Interim Framework Retrofit PY2021 Evaluation Results

Submitted to IESO

in partnership with NMR Group

Date: 09.20.2022

Principal authors:

Resource Innovations – Henri van Rensburg, Ron Shaw, Bashar Alhayek

NMR Group – Joanne O'Donnell, Kiersten von Trapp, Christine Smaglia, Julian Ricardo, Eugene McGowan

Resource Innovations

TD Canada Trust Tower

161 Bay Street, 27th Floor

M5J 2S1 Toronto, Canada

416.572.2433

resource-innovations.com

Contents

Acknowledgements

The evaluation team would like to thank Jessei Kanagarajan, Alice Herrera, 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.

The evaluation team would also like to thank all the IESO program staff, program delivery vendors, applicant representatives, and contractors that the evaluation team interviewed or surveyed. Their insights have been invaluable to the evaluation team's efforts to improve the Conservation Programs.

Finally, 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
CDM-IS	Content data management information system
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
P1	Evaluation Period 1 (January through June)
P2	Evaluation Period 2 (July through December)
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 impact and process evaluations of the Interim Framework (IF) Retrofit Program. The IF operated from 2019 through 2021 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 a high-level overview of the impact and process evaluation results, key findings and recommendations for the IF Retrofit Program during the January 1 through December 31, 2021 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 the goals and objectives of the PY2021 evaluation of the IF Retrofit Program:

- Conduct audits of completed projects to verify equipment installation and evaluate operating parameters through desk reviews and site visits.
- Verify energy and summer peak demand savings with a high degree of confidence and precision.
- Assess free-ridership (FR) and participant spillover (SO) to determine an appropriate net-to-gross (NTG) ratio.
- Conduct cost-effectiveness and greenhouse gas quantification analyses using IESO's CE tool.
- Conduct a job impact evaluation to quantify the jobs created by the IF Retrofit program in PY2021.
- Provide recommendations on program improvements based on feedback obtained through the evaluations.

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 PY2021. During the evaluation

period, 4,421 evaluation projects were completed across Ontario. The net verified impact results of the PY2021 Retrofit Program are presented in Table 1-1.

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)	439,095.9	104.8%	460,167.5	78.4%	360,855.8	360,855.8
Summer Peak Demand (MW)	63.4	105.7%	67.0	78.6%	52.7	52.7

1.4. Key Findings and Recommendations

Below is a list of the key findings and recommendations. A full list of the impact and process evaluations findings and recommendations along with additional detail is provided in Section 8.

Finding 1: IESO deemed hours of use (HOU) for some lighting end-uses fall outside the verified HOU range. Upon reviewing all sampled prescriptive lighting projects, verified HOU seem to be inconsistent with the IESO MAL deemed HOU for some end-uses. Specifically, general end-uses, such as "Lighting – General," "Lighting – Other (all measures)," and "Lighting – Other Commercial buildings," which allow for selection by a wide range of facilities. These end-uses have the highest impact on the realization rate.

- **Recommendation 1***:* Considering that the IF is ending and the IESO has launched the 2021-2024 CDM Retrofit program, it is recommended, where applicable, to review and update the 2021-2024 MAL measures HOU for end-uses that fall outside the verification HOU range. End-uses that fell outside the verified HOU range and had a strong impact on the program realization rate include "Lighting – General," "Lighting – Other (all measures)," and "Lighting – Other Commercial buildings." The evaluation HOU verification analyses of these end-uses have achieved precision below 10%.

Finding 2: Participation in the Prescriptive Non-Lighting track remains low. The prescriptive non-lighting track comprised 1.9% of the total net verified energy savings in 2021. The same track comprised 4% of the program's net verified savings in 2020.

- **Recommendation 2***:* Continue to increase the promotion and marketing of the prescriptive non-lighting track through the service providers and applicant representatives. It is also recommended to review and consider increasing the incentive levels for measures in the prescriptive non-lighting track. This is particularly important as the Retrofit program shifts to a prescriptive-only design.

Finding 3: IESO deemed baseline wattages for some prescriptive lighting measures fall outside the verified baseline wattages. Upon reviewing all sampled prescriptive lighting projects,

verified baseline wattages for some measures seem inconsistent with the IESO MAL deemed baseline wattages.

- **Recommendation 3*:*** While the verified baseline wattages closely align with the IESO MAL assumptions, some measures fall outside the verified range. Reviewing and updating MAL baseline assumption for measures that fall outside the verified range is recommended. Additional information regarding the verified and deemed baseline assumptions is included in the evaluation report. Measures that fell outside the verification range include “Three-lamp Std. T8 fixtures (4' 32W)”, “100 - 175W MH/HPS”, and “Ubend 32W- 2 lamp T8.”

Finding 4: A desire for additional training exists among applicant representatives and contractors. The most-requested training and education topics mentioned by applicant representatives and contractors were program rules and application process (34%), direction on receiving application support (34%), and program offerings (33%). The IESO program staff and delivery vendor staff indicated that the training webinars about program processes and changes were well-received by attendees, which included applicant representatives, contractors, and customers.

- **Recommendation 4:** Ensure that training covers topics of most interest to the applicant representatives and contractors and provides them with the knowledge they need to effectively support the program. Key training topics to consider include the program rules and application process, direction on receiving application support, and program offerings.

2. Introduction

This report summarizes the evaluation results of the Retrofit Program and includes projects that were completed and reported to the IESO during PY2021. 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. The program evaluation of PY2021 was split into two evaluation cycles consisting of Period 1 (P1) from January through June and Period 2 (P2) from July through December. During each 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 eight independent evaluations. Process evaluation tasks, such as in-depth interviews with the IESO program staff and implementation vendors and surveys with applicant representatives and contractors, were conducted once across the two evaluation periods.

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 Retrofit Program Requirements, found on the Save on Energy website, provides criteria for eligible participants, facilities, and projects. The program offers 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 PY2021 evaluation of the Retrofit Program:

- Conduct audits of completed projects to verify equipment installation and evaluate operating parameters through desk reviews and site visits.
- Verify energy and summer peak demand savings with a high degree of confidence and precision.
- Assess free-ridership (FR) and participant spillover (SO) to determine an appropriate net-to-gross (NTG) ratio.

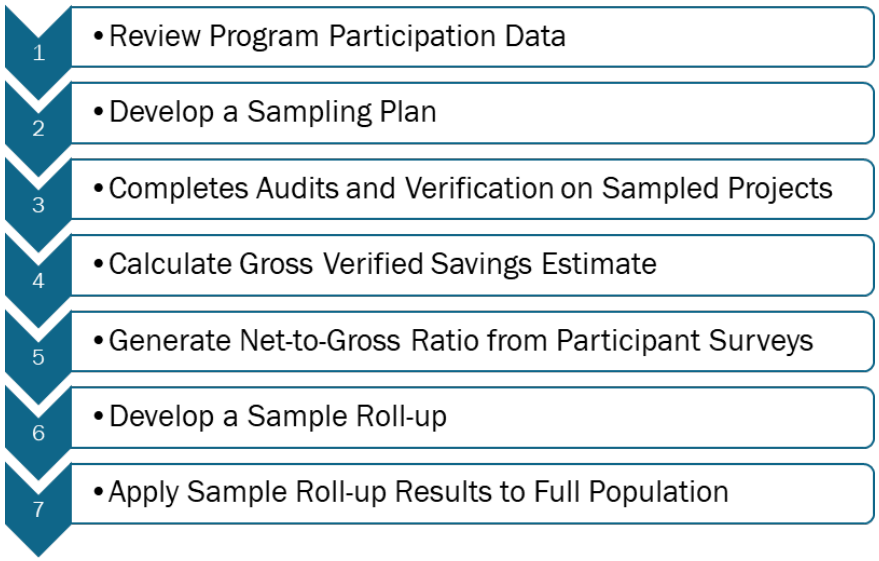
- Conduct cost-effectiveness and greenhouse gas quantification analyses using IESO's CE tool.
- Conduct a job impact evaluation to quantify the jobs created by the Retrofit program in PY2021.
- Provide recommendations on program improvements based on feedback obtained through the evaluations.

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 and Appendix B.

Figure 3-1:Impact Evaluation Methodology



3.2. Process Evaluation Methodology

The process evaluation focused on program design and delivery. Program processes were assessed through interviews and surveys with relevant program actors, including the IESO program staff, program delivery vendor staff, applicant representatives, contractors, and participants. For each respondent type, a customized interview guide or survey instrument was developed to ensure 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 or interviews, the total number of completed surveys, and the sampling error at the 90% confidence level for each respondent type. The following subsections provide context regarding each surveyed group. Additional detail regarding the process evaluation methodology can be found in Appendix C.

Table 3-1: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Population	Completed	Response Rate	90% CI Error Margin
IESO Program Staff	Phone In-depth Interviews (IDIs)	3	3	100%	-
Program Delivery Vendor Staff	Phone IDIs	3	3	100%	-
Applicant Representatives and Contractors	Web Survey	545	68	12%	9.4%
Participants	Web and Phone Survey	2 ,087	413[1]	20%	3.6%

[1] The NTG evaluation included 16 more respondents (n=429) than the process evaluation (n=413) because 16 respondents did not fully answer the process evaluation survey questions.

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 PY2021. The evaluation of PY2021 was split into two separate evaluation cycles: projects post-approved and funded from January 1st to June 30th, 2021 (P1), and projects post-approved and funded from July 1st to December 31st, 2021 (P2). The impact evaluation section presents the combined results from both P1 and P2 evaluation cycles across the full province of Ontario.

4.1. Project Participation and Sampling

The evaluation sample for PY2021-P1 was drawn from the list of post-approved and paid projects between January 1st and June 30th, 2021. In contrast, the PY2021-P2 evaluation sample was generated from a list of post-approved and paid projects between July 1st and December 31st, 2021, and then merged with the PY2021-P1 sample to create a rolling sample. As a result, the evaluation increased the number of projects used in the roll-up, leading to higher precision and less uncertainty in the evaluated results. A rolling sample of 328 projects was achieved by adding the P2 impact evaluation sample of 190 projects with the P1 sample of 138 evaluated projects.

Confidence and precision levels of 90% and 10% were achieved for the PY2021 evaluation. Table 4-1 presents the sample and project counts for the evaluation of the PY2021-P1 and P2 cycles.

Table 4-1: PY2021 Project and Sample Counts

Track/Type	P1 Sample	P2 Sample	Rolling Sample	P1 Project Count	P2 Project Count	Total Project Count
Prescriptive Lighting	83	116	199	1,495	734	2,229
Prescriptive Non-lighting	7	14	21	78	47	125
Custom Lighting	34	37	71	987	541	1,528
Custom Non-lighting	14	23	37	301	238	539
Total	138	190	328	2,861	1,560	4,421

4.2. Impact Evaluation Results and Findings

The P1 and P2 energy and summer peak demand sample realization rates are presented in Table 4-2. Interactive effect[2]and baseline shift adjustment[3] factors have been considered for applicable lighting measures.

Table 4-2: P2021 Samples Realization Rates

Measurement	Realization Rate
PY2021-P1	
Energy	105.5%
Summer Peak Demand	109.5%
PY2021-P2	
Energy	104.0%
Summer Peak Demand	101.0%
PY2021 Total	
Energy	104.8%
Summer Peak Demand	105.7%

During PY2021, the IF Retrofit program generated 360.9 GWh first-year net verified energy savings and 52.7 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.

Table 4-3 and Table 4-4 present the province-wide results of the PY2021 Retrofit program impact evaluation. Baseline shift adjustment factors have been considered for applicable lighting measures. PY2019 through PY2021 IF Retrofit net impact results, including the PY2019 true-up projects, are also provided in Table 4-5 for comparison.

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

[3] Includes savings adjustments recommended by the Lighting Baseline Study. *IESO Business Programs: Lighting Baseline Shift Study*, April 30th, 2018

Table 4-3: 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	89,976.0	106.1%[4, 5]	95,448.1	78.4%	75,401.8	75,401.8
Prescriptive	Non-Lighting	8,502.0	102.3%	8,701.7	78.4%	6,824.9	6,824.9
Custom	Lighting	205,082.3	105.2%[4]	215,837.1	78.4%	169,521.8	169,521.8
Custom	Non-Lighting	135,535.6	103.4%	140,180.6	78.4%	109,107.3	109,107.3
Total		439,095.9	104.8%	460,167.5	78.4%	360,855.8	360,855.8

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

[5] Includes savings adjustments recommended by the Lighting Baseline Study. *IESO Business Programs: Lighting Baseline Shift Study*, April 30th, 2018

Table 4-4: 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	13.8	109.5%[2, 3]	15.1	78.6%	11.9	11.9
Prescriptive	Non-Lighting	1.5	93.4%	1.4	78.6%	1.1	1.1
Custom	Lighting	33.7	108.9%[4]	36.7	78.6%	28.9	28.9
Custom	Non-Lighting	14.4	95.8%	13.8	78.6%	10.8	10.8
Total		63.4	105.7%	67.0	78.6%	52.7	52.7

Table 4-5: 2019-2021 IF Retrofit Net Results Comparison

Measurement	Metric	2019	2020	2021
Project Count		937	3,157	4,421
Energy	Gross Reported Savings (MWh)	45,431	210,152	439,095.9
Energy	Realization Rate	118.5%	107.9%	104.8%
Energy	Gross Verified Savings (MWh)	53,858	226,727	460,167.5
Energy	Net-to-gross Ratio	92%	76%	78.4%
Energy	Net Verified Savings (MWh)	49,334	171,680	360,855.8
Summer Peak Demand	Gross Reported Savings (kW)	7,384.95	35,574.60	63,376.5
Summer Peak Demand	Realization Rate	133.9%	111.0%	105.7%
Summer Peak Demand	Gross Verified Savings (kW)	9,888.61	39,491.50	66,981.8
Summer Peak Demand	Net-to-gross Ratio	99%	75%	78.6%
Summer Peak Demand	Net Verified Savings (kW)	9,799.61	29,791.40	52,667.4

The prescriptive track accounted for 53% of all projects in the PY2021 population and, 23% of the first-year net verified energy savings. Alternatively, the custom track contained a lower portion of program projects (47%) yet represented 77% of the first-year net verified energy savings. The average net verified energy savings per project within the custom track (134.8 MWh) is approximately nearly four times that of the prescriptive track (35 MWh). A similar trend is exhibited for the average net verified summer peak demand savings per project under the custom track (19.2 kW), which is larger than that of the prescriptive track (5.5 kW). Additional detail is provided in the remainder of this section.

The PY2021 IF Retrofit program is expected to achieve 4,504.2 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 2021 Retrofit program over time. The shortest EUL for the 2021 Retrofit program is five years, and 85% of the first-year net verified energy savings will persist until 2032.

Figure 4-1: 2021 Retrofit Net Verified Savings Over Time

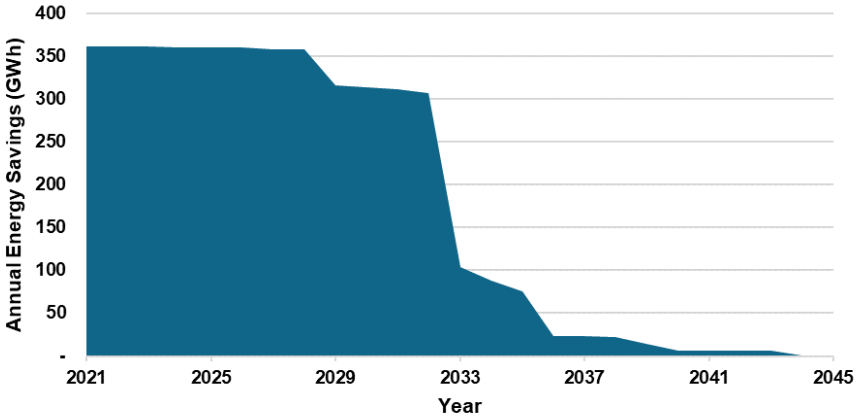


Figure 4-2 and Figure 4-3 present the distribution of the first-year net verified energy and summer peak demand savings by building type during PY2021 across the province of Ontario. Industrial/Manufacturing, retail facilities, and government and public facilities account for the majority (54%) of the first-year net verified energy and summer peak demand savings.

Figure 4-2: PY2021 First-Year Net Energy Savings by Building Type

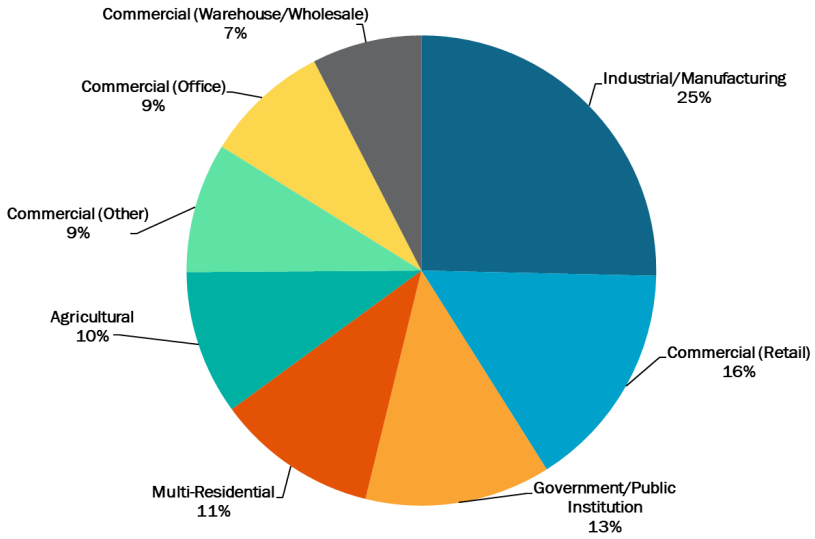


Figure 4-3: PY2021 First-Year Net Summer Peak Demand Savings by Building Type

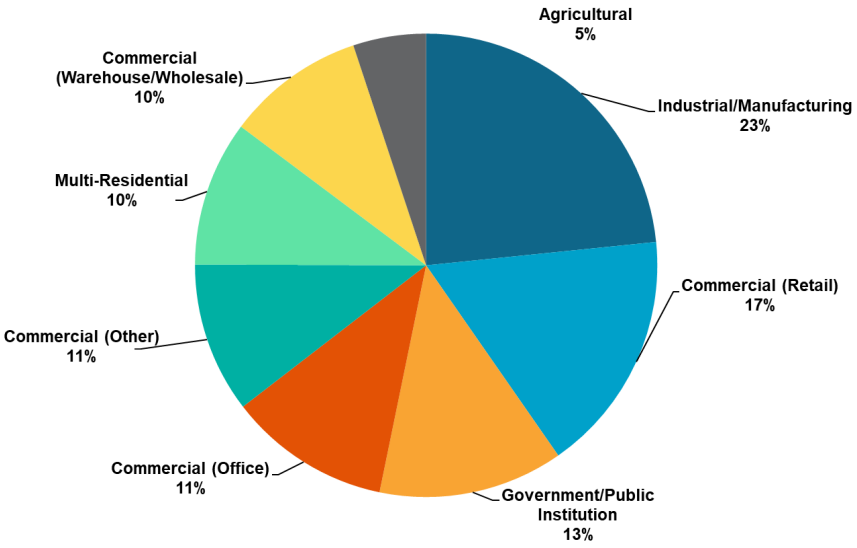


Figure 4-4 and Figure 4-5 depict the first-year net verified energy and summer peak demand savings distribution across program tracks and measure types (lighting/non-lighting) for the PY2021 Retrofit program across the province. Lighting projects generated the majority of the program's net verified savings, accounting for 68% of the total first-year net verified energy savings and 78% of the first-year net verified summer peak demand savings. While the lighting projects' contribution has decreased compared to PY2020, the overall trend is consistent, where lighting measures comprised 80% and 87% of the first-year net verified energy and summer peak demand savings, respectively. The majority of non-lighting projects' net verified savings are derived from the custom track, accounting for 94% and 91%of the total non-lighting first-year net verified energy and summer peak demand savings, respectively.

Figure 4-4: 2021 Net verified Energy Savings by Track and Technology

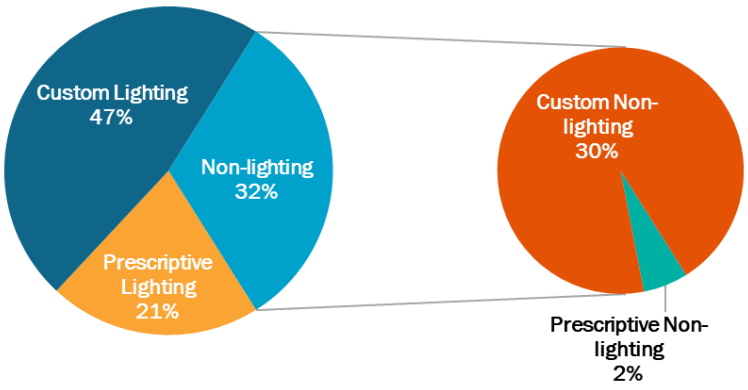
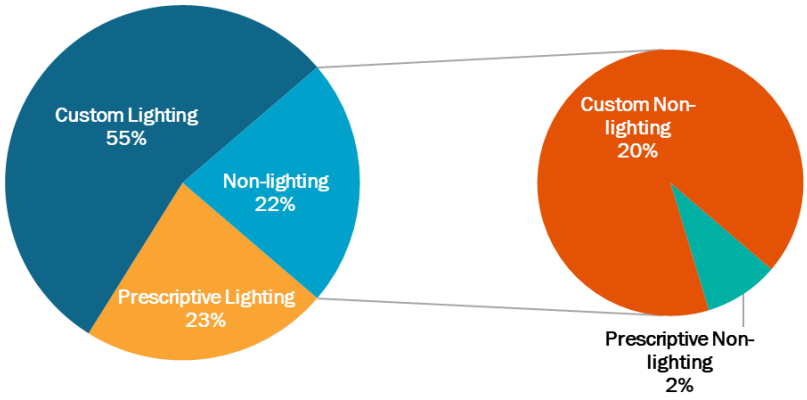


Figure 4-5: 2021 Net verified Summer Peak Demand Savings by Track and Technology



4.2.1. Prescriptive Lighting Measure

The prescriptive lighting track accounted for 53% of all completed Retrofit projects in the PY2021 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 is 33.8 MWh.

The most common lighting measures installed within the prescriptive track are exterior lights (39% of net energy savings), LED troffers (31% of net energy savings) and high bay lighting (10% of net energy savings). Collectively, these three measures accounted for 80% of the prescriptive lighting stratum's first-year net verified energy savings. Additional savings are derived from LED tube re-lamping (8%), controls (4%), refrigerated display lights (2%), and omni-directional A-shape lamps (2%).

The main contributors to the net verified summer peak demand savings are LED troffers (58%), high bays (17%), and LED tube re-lamps (13%). Additional demand savings were generated by omni-directional A-shape lamps (3%), reflectors (3%), downlights (2%), and refrigerated display lights (2%). 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[6].

Figure 4-6 and Figure 4-7 depict the full distribution of prescriptive measures' net verified energy and summer peak demand savings for the PY2021 IF Retrofit program, respectively.

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

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

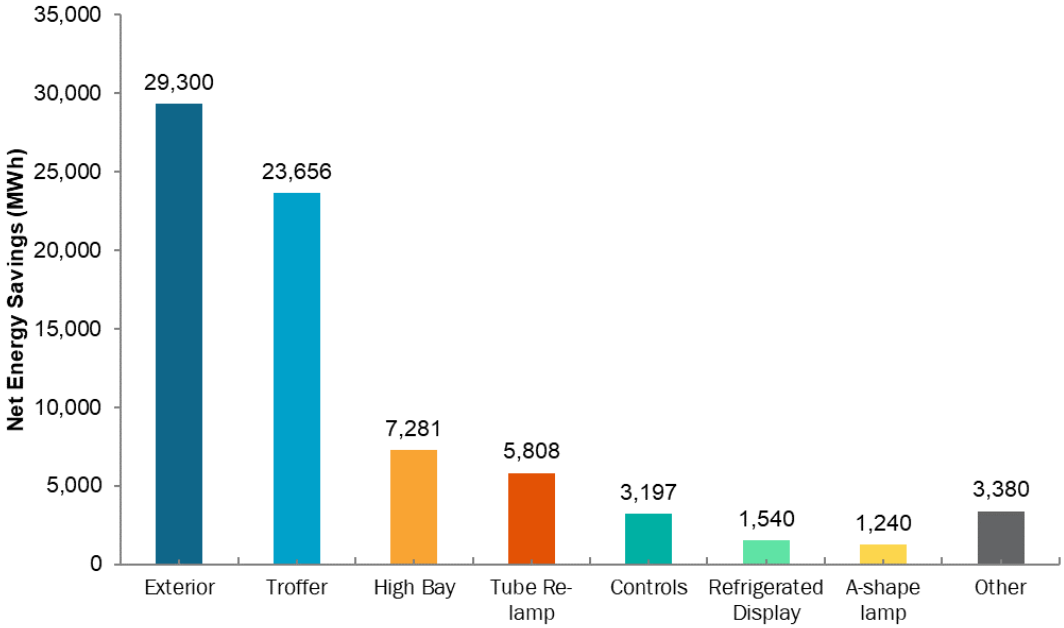
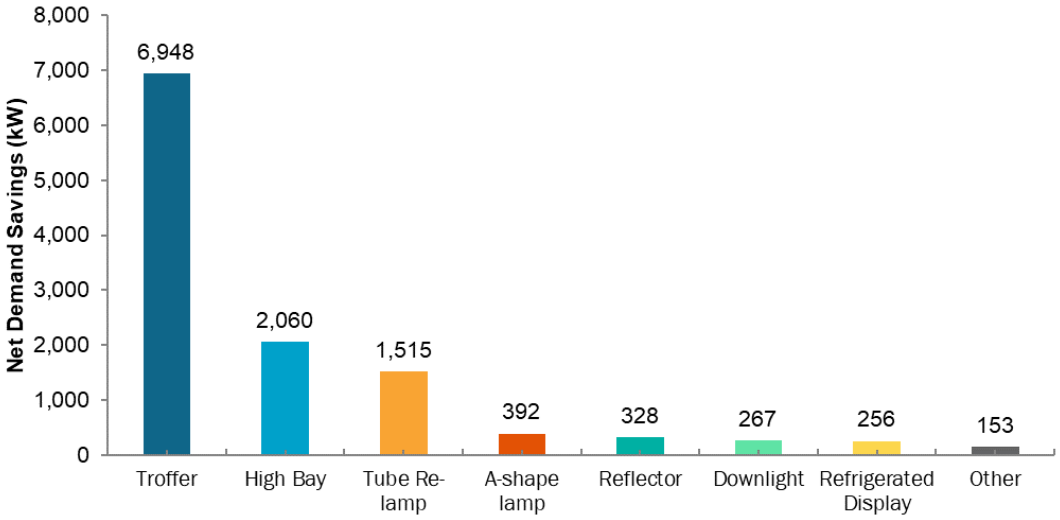


Figure 4-7: Prescriptive Lighting Measure Net Verified Summer Peak Demand Savings

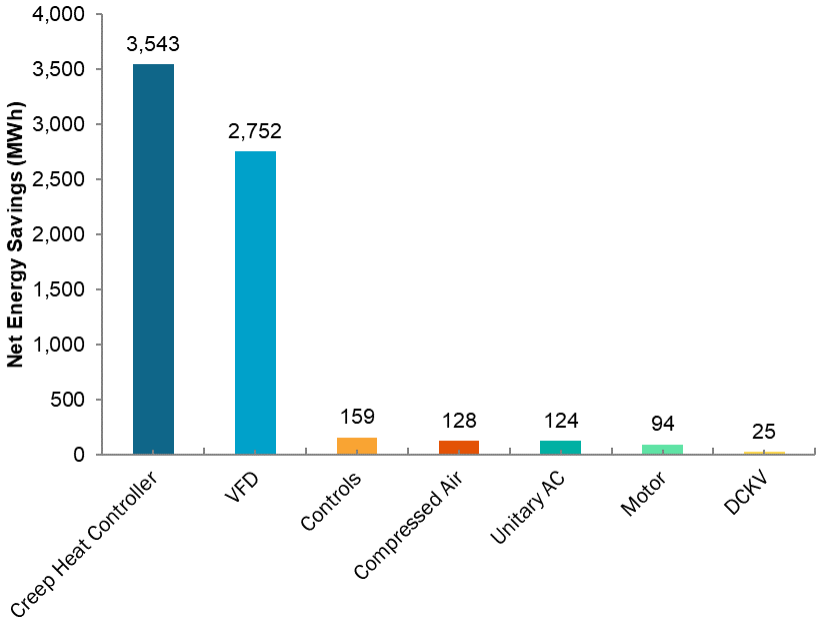


4.2.2. Prescriptive Non-Lighting Measure

Prescriptive non-lighting measures achieved 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 PY2021 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.

Creep heat controllers (52%) and Variable Frequency Drives (VFDs) (40%) collectively account for 92% of the prescriptive non-lighting measures' total first-year net verified energy savings. Controls, compressed air measures, and Unitary AC account for the majority of remaining net verified energy savings in this stratum (Figure 4-8).

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



4.2.3. Custom Lighting Measures

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

LED high bay fixtures (39% of energy savings and 40% demand savings) and LED tube re-lamps (31%/34%) together account for 70% of first-year net verified energy savings and 74% of the first-year net verified summer peak demand savings of the custom lighting stratum.

Additional savings were achieved by exterior lighting (6%/3%), LED troffers (4%/5%), ambient lighting (4%/4%), reflectors (3%/4%), and downlights (2%/2%).

Figure 4-9 and Figure 4-10 present the first-year net verified energy and summer peak demand savings for the lighting measures within the custom track for the PY2021 IF Retrofit program.

Figure 4-9: Custom Lighting Measure Net Verified Energy Savings

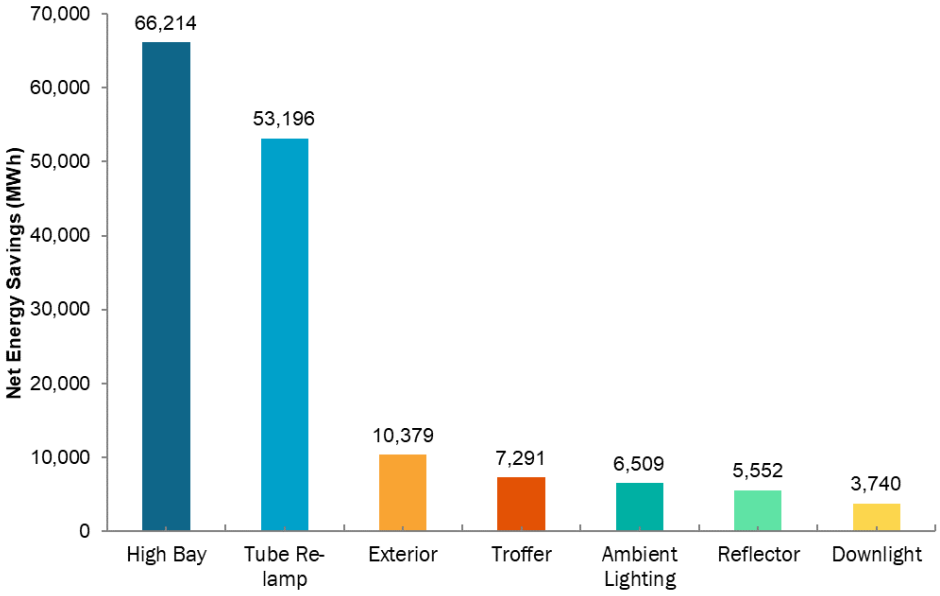
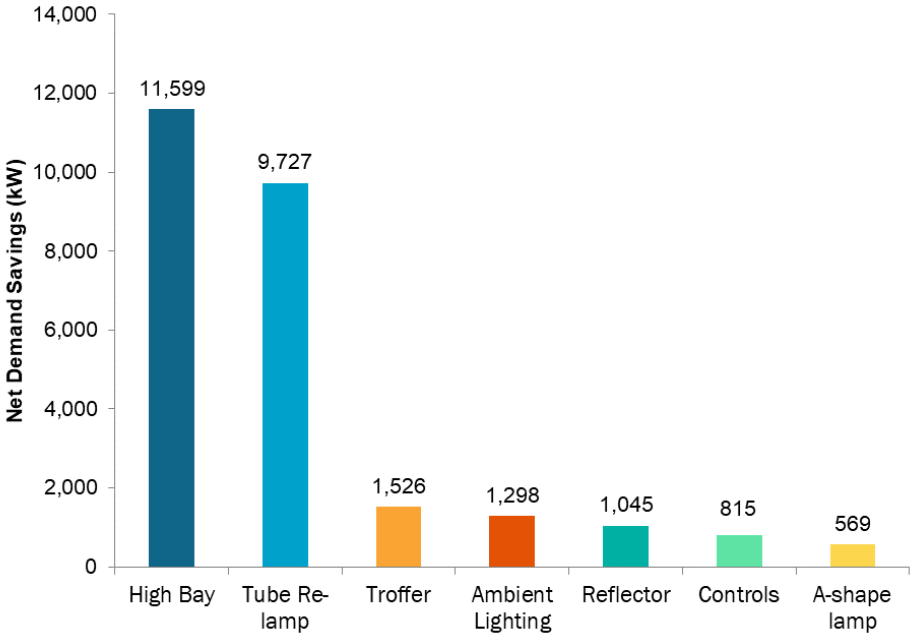


Figure 4-10: Custom Lighting Measure Net Verified Summer Peak Demand



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 12% of the total completed projects and comprise 30% of the province's net verified energy savings. The first-year net verified energy and demand savings for this stratum are 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) is nearly four times higher than the average prescriptive non-lighting project size (54.6 MWh).

The most common non-lighting measures installed within the custom track in the PY2021 IF Retrofit program are controls and agricultural lighting controls and optimization, accounting for 32% and 20% of the stratum's first-year net verified savings, respectively. Additional savings are derived from compressed air systems (14%), HVAV measures (8%), and VFDs (7%).

The main contributors to the net verified summer peak demand savings within the custom non-lighting stratum are controls (26%) and compressed air systems (17%). Additional demand savings were generated by agricultural lighting controls and optimization (12%), HVAC measures (10%), and chillers (9%).

Figure 4-11 and Figure 4-12 present the first-year net verified energy and summer peak demand savings for the non-lighting measures within the custom track for the PY2021 IF Retrofit program.

Figure 4-11: Custom Non-Lighting Measure Net Verified Energy Savings

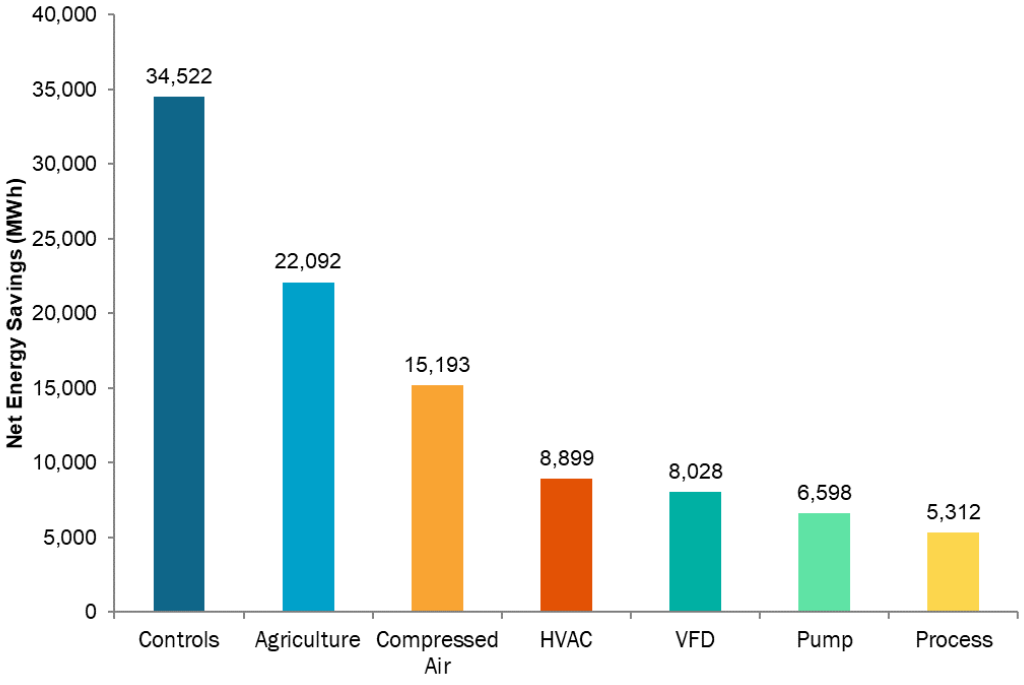
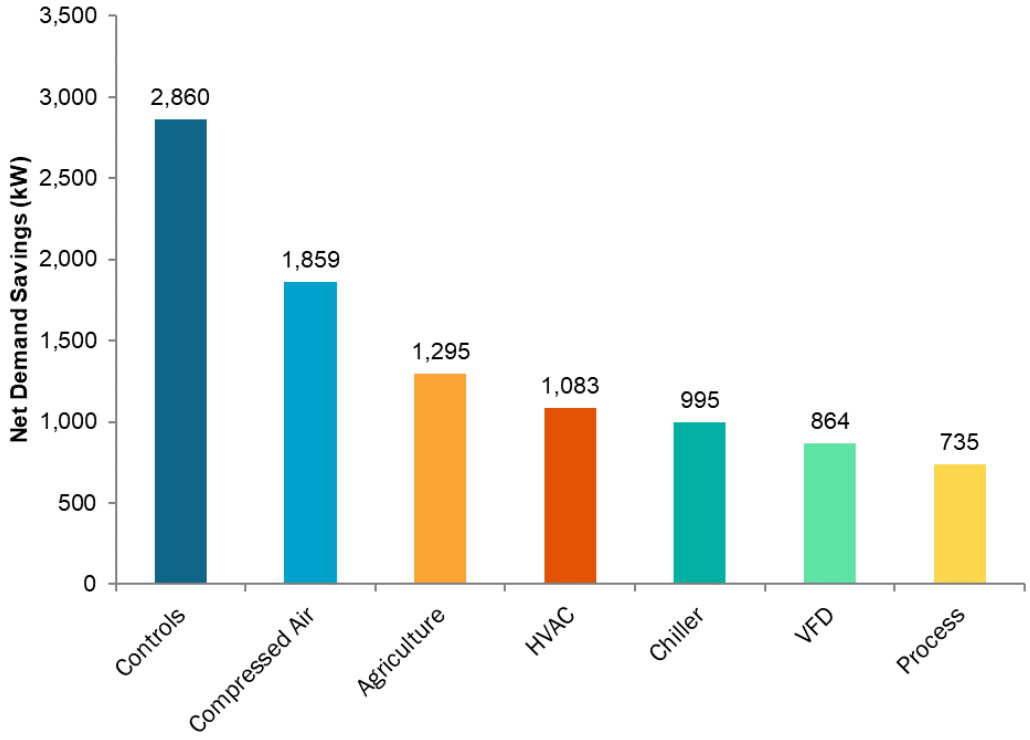


Figure 4-12: Custom Non-Lighting Measures Net Verified Summer Peak Demand Savings



4.3. Net-to-Gross Evaluation

Table 4-6 presents the results of the PY2021 Retrofit program Net-to-Gross (NTG) evaluation. The evaluation team targeted and achieved 90% confidence and 10% precision levels in the savings results. Participant feedback indicates moderately high levels of FR at 22.5%. Nearly one-fourth (22%) of participants stated they would have done the "exact same upgrade" in the program's absence, which is indicative of higher FR for these respondents. Over one-third of respondents (36%) showed no indication of free-ridership since they stated they would have put off the upgrade for at least one year (25%) or cancelled their upgrade altogether (11%) 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 (27%) or if they did not know what they would have done in the absence of the program (15%). Nearly three-fourths of respondents' decisions to participate in the program were influenced by the availability of the incentive (69%) and information or recommendations provided by contractors, vendors, or suppliers (68%). Participation in the program resulted in a relatively low SO at 0.7%. SO savings were primarily driven by the installation of new lighting measures. Additional analyses performed to assist in interpreting these values can be found in Appendix D.3.

Table 4-6: PY2021 Retrofit Program Net-to-Gross Results

Unique Participants	NTG Responses	Savings Weighted Free-Ridership	Spillover – Energy	Spillover – Summer Demand	Weighted Net-to-Gross – Energy	Weighted Net-to-Gross – Summer Demand	Energy NTG Precision at 90% Confidence
2,087	429	22.5%	0.7%	0.9%	78.2%	78.4%	± 2.6%

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 cost-effectiveness results are presented in Table 5-1. The PY2021 program passed the Total Resource Cost (TRC) test and the Program Administrator Cost (PAC) test, with both benefits exceeding their respective costs. In line with the program's maturity and a decrease in administrative expenditures, the PY2021 IF Retrofit program CE is higher than it was in 2019 and 2020.

Table 5-1: 2019-2021 IF Retrofit Program Cost Effectiveness Results

Cost Effectiveness Test	2019*	2020	2021	2019-2021
Total Resource Cost (TRC)				
TRC Costs ($)	$25,386,730	$91,263,150	$176,905,121	**$293,555,001**
TRC Benefits ($)	$25,981,888	$93,063,912	$192,212,072	**$311,257,872**
TRC Net Benefits ($)	$595,159	$1,800,762	$15,306,951	**$17,702,872**
TRC Net Benefit (Ratio)	1.02	1.02	1.09	**1.06**
Program Administrator Cost (PAC)				
PAC Costs ($)	$12,048,923	$41,313,073	$46,158,808	**$99,520,804**
PAC Benefits ($)	$26,993,507	$90,933,185	$185,819,779	**$303,746,471**
PAC Net Benefits ($)	$14,944,584	$49,620,112	$139,660,971	**$204,225,667**
PAC Net Benefit (Ratio)	2.24	2.20	4.03	**3.05**
Levelized Unit Energy Cost (LUEC)				
$/kWh	$0.02	$0.03	$0.01	**$0.02**
$/kW	$121.6	$151.5	$98.1	**$118.1**

6. Process Evaluation

A process evaluation was performed to better understand the design and delivery of the Retrofit program. Program staff interviews, as well as applicant representative, contractor, and participant surveys, were utilized to gather primary data to support this evaluation. In the sections below, if the number of respondents to a question is under 20, counts are shown rather than percentages. The results should be considered directional given the small number of respondents.

6.1. IESO Program Staff and Program Delivery Vendor Staff Perspectives

The following subsections highlight the feedback received from the IESO program staff and program delivery vendor staff IDIs.

6.1.1. Key Findings

Key findings from the IESO program staff and program delivery vendor staff IDIs include the following:

- The program's transition to a prescriptive-only offering in PY2021 had both positive and negative implications, according to both the IESO staff and delivery staff. Streamlining of the program and increases in incentive delivery time were positives, and the limited equipment offerings and related impacts on customer satisfaction with the equipment available were negatives.
- Direct engagement webinars that informed customers, applicant representatives and contractors about program changes and requirements were mentioned by the IESO staff as well-received by attendees. The delivery vendor staff reported seeing an uptick in customer inquiries following each webinar.
- Multiple updates were made in PY2021 to the Retrofit application portal to address user concerns, with additional updates planned in the year ahead.
- COVID-19 remained a barrier to the program in PY2021, though the IESO staff and delivery vendor staff reported collaborating well to ensure the program's effective delivery.
- Other challenges included the surge of applications at the end of PY2020 having an impact on PY2021 budgets and the disproportionate impact of horticultural lighting projects on program savings and incentives.
- The IESO staff and delivery vendor staff reported an increasing interest in projects supporting decarbonization efforts due to concerns about reducing carbon emissions. Identifying ways to align program offerings with this issue, such as further collaborations with gas utilities, was recommended.

6.1.2. Design and Delivery

The IESO staff and the delivery vendor staff reported collaborating well to ensure the program's successful delivery in PY2021 despite continued interruptions due to the COVID-19 pandemic. The IESO staff indicated the delivery vendors communicated frequently with them regarding market feedback and ideas for program improvement. In PY2021, the program design transitioned from offering both prescriptive and custom tracks to a prescriptive-only approach. The IESO staff reported that this adjustment enabled a more streamlined process in which customers may participate more easily and receive their incentives sooner. To compensate for the absence of the custom track, additional offerings were added to the list of eligible equipment, and a form was added to the program's website to allow recommendations for additional equipment to be submitted for consideration. According to some delivery vendor staff, this transition has impacted customer satisfaction as it does not fulfill as many customers' needs as the custom offering did. This has, in turn, led to difficulty in retaining some customers (for example, those with larger projects or industrial customers). One of the delivery vendor staff also noted that while the new process for submitting measures for consideration to the program is helpful, some customers and contractors have reported that it can be onerous or confusing to complete. Additionally, the delivery vendor staff stated that large projects are not served well under the prescriptive-only approach and suggested offering more specialized equipment options for these projects.

6.1.3. Outreach and Marketing

According to the IESO staff, the most successful marketing approaches for PY2021 were direct engagement webinars. They drew high attendance with an interested audience of customers, applicant representatives, and contractors. The webinars provided information about program changes and rules and allowed attendees to ask questions about the program. IESO staff reported that customers' feedback indicated that the webinars were highly valuable. Delivery vendors agreed with IESO staff that the webinars were a useful marketing tactic as they noticed new inquiries were often submitted after the webinars. The IESO staff reported that in addition to the webinars, the Save on Energy website, the IESO program announcements (for example, e-blasts and newsletters), and the IESO's social media posts were all successful marketing and outreach approaches in PY2021. Delivery vendors noted that equipment suppliers and contractors who often promote the program to their customers are another common outreach channel beyond the IESO's efforts and their direct customer engagement.

6.1.4. Application Portal

The IESO staff reported that in PY2021, changes were made to the Retrofit application Portal to address user concerns. Key documents were added to the webpage, including the participant agreement, requirements document, and technical worksheets. The delivery vendor staff indicated that offering documents directly on the website has made it easier for participants to get information about the program. Although enhancements were made to the Portal in PY2021, the IESO staff stated that further adjustments could and will be made to it to better meet the needs of participants and vendors. The IESO staff noted that after the

program transitioned to the prescriptive-only approach, a feature was added to the Portal that allows participants or contractors to suggest new equipment for inclusion in the program. The delivery vendor staff indicated that the addition of this feature has been helpful, with some of the suggestions leading to additional equipment types being selected for inclusion in the program.

6.1.5. Barriers and Opportunities

In PY2021, the COVID-19 pandemic still had significant impacts on program delivery. The IESO and delivery vendor staff reported supply chain issues which impacted costs and timelines. They also reported increased equipment costs, leading to some participants not continuing with their projects. The IESO staff indicated that other customers reallocated capital improvement budgets to areas that became higher priorities during the pandemic. Many participants also had less funding to put towards projects resulting in a rise of smaller scale projects. The delivery vendor staff also reported slower response rates from participants, which delayed equipment procurement and occasionally resulted in equipment being unavailable.

During the pandemic, the delivery vendor staff also reported high staff turnover rates at customers' businesses, which led to project communication difficulties and/or delays. The delivery vendors expect the COVID-19 pandemic to continue to impact delivery in the year ahead, with impacts on the scale of projects as well as with costs continuing to rise, which may, in turn, result in higher project cancellation rates.

Aside from the obstacles caused by the COVID-19 pandemic, the IESO staff noted that a rise in applications at the end of PY2020 had a significant impact on the PY2021 budget. These applications were submitted to meet the program deadline for the year, with many participants applying before custom incentives were no longer available.

The IESO staff and delivery vendor staff agreed that the horticultural lighting projects, especially those in Southwest Ontario, present both opportunities and challenges. While these projects result in large energy savings, they do not result in comparable peak demand savings since most of these facilities (for example, greenhouses) have a decreased requirement for lighting during the summer months. The IESO staff stated that this creates competing priorities within the program since these projects account for a large percentage of the incentives provided but do not significantly contribute to peak demand reduction goals. Some delivery vendor staff suggested not offering horticultural lighting through the Retrofit program.

The IESO staff and delivery vendor staff indicated that there is increasing interest in projects supporting decarbonization efforts due to concerns about reducing carbon emissions. They suggested looking for opportunities to potentially align programs with these interests, such as considering more future partnership opportunities with gas utilities.

6.2. Applicant Representative and Contractor Perspectives

The following subsections highlight the feedback received from the applicant representative and contractor survey. Additional results can be found in Appendix D.2.

6.2.1. Key Findings

Key findings from the applicant representative and contractor survey include the following:

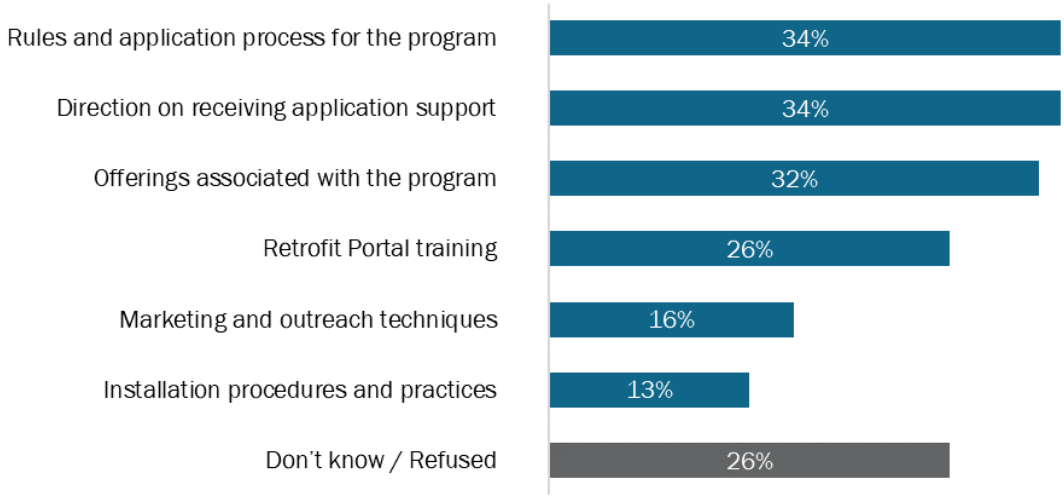
- Respondents were predominately applicant representatives (51%) or both applicant representatives and contractors (43%).
- Respondents' most-requested training and education topics were program and application rules (34%), direction on how to receive support when they or a customer are applying (34%), and program offerings (32%).
- The highest-rated aspect of the program was interactions with representatives from the IESO (76% with a rating of 4 or 5), and the lowest-rated aspect was program marketing and outreach (51% with a rating of 4 or 5).
- More than one-half of respondents (54%) reported no impact on customer participation due to the Retrofit program's incentive cap.
- One-fourth of respondents (24%) indicated their participants installed additional energy-efficient equipment that exceeded the incentive cap, with lighting being the most common equipment type installed.
- Three-fourths (75%) of respondents indicated their customers were typically able to install all equipment they were interested in through the Retrofit Program. Among those who indicated they could not (21% of respondents), the most common measure that was not able to be installed through the program was exterior lighting.

6.2.2. Training and Education

The most requested training and education that respondents indicated would most support their work with the Retrofit program included those that covered program and application rules (34%), direction on how to receive training or support when they or a customer are applying (34%), and program offerings (32%), and Details regarding training and education received can be found in Figure 8-6 in Appendix D.2.

Figure 6-1: Recommended Training and Education Topics

(Open-ended and multiple responses allowed; n=68)*



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

Respondents rated their satisfaction with training on a scale of one (1) to five (5), where one indicates "not satisfied at all" and five indicates "completely satisfied." About five-eights (65%) were satisfied or very satisfied with the training. Those who rated the training a three or below provided improvement suggestions. Suggestions include training for new applicant representatives prior to starting, more in-person training, increased training for application reviewers and program delivery vendors, and the creation of video tutorials, as mentioned by one respondent each.

6.2.3. Program Experience and Improvement Suggestions

Over four-fifths (83%) of respondents identified one or more barriers to customer participation in the Retrofit program, with about one-third of these each stating that customers did not perceive the upgrades as being worth the trouble of participating (34%) and that the energy-efficiency upgrades were not a priority given other priorities (29%). A full list of barriers can be found in Figure 8-7 in Appendix D.2.

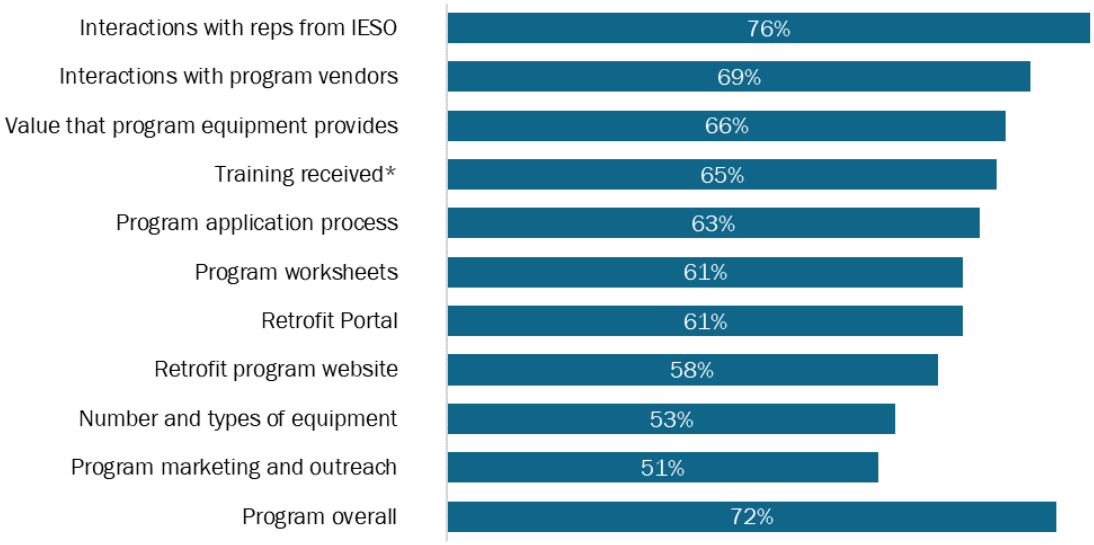
When these respondents were asked what they thought the Retrofit program could do to overcome these barriers, common responses included making the application process easier (22%), increasing incentive amounts (17%), and increasing marketing (15%). A full list of suggestions for overcoming customer barriers to participation can be found in Figure 8-8 in Appendix D.2.

Respondents were asked to rate their satisfaction with different aspects of the Retrofit program on a scale of one (1) to five (5), where one indicates "not satisfied at all" and five indicates "completely satisfied" (Figure 6-2). The highest-rated aspect of the program was interactions with representatives from the IESO (76% with a rating of 4 or 5), and the lowest-

rated aspect was program marketing and outreach (51% with a rating of 4 or 5). A full breakdown of the satisfaction results can be found in Figure 8-9 in Appendix D.2, and respondent improvement suggestions for key aspects of the program can be found in Figure 8-10, Figure 8-11, Figure 8-12, and Table 8-10.

Figure 6-2: Satisfaction with Aspects of Retrofit Program (n=68)

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

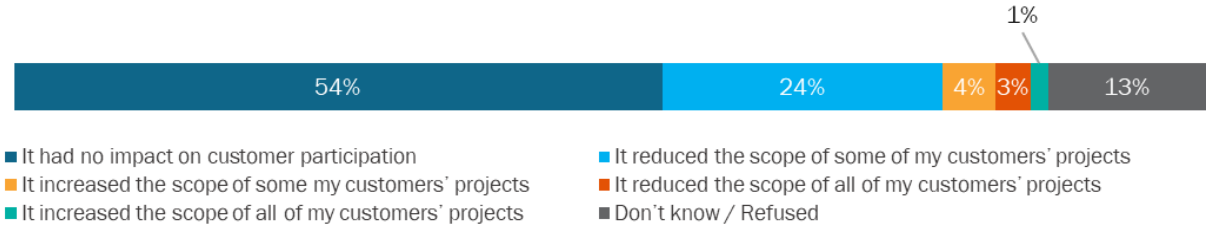


*For "Training received", n=51 since this was only asked of respondents indicating they had received training.

6.2.4. Incentive Cap

Respondents described the impacts, if any, of the Retrofit program's prescriptive track incentive cap of 50% of the total project cost, which went into effect in May 2019 (Figure 6-3). Over one-half (54%) reported no impact on customer participation, and about one-fourth (24%) reported reductions to the scope of some projects. Additional detail regarding the extent of the scope reduction can be found in Figure 8-13 in Appendix D.2.

Figure 6-3: Assessment of Retrofit Program Prescriptive Incentive Cap (n=68)*



*Does not sum to 100% due to rounding.

About one-fourth (24%, 16 respondents) indicated that participants installed additional energy-efficient equipment types that exceeded the incentive cap during their projects. Of these respondents, ten indicated that lighting was the additional equipment that was typically installed. A complete list of installed equipment that exceeded the incentive cap, as well as respondent explanations for why the equipment was installed without the incentive cap can be found in Figure 8-14 in Appendix D.2.

Nearly three in five (59%) respondents indicated that some participants' completed projects did not reach the incentive cap. When asked why, the most common reasons were that the participant did not need to install additional equipment (38%) and that it was cost prohibitive (20%). A full list of reasons can be found in Figure 8-15 in Appendix D.2.

6.2.5. Equipment Offerings

When asked if participants were typically able to install the equipment they were interested in through the program, three-fourths of respondents (75%) indicated that participants were able to do so. Those who indicated that participants were not able to install all equipment of interest identified exterior lighting (6 respondents) and non-approved LED lighting (3 respondents) as typical ineligible equipment of interest. A full list of equipment mentioned by respondents can be found in Table 8-11 in Appendix D.2. Respondents were also asked what additional energy-efficient equipment or services they would recommend for inclusion in the Retrofit program. The most common recommendations were exterior lighting (50%) and building automation (12%). A full list of recommended equipment can be found in Table 8-12 in Appendix D.2.

6.3. Retrofit Participant Perspectives

The following subsections highlight the feedback received from the participant survey. Additional results can be found in Appendix D.4.

6.3.1. Key Findings

Key findings from participants' responses include the following:

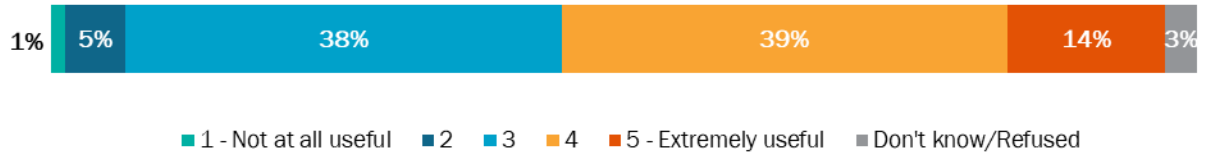
- All titles respondents shared indicated they held either an administrative or managerial role. Nearly one-third (29%) were maintenance and/or facility managers, over one-fifth (21%) were the owner and/or president of the company, and one-fifth (20%) specified another administrative or management role.
- Three-fifths of respondents (60%) reported visiting the Save on Energy program website to look for information about energy-efficiency offerings. Of those who visited the website, over one-half (53% with a rating of 4 or 5) stated it was very useful.
- Nearly three-fourths of respondents (74%) reported never using the Retrofit Support line. Of those who used it, nearly three-fourths (73% with a rating of 4 or 5) stated it was very useful.

- Only four respondents stated their application was reviewed using more than one Save on Energy representative across the different regions of Ontario. They indicated that more consistent response times, having a single point of contact, and consistent levels of customer support were areas for improvement.
- Nearly two-thirds (63%) of respondents reported that the Retrofit program's prescriptive track incentive cap had no impact on the way they were able to participate in the program. Of the one-tenth (10%) who reported that it reduced the scope of their projects, over one-fourth (26%) indicated a 26% to 50% reduction.
- Nearly three-fifths (56%) of respondents indicated that the program design shift to prescriptive-only projects did not impact their participation. Of the less than one-tenth (4%) who indicated the shift reduced the scope of their project, six estimated a 26-50% reduction.

6.3.2. Save on Energy Program Website

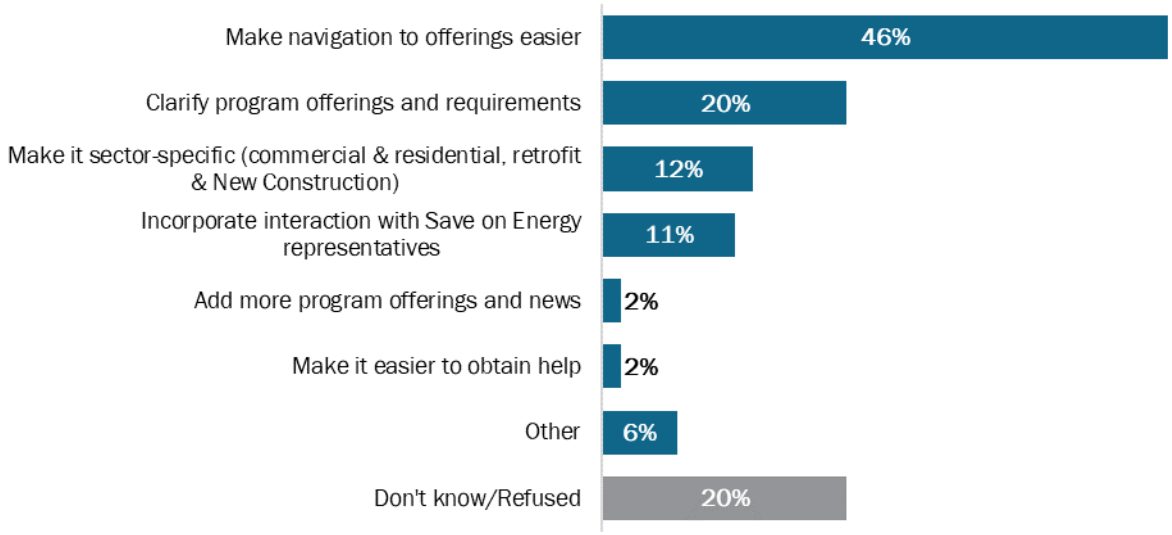
Three-fifths of respondents (60%) reported visiting the Save on Energy program website to find information about energy-efficiency offerings. Of those who visited the website, over one-half (53%) provided a rating of a 4 or 5, on a scale of one (1) to five (5), where one indicates the website is "not at all useful" and five indicates the website is "extremely useful" (Figure 6-4).

Figure 6-4: Program Website Usefulness (n=247)



Of the 110 respondents who provided a neutral or negative rating of their program website experience, nearly three-fifths (59%) provided suggestions for improving website information. Among these respondents, the most common suggestion was simplifying navigation to program offerings (46% of respondents), followed by clarifying program offerings and requirements (20%) (Figure 6-5).

Figure 6-5: Recommendations for Website Improvement (n=65)*

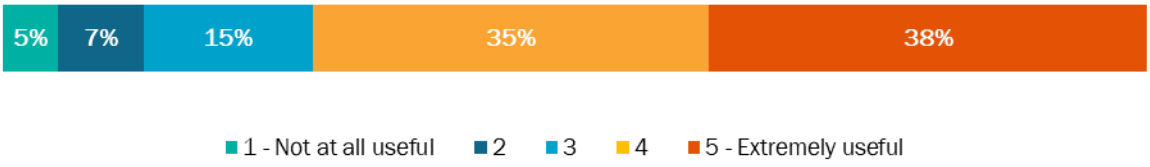


*Does not sum to 100% due to multiple responses.

6.3.3. Retrofit Support Line

Nearly three-fourths of respondents (74%) reported never using the Retrofit Support line. Of those who used it, nearly three-fourths (73%) provided a rating of a 4 or 5, on a scale of one (1) to five (5), where one indicates the Support Line is "not at all useful" and five indicates the Support Line is "extremely useful" (Figure 6-6). Over four-fifths (85%) of respondents who used the Support Line reported that they received feedback in a timely manner. Of the 22 respondents who found the Support Line less useful (ratings of 3 and below), 12 provided recommendations for improving the Support Line. Most commonly, respondents suggested providing more support on how the application works (4 respondents) and improving communication through the application process (3 respondents).

Figure 6-6: Program Support Line Usefulness (n=81)



6.3.4. Working with Multiple Delivery Vendors

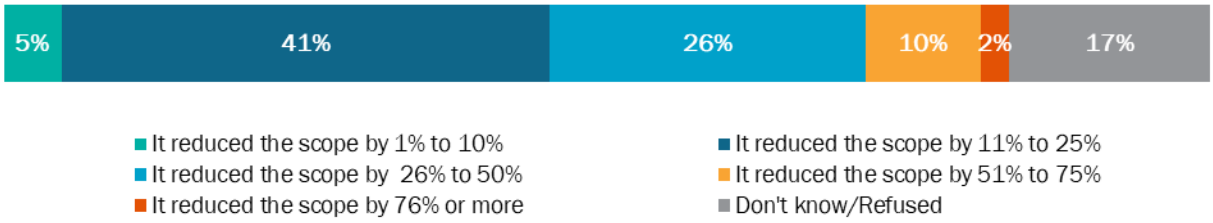
Of the ten respondents who the sample identified as having completed projects in more than one region of Ontario, four stated that their application was reviewed using more than one Save on Energy representative across the different regions. Of these, two respondents indicated that the application process was not the same across the different Save on Energy representatives but did not clarify in which ways. The other two respondents either indicated the process was the same (one respondent) or did not know if it was the same (one

respondent). Respondents appreciated having a consistent point of contact across the multiple regions (one respondent), having consistent requirements for supporting documentation across regions (one respondent), and having representatives who were knowledgeable about the entire region (one respondent). When asked how the application process could be improved when working with multiple Save on Energy Representatives, respondents suggested providing a consistent level of support (one respondent), having consistent response times (one respondent), and having a single point of contact (one respondent).

6.3.5. Incentive Cap

Respondents described the impacts, if any, of the Retrofit program's prescriptive track incentive cap of 50% of the total project cost, which went into effect in May of 2019. Nearly two-thirds (63%) of respondents reported that the incentive cap had no impact on the way they were able to participate in the program, while one-tenth (10%) reported that it reduced the scope of their projects.[7] Of the respondents who reported a reduction in scope, over two-fifths (41%) indicated an 11% to 25% reduction and over one-fourth (26%) indicated a 26% to 50% reduction (Figure 6-7).

Figure 6-7: Extent of Project Scope Reduction (n=42)*



*Does not sum to 100% due to rounding.

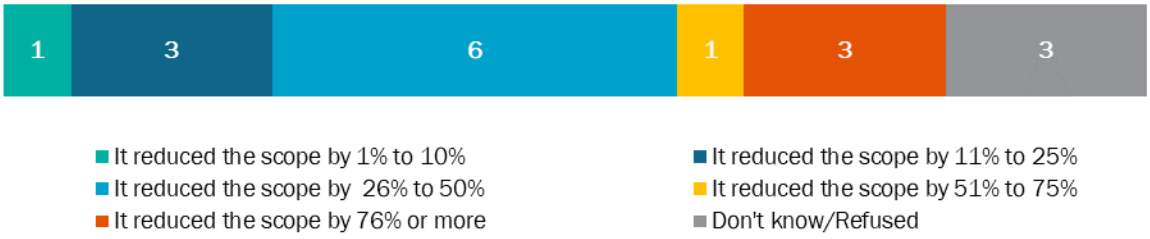
6.3.6. Shift to Prescriptive-only Projects

Nearly three-fifths (56%) of respondents indicated that the program design shift to prescriptive-only projects did not impact their participation. Over one-third (35%) did not know if it impacted their participation, and less than one-tenth (4%) indicated it reduced the scope of their projects.[8] Of the respondents who indicated a reduction in their project scope, three estimated an 11-25% reduction and six estimated a 26-50% reduction (Figure 6-8).

[7] Forty-four respondents indicated a reduction in scope in a question that allowed open-end responses. As a result, only 42 of these respondents provided feedback about the magnitude of the reduction.

[8] Twenty-four respondents indicated a reduction in scope in a question that allowed open-end responses. As a result, only 17 of these respondents provided feedback about the magnitude of the reduction.

Figure 6-8: Assessment of Retrofit Program Shift to Prescriptive-only Projects (n=17)*



* Counts displayed rather than percentage due to small n.

7. Other Energy Efficiency Benefits

7.1. 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 and 2021 and the lifetime of the measures. Table 7-1 below represents the results of the avoided GHG emissions calculations.

Table 7-1: 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	10,395.58	(4,416.58)	5,979.00	206,746.55	(55,728.43)	151,018.11
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
2019 - 2021	70,533.15	(36,046.98)	34,486.18	1,224,737.87	(445,607.98)	779,129.90

*Interactive gas penalty

7.2. Jobs Impact Results

7.2.1. Key Findings

Key findings from the PY2021 jobs impacts evaluation include the following:

- The analysis used an input-output model, which estimated that Retrofit would create 4,172 total jobs in Canada, of which 3,724 will be in Ontario.
- $1M of program investment resulted in the creation of 93.3 jobs, compared to 48.8 jobs in PY20.
- The observed increase in job creation per $1M of spent is primarily due to large increases in the jobs created by the reinvestment shock.
- 334 out of 4,172 (8%) of jobs impacts were realized in the first year – 167 of the 334 first-year jobs impacts were due to first-year savings.

7.2.2. Input Values

The job impacts 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 represents 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 7-2 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 7-2: Summary of Input Values for Demand Shock

Category Description	Non-Labour	Labour	Total Demand Shock
	($ Thousands)		
Lighting fixtures	52,790	30,815	83,605
Electric light bulbs and tubes	42,880	24,851	67,731
Heating and cooling equipment (except household refrigerators and freezers)	19,142	10,872	30,014
Switchgear, switchboards, relays and industrial control apparatus	14,871	8,362	23,234
Pumps and compressors (except fluid power)	9,380	5,352	14,732
Metalworking machinery and industrial molds	3,069	1,781	4,850
Other industry-specific machinery	2,319	1,377	3,696
Industrial and commercial fans, blowers and air purification equipment	1,196	690	1,886
Metal windows and doors	1,117	594	1,712
Measuring, control and scientific instruments	874	487	1,361
Electric motors and generators	679	395	1,074
Other professional, technical and scientific services	421	264	686
Batteries	163	86	249
Repair construction services	59	31	90
Waterworks engineering construction	5	3	7
Subtotal	**148,965**	**85,962**	**234,927**
Office Administrative Services	-	-	4,765
Total			**239,603**

The second shock modelled by the IO Model was the business reinvestment shock. This shock represented the amount businesses would reinvest and thus inject back into the economy. This amount was split over various industries to properly model the demand shock. The business reinvestment shock totaled $308.7 million over 36 different industries. Additional 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.[9] This shock represents the incremental increase in electricity bills to the residential sector from funding the program. The

[9] 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.

assumption is that the IESO programs are funded by all customers in proportion to the overall electricity consumption. Thus, the residential funding portion was 35% of the $44.7M program budget or $15.7M.

7.2.3. 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, three different sets of job impacts are combined into the overall job impacts. Table 7-3 presents the total estimated job impacts by type – combining the impacts from the demand, business reinvestment and household expenditure shocks. The majority (3,724 out of the 4,172 estimated total jobs) were in Ontario. Of the 2,101 direct jobs created across Canada, 2,039 were created in Ontario. A slightly smaller proportion of the indirect and induced jobs were in Ontario. A total of 827 of 1,018 indirect and 858 out of 1,053 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 3,091 FTEs (of all types) created in Ontario and 3,460 FTEs added nationwide. A large portion of direct FTEs (1,763 of 1,821) were added in Ontario, representing approximately 57% of the total FTEs added in Ontario, and 51% of all FTEs created across Canada. In 2021, each $1M of program spent resulted in the creation of 93.3 total jobs compared to 48.8 jobs per $1M in 2020. The primary driver of the additional jobs created is a substantial increase in the amount reinvested by customers (over $309M in 2021 vs. $133M in 2020). The increases in jobs created along with the similar overall program budget resulted in the observed difference between years.

Table 7-3: Total Job Impacts by Type

Job Impact Type	FTE *(In Person-Years)*		Total Jobs *(In Person-Years)*		Total Jobs Per $1M Investment *(In Person-Years)*
	Ontario	Total	Ontario	Total	
Direct	1,763	1,821	2,039	2,101	47.0
Indirect	698	862	827	1,018	22.8
Induced	629	778	858	1,053	23.5
Total[1]	**3,091**	**3,460**	**3,724**	**4,172**	**93.3**

[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.

An extensive discussion the model impacts – including a breakdown of impacts by industry, impacts attributable to first-year savings and verbatims from program contractors – can be found in Appendix F.

8. Key Findings and Recommendations

Finding 1: IESO deemed hours of use (HOU) for some lighting end-uses fall outside the verified HOU range. Upon reviewing all sampled prescriptive lighting projects, verified HOU seem to be inconsistent with the IESO MAL deemed HOU for some end-uses. Specifically, general end-uses, such as "Lighting – General," "Lighting – Other (all measures)," and "Lighting – Other Commercial buildings," which allow for selection by a wide range of facilities. These end-uses have the highest impact on the realization rate.

- **Recommendation 1***:* Considering that the IF is ending and the IESO has launched the 2021-2024 CDM Retrofit program, it is recommended, where applicable, to review and update the 2021-2024 MAL measures HOU for end-uses that fall outside the verification HOU range. End-uses that fell outside the verified HOU range and had a strong impact on the program realization rate include, "Lighting – General," "Lighting – Other (all measures)," and "Lighting – Other Commercial buildings." The evaluation HOU verification analyses of these end-uses have achieved precision below 10%.

Finding 2: Participation in the Prescriptive Non-Lighting track remains low. The prescriptive non-lighting track comprised 1.9% of the total net verified energy savings in 2021. The same track comprised 4% of the program's net verified savings in 2020.

- **Recommendation 2***:* Continue to increase the promotion and marketing of the prescriptive non-lighting track through the service providers and applicant representatives. It is also recommended to review and consider increasing the incentive levels for measures in the prescriptive non-lighting track. This is particularly important as the Retrofit program shifts to a prescriptive-only design.

Finding 3: IESO deemed baseline wattages for some prescriptive lighting measures fall outside the verified baseline wattages. Upon reviewing all sampled prescriptive lighting projects, verified baseline wattages for some measures seem inconsistent with the IESO MAL deemed baseline wattages.

- **Recommendation 3***:* While the verified baseline wattages closely align with the IESO MAL assumptions, some measures fall outside the verified range. Reviewing and updating the MAL baseline assumption for measures that fall outside the verified range is recommended. Additional information regarding the verified and deemed baseline assumptions is included in the evaluation report. Measures that fell outside the verification range include "Three-lamp Std. T8 fixtures (4' 32W)", "100 – 175W MH/HPS", and "Ubend 32W- 2 lamp T8".

Finding 4: A desire for additional training exists among applicant representatives and contractors. The most-requested training and education topics mentioned by applicant representatives and contractors were program rules and application process (34%), direction on receiving application support (34%), and program offerings (33%). The IESO program staff

and delivery vendor staff indicated that the training webinars about program processes and changes were well-received by attendees, which included applicant representatives, contractors, and customers.

- **Recommendation 4:** Ensure that training covers topics of most interest to the applicant representatives and contractors and provides them with the knowledge they need to effectively support the program. Key training topics to consider include the program rules and application process, direction on receiving application support, and program offerings.

Please note that a similar recommendation to Recommendation 4 was also included in the PY2019 and PY2020 evaluations. In response to the recommendation in PY2020, the IESO indicated that they have continued to offer training based on feedback from the market. At the time, they indicated they had completed recent training on the IF post-project submission requirements and technology-specific training. The IESO also indicated that it would continue to consider feedback on the program and adapt the training offerings and program material as needed. Given this additional feedback received from the applicant representatives and contractors in PY2021 regarding additional training needs, a similar recommendation is provided again to ensure that the program considers offering additional training opportunities that reach more applicant representatives and contractors.

Finding 5: The incentive cap had an impact on some customer participation. About one-fourth of applicant representatives and contractors (24%) stated that the incentive cap reduced the scope of some of their customers' projects, and one-tenth (10%) of participants reported that the incentive cap reduced the scope of their projects. Over two-thirds of these participants (67%) estimated an 11% to 25% reduction (41% of participants) and a 26% to 50% reduction (26% of participants).

- **Recommendation 5**: Provide training and support to contractors to ensure that they are able to help customers complete as much as possible within the constraints of the incentive cap. Additionally, encourage customers to install additional equipment beyond what is covered through the program if it is feasible for them to do so.

Finding 6: Expanding measure offerings would likely increase customer, applicant representative, and contractor satisfaction with the shift to a prescriptive-only approach. Nearly three-fifths (56%) stated that the shift to the prescriptive-only approach did not impact their participation. However, the IESO program staff and delivery vendor staff indicated that customer satisfaction with the available equipment could be improved, noting that the shift has most impacted industrial customers and those with more complex projects. Applicant representatives and contractors demonstrated relatively low satisfaction with the number and types of equipment offered through the program (53% with a rating of 4 or 5) and most often recommended additional lighting types, building automation, and heat pumps. The delivery vendor staff indicated that the new process that allows for measure recommendations to be submitted online has been well-received, but can be onerous or confusing for some customers and contractors to complete.

- **Recommendation 6a:** To better understand market demands, collect feedback on measure suggestions and support requirements from customer segments that may have been most affected by the shift to a prescriptive-only approach.
- **Recommendation 6b:** Further promote the availability of the online form to submit new program measure recommendations and consider methods to simplify the form to enable easier completion.

Please note that a similar recommendation to Recommendation 6a was also included in the PY2020 evaluations. In response to the recommendation in PY2020, the IESO indicated that they had developed a formal process to receive new program measure recommendations. This process allows participants, applicant representatives, contractors, or other program stakeholders to submit new measure suggestions for the IESO's consideration using an online form. Given this additional feedback received in PY2021, an updated version of this recommendation is provided to ensure that the online form is easy to use and well-publicized and that the program considers additional avenues for gathering feedback on measure recommendations.

Finding 7: More marketing and outreach opportunities exist. The IESO staff and delivery vendor staff reported using a wide array of marketing and outreach activities in support of the program in PY2021. Such activities included direct engagement webinars where information was shared about the program, the Save on Energy website, program announcements (for example, e-blasts and newsletters), the IESO's social media posts, and direct engagement by the program delivery vendors with customers and program partners. Program marketing and outreach, however, was the program aspect that applicant representatives and contractors provided the lowest rating for (51% were satisfied or very satisfied with it), and increased marketing was one of the main suggestions they provided for overcoming customer barriers to participation (recommended by 15%).

- **Recommendation 7:** Consider ways in which to further market the program to expand the program's reach (for example, additional frequent webinars or e-blasts informing stakeholders of program changes, further social media engagement, and additional in-person events as feasible given the ongoing pandemic).

Finding 8: Program website changes have proven useful, but there is additional room for improvement. The IESO staff indicated that key documents (for example, participant agreement, requirements document, and technical worksheets) were added to the Save on Energy website in PY2021. The delivery vendor staff noted that doing so has made it easier for participants to get the information they need about the program. Three-fifths of participants (60%) reported visiting the Save on Energy program website to search for information about energy-efficiency offerings. Of those who visited the website, over one-half (53% with a rating of 4 or 5) stated it was very useful. The most common improvement suggestions were to make navigation to program offerings easier (mentioned by 46% of participants), followed by clarifying program offerings and requirements (20%).

- **Recommendation 8:** Consider ways to further improve navigation to program offerings and key documents to help customers quickly understand what the offerings are and the related program requirements. Gathering additional feedback both from participants who do and do not look to the Save on Energy website for program information could lead to more specific suggestions on site design improvements.

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. To enhance the evaluation results, previously evaluated projects from 2021-P1 were combined with new 2021-P2 projects to create a rolling sample that reduces uncertainty by including a larger number of evaluated projects from a greater population. 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, project audits representing the entire Retrofit population were completed. Sampled projects received Level 1 audits, consisting of desk reviews of project documentation available from the program delivery vendor. These documents include 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 includes Level 2 audits with on-site visits and extensive metering to estimate equipment hours of use and operational load. However, the 2021 evaluation cycle was disrupted by the COVID-19 pandemic with corresponding facility closures and social distancing requirements, leading to the suspension of on-site visits.

To maximize participant responses, we expanded the types of outreach conducted for the impact evaluation. In addition to verification phone calls, the evaluation added an internally developed self-assessment survey for lighting projects and an option to complete virtual site visits through a software solution.

The web-based self-assessment survey imported project-specific details from the program, including the measure name. It allowed the participant to verify the equipment installed and other key operating parameters. Information provided by the participant was then cross-referenced against the program database to ensure the accuracy of their responses.

With the participant's approval, virtual site visits permitted the EM&V staff to view through the phone, tablet, or computer camera . The software acts like a virtual meeting that allows screen sharing and can be moved around a facility to verify equipment installation, quantities, and operating parameters. However, we faced difficulty as many participants were still working from home, which limited the opportunity to complete a virtual site visit, or participants were uncomfortable sharing access through their mobile equipment.

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

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

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.

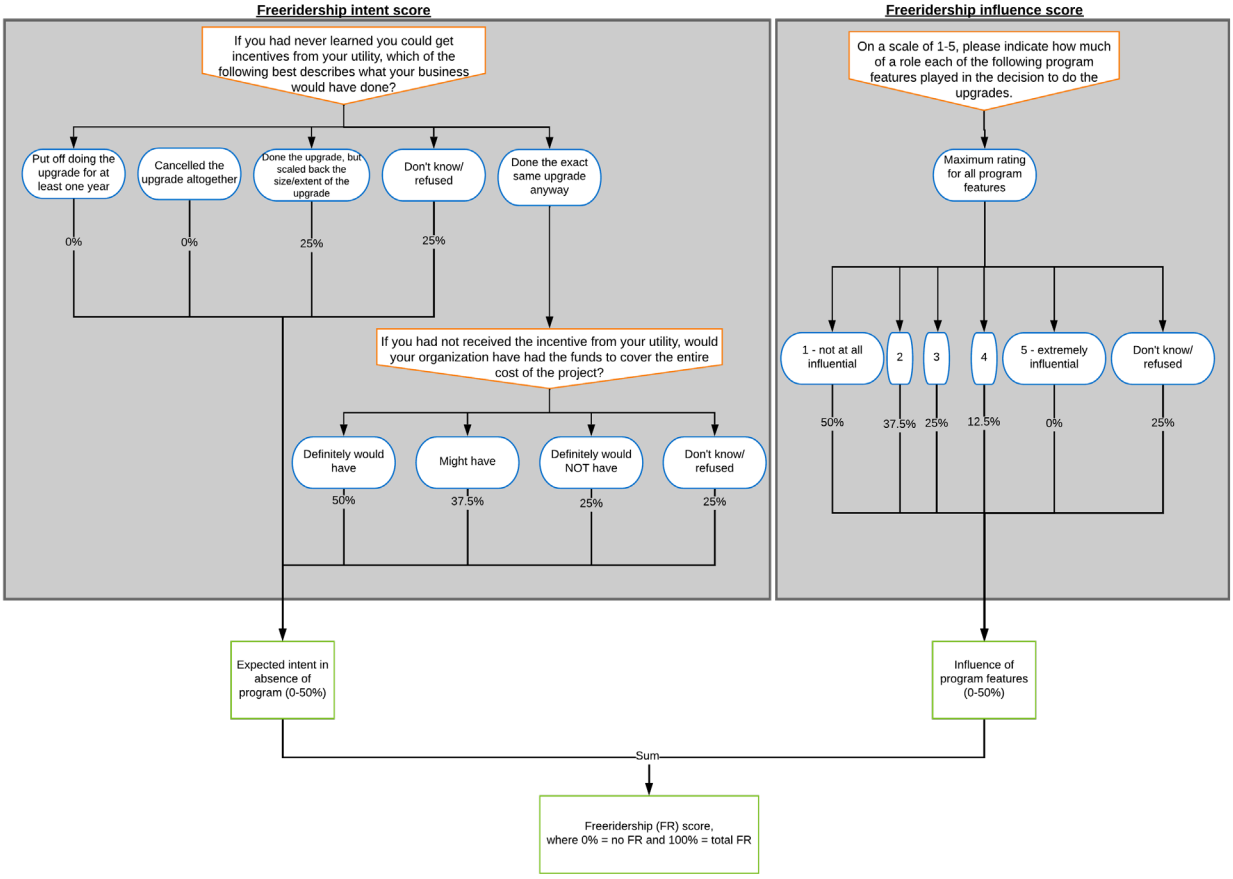
B.1 Free-Ridership Methodology

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-2: 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-1: 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:

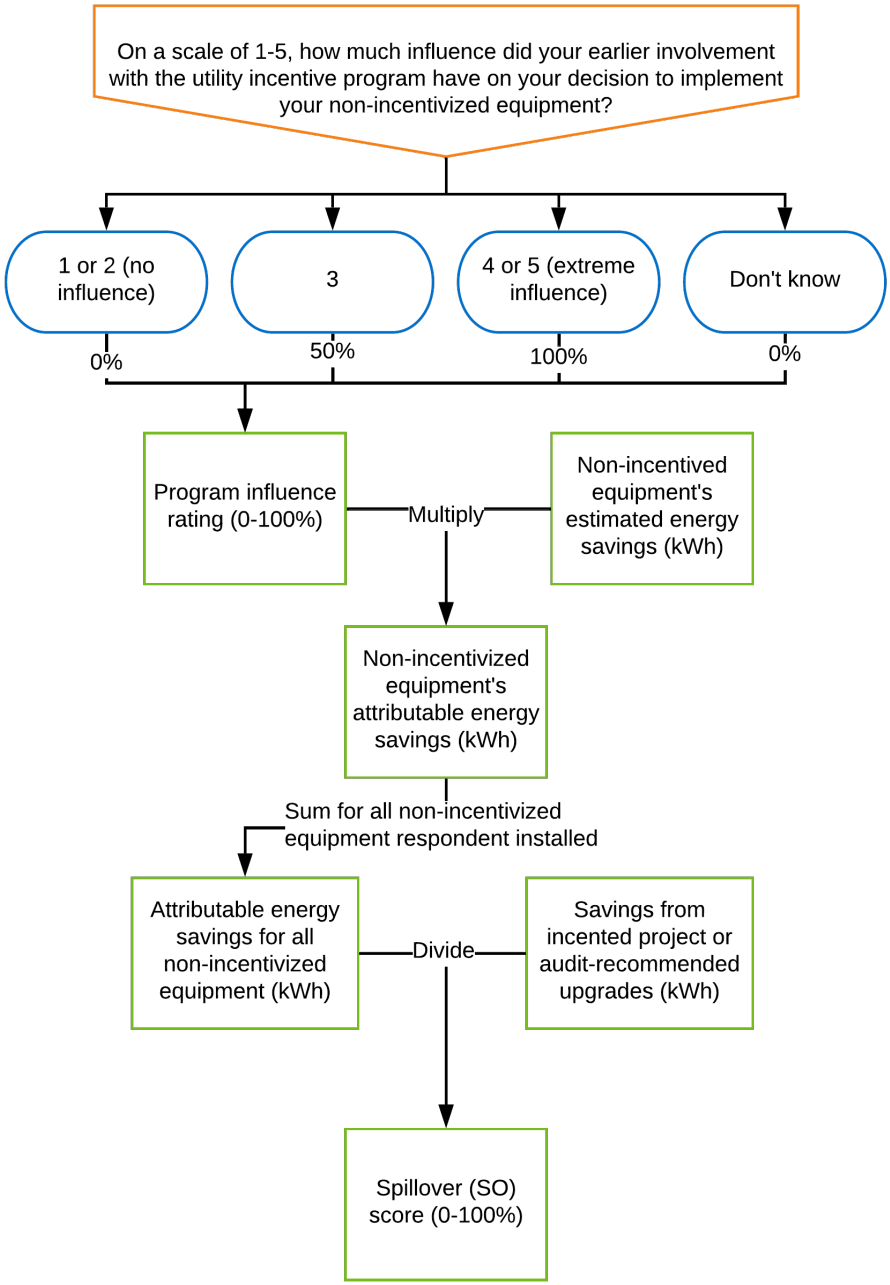
- Maximum rating of 1 or 2 (no influence) = 0%
- Maximum rating of 3 = 50%
- Maximum rating of 4 or 5 (great influence) = 100%
- Respondent does not know how much influence any factor had = 0%

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-1: 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 Detailed Process Evaluation Methodology

This appendix provides additional detail about the process evaluation methodology. A summary of the methodology was provided in Section 3.2.

C.1 Research Question Development

Table C-1 provides a list of the key research questions and the data sources used to investigate each. These research questions were developed at the beginning of the PY2021 evaluation period in January and February of 2022. They were written in consultation with the IESO program staff and the IESO EM&V staff and after reviewing the timing of the related survey instruments to ensure respondent fatigue would be minimized. After the research questions were finalized, they were adapted for inclusion in the interview guides and survey instruments which were, in turn, reviewed and approved by the IESO EM&V and program staff (refer to Appendix C.2 for more information on the interview and survey methodology).

Table C-1: Retrofit Program Process Evaluation Research Objectives and Data Sources

Research Questions	Document and Program Records Review	IESO & Delivery Vendor Staff Interviews	Participant Surveys	Applicant Representative & Contractor Surveys
Is sufficient data being captured to effectively verify recommendations and savings?	✓	✓		
What are the goals and objectives of the program, and how well is the program doing in terms of meeting them?		✓		
What program processes are followed by the IESO and program vendors? What areas of process improvement may exist? Have the recent changes to the program created confusion in the marketplace?		✓		✓
What strategies implemented by the IESO were effective in terms of driving participation, increasing program awareness, and avoiding free ridership?		✓	✓	✓
What were the experiences of applicant representatives and contractors in participating in the program?				✓

What are the program strengths, barriers, and areas of improvement?		✓	✓	✓
How useful and clear were the application forms and program materials? What, if any, improvements could be made to them?			✓	✓
What were the impacts of the program's project incentive cap? What additional equipment purchases occurred above the project incentive cap? Why did some work not occur despite the project incentive cap not being reached?			✓	✓
Do the current range of program equipment/services meet customer needs? Were participants able to install all equipment models of interest to them? What suggestions exist for additional equipment/services?			✓	✓
What were the experiences of participants and applicant representatives in submitting applications or accessing information from the Retrofit Portal? What were their experiences with the program website?			✓	✓
What were the experiences of participants when working with multiple delivery vendors?			✓	
How were participants, applicant representatives, and contractors impacted by the COVID-19 crisis? Are provincial guidelines for health and safety followed by the contractors?			✓	✓
What program marketing and outreach occurred in support of other Save on Energy programs? What other programs have customers participated in?			✓	
What firmographics are associated with participating customers (for example, building type, business ownership, building size, number of employees, etc.)?			✓	

C.2 In-Depth Interview and Survey Methodology

The process evaluation collected primary data from key program actors, including the IESO program staff, program delivery vendor staff, applicant representatives, contractors, and participants (Table C-2). Data were collected using different methods, including web surveys, telephone surveys, or

telephone-based IDIs, depending on what was the most suitable for a particular respondent group. When collected and synthesized, this data provides a comprehensive understanding of the program.

All process evaluation data collection activities were carried out or managed by the evaluators. All survey instruments, interview guides, and sample files were developed by the evaluators for interviews and surveys. The IESO EM&V staff approved the survey instruments and interview guides. The data used to develop the sample files was retained from program records supplied either by the IESO EM&V staff or the program delivery vendor.

Table C-2: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Population	Completed	Response Rate	90% CI Error Margin
IESO Program Staff	Phone In-depth Interviews (IDIs)	3	3	100%	0%
Program Delivery Vendor Staff	Phone IDIs	3	3	100%	0%
Applicant Representatives and Contractors	Web Survey	545	68	12%	9.4%
Participants	Web and Phone Survey	2,087	413[10]	20%	3.6%

The following subsections provide additional details about the process evaluation methodology.

IESO Program Staff and Program Delivery Vendor Staff Interviews

IDIs were completed with three members from the IESO program staff and three members from the program delivery vendor staff (Table C-3). The purpose of the interview was to better understand the perspectives of the IESO program staff and the program delivery vendor staff related to the program design and delivery.

[10] The NTG evaluation included 16 more respondents (n=429) than the process evaluation (n=413) because 16 respondents did not fully answer the process evaluation survey questions.

Table C-3: IESO Program Staff and Program Delivery Vendor Staff IDI Disposition

Disposition Report	IESO Program Staff	Program Delivery Vendor Staff	Total
Completes	3	3	6
No Response	0	0	0
Unsubscribed	0	0	0
Partial Complete	0	0	0
Bad Contact Info (No Replacement Found)	0	0	0
Total Invited to Participate	3	3	6

The interview topics covered included program roles and responsibilities, program design and delivery, marketing and outreach, applicant representative and contractor engagement, program strengths and weaknesses, and suggestions for improvement.

The appropriate staff to interview were identified in consultation with the IESO EM&V staff. Telephone IDIs were conducted with the IESO program staff and program delivery vendor staff using in-house staff (rather than through a survey lab). The interviews were completed between April 22 and May 11, 2022. Each interview took approximately one hour to complete.

Applicant Representative and Contractor Survey

A total of 68 application representatives and contractors were surveyed from a sample of 545 unique companies (Table C-4). The purpose of the survey was to better understand the applicant representative and contractors' perspectives on to program delivery.

Table C-4: Applicant Representative and Contractor Survey Disposition

Disposition Report	Total
Completes	68
Emails bounced	29
Bad Contact Info (No Replacement Found)	-
Unsubscribed	-
Partial Complete	17
Screened Out	10
No Response	421
Total Invited to Participate	545

The survey topics included:

- firmographics,
- program roles and responsibilities,
- projects completed,
- impacts of the new incentive cap on project scope,
- program-specific communications from the IESO,
- how customers heard about the program,
- training and education,
- barriers to participation,
- satisfaction with various aspects of the program,
- incentive cap perspectives,
- equipment offering feedback,
- program improvement suggestions,
- FR and SO,
- jobs impacts, and
- impacts of the COVID-19 pandemic.

The sample was developed from the 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 over the web by the NMR staff using Qualtrics survey software. Survey implementation was conducted between March 22 and April 18, 2022. The survey took an average

of 18 minutes to complete after removing outliers.[11] Weekly e-mail reminders were sent to non-responsive contacts through web survey fielding.

Participant Survey

A total of 413 participants were surveyed from a sample of 2,086 unique contacts (Table C-5). The purpose of the survey was to better understand the participants' perspectives on the program experience.

Table C-5: Participant Survey Disposition

Disposition Report	Web	Phone	Total
Completes	356	57	413
Emails bounced	33	0	33
Bad Contact Info (No Replacement Found)	0	0	0
Unsubscribed	0	0	0
Partial Complete	27	0	27
Screened Out	42	0	42
Busy	0	52	52
Callback	0	101	101
Hard Refusal	0	43	43
No answer	0	91	91
No Eligible Respondent	0	19	19
Non-working #	0	14	14
Voicemail	0	243	243
Agreed to Complete Online	0	23	23
Wrong Number	0	12	12
Answering Machine	0	157	157
No Response	1629	71	1700
Total Invited to Participate	2087	883	2970

The survey topics included:

- firmographics,
- energy management training path or certification,

[11] 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.

- experience with and suggestions for improvement of the Retrofit Support Line and Save on Energy program website,
- experience working with the application process when working with multiple program delivery vendors,
- impacts of the custom track removal on project scope,
- impacts of the new incentive cap on project scope,
- participation in other programs,
- FR and SO,
- job impacts, and
- impacts of the COVID-19 pandemic.

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 implementation was conducted in two separate rounds. The first round was conducted between September 27 and October 28, 2021, with contacts who had participated in the program in Period 1 (January through June 2021). The second round was conducted between March 3 and March 29, 2022, with contacts who had participated in the program in Period 2 (July through December 2021). The survey took an average of 14 minutes to complete after removing outliers.[12] Weekly e-mail reminders were sent to non-responsive contacts through web survey fielding.

[12] 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.

Appendix D Additional Net-to-Gross and Process Evaluation Results

This appendix provides additional results in support of the NTG and process evaluations.

D.1 Contractor Net-to-Gross Results

This section provides a summary of the FR and SO results collected as part of the Retrofit applicant representative and contractor survey. Given that only a small number of contractors responded to these survey questions, these results were not used to calculate the Retrofit program's NTG. Only the FR and SO results collected as part of the participant survey were used to calculate NTG.

Contractor FR. The survey collected feedback from respondents to better understand contractors' perspectives on the extent of FR within the Retrofit program. Contractors were asked to estimate the percentage of various equipment types that would have been installed with the same efficiency level had there been no incentive available through the program. Fourteen contractors responded to the questions in the survey.

Ten of the fourteen surveyed contractors stated that at least some of their projects would have installed the same equipment with the same efficiency level in the Retrofit program's absence. Of the 267 total projects reported among these contractors, they indicated a total of 90 would have installed the same equipment (34%).

The contractors were asked to estimate the percentage of various equipment types that would have been installed with the same efficiency level had there been no incentive available through the program. The average percentage among the ten contractors who made an estimate for lighting was 28%.

Contractor SO. To estimate SO, contractors were asked if they installed any energy-efficient equipment that did not receive incentives. The five contractors who responded to this question reported that of the 231 projects that did not go through the program, 167 (72%) installed equipment that would have been eligible for an incentive but did not receive one. This was largely driven by one contractor who stated that 150 of their 200 non-program projects had efficient equipment that would have been eligible to receive an incentive. The respondents rated the program's influence on the decision to install that equipment as an average of 1.4 out of 5 on a scale from one (1) to five (5), where one indicates the program was "not at all influential" and five indicates the program was "extremely influential."

D.2 Additional Applicant Representative and Contractor Process Results

This section provides additional detail regarding the process evaluation results collected as part of the Retrofit applicant representative and contractor survey.

Firmographics

As presented in Figure D-1, just over one-half of respondents (51%) were applicant representatives in the Retrofit program, over two-fifths (43%) were both applicant representatives and contractors, and less than one-tenth (6%) were contractors only.

Figure D-1: Respondents' Role in Retrofit Program (n=68)

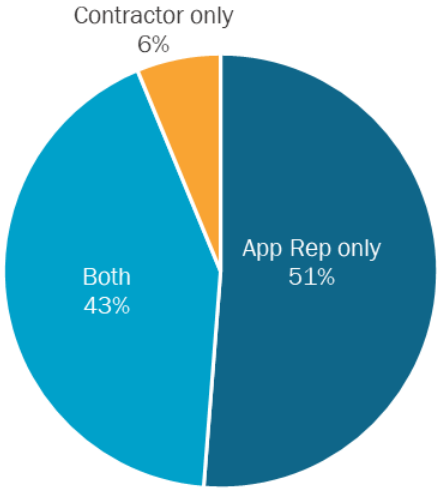


Table D-1 displays the number of full and part-time employees at the respondents' companies. Nearly one in three (29%) were affiliated with companies that had five or fewer full-time positions. Over one in five (22%) were affiliated with companies that had over 20 full-time positions. One in four (26%) reported having part-time positions.

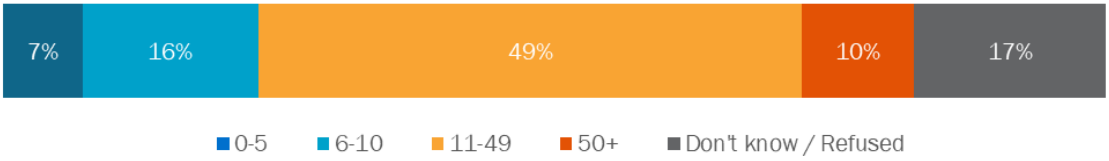
Table D-1: Respondents' Full- and Part-time Employees (n=68)

Number of Employees	Full-Time*	Part-Time
0-5	29%	18%
6-10	7%	1%
11-20	7%	3%
20+	22%	4%
Don't know/Refused	34%	43%
None	0%	31%

*Does not sum to 100% due to rounding.

The breakdown of the respondents' company age is presented in Figure D-2. Less than one-tenth of respondents (7%) were affiliated with companies that had been in business for less than five years. Nearly one-half (49%) were affiliated with companies that had been in business between eleven and forty-nine years. One-tenth (10%) were affiliated with older businesses that had been in operation for more than 50 years.

Figure D-2: Respondents' Company Age (n=68)*

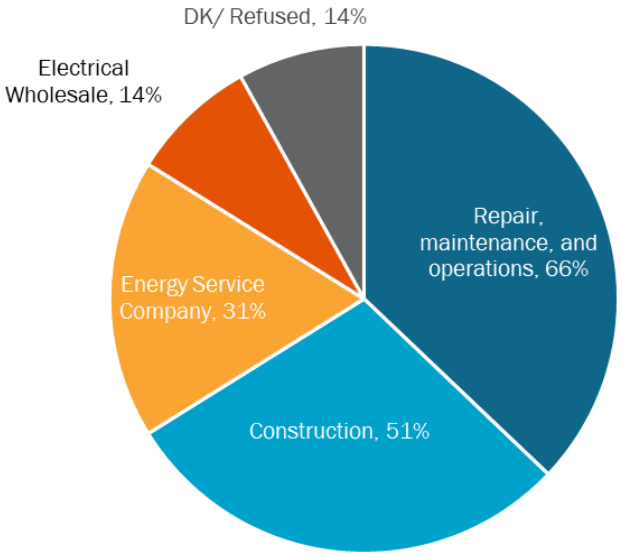


*Does not sum to 100% due to rounding.

Respondent business categories varied, as presented in Figure D-3. Close to two-thirds (66%) worked in repair, maintenance, and operations. Over one-half (51%) worked in construction.

Figure D-3: Respondents' Business Category

(Open-ended and multiple responses allowed; n=33)*



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

Respondents who reported being in the repair, maintenance, and operations business category were asked to specify further. Nearly all (91%) of these respondents indicated they worked in repair and maintenance. Respondents who reported being in the construction business category were also asked to specify further. Almost one-half (47%) indicated they worked in non-residential building construction, and an equal amount (47%) worked in repair construction.

Project Background

Both applicant representatives and contractors were asked to provide background information about the projects they completed through the Retrofit program.

Applicant Representatives

Of the 64 responding applicant representatives, 55 provided estimates on the number of clients they assisted with applications. In total, applicant representatives reported representing 983 clients, an average of 18 clients per respondent.

Contractors

Of the 33 responding contractors, 26 provided detail on the total number of projects their company completed through the program in 2021. In aggregate, respondents reported a total of 889 projects,

558 (63%) of which were completed through the Retrofit program. The average estimate of the percentage of total sales that went through the Retrofit program was 35%.

Respondents were asked to provide the total sales estimates by equipment type for program-eligible measures, regardless of whether the equipment received an incentive through the program. They were then asked what percentage of those sales by equipment type went through the Retrofit program. Table D-2 presents the average estimates of the percentage of sales by equipment type and the percentage of those sales that went through the Retrofit program. Lighting represents the largest percentage of sales (71%), and nearly two-thirds (65%) of reported lighting sales went through the Retrofit program. HVAC measures (including controls) represent a small portion of sales (<1%), but nearly all those sales (90%) went through the Retrofit program.

Table D-2: Percent of Sales by Equipment Type

(Open-ended and multiple responses allowed; n=20)

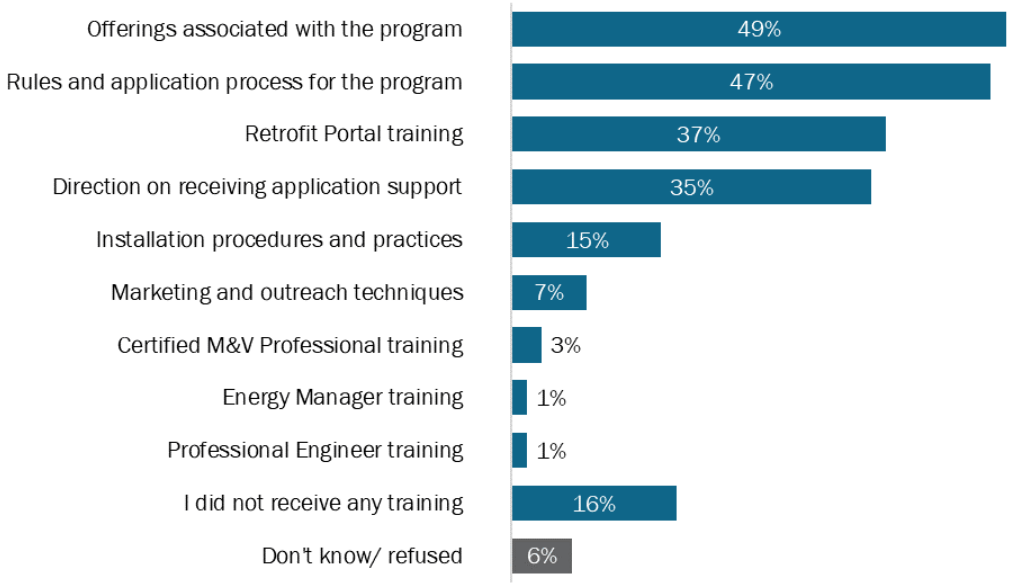
Equipment Type	% of Total Sales	% Sold through Retrofit Program
Lighting	71%	65%
Lighting, controls	3%	100%
HVAC	<1%	90%
HVAC, controls	<1%	90%
Motor VFD	2%	100%
Pump VFD	2%	95%
EMS	5%	40%
Other program eligible measures	13%	100%
Other nonprogram eligible measures	4%	N/A

Training and Education

Respondents reported the types of training they had received in support of the Retrofit program (Figure D-4). Nearly one-half of respondents received training on the offerings associated with the program (49%) and the rules and application process (47%). Almost one-sixth (16%) of respondents indicated that they had not received any training at all. Section 6.2.2 includes an additional discussion around training and education.

Figure D-4: Types of Training Received

(Open-ended and multiple responses allowed; n=68)*



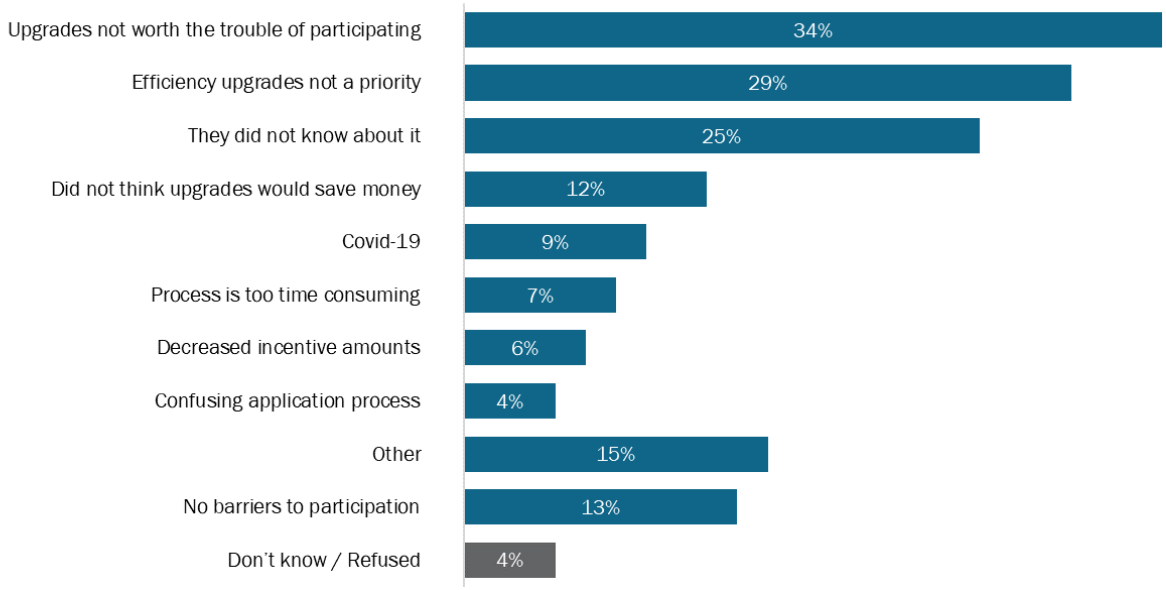
*Does not sum to 100% due to multiple responses.

Program Experience and Improvement Suggestions

Figure D-5 includes a full list of barriers to customer participation, as reported by applicant representatives and contractors. Section 6.2.3 includes an additional discussion around program barriers.

Figure D-5: Barriers to Customer Participation

(Open-ended and multiple responses allowed; n=68)

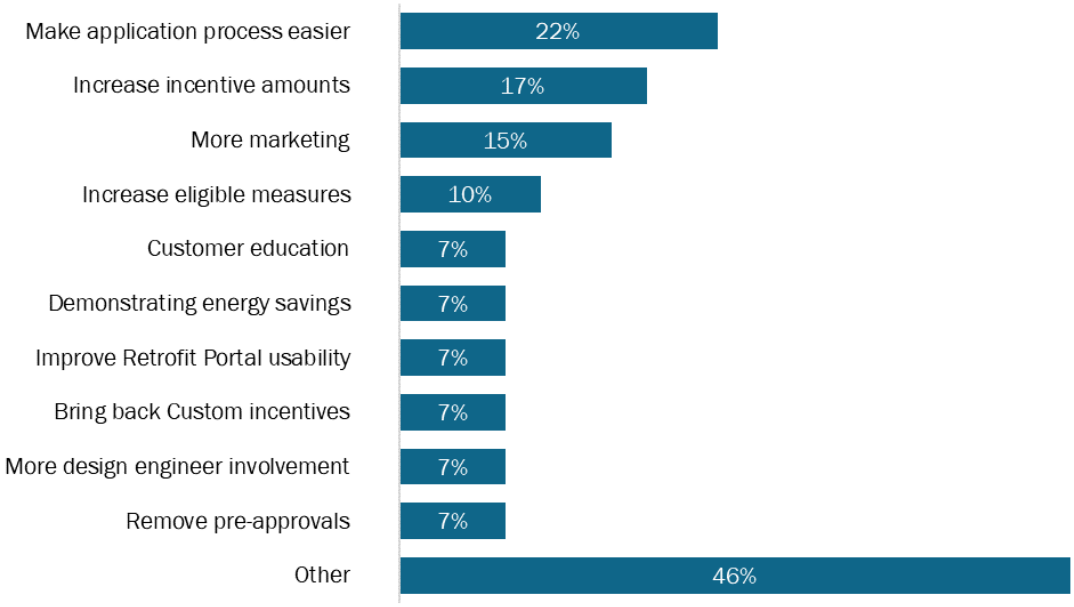


*Does not sum to 100% due to multiple responses.

Figure D-6 includes a full list of suggestions to overcome participation barriers, as reported by applicant representatives and contractors. Section 6.2.3 includes an additional discussion around overcoming customer barriers.

Figure D-6: Suggestions to Overcome Participation Barriers

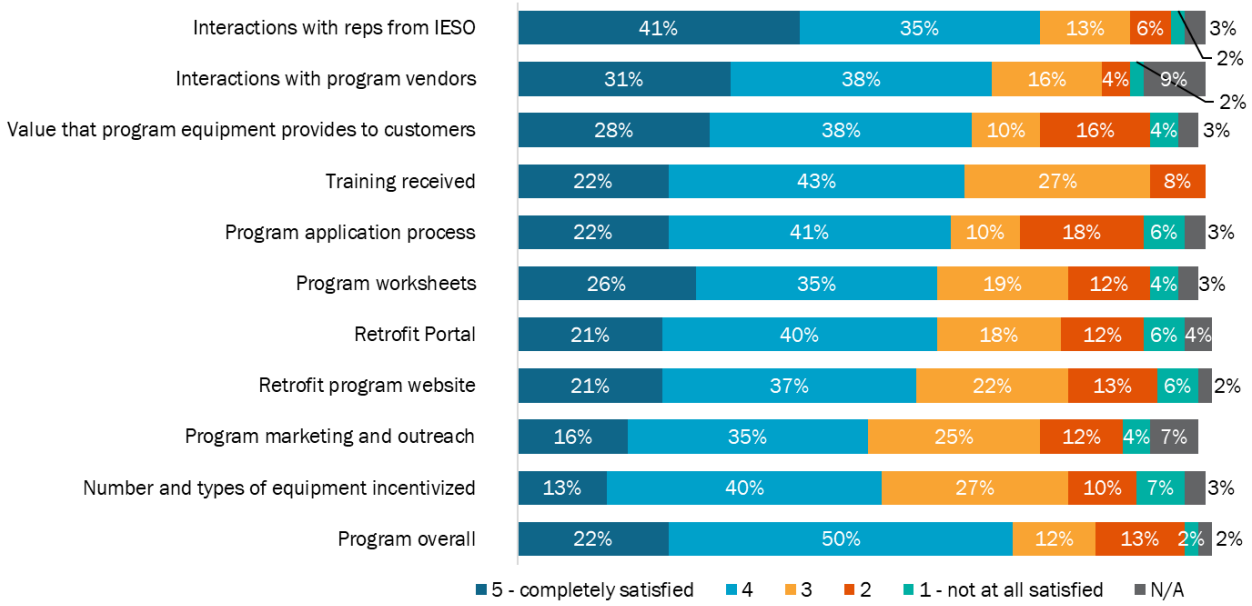
(Open-ended and multiple responses allowed; n=47)*



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

Figure D-7 includes a full breakdown of results associated with the applicant representative and contractor satisfaction with various aspects of the Retrofit program. Section 6.2.3 includes an additional discussion around satisfaction.

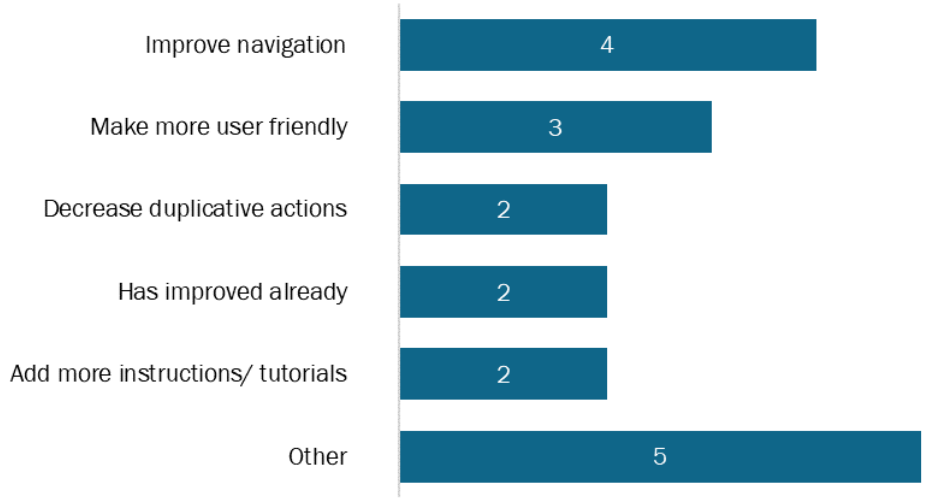
Figure D-7: Satisfaction with Aspects of the Retrofit Program (n=68)



Respondents who provided a satisfaction rating for the Retrofit program website of three or below were asked for suggestions on how to improve this aspect of the program (Figure D-8). The most common suggestions were to improve navigation (4 respondents) and to make the website more user-friendly (3 respondents). Other suggestions include adding a search function, creating a mobile app, and clarifying necessary information for an application, each mentioned by one respondent. Section 6.2.3 includes an additional discussion around satisfaction.

Figure D-8: Suggested Improvements for Retrofit Program Website

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

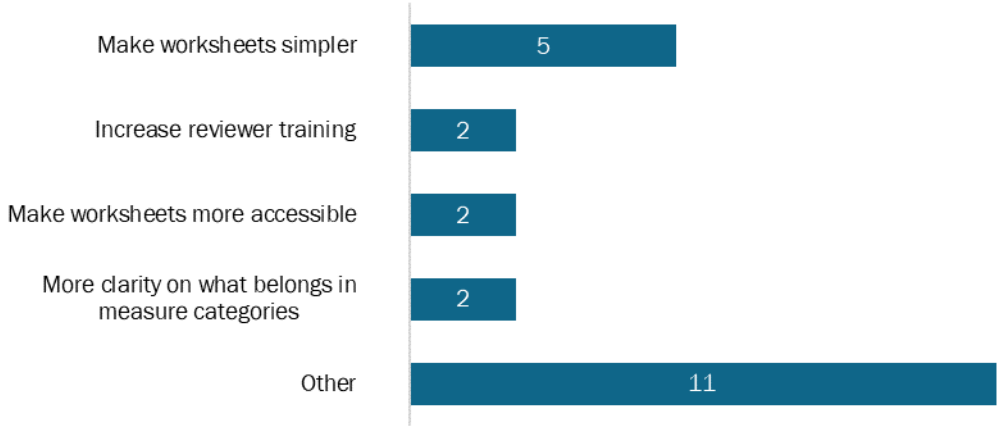


* Counts displayed rather than percentage due to small n.

Respondents who provided a satisfaction rating for the Retrofit Program worksheets of three or below were asked for suggestions on how to improve this aspect of the program (Figure D-9). The most common suggestion was to make the worksheets simpler (5 respondents). Other suggestions include creating video tutorials, allowing copying directly from worksheets to the portal, and auto-populating data for approved measures, each mentioned by one respondent. Section 6.2.3 includes an additional discussion around satisfaction.

Figure D-9: Suggested Improvements for Retrofit Program Worksheets

(Open-ended and multiple responses allowed; n=17)*

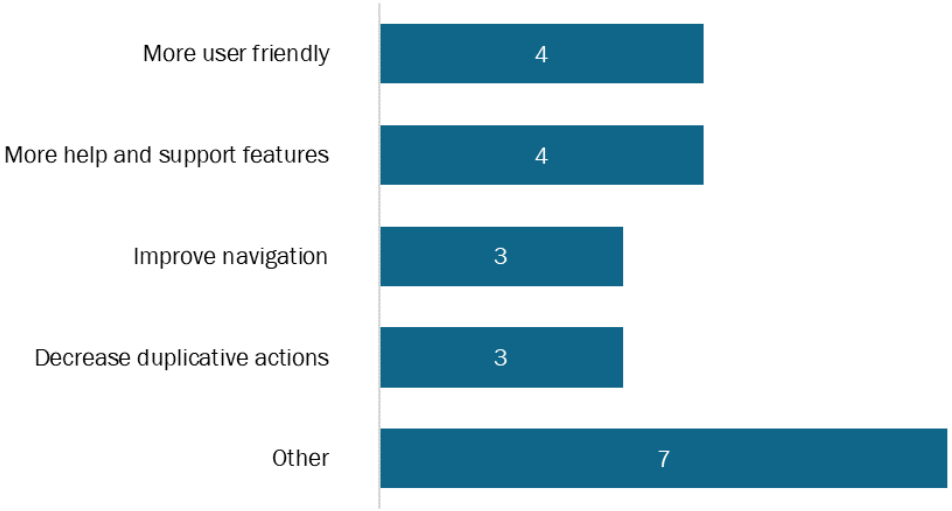


* Counts displayed rather than percentage due to small n.

Respondents who provided a satisfaction rating for the Retrofit Portal of a three or below were asked for suggestions on how to improve this aspect of the program (Figure D-10). The most common suggestions were to make the Portal more user-friendly (4 respondents) and to add more help and support features (4 respondents). Other suggestions include displaying all project information on one screen with tabs, allowing clients to log in and easily approve projects, and making it easier to edit applications, each mentioned by one respondent. Section 6.2.3 includes an additional discussion around satisfaction.

Figure D-2: Suggested Improvements for Retrofit Portal

(Open-ended and multiple responses allowed; n=15)*



* Counts displayed rather than percentage due to small n. Does not sum to 15 due to multiple responses.

Respondents who provided a satisfaction rating for the program overall of a three or below were asked for suggestions on how to improve it (Table D-3). Some suggestions included expanding measure offerings, increasing incentives, more training for application reviewers, more clarity on eligible measures, and making post-project submission easier, each mentioned by one respondent. Section 6.2.3 includes an additional discussion around satisfaction.

Table D-3: Suggestions to Improve Program Overall

(Open-ended and multiple responses allowed; n=17)

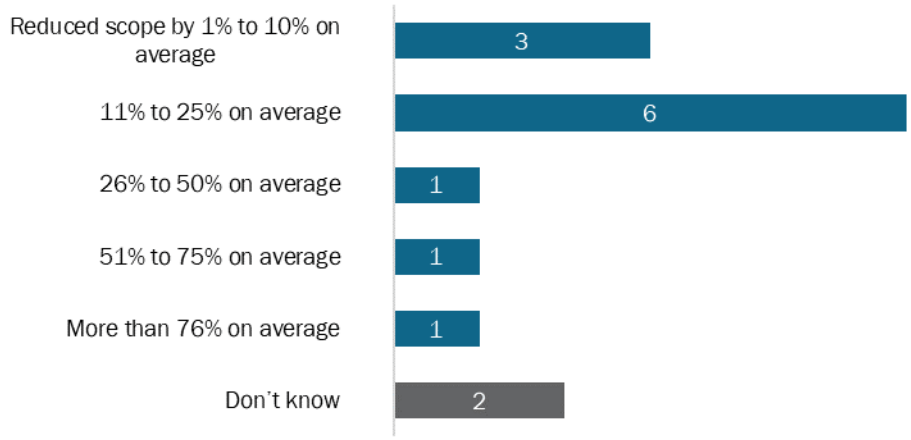
Program Recommendation	Respondents
Expand measure offerings	1
Increase incentives	1
Increase marketing	1
Offer incentives to contractors	1
Rethink qualifications for Unitary AC	1
More training for applicants and applicant reps	1
Add offerings specifically for data center AC	1
Make portal more user friendly	1
More IESO staff support	1
Create a mobile app	1
Bring back Custom offering	1
Higher incentives for premium efficiency products	1
More training for reviewers	1
More application help and support	1
Bring back one page application	1
Remove pre-approval	1
Make post-submission easier	1
Clarity on eligible measures	1
Bring back power conditioning equipment	1

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

Incentive Cap

About one-fourth (22%) of respondents indicated the incentive cap reduced the scope of some of their projects. When asked to quantify the extent of the scope reduction, over two-fifths (6 respondents) indicated the scope was reduced in the range of 11% to 25% (Figure D-11). Section 6.2.4 includes an additional discussion around the impact of the incentive cap.

Figure D-11: Retrofit Program Prescriptive Incentive Cap Scope Reduction (n=14)*

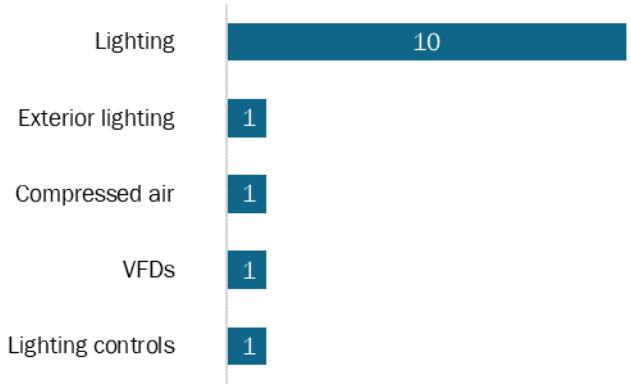


* Counts displayed rather than percentage due to small n.

Figure D-12 includes a full list of energy-efficient equipment installed beyond the program incentive cap, as reported by the applicant representatives and contractors. When the respondents were asked why projects exceeded the incentive cap, the most common reason was that the incentive cap was not sufficient to complete the project (8 respondents), followed by the energy or monetary savings justifying the additional cost (6 respondents). Two respondents reported not knowing the reason. Section 6.2.4 includes an additional discussion around the impact of the incentive cap.

Figure D-3: Energy-Efficient Equipment Installed Beyond Program Incentive Cap

(Open-ended and multiple responses allowed; n=14)*

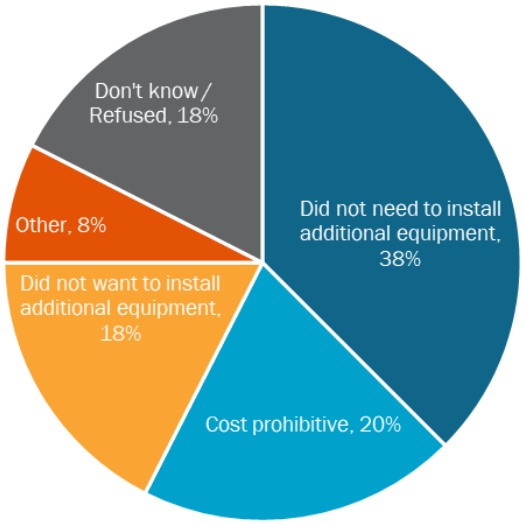


* Counts displayed rather than percentage due to small n.

Figure D-13 provides feedback on why some participant projects did not reach the incentive cap, as reported by the applicant representatives and contractors. Section 6.2.4 includes an additional discussion around the impact of the incentive cap.

Figure D-13: Reason for Not Reaching Incentive Cap

(Open-ended and multiple responses allowed; n=40)



Equipment Offerings

Table D-4 includes the full list of equipment of interest that were not eligible for the Retrofit program as reported by applicant representatives and contractors. Section 6.2.5 includes an additional discussion around equipment offerings.

Table D-4: Equipment of Interest that were Not Eligible for Retrofit Program Incentives

(Open-ended and multiple responses allowed; n=12)*

Ineligible Equipment	Respondents
Exterior lighting	6
Non-approved LEDs	3
Non-VSD controls	2
Custom measures	1
ECMs	1
Data center cooling	1

*Does not sum to 12 due to multiple responses.

Table D-5 includes the full list of equipment recommended for inclusion in the Retrofit program as reported by applicant representatives and contractors. Section 6.2.5 includes an additional discussion around equipment offerings.

Table D-5: Suggestions of Equipment to Consider Adding to Program

(Open-ended and multiple responses allowed; n=41)

Equipment Recommendation	Respondents
Exterior lighting	16
Building automation	5
Heat pumps	2
ECMs	2
Third party M&V	2
VFDs	2
Custom path	2
EV chargers	1
HVAC controls	1
Energy management systems	1
Compressed air controls	1
Thermostats	1
Centrifugal compressors	1
Data Center cooling	1
Voltage regulator	1
Agricultural cooling	1
Higher efficiency thresholds	1
Equipment maintenance	1
UV controllers	1
Fan coil units	1
Heat management systems	1
Power conditioning systems	1
Low voltage relay panels	1
Large air compressors	1

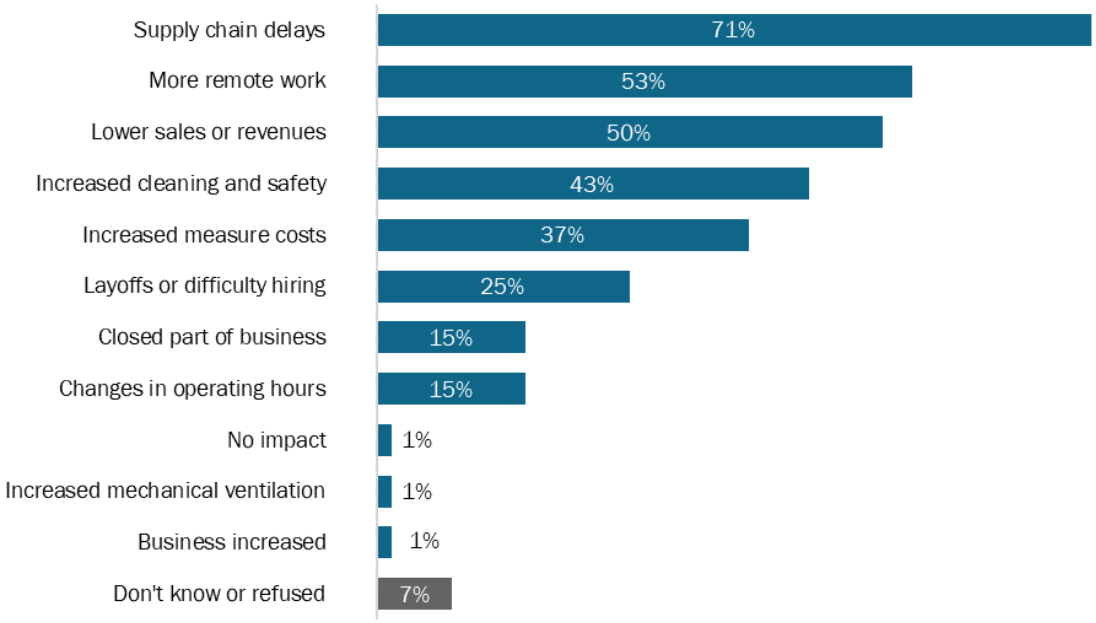
*Does not sum to 100% due to multiple responses.

Business Response to the COVID-19 Pandemic

Respondents were asked how the COVID-19 pandemic had impacted their company and its operations (Figure D-14). More than two-thirds (71%) reported that the COVID-19 pandemic had resulted in supply chain delays or shortages. Over one-half reported more remote work (53%) and lower sales or revenues (50%).

Figure D-14: Changes to Business Operations due to COVID-19

(Open-ended and multiple responses allowed; n=68)*



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

Contractors were asked a follow-up question to indicate how difficult it had been to adhere to health and safety protocols during the pandemic, rating them on a scale from one (1) to five (5), where one indicates “unduly difficult,” and five indicates “not difficult at all” (Figure D-15). Over one-half (52%) of respondents thought adhering to protocols was either not very difficult (36%) or not difficult at all (16%).

Figure D-15: Difficulty Adhering to Covid-19 Protocols (n=31)

D.3 Additional Participant Net-to-Gross Results

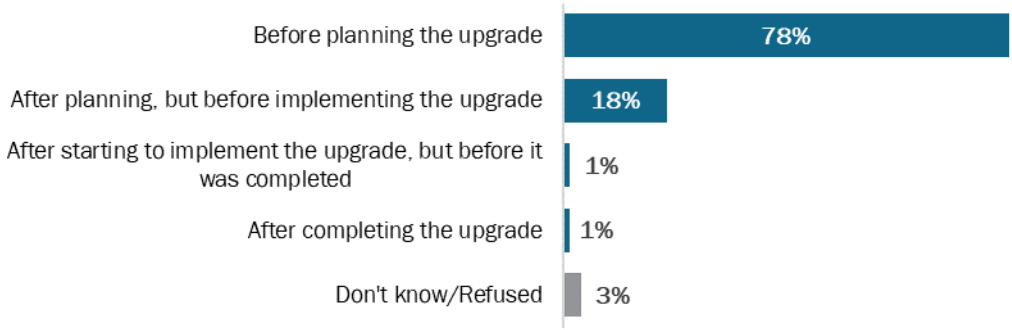
This section includes detailed FR and SO results associated with the NTGR for Retrofit participants.

Free-Ridership (FR)

The extent of FR within the program was assessed by surveying Retrofit program participants to understand 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 three-fourths (78%) of respondents stated they first learned they could receive energy-efficiency incentives through the Retrofit program before starting to plan their upgrades (Figure D-16). This may suggest the program was influential in many of these respondents' decisions to begin the project. Nearly one-fifth (18%) of respondents learned about the program after planning had started but before beginning the project. The remainder learned after beginning but before completing their projects (1%), after completing the upgrade (1%), or did not know or refused to answer (3%). 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-16: When Participants First Learned About the Program (n=429)*

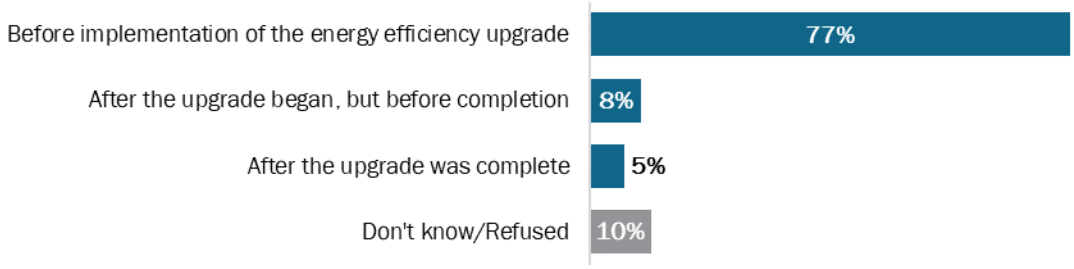


*Does not sum to 100% due to rounding.

Participants were then asked about the timing of their application to the program in relation to the start of their energy-efficient upgrades (Figure D-17). Nearly four out of five respondents (77%) indicated they applied before their company began implementing the upgrade, suggesting that most

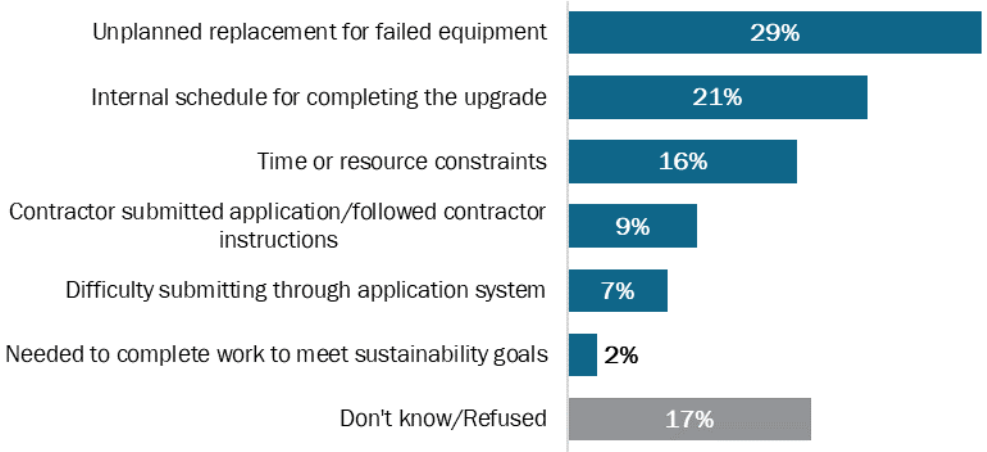
participants applied to the program as intended. Less than one in ten (8%) did so after their energy-efficiency upgrade began but before its completion. The remainder either did so after the upgrade was complete (5%) or did not know or refused to answer (10%). Similar to the previous question, this question was not used to calculate the FR score, yet it provides additional context regarding participant intentions.

Figure D-17: Timing of Program Application (n=429)



Respondents whose companies submitted a Retrofit program application after starting an energy-efficiency upgrade were asked their reasoning for doing so (Figure D-18). The most common reasons provided were an unplanned replacement (29%) or the need to stick to an internal schedule (21%). The responses suggest that many of these respondents would have applied earlier if it had been possible. 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-18: Reason for Submitting After Starting Upgrade (n=56)*

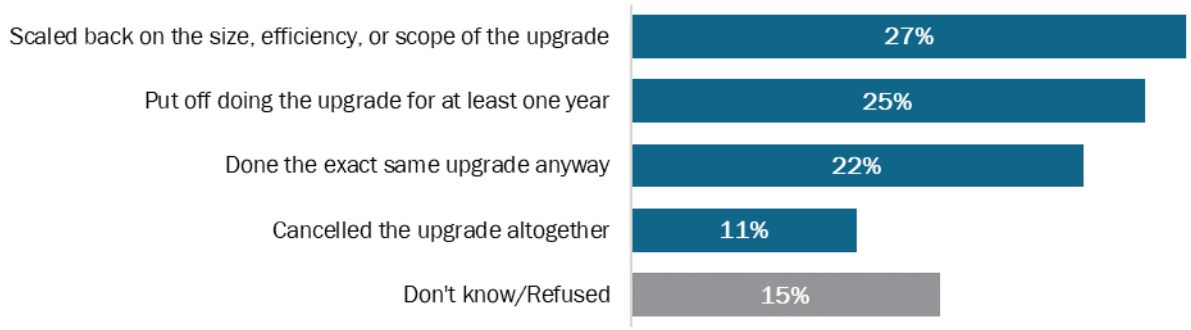


*Does not sum to 100% due to rounding.

Respondents were then asked what they would have done in the program's absence (Figure D-19). Nearly one-fourth of respondents would have done the "exact same upgrade" anyway (22%), which is indicative of higher FR for these respondents. Over one-third of respondents (36%) showed no indication of FR since they stated they would have put off the upgrade for at least one year (25%) or cancelled their upgrade altogether (11%) if the program had not been available to them. Other

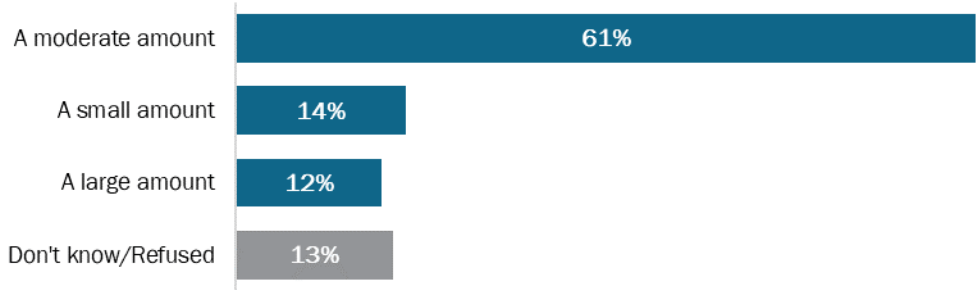
respondents were considered partial free riders if they reported that they would have scaled back on the size, efficiency, or scope of their project (27%) or if they did not know what they would have done in the absence of the program (15%). The evaluation team factored responses from this participant intent question into the FR analysis.

Figure D-19: Actions in the Absence of Program (n=429)



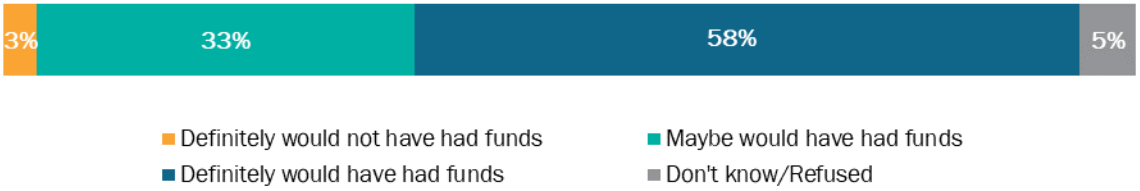
Respondents who indicated they would have installed less energy-efficient or less expensive equipment were then asked to describe how much they would have reduced the project's size, scope, or efficiency. Over three-fifths of these respondents (61%) would have scaled it back by a moderate amount (Figure D-20). These results indicate the program allowed these participants to increase their project's size and/or extent 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 (14%), those who would have scaled it back by a large amount (12%), and those who did not know how their project scope would have changed (13%). This question was not used to calculate the FR score, though it provided additional context around participant intentions.

Figure D-20: Scaled Back Size or Extent of Upgrade in Absence of Program Incentives (n=116)



Respondents who stated they would have done the "exact same upgrade" in the program's absence were asked to confirm they would have had the funds to cover the project's entire cost without the program funding (Figure D-21). Nearly three-fifths (58%) of respondents stated they 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 (33%). This feedback indicates some degree of FR and suggests the program may have helped a portion of these participants complete projects they might not have been able to independently. This participant intent question was factored into the FR analysis.

Figure D-21: Availability of Funds in Absence of Program Incentives (n=96)*



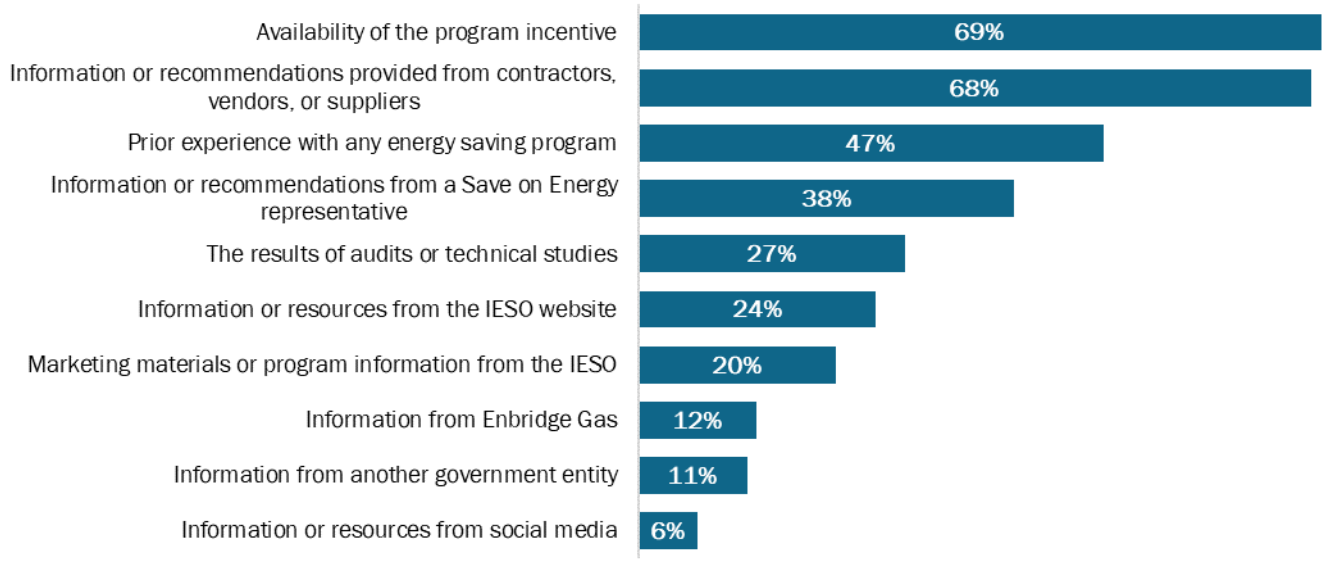
*Does not sum to 100% due to rounding.

Respondents were asked how influential various program features were on their decision to install energy-efficient equipment (Figure D-22). They rated each feature's influence on 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 highest-rated responses were the availability of incentives (69% with a rating of 4 or 5 for each response) and the recommendations from contractors, vendors, or suppliers (68% with a rating of 4 or 5). The next most influential program feature was a previous experience with energy-saving programs (47% with a rating of 4 or 5). This question, which focuses on the program's influence, along with the prior questions about customer intentions, was used 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-22: Influence of Program Features on Participation (n=429)

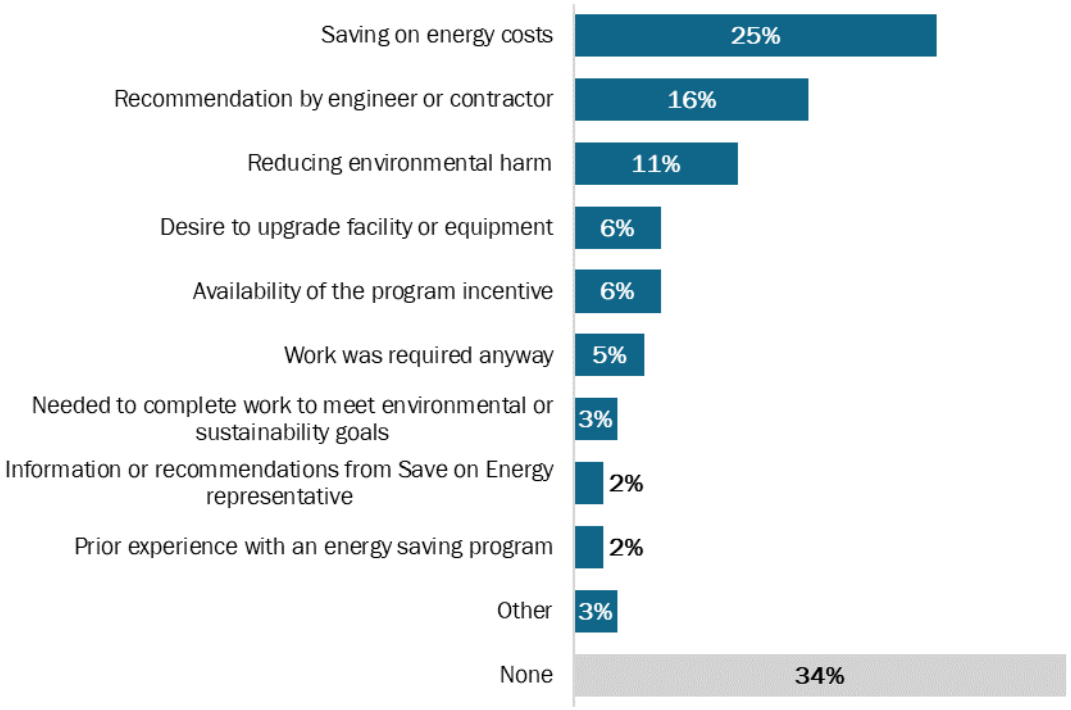
(Rating of 4 or 5 on a scale from 1 to 5)



When respondents were asked whether any other factors played "a great role" in influencing their organization to install energy-efficient equipment, the respondents' answers varied widely (Figure D-23). The most common responses included wanting to save on energy costs (25%), recommendations by an engineer or contractor (16%), and a desire to reduce environmental harm (11%).

Figure D-23: Other Influential Factors on Upgrade Decision

(Open-ended and multiple responses allowed; n=247)*

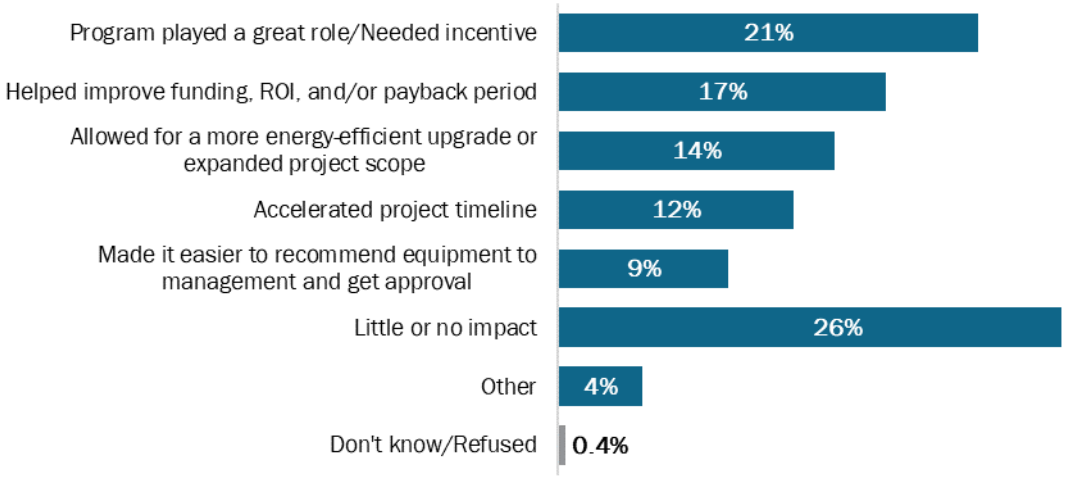


*Does not sum to 100% due to multiple responses.

Respondents were asked to explain in their own words 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-24). The most common response related to the program playing a great role and needing the incentive (21%). Other responses related to the financial incentive helping their funding, ROI, or payback period (17%) and allowing for a more energy-efficient upgrade or expanding the project scope (14%).

Figure D-24: Program Impact on Decision to Install Equipment

(Open-ended and multiple responses allowed; n=276)*

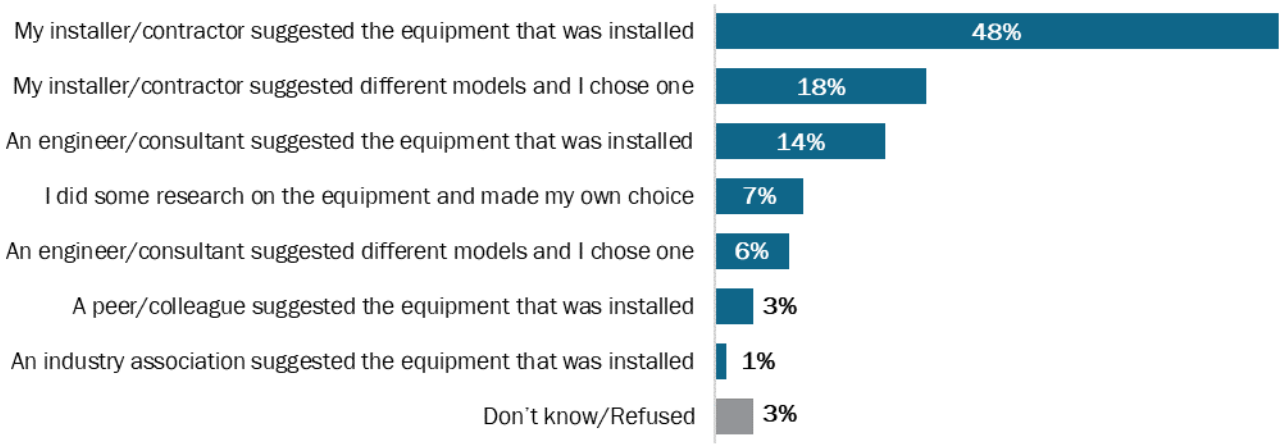


*Does not sum to 100% due to multiple response.

As shown in Figure D-25, nearly one-half (48%) of surveyed participants selected equipment based on their installer's or contractor's suggestions, which is two to three times the number of participants who chose from a shortlist of equipment models provided by their installer or contractor (18%) or followed an engineer's or consultant's suggestions (14%). This reinforces the importance of contractors' role in helping drive customers to efficient equipment decisions.

Figure D-25: Equipment Selection Process

(Open-ended and multiple responses allowed; n=429)



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. Nearly one-fifth (16%) reported installing new equipment.

Table D-6 displays the types of non-incentivized equipment installed by companies after their Retrofit project was completed. Some survey respondents installed multiple equipment types. Non-incentivized lighting was the most common equipment installed. Over one-half of respondents (55%) stated they installed lighting, more than three times the number that mentioned any other equipment type.

Table D-6: Types of Upgrades Installed after Program Participation

(Open-ended and multiple responses allowed; n=67)*

Upgrade	Respondents
Lighting	55%
Motor/Pump Upgrade	18%
HVAC - Air conditioner replacement, above code minimum	15%
Lighting - Controls	15%
Motor/Pump Drive Improvement	12%
ENERGY STAR Appliance	9%
Fan	4%
Injection molding process equipment	3%
Other	9%

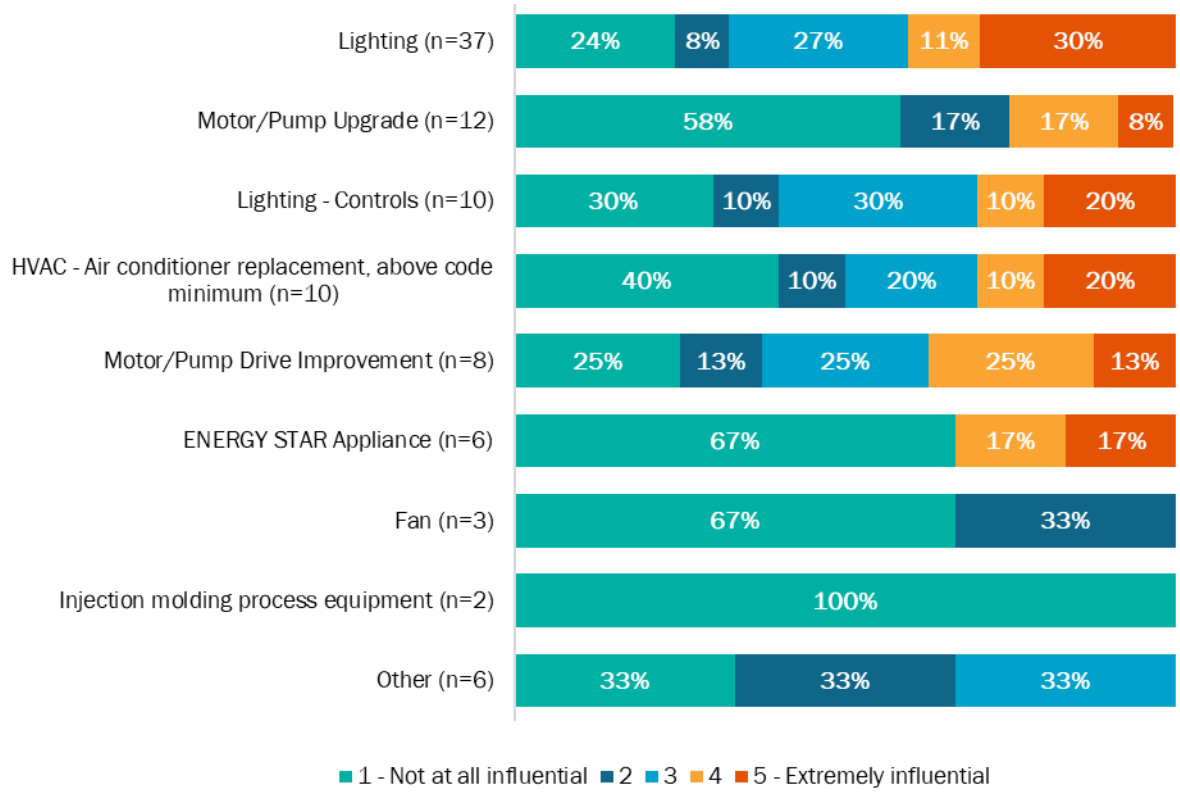
*Does not sum to 100% due to multiple responses.

Respondents were then asked what level of influence their participation in the Retrofit program had on their decision to install this additional energy-efficient equipment. Participants rated the program's influence on a scale from one (1) to five (5), where one indicates the program was "not at all influential" and five indicates the program was "extremely influential."

Figure D-26 presents that for the equipment installed most commonly (i.e., lighting, motor/pump upgrade, lighting controls, HVAC, motor/pump drive improvement, and ENERGY STAR appliance). Between one-third and three-fourths of respondents indicated that the program was influential in their decision to install the additional energy-efficient equipment (ratings of 3.0 and above). Respondents indicated that the program did not play a significant role (ratings below 3.0) in their

decision to install the less commonly installed equipment (i.e., fan, injection moulding process equipment, and other equipment, including air compressors, compressed air valves, furnaces, ice rink process equipment, power factor correction, and a welding machine (each mentioned once)).

Figure D-26: Program Influence on Equipment Installed Outside the Program*



*May not sum to 100% due to rounding.

Participants who had indicated they installed the program-influenced non-incentivized equipment were then asked a series of follow-up questions (for example, capacity, efficiency, annual hours of operation). These detailed questions are displayed in Table D-7 and Table D-17 and were used within the NTG algorithm to attribute SO savings to each equipment installation. SO savings were primarily driven by the installation of 2,662 new linear LEDs and 318 new LED exterior lights.

Table D-7: Type of ENERGY STAR® Appliance Installed
(Multiple responses allowed; n=2)

Spillover Appliance	Respondents	Quantity
Dishwasher	1	1
Refrigerator	1	3

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

Table D-8: Size of Air Conditioner Installed
(Multiple responses allowed; n=5)

Size (tons)	Respondents
Less than 5.4	1
20.0 – 63.6	2
63.61 or more	2

Table D-9: Type of Lighting Installed
(Multiple responses allowed; n=25)

Spillover Lighting	Respondents
LED exterior	12
LED linear or troffers	12
LED screw base	2
Linear fluorescent	2
Compact fluorescent (CFL)	1

*Does not sum to 25 due to multiple responses.

Table D-10: LED Exterior Lighting Mount (n=12)

Location	Respondents	Quantity
Pole mount	8	268
Against building	3	38
Under canopy	1	12

Table D-11: LED Linear Lamps or Troffers (n=12)

Respondents	Equipment	Quantity
12	2,662	1,000

Table D-12: LED Screw Base (n=2)

Wattage	Respondents	Quantity
< 10	1	20
31+	1	50

Table D-13: Linear Fluorescent (n=2)

Equipment	Respondents	Lamps per Fixture	Fixtures
T8	2	2	270

Table D-14: Compact Fluorescent (CFL) (n=1)

Respondents	Quantity
1	200

Table D-15: Lighting Controls (n=6)

Control Type	Respondents
Occupancy Sensor	4
Timer	2

Table D-16: End-Uses of Motor/Pump Upgrades (n=3)

Motor/Pump End Use	Efficiency	Size (hp)	Respondents	Equipment
Domestic hot water pump	Standard	1 – 5.0	1	4
HVAC fan	Standard	15.1 – 30.0	1	1
HVAC Water Pump	Premium	5.1 – 15.0	1	8

Table D-17: Size of Motor/Pump Drive Improvements Installed (n=5)

Motor Improvement	Size (hp)	Respondents	Equipment
Variable speed drive	5.1 – 15.0	2	4
Variable speed drive	15.1 – 30.0	1	1
Variable speed drive	30.1 – 50.0	1	2
Variable speed drive	50.1+	1	3

D.4 Additional Participant Process Results

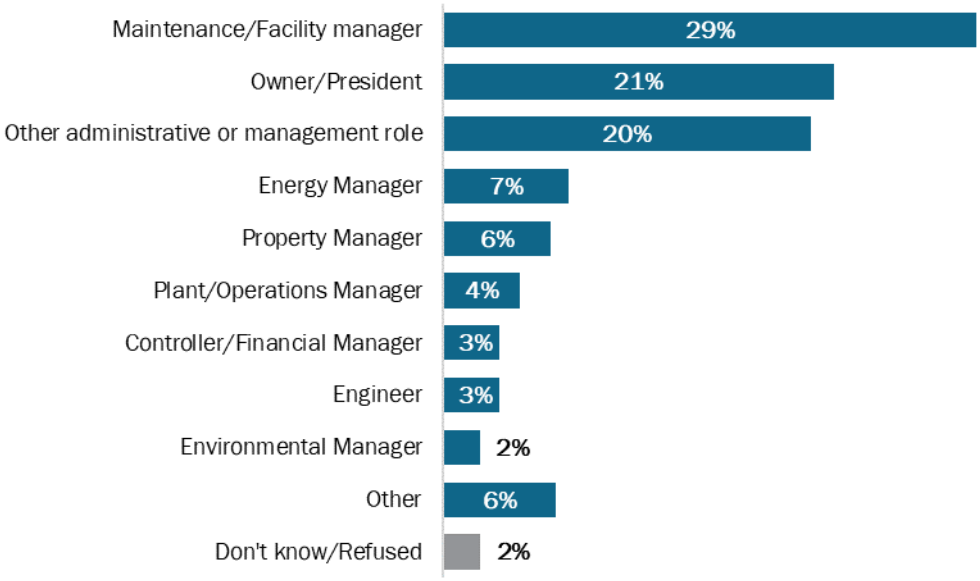
Firmographics

Participants were asked various questions to collect information such as their job title, ownership status, responsibilities in relation to the program, and training received. Details on the participants' companies were also gathered during the survey.

As presented in Figure D-27, nearly all titles that respondents shared indicated they held either an administrative or managerial role. Nearly one-third (29%) were maintenance and/or facility managers. Over one-fifth (21%) of respondents were the owner and/or president of the company, and one-fifth (20%) specified an administrative or management role other than those listed on the survey.

Figure D-27: Titles of Respondent

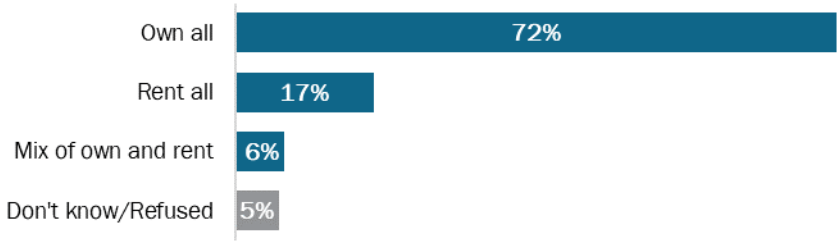
(Open-ended and multiple responses allowed; n=413)*



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

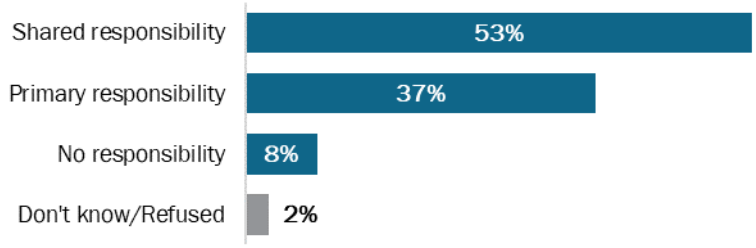
Respondents predominately owned the facilities for which they applied for incentives, as presented in Figure D-28. Over two in three (72%) owned all the affected facilities, while nearly one-fifth (17%) were exclusively renting them. Over one-tenth (11%) of respondents indicated that their business is part of a chain or franchise.

Figure D-28: Ownership Status (n=413)



Respondents specified whether they had the primary or shared responsibility for the budget and/or expenditures related to the Retrofit program project. Over one-half (53%) had shared responsibility, and nearly two-fifths (37%) had primary responsibilities (Figure D-29). A relative few (8%) stated they had no responsibilities at all for the budget and/or expenditure decisions.

Figure D-29: Responsibility for Budget and Expenditures (n=413)



Less than one-tenth (7%) confirmed participation in the IESO's subsidized training programs. Of those that had training experience, over three-fifths (61%) referenced the Certified Energy Manager (CEM) training (Figure D-30). Around one-third each referenced Dollars to $ense Energy Management Workshops (36%) and RETScreen Expert Training (32%).

Figure D-30: Participation in IESO-Subsidized Training

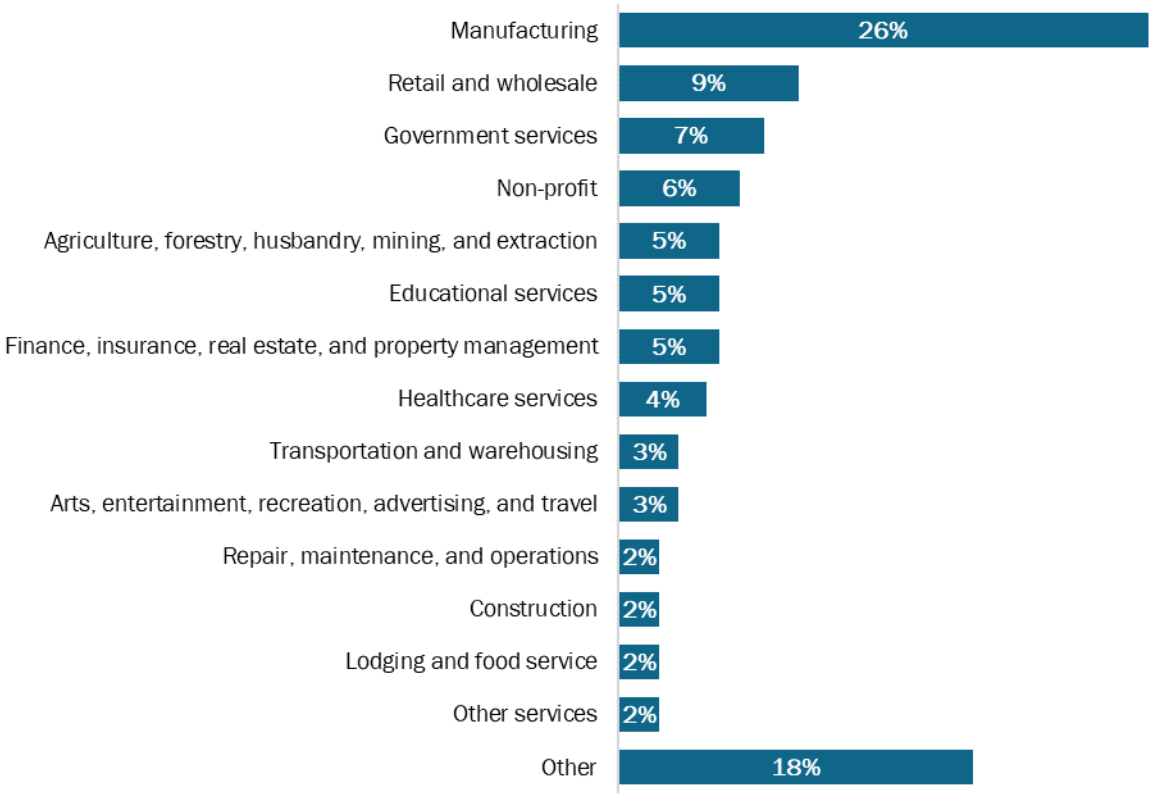
(Open-ended and multiple responses allowed; n=28)*

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

Respondent business categories varied, as presented in Figure D-31. Over one-fourth (26%) worked in manufacturing, and nearly one-tenth each worked in retail and wholesale (9%) and government services (7%).

Figure D-31: Respondents' Business Category

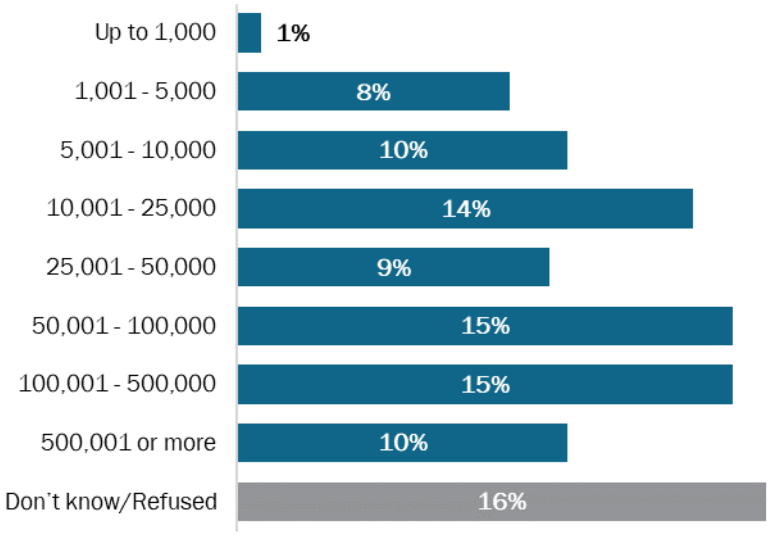
(Open-ended and multiple responses allowed; n=413)*



*Does not sum to 100% due to rounding.

Participants were asked to provide the total area of their facilities. The most-frequent facility sizes were between 50,001 to 100,000 sq. ft. (15%) and 100,001 to 500,000 sq. ft. (15%) (Figure D-32).

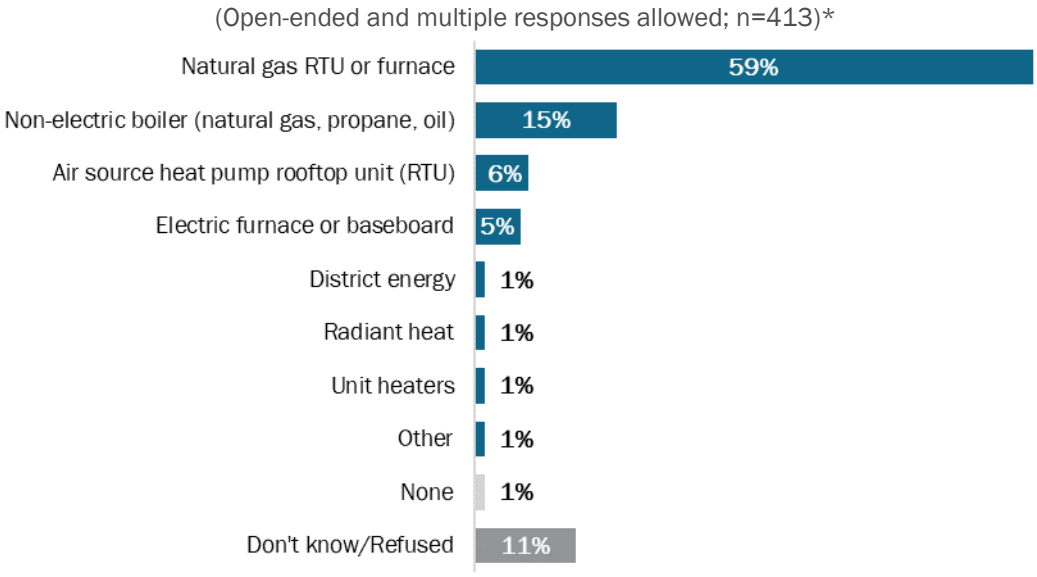
Figure D-32: Total Square Footage for All Buildings (n=413)*



*Does not sum to 100% due to rounding.

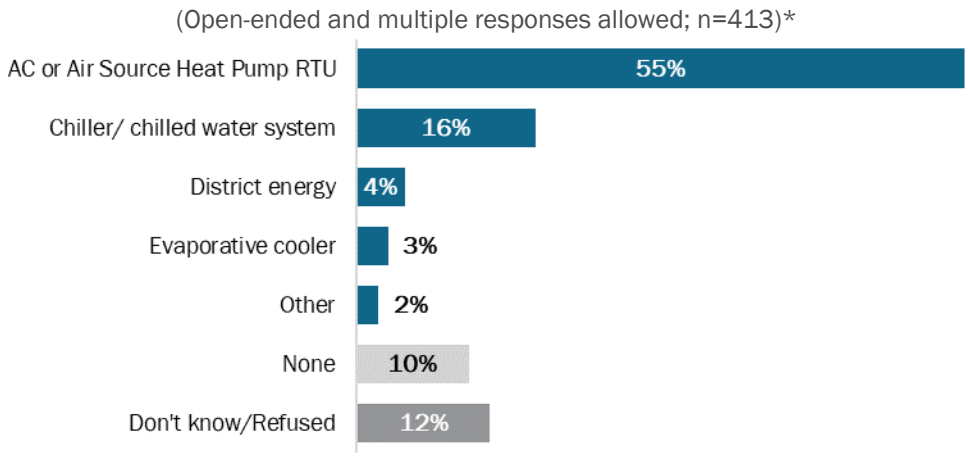
Nearly three-fifths of responding participants (59%) reported a natural gas rooftop unit (RTU) or furnace heating at their facilities. More than one-tenth (15%) reported heating their facilities with a non-electric boiler (Figure D-33). On the cooling side, nearly three-fifths (55%) reported an air conditioner or air source heat pump RTU, followed by nearly one-fifth (16%) with a chiller or chilled water system (Figure D-34).

Figure D-33: Facility Primary Heating System



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

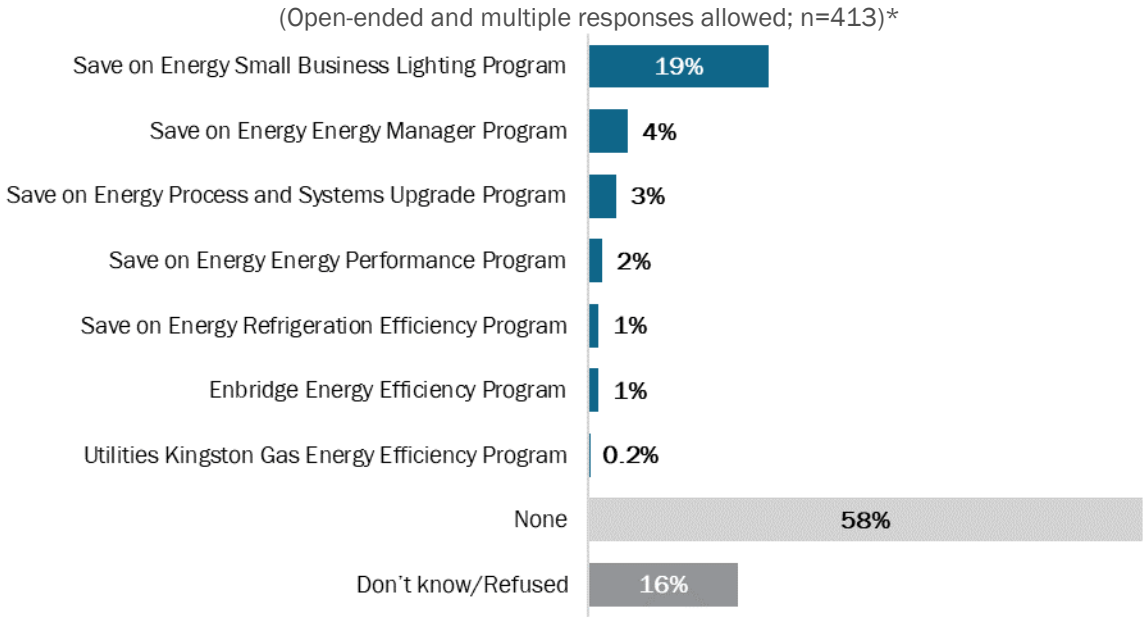
Figure D-34: Facility Primary Cooling System



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

When respondents were asked which other energy-efficiency programs their business had applied to, nearly one-fifth (18%) had participated in the Small Business Lighting (SBL) program. Relatively few participated in any of the other programs. Three-fifths (58%) reported that their business had not applied to any other energy-efficiency programs (Figure D-35).

Figure D-35: Participation in Additional Energy Efficiency Programs



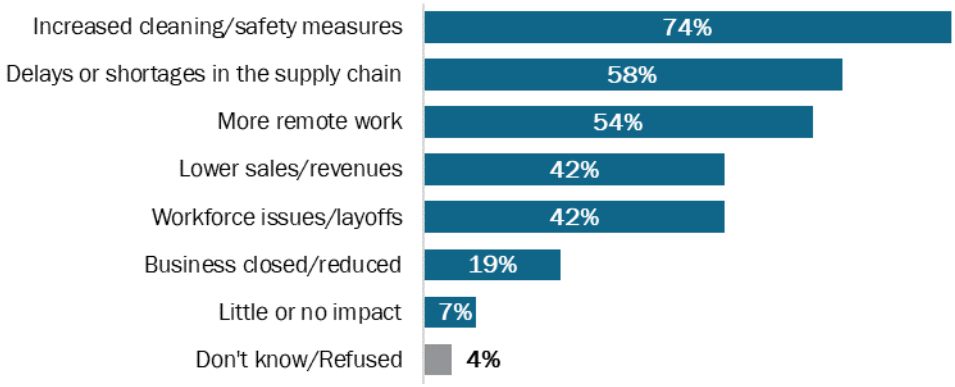
*Does not sum to 100% due to multiple responses.

Business Response to the COVID-19 Pandemic

Respondents were asked how the COVID-19 pandemic had impacted their company and its operations (Figure D-36). Nearly all (98%) respondents provided feedback. Of these, nearly three-fourths (74%) stated increased cleaning and safety measures, close to three-fifths (58%) stated delays or shortages in the supply chain, and over one-half (54%) mentioned an increase in remote work.

Figure D-4: Impacts to Business Operations of COVID-19

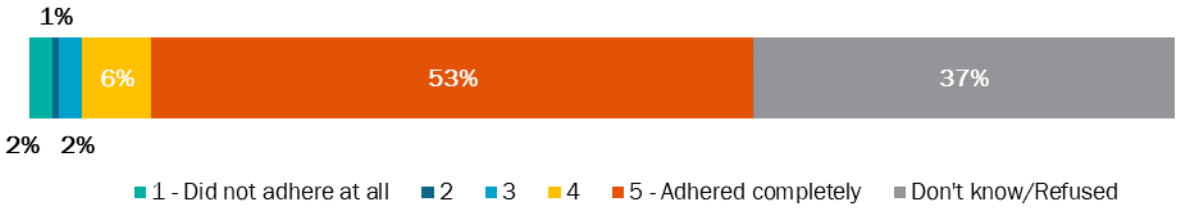
(Open-ended and multiple responses allowed; n=151)*



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

Respondents were asked how closely Save on Energy representatives adhered to the relevant health and safety standards associated with the COVID-19 crisis when they conducted site inspections or performed metering at the participant's facility. Over one-half of respondents (53%) stated that a Save on Energy representative did not visit their facility. Of the remaining respondents, nearly three-fifths (59%) provided a rating of a 4 or 5, on a scale of one (1) to five (5), where one indicates the representative "did not adhere at all" and five indicates the representative "adhered completely" (Figure D-37).

Figure D-37: Representative Adherence to Health and Safety Standards (n=413)*



*Does not sum to 100% due to rounding.

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 F1). 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.

1. **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.
2. **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 Table F-1 presents the total job impacts by type. As the fourth and fifth columns indicate, the analysis estimated that the Retrofit program would create 4,172 total jobs in Canada, with 3,724 jobs created in Ontario. Of the 4,172 estimated total jobs, 2,101 are direct jobs, 1,018 are indirect jobs, and another 1,053 are induced. In terms of FTEs, the numbers are slightly lower, with 3,091 FTEs created in Ontario and 3,460 FTEs created nationwide. Of these 3,460 FTEs, direct jobs account for 1,821 FTEs, 862 FTEs are indirect jobs, and 778 FTEs are induced jobs. In total, the Retrofit Program created 93.3 jobs per million dollars of investment (i.e. program budget).

Table F-2: Total Job Impacts by Type

Job Impact Type	FTE *(in person-years)*		Total Jobs *(in person-years)*		Total Jobs per $1M Investment *(in person-years)*
	Ontario	Total	Ontario	Total	
Direct	1,763	1,821	2,039	2,101	47.0
Indirect	698	862	827	1,018	22.8
Induced	629	778	858	1,053	23.6
Total[1]	**3,091**	**3,460**	**3,724**	**4,172**	**93.3**

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-3: Summary of Input Values for Demand Shock

Category Description	Non-Labour	Labour	Total Demand Shock
	($ Thousands)		
Lighting fixtures	52,790	30,815	83,605
Electric light bulbs and tubes	42,880	24,851	67,731
Heating and cooling equipment (except household refrigerators and freezers)	19,142	10,872	30,014
Switchgear, switchboards, relays and industrial control apparatus	14,871	8,362	23,234
Pumps and compressors (except fluid power)	9,380	5,352	14,732
Metalworking machinery and industrial moulds	3,069	1,781	4,850
Other industry-specific machinery	2,319	1,377	3,696
Industrial and commercial fans, blowers and air purification equipment	1,196	690	1,886
Metal windows and doors	1,117	594	1,712
Measuring, control and scientific instruments	874	487	1,361
Electric motors and generators	679	395	1,074
Other professional, technical and scientific services	421	264	686
Batteries	163	86	249
Repair construction services	59	31	90
Waterworks engineering construction	5	3	7
Subtotal	**148,965**	**85,962**	**234,927**
Office Administrative Services	-	-	4,765
Total			**239,603**

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 ($405.0 million) was the net of electricity bill savings (NPV = $599.9 million), and the portion of project costs not covered by incentives ($194.9 million). The portion of this $405.0 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 77% of bill savings would be reinvested ($308.7 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-4: Summary of Input Values for Business Reinvestment Shock

Category Description	Business Reinvestment Shock *($ Thousands)*
Other	48,433
Crop and animal production	26,401
Non-profit institutions serving households	18,847
Automotive and transportation	17,963
Retail trade	17,963
Transportation and warehousing	16,422
Other municipal government services	16,144
Chemical, soap, plastic, rubber, and non-metallic minerals	13,339
Primary and fabricated metal	13,339
Health care and social assistance	10,636
Repair, maintenance and operating and office supplies	10,030
Owner occupied dwellings	9,197
Furniture, cabinet, and fixtures	9,146
Arts, entertainment and recreation	8,488
Crop, animal, food, and beverage	8,488
Educational services	7,656
Wholesale trade	7,276
Accommodation and food services	6,998
Professional, scientific and technical services	5,786

Finance, insurance, real estate, rental and leasing and holding companies	5,457
Machinery	5,231
Non-residential building construction	4,851
Other activities of the construction industry	3,638
Other services (except public administration)	2,425
Residential building construction	2,425
Administrative and support, waste management and remediation services	1,213
Computer and electrical	1,213
Engineering Construction	1,213
Forestry and logging	1,213
Forestry, logging, paper, and printing	1,213
Government health services	1,213
Mining, quarrying, and oil and gas extraction	1,213
Oil and Gas	1,213
Other provincial and territorial government services	1,213
Medical and Pharmaceutical	606
Textile and clothing	606
Total	**308,706**

The third model input is the household expenditure shock.[13] 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 $44.7M program budget or $15.7M.

F.2 Results

The StatCan IO Model generated results based on the input values detailed in Section F.1.2 and Section F.1. 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 would result in the creation of 2,222 total jobs (measured in person-years) in Canada, of which 2,045 will be in Ontario. Of the 2,222 jobs, 1,166 were direct, 480 were indirect, and 576 were induced. In terms of FTEs, the numbers are slightly lower; 1,830 FTEs were estimated to be created in Ontario and 1,683 in total across Canada. Of those 1,830 FTEs, 982 were direct, 422 were indirect, and 425 were induced. Direct job 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.

[13] 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-5: Job Impacts from Demand Shock

Job Impact Type	FTE *(In Person-Years)*		Total Jobs *(In PersonYyears)*	
	Ontario	Total	Ontario	Total
Direct	982	982	1,166	1,166
Indirect	347	422	395	480
Induced	354	425	483	576
Total	**1,683**	**1,830**	**2,045**	**2,222**

Table F-5 presents the results of the model run for the business reinvestment shock. Job impacts generated by business investment were equal to 893 direct total FTEs and 1,011 total direct jobs. Overall, business investments were responsible for 1,731 FTEs and 2,086 total jobs across Canada. The number of jobs created by the business reinvestment shock in PY21 is almost equal to the number created by the demand shock and was substantially larger (as a portion of the total jobs created) than in PY20. This is due to the large increase in the total amount reinvested by businesses in PY21 ($309M compared to $133M in PY20).

Table F-6: Job Impacts from Business Reinvestment Shock

Job Impact Type	FTE *(In Person-Years)*		Total Jobs *(In Person-Years)*	
	Ontario	Total	Ontario	Total
Direct	832	893	944	1,011
Indirect	373	467	459	574
Induced	289	370	394	502
Total	**1,494**	**1,731**	**1,796**	**2,086**

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 100 FTEs and 136 total jobs across Canada due to decreased household spending.

Table F-7: Job Impacts from Residential Funding Shock

Job Impact Type	FTE *(In Person-Years)*		Total Jobs *(In Person-Years)*	
	Ontario	Total	Ontario	Total
Direct	51	55	71	76
Indirect	21	27	27	36
Induced	14	18	19	24
Total	**86**	**100**	**117**	**136**

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 modelled 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 the small decreases in electricity production. Total electricity demand has been increasing over time and is projected to continue increasing[14]. 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 indicates that it will provide estimates regardless of the impact size. 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 presents the total estimated job impacts by type, calculated by combining the jobs estimated in Table F-4, Table F-5, and Table F-6. Of the 2,101 estimated total direct jobs, 2,039 were in Ontario. A slightly smaller proportion of the indirect and induced jobs were in Ontario; 827 out of 1,018 indirect jobs and 858 out of 1,053 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 3,091 FTEs (of all types) created in Ontario and 3,460 FTEs added nationwide. The majority of all direct FTEs (1,763 of 1,821) were added in Ontario, representing approximately 57% of the total FTEs added in Ontario and 51% of all FTEs created across Canada. In 2021, each $1M of the program spent created 93.3 total jobs compared to 48.8 jobs per $1M in 2020. The primary driver of the additional jobs created is the substantial increase in the amount reinvested by customers ($309M in 2021 vs $133M in 2020). Additionally, the program budget remained relatively consistent from year to year. Due to these two factors, the amount of program budget spent relative to each job created was cut roughly in half (from $20,485 to $10,723). The increases in jobs created along with the similar overall program budget resulted in the observed difference between years.

[14] Annual Planning Outlook – A view of Ontario's electricity system needs; 2021. IESO.

Table F-8: Total Job Impacts by Type

Job Impact Type	FTE *(In Person-Years)*		Total Jobs *(In Person-Years)*		Total Jobs per $1M Investment *(In Person-Years)*
	Ontario	Total	Ontario	Total	
Direct	1,763	1,821	2,039	2,101	47.0
Indirect	698	862	827	1,018	22.8
Induced	629	778	858	1,053	23.5
Total[1]	**3,091**	**3,460**	**3,724**	**4,172**	**93.3**

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 presents the total jobs created due to program activities and energy savings in the first year versus 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 comprise roughly 8% of the total, with 334 out of the total of 4,172 person-years. A total of 167 of these person-years are derived from the first-year energy savings. The remaining 3,960 total job years are due to energy savings after the first year—and the reinvestment generated by the bill savings.

Table F-9: Job Impacts from First Year Shocks

Job Impact Type	Total Jobs *(in person-years)*		
	From First Year Activities	From Bill Savings After First Year	Total
Direct	168	1,933	2,101
Indirect	82	936	1,018
Induced	84	969	1,053
Total[1]	**334**	**3,838**	**4,172**

[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 presents the job impacts in additional 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 presents that the industry with the largest job impacts was Administrative and support, waste management and remediation services, which added 1,302 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 needs (for example, office administration, call centre operations, program management, etc.). Retail trade and Manufacturing were the industries with the next most added jobs, gaining 410 and 360 jobs, respectively.

Table F-10: 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	1,061	1,080	1,276	1,302
Retail trade	277	303	375	410
Manufacturing	254	348	261	360
Wholesale trade	289	335	299	347
Professional, scientific and technical services	184	225	230	283
Non-residential building construction	232	232	265	265
Finance, insurance, real estate, rental and leasing and holding companies	139	166	175	208
Accommodation and food services	72	95	109	143
Transportation and warehousing	86	112	103	134
Government education services	81	84	98	101
Engineering construction	88	88	93	93
Other services (except public administration)	48	59	70	86
Information and cultural industries	49	66	55	75
Residential building construction	51	51	65	65
Health care and social assistance	33	36	53	58
Repair construction	33	37	38	43
Arts, entertainment and recreation	15	19	28	37
Non-profit institutions serving households	17	19	21	24
Educational services	9	10	21	24
Other municipal government services	18	21	19	22
Crop and animal production	5	10	11	22
Other federal government services	19	20	21	22
Utilities	11	13	12	14
Government health services	9	11	10	12
Mining, quarrying, and oil and gas extraction	6	13	6	12
Other provincial and territorial government services	3	4	3	4
Other activities of the construction industry	1	1	2	2
Support activities for agriculture and forestry	1	2	1	2
Forestry and logging	1	2	1	2
Fishing, hunting and trapping	0	1	0	1
Total[1]	**3,091**	**3,460**	**3,723**	**4,172**

[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 on respondents, which would be considered direct impacts. These two questions with relevant illustrative verbatim responses are detailed below:

1) Did the 2021 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:

- "Added value to my company."
- "The incentive on interior lighting helped sell the projects. Long-term energy savings was the big seller."
- "Allowed us to secure more orders due to a reduction in order cost when considering the incentive."
- "Sales are always easier when costs go down. As well, the program adds credibility to our offerings, as we have a history of achieving good results."
- "Lighting incentives help move the projects forward when competing for budget dollars."

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

- "Incentive is not as much as it was before."
- "This process takes too long."
- "COVID killed many retrofit projects."
- "A lot of clients find the wait time too long vs what they receive in the rebate."

2) Did the 2021 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:

- "10 [extra employees]."
- "We hired a new person to handle audits and incentive applications."
- "We have expanded our business and our work schedule."
- "Hired 1 new employee."

Negative Impacts:

- “Less business means less hiring for us.”
- “Reduced staff, consultants no longer needed, salespeople can do it.”

Respondents indicated that the program generally resulted in slight increases in staffing overall. Participants stated that the program added value to projects and allowed contractors to win projects that otherwise would have been lost. Lighting measures were called out as a specific measure category that helped secure contracts. 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. One respondent indicated that hiring had slowed down in response to less business from the Retrofit program, while another stated that jobs were cut due to staffing redundancies that came to light. In general, responses reveal the potential benefits of the program for firms. Respondents that indicated a negative effect on their business primarily stated that the length of time it took to complete projects and the smaller incentives than in prior years were the biggest issues. Contractors additionally stated that changes to the program – specifically the cancellation of the custom track and the removal of exterior lighting measures – also 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.