impacts from new demand for EE measures and related program delivery services?** Funds collected for the Retrofit program generate demand for efficient equipment and appliances. They also generate demand for services related to program delivery, such as general overhead for program implementation and staffing. This demand creates jobs among firms that supply these products and services. Third-party implementers collect funds from the IESO to cover a portion of the project cost, while the participant covers the remainder of the costs.

2) **What are the job impacts from business reinvestments?** Once energy-efficient equipment is installed, the customers realize annual energy savings for the useful life of the measures. Businesses can choose to use this money to pay off debt, disburse it to shareholders as dividends, or reinvest it in the business. This additional money and the decision to save or spend have implications for additional job creation. For instance, additional business spending on goods and services generates demand that can create jobs in other sectors of the economy.

3) **What are the job impacts from funding the EE program?** IESO EE programs are funded via volumetric bill charges for all customers—both residential and non-residential. This additional charge can reduce the money that households have for savings and for spending on other goods and services, which results in a negative impact on jobs in the Canadian economy.

4) **What are the job impacts from reduced electricity production?** The energy-efficient measures will allow businesses to receive the same benefit while using less electricity. The program as a whole will reduce the demand for electricity in the commercial sector. This

reduced demand could have upstream impacts on the utility industry (for example, generation) and related industries, such as companies in the generator fuel supply chain.

E.2 Developed Model Inputs

The second step in modelling job impacts was gathering the data required for the StatCan IO model to answer each research question. Model input data included the dollar values of the exogenous shocks from program implementation. The sources of data for each research question were as follows:

1) Demand for EE measures and related program delivery services: The StatCan IO Model divides the Canadian economy into 240 industry classifications and 500 SUPCs. Each measure installed as part of the program was classified into one of the SUPCs. The dollar value for each product-related demand shock was calculated using the project cost and measure savings data from the impact evaluation (see Appendix F). Services that were part of the implementation process were also classified into SUPCs. These services were entirely program administrative services, the value of which was obtained from program budget actuals.

   It was necessary to specify the amount of each demand shock attributed to labour versus non-labour. For the product categories, we used a representative sample of invoices to estimate the average labour versus non-labour cost proportions. For the service categories, the IO model contained underlying estimates that defined the portion of labour versus overhead (non-labour).

2) Business energy bill savings: This value was calculated for the model as the net present value (NPV) of the discounted future stream of energy bill savings by participants. It was calculated by multiplying net energy savings (in kWh) in each future year by that future year's retail rate ($/kWh). This calculation was performed for each future year through the end of the measure's expected useful life (EUL). Savings beyond the EUL were assumed to be zero. Project-level net energy savings were obtained using results from the impact evaluation and already accounted for other calculation parameters (i.e. discount rate, measure EULs, and retail rate forecast).

   Customers' intentions for whether to reinvest, save, or distribute to owners/shareholders the money saved on energy bills were obtained via a short section on the participant surveys, as follows:

J1. *How do you anticipate your company will spend the money it saves on its electricity bill from the energy-efficient equipment upgrades?*

1. *Pay as dividends to shareholders or otherwise distribute to owners*
2. *Retain as savings*
3. *Reinvest in the company (labour/additional hiring, materials, equipment, reduce losses, etc.)*
4. *Split – Reinvest and pay as dividends/retain as savings*

96. Other, please specify:

98. Don't know

99. Refused

J2. Do you anticipate the distribution of these electricity bill savings to be treated differently than any other earnings?

1. *Yes – More distributed to shareholders/owners*
2. *Yes – More to savings*
3. *Yes – More to reinvestment*
4. *No*

98. Don't know

99. Refused

J3. Approximately what would be the split between distribution, retention, and reinvestment of money saved on electricity bills? [ALLOW MULTIPLE RESPONSE OPTION]

1. *Percent distribute [NUMERIC RESPONSE BETWEEN 0 AND 100]*
2. *Percent save/retain earnings [NUMERIC RESPONSE BETWEEN 0 AND 100]*
3. *Percent reinvest [NUMERIC RESPONSE BETWEEN 0 AND 100]*

For estimating job impacts, the key input value was the amount of bill savings that businesses would reinvest as opposed to paying down debt or redistributing to shareholders.

3) Retrofit funding: The IESO EE programs are funded by a volumetric charge on electricity bills, and, volumetrically, residential customers accounted for 35 percent of consumption and non-residential customers accounted for 65 percent in 2021. The overall program budget was distributed between these two customer classes by these percentages and used as input values for the analysis.

4) Reduced electricity production: The NPV of retail savings (estimated as part of RQ2) was also the input for examining the potential impact of producing less electricity.

E.3 Run Model and Interpret Results

Determining the total job impacts from the Retrofit program required considering possible impacts from each of the four shocks represented by the research questions. Addressing the four research questions above required three runs of the StatCan IO model, as certain components of the shocks could be consolidated, and others addressed without full runs of the model. The three shocks that were modelled were as follows:

1) Demand shock, as outlined in RQ1, representing the impact of the demand for EE products and services due to the Retrofit program.
2) Business Reinvestment shock representing the net amount of additional spending that the commercial sector would undertake as described in RQ2. This was estimated by taking the NPV of energy bill savings and subtracting the amount of project costs covered by participants.
3) Household Expenditure shock representing the portion of household funds that are captured by increased bill charges and thus acts as a negative shock on the economy (RQ3). This was estimated by taking the portion of program funding that is paid for by increases to residential electricity bills.

The model output generated three types of job impact estimates:

Direct Impacts

Jobs are created during the initial round of spending from the exogenous shocks. For the demand shock for EE products and services, direct impacts would be from first adding employees to install measures and handle administrative duties. For the business reinvestment shock, direct impacts could be internal jobs created by businesses reinvesting savings back into the company, or they could be jobs created by businesses buying additional goods and services with energy bill savings.

Indirect Impacts

Job impacts due to inter-industry purchases as firms respond to the new demands of the directly affected industries. These include jobs created up supply chains due to the demand created by the EE program – such as the manufacturing of goods or the supply of inputs.

Induced Impacts

Job impacts due to changes in the production of goods and services in response to consumer expenditures induced by households' incomes (i.e., wages) generated by the production of the direct and indirect requirements.

The IO model provides estimates for each type of job impact in the unit of *person-years* or a job for one person for one year. It further distinguishes between two types of job impacts:

> **Total number of jobs:** This covers both employee jobs and self-employed jobs (including persons working in a family business without pay). The total number of jobs includes full-time, part-time, temporary jobs and self-employed jobs. It does not take into account the number of hours worked per employee.
>
> **Full-time Equivalent (FTE) number of jobs:** This includes only employee jobs that are converted to full-time equivalence based on the overall average full-time hours worked in either the business or government sectors.

Model run results are presented in terms of the above job impact types (direct, indirect, and induced) and also the type of job (total jobs vs. FTEs). These results—along with the model input shock values—are presented and discussed at a high level in Section 6.2 and in additional detail in Appendix F.

Appendix F Detailed Job Impacts Inputs & Results

This section presents the detailed results of the job impact analysis, as summarized in Section F.1 Total Job Impacts by Type presents the total jobs impacts by type. As the fourth and fifth columns indicate, the analysis estimated that the Retrofit program would create 2,688 total jobs in Canada, with 2,370 jobs created in Ontario. Of the 2,688 estimated total jobs, 1,307 are direct jobs, 690 are indirect jobs, and another 692 are induced. In terms of FTEs, the numbers are slightly lower, with 1,956 FTEs created in Ontario and 2,218 FTEs created nationwide. Of these 2,218 FTEs, direct jobs account for 1,128 FTEs, 577 FTEs are indirect jobs and 513 FTEs are induced jobs. In total, the Retrofit Program created 97.8 jobs per million dollars of investment (i.e. program budget).

Table F-1: Total Job Impacts by Type

Job Impact	FTE	*(in person-years)*	Total Jobs	*(in person-years)*	Total Jobs per $1M Investment
Type	Ontario	Total	Ontario	Total	*(in person-years)*
Direct	1,082	1,128	1,256	1,307	47.5
Indirect	460	577	554	690	25.1
Induced	414	513	560	692	25.2
Total[1]	**1,956**	**2,218**	**2,370**	**2,689**	**97.8**

Section F.1 details the values of the inputs used in the model runs. Section F.2 presents the analysis results, including the details of job impacts and assumptions.

F.1 Model Inputs

The model was used to estimate the impacts of three economic shocks:

- The demand shock, representing the demand for energy-efficient products and services from Retrofit
- The business reinvestment shock, representing the increased business reinvestment due to bill savings (and net of project funding)
- The household expenditure shock, representing decreases in household spending on goods and services due to increases in the residential portion of program funding.

Table F-2 below displays the input values for the demand shock representing the products and services related to Retrofit. Each measure installed as part of the program was categorized according to the StatCan IO Supply and Use Product Classifications (SUPCs).

The first fifteen rows of Table F-2 contain the categories corresponding to products, which were the measures installed in businesses. The last row contains the services. Lighting fixtures had the highest total cost of the two product categories and accounted for $83.6 million of the overall program cost. The second largest product category, Electric light bulbs and tubes, had $67.7 million in total costs. Each measure's cost was divided into labour and non-labour, as the IO Model required this distinction to determine direct versus indirect impacts. The labour costs were determined by examining a random sample of invoices from the program. The analysis used a sample size of 122 invoices that specified the portion of the project cost for labour versus materials. Labour percentages were calculated and applied by measure type and based on when the project was completed in the year. Of the 122 invoices examined, the weighted average labour percentage for these projects was 34%. Thus, the demand shock for each SUPC was assumed to be 34% labour and 66% non-labour.

The single service category in the table, Office administrative services, included general overhead and administrative services associated with program delivery. The labour and non-labour amounts are not specified for this category, as the IO Model has built-in assumptions for this category.

Table F-2: Summary of Input Values for Demand Shock

Category Description	Non-Labour	Labour	Total Demand Shock
	($ Thousands)		
Lighting fixtures	19,917	11,339	31,256
Electric light bulbs and tubes	17,246	9,931	27,177
Heating and cooling equipment (except household refrigerators and freezers)	14,936	8,042	22,978
Switchgear, switchboards, relays and industrial control apparatus	9,877	5,363	15,239
Industrial and commercial fans, blowers and air purification equipment	8,143	4,385	12,527
Pumps and compressors (except fluid power)	7,088	3,817	10,905
Electric motors and generators	2,919	1,572	4,491
Glass (including automotive), glass products and glass containers	2,305	1,241	3,546
Metalworking machinery and industrial moulds	792	427	1,219
Other industry-specific machinery	660	356	1,016
Other miscellaneous manufactured products	436	235	671
Measuring, control and scientific instruments	380	206	586
Other commercial buildings	145	78	224

Electric power engineering construction	61	33	95
Other professional, technical and scientific services	4	2	7
Subtotal	**84,910**	**47,025**	**131,935**
Office Administrative Services	-	-	6,636
Total			**138,571**

The second shock modelled by the IO Model was the business reinvestment shock. This shock represented the amount that businesses would reinvest and thus inject back into the economy. The net amount that businesses have available to either reinvest, pay off debt, or distribute to owners/shareholders ($350.5 million) was the net of electricity bill savings (NPV = $461.6 million), and the portion of project costs not covered by incentives ($111.1 million). The portion of this $350.5 million that was to be reinvested was estimated using the surveys administered to participants as part of the Retrofit Process Evaluation. The surveys included several questions about what businesses would do with the money they saved on their electricity bills and the type of business. Overall, respondents indicated that 73% of bill savings would be reinvested ($256.1 million). The remaining savings would either be used to pay off debt or disbursed to owners/shareholders.

To properly model the effects of the business reinvestment shock, the IO Model required the reinvestment estimates by industry. Each industrial category has a production function in the model, and these functions were adjusted to account for the reinvestment shock. Table F-3 presents the input values for the business reinvestment shock by industry. The total business expenditure shock would be $308.7 million over 36 industries, as shown in the table.

Table F-3: Summary of Input Values for Business Reinvestment Shock

Category Description	Business Reinvestment Shock *($ Thousands)*
Other	41,380
Crop and animal production	23,842
Retail trade	21,126
Educational services	20,254
Health care and social assistance	15,235
Non-profit institutions serving households	13,581
Primary and fabricated metal	13,257
Other municipal government services	12,106
Automotive and transportation	11,692
Chemical, soap, plastic, rubber, and non-metallic minerals	10,954
Transportation and warehousing	10,954
Arts, entertainment and recreation	8,562

Accommodation and food services	4,695
Furniture, cabinet, and fixtures	4,695
Government education services	4,695
Machinery	4,695
Wholesale trade	4,695
Non-residential building construction	4,281
Repair, maintenance and operating and office supplies	4,281
Other services (except public administration)	3,130
Textile and clothing	3,130
Crop, animal, food, and beverage	2,716
Utilities	2,716
Computer and electrical	1,565
Finance, insurance, real estate, rental and leasing and holding companies	1,565
Forestry and logging	1,565
Government health services	1,565
Owner occupied dwellings	1,565
Repair construction	1,565
Total	**256,063**

The third model input is the household expenditure shock.[6] This shock represents the incremental increase in electricity bills to the residential sector from funding the program. The assumption is that the IESO programs are funded by all customers in proportion to the overall consumption of electricity. Thus, the residential funding portion was 35% of the $20.1M program budget or $7.3M.

F.2 Results

The StatCan IO Model generated results based on the input values detailed in Section F.1 and Section F.2. Table F-4 presents the results of the model run for the demand shock for products and services. This shock accounts for over half of all job impacts. As the two right columns show, the model estimated that the demand shock will result in the creation of 1,084 total jobs (measured in person-years) in Canada, of which 985 will be in Ontario. Of the 1,084 jobs, 536 were direct, 245 indirect and 302 induced. In terms of FTEs the numbers are slightly lower; 803 FTEs were estimated to be created in Ontario and 884 in total across Canada. Of those 884 FTEs, 446 were direct, 215 indirect and 224 induced. Direct jobs impacts were realized exclusively in Ontario, as shown in the table. As we move to indirect and induced jobs, impacts are dispersed outside of the province.

[6] The model is actually run with a normalized value of $1 million in extra household expenditures, and the job results can be scaled by the actual demand shock.

Table F-4: Job Impacts from Demand Shock

Job Impact Type	FTE (in person-years)		Total Jobs (in person-years)	
	Ontario	Total	Ontario	Total
Direct	446	446	536	536
Indirect	170	215	196	245
Induced	186	224	253	302
Total	**803**	**884**	**985**	**1,084**

Table F-5 shows the results of the model run for the business reinvestment shock. Job impacts generated by business investment were equal to 712 direct total FTEs and 811 direct total jobs. Overall, business investments were responsible for 1,387 FTEs and 1,677 total jobs across Canada. Unlike previous years, impacts from the reinvestment shock were larger than impacts from the demand shock. This is reflective of the increased amount of money reinvested relative to each dollar spent by customers in the demand shock. In PY21, customers reinvested $1.58 for every dollar they spent to purchase goods and services. In PY22, customers reinvested $2.31 for every dollar spent. This increase is what drove the larger reinvestment impacts, and may shift back in future years depending on the level of reinvestment relative to participant portion the demand shock.

Table F-5: Job Impacts from Business Reinvestment Shock

Job Impact Type	FTE (in person-years)		Total Jobs (in person-years)	
	Ontario	Total	Ontario	Total
Direct	663	712	757	811
Indirect	301	377	372	463
Induced	235	299	317	403
Total	**1,199**	**1,387**	**1,447**	**1,677**

The third shock was the reduction in household spending from the increase in electricity bills to fund the program._Table F-6 presents the job impacts from the model run. It represents the number of jobs attributed to reduced household spending; this amount could have been spent in other sectors of the economy but was instead spent on funding the Retrofit program. The model estimated a reduction of 53 FTEs and 72 total jobs across Canada due to the decreased household spending.

Table F-6: Job Impacts from Residential Funding Shock

Job Impact Type	FTE (in person-years)		Total Jobs (in person-years)	
	Ontario	Total	Ontario	Total
Direct	27	29	38	40
Indirect	11	14	15	19
Induced	7	10	10	13
Total	**46**	**53**	**62**	**72**

The non-residential sector also contributes to program funding. The StatCan IO Model does not adjust production functions for all industries experiencing marginally higher electricity price changes, so this portion of the shock would be modeled by assuming that surplus would be reduced by the extra amount spent on electricity. The model captures energy bill increases from program funding as an impact on direct GDP (value-added) and not as a reduction in employment. The GDP impact is equivalent to the profit loss resulting from the increase in electricity bills from program funding.

The economic impact of the reduction of electricity production as a result of the increase in energy efficiency was another potential economic shock. Technically speaking, it can be estimated using StatCan Input-Output multipliers without running the model. However, the IO model is linear, and not well suited to model small decreases in electricity production. Total electricity demand has been increasing over time and is projected to continue increasing[7]. The relatively small decrease in overall consumption attributed to Retrofit program savings may work to slow the rate of consumption growth over time, but would likely not result in actual job losses in the utility industry or upstream suppliers. The linearity of the IO model means that it will provide estimates regardless of the size of the impact. Given the nature of electricity production, it is reasonable to conclude that the linear IO multiplier is not appropriate for estimating job impacts. This analysis assumes that job losses from decreased electricity production are negligible.

Table F-7 shows the total estimated job impacts by type, calculated by combining the jobs estimated Table F-7, Table F-8, and Table F-9. Of the 1,307 estimated total direct jobs, 1,256 were in Ontario. A slightly smaller proportion of the indirect and induced jobs were in Ontario; 554 out of 690 indirect jobs and 560 out of 692 induced jobs were estimated to be created within the province. The FTE estimates were slightly lower overall than the total jobs, with a total of 1,956 FTEs (of all types) created in Ontario and 2,218 FTEs added nationwide. The majority of all direct FTEs (1,082 of 1,128) were added in Ontario, with this number representing approximately 55% of the total FTEs added in Ontario and 49% of all FTEs created across Canada. In 2022, each $1M of program spend resulted in the creation of 97.8 total jobs compared to 93.3 jobs per $1M in 2021. The primary driver of the additional jobs created is the twofold. Firstly, demand and reinvestment shocks remained relatively consistent from year to year. Additionally, program budget in PY22 was about 60% of the budget in PY21. Due to these two factors, the amount of program budget spent relative to each job created was stayed more or less the same ($10,683 in PY21 vs. $10,229 in PY22) and as a result jobs impacts per $1M of program spend stayed relatively flat compared to last year.

[7] Annual Planning Outlook – A view of Ontario's electricity system needs; 2022. IESO.

Table F-7: Total Job Impacts by Type

Job Impact	FTE	*(in person-years)*	Total Jobs	*(in person-years)*	Total Jobs per $1M Investment
Type	Ontario	Total	Ontario	Total	*(in person-years)*
Direct	1,082	1,128	1,256	1,307	47.5
Indirect	460	577	554	690	25.1
Induced	414	513	560	692	25.2
Total[1]	**1,956**	**2,218**	**2,370**	**2,689**	**97.8**

The model does not provide year-by-year results for job impacts, but we are able to make some estimates about the temporal nature of the impacts. Table F-8 shows the total jobs created due to program activities and energy savings in the first year versus from after the first year. The table assumes that "first year activities" are the initial demand shock for EE products and services, the program funding shock, and the first year energy savings (resulting in bill savings and reinvestment). Job impacts after the first year are due to energy savings over the course of the measures' EULs. Job impacts from first year activities make up roughly 7% of the total, with 197 out of the total of 2,688 person-years. 123 of these person-years come from first year energy savings. The remaining 2,565 total job-years are due to energy savings after the first year—and the reinvestment generated by the bill savings.

Table F-8: Job Impacts from First Year Shocks

Job Impact	Total Jobs *(in person-years)*		
Type	From First Year Activities	From Bill Savings After First Year	Total
Direct	96	1,211	1,307
Indirect	50	639	690
Induced	51	642	692
Total[1]	**197**	**2,492**	**2,688**

[1] Columns may not add to totals due to rounding. Real values are rounded to the nearest whole number and the whole numbers do not sum exactly to the whole number total in every column.

Table F-9 shows the job impacts in more detail, with jobs added by type and industry category. Industries are sorted from top to bottom by those with the most impacts to the least, with industries that showed no impacts not included in the table. The table shows that the industry with the largest job impacts was Administrative and support, waste management and remediation services, which added 632 jobs. This category is large and non-specific, and reflects the need to hire individuals to fill a large range of roles based on program need (e.g. office administration, call centre operations, program management, etc.). Retail trade and Non-residential building construction were the industries with the next most added jobs, gaining 285 and 252 jobs respectively.

Table F-9: Job Impacts by Industry

Output Industry Category	*FTE (in person-years)*		*Total Jobs (in person-years)*	
	Ontario	Total	Ontario	Total
Administrative and support, waste management and remediation services	502.7	515.2	614.7	632.3
Retail trade	191.6	210.0	260.6	285.2
Non-residential building construction	218.3	218.3	252.4	252.4
Manufacturing	164.6	233.5	170.4	242.8
Wholesale trade	177.7	209.8	182.9	216.5
Professional, scientific and technical services	135.9	163.6	171.7	206.7
Finance, insurance, real estate, rental and leasing and holding companies	99.0	117.0	121.7	144.0
Accommodation and food services	51.8	68.7	79.1	103.8
Transportation and warehousing	65.7	84.6	77.8	100.1
Government education services	66.9	68.4	80.4	82.2
Information and cultural industries	37.9	52.9	43.4	61.0
Other services (except public administration)	32.6	40.0	47.2	57.9
Engineering construction	56.1	56.1	57.2	57.2
Health care and social assistance	23.4	25.8	37.2	41.5
Residential building construction	22.7	22.7	31.1	31.1
Repair construction	23.1	25.9	27.2	30.5
Arts, entertainment and recreation	10.0	13.1	18.9	24.8
Other federal government services	16.9	17.3	18.1	18.6
Educational services	6.8	7.6	16.1	18.0
Non-profit institutions serving households	11.6	13.3	14.9	17.1
Other municipal government services	13.1	14.8	13.9	15.8
Crop and animal production	5.0	8.4	8.8	15.7
Utilities	8.6	9.9	8.8	10.3
Government health services	6.3	7.6	7.0	8.4
Mining, quarrying, and oil and gas extraction	3.9	7.9	3.6	7.3
Other provincial and territorial government services	2.2	2.9	2.2	3.0
Support activities for agriculture and forestry	0.5	1.1	0.7	1.4

Output Industry Category	*FTE (in person-years)*		*Total Jobs (in person-years)*	
	Ontario	Total	Ontario	Total
Other activities of the construction industry	0.5	0.6	1.1	1.4
Forestry and logging	0.4	1.0	0.4	1.1
Fishing, hunting and trapping	0.0	0.3	0.1	0.4
Total[1]	**1,956**	**2,218**	**2,370**	**2,688**

[1] Columns may not add to totals due to rounding. Real values are rounded to the nearest whole number and the whole numbers do not sum exactly to the whole number total in every column. Values presented in this table are rounded to the nearest 0.1 to better show the distribution of small jobs impacts.

The Retrofit Contractor and Applicant Representative survey responses support the results of the model showing positive job impacts. The survey instrument contained questions for contractors and applicant representatives related to the impact of the Retrofit program on their firms and employment levels. Two questions in particular were informative to understand the nature of the impacts to respondents, which would be considered direct impacts. These two questions are below, with relevant illustrative verbatim responses below:

1) Did the 2022 program help or hinder the growth of your business in any way? If so, please explain how:

   The program helped the growth of my business in the following ways:

   - *"Helped with the ROI."*
   - *"We are slowly doing more lighting/energy efficiency upgrades."*
   - *"Increase in clients."*
   - *"[A] major part of our success in winning business was the programs and us doing the application work for our customers."*
   - *"Increased sales and profit, as I added value to the customers."*

   The program hindered the growth of my business in the following ways:

   - *"Not as many RTUs were being replaced as the $ value declined."*
   - *"Withdrawing the outside lighting and RTU incentives."*

2) Did the 2022 program have an impact on the number of people you hired in the last year? Yes, the program impacted the number of people hired in the last year in the following ways:

   Positive Impacts:

   - *"One site manager was hired."*
   - *"We received more projects which led to 2 full time and 1 part time employee being brought on board."*

Negative Impacts:

- *No negative impacts provided by respondents this year*

Respondents indicated that the program generally resulted in slight increases in staffing overall. Participants stated that the program added value to projects and drove an increase in customers engaging with contractors. Respondents indicated that greater value added to the customer also resulted in more business and larger profits. Contractor verbatims further support the direct job gains estimated by the model, with respondents indicating that additional staff members had been hired as a result of the Retrofit program. No respondents indicated a decrease in employment or hiring due to program activities this year. In general, responses reveal the potential for beneficial impacts the program can have on firms. Respondents that indicated a negative effect on their business primarily stated that that changes to the program – specifically the reduction of incentives for RTUs and lighting measures –played a role in the negative effects felt by their businesses. These could be examined further if parts of the program were to be redesigned in order to enhance job impacts.

Input-Output models are informative for understanding the potential magnitudes and dynamics of economic shocks created by policies and programs. While useful, the StatCan IO Model is a simplified representation of the Canadian economy and thus has limitations. The model is based on the assumption of fixed technological coefficients. It does not take into account economies of scale, constraint capabilities, technological change, externalities, or price changes. This makes analyses less accurate for long term and large impacts, where firms would adjust their production technology and the IO technological coefficients would become outdated. Assuming that firms adjust their production technology over time to become more efficient implies that the impact of a change in the final demand will tend to be overestimated. For household consumption, the model is based on the assumptions of constant consumption behaviour and fixed expenditure shares relative to incomes.