2021-2024 CDM Framework Retrofit PY2021 Evaluation Results

Submitted to IESO

in partnership with NMR Group

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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
GTA	Greater Toronto Area
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

Resource Innovations, Inc. (formerly Nexant, Inc.) and its partner, NMR Group, Inc. (noted throughout this report as 'the evaluation team'), were retained by the Independent Electric System Operator (IESO) for the evaluation of the 2021-2022 program years of the 2021-2024 Conservation and Demand Management (CDM) Framework business programs. This report presents the results of the impact and process evaluations, cost-effectiveness assessment, job impacts, and Non-Energy Benefits (NEBs) analysis for the 2021 Retrofit program.

1.1. 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, on the Save on Energy website, outline eligibility criteria for participants, facilities, and projects. The Program Year (PY) 2021 Retrofit program only offered prescriptive track measures. Prescriptive track applications offer a program-defined list of approved equipment and fixed incentives available for installation. Limited documentation is required to ensure a simplified experience for program participants.

1.2. Evaluation Objectives

The IESO outlined the following objectives for the PY2021 Retrofit program evaluation:

- Conduct audits of completed projects to evaluate, measure and verify completion and operating parameters through desk reviews, virtual site visits, and on-site inspections and metering.
- Annually verify gross energy and summer peak demand savings province-wide for the Retrofit program at a 90% confidence level and 10% precision.
- Assess free-ridership and participant spillover to determine an appropriate net-to-gross (NTG) ratio.
- Research specific areas of interest to help the IESO improve the Retrofit program and prepare for future program design and evaluations.
- Perform a cost-effectiveness assessment, greenhouse gas reduction estimate, Non-Energy Benefits (NEBs) analysis, and job impact quantification.
- Deliver annual reports, memos, impact results templates, and a final report that meets the IESO's requirements and timelines.
- Provide thoughtful recommendations on program improvements based on feedback obtained through the evaluations.

1.3. Summary of Results

The following summarizes the savings and cost-effectiveness results verified through the impact evaluation. The impact evaluation analyzed the program's impact and quantified the savings realized as an outcome of implementing energy efficiency Retrofit projects in the province of Ontario during PY2021.

The overall impact results of the PY2021 Retrofit program are presented in Table 1-1. The first-year net verified energy and summer peak demand savings are 63,794 MWh and 11,792 kW, respectively. Interactive effects and baseline shift adjustment factors have been included in the gross verified savings for applicable lighting measures.

Table 1-1: Energy and Summer Peak Demand Impacts

Savings Type	Gross Reported Savings	Gross Verified Savings	Net Verified Savings
First Year Energy (MWh)*	60,586	69,251	63,794
First Year Summer Peak Demand (kW)*	7,679	11,675	11,792

*Includes Interim Framework carry-over projects

The results presented in Table 1-1 include savings from the 2021-2024 CDM Framework projects as well as Interim Framework (IF) carry-over projects described in Section 2.1. These IF projects contribute 20,404 MWh (32%) of total first-year net verified energy savings and 3,400 kW (29%) of total summer peak demand savings.

Interim Framework carry-over projects were not included in the sampling for the PY2021 of the 2021-2024 CDM Framework program due to the differences between the two programs. The IF Retrofit program was delivered differently, where the IF carry-over population contained both Custom and Prescriptive track projects. The realization rates and net-to-gross ratios applied to the IF Retrofit carry-over projects were taken from the PY2021 IF Retrofit evaluations. To allow the presentation discussion of the 2021-2024 CDM Retrofit program performance, the information presented in the remainder of this report is based solely on the projects in the 2021-2024 CDM Framework population.

The energy and summer peak demand sample realization rates for the PY2021 2021-2024 CDM Framework sample are presented in Table 1-2. The program achieved an energy realization rate of 117.30% and a summer peak demand realization rate of 164.98%. The precision of the energy realization rates for both lighting and non-lighting samples where just above the 10% target at the 90% confidence level. A precision of 8.28% at the 90% confidence level was achieved for the overall program.

Table 1-2 : PY2021 2021-2024 CDM Framework Sample Realization Rates

Measure Type	Energy Realization Rate	Energy RR Relative Precision	Summer Peak Demand Realization Rate	Demand RR Relative Precision
Lighting	119.82%	10.02%	180.46%	39.23%
Non-Lighting	107.23%	10.35%	134.56%	7.12%
TOTAL	117.30%	8.28%	164.98%	26.10%

Figure 1-1 and Figure 1-2 below display the net verified first-year energy and summer peak demand savings percentages for the Prescriptive Lighting and Non-lighting tracks within PY2021 of the 2021-2024 CDM program. The Prescriptive Lighting track represents 86% of the total net verified first-year energy savings achieved by the program, while the Prescriptive Non-lighting accounts for 14%. A similar trend was observed for the summer peak demand savings.

Figure 1-1: First-Year Net Verified Energy Savings % by Track

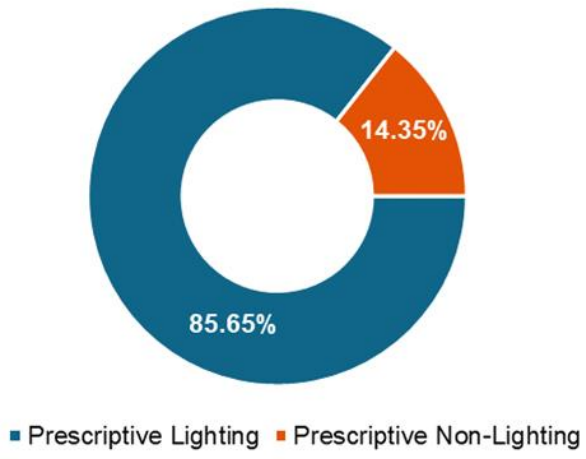
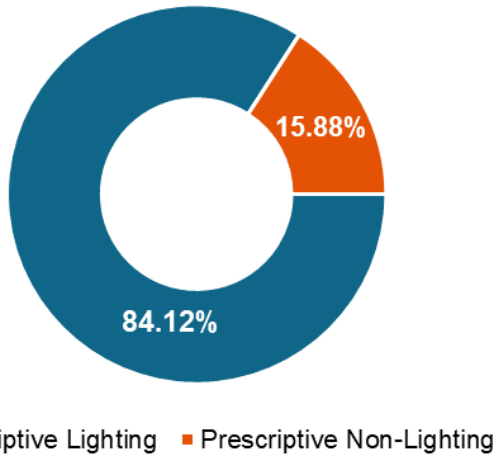
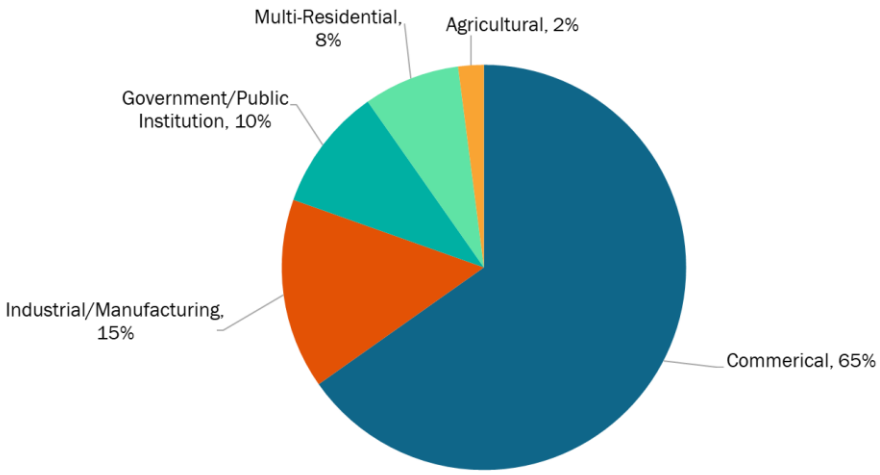


Figure 1-2: First-Year Net Verified Summer Peak Demand Savings % by Track & Type



A total of 848 Retrofit projects were completed in the province during PY2021 of the 2021-2024 CDM Framework. Figure 1-3 displays the percentages of each facility type within the population. The commercial facility portfolio represents 65% of the total program. On the other hand, agricultural facilities account for only 2% of the program.

Figure 1-3: Facility Type Count %



1.4. Key Findings and Recommendations

Finding 1: New horticultural lighting measures are producing large amounts of energy savings. New horticultural measures were installed in eight facilities and generated 30% of the total program net verified first-year energy savings. The average energy savings per facility was 2,109 MWh. The average energy realization rate is 128% for the seven projects evaluated. While a sample of seven projects is insufficient to support a finding, the verified annual hours of use were generally higher than the deemed values, and the conservation case wattages were lower than the deemed values. Across the 7 sample projects, the weighted average annual hours of use were found to be 106% of deemed values, base case wattages were found to be 99% of deemed base wattages, and efficient case wattages were found to be 83% of deemed values. The differences between deemed and verified annual hours of use and efficient wattages are, therefore, the main drivers of the high realization rates.

Furthermore, the deemed base case wattage used in the largest project is based on the assumption that ten T8 fluorescents "provide the equivalent brightness at the same distance away from the vertical growing surface as one EE fixture." This assumption is difficult to verify and 2) creates a large amount of savings per unit which could be quickly adopted as the market baseline in the near future.

There are also currently only three available prescriptive horticultural measures which may limit applicants' ability to select suitable matches for the projects/measures they would like to implement.

- **Recommendation 1a:** Regularly review the horticultural baseline case, conservation case and operational assumptions to determine if measure assumptions are appropriate.

- **Recommendation 1b:** Continue research into the horticulture lighting market to assess the need for additional measures and what the current market baselines are for existing measures. This is particularly relevant to the Inter-Lighting LED Grow Light Fixture as it gains popularity.

Finding 2: 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%). IESO program and delivery vendor staff indicated that their training webinars about program processes and changes were well-received by attendees, which included applicant representatives, contractors, and customers.

- **Recommendation 2a:** Ensure that training covers topics that are of most interest to the applicant representatives and contractors and that provide 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.
- **Recommendation 2b.** Expand promotion of training and education events to raise awareness and ensure as many applicant representatives and contractors participate in them as possible.

Finding 3: Expanding measure offerings would likely increase customer, applicant representative, and contractor satisfaction with the shift to a prescriptive-only approach. Over one-half of participants (52%) stated that the shift to the prescriptive-only approach did not have an impact on their participation. However, the IESO program 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. Participants most commonly recommend additional HVAC measures, lighting controls, building envelope materials, and lighting. Delivery vendor staff indicated that the new process that allows for measure recommendations to be submitted online has been well-received but that it can be onerous or confusing for some customers and contractors to fill out.

- **Recommendation 3a:** Gather feedback on measure suggestions and support needs, specifically from customer segments that may have been most impacted by the shift to the prescriptive-only approach to better understand market needs.
- **Recommendation 3b:** Further promote the availability of the online form to submit new program measure recommendations and identify ways in which to simplify the form to make it easier to fill out.

Finding 4: There is an opportunity to assist some participants in completing additional work through the program. Only about one-tenth (13%) of participants reported installing additional efficient equipment following their participation in the program. Of these participants, only 10% stated that it was recommended to them by a Save on Energy representative at the time of their participation in the program. When asked why they made these additional upgrades without the assistance of the program, participants most frequently mentioned that the energy or monetary savings justified the additional cost (35%). This suggests an opportunity for contractors to help customers maximize the work that can be completed at the time of participation where it is feasible for them to do so.

- **Recommendation 4:** Provide training and support to contractors to ensure they raise customer awareness of all relevant program-eligible equipment and help them complete as much work as possible at the time of their participation in the program.

Finding 5: More marketing and outreach opportunities exist. The IESO and delivery vendor staff reported using a wide array of marketing and outreach activities in support of the program in PY2021, including 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. However, program marketing and outreach received the lowest rating from applicant representatives and contractors (16% were dissatisfied or very dissatisfied), and increased marketing was one of the main suggestions they provided for overcoming customer barriers to participation (recommended by 15%). While participants were not surveyed on their satisfaction with program marketing and outreach, between one-tenth and one-fourth (7% to 25%) indicated that various types of program marketing and outreach (for example, program materials, the program website, program social media) influenced their decision to complete their projects.

- **Recommendation 5:** Increase the frequency of marketing and outreach activities to further expand the program's reach (for example, more frequent webinars or e-blasts informing stakeholders of program changes, further social media engagement, and more in-person events as is feasible given the ongoing pandemic).

2. Introduction

This report summarizes the evaluation results for the PY2021 of the 2021-2024 CDM Framework Retrofit program and includes projects that were completed and reported to the IESO between January 1st and December 31st, 2021.

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 on the Save on Energy website outline eligibility criteria for participants, facilities, and projects. The 2021-2024 CDM Framework Retrofit program only offers a prescriptive track which includes 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 to ensure a simplified experience for program participants.

Savings results from both the 2021-2024 CDM Framework Retrofit program, as well as carry-over projects from the PY2021 Interim Framework (IF) Retrofit program, are presented in this report. The PY2021 IF carry-over projects were projects that received pre-approval by April 30, 2021, and were submitted for post-approval by December 31, 2021. The IESO provided the list of these projects to be included in the 2021-2024 CDM Framework results. While the impacts of these projects were included in the PY2021 of the 2021-2024 CDM Framework results, the appropriate regional realization rates from the PY2021 IF Retrofit evaluation were applied to the IF carry-over projects.

2.2. Evaluation Objectives

The goals and objectives of the PY2021 2021-2024 CDM Framework Retrofit program evaluation were:

- Conduct audits of completed projects to evaluate, measure and verify completion and operating parameters through desk reviews, virtual site visits, and on-site inspections and metering.
- Annually verify gross energy and summer peak demand savings province-wide for the Retrofit program at a 90% confidence level and 10% precision.
- Assess free-ridership and participant spillover to determine an appropriate net-to-gross (NTG) ratio.
- Research specific areas of interest to help the IESO improve the Retrofit Program and prepare for future program design and evaluations.
- Perform a cost-effectiveness assessment, greenhouse gas reduction estimate, Non-Energy Benefits (NEBs) analysis, and job impact quantification for.

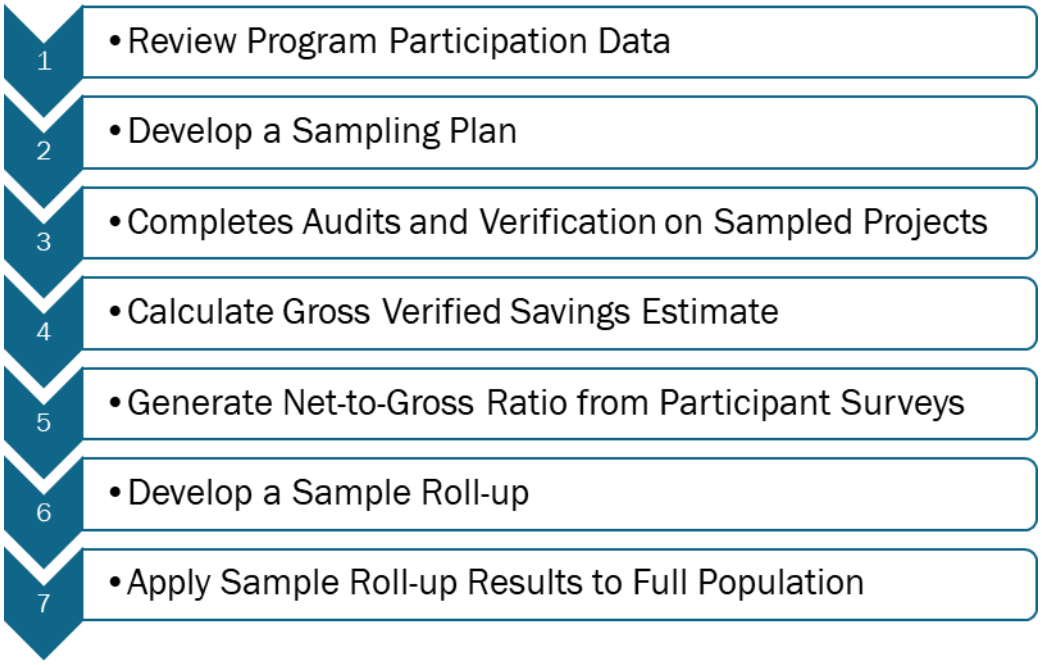
- Deliver annual reports, memos, impact results template, and a final report that meets the IESO's requirements and timelines.
- Provide thoughtful recommendations on program improvements based on feedback obtained through the evaluations.

3. Methodology

3.1. Impact Evaluation Methodology

The impact evaluation methodology, comprised of distinct components, is presented in Figure 3-1.

Figure 3-1: Impact Evaluation Methodology



3.1.1. Project Participation and Sampling

The impact evaluation sample was drawn solely from a list of PY2021 within the 2021-2024 CDM Framework projects that were post-approved and paid between January 1st and December 31st, 2021. Interim Framework carry-over projects were not included in the sampling for the 2021-2024 CDM Framework program due to the differences in program delivery between the two frameworks. Impact sampling first involved stratifying the population into similar project types to minimize variability and improve the confidence and precision of the sample results. The population was stratified by measure type and then randomly sampled from each stratum. The number of projects selected from each stratum targeted results that achieved a 90% confidence level at a 10% precision level, assuming a coefficient of variation of 0.5. A total of 139 random sample projects were selected between the Lighting and Non-lighting, as shown in Table 3-1.

Table 3-1: Impact Evaluation Sample

Measure Type	Population Project Count	Sample Project Count
Lighting	727	75
Non-Lighting	121	64
TOTAL	848	139

Each sampled project was reviewed to verify the amount of gross and net savings. These individual sample project results were then used to calculate realization rates and net-to-gross ratio adjustment factors that were applied to the savings of the projects in the PY2021 of the 2021-2024 CDM Framework population. The sample results from the PY2021 IF Retrofit evaluation were applied to the IF carry-over projects being attributed to the 2021-2024 CDM framework. Additional detail on the impact and net-to-gross methodology can be found in Appendix A and Appendix B, respectively.

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 3-2 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.

Table 3-2: 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%	0.0%
Program Delivery Vendor Staff	Phone IDIs	3	3	100%	0.0%
Applicant Representatives and Contractors	Web Survey	545	68	12%	9.4%
Participants	Web and Phone Survey	683	153[1]	22%	5.9%

[1] The NTG evaluation included 13 more respondents (n=166) than the process evaluation (n=153) because 13 respondents did not fully answer the process evaluation survey questions.

The Process Evaluation section (Section 5) provides context regarding each surveyed group. Additional detail regarding the process evaluation methodology can be found in Appendix C.

3.3. Other Energy Benefits Methodology

3.3.1. Non-Energy Benefits Methodology

The NEBs methodology for the PY2021 Retrofit program followed the same methodology as the Phase II study, which assessed the NEBs from energy-efficiency projects funded by the IESO over the 2017-2019 period.[2] The NEBs were calculated using two different techniques, the relative scaling approach, and the willingness to pay approach, to determine the value of NEBs that program participants realized by installing program measures. All survey respondents were asked to value all NEBs using both techniques. The data collected from these questions were then used to quantify the NEBs. Additional detail regarding the NEBs methodology can be found in Appendix F.

3.3.2. Job Impacts Assessment Methodology

The analysis of job impacts utilized the Statistics Canada[3] (StatCan) Input-Output (IO) model to estimate the direct, indirect, and induced job impacts. IO models are used to analyze the propagation of exogenous economic shocks throughout an economy. The models represent relationships, or flows, of inputs and outputs between industries. When an Energy Efficiency (EE) program such as the Retrofit program is funded and implemented, it creates a set of "exogenous shocks"—or events occurring outside of the system—such as demand for specific products and services and additional reinvestment by businesses from energy bill savings. These shocks propagate throughout the economy, and their impacts can be measured in terms of variables such as economic output and employment. Additional detail regarding the job impacts evaluation methodology can be found in Appendix E.

[2] Dunsky. (July 2021). *Non-Energy Benefits: Phase II; Quantified Benefits and Qualitative Insights*. https://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation-reports/Non-Energy-Benefits-Study-Phase-II.ashx

[3] Statistics Canada is the Canadian government agency commissioned with producing statistics to help better understand Canada, its population, resources, economy, society, and culture.

4. Impact Evaluation Results

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.

4.1. Energy and Demand Savings

The overall impact savings results of the PY2021 Retrofit Program are presented in Table 4-1. The total first-year net verified energy and summer peak demand savings are 63,794 MWh and 11,792 kW, respectively. Interactive effects and baseline shift adjustment factors have been included in the gross verified savings for applicable lighting measures.

Table 4-1: Energy and Summer Peak Demand Savings

Savings Type	Gross Reported Savings	Gross Verified Savings	Net Verified Savings	Net Verified Savings at 2026
First-Year Energy (MWh)*	60,586	69,251	63,794	63,754
Summer Peak Demand (kW)*	7,679	11,675	11,792	11,784

*Includes Interim Framework carry-over projects

The results presented in Table 4-1 include savings from the PY2021 of the 2021-2024 CDM Framework projects and the Interim Framework (IF) carry-over projects described in Section 2.1. These IF projects contribute 20,404 MWh (32%) of the total first-year net verified energy savings and 3,400 kW (29%) of the total Summer Peak Demand Savings.

Interim Framework carry-over projects were not included in the sampling for the 2021-2024 CDM Framework program due to the differences between the two programs. The IF Retrofit program was delivered differently, and the IF carry-over population contained both Custom and Prescriptive tracks projects. The realization rates and net-to-gross ratios applied to the IF Retrofit carry-over projects were taken from the PY2021 IF Retrofit evaluations. To allow the presentation discussion of the 2021-2024 CDM Framework Retrofit program performance, the information presented in the remainder of this report is based solely on the PY2021 projects in the 2021-2024 CDM Framework population.

The energy and summer peak demand sample realization rates for the PY2021 of the 2021-2024 CDM Framework sample are presented in Table 4-2. The program achieved an energy realization rate of 117.30% and a summer peak demand realization rate of 164.98%. Both the lighting and non-lighting sample results achieved a precision of 10% at the 90% confidence level. A precision of 8.28% was achieved at the 90% confidence level for the overall program.

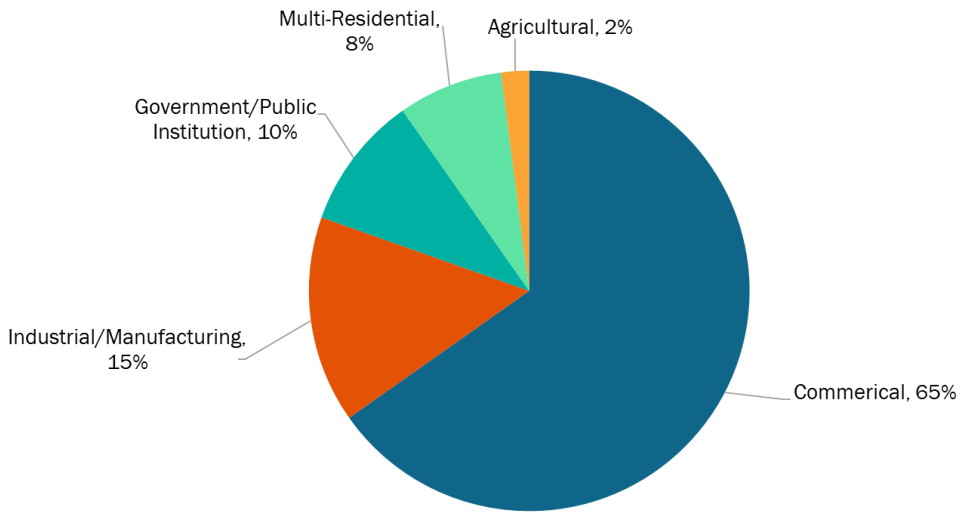
Table 4-2 : PY2021 2021-2024 CDM Framework Sample Realization Rates

Measure Type	Energy Realization Rate	Energy RR Relative Precision	Summer Peak Demand Realization Rate	Demand RR Relative Precision
Lighting	119.82%	10.02%	180.46%	39.23%
Non-Lighting	107.23%	10.35%	134.56%	7.12%
TOTAL	117.30%	8.28%	164.98%	26.10%

4.2. Participation and Net Savings by Facility Type

A total of 848 Retrofit projects were completed in the province during PY2021 of the 2021-2024 CDM Framework. This section will describe the makeup of these projects in terms of measure counts and firs- year net verified energy savings by facility and measure types. Figure 4-1 displays the percentage of total measures by facility type within the population.

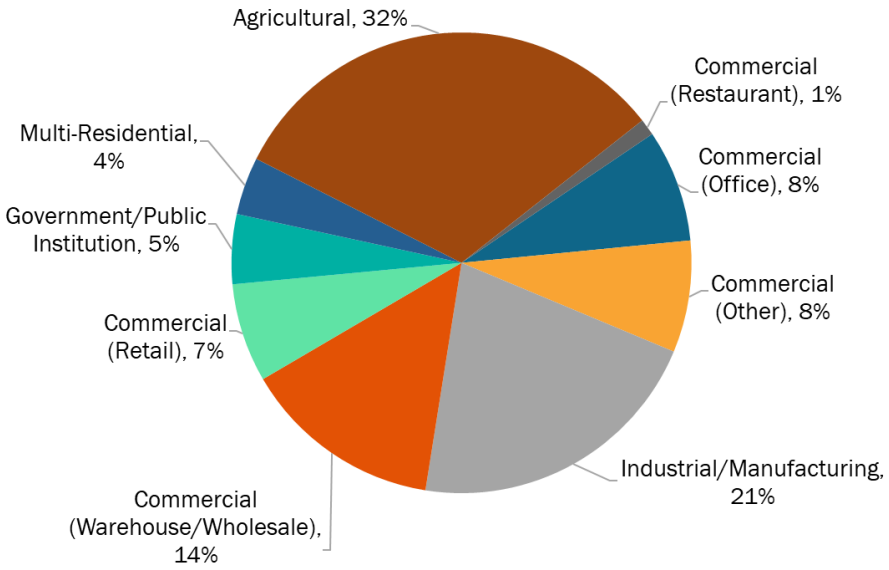
Figure 4-1 Measure Count Percentage by Facility Type



The commercial facility type is the most common by measure count, with 65% of all installed measures. The commercial facility type contains subcategories that include Office (21%), Other (16%), Warehouse/Wholesale (14%), Retail (12%) and Restaurant (2%).

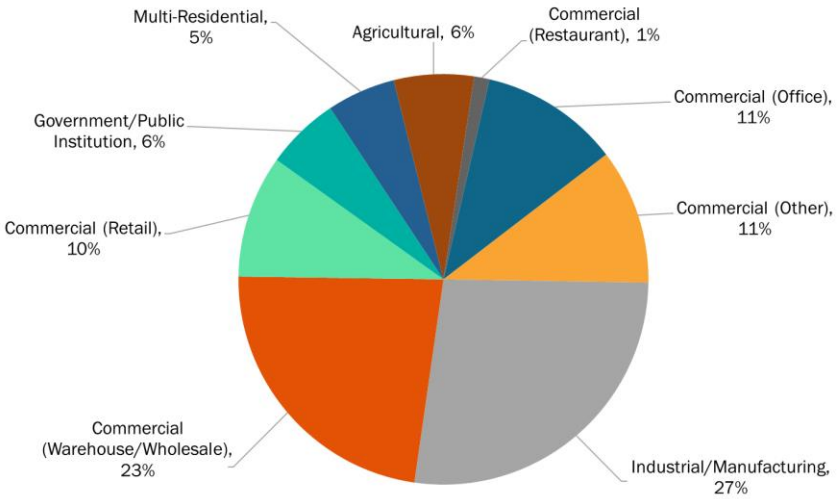
Agricultural facilities made up only 2% of the installed measures but accounted for 32% of the total net verified first-year energy savings (Figure 4-2). The majority (92%) of savings from Agricultural facilities were produced by horticultural grow lighting measures. Although Agricultural facilities achieved the largest energy savings, they represent only 6% of the summer peak demand savings of the program (Figure 4-3).

Figure 4-2: Net Verified First-Year Energy Savings Percentage by Facility Type



A total of 65% of measures were installed in various commercial facilities but only accounted for 38% (16,446 MWh) of the total net verified first-year energy savings and 55% (4,654 kW) of the total net verified first-year summer peak demand savings. Industrial/Manufacturing facilities accounted for 15% of measures, 22% of the net verified first-year energy savings and 28% of net first-year summer peak demand savings.

Figure 4-3: Net Verified First Year Summer Peak Demand Savings Percentage by Facility Type



4.3. Measure Categories

Prescriptive Lighting measures contributed 85% and 84% of the total net verified first-year energy and summer peak demand savings, respectively, while Prescriptive Non-lighting measures contributed 15% and 16% of energy and summer peak demand savings. Figure 4-4 displays the number of projects for each measure category and percent of total lighting projects by measure category. Troffers are the most common lighting measure accounting for 52% of the lighting measures installed for the program, followed by high bay at 16%.

Figure 4-4: Lighting Project Count and Percentage by Measure Category

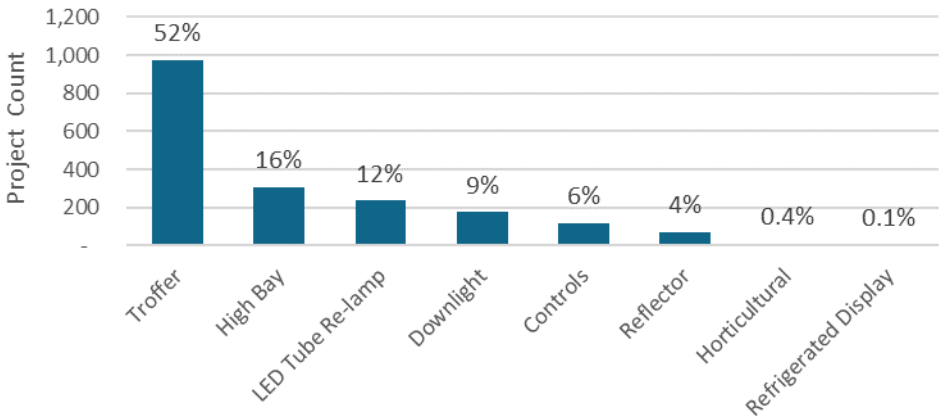


Figure 4-5 and Figure 4-6 display the percent of net verified energy and summer peak demand savings by lighting measure category. Although troffers are the most common lighting measure of the program, they rank third for the savings achieved. High bay measures achieved the most energy and demand savings.

Figure 4-5: Lighting Net Verified Energy Savings Percentages

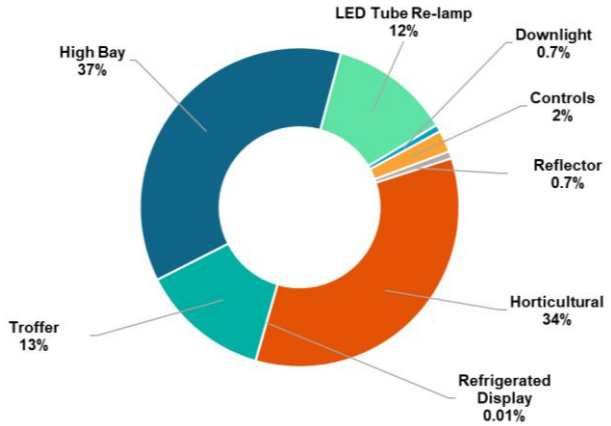
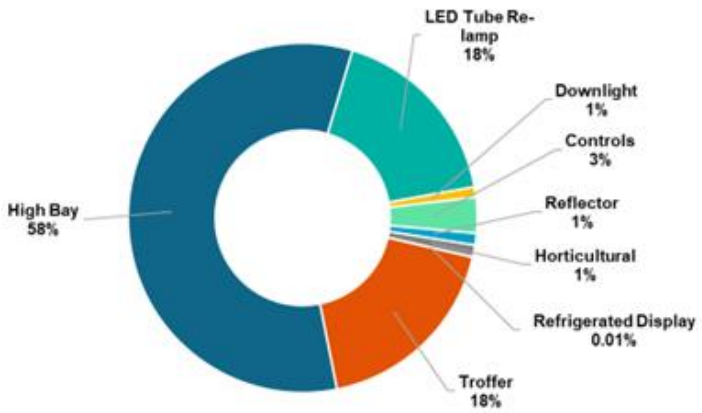


Figure 4-6: Lighting Net Verified Summer Peak Demand Savings Percentages



Horticultural lighting measures were implemented in only eight projects yet achieved the largest portion of lighting measure savings, with an average net verified energy savings of 1,598 MWh per project. The next highest average energy savings per project for a lighting measure was with high bay fixtures, at 84 MWh per project. Although troffer measures account for more than half of the total lighting measures, they only had an average savings of 4.4 net MWh per project.

Figure 4-7 displays the number of projects for each measure category and percent of total non-lighting projects by measure category.

Figure 4-7: Non-Lighting Project Count and Percentage by Measure Category

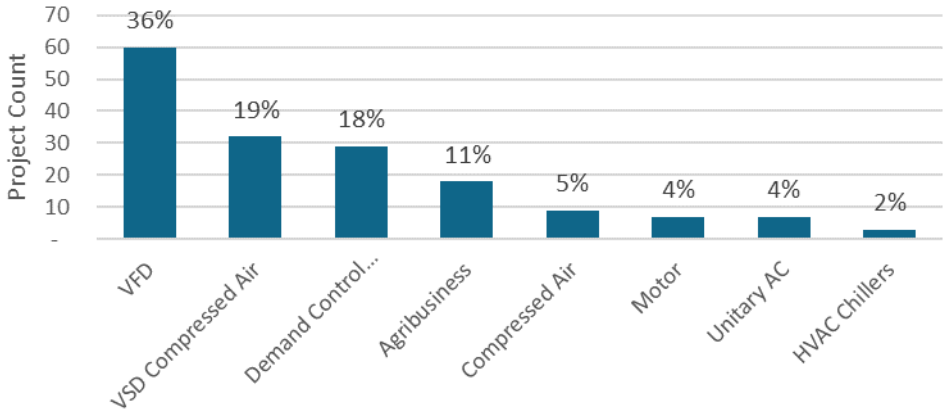


Figure 4-8 and Figure 4-9 below display the percent of net verified energy and summer peak demand savings by non-lighting measure category.

Figure 4-8: Non-Lighting Net Verified Energy Savings Percentages

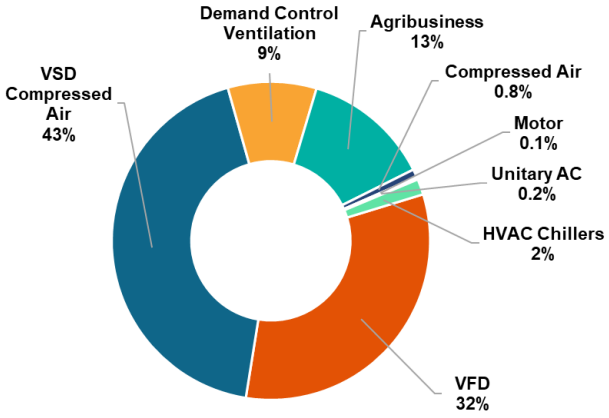
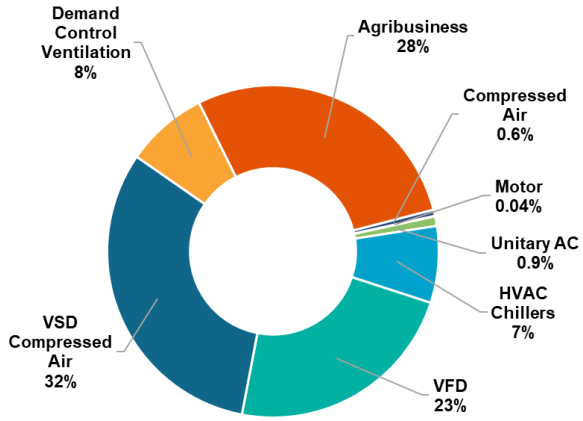


Figure 4-9: Non-Lighting Net Verified Summer Peak Demand Savings Percentages



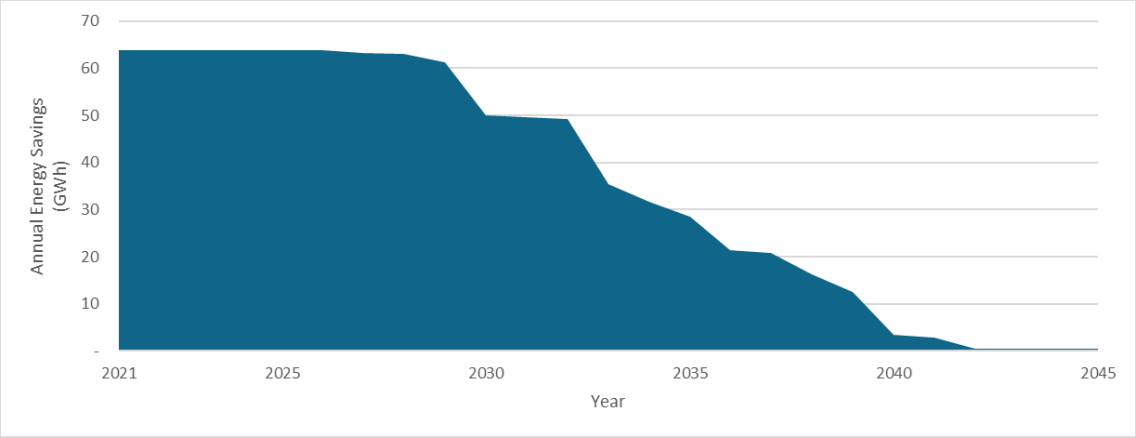
Despite VFD measures accounting for the highest number of measures installed, the VSD compressed air measure achieved more energy savings due to a higher average per project

savings of 84 MWh per project vs 34 net MWh per project for VFD measures. Energy savings achieved by VSD compressed air measure savings account for 43% of all non-lighting net verified energy savings. Agribusiness non-lighting measures, primarily box fans, contribute a disproportionate amount of summer peak demand savings due to the high coincidence with peak demand periods.

4.4. Savings Persistence

The persistence of the total net energy savings is shown in Figure 4-10.

Figure 4-10: Net Energy Savings Persistence



Close to one hundred percent (99.94%) of net savings persist until 2026. The amount of annual savings that persist past the first program year begins to be reduced when certain measures reach the end of their effective useful life (EUL). Fortunately, the weighted average EUL of both lighting and non-lighting measures is just over 14 years. By 2034, half of the initial first-year savings will not persist. For the 2021 program year, measures with EULs of five years or less contributed to the 0.06% decrease in net savings in 2026. These measures include two prescriptive measures implemented during PY 2021 that include occupancy sensors and LED reflector flood/spot lamps with a pin or screw base.

4.5. Key Impact Evaluation Findings

The key impact findings are provided below:

4.5.1. Horticultural Lighting Measures

New horticultural measures were installed in eight facilities and generated 29% of the total program net verified first-year energy savings. The average energy savings per facility was 1,598 MWh. The average energy realization rate is 128% for the seven projects evaluated. While a sample of seven projects is insufficient to support a finding, the verified annual hours of use were generally higher than the deemed values, and the conservation case wattages were generally

lower than the deemed values. Across the seven sample projects, the weighted average annual hours of use were found to be 106% of deemed values, base case wattages were found to be 99% of deemed base wattages, and efficiency case wattages were found to be 83% of deemed values. The differences between deemed and verified annual hours of use and efficiency wattages are, therefore, the main drivers of the high realization rates.

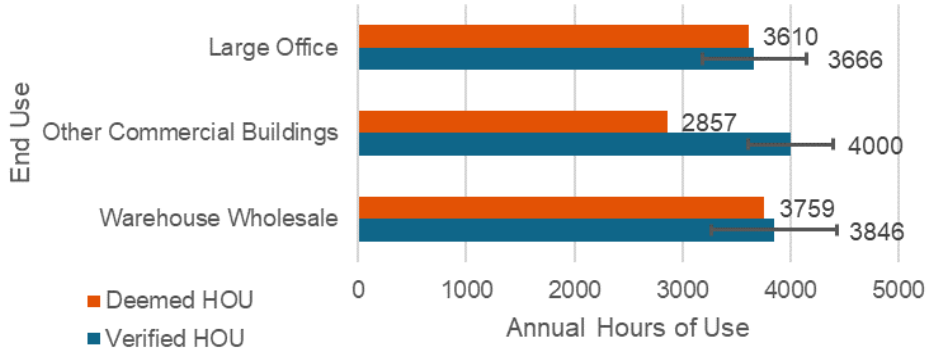
Furthermore, the deemed base case wattage used in the largest project is based on the assumption that ten T8 fluorescents "provide the equivalent brightness at the same distance away from the vertical growing surface as one EE fixture." This assumption 1) is difficult to verify and 2) creates a large amount of savings per unit which could be quickly adopted as the market baseline in the near future.

There are also currently only three available prescriptive horticultural measures which may limit applicants' ability to select suitable matches for the projects/measures they would like to implement.

4.5.2. Deemed Hours of Use

The hours of use (HOU) values were reviewed for all sampled lighting measures. Most end-uses (large offices, warehouses, hospitals, etc.) defined in the Measures and Assumptions List (MAL) have one HOU value for all measures associated with the end-use. The evaluation team compared the average verified HOU estimates from the impact sample projects to the MAL deemed HOU values. There were three end-uses with sufficient sample and low precision to support a finding. These three end uses are warehouse/wholesale, large office, and other commercial buildings. These three end-uses were also the most common end-uses in the population. The deemed HOU for other commercial buildings was the only value that fell outside of the error bounds of the verified HOU (Figure 4-11). The deemed HOU for warehouse/wholesale and large office end-uses were found to be within the 90% confidence error bounds of the average verified estimates.

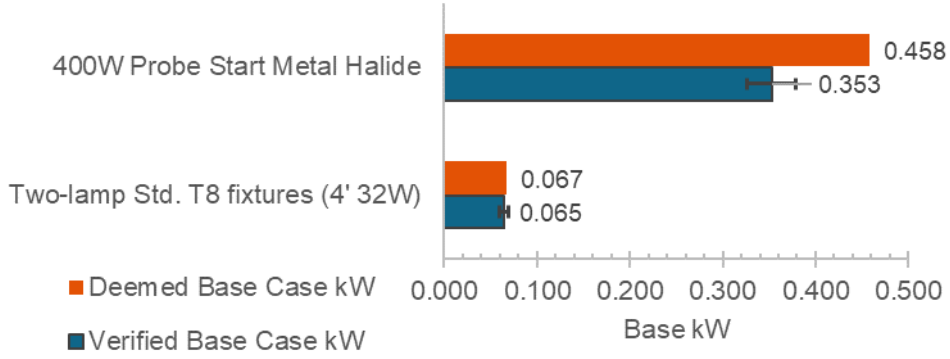
Figure 4-11: Deemed vs Verified HOU



4.5.3. Deemed Base Case Wattages

Deemed base case wattage values were reviewed for all sampled lighting measures. The evaluation team compared the average verified base case wattage estimates from the impact sample projects to the MAL deemed values. There were two base cases with sufficient samples and low precision to support a finding. These two base cases are the "Two-lamp Std. T8 fixtures (4' 32W)", and "400W Probe Start Metal Halide" fixtures. These base cases were also two of the three most common base cases in the lighting measure population. The deemed wattage for the "400W Probe Start Metal Halide" base case fell outside of the error bounds of the average verified wattage (Figure 4-12). The lower verified base case wattage for the Probe Start Metal Halide is a result of base case fixtures that have a rated wattage less than the prescribed 400W. The deemed wattage for the "Two-lamp Std. T8 fixtures (4' 32W)" base case was found to be within the 90% confidence error bounds of the average verified estimates.

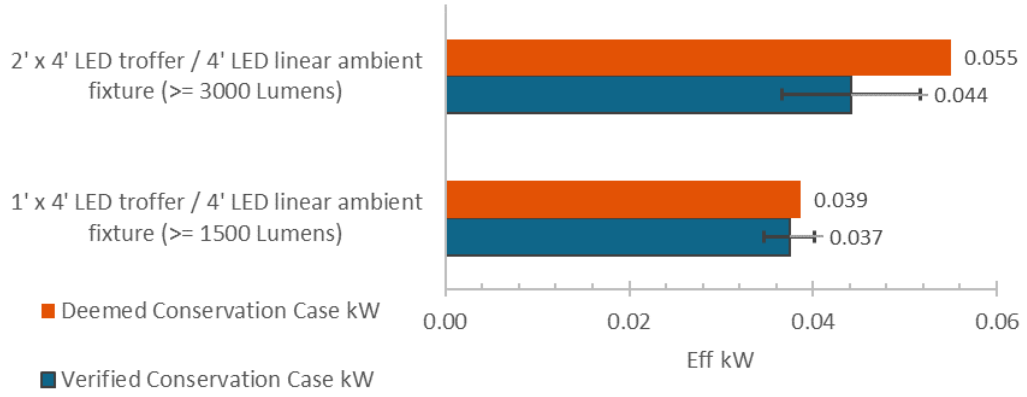
Figure 4-12: Deemed vs Verified Base Case kW



4.5.4. Deemed Conservation Case Wattages

Deemed conservation case wattage values were reviewed for all sampled lighting measures. The evaluation team compared the average verified conservation case wattage estimates from the impact sample projects to the MAL deemed values. There were two conservation cases with sufficient samples and low precision to support a finding. These two conservation cases are the "1' x 4' LED troffer/4' LED linear ambient fixture (>= 1500 Lumens)", and "2' x 4' LED troffer/4' LED linear ambient fixture (>= 3000 Lumens)" fixtures. These two conservation cases were also the two most common conservation cases in the lighting measure population. The deemed wattage for the "2' x 4' LED troffer/4' LED linear ambient fixture (>= 3000 Lumens)" conservation case fell outside of the error bounds of the average verified wattage (Figure 4-13). The deemed wattage for the "1' x 4' LED troffer/4' LED linear ambient fixture (>= 1500 Lumens)" conservation case was found to be within the 90% confidence error bounds of the average verified estimates.

Figure 4-13: Deemed vs Verified Conservation Case kW



4.6. Net-to-Gross Evaluation

Table 4-3 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.

Table 4-3: Retrofit Net-to-Gross Results

Unique Participants	NTG Responses	Savings Weighted Free-ridership	Spillover – Energy	Spillover – Summer Demand	Weighted NTG – Energy	Weighted NTG – Summer Demand	Energy NTG Precision at 90% Confidence
683	166	11.6%	3.7%	12.6%	92.1%	101.0%	± 7.3%

As presented in Table 4-3, participant feedback indicates moderately low levels of FR at 11.6%. Nearly one-fourth (24%) of participants stated they would have done the "exact same upgrade" in the program's absence, which is indicative of higher FR for these 39 respondents. However, close to two-fifths of respondents (38%) showed no indication of FR since they stated they would have put off the upgrade for at least one year (21%) or cancelled their upgrade altogether (17%) 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 (30%) or if they did not know what they would have done in the program's absence (10%). These responses were then combined, with the results indicating moderately low levels of FR for the surveyed participants.

Nearly three-fourths of respondents' decisions to participate in the program were influenced by the availability of the incentive (72%) and information or recommendations provided from contractors, vendors, or suppliers (69%). Participation in the program resulted in a moderately

low SO at 3.7%. The installation of new lighting measures primarily drove spillover savings. Additional analyses performed to assist in interpreting these values can be found in Appendix D.3.

4.7. Cost Effectiveness

Cost effectiveness for the Retrofit program achieved a Program Administrator Cost (PAC) ratio of 1.81 (Table 4-4). This result exceeds the target threshold of 1.00 set to determine if a program is cost effective.

Table 4-4: Retrofit Cost Effectiveness Results

Cost Effectiveness	
Program Administrator Cost (PAC)	
PAC Costs ($)	$15,590,964
PAC Benefits ($)	$28,188,957.36
PAC Net Benefits ($)	$12,597,993.45
PAC Net Benefit (Ratio)	1.81
Levelized Unit Energy Cost (LUEC)	
$/kWh	$0.02
$/kW	$126

5. 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 as directional given the small number of respondents.

5.1. 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.

5.1.1. 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, with streamlining of the program and increases in incentive delivery time mentioned as positives and the limited equipment offerings and related impacts on customer satisfaction with equipment available mentioned as negatives.
- Direct engagement webinars that informed customers, applicant representatives, and contractors about program changes and requirements were mentioned by the IESO staff as being well-received by attendees, and 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 more updates planned in the year ahead.
- COVID-19 remained a barrier to the program in PY2021, though the IESO and delivery vendor staff reported collaborating well to ensure the program's effective delivery.
- Some applications from the PY2020 Interim Framework Retrofit program were converted to PY2021 CDM Retrofit program applications, given a surge of applications that occurred at the end of 2020. This, in turn, indicated that the budget and resources available for the CDM Retrofit program participants in PY2021 were more limited than anticipated.
- A final challenge mentioned included the disproportionate impact of horticultural lighting projects on program savings and incentives.
- The IESO 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.

5.1.2. Design and Delivery

The IESO and the delivery vendor staff reported working effectively together to ensure the program was successfully delivered 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 change allowed for a more streamlined process where it is easier for customers to participate and receive their incentives sooner. To compensate for the absence of the custom track, additional offerings were added to the list of eligible measures, and a form was introduced to the program's website to allow requests for further measures to be submitted for consideration. Some delivery vendor staff indicated that this transition had impacted customer satisfaction as it did not fulfill as many customers' needs as the custom offering. This has, in turn, led to difficulty in retaining some customers (for example, those with larger projects or industrial customers especially). One of the delivery vendor staff also noted that while the new process for submitting measures for consideration to the program is helpful, they have heard from some customers and contractors that it can be onerous or confusing to fill out. Additionally, the delivery vendor staff stated that large projects are not served as well under the prescriptive-only approach and suggested offering more specialized equipment options for these projects.

5.1.3. 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. The IESO staff reported that customers' feedback indicated that the webinars were highly valuable. Delivery vendors agreed with the 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. Beyond the IESO's efforts and their direct customer engagement, the delivery vendors noted that another common outreach avenue comes through equipment suppliers and contractors, who often promote the program to their customers.

5.1.4. Application Portal

The IESO staff reported that in PY2021, changes were made to the Retrofit application portal to address several 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 simpler for participants to obtain information about the program. The IESO staff stated that although there were changes made to the Portal in PY2021, more changes 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 adding this feature has been helpful, with some of the suggestions leading to additional equipment types being selected for inclusion in the program.

5.1.5. 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 that equipment costs have increased, which has led 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 caused delays in ordering equipment and occasionally resulted in the equipment being unavailable.

During the pandemic, the delivery vendor staff also reported high turnover rates of staff at customers' businesses, which led to project communication difficulties and/or delays. The delivery vendors anticipate that the COVID-19 pandemic will continue to have an impact on delivery in the coming year, affecting both the size of projects and the cost of delivery, which may lead to a greater rate of project cancellation.

At the end of PY2020, there was a surge of applications to the Interim Framework Retrofit program, likely given that it was the last year of the Interim Framework and since the custom track offering would no longer be available as part of the new CDM Framework Retrofit program in PY2021. The IESO staff indicated that this had some implications for the PY2021 CDM Retrofit program, namely that some of the Interim Framework Retrofit program applications were converted to CDM Retrofit program applications for PY2021 to account for the surge. As a result, the budget and resources available to participants in the CDM Retrofit program in PY2021 were less than anticipated.

The IESO and delivery vendor staff agreed that the horticultural lighting projects, especially those in Southwest Ontario, present both opportunities and challenges. While a significant

amount of energy savings is generated from these projects, a similar amount of peak demand savings is not generated since most of these facilities (for example, greenhouses) have a reduced need 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 as part of the new 2021-2024 CDM Framework in future years.

The IESO 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.

5.2. 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 in Appendix D.2.

5.2.1. Key Findings

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

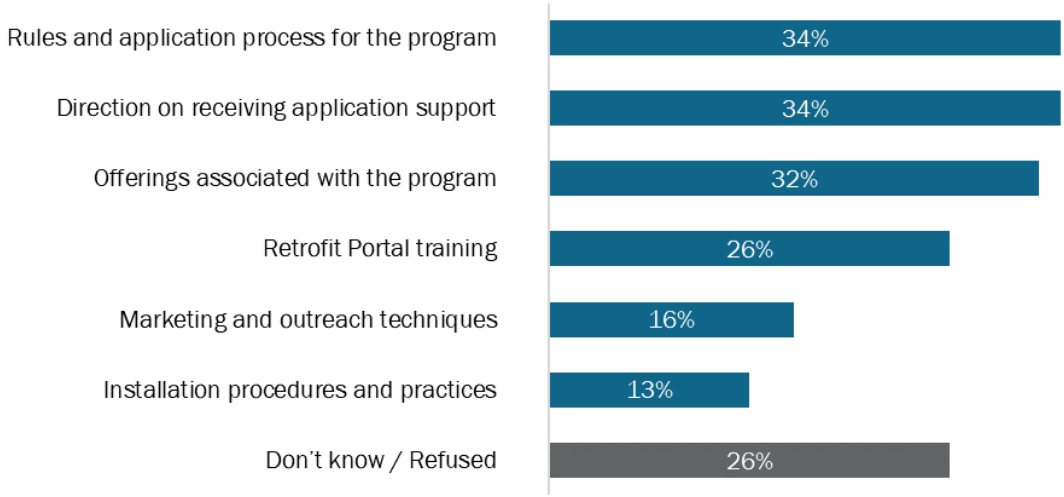
- Respondents were predominately applicant representatives (51%) or both applicant representatives and contractors (43%).
- Respondents' most-requested training and education topics were program and application rules (34%), direction on how to receive support when they or a customer are applying (34%), 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).
- 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.

5.2.2. 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%). Details regarding training and education received can be found in Figure D-4 in Appendix D.2.

Figure 5-1: 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. Respondents who rated the training a three or below provided improvement suggestions for the training. Suggestions include training for new applicant representatives before starting, more in-person training, increased training for application reviewers and program delivery vendors, and the creation of video tutorials, mentioned by one respondent each.

5.2.3. Program Experience and Improvement Suggestions

Over four-fifths (83%) of respondents identified one or more barriers to customer participation in the Retrofit program. Customers' responses include not perceiving the upgrades as 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

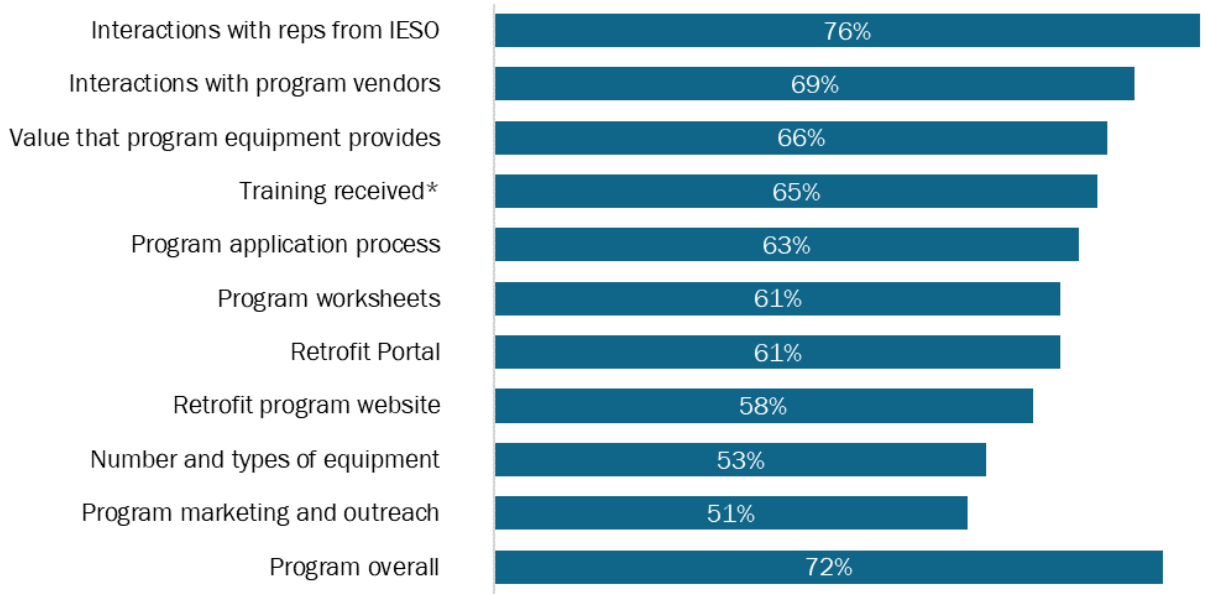
Figure D-5 in Appendix D.2.

When these respondents were asked what they thought the Retrofit program could do to overcome these barriers, the most 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 D-6 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 5-2). The highest-rated aspect of the program was interactions with representatives from the IESO (76% with a rating of 4 or 5). 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 D-7 in Appendix D.2, and respondent improvement suggestions for key aspects of the program can be found in Figure D-8, Figure D-9, Figure D-10, and Table D-3.

Figure 5-2: 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.

5.2.4. 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 they could do so. Exterior lighting (6 respondents) and non-approved LED lighting (3 respondents) were mentioned as common ineligible equipment of interest to participants by respondents who indicated that participants were unable to install all equipment of interest. A full list of equipment mentioned by respondents can be found in Table D-4 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 D-5 in Appendix D.2.

5.3. Retrofit Participant Perspectives

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

5.3.1. Key Findings

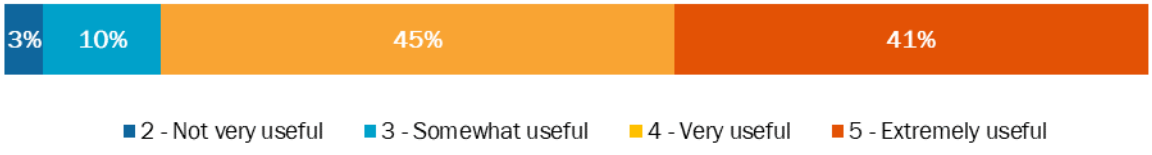
Key findings from participants' responses include the following:

- Similar proportions of respondents either had the primary responsibility for budget and expenditures (48% of respondents) or a shared responsibility (44% of respondents).
- Three-fourths of respondents (76%) reported never using the Retrofit Support line. Of those who used it, more than four-fifths (86% with a rating of 4 or 5) stated it was very useful.
- The 20 respondents who decided to install additional energy-efficient upgrades without the assistance of the Retrofit program most commonly did so because the energy or monetary savings justified the additional cost (35%) or the equipment of interest was not included in the program (30%).
- Over one-half (54%) of respondents who indicated that they did not install additional energy-efficient equipment without the assistance of the Retrofit Program cited that they did not need to install additional energy-efficient equipment.
- Over one-half of respondents (52%) reported that the program's shift to prescriptive-only projects had no impact on their participation.
- Respondents most commonly recommended that HVAC equipment (11%), lighting controls (9%), building envelope materials (8%), and lighting (8%) be included in the Save on Energy Retrofit Program.
- Respondents most frequently suggested simplifying both the application portal navigation (10%) and the application process (10%) to improve the Save on Energy Retrofit Program.

5.3.2. Retrofit Support Line

Over three-fourths of respondents (76%) reported never using the Retrofit Support line. As presented in Figure 5-3, of those who used it, over four-fifths (86%) gave it a rating of a 4 or 5, on a scale of one (1) to five (5), where one indicates "not at all useful" and five indicates "extremely useful."

Figure 5-3: Program Support Line Usefulness (n=29)



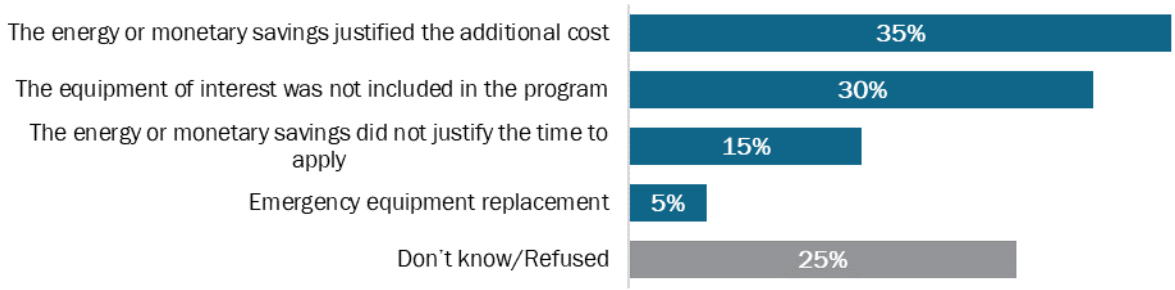
*Does not sum to 100% due to rounding.

5.3.3. Decision to Install Additional Energy-Efficient Equipment

A total of 20 respondents indicated having installed energy-efficient equipment for which they did not receive an incentive following their participation in the Retrofit program. Of these respondents, one-tenth (10%) reported that their additional energy-efficient upgrades were recommended by a Save on Energy representative at the time of their participation in the Retrofit program. When asked why their business decided to install the additional energy-efficient upgrades without the assistance of the Retrofit program, respondents most commonly cited that the energy or monetary savings justified the additional cost (35%), the equipment of interest was not included in the program (30%), and the energy or monetary savings did not justify the time to apply (15%) (Figure 5-4).

Figure 5-4: Reasons for Installing Additional Equipment Outside the Retrofit Program

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

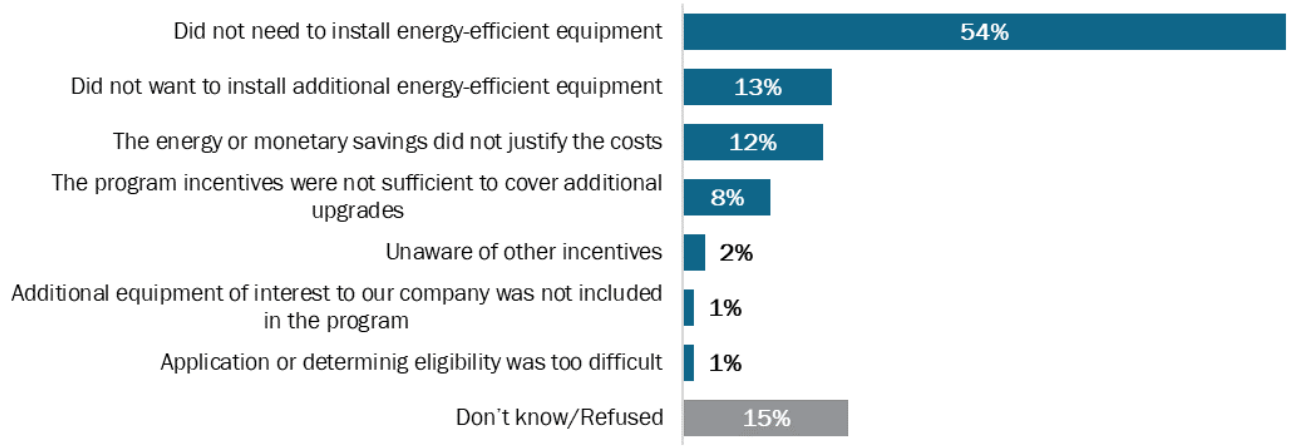


*Does not sum to 100% due to multiple responses.

Over one-half (54%) of respondents who indicated that they did not install additional energy-efficient equipment without the assistance of the Retrofit program cited that they did not need to install additional energy-efficient equipment (Figure 5-5). Other less common responses were they did not want to install additional equipment (13%), the energy or monetary savings did not justify the costs (12%), and the program incentives were not sufficient to cover additional upgrades (8%).

Figure 5-5: Reasons for Not Installing Additional Equipment Outside the Retrofit Program

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

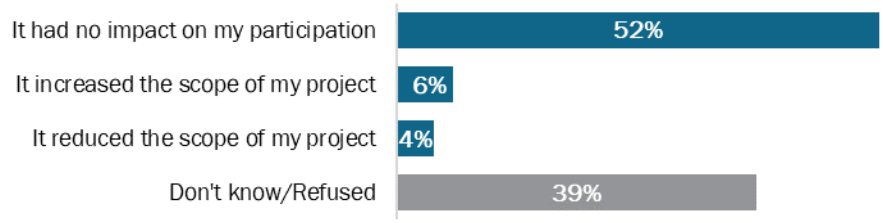


*Does not sum to 100% due to multiple responses.

5.3.4. Shift to Prescriptive-only Projects

Over one-half (52%) of respondents indicated that the program design shift to prescriptive-only projects did not impact their participation, and close to two-fifths (39%) did not know if it impacted their participation (Figure 5-6). Less than one-tenth (6%) indicated it increased the scope of their projects, and only 4% reported a reduction in the scope of their projects. Of the five respondents who indicated a reduction in the scope of their projects, two indicated a reduction of 76% or more, one estimated a 26-50% reduction, one estimated an 11-25% reduction, and one estimated a 1-10% reduction.

Figure 5-6: Assessment of Retrofit Program Shift to Prescriptive-only Projects (n=153)*



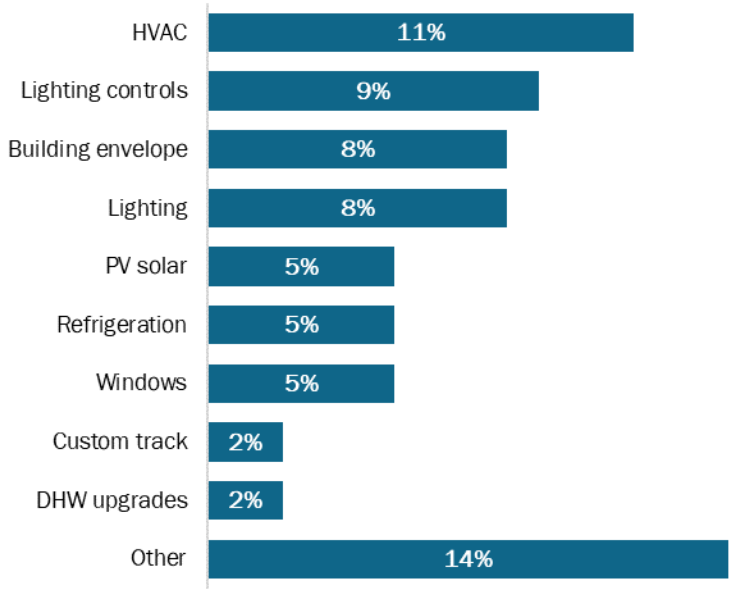
*Does not sum to 100% due to rounding.

5.3.5. Recommendations for Retrofit Program Improvement

A total of 36% of respondents (55 out of 153) offered recommendations for additional energy-efficient equipment or services to include in the Retrofit program, as shown in Figure 5-7. The most common recommendations included HVAC equipment (11%), lighting controls (9%), building envelope materials (8%), and lighting (8%).

Figure 5-7: Recommended Energy-Efficient Equipment or Services to Improve the Retrofit Program

(Open-ended and multiple responses allowed; n=55)*

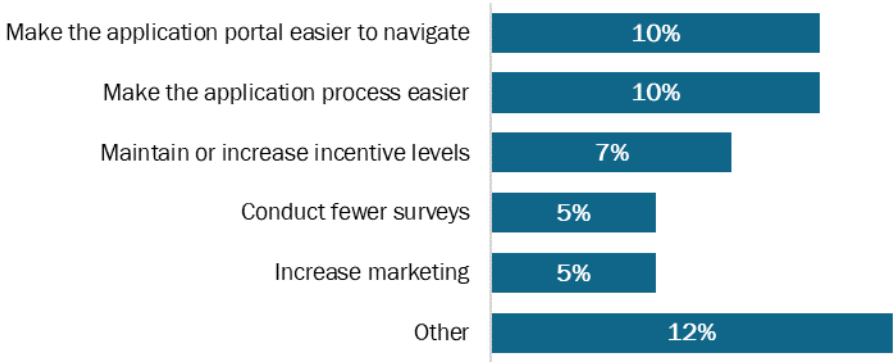


*Does not sum to 100% due to multiple responses.

A total of 13% of respondents (20 out of 153) had additional recommendations to improve the Retrofit program, as shown in Figure 5-8. The most common suggestions included simplifying the application portal navigation (10%) and the application process (10%).

Figure 5-8: Additional Recommendations to Improve the Retrofit Program

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



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

6. Other Energy Efficiency Benefits

6.1. Avoided Greenhouse Gas Emissions

The evaluation team used the IESO CE Tool V9.1 to calculate the avoided GHG emissions for the first year and lifetime savings of the measures in the 2021 program year. Table 6-1 below represents the results of the avoided GHG emissions calculations. The first-year avoided GHG resulting from electricity savings are reduced by the increase in GHG consumption due to the gas penalty, resulting in a total of 2,024.42 Tonnes of CO_2 in 2021. The lifetime GHG avoided emission from PY2021 Retrofit program is expected to be a total of 94,685.54 Tonnes throughout the EUL of the installed measures. This is mainly due to the IESO estimates of the future avoided GHG in Ontario, where avoided future electricity consumption is estimated to have higher GHG reduction, while the GHG increase due to gas penalty is estimated to remain consistent. All GHG emissions below are in Tonnes of CO2 equivalent, unless otherwise mentioned.

Table 6-1: Retrofit Avoided Greenhouse Gas Emissions

Electric First Year GHG Avoided	Gas* First Year GHG Avoided	Total First Year GHG Avoided	Electric Lifetime GHG Avoided	Gas Lifetime GHG Avoided	Total Lifetime GHG Avoided
7,135.55	(5,111.13)	2,024.42	166,019.07	(71,333.53)	94,685.54

*Interactive gas penalty resulting from lighting measures

6.2. Non-Energy Benefits

The following subsection discusses the non-energy benefits (NEBs) from the Retrofit Program in PY2021. Additional detail regarding the NEBs methodology and results can be found in Appendix F. Please note that the PY2021 NEBs results are presented in this section for informational purposes only. The team used the Phase II study NEBs values within the PY2021 cost-effectiveness calculator rather than the PY2021 NEBs study values per the IESO's request. This will allow the team to collect additional NEBs data in future evaluation years.[4]

6.2.1. Key Findings

Key findings from the NEBs analysis include the following:

[4] The team estimated the PY2021 Cost-Effectiveness using the Phase II study NEBs values ($/kWh), which were significantly higher than the equivalent adder used for the Interim Framework programs (15% adder). The effective IF $/kWh using the 15% adder was equal to $0.07/kWh, whereas the overall $/kWh NEB value for the PY2021 in the 2021-2024 CDM Framework is $0.16/kWh.

- Using the **hybrid, minimum approach**, the PY2021 NEBs values were $0.20/kWh for reduced building and equipment O&M, $0.05/kWh for thermal comfort, and $0.007/kWh for improved air quality. There were no survey respondents who provided a NEBs estimate for reduced spoilage.

6.2.2. Quantified NEBs Values

The PY2021 Retrofit participant survey included 78 participants who had experienced at least one NEB from the measures installed through the Retrofit program. The Retrofit participant survey asked about participant experiences with four NEBs:

- **Reduced building and equipment operations & maintenance (O&M):** Reduced labour or other costs associated with reduced operations and maintenance to maintain building systems.
- **Thermal comfort:** Improvement in the ability for the building to maintain a comfortable temperature.
- **Improved indoor air quality:** Reduction in air pollutants in the indoor environment.
- **Reduced spoilage:** Reduced spoilage of perishable products due to improved refrigeration or ventilation.

Nearly nine-tenths (87%) of participants experienced NEBs from reduced building and equipment operations and maintenance. Just over one-fifth (22%) experienced NEBs from improved thermal comfort, and over one-tenth (13%) experienced NEBs from improved indoor air quality. Reduced spoilage is specific to sub-sectors that use or sell perishable goods; in PY2021, there were no survey respondents associated with this small subset (Figure 6-1).

Figure 6-1: Participant Observation of NEBs, Phase II & PY2021

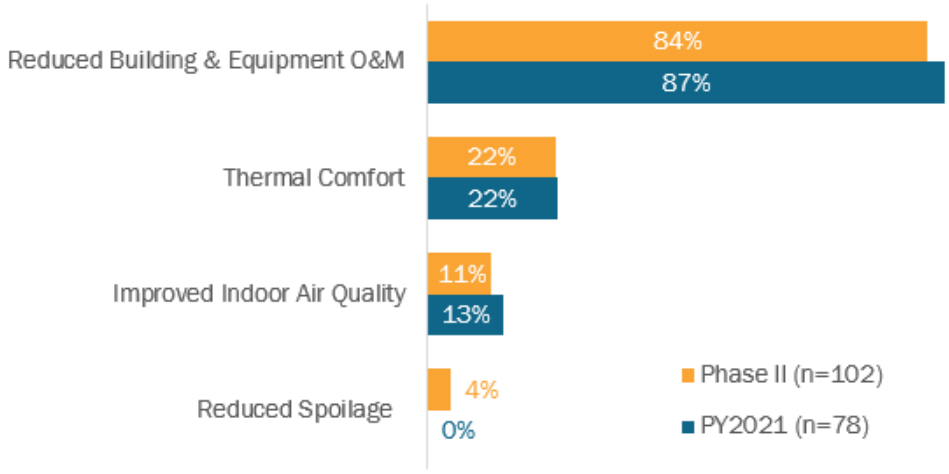


Table 6-2 presents quantified NEBs values for Phase II and PY2021 based on the hybrid, minimum ($/kWh) valuation, the approach recommended by the Phase II study[5]. Note that quantified NEBs from the Phase II study combined participants from the retrofit and small business lighting programs, yet the PY2021 results only included Retrofit program participants.

As in the Phase II study, the reduced building and equipment O&M NEB was valued highest by Retrofit participants in PY2021 ($0.20/kWh), followed by thermal comfort ($0.05/kWh) and improved air quality ($0.02/kWh).

This participant feedback is similar to the NEBs that contractors reported their customers might have experienced due to their participation in the Retrofit program. The majority of contractors (88%) indicated that their customers experienced reduced building and equipment O&M and ranked this as the most important NEB to their customers, and 25% of contractors indicated their customers had experienced increased thermal comfort in their buildings. To see all contractor feedback associated with the NEBs, refer to Figure F-1 in Appendix F.2.

Table 6-2: Quantified NEBs ($/kWh), Phase II & PY2021-P1

NEB	PY2021 (Retrofit Only)	Phase II (Retrofit & SBL)
Reduced building and equipment O&M	$0.20	$0.08
Thermal comfort	$0.07	$0.05
Improved indoor air quality	$0.02	$0.007
Reduced spoilage	-	$0.0002

The Phase II study found that program participants placed significant value on NEBs. In many cases, the value of the NEBs exceeded the value of the participants' energy savings. This was also the case in PY2021, with most respondents reporting NEBs having an equal or higher value on an annual basis than the amount of their electricity bill or savings. Furthermore, when asked if they had to pay for a certain benefit, independently from the energy savings, nearly one-fourth (24%) were prepared to pay an equal or higher value per year than the amount of their electricity bill or savings. This highlights that factors beyond energy savings may motivate participation in energy efficiency or contribute to positive customer experiences with programs.

[5] Dunsky. (July 2021). *Non-Energy Benefits: Phase II; Quantified Benefits and Qualitative Insights*. https://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation-reports/Non-Energy-Benefits-Study-Phase-II.ashx

6.3. Job Impacts

6.3.1. Key Findings

Key findings from the PY21 Jobs Impacts approach include the following:

- The analysis used an input-output model which estimated that the PY2021 Retrofit program of the 2021-2024 CDM Framework will create 795 total jobs in Canada, of which 710 will be in Ontario.
- $1M of program investment resulted in the creation of 51.0 jobs, compared to 48.8 jobs in PY20.
- 57 out of 795 (7%) of jobs impacts were realized in the first year – 29 of the 57 first-year jobs impacts were due to first-year savings.

6.3.2. Input Values

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

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

Table 6-3 below displays the input values for the demand shock representing the products and services related to Retrofit. Each measure installed as part of the program was categorized according to the StatCan IO Supply and Use Product Classifications (SUPCs).

Table 6-3: Summary of Input Values for Demand Shock

Category Description	Non-Labour *($ Thousands)*	Labour *($ Thousands)*	Total Demand Shock*($ Thousands)*
Lighting fixtures	9,394	5,447	14,841
Switchgear, switchboards, relays and industrial control apparatus	3,902	2,172	6,074
Electric light bulbs and tubes	2,979	1,727	4,706
Heating and cooling equipment (except household refrigerators and freezers)	2,599	1,416	4,015
Industrial and commercial fans, blowers and air purification equipment	609	330	939
Pumps and compressors (except fluid power)	271	151	423
Other industry-specific machinery	178	103	282
Electric motors and generators	94	55	149

Measuring, control and scientific instruments	17	10	26
Agricultural, lawn and garden machinery and equipment	0.7	0.4	1
Subtotal	20,045	11,412	31,457
Office Administrative Services	-	-	9,095
Total			**40,552**

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 $67.7 million over 36 different industries. More detail on the business reinvestment shock, along with the reinvestment values by industry, can be found in **Error! Reference source not found.**.

The third model input is the household expenditure shock.[6] This shock represents the incremental increase in electricity bills to the residential sector from funding the program. The assumption is that the IESO programs are funded by all customers in proportion to the overall consumption of electricity. Thus, the residential funding portion was 35% of the $15.6M program budget or $5.5M.

6.3.3. 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 6-4 presents the total estimated job impacts by type – combining the impacts from the demand, business reinvestment and household expenditure shocks. The majority of the estimated total jobs (710 out of the 795) were in Ontario. Of the 400 direct jobs created across Canada, 388 were created in Ontario. A slightly smaller proportion of the indirect and induced jobs were in Ontario; 157 of 194 indirect jobs and 165 of 202 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 591 FTEs (of all types) created in Ontario and 661 FTEs added nationwide. Almost all direct FTEs (337 of 347) 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 resulted in creating 51.0 total jobs compared to 48.8 jobs per $1M in 2020.

Table 6-4: Total Job Impacts by Type

Job Impact Type	Ontario FTE (In Person-Years)	Total FTE (In Person-Years)	Ontario Total Jobs (In Person-Years)	Total Jobs (In Person-Years)	Total Jobs per $1M Investment *(In Person-Years)*

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

Direct	337	347	388	400	25.6
Indirect	133	164	157	194	12.4
Induced	121	149	165	202	13.0
Total[1]	**591**	**661**	**710**	**795**	**51.0**

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

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

7. Key Findings and Recommendations

Finding 1: New horticultural lighting measures are producing large amounts of savings. New horticultural lighting measures were installed in eight facilities and generated 29% of the total program verified net first-year energy savings. The average energy savings per facility was 1,598 MWh. The average energy realization rate is 128% for the seven projects evaluated. While a sample of seven projects is insufficient to support a finding, the verified annual hours of use were generally higher than the deemed values, and the conservation case wattages were lower than the deemed values. Across the 7 sample projects, the weighted average annual hours of use were found to be 106% of deemed values, base case wattages were found to be 99% of deemed base wattages, and efficiency case wattages were found to be 83% of deemed values. The differences between deemed and verified annual hours of use and efficiency wattages are, therefore, the main drivers of the high realization rates.

Furthermore, the deemed base case wattage used in the largest project is based on the assumption that ten T8 fluorescents "provide the equivalent brightness at the same distance away from the vertical growing surface as one EE fixture." This assumption is difficult to verify and creates a large amount of savings per unit which could be quickly adopted as the market baseline in the near future.

There are also currently only three available prescriptive horticultural measures which may limit applicants' ability to select suitable matches for the projects/measures they would like to implement.

- **Recommendation 1a:** Regularly review the horticultural baseline case, conservation case and operational assumptions to determine if measure assumptions are appropriate.
- **Recommendation 1b:** Continue research into the horticulture lighting market to assess the need for additional measures and what the current market baselines are for existing measures. This is particularly relevant to the Inter-Lighting LED Grow Light Fixture as it gains popularity.

Finding 2: Update the MAL HOU for Other Commercial Buildings. The evaluation team compared the average verified Hour of Use (HOU) estimates from the impact sample projects to the Measure and Assumption List (MAL) deemed HOU values. The deemed HOU for Other Commercial Buildings was the only value that fell outside the error bounds of the verified HOU estimate. This lighting category was used for 51% of measures in the population. The average verified HOU value was found to be 4,000 hours, whereas the deemed HOU value is 2,857 hours. The precision of the verified estimate is 12% at the 90% confidence level. The error bounds of the verified estimate range from 3,518 to 4,483 hours.

- **Recommendation 2:** Update the HOU assumption for the Other Commercial Buildings end use after discussions with the program team regarding the makeup of the PY2021 population and sample and how representative that may be of the future program populations. One possible update could be to create additional lighting end-use categories, such that projects use the "Other Commercial Buildings" category and instead use a category that is more aligned with the business type and assumed annual hours of use.

Finding 3: Update the MAL wattage value for the 400W Probe Start Metal Halide base case. The evaluation team compared the average verified base case wattage estimates from the impact sample projects to the MAL deemed values. The deemed wattage for the "400W Probe Start Metal Halide" base case fell outside of the error bounds of the average verified wattage. This base case was used for 12% of measures in the population. The average verified base case wattage was found to be 353 watts, whereas the deemed base case value is 458 watts. The lower verified base case wattage is a result of base case fixtures that have a rated wattage less than the prescribed 400W. The precision of the verified estimate is 8% at the 90% confidence level. The error bounds of the verified estimate range from 326 watts to 379 watts.

- **Recommendation 3:** Update the base case wattage assumption for the 400W Probe Start Metal Halide base case to 353 watts.

Finding 4: Update the MAL wattage value for the 2' x 4' LED troffer/4' LED linear ambient fixture (>= 3000 Lumens) conservation case. The evaluation team compared the average verified conservation case wattage estimates from the impact sample projects to the MAL deemed values. The deemed wattage for the 2' x 4' LED troffer / 4' LED linear ambient fixture (>= 3000 Lumens) conservation case fell outside of the error bounds of the average verified wattage. This conservation case was used for 28% of measures in the population. The average verified efficient case wattage was found to be 44 watts, whereas the deemed efficient case value is 55 watts. The precision of the verified estimate is 8% at the 90% confidence level. The error bounds of the verified estimate range from 41 watts to 47 watts.

- **Recommendation 4:** Update the wattage assumption for the 2' x 4' LED troffer/4' LED linear ambient fixture (>= 3000 Lumens) conservation case to 44 watts.

Finding 5: 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 and delivery vendor staff indicated that their training webinars about program processes and changes were well-received by attendees, which included applicant representatives, contractors, and customers.

- **Recommendation 5a:** Ensure that training covers topics that are of most interest to the applicant representatives and contractors and that provide 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.
- **Recommendation 5a:** Expand the promotion of training and education events to raise awareness and ensure as many applicant representatives and contractors participate in them as possible.

Finding 6: Expanding measure offerings would likely increase customer, applicant representative, and contractor satisfaction with the shift to prescriptive-only approach. Over one-half of participants (52%) stated that the shift to the prescriptive-only approach did not have an impact on their participation. However, the IESO program 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. Participants most commonly recommend additional HVAC measures, lighting controls, building envelope materials, and lighting. Delivery vendor staff indicated that the new process that allows for measure recommendations to be submitted online has been well-received but that it can be onerous or confusing for some customers and contractors to fill out.

- **Recommendation 6a:** Gather feedback on measure suggestions and support needs from customer segments that may have been most impacted by the shift to the prescriptive-only approach to better understand market needs.
- **Recommendation 6b:** Further promote the availability of the online form to submit new program measure recommendations and identify ways in which to simplify the form to make it easier to fill out.

Finding 7: There is an opportunity to assist some participants in completing additional work through the program. Only about one-tenth (13%) of participants reported installing additional efficient equipment following their participation in the program. Of these participants, only 10% stated that it was recommended to them by a Save on Energy representative at the time of their participation in the program. When asked why they made these additional upgrades without the assistance of the program, participants most frequently mentioned that the energy or monetary savings justified the additional cost (35%). This suggests an opportunity for contractors to help customers maximize the work that can be completed at the time of participation where it is feasible for them to do so.

- **Recommendation 7:** Provide training and support to contractors to ensure they raise customer awareness of all relevant program-eligible equipment and help them complete as much work as possible at the time of their participation in the program.

Finding 8: More marketing outreach opportunities exist. The IESO and delivery vendor staff reported used a wide array of marketing and outreach activities in support of the program in PY2021 including 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. However, program marketing and outreach received the lowest rating from applicant representatives and contractors (16% were dissatisfied or very dissatisfied) and increased marketing was one of the main suggestions they provided for overcoming customer barriers to participation (recommended by 15%). While participants were not surveyed on their satisfaction with program marketing and outreach, between one-tenth and one-fourth (7% to 25%) indicated that various types of program marketing and outreach (for example, program materials, the program website, program social media) influenced their decision to complete their projects.

- **Recommendation 8:** Increase the frequency of marketing and outreach activities to further expand the program's reach (for example, more frequent webinars or e-blasts informing stakeholders of program changes, further social media engagement, and more in-person events as is feasible given the ongoing pandemic).

Appendix A Impact Evaluation Methodology

A.1 Sample Plan

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

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

A.2 Project Counts

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

- Application identification (ID)
- Measure type (lighting/non-lighting)

As a result, a number of IESO-defined projects were split into various evaluation projects, often due to measure types within the same application. 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 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 metering to estimate equipment hours of use and operational load.

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, and provided the participant with an opportunity 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.

Virtual site visits permitted the EM&V staff to view through the phone, tablet, or computer camera with the participant's approval. 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. Another challenge encountered was surrounding security concerns by participants who 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. For a specific stratum, the verified savings are compared to the reported savings 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 verified savings. Equation A-1 displays the formula for calculating a stratum's realization rate.

Equation A-1: Realization Rate

$$\text{Realization Rate} = \frac{\sum_{i} \square\square\square\square\square\square\square_{\text{verified}}}{\sum_{i} \square\square\square\square\square\square\square_{\text{reported}}}$$

Where:

$\text{Savings}_{\text{verified}}$ = Energy (kWh) or demand (kW) savings verified for each project in the sample

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

The total verified savings reflect the program's operations' direct energy and demand impact. 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 savings over the retrofitted equipment's lifetime. 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

$$L\square\square\square\square\square\square\square\square\ \square\square\square\square\square\square\ \square\square\square\square\square\square\square\square = \square\square\square \times \square\square\square\square\square\square\ \square\square\square\square\square\square\ \square\square\square\square\square\square\square\square$$

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.

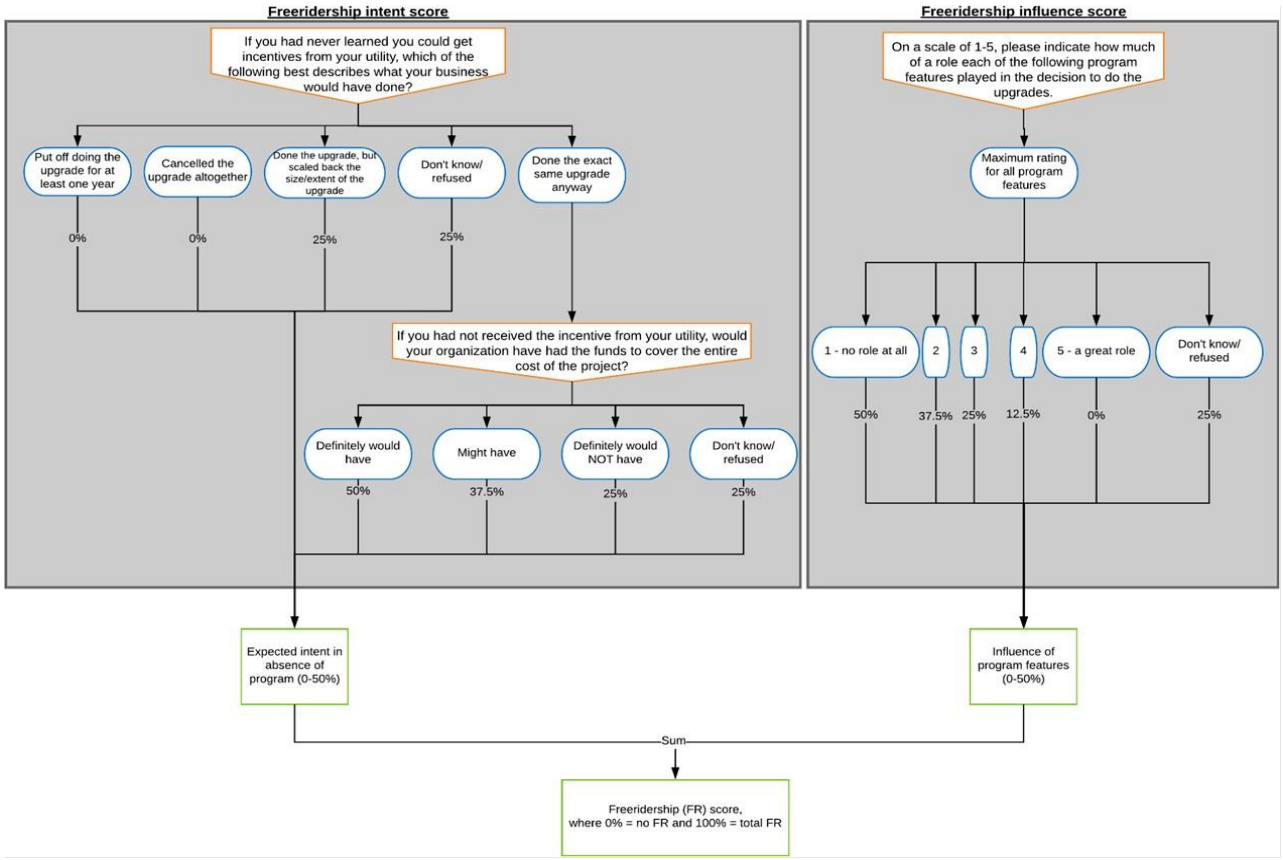
B.1 Free-Ridership Methodology

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 or extent of the upgrade.
> 4. Done the exact same upgrade anyway Ask Question 2
> 98. Don't know
> 99. Refused

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

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

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

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

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

If a respondent provided an answer of 1 or 2 (would postpone or cancel the upgrade) to the first question, the respondent would receive an FR intention score of 0% (on a scale from 0% to 50%, where 0% is associated with no FR and 50% is associated with high FR). If a respondent answered 3 (would have done the project but scaled back the size or extent) 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 project 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 project, 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 received a score of 50% (associated with high FR). If the respondent answered 2 (might have had the funds), they received 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 an 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 much of a role various potential program-related influence factors had on their decision to do the upgrade(s) in question. Influence is reported using a scale from one (1) to five (5), where one indicates "it played no role at all" and five indicates "it played a great role." The potential influence includes the following:

- Availability of the incentives
- Information or recommendations provided to you by an IESO representative (if applicable)
- The results of any audits or technical studies done through this or another program provided by the IESO (if applicable)
- 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's 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 (great role) to at least one of the influence factors. In that case, the program is considered to have had a great role in their decision to do the upgrade, and the influence component of FR is set to 0% (not a free rider).

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

Maximum Influence Rating	Influence Score (%)
5 - program factor(s) highly influential	0
4	12.5
3	25
2	37.5
1 - program factor(s) not 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: type, size, quantity
- HVAC: air conditioner replacement, above code minimum: tonnage and quantity
- Lighting: type, quantity, wattage, hours of operation, location, and fixture length
- Lighting – controls: type of control, type and quantity of lights connected to control, hours of operation, and percentage of time the timer turns off lights
- Motor/Pump Upgrade: type, end-use, horsepower, and efficiency quantity
- Motor/Pump Drive Improvement (VSD and Sync Belt): type, end-use, 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 instrument 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 played no role at all" and five indicates "it played a great role." Suppose the influence score is between 3 and 5 for a particular equipment type. In that case, the survey instrument solicits details about the upgrades to estimate the quantity of energy savings that the upgrade produced.

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

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

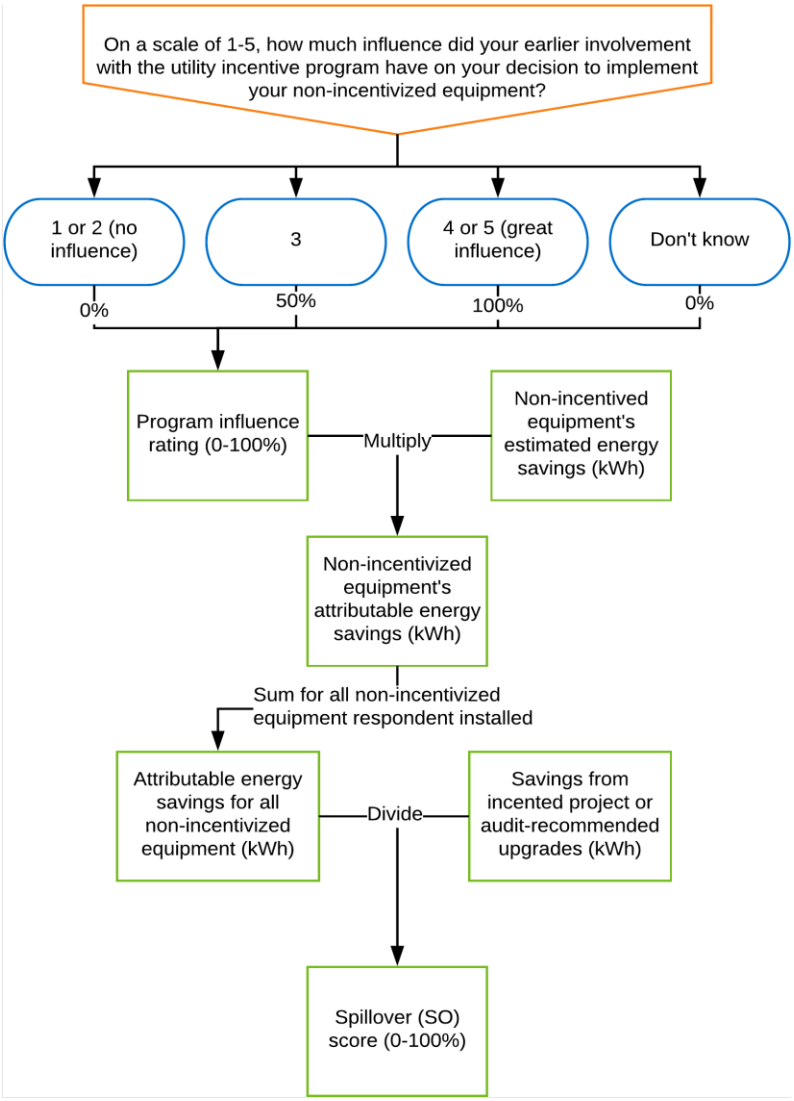
The following procedure was used to calculate an SO percentage for each respondent:

- Multiplying the estimated energy savings for each upgrade by the influence percentage to calculate the upgrade's program-attributable energy savings.

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

Figure B-2 illustrates the SO methodology.

Figure B-2: Spillover Methodology



B.3 Identification of Project or Upgrade for NTG Assessment

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

B.4 Other Survey Questions

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

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

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

B.5 Net-to-Gross Survey Implementation

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

For each phone survey, 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 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 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?			✓	✓
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. The evaluators developed all survey instruments, interview guides, and sample files 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	683	153[7]	22%	5.9%

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 and program delivery vendor staff related to the program design and delivery.

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

[7] The NTG evaluation included 13 more respondents (n=166) than the process evaluation (n=153) because 13 respondents did not fully answer the process evaluation survey questions.

Partial Complete	0	0	0
Bad Contact Info (No Replacement Found)	0	0	0
Total Invited to Participate	3	3	6

The interview topics 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 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 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)	0
Unsubscribed	0
Partial Complete	17
Screened Out	10
No Response	421
Total Invited to Participate	545

The survey topics included firmographics, program roles and responsibilities, audits and/or projects completed, program-specific communications from IESO, how customers heard about the program, training and education, barriers to participation, satisfaction with various aspects of the program, equipment offering feedback, program improvement suggestions, FR and SO, jobs impacts, NEBs perspectives, 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.[8] Weekly e-mail reminders were sent to non-responsive contacts through web survey fielding.

Participant Survey

A total of 153 participants were surveyed from a sample of 683 unique contacts (

Table C-5). The purpose of the survey was to better understand the participants' perspectives related to the program experience.

Table C-5: Participant Survey Disposition

Disposition Report	Web	Phone	Total
Completes	129	24	153
Emails bounced	6	-	6
Bad Contact Info (No Replacement Found)	-	-	0
Unsubscribed	-	-	0
Partial Complete	12	5	17
Screened Out	10	2	12
Busy	-	14	14
Callback	-	19	19
Hard refusal	-	12	12
No answer	-	18	18
No Eligible Respondent	-	19	19
Non-working #	-	2	2
Voicemail	-	158	158
Agreed to Complete Online	-	23	23
Wrong Number	-	5	5

[8] 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.

No Response	526	14	156
Total Invited to Participate	683	291	974

The survey topics included firmographics, energy management training path or certification, experience with and suggestions for improvement of the Retrofit Support Line, reasons for installing or not installing additional energy-efficient equipment upgrades, impacts of the custom track removal on project scope, equipment recommendations, program improvement recommendations, participation in other programs, FR and SO, job impacts, NEBs perspectives, 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. NMR staff worked closely with the Resource Innovations survey lab to test the survey's programming and perform quality checks on all data collected.

The survey implementation was conducted between March 29 and April 22, 2022. The survey took an average of 18 minutes to complete after removing outliers.[9] Weekly e-mail reminders were sent to non-responsive contacts through web survey fielding.

[9] 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 estimated 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)

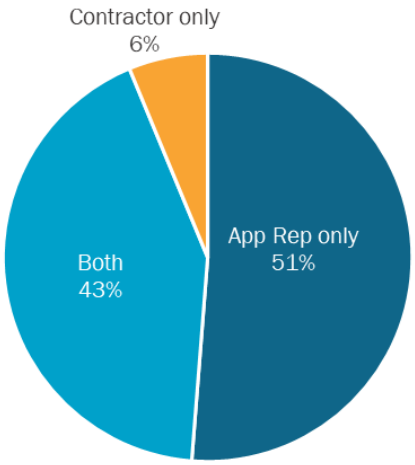


Table D-1 displays the number of full and part-time employees at the respondents' companies. Nearly one in three (29%) were affiliated with companies that had five or fewer full-time positions. Over one in five (22%) were affiliated with companies that had over 20 full-time positions. One in four (26%)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

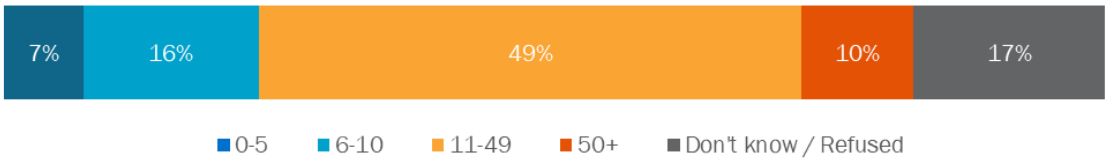
Table D-1: Respondents' Full- and Part-time Employees (n=68)

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)*

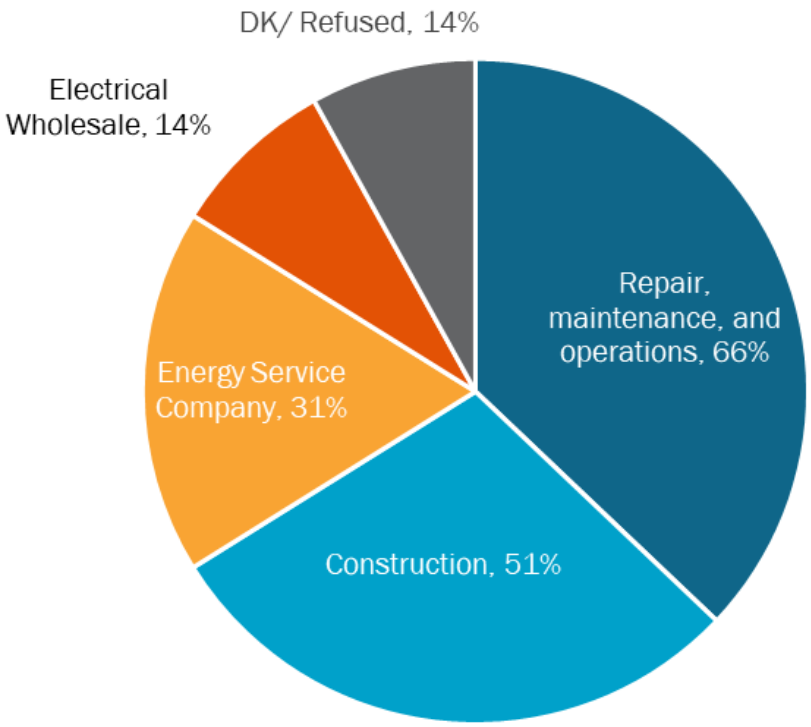


*Does not sum to 100% due to rounding.

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 of 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 non-program eligible measures	4%	N/A

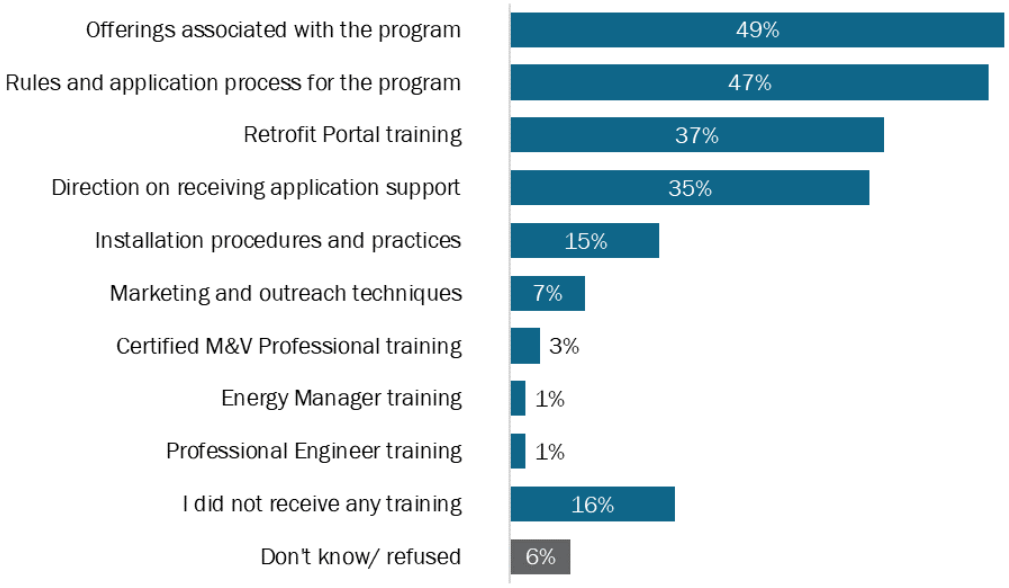
Training and Education

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 5.2.2 includes an additional discussion around training and education.

Figure D-4: Types of Training Received

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



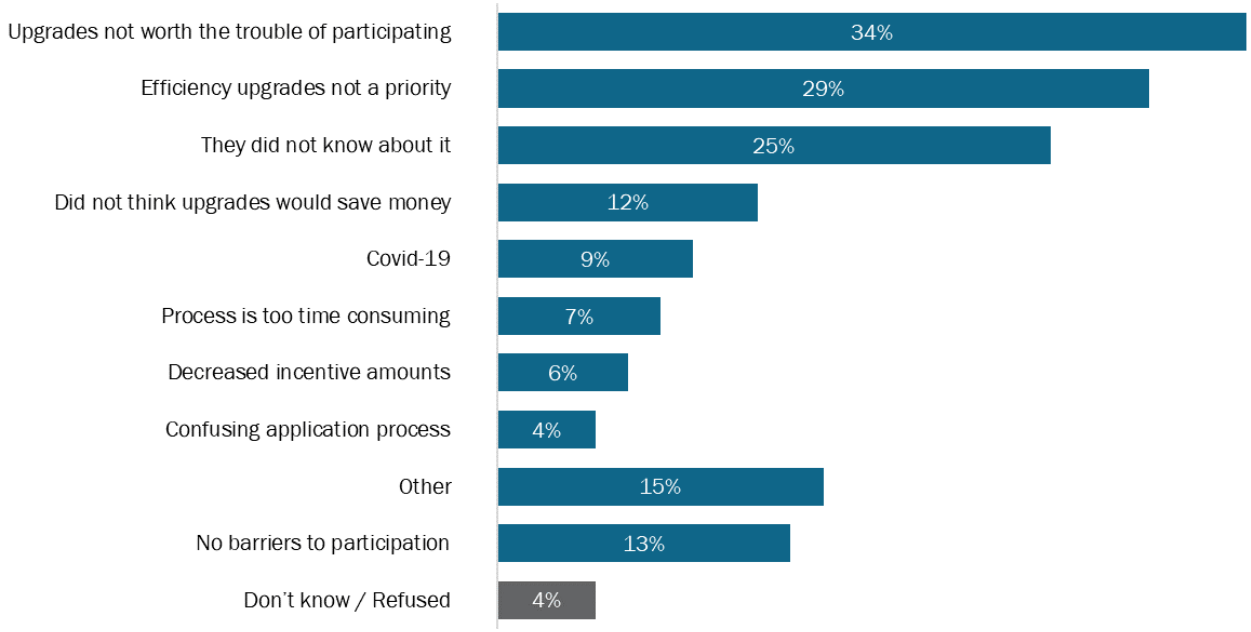
*Does not sum to 100% due to multiple responses.

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 5.2.3 includes an additional discussion around program barriers.

Figure D-5: Barriers to Customer Participation

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

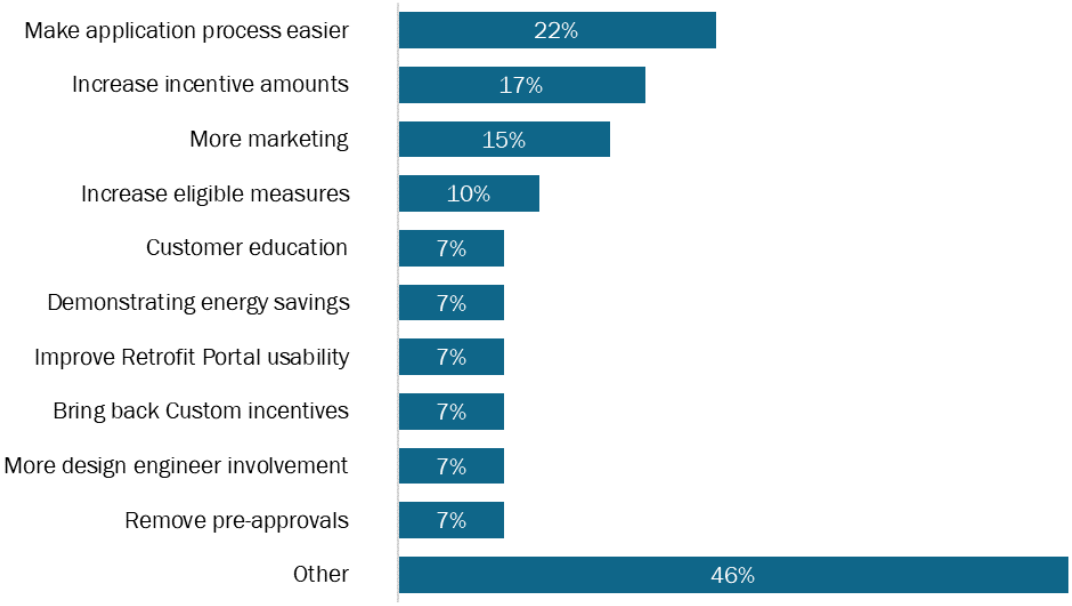


*Does not sum to 100% due to multiple responses.

Figure D-6 includes a full list of suggestions to overcome participation barriers, as reported by applicant representatives and contractors. Section 5.2.3 includes an additional discussion around overcoming customer barriers.

Figure D-6: Suggestions to Overcome Participation Barriers

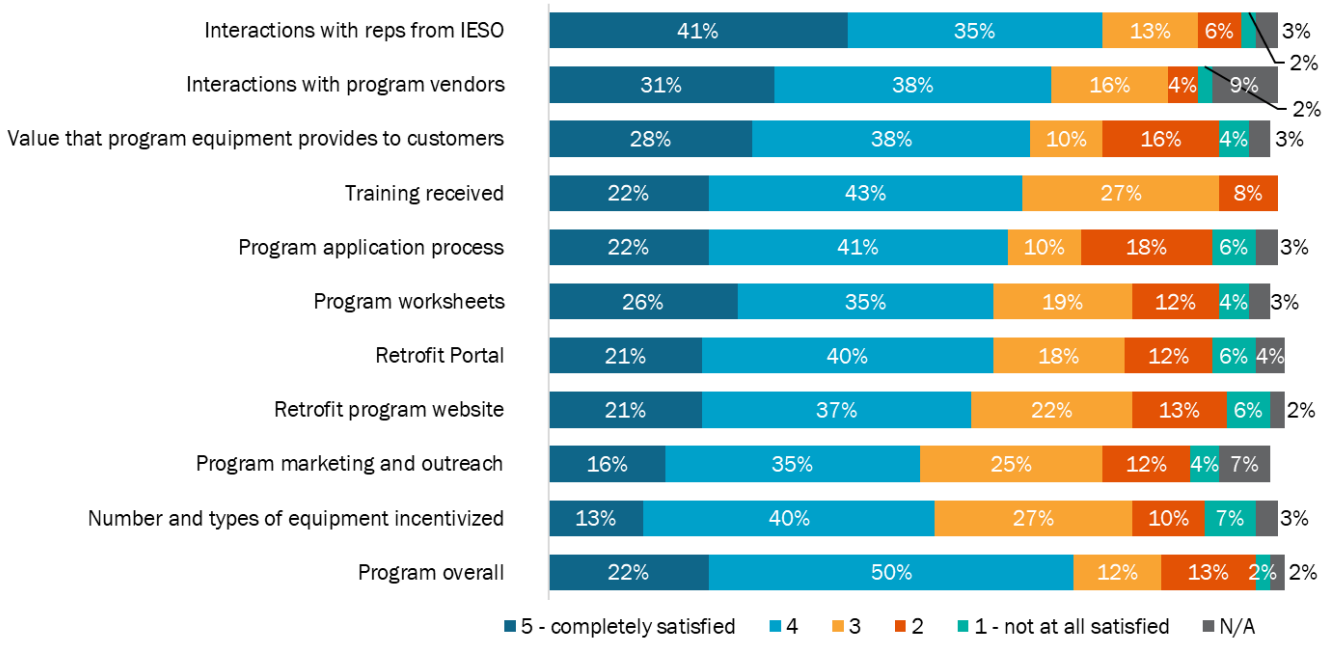
(Open-ended and multiple responses allowed; n=47)*



*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 5.2.3 includes an additional discussion around satisfaction.

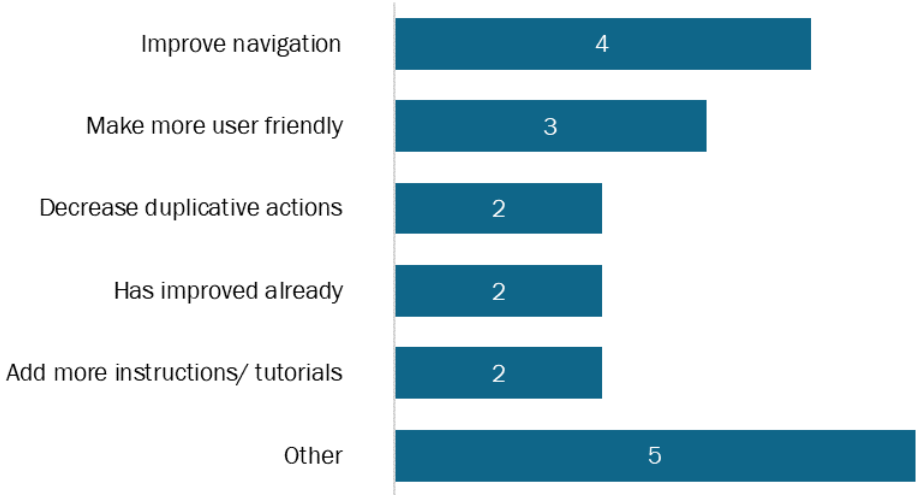
Figure D-7: Satisfaction with Aspects of the Retrofit Program (n=68)



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 5.2.3 includes an additional discussion around satisfaction.

Figure D-8: Suggested Improvements for Retrofit Program Website

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

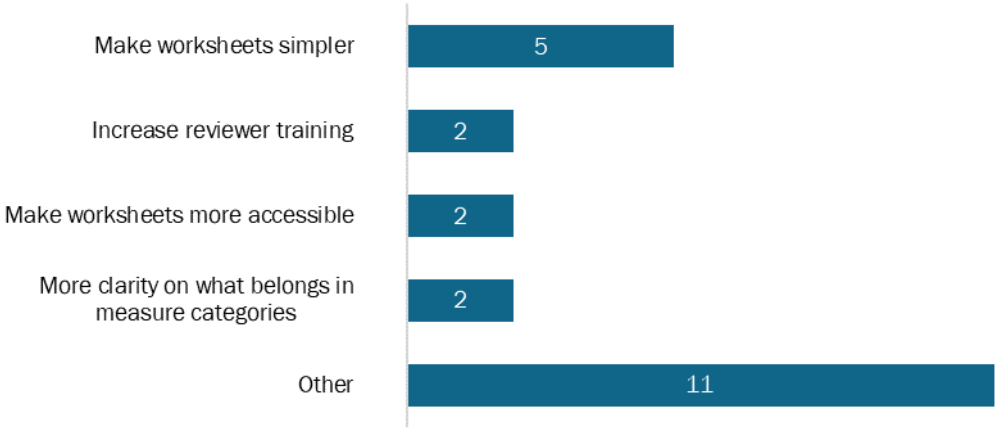


* Counts displayed rather than percentage due to small n.

Respondents who provided a satisfaction rating for the Retrofit Program worksheets a three or below were asked for suggestions on how to improve it (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 5.2.3 includes an additional discussion around satisfaction.

Figure D-9: Suggested Improvements for Retrofit Program Worksheets

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



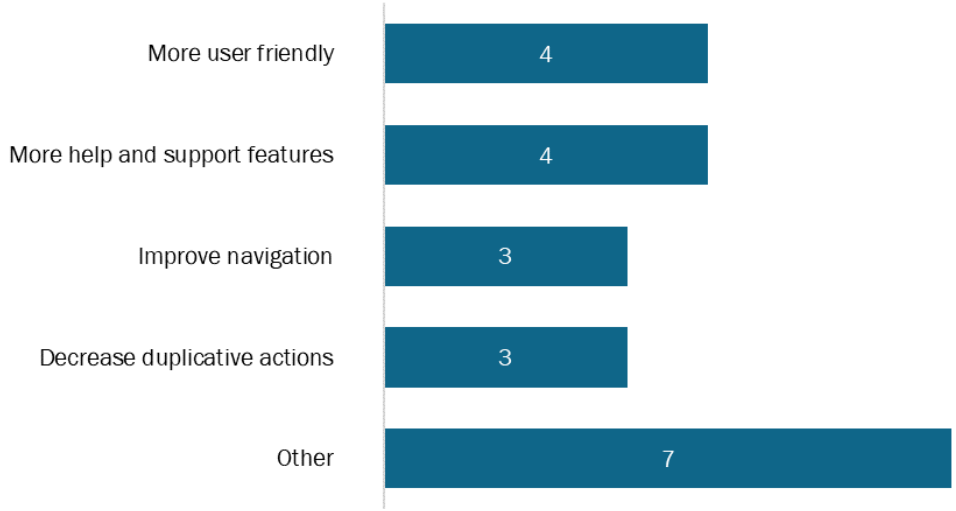
* Counts displayed rather than percentage due to small n.

Respondents who provided a satisfaction rating for the Retrofit Portal of a three or below were asked for suggestions on how to improve it (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 5.2.3 includes an additional discussion around satisfaction.

Figure D-10: 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 gave the program a satisfaction rating of 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 5.2.3 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 centre 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.

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 5.2.4 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 centre 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 5.2.4 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 Centre 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

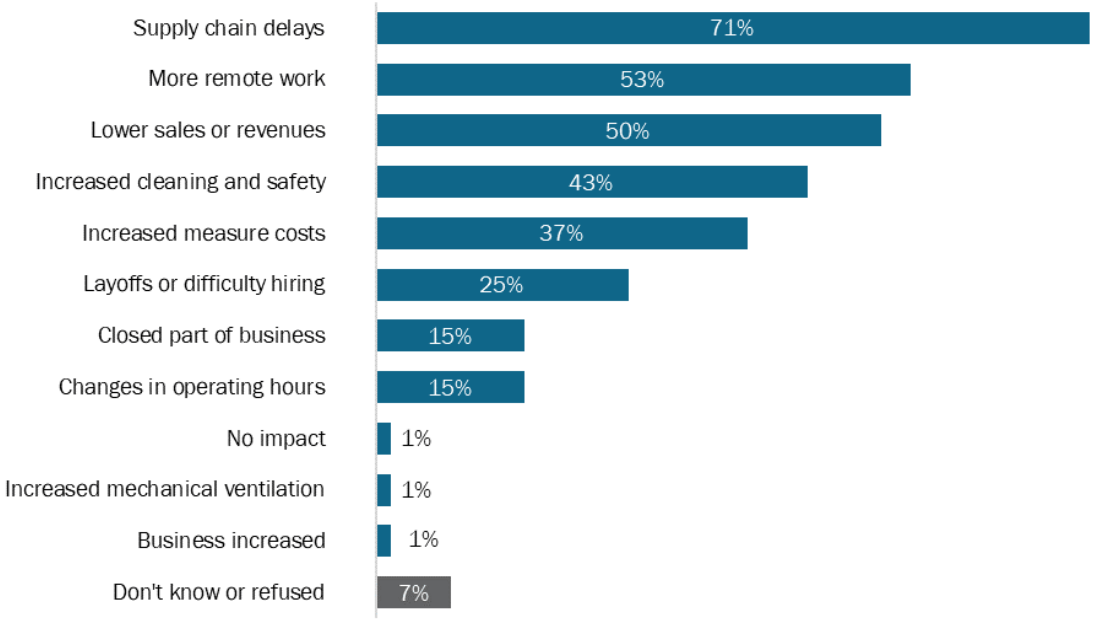
*Does not sum to 100% due to multiple responses.

Business Response to the COVID-19 Pandemic

Respondents were asked how the COVID-19 pandemic had impacted their company and its operations (Figure D-11). 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-11: 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-12). Over one-half (52%) of respondents thought adhering to protocols was either not very difficult (36%) or not difficult at all (16%).

Figure D-12: Difficulty Adhering to Covid-19 Protocols (n=31)

D.3 Additional Participant Net-to-Gross Results

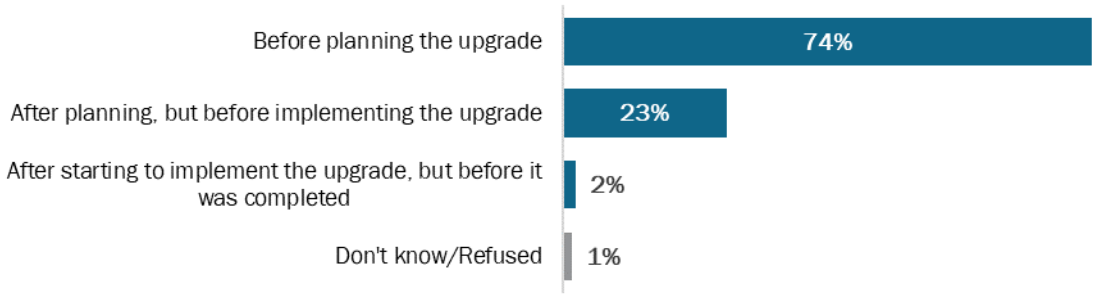
This section includes detailed FR and SO results associated with the NTGR for Retrofit participants.

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.

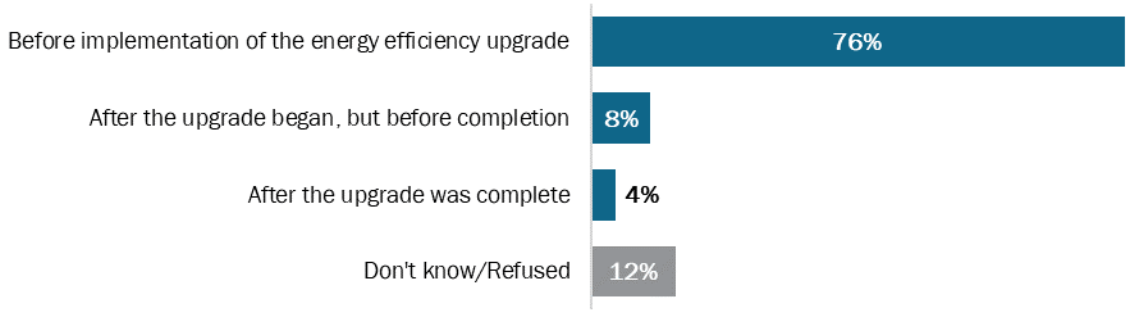
Nearly three-fourths (74%) of respondents stated they first learned they could receive energy-efficiency incentives through the Retrofit program before starting to plan their upgrades (Figure D-13). This may suggest the program was influential in many of these respondents' decisions to begin the project. Nearly one-fourth (23%) of respondents learned about the program after planning started but before the project began. The remainder learned after beginning but before completing their projects (2%), or did not know or refused to answer (1%). 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-13: When Participants First Learned About the Program (n=166)



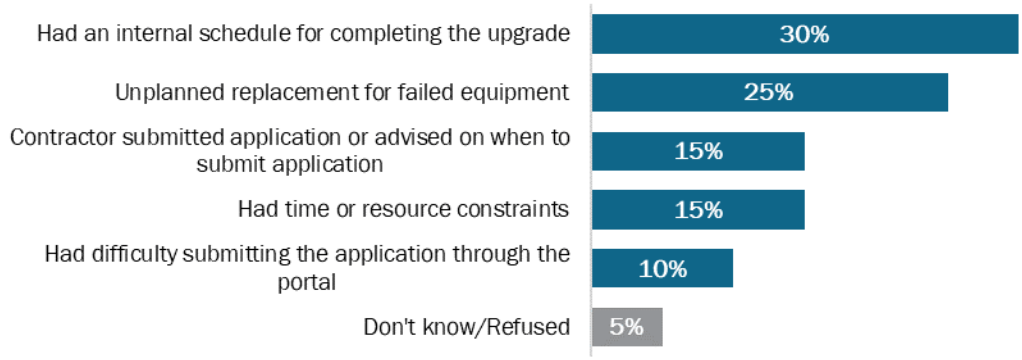
Participants were then asked about the timing of their application to the program in relation to the start of their energy-efficient upgrades (Figure D-14). Nearly four out of five respondents (76%) indicated they applied before their company began implementing the upgrade, suggesting that most participants 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 (4%) or did not know or refused to answer (12%). 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-14: Timing of Program Application (n=166)



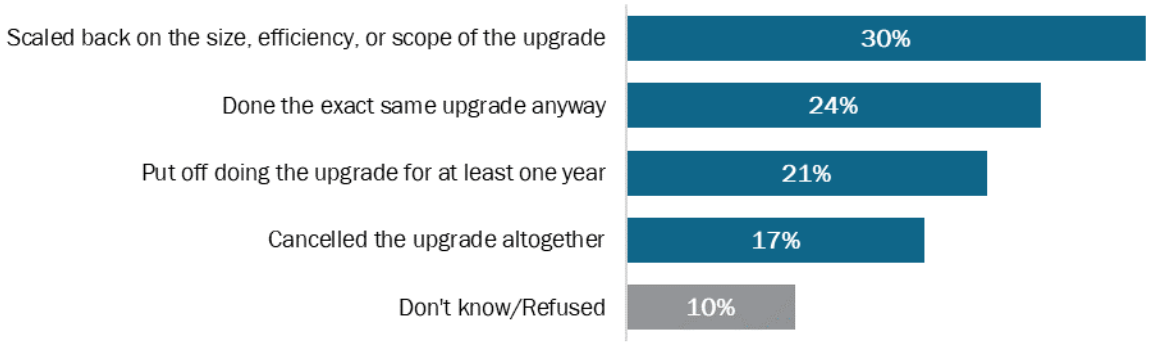
Respondents whose companies submitted a Retrofit program application after starting an energy-efficiency upgrade were asked their reasoning for doing so (Figure D-15). The most common reasons provided were to stick to an internal schedule (30%) or that there was an unplanned replacement (25%). The responses 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-15: Reason for Submitting After Starting Upgrade (n=20)



Respondents were then asked what they would have done in the program's absence (Figure D-16). Nearly one-fourth of respondents would have done the "exact same upgrade" anyway (24%), which is indicative of higher FR for these respondents. Close to two-fifths of respondents (38%) showed no indication of FR since they stated they would have put off the upgrade for at least one year (21%) or cancelled their upgrade altogether (17%) 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 (30%) or if they did not know what they would have done in the absence of the program (10%). The evaluation team factored responses from this participant intent question into the FR analysis.

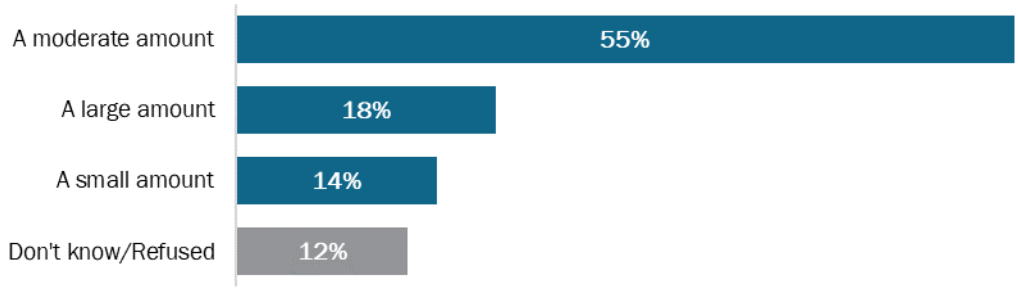
Figure D-16: Actions in the Absence of Program (n=166)*



*Does not sum to 100% due to rounding.

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 one-half of these respondents (55%) would have scaled it back by a moderate amount (Figure D-17). 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 large amount (18%), those who would have scaled it back by a small amount (14%), and those who did not know how their project scope would have changed (12%). This question was not used to calculate the FR score, though it provided additional context around participant intentions.

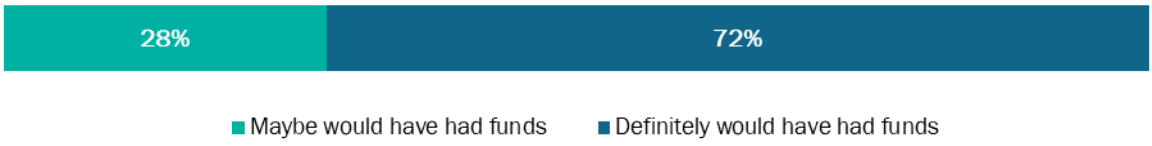
Figure D-17: Scaled Back Size or Extent of Upgrade in Absence of Program Incentives (n=39)*



*Does not sum to 100% due to rounding.

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-18). Nearly three-fourths (72%) of respondents stated they definitely would have had the funds to cover all project costs, more than twice as many as the respondents who stated they might have had the funds (28%). 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-18: Availability of Funds in Absence of Program Incentives (n=39)

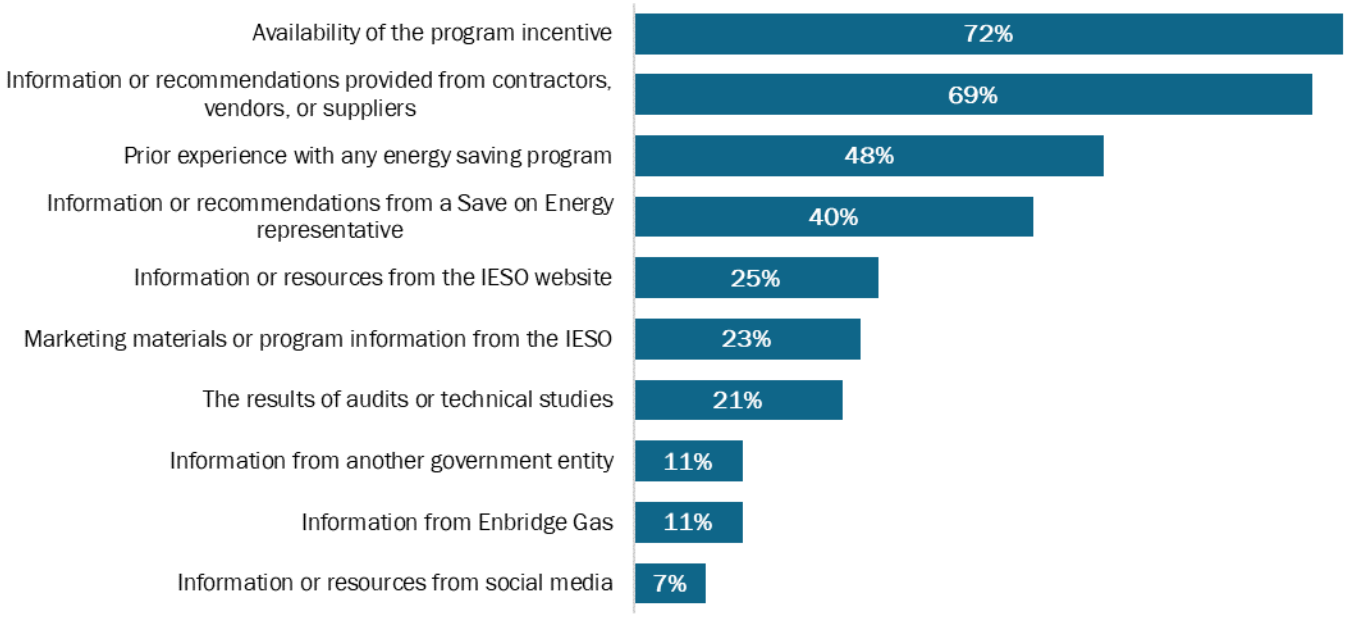


Respondents were asked how influential various program features were on their decision to install energy-efficient equipment (Figure D-19). They rated each feature's influence on a scale from one (1) to five (5), where one indicates it was "not at all influential" and five indicates it was "extremely influential." The highest-rated responses were the availability of incentives (72% with a rating of 4 or 5 for each response) and recommendations from contractors, vendors, or suppliers (69% with a rating of 4 or 5). The next most influential program feature was a previous experience with energy-saving programs (48% with a rating of 4 or 5). This question, which focuses on the program's influence and 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-19: Influence of Program Features on Participation (n=166)

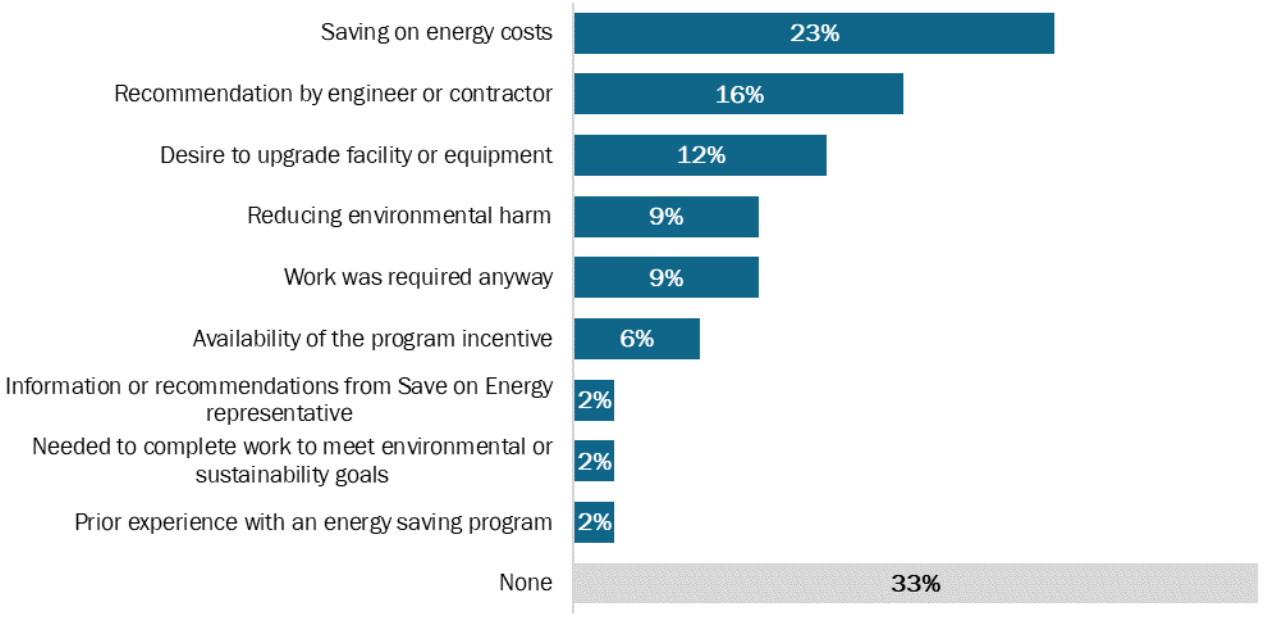
(Rating of 4 or 5 on a scale from 1 to 5)



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-20). The most common responses included saving on energy costs (23%), recommendations by the engineer or contractor (16%), and a desire to upgrade their facility or equipment (12%).

Figure D-20: Other Influential Factors on Upgrade Decision

(Open-ended and multiple responses allowed; n=81)*

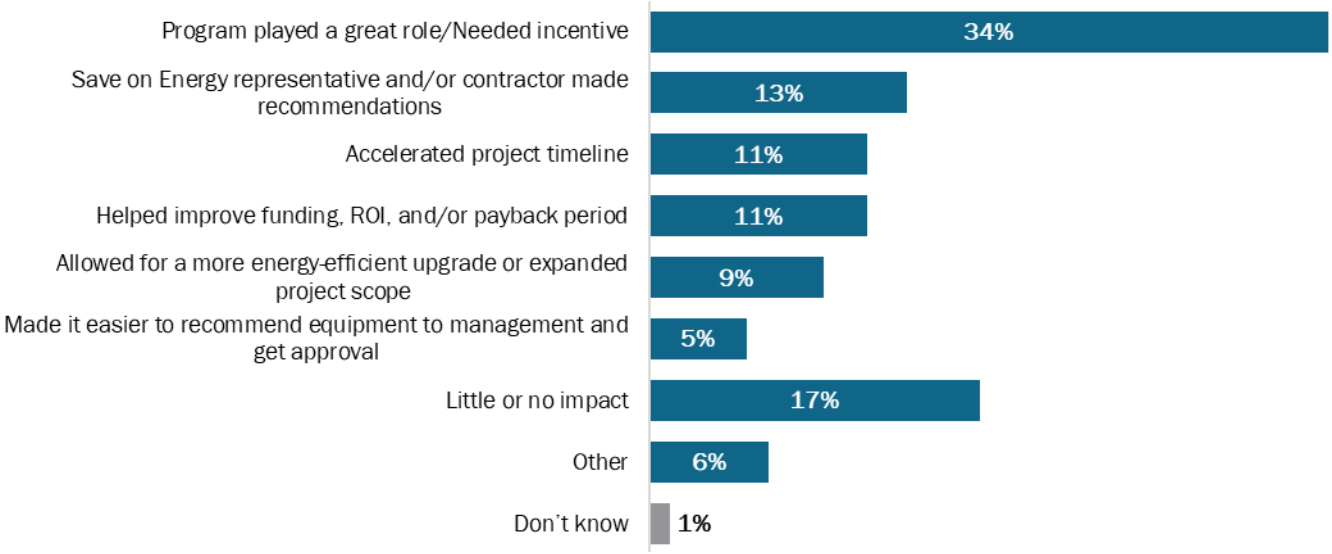


*Does not sum to 100% due to multiple responses.

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-21). The most common response related to the program playing a great role and needing the incentive (34%). Other responses related to the Save on Energy representative and/or contractor making recommendations (13%), accelerating the project timeline (11%), and the financial incentive helping their funding, ROI, or payback period (11%).

Figure D-21: Program Impact on Decision to Install Equipment

(Open-ended and multiple responses allowed; n=102)*

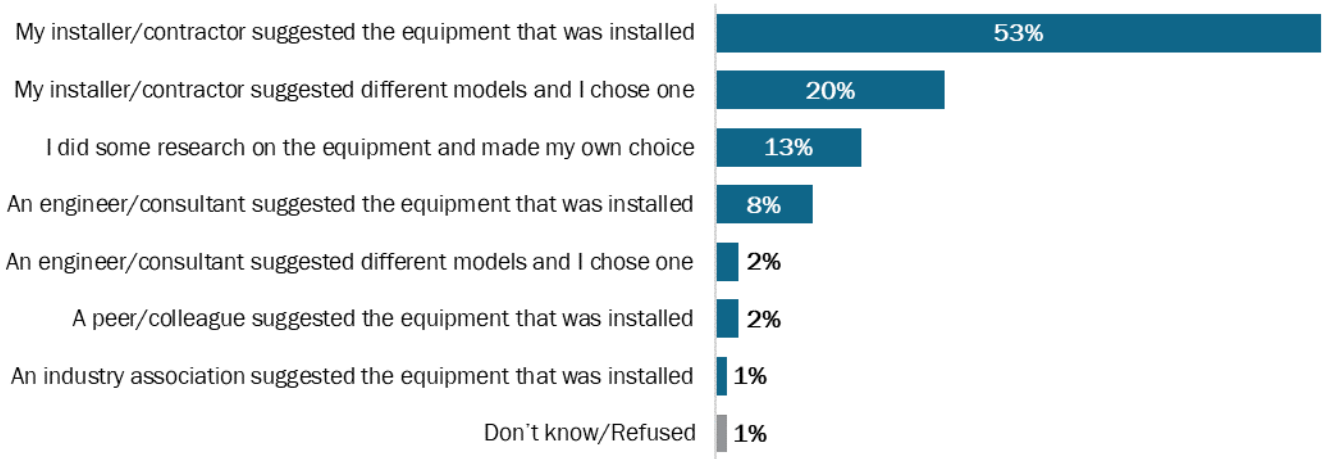


*Does not sum to 100% due to multiple responses.

As shown in Figure D-22, over one-half (53%) 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 (20%), did their own research (13%) or followed an engineer's or consultant's suggestions (8%). This reinforces the importance of contractors' role in helping drive customers to efficient equipment decisions.

Figure D-22: Equipment Selection Process

(Open-ended and multiple responses allowed; n=165)



Spillover (SO)

To estimate the SO rate, participants were asked if they installed any energy-efficient equipment for which they did not receive an incentive following their participation in the Retrofit program. Over one-tenth (13%) 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 three-fourths of respondents (77%) stated they installed lighting, more than two 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=22)*

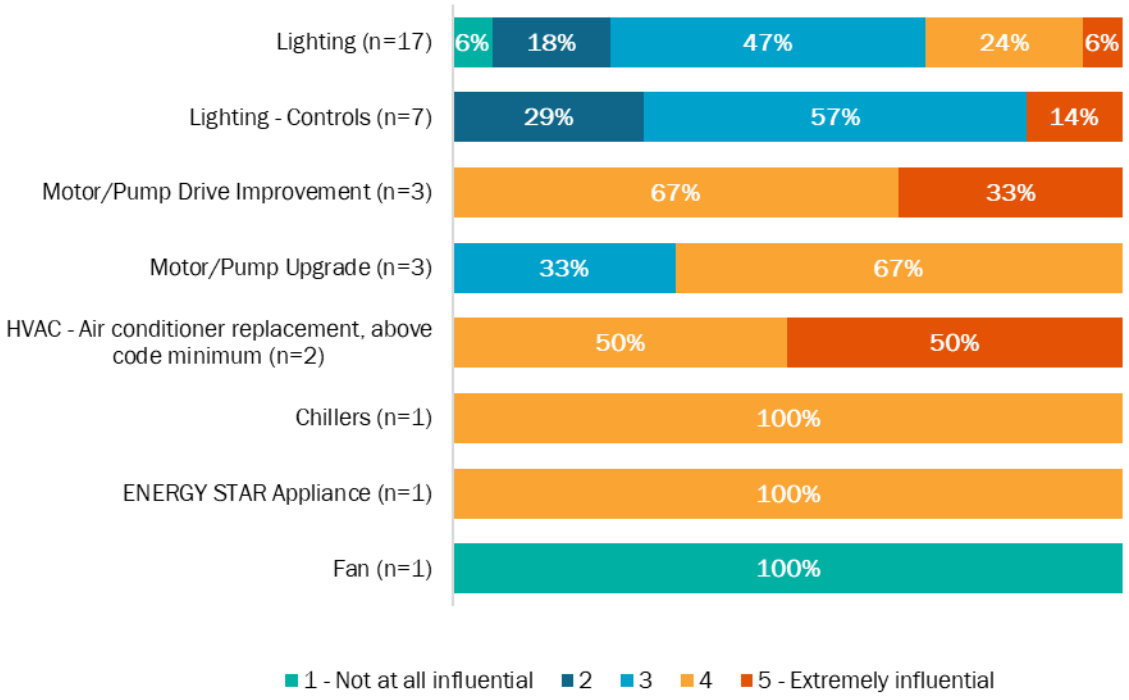
Upgrade	Respondents
Lighting	77%
Lighting - Controls	32%
Motor/Pump Drive Improvement	14%
Motor/Pump Upgrade	14%
HVAC - Air conditioner replacement, above code minimum	9%
Chillers	5%
ENERGY STAR Appliance	5%
Fan	5%

*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-23 displays that for most of the installed equipment, respondents indicated that the program was influential in their decision to install the additional energy-efficient equipment (ratings of 3.0 and above). Four respondents who installed lighting, two who installed lighting controls, and one who installed a fan indicated that the program did not play a significant role in their decision (ratings below 3.0).

Figure D-23: Program Influence on Equipment Installed Outside the Program (n=22)*



*Does 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 through Table D-15 and were used within the NTG algorithm to attribute SO savings to each equipment installation. SO savings were primarily driven by the installation of 2,326 new linear LEDs and 850 screw base LEDs.

Table D-7: Type of ENERGY STAR® Appliance Installed

(Multiple responses allowed; n=1)

Spillover Appliance	Respondents
Dishwasher	1

Table D-8: Size of Air Conditioner Installed

(Multiple responses allowed; n=2)

Size (tons)	Respondents
11.41 – 20.0	1
63.6 or more	1

Table D-9: Type of Lighting Installed

(Multiple responses allowed; n=12)

Spillover Lighting	Respondents
LED exterior	2
LED linear or troffers	10
LED screw base	2

Table D-10: LED Screw Base Wattage (n=2)

Spillover Appliance	Respondents	Equipment
< 10	1	200
31+	1	650

Table D-11: LED Exterior Lighting Mount (n=2)

Location	Respondents	Equipment
Pole mount	1	45
Against building	1	3

Table D-12: Quantity of LED Linear Lamps (n=10)

Respondents	Equipment	Max Installed
10	2,326	1,136

Table D-13: Lighting Controls and Lighting Type

(Multiple responses allowed; n=3)

Location	LED Linear
Occupancy Sensor	55
Timer	12

Table D-14: End Uses of Motor/Pump Upgrades (n=2)

Motor/Pump End Use	Efficiency	Size (hp)	Respondents	Equipment
HVAC Water Pump	Premium	30.1 – 50.0	1	2
Process	Premium	50.1+	1	2

Table D-15: Size of Motor/Pump Drive Improvements Installed (n=2)

Motor Improvement	Size (hp)	Respondents	Equipment
Variable speed drive	1.1 – 5.0	1	2
	30.1 – 50.0	1	2

D.4 Additional Participant Process Results

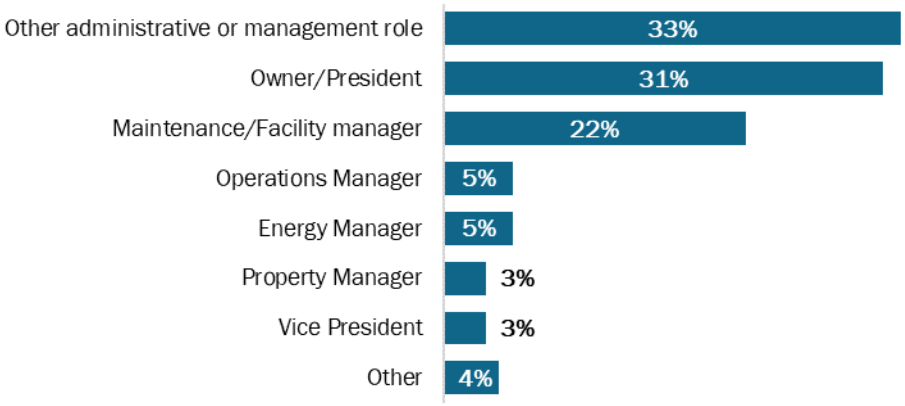
Firmographics

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-24, nearly all titles respondents shared indicated they held either an administrative or managerial role. One-third (33%) specified an administrative or management role other than those listed on the survey. Nearly one-third of respondents were the company's owner and/or president (31%), and about one-fifth were the maintenance/facility managers (22%).

Figure D-24: Titles of Respondent

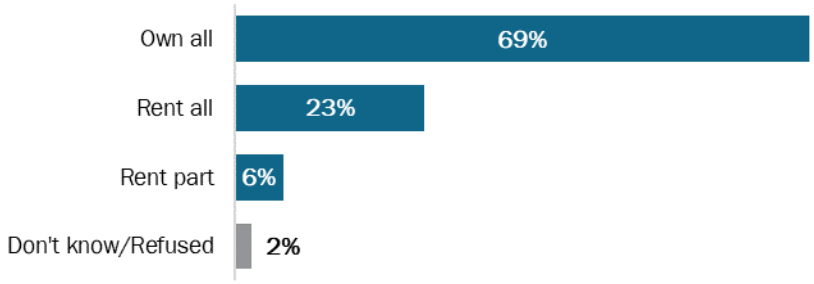
(Open-ended and multiple responses allowed; n=153)*



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

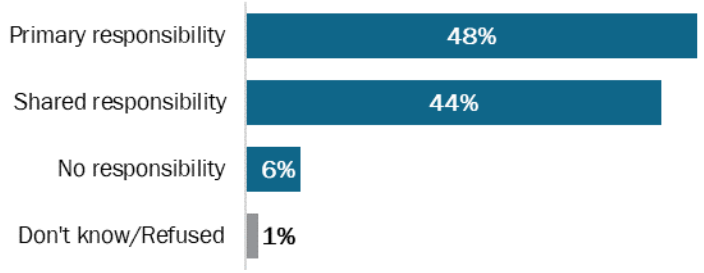
Respondents predominately owned the facilities for which they applied for incentives, as presented in Figure D-25. Over two-thirds (69%) owned all the affected facilities, while one in five (23%) were exclusively renting them.

Figure D-25: Ownership Status (n=153)



Respondents specified whether they had the primary or shared responsibility for the budget and/or expenditures related to the Retrofit program project. Nearly one-half (48%) had the primary responsibility, similar to the number (44%) that shared such responsibilities (Figure D- 26). A relative few (6%) stated they had no responsibilities at all for the budget and/or expenditure decisions.

Figure D- 26: Responsibility for Budget and Expenditures (n=153)*



*Does not sum to 100% due to rounding.

Less than one in twenty (4%) confirmed participation in the IESO's subsidized training programs. Of those that had training experience, three respondents referenced the Certified Energy Manager (CEM) training (

Figure D-27). Respondents also referenced RETScreen Expert Training (2 respondents), End-Use Training (2 respondents), Dollars to $ense Energy Management Workshops (2 respondents), and the Certified Measurement and Verification Professional (CVMP) training (2 respondents).

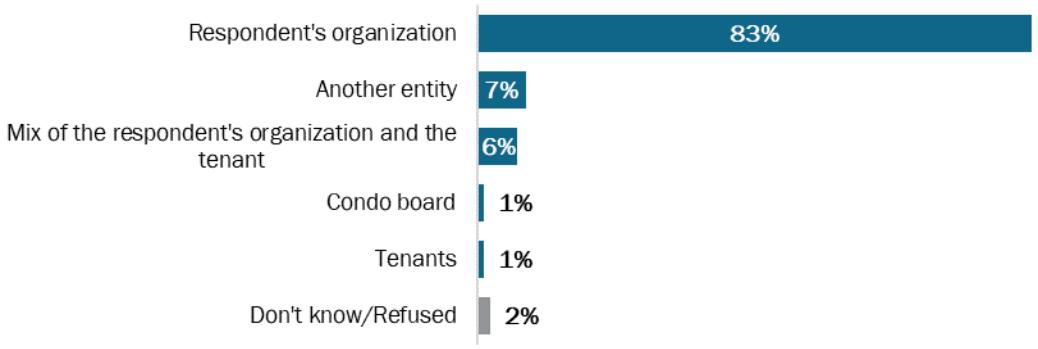
Figure D-27: Participation in IESO-Subsidized Training

(Open-ended and multiple responses allowed; n=5)*

*Counts displayed rather than percentage due to small n. Does not sum to n=5 due to multiple responses.

Over four-fifths (83%) of respondents indicated that their organization pays the electricity bills for the facility where the program updates were made (Figure D-28). Less than one-tenth reported that another entity (7%) or a mix of their organization and the tenant (6%) pay the electricity bills.

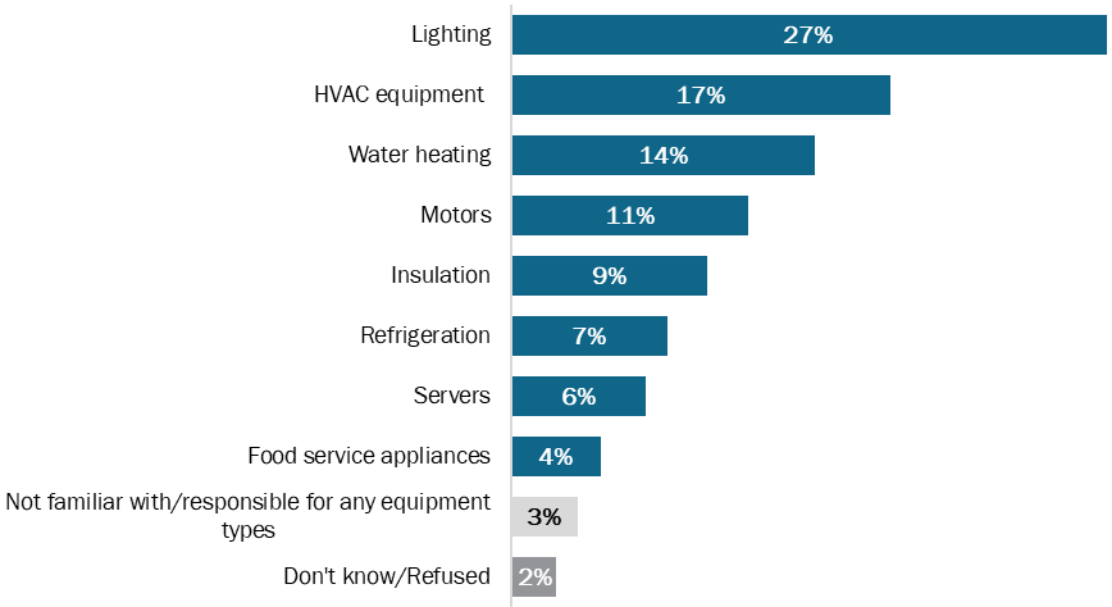
Figure D-28: Entity that Pays the Facility's Electricity Bills (n=153)



Respondents were most familiar with or responsible for the maintenance of lighting (27%), HVAC equipment (17%), water heating equipment (14%), and motors (11%) at the facility where the program upgrades were made (Figure D-29). Only 3% of respondents were not familiar with or responsible for any equipment maintenance.

Figure D-29: Familiarity with or Responsibility for Equipment Maintenance

(Open-ended and multiple responses allowed; n=153)

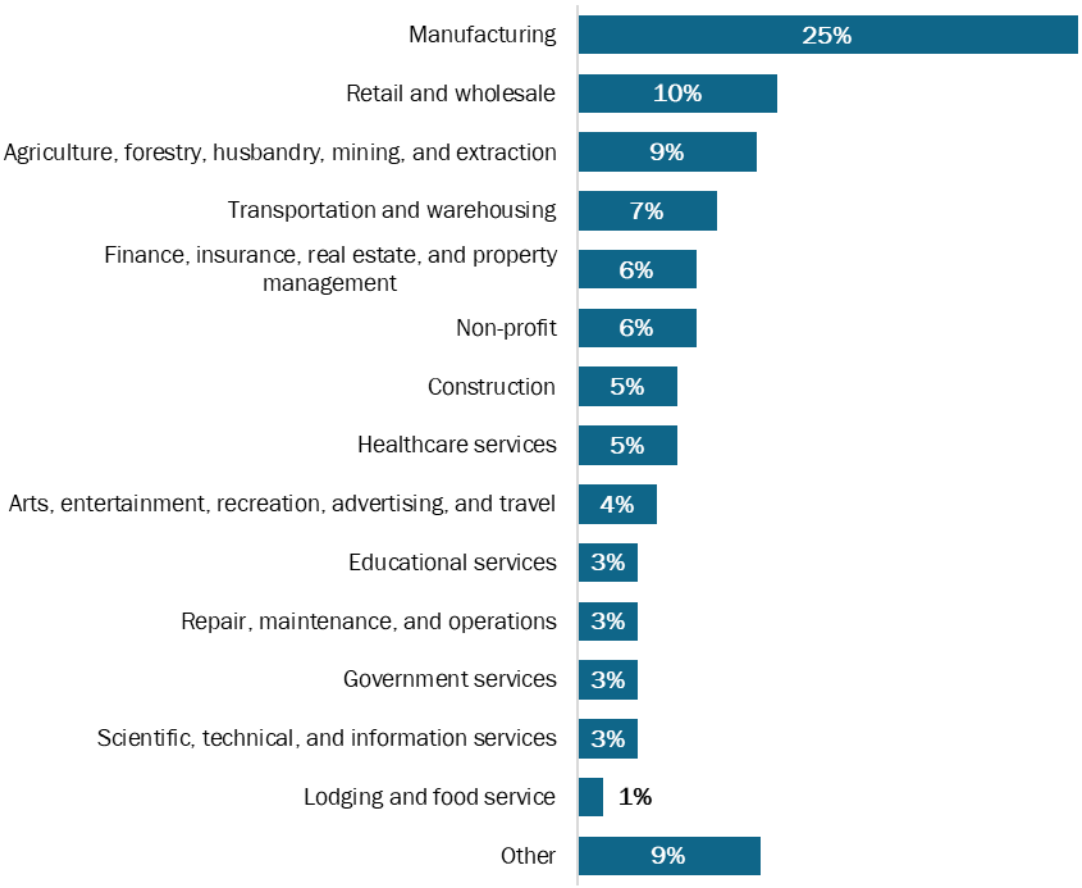


*Does not sum to 100% due to multiple responses.

Respondent business categories varied, as presented in Figure D-30. One-fourth (25%) worked in manufacturing, and about one-tenth each worked in retail and wholesale (10%) and agriculture (9%).

Figure D-30: Respondents' Business Category

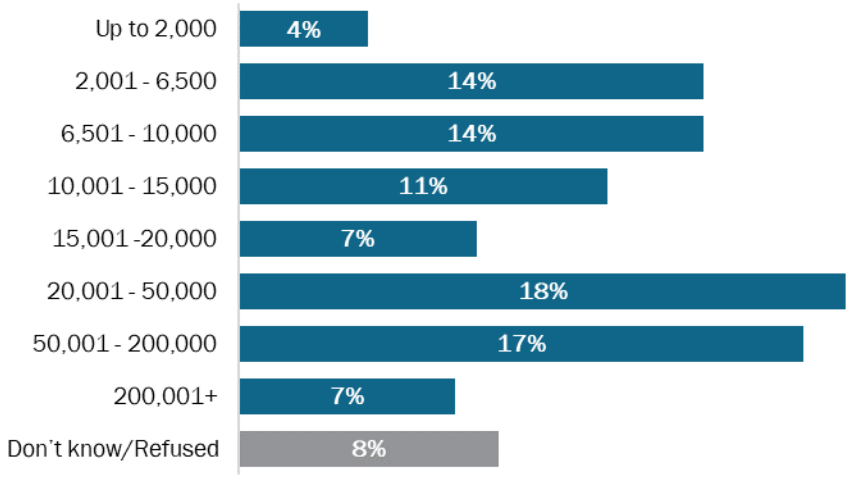
(Open-ended and multiple responses allowed; n=153)*



*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 20,001 to 50,000 sq. ft. (18%) and 50,001 to 200,000 sq. ft. (17%) (Figure D-31).

Figure D-31: Total Square Footage for All Buildings (n=153)



Nearly two-thirds of responding participants (63%) reported a natural gas rooftop unit (RTU) or furnace heating at their facilities. Another one-tenth (11%) reported heating their facilities with a non-electric boiler (Figure D-32). On the cooling side, over two-thirds (67%) reported an air conditioner or air source heat pump RTU, followed by nearly one-tenth (8%) with a chiller system (

Figure D-33).

Figure D-32: Facility Primary Heating System

(Open-ended and multiple responses allowed; n=153)

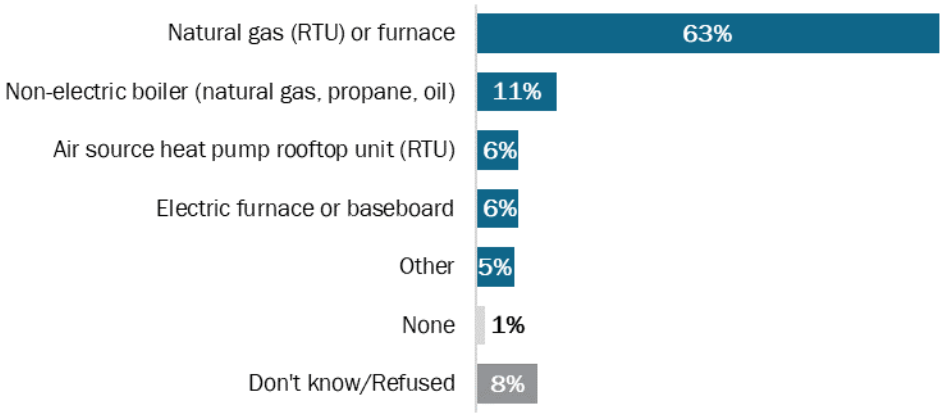
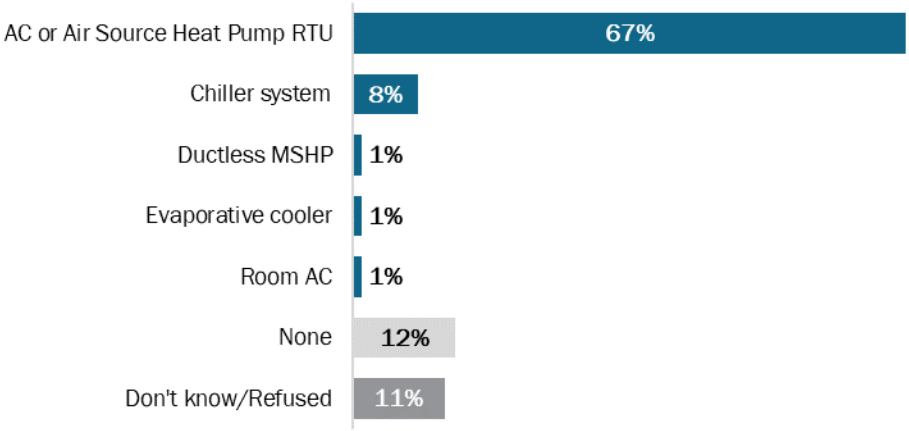


Figure D-33: Facility Primary Cooling System

(Open-ended and multiple responses allowed; n=153)*

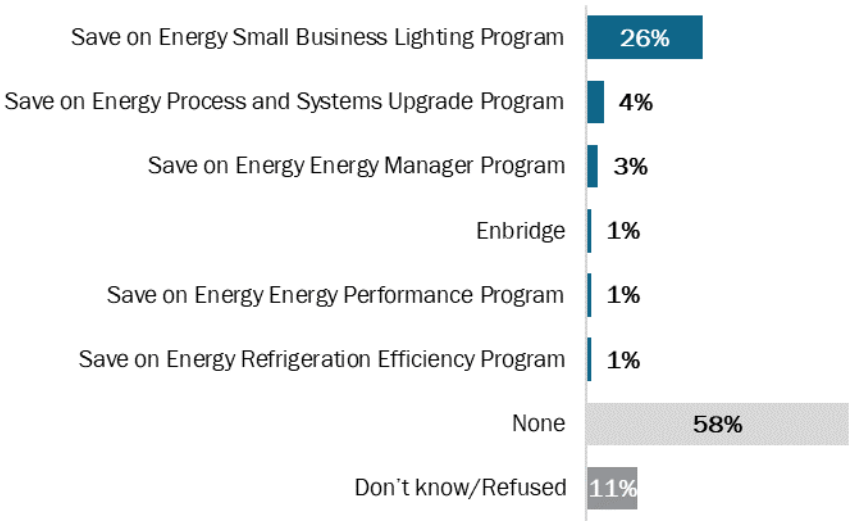


*Does not sum to 100% due to multiple responses.

When respondents were asked which other energy-efficiency programs their business had applied to, more than one-fourth (26%) had participated in the Small Business Lighting (SBL) program. Relatively few participated in any of the other programs. Nearly three-fifths (58%) reported that their business had not applied to any other energy-efficiency programs (Figure D-34).

Figure D-34: Participation in Additional Energy Efficiency Programs

(Open-ended and multiple responses allowed; n=153)*



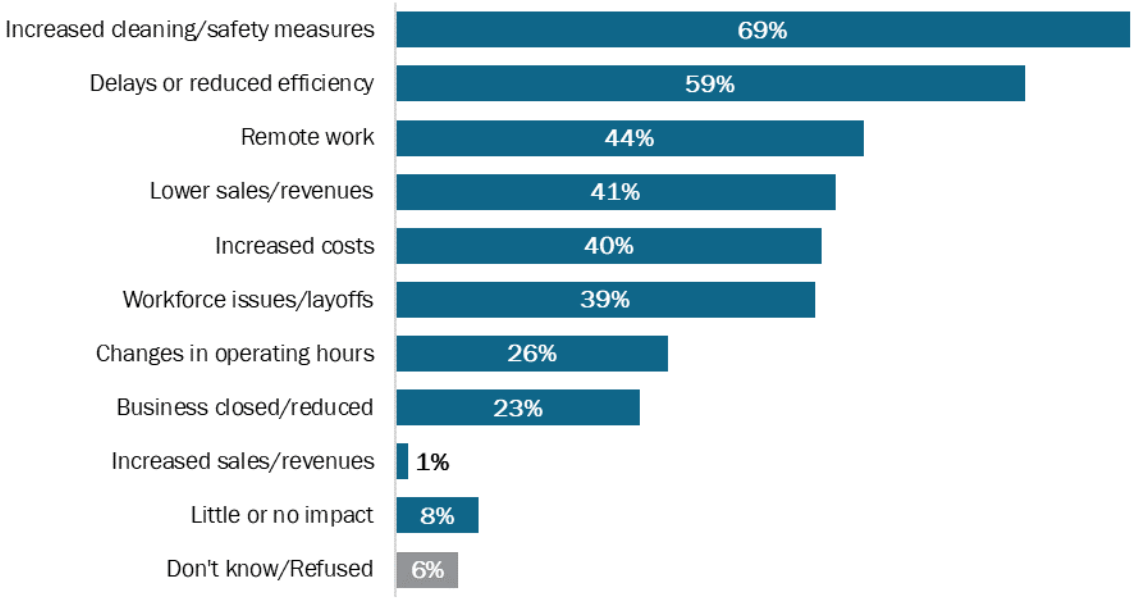
*Does not sum to 100% due to multiple responses.

Business Response to the COVID-19 Pandemic

Respondents were asked an open-ended question about how the COVID-19 pandemic had impacted their company and its operations (Figure D-35). Nearly all (99%) respondents provided a response. Of these, over two-thirds stated increased cleaning and safety measures (69%), and close to three-fifths (59%) stated delays or shortages in the supply chain (59%). Nearly three-fifths mentioned an increase in remote work (44%), lower sales or revenues (41%), increased costs (40%), or workforce issues or layoffs (39%).

Figure D-35: Impacts to Business Operations of COVID-19

(Open-ended and multiple responses allowed; n=152)*



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

Appendix EJob Impacts Methodology

This section presents the detailed results of the job impact analysis, as summarized in Section 6.3. Table 7-1 presents the total jobs impacts by type. As the fourth and fifth columns indicate, the analysis estimated that the Retrofit program would create 795 total jobs in Canada, with 710 jobs created in Ontario. Of the 795 estimated total jobs, 400 are direct jobs, 194 are indirect jobs, and another 202 are induced. In terms of FTEs, the numbers are slightly lower, with 591 FTEs created in Ontario and 661 FTEs created nationwide. Of these 661 FTEs, direct jobs account for 347 FTEs, 164 FTEs are indirect jobs, and 149 FTEs are induced jobs. In total, the Retrofit Program created 51.0 jobs per million dollars of investment (i.e., program budget).

Table 7-1: Total Job Impacts by Type

Job Impact Type	Ontario FTE (In Person-Years)	Total FTE (In Person-Years)	Ontario Total Jobs (In Person-Years)	Total Jobs (In Person-Years)	Job Impact Type
Direct	337	347	388	400	25.6
Indirect	133	164	157	194	12.4
Induced	121	149	165	202	13.0
Total[1]	**591**	**661**	**710**	**795**	**51.0**

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

E.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 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).

The first ten rows of Table 7-2 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 $14.8 million of the overall program cost. The second largest product category – switchgear, switchboards, relays and industrial control apparatus – had $6.1 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 7-2: Summary of Input Values for Demand Shock

Category Description	Non-Labour *($ Thousands)*	Labour *($ Thousands)*	Total Demand Shock *($ Thousands)*
Lighting fixtures	9,394	5,447	14,841
Switchgear, switchboards, relays and industrial control apparatus	3,902	2,172	6,074
Electric light bulbs and tubes	2,979	1,727	4,706
Heating and cooling equipment (except household refrigerators and freezers)	2,599	1,416	4,015
Industrial and commercial fans, blowers and air purification equipment	609	330	939
Pumps and compressors (except fluid power)	271	151	423
Other industry-specific machinery	178	103	282
Electric motors and generators	94	55	149
Measuring, control and scientific instruments	17	10	26
Agricultural, lawn and garden machinery and equipment	0.7	0.4	1
Subtotal	20,045	11,412	31,457
Office Administrative Services	-	-	9,095
Total			**40,552**

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. The net amount that businesses have available to either reinvest, pay off debt, or distribute to owners/shareholders ($88.9 million) was the net electricity bill savings (NPV = $113.8 million), and the portion of project costs not covered by incentives ($24.9 million). The portion of this $88.9 million 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 ($67.7 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 7-3 presents the input values for the business reinvestment shock by industry. The total business expenditure shock would be $67.7 million over 36 industries, as shown in the table.

Table 7-3: Summary of Input Values for Business Reinvestment Shock

Category Description	Business Reinvestment Shock *($ Thousands)*
Other	10,625
Crop and animal production	5,792
Non-profit institutions serving households	4,135
Automotive and transportation	3,941
Retail trade	3,941
Transportation and warehousing	3,603
Other municipal government services	3,542
Chemical, soap, plastic, rubber, and non-metallic minerals	2,926
Primary and fabricated metal	2,926
Health care and social assistance	2,333
Repair, maintenance and operating and office supplies	2,200
Owner occupied dwellings	2,018
Furniture, cabinet, and fixtures	2,006
Arts, entertainment and recreation	1,862
Crop, animal, food, and beverage	1,862
Educational services	1,680
Wholesale trade	1,596
Accommodation and food services	1,535
Professional, scientific and technical services	1,269
Finance, insurance, real estate, rental and leasing and holding companies	1,197
Machinery	1,147
Non-residential building construction	1,064
Other activities of the construction industry	798
Other services (except public administration)	532
Residential building construction	532
Administrative and support, waste management and remediation services	266
Computer and electrical	266

Engineering Construction	266
Forestry and logging	266
Forestry, logging, paper, and printing	266
Government health services	266
Mining, quarrying, and oil and gas extraction	266
Oil and Gas	266
Other provincial and territorial government services	266
Medical and Pharmaceutical	133
Textile and clothing	133
Total	**67,725**

The third model input is the household expenditure shock.[10] 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 $15.6M program budget or $5.5M.

E.2 Results

The StatCan IO Model generated results based on the input values detailed in Sections 6.3.2 and Appendix E.1. Table 7-4 presents the results of the model run for the demand shock for products and services. This shock accounts for over one-half of job impacts. As the two right columns show, the model estimated that the demand shock would result in the creation of 432 total jobs (measured in person-years) in Canada, of which 397 will be in Ontario. Of the 432 jobs, 227 were direct, 93 were indirect, and 112 were induced. In terms of FTEs, the numbers are slightly lower; 327 FTEs were estimated to be created in Ontario and 355 in total across Canada. Of those 355 FTEs, 191 were direct, 82 indirect and 83 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.

Table 7-4: Job Impacts from Demand Shock

Job Impact Type	Ontario FTE (In Person-Years)	Total FTE (In Person-Years)	Ontario Total Jobs (In Person-Years)	Total Jobs (In Person-Years)
Direct	191	191	227	227
Indirect	67	82	77	93
Induced	69	83	94	112
Total	**327**	**355**	**397**	**432**

[10] 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 7-5 presents the results of the model run for the business reinvestment shock. Job impacts generated by business investment were equal to 174 direct total FTEs and 196 total direct jobs. Overall, business investments were responsible for 336 FTEs and 405 total jobs across Canada.

Table 7-5: Job Impacts from Business Reinvestment Shock

Job Impact Type	Ontario FTE (In Person-Years)	Total FTE (In Person-Years)	Ontario Total Jobs (In Person-Years)	Total Jobs (In Person-Years)
Direct	162	174	183	196
Indirect	72	91	89	111
Induced	56	72	76	97
Total	**290**	**336**	**349**	**405**

The third shock was the reduction in household spending from the increase in electricity bills to fund the program. Table 7-6 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 19 FTEs and 26 total jobs across Canada due to decreased household spending.

Table 7-6: Job Impacts from Residential Funding Shock

Job Impact Type	Ontario FTE (In Person-Years)	Total FTE (In Person-Years)	Ontario Total Jobs (In Person-Years)	Total Jobs (In Person-Years)
Direct	16	17	22	23
Indirect	6	8	8	11
Induced	4	6	6	8
Total	**27**	**31**	**36**	**42**

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 small decreases in electricity production. The total electricity demand has been

increasing over time and is projected to continue increasing[11]. 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 7-7 presents the total estimated job impacts by type, calculated by combining the jobs estimated in Table 7-4, Table 7-5, and Table 7-6. Of the 795 estimated total direct jobs, 710 were in Ontario. A slightly smaller proportion of the indirect and induced jobs were in Ontario; 157 out of 194 indirect jobs and 165 of 202 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 591 FTEs (of all types) created in Ontario and 661 FTEs added nationwide. Almost all direct FTEs (337 of 347) 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 resulted in the creation of 51.0 total jobs compared to 48.8 jobs per $1M in 2020.

Table 7-7: Total Job Impacts by Type

Job Impact Type	Ontario FTE (In Person-Years)	Total FTE (In Person-Years)	Ontario Total Jobs (In Person-Years)	Total Jobs (In Person-Years)	Total Jobs per $1M Investment (In Person-Years)
Direct	337	347	388	400	25.6
Indirect	133	164	157	194	12.4
Induced	121	149	165	202	13.0
Total[1]	**591**	**661**	**710**	**795**	**51.0**

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.

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

Table 7-8 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 throughout the measures' EULs. Job impacts from first-year activities comprise roughly 7% of the total, representing 57 out of 795 person-years. A total of 29 of these person-years come from first-year energy savings. The remaining 738 total job-years are due to energy savings after the first year—and the reinvestment generated by the bill savings.

Table 7-8: Job Impacts from First Year Shocks

Job Impact Type	Total Jobs (In Person-Years) From First Year Activities	Total Jobs (In Person-Years) From Bill Savings After First Year	Total
Direct	29	371	400
Indirect	14	180	194
Induced	14	187	202
Total[1]	**57**	**738**	**795**

[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 7-9 presents the job impacts in more detail, with jobs added by type and industry category. Industries are sorted from top to bottom by those with the most impacts to the least, with industries that showed no impacts not included in the table. The table presents that the industry with the largest job impacts was Administrative and support, waste management and remediation services, adding 252 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 76 and 69 jobs, respectively.

Table 7-9: Job Impacts by Industry

Output Industry Category	Ontario FTE (In Person-Years)	Total FTE (In Person-Years)	Ontario Total Jobs (In Person-Years)	Total Jobs (In Person-Years)
Administrative and support, waste management and remediation services	206	209	247	252
Retail trade	51	56	69	76
Manufacturing	49	67	50	69
Wholesale trade	56	65	58	67
Professional, scientific and technical services	35	43	44	54
Non-residential building construction	45	45	51	51
Finance, insurance, real estate, rental and leasing and holding companies	26	31	33	39
Accommodation and food services	13	17	20	26
Transportation and warehousing	16	21	19	25
Government education services	15	16	19	19
Engineering construction	17	17	18	18
Other services (except public administration)	9	11	13	16
Information and cultural industries	9	12	10	14
Residential building construction	10	10	13	13
Health care and social assistance	6	6	9	10

Repair construction	6	7	7	8
Arts, entertainment and recreation	3	4	5	7
Educational services	2	2	4	4
Non-profit institutions serving households	3	3	4	4
Other federal government services	4	4	4	4
Other municipal government services	3	4	4	4
Crop and animal production	1	2	2	4
Utilities	2	2	2	3
Government health services	2	2	2	2
Mining, quarrying, and oil and gas extraction	1	2	1	2
Other provincial and territorial government services	1	1	1	1
Total[1]	**601**	**672**	**723**	**811**

[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 are below, with relevant illustrative verbatim responses:

1) Did the 2021 program help or hinder the growth of your business in any way? If so, please explain how: The program <u>helped</u> the growth of my business in the following ways:

- "Enabled additional energy efficiency projects."
- "People/business love what they consider to be free money, most of the time the client knows to ask about incentives before it is even brought up by the contractor."
- "Government incentives serve as additional stimulus to implement a project."
- "Helped me find efficiency projects for my customers to take advantage of."
- "Increase in sales and satisfied customers."

- **The program <u>hindered</u> the growth of my business in the following ways:**

- "Lack of custom retrofit meant companies were not as interested in making improvements."
- "Removal of the custom track and a few important categories (such as exterior lighting) significantly impacted our business, as the ROI and payback if exterior products were included helped us win deals."
- "We are consultants and don't sell equipment. There are only incentives for sales."
- "A lot of clients find the wait time too long vs. what they receive in rebates."
- "No exterior program equals less customers willing to update their outdoor lights."

- "Our projects are no longer eligible under the new program."

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 one 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 additionally stated that the program added value to projects and allowed contractors to win projects that otherwise would have been lost; lighting measures were identified 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 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 biggest drivers were program changes, particularly the removal of exterior lighting measures and the cancellation of the custom project track. This issue could be examined further if parts of the program were redesigned 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 assumes fixed technological coefficients. It does not consider 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.

Appendix F Detailed Non-Energy Benefits Methodology and Additional Results

This appendix provides additional detail about the NEBs methodology as well as additional NEBs results. A summary of the methodology was provided in Section 0.

F.1 Methodology

Participant Survey

The *Non-Energy Benefits Study: Phase II* assessed the NEBs from energy efficiency projects funded by the IESO over the 2017-2019 period.[12] The PY2021 evaluation applied the same methodology as the Phase II study to assess NEBs, using two different types of questions to determine the value of NEBs that program participants realized by installing program measures:

- **Relative scaling:** Relative scaling questions ask participants to state the value of an item of interest relative to some base. For this survey, participants were asked to state the value of each NEB relative to the annual electricity bill savings that they estimated or (if they could not estimate savings) their annual electricity bill.
- **Willingness-to-pay:** Willingness-to-pay questions ask participants to assign the dollar value they would be willing to pay for the item of interest. In this case, participants were asked what they would be willing to pay for each relevant NEB.

All survey respondents were asked to value all NEBs using both techniques. The data collected from these questions were then used to quantify the NEBs.

NEBs Quantification

For each individual NEB, the total value across all participants was divided by the total gross savings values across all participants. This was completed using both Relative Scaling and Willingness to Pay NEB values. Two hybrid approaches were then calculated in order to be more representative of the sample:

- **Hybrid, relative scaling priority** – in which we give priority to the relative-scaling response value. In this approach, we only consider the willingness-to-pay if the participant did not answer the relative scaling question.

[12] Dunsky. (July 2021). *Non-Energy Benefits: Phase II; Quantified Benefits and Qualitative Insights*. https://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation-reports/Non-Energy-Benefits-Study-Phase-II.ashx

- **Hybrid, minimum approach** – in which we consider the lowest non-null response between the relative scaling and the willingness-to-pay questions.

As a final step, we calculated the average value ($/kWh) for each NEB weighted by energy savings across all participants. Table F-1 presents the average NEB values based on two different calculation approaches:

- **Average (per participant):** A $/kWh value was calculated for each individual participant, then all values were averaged.
- **Average (overall):** Refers to an overall average value where total NEB benefits ($'s) were summed across all participants and then divided by the total energy savings (kWh) across all participants.

Table F-1: Quantified NEBs by Participant and by Savings, Phase II & PY2021

Test	NEB	PY2021 (Retrofit) Average (Per Participant)	PY2021 (Retrofit) Average (Overall)	Phase II (Retrofit & SBL) Average (Per Participant)	Phase II (Retrofit & SBL) Average (Overall)
Hybrid (min approach) ($/kWh)	Reduced spoilage	$0.00	$0.00	$0.01	$0.0002
	Improved indoor air quality	$0.02	$0.02	$0.09	$0.007
	Thermal comfort	$0.06	$0.07	$0.63	$0.05
	Reduced building & equipment O&M	$0.26	$0.20	$0.12	$0.08
Hybrid (RS-priority) ($/kWh)	Reduced spoilage	$0.00	$0.00	$0.01	$0.00
	Improved indoor air quality	$0.08	$0.10	$0.10	$0.02
	Thermal comfort	$0.19	$0.28	$0.65	$0.09
	Reduced building & equipment O&M	$0.31	$0.24	$0.72	$0.17

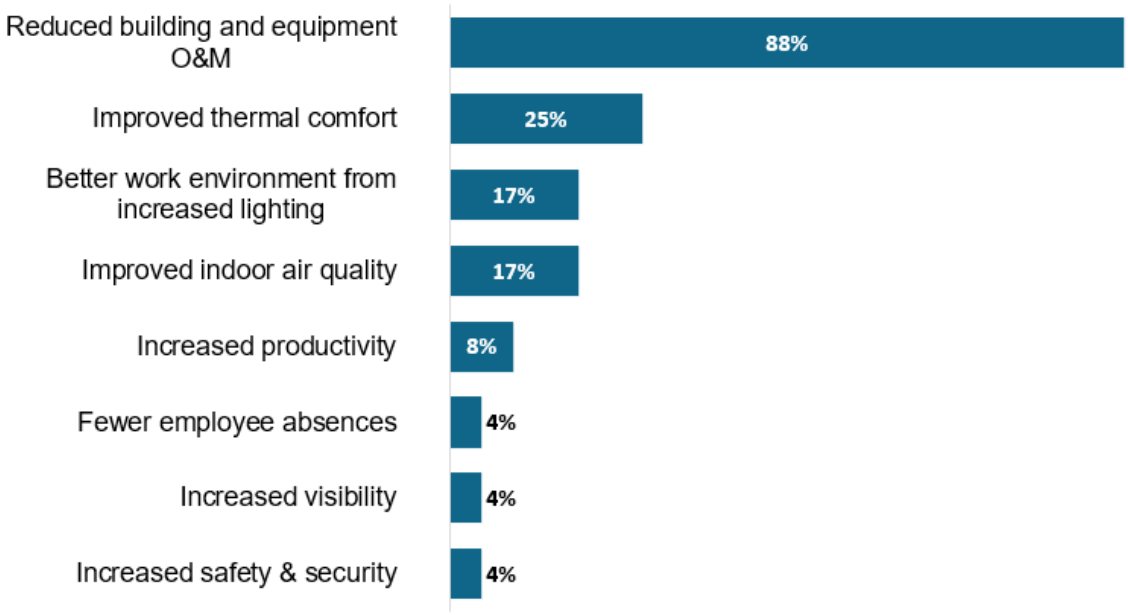
All recommended values in the Phase II study were based on the hybrid, minimum approach. Additional detail on the methodology and NEBs quantification can be found in the Phase II report.

F.2 Applicant Representative and Contractor Non-Energy Benefits Results

As part of the applicant representative and contractor survey, contractors were asked to indicate NEBs that they believe their customers may have experienced as a result of their participation in the Retrofit program (Figure F-1). Among the contractors reporting NEBs, nearly nine of ten (88%) indicated that their customers experienced reduced building and equipment O&M. One in four (25%) indicated their customers experienced increased thermal comfort in their buildings. When asked to rank the importance of various NEBs to their customers, a majority (5 of 7) contractors rated the time and costs for operations and maintenance as the most important.

Figure F-1: Contractor Reported Non-Energy Benefits

(Open-ended and multiple responses allowed; n=24)*



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