2021-2024 CDM Framework Retrofit PY2023 Evaluation Results

Submitted to IESO

in partnership with NMR Group

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Principal authors:

Resource Innovations – Bashar Alhayek, Dabeet Srinivas, Andrew Hauser

NMR Group – Joanne O'Donnell, Christine Smaglia, Kiersten von Trapp, Julian Ricardo, Denisse Manzo Gonzalez, Alicia Potter, and Calissa Jones

Resource Innovations

TD Canada Trust Tower

161 Bay Street, 27th Floor

M5J 2S1 Toronto, Canada

416.572.2433

resource-innovations.com

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

Acronyms and Abbreviations

CDM-IS	Conservation and demand management information system
DCKV	Demand control kitchen ventilation
DCV	Demand control Ventilation
EM&V	Evaluation, measurement, and verification
EUL	Effective useful life
FR	Free-ridership
GW or GWh	Gigawatt or Gigawatt-hour
HVAC	Heating, ventilation, and air conditioning
IDI	In-depth interview
IESO	Independent Electricity System Operator
IF	Interim Framework
kW or kWh	Kilowatt or Kilowatt-hour
LED	Light emitting diode
MW or MWh	Megawatt or Megawatt-hour
NTG	Net-to-gross
PY	Program year
SO	Spillover
VFD	Variable frequency drive
VSD	Variable speed drive

1 Executive Summary

The Independent Electric System Operator (IESO) retained Resource Innovations, Inc., and its subcontractor, NMR Group, Inc., (referenced throughout this report as 'the evaluation team'), for the evaluation 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, and non-energy benefits (NEBs) analysis for the Program Year (PY) 2023 Retrofit program.

1.1 Program Description

The Retrofit program offers incentives to industrial, commercial, institutional, and multifamily residential facility clients interested in upgrading existing equipment with energy-efficient alternatives. The program requirements on the Save on Energy website[1] outline eligibility criteria for participants, facilities, and projects. The 2021-2024 CDM Framework Retrofit offers Prescriptive, Greenhouse and Custom track measures. The Greenhouse stream offers incentives for horticulture lighting, both top and inter-lighting and advanced lighting controls for greenhouses across the province. Prescriptive track applications provide a program-defined list of approved equipment and fixed incentives available for installation, and the Custom track offers customers the flexibility to incorporate measures not covered by the Prescriptive track and to suggest modifications that best suit their facilities' needs.

1.2 Evaluation Objectives

For the PY2023 Retrofit program evaluation, the IESO outlined the following objectives:

- Conduct audits of completed projects to evaluate, measure, and verify completion and operating parameters through desk reviews, site visits, and on-site inspections and metering.
- Annually verify Retrofit program gross energy and summer peak demand savings province-wide at 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 designs and evaluations.
- Perform a cost-effectiveness assessment, greenhouse gas (GHG) reduction estimate, non-energy benefits (NEBs) analysis, and job impact quantification.

[1] Save on Energy website: https://saveonenergy.ca

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

1.3 Summary of Results

1.3.1 Impact Evaluation Results

The evaluation analyzed the program's impacts and quantified savings realized due to implementation of energy-efficiency retrofit projects in the province of Ontario during PY2023. This section summarizes the savings and cost-effectiveness results verified through the impact evaluation.

Table 1-1 presents overall impact results for the PY2023 Retrofit program. During PY2023, 2,426 Retrofit projects were completed in the province, which is slightly higher than the number of projects (2,310) completed in the province during PY2022, hence indicating stable participation levels. The first-year net verified energy and summer peak demand savings were 275,031 MWh and 25,903 kW, respectively. The net verified energy and demand savings persisting in 2026 is estimated to be 274,712 MWh and 25,865 kW, respectively. Gross verified savings for applicable lighting measures include Interactive effects and baseline shift-adjustment factors.

Table 1-1: Energy and Summer Peak Demand Impacts

Savings Type	Gross Reported Savings	Gross Verified Savings	Net Verified Savings	Net Verified Savings at 2026
First Year Energy (MWh)*	404,608	320,221	275,031	274,712
First Year Summer Peak Demand (kW)*	38,316	33,033	25,903	25,865

*Includes Targeted Greenhouse projects.

Figure 1-1 and Figure 1-2 display PY2023 net verified first-year energy and summer peak, demand savings percentages for the Prescriptive Lighting, Non-Lighting, Lighting–Greenhouses[2], and Custom tracks of the 2021-2024 CDM Retrofit program. The Prescriptive Lighting–Greenhouse's track represents 49% of total net verified first-year energy savings achieved by the program, with the Prescriptive Lighting track

[2] The Prescriptive Lighting–Greenhouse track consists of projects funded under the Targeted Greenhouse Program (TGP), as well as Standard Greenhouse projects which are funded under the broader Retrofit Program.

accounting for 39%, the Prescriptive Non-Lighting track accounting for 8%, and the Custom track accounting for 5%.

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

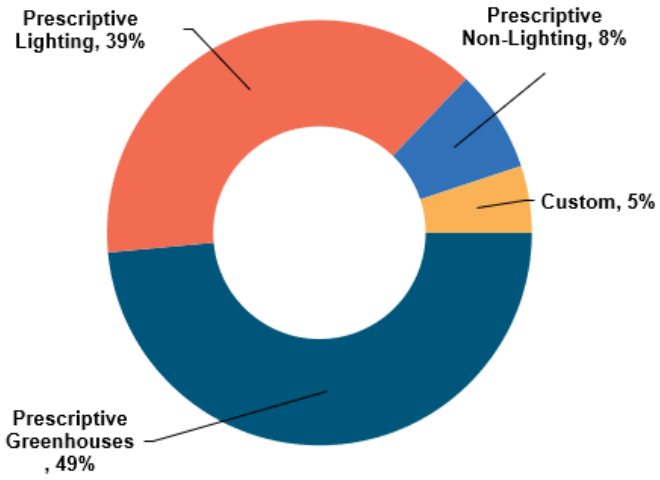
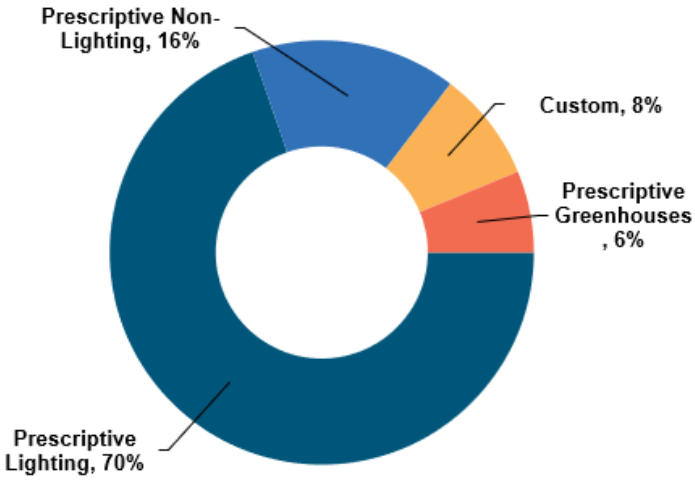


Figure 1-2: First-Year Net Verified Summer Peak Demand Savings % by Track & Type



For summer peak demand savings, the Prescriptive Lighting track represents 70% of total net verified first-year summer peak demand savings achieved by the program, and the Prescriptive Lighting–Greenhouse's track accounted for only 6% due to greenhouse lights popular winter operation and lights not being utilized during most of the IESO peak demand window. The Prescriptive Non-Lighting track represents 16% and the Custom track accounts for 8% of the remaining summer peak demand savings.

These trends differ slightly when compared to the PY2022 results, where Prescriptive Lighting projects represented 49% of total net verified first-year energy savings achieved by the program, with the Prescriptive Lighting–Greenhouse's track accounting for 44% and the Prescriptive Non-Lighting accounting for 7%, showing a slight increase in the PY2023 Prescriptive Lighting–Greenhouse track's energy contribution. In PY2022, the Prescriptive Lighting track represented 79% of total net verified first year summer peak demand savings achieved by the program, with the Prescriptive Lighting–Greenhouse's track accounting for only 6% and the Prescriptive Non-lighting accounting for 15%.

The PY2023 Retrofit program achieved a Program Administrator Cost (PAC) ratio of 3.01, exceeding the 1.00 target threshold. The PY2023 Retrofit CE results are consistent with the PY2022 CDM Framework Retrofit program, which achieved a PAC ratio of 3.66. First-year avoided GHG emissions from electricity savings were reduced by the increase

in GHG consumption due to interactive effects[3], resulting in 45,487 Tonnes of CO_2. PY2023 Retrofit program projects are expected to achieve a total of 613,571 Tonnes of avoided GHG throughout the effective useful life of the installed measures.

1.4 Key Findings and Recommendations

Finding 1: Lighting measures base case MAL-assumed wattages. The evaluation team compared the average verified base case wattage estimates from the impact sample projects to MAL-deemed values for PY21 through PY23. The "Average 750-watt HID lamp/ T8 HO" base measure provided sufficient samples and low precision to support a finding. Table 1-2 presents the average deemed and verified values for the "Average 750-watt HID lamp/ T8 HO "base case wattages in the PY2023 and PY2021-PY2023 rolling population. The deemed base case wattage for this measure fell outside of the error bounds of the verified base case wattage estimates. The error bounds of the verified estimate for PY2021 to PY2023 rolling population and PY2023 population ranged from 0.34 kW to 0.40 kW and 0.32 kW to 0.38 kW respectively.

Table 1-2: Comparison of Base Case Wattages by Measure Type

Measure Type	PY23 Avg Deemed Base Case kW	PY23 Avg Verified Base Case kW	PY23 Sample Precision	PY21 to 23 Avg Verified Base Case kW	PY21 to 23 Sample Precision
Average 750-watt HID lamp/ T8 H0	0.63	0.35	8%	0.37	8%

- **Recommendation 1:** Consider updating the base case wattage MAL assumption for the "Average 750-watt HID lamp/ T8 HO" to better align with the evaluation verified base case wattages.

Finding 2: Conservation case wattages for horticultural lighting measures. The differences between deemed and verified conservation case wattages are drivers of the low average realization rate for Lighting greenhouse measures. To obtain a comprehensive understanding, the combined results from PY2021, PY2022, and PY2023 were utilized to verify the conservation case wattages for each horticultural lighting measure. The average deemed and verified values for conservation case wattages in the PY2023 and PY2021-PY2023 rolling population with their respective precision values (at 90% confidence) are presented in Table 1-3 below. Analysis results do not include the LED grow lights - cannabis warehouses measure due to their limited sample size. The deemed conservation wattage for vegetable LED grow lights fell outside of the error bounds of the verified conservation wattage estimate. The error

[3] Interactive effects refer to the indirect effect on HVAC energy usage due to the installation of energy efficient lighting measures.

bounds of the verified estimate for LED grow lights–vegetable greenhouses, range from 0.57 kW to 0.64 kW.

Table 1-3: Comparison of Conservation Case Wattage by Measure Type

Measure Type	PY23 Avg Deemed Conservation Case kW	PY23 Avg Verified Conservation Case kW	PY23 Sample Precision	PY 21 to 23 Avg Verified Conservation Case kW	PY21 to 23 Sample Precision
LED GROW LIGHTS – VEGETABLE GREENHOUSES	0.54	0.59	6.1%	0.60	5.7%

While inter-lighting LEDs exhibited a similar trend, their sample error bounds are not sufficient to support a recommendation. In PY2023, verified inter-lighting LEDs conservation case measures fell within the sample error bound (i.e. wide precision bound of 23%). The evaluation team will continue to monitor and gather additional data over the coming years for the inter-lighting LED grow light fixtures and provide recommendations, appropriately.

- **Recommendation 2:** It is recommended to review and consider updating the conservation case assumptions for the LED grow lights–vegetable greenhouses horticultural lighting measure to better align with verified data presented in Table 8-2.

Finding 3: An opportunity exists to increase uptake and savings by deepening relationships with key sectors interested in non-lighting equipment. IESO staff explained that they were working to develop direct relationships with relevant organizations associated within the various business sectors eligible for the program. IESO staff, delivery vendors, and applicant representatives and contractors suggested that the commercial and industrial sectors (11 applicant representatives and contractors; one delivery vendor) and multifamily residential sectors (five applicant representatives and contractors; one delivery vendor) would be most interested in non-lighting equipment. In addition, four applicant representatives mentioned the food/agricultural sector and the municipal sectors. Applicant representatives and contractors thought the commercial/industrial and multifamily residential sector might be most interested in HVAC upgrades (eight and four respondents, respectively), ventilation upgrades (three respondents) for the food/agricultural sector, HVAC upgrades (two respondents), and insulation (two respondents) for the municipal sector. One delivery vendor mentioned that VFDs, motors, pumps, heat pumps, cooling systems, and highly specialized, sector-specific non-lighting equipment might be of interest to these sectors.

- **Recommendation 3a**: As part of these relationship-building efforts with key business sectors and associated organizations, further explore which non-lighting measures most interest them and what program participation barriers they may face.
- **Recommendation 3b**: Analyze participation data to identify any sector-level participation gaps that could be addressed by targeted marketing or outreach. For example, the recent address standardization update within the Retrofit Portal may make it easier to cross-check participants against population data (e.g., sector-specific lists of hospitals, institutions, etc.) to reveal sectors that show the most uptake potential.
- **Recommendation 3c**: Consider consumer-to-consumer outreach and marketing strategies to encourage past participants to help promote the program to their peers. An example of this may be to create an e-mail template or social media post describing the program that the participant could easily share with their networks (e.g., other businesses in their sector, sector-related organizations, other business groups). Participants could be encouraged to customize the e-mail or post to indicate which upgrades they completed, or savings achieved.

2 Introduction

This report presents the evaluation results for PY2023 of the 2021-2024 CDM Framework Retrofit program and includes projects completed and reported to the IESO between January 1 and December 31, 2023.

2.1 Program Description

The Retrofit program offers incentives to industrial, commercial, institutional, and multifamily residential facility customers that express interest in upgrading existing equipment with energy-efficient alternatives., The program requirements and eligibility criteria for participants, facilities, and projects can be found on the Save on Energy website. During previous years, the Retrofit program offered only a prescriptive stream. However, in PY2023, the Retrofit program offered two new streams—the Custom and Greenhouse streams—in addition to the Prescriptive stream. As such, the PY2023 Retrofit program consisted of the following three streams:

- **Prescriptive Stream**: Prescriptive applications offer a program-defined list of approved lighting and non-lighting equipment and fixed incentives available for installation. Limited documentation is required for this track to ensure a simplified experience for program participants.
- **Greenhouse Stream**: Customers receive incentives for common measures in this sector, such as horticulture top and inter-lighting, as well as new advanced lighting controls measures incentivized at $0.35/kWh.
- **Custom Stream**: The Custom stream provides customers with the flexibility to incorporate measures not covered by the Prescriptive stream and enables the program to incent more energy-efficiency measures (at the greater of $1,200/kW or $0.13/kWh, capped at 50% of project costs) in non-standard projects more reflective of actual operating conditions, thus capturing more savings

2.2 Evaluation Objectives

The PY2023 Retrofit program evaluation goals and objectives included the following:

- 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.

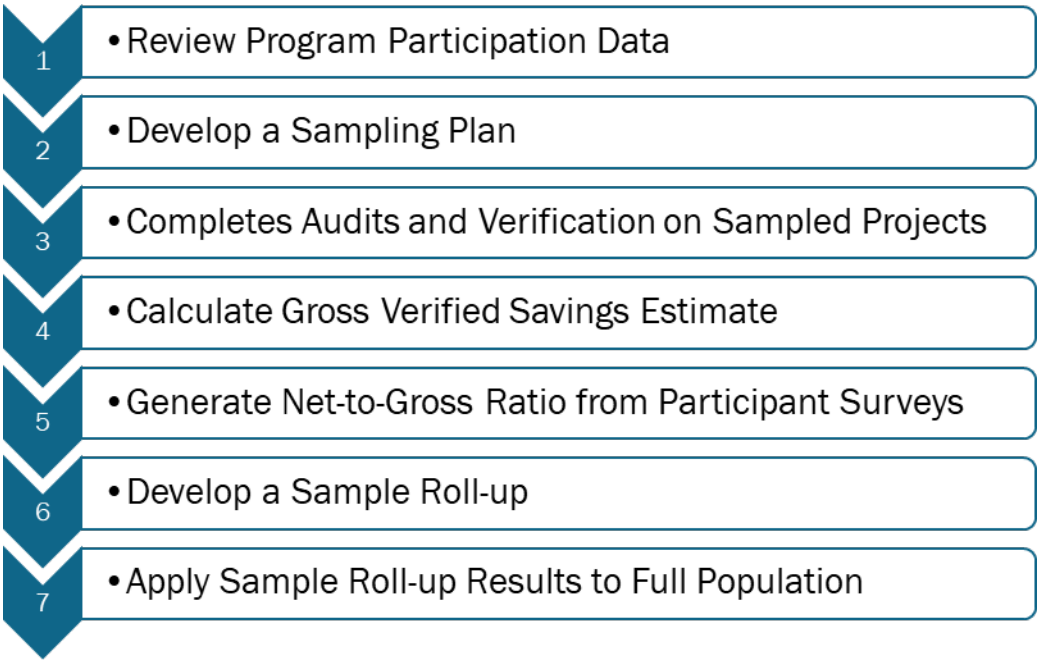
- Research specific areas of interest to help the IESO improve the Retrofit Program and to prepare for future program designs and evaluations.
- Perform a cost-effectiveness assessment, greenhouse gas (GHG) reduction estimate, non-energy benefits (NEBs) analysis, and job impact quantification.
- Deliver annual reports, memos, an 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

Figure 3-1 presents the impact evaluation methodology, comprised of the following distinct components.

Figure 3-1: Impact Evaluation Methodology



Appendix A and Appendix B, respectively, provide additional details on the impact and NTG methodology.

3.1.1 Project Participation and Sampling

The evaluation team drew the impact evaluation sample from a list of PY2023 2021-2024 CDM Framework projects, post-approved and paid between January 1 and December 31, 2023.

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 team then stratified the population by measure and stream type, followed by randomly sampling from each. The number of projects selected from each stratum targeted achieving a 90% confidence level at a 10% precision level, assuming a coefficient of variation of 0.5. As shown in Table 3-1, the PY2023 program population

was stratified into the following strata: Prescriptive Lighting, Prescriptive Non-Lighting, Prescriptive Lighting—Greenhouses, and Custom tracks. To improve the evaluation results' precision, the team added rolling samples using previously evaluated projects (from PY2022) for the Prescriptive Lighting and Prescriptive Non-Lighting strata to the current evaluation cycle. Final rolling samples are discussed in more detail in Section 4.1.

Table 3-1: PY2023 Impact Evaluation Sample

Measure Type	Population Project Count	Sample Project Count
Prescriptive Lighting	1,829	79
Prescriptive Non-Lighting	310	80
Prescriptive Lighting – Greenhouses	54	37
Custom	233	62
TOTAL	**2,426**	**258**

Each sampled project received a desk review, or a site visit as well as an independent project analysis using equipment-specific data collected from participants during the desk review or using data collected on-site to verify gross savings. Using these individual sample project results, the team calculated realization rates for each stratum which were applied to stratum population savings.

3.1.2 Net-to-Gross Evaluation Methodology

The evaluation team utilized the participant self-report survey results to estimate the NTG ratio for each Retrofit Program stream: Prescriptive, Custom, and Greenhouse. The survey's sample design was the same for the NTG and process evaluations as the participant self-report survey included both evaluation areas. The sample was developed at the province-wide level. The survey sought and achieved a NTG at 90% confidence and 10% precision for the Prescriptive and Greenhouse results. Though the evaluation team targeted 90% confidence and 10% precision levels for the Custom track, these were not achieved due to low project volumes and relatively homogenous savings levels represented by each project. Rather, 85% confidence and 15% precision levels were achieved when calculating NTG for the Custom stream. Overall, the Retrofit program achieved a NTG at 90% confidence and 10% precision.

The evaluation team calculated net energy and summer peak demand savings attributable to each stream of the Retrofit Program by multiplying the gross verified energy and summer peak demand savings by the NTG. This equation and general methodology were used for estimating net energy and summer peak demand savings.

The NTG ratio was based on measurement of free-ridership (FR) and spillover (SO) rates, as defined in Equation 3-1.

Equation 3-1: NTG Ratio

$$NTG = 1 - Free\ Ridership + Spillover$$

Appendix B provides additional detail on the NTG methodology.

3.2 Process Evaluation Methodology

The process evaluation focused on program design and delivery. The evaluation team assessed program processes through interviews and surveys with relevant program actors, including IESO staff, program delivery vendor staff, applicant representatives, contractors, and participants. The team developed customized interview guides or survey instruments for each respondent type 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 in-depth interviews (IDIs), the total number of completed surveys, and the sampling error at the 90% confidence level for each respondent type. Appendix C provides additional detail regarding the process evaluation methodology.

Table 3-2: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Population	Completed	Response Rate	90% CI Error Margin
IESO Staff	Phone IDIs	7	7	100%	0%
Program Delivery Vendor Staff	Phone IDIs	3	3	100%	0%
Applicant Representatives and Contractors	Web Survey	314	48	15%	11%
Retrofit Participants[4]	Web and Phone Survey	1,623	254[5]	16%	10.5%

[4] This includes participants from the Prescriptive stream (n=205), Custom stream (n=36), and Greenhouse stream (n=13). Note: the total number of participants by stream was greater than the total number of participants overall as some participants completed projects in multiple streams.

[5] The NTG evaluation included more respondents (n=279) than the process evaluation (n=254) as 25 respondents did not fully answer the process evaluation survey questions.

3.3 Other Energy Efficiency Benefits Methodology

3.3.1 Non-Energy Benefits Methodology

The NEBs methodology for the PY2023 Retrofit Program followed the same methodology as that from the three previous studies (the *PY2022 and PY2021 2021-2024 CDM Retrofit Evaluation Report;* and the *Non-Energy Benefits Study: Phase II*). These studies assessed NEBs from energy-efficiency projects funded by the IESO over the 2017-2023 period.[6]

The evaluation team calculated NEBs 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 surveys required respondents to value all NEBs using both techniques. Data collected from these questions could then be used to quantify the NEBs. Appendix G provides additional detail regarding the NEBs methodology.

3.3.2 Job Impacts Assessment Methodology

The evaluation team's analysis of job impacts utilized the Statistics Canada[7] (StatCan) Input-Output (IO) model to estimate 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. Funding and implementing an energy efficiency program, such as the Retrofit program, creates a set of "exogenous shocks"—or events occurring outside of the system (e.g., demand for specific products and services, 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. Appendix E provides additional detail regarding the job impacts used in the evaluation methodology.

[6] 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

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

4 Impact Evaluation Results

The evaluation team performed an impact evaluation to assess energy and summer peak demand savings attributable to the program and to quantify savings generated by implementing Retrofit projects in the province of Ontario during PY2023.

4.1 Energy and Demand Savings

Table 4-1 presents overall impact savings for the PY2023 Retrofit Program. The net verified energy and demand persisting savings in 2026 is estimated to be 274,712 MWh and 25,865 kW. Gross verified savings included interactive effects and baseline shift adjustment factors for applicable lighting measures. The overall energy savings results increased, while the demand savings results decreased in comparison to the PY2022 Retrofit Program which produced total first year net verified energy and summer peak demand savings of 265,878 MWh and 29,471 kW, respectively.

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)*	404,608	320,221	275,031	274,712
First Year Summer Peak Demand (kW)*	38,316	33,033	25,903	25,865

*Includes Targeted Greenhouse projects.

Table 4-2 presents energy and summer peak demand sample realization rates for PY2023's Retrofit program sample. The program achieved an effective energy realization rate of 79.1% and 86.2% summer peak demand realization rate. The Prescriptive Lighting sample achieved a 15% precision at 90% confidence, while the Prescriptive Non-Lighting sample achieved just above the 10% target at the 90% confidence level. The Prescriptive Lighting Greenhouse sample, which achieved 9.0 % precision at the 90% confidence level, and the Custom sample which achieved 5.0% precision at the 90% confidence level, consisted solely of PY2023 projects.

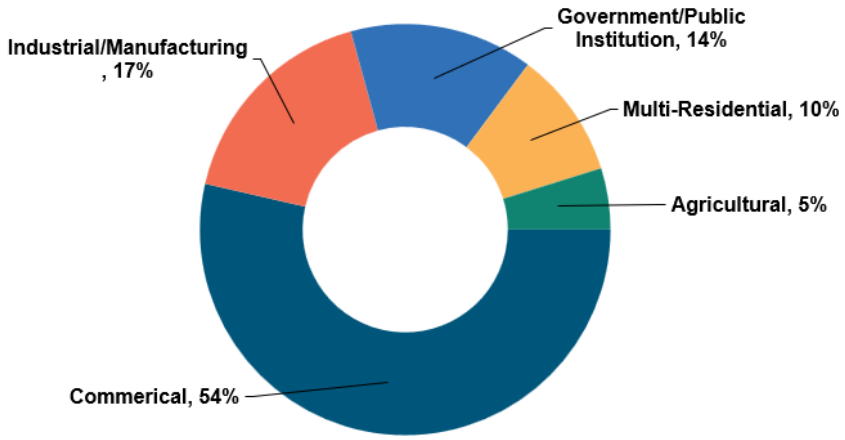
Table 4-2 : PY2023 2021-2024 CDM Framework Sample Realization Rates

Measure Type	Energy Realization Rate	Energy RR Relative Precision	Summer Peak Demand Realization Rate	Demand RR Relative Precision
Prescriptive Lighting	88.5%	15.1%	88.7%	12.3%
Prescriptive Non-Lighting	87.1%	10.3%	64.8%	20.6%
Prescriptive Lighting - Greenhouses	69.2%	9.0%	221.5%	46.4%
Custom	93.1%	5.0%	90.7%	8.2%

4.2 Participation and Net Savings by Facility Type

During PY2023, 2,426 Retrofit projects were completed. This section describes the makeup of these projects, and first-year net verified savings by facility types. Figure 4-1 displays the breakdown of total projects by facility type within the population.

Figure 4-1: Project Count Percentage by Facility Type

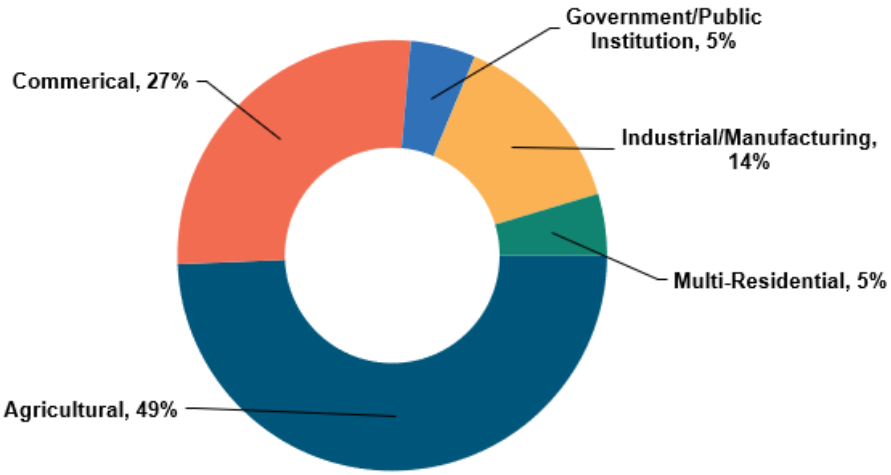


Commercial facility types made up 54% of all completed projects. The Commercial facility type contained subcategories such as Retail (10%), Office (12%), Warehouse/Wholesale (14%), Restaurant (2%), and "Other" commercial types (15%). These trends remained consistent with PY2022's results, where the Commercial facility type was the most common by project count, with 55% of all completed projects.

As shown in Figure 4-2, while Agricultural facilities made up only 5% of completed projects, it accounted for 49% (135,731 MWh) of total net verified first-year energy savings in PY2023. This trend is consistent with the PY2022 results, where Agricultural

facilities made up only 4% of completed projects but accounted for 45% of total net verified first year energy savings. The majority of PY2023 Agricultural facilities savings (99%) were derived from LED grow lighting (81%) and horticultural inter-lighting (18%) in vegetable greenhouses, in contrast to PY2022 Agricultural savings (99%), where horticultural inter-lighting (53%) in vegetable greenhouses was the largest contributor.

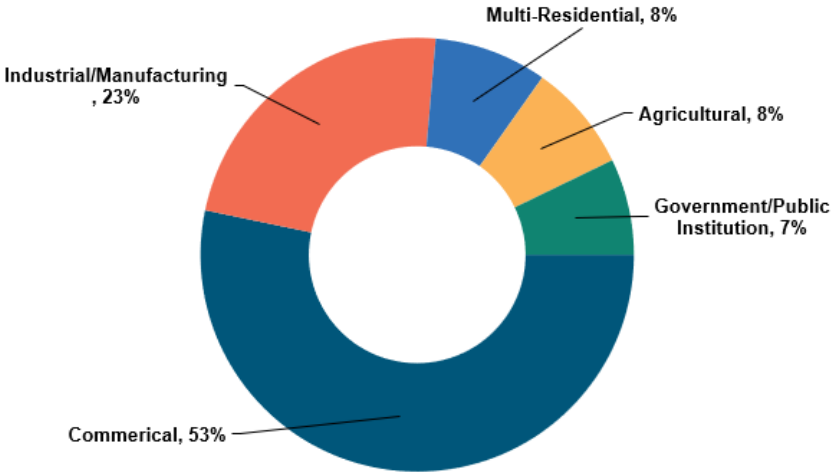
Figure 4-2: Net Verified First-Year Energy Savings Percentage by Facility Type



Despite Agricultural facilities achieving the greatest energy savings, they represented only 8% (2,082 kW) of summer peak demand savings for the program, as shown in Figure 4-3. These levels proved consistent with PY2022, where they represented 9% (2,428 kW) of summer peak demand savings. This mainly resulted from operation schedules that were not in use during summer months.

While 54% of completed projects are implemented in various Commercial facilities, these only accounted for 27% (74,360 MWh) of total net verified first year energy savings and 53% (13,804 kW) of total net verified first year summer peak demand savings. Industrial/Manufacturing facilities accounted for 17% of projects, 14% (38,770 MWh) of net verified first-year energy savings, and 23% (5,977 kW) of net first-year summer peak demand savings. Government/ Public Institution facilities accounted for 14% of projects, 5% (13,456 MWh) of net verified first year energy savings and 7% (1,858 kW) 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

PY2023 Retrofit projects are divided into four main tracks: Prescriptive Lighting, Prescriptive Non-Lighting, Prescriptive Lighting–Greenhouse, and Custom measures. The Prescriptive Non-Lighting measure track is further subdivided into Prescriptive HVAC and Prescriptive Process tracks. Table 4-3 presents the first-year energy savings and persisting savings in 2026 for each PY2023 Retrofit project track.

Table 4-3: Energy Savings by Project Track

Project Track	Gross Reported Savings (MWh)	Gross Verified Savings(MWh)	Net Verified Savings(MWh)	Net Verified Energy Savings % Program Contribution	Net Verified Energy Savings at 2026 (MWh)
Prescriptive Lighting	153,842	135,931	106,221	39%	105,903
Prescriptive Non–Lighting	31,461	27,400	21,411	8%	21,411
Prescriptive Lighting – Greenhouse	197,215	136,433	133,434	49%	133,434
Custom	22,090	20,457	13,965	5%	13,965
TOTAL	**404,608**	**320,221**	**275,031**	**100%**	**274,712**

While the Prescriptive Lighting-Greenhouse track represents the majority (49%) of total net verified first-year energy savings achieved by the program, this track contributes the lowest (6%) towards the program's total net verified first-year summer peak demand savings. This is due to the greenhouse lights popular winter operation and

lights not being utilized during most of the IESO peak demand window. The general Prescriptive Lighting track represents the majority (70%) of the program's total net verified first-year summer peak demand savings. Table 4-4 presents the first-year and persisting summer peak demand savings in 2026 for each PY2023 Retrofit project track.

Table 4-4: Summer Peak Demand Savings by Project Category

Project Track	Gross Reported Summer Peak Demand Savings (kW)	Gross Verified Summer Peak Demand Savings (kW)	Net Verified Summer Peak Demand Savings (kW)	Net Verified Summer Peak Demand Savings % Program Contribution	Net Verified Summer Peak Demand Savings at 2026 (kW)
Prescriptive Lighting	25,988	23,004	18,056	70%	18,017
Prescriptive Non-Lighting	7,979	5,173	4,060	16%	4,060
Prescriptive Lighting – Greenhouse	744	1,648	1,611	6%	1,611
Custom	3,606	3,208	2,176	8%	2,176
TOTAL	**38,316**	**33,033**	**25,903**	**100%**	**25,865**

4.3.1 Prescriptive Lighting Measures

The Prescriptive Lighting track contributed 39% (106,221 MWh) and 70% (18,056 kW) of total net verified first-year energy and summer peak demand savings, respectively. This represents a slight decrease in energy and demand savings in comparison to PY2022 projects, where prescriptive lighting projects represented 49% (120,095 MWh) and 79% (20,831 kW) of total net verified first-year energy and summer peak demand savings.

Figure 4-4 displays the project count percentage of total installed Lighting projects by measure category.

Figure 4-4: Lighting Project Count Percentages

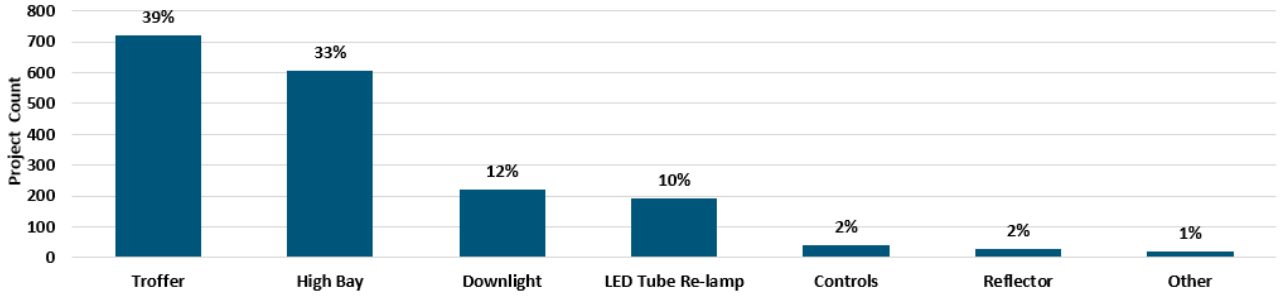


Figure 4-5 and Figure 4-6 display the percentage of net verified energy and summer peak demand savings by Lighting measure category. While troffers remained the most commonly installed Lighting measures, they ranked second for savings achieved. High-Bay measures achieved the greatest share of energy and summer peak demand savings at 67% and 70%, respectively. This trend remained consistent with PY2022 results, where High-Bay measures contributed 65% and 68% of energy and summer peak demand savings, respectively.

Figure 4-5: Lighting Net Verified Energy Savings Percentages

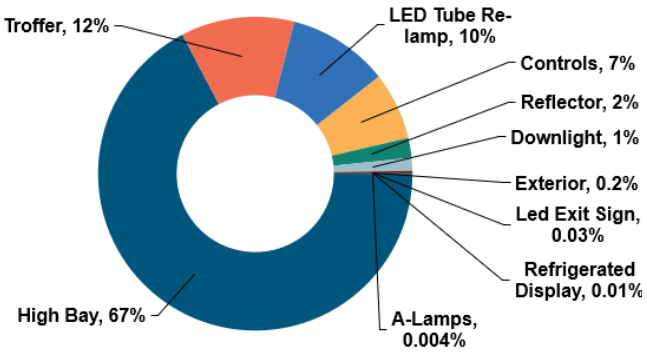
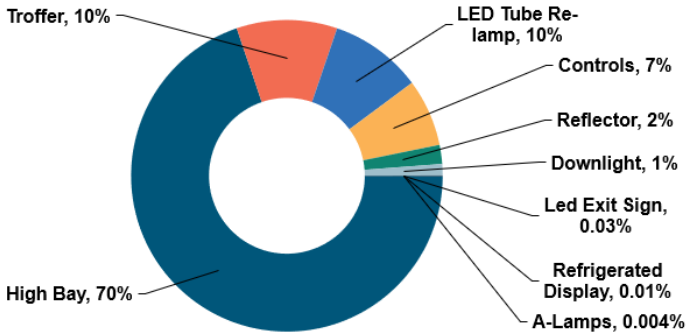


Figure 4-6: Lighting Net Verified Summer Peak Demand Savings Percentages



4.3.2 Prescriptive Non-Lighting Measures

The Prescriptive Non-Lighting measures included Process and HVAC projects. Together, they contributed 8% and 16% of total program first-year and persisting net verified first-year energy and summer peak demand savings, respectively. The Non-Lighting projects' energy and demand savings contribution slightly increased in comparison to the PY2022 projects, where they accounted for 7% and 15% of total program first-year and persisting net verified energy and summer peak demand savings.

Table 4-5 presents the first-year and persisting energy savings in 2026 for the Process and HVAC projects. The Process sub-track represented 4.5% and the HVAC sub-track represented 3.5% of the total net verified energy savings in PY2023.

Table 4-5: Energy Savings by Non-Lighting Project Track

Non-Lighting Project Track	Gross Reported Savings	Gross Verified Savings	Net Verified Savings	Net Verified Energy Savings % Program Contribution	Net Verified Energy Savings at 2026
Process (MWh)	17,912	15,600	12,190	4.5%	12,190
HVAC (MWh)	13,549	11,800	9,221	3.5%	9,221
TOTAL	**31,461**	**27,400**	**21,411**	**8%**	**21,411**

Table 4-6 presents the first-year and persisting summer peak demand savings in 2026 for the Process and HVAC projects. The Process sub-track represents 5% of total net verified first-year summer peak demand savings and the HVAC sub-track represents 11%.

Table 4-6: Summer Peak Demand Savings by Non-Lighting Project Track

Non-Lighting Project Track	Gross Reported Summer Peak Demand Savings	Gross Verified Summer Peak Demand Savings	Net Verified Summer Peak Demand Savings	Net Verified Summer Peak Demand Savings Contribution	Net Verified Summer Peak Demand Savings at 2026 (kW)
Process (kW)	2,329	1,510	1,185	5%	1,185
HVAC (kW)	5,650	3,663	2,875	11%	2,875
TOTAL	**7,979**	**5,173**	**4,060**	**16%**	**4,060**

4.3.2.1 Process Measures

Figure 4-7 displays the project count percentage of total Process Non-Lighting projects by measure category.

Figure 4-7: Process Non-Lighting Project Count Percentages

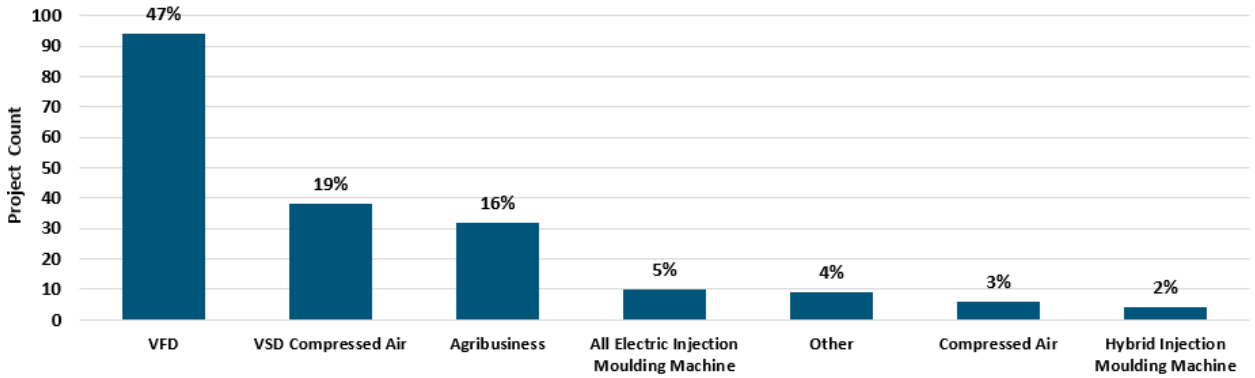


Figure 4-8 and Figure 4-9 display the percentage of net verified energy and summer peak demand savings by the Process Non-Lighting measure category.

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

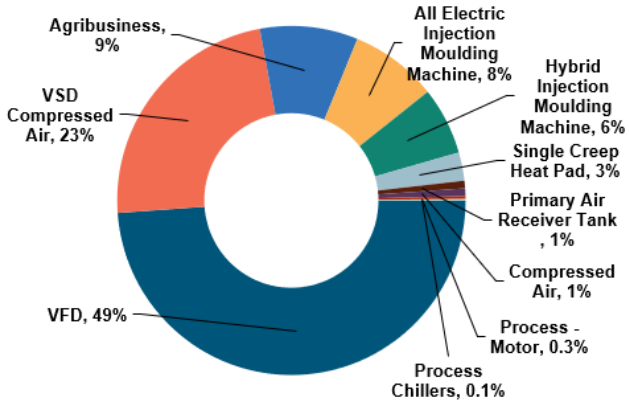
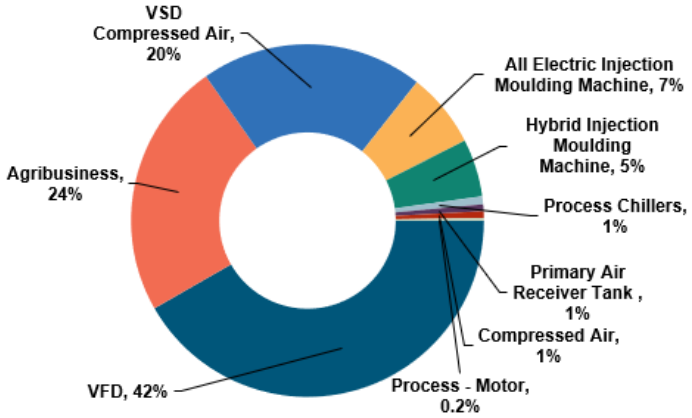


Figure 4-9: Process Non-Lighting Net Verified Summer Peak Demand Savings Percentages



The Variable Frequency Drive (VFD) measure was implemented in 47% of Process Non-Lighting projects and achieved the greatest energy savings (49%), followed by Variable Speed Drive (VSD) compressed air measure savings, accounting for 23% of total net verified energy savings for this category in PY2023. This remained consistent with PY2022, where VFD measures achieved the category's greatest net verified energy savings (38%). VFDs also achieved the greatest summer peak demand savings (42%), contrary to PY2022 where Agribusiness Process measures (primarily high-volume, low-speed fans) had the highest contribution (33%) to summer peak demand savings. During PY2023, Agribusiness measures contributed 24% of summer peak demand savings in this measure category.

4.3.2.2 HVAC Measures

Figure 4-10 displays the project count percentage of total HVAC Non-Lighting projects by measure category.

Figure 4-10: HVAC Non-Lighting Project Count and Percentages

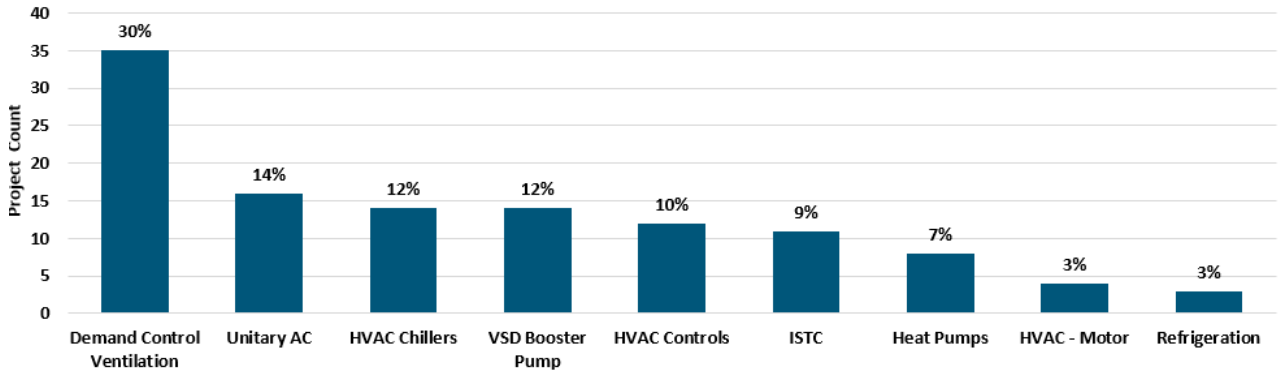


Figure 4-11 and Figure 4-12 display the percentage of net verified energy and summer peak demand savings in the HVAC Non-Lighting measure category.

Figure 4-11: HVAC Non-Lighting Net Verified Energy Savings Percentages

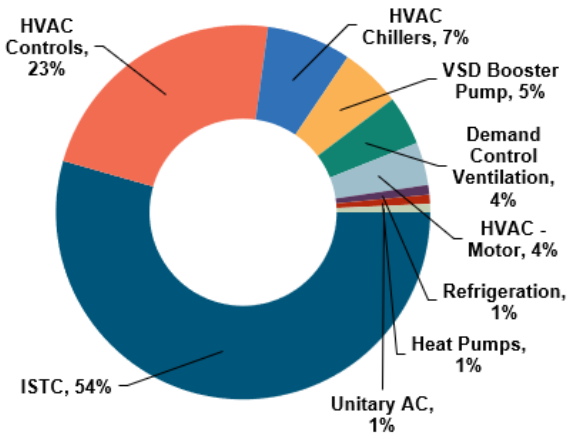
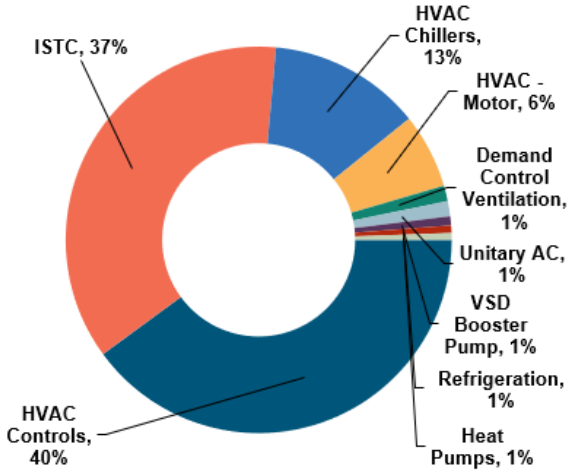


Figure 4-12: HVAC Non-Lighting Net Verified Summer Peak Demand Savings Percentages



Though the Demand Control Ventilation (DCV) measure was implemented in 30% of total HVAC Non-Lighting projects completed in PY2023, projects that installed the In-Suite Temperature Controls (ISTC) measure achieved greater energy savings (54%) due to higher average per-project savings of 456 MWh per project vs. 11 MWh per project for DCV measures. The ISTC measure was implemented in only 9% of HVAC Non-Lighting projects completed in PY2023. This proved inconsistent with PY2022 program metrics, where the HVAC Controls measure achieved the greatest energy savings (38%) for the HVAC category. Similar to PY2023, projects that implemented ISTC measures during PY2022 achieved the greatest average per-project savings (231 MWh). Energy savings achieved by the ISTC measures accounted for 54% and 37% of total net verified energy savings and net summer peak demand savings for the PY2023 HVAC category.

4.3.3 Prescriptive Lighting–Greenhouse Measures

The Prescriptive Lighting–Greenhouse track consists of projects funded under the Targeted Greenhouse Program (TGP), as well as prescriptive greenhouse projects funded under the broader Retrofit Program. Targeted Greenhouse projects were delivered under the Retrofit Greenhouse Enhancement. Evaluation results regarding these Targeted Greenhouse projects specifically were detailed in a "Targeted Greenhouse" memo submitted to the IESO. This section includes measure details for all Lighting–Greenhouse projects.

Prescriptive Lighting–Greenhouse measures contributed 49% and 6% of the total net verified first-year and persisting energy and summer peak demand savings in 2026, respectively. The contribution of Prescriptive Lighting–Greenhouse projects increased in comparison to the PY2022 projects, where the same measures contributed 44% and 6% of total net verified energy and summer peak demand savings, respectively.

Figure 4-13 displays the project count percentage of total Lighting–Greenhouse projects by measure category.

Figure 4-13: Lighting–Greenhouse Project Count Percentages

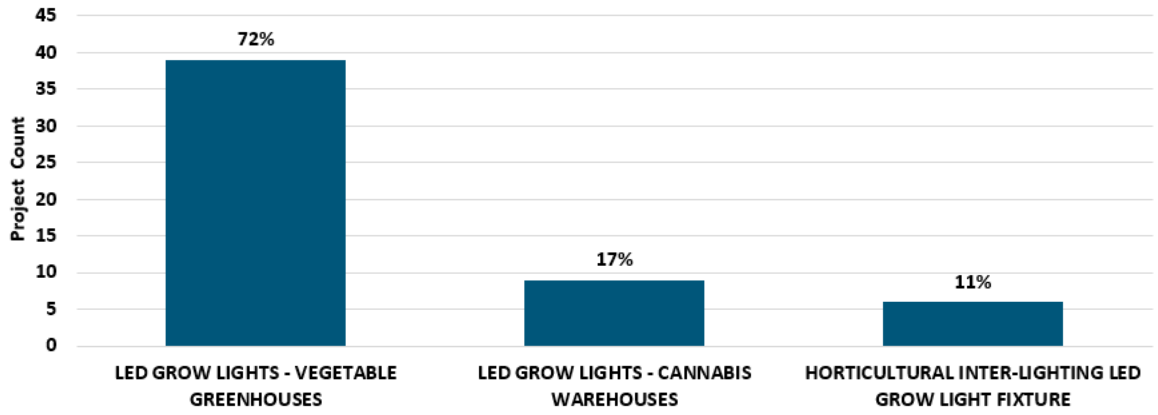


Figure 4-14 and Figure 4-15 display the percentage of net verified energy and summer peak demand savings by the Lighting—Greenhouse measure category.

Though only 54 projects implemented Horticultural Lighting measures, these achieved the largest portion of overall program savings, with average, net verified energy savings of 2,470 MWh per project. High-Bay Fixtures provided the next-highest average energy savings per project for a lighting measure, at 118 MWh per project. Although troffer measures accounted for almost one-half of total lighting measures, they only produced average savings of 17 net MWh per project.

Figure 4-14: Lighting—Greenhouse Net Verified Energy Savings Percentages

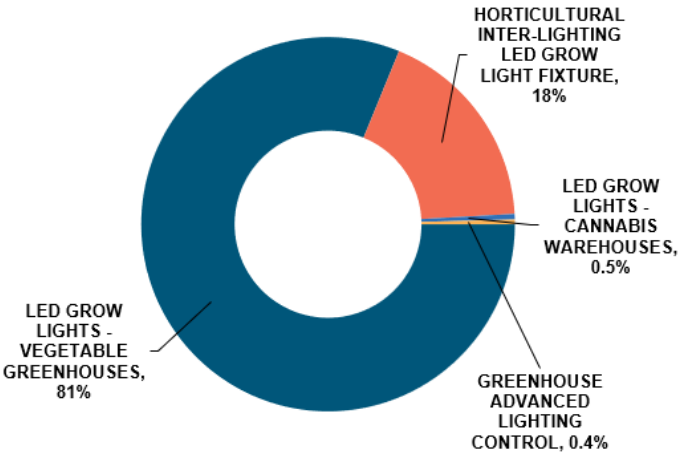
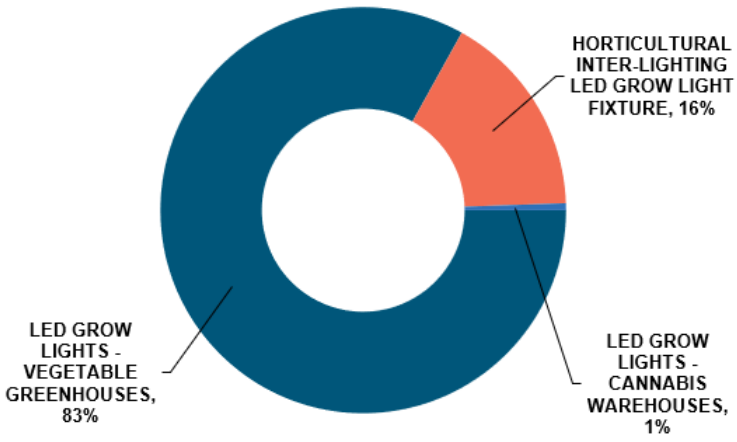


Figure 4-15: Lighting—Greenhouse Net Verified Summer Peak Demand Savings Percentages



4.3.4 Custom Measures

As discussed in Section 1.1, the Custom stream was introduced during PY2023 of the 2021-2024 CDM Framework Retrofit program. In PY2023, the Custom track allowed the implementation of lighting and non-lighting measures. Custom Lighting projects were the most common, accounting for 84% (195) of Custom projects, and the Custom Non-Lighting projects accounted for the remaining 16% (38).

Together, the two strata contributed 5% and 8% of total program first-year and 2026 persisting net verified energy and summer peak demand savings, respectively. Table 4-7 presents the energy savings for the Custom Lighting and Custom Non-Lighting projects. The Custom Lighting subtrack represented 3% and the Custom Non-Lighting subtrack represented only 2% of the total, net verified energy savings in PY2023.

Table 4-7: Energy Savings by Custom Project Track

Custom Project Track	Gross Reported Savings (MWh)	Gross Verified Savings (MWh)	Net Verified Savings (MWh)	Net Verified Energy Savings % Program Contribution (MWh)	Net Verified Energy Savings at 2026 (MWh)
Custom Lighting	12,283	11,436	7,807	3%	7,807
Custom Non-Lighting	9,807	9,021	6,158	2%	6,158
TOTAL	**22,090**	**20,457**	**13,965**	**5%**	**13,965**

Table 4-8 presents the first-year and persisting summer peak demand savings in 2026 for the Custom Lighting and Custom Non-Lighting projects. The Custom Lighting subtrack represented 5% of total net verified first-year summer peak demand savings, and the Custom Non-Lighting subtrack represented 3%.

Table 4-8: Summer Peak Demand Savings by Custom Project Track

Custom Project Track	Gross Reported Summer Peak Demand Savings (kW)	Gross Verified Summer Peak Demand Savings (kW)	Net Verified Summer Peak Demand Savings (kW)	Net Verified Summer Peak Demand Savings Contribution (kW)	Net Verified Summer Peak Demand Savings at 2026 (kW)
Custom Lighting	2,076	1,884	1,278	5%	1,278
Custom Non-Lighting	1,529	1,324	898	3%	898
TOTAL	**3,606**	**3,208**	**2,176**	**8%**	**2,176**

4.3.4.1 Custom Lighting Measures

Custom Lighting projects comprise 4% of total completed projects in the PY2023 Retrofit program and contributed to 3% of total program net verified energy savings and 5% of total net verified summer peak demand savings. The net verified energy and summer peak demand savings for this stratum were 7,807 MWh and 1,278 kW, respectively. The average, net verified energy savings per project in the Custom Lighting stratum (40 MWh) was lower than the average Prescriptive Lighting project size (58 MWh).

4.3.4.2 Custom Non-Lighting Measures

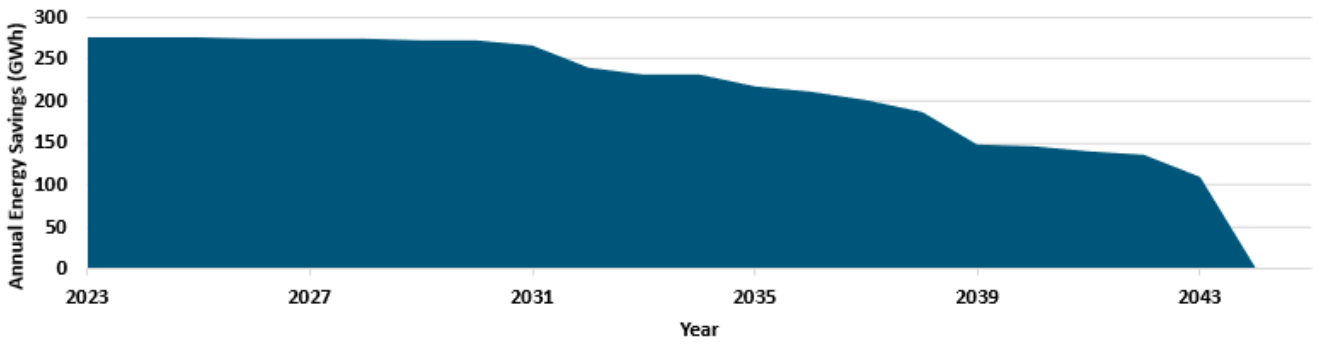
Custom Non-Lighting measures typically cover the implementation of a wide range of Non-Lighting equipment upgrades and/or replacements. Non-Lighting measures installed within the Custom track included HVAC upgrades, pump upgrades, refrigeration system and chiller upgrades, HVAC controls, and VFD installations. Custom Non-Lighting projects comprised just 0.7% of total completed projects in the PY2023 Retrofit program, and contributed 2% of total program net verified energy savings and 3% of total net verified summer peak demand savings. Net verified energy and summer peak demand savings for this stratum were 6,158 MWh and 898 kW, respectively. Although this measure subtrack contributed low savings to the overall program, the average net verified energy savings per project in the Custom Non-Lighting stratum (162 MWh) was close to three times the average Prescriptive Non-Lighting project size (69 MWh).

4.4 Savings Persistence

The PY2023 Retrofit program is expected to achieve 4,654 GWh of lifetime net-verified energy savings, based on installed measures and their respective effective useful lives (EULs). Nearly all (99.9%) of net savings will persist until 2026. Persisting annual savings begin to reduce after the first program year, when certain measures reach the end of their EUL. The weighted average EUL for lighting and non-lighting measures was just over 14 years. Figure 4-16 shows the annual net-verified energy savings for the 2023 Retrofit program over time.

For PY2023, measures with EULs of four years or less will contribute a 0.12% decrease in net savings by 2026. These measures usually relate to LED Reflector (Flood/Spot) Lamp Pin & Screw Base and occupancy controls projects, with EULs of three and four years respectively.

Figure 4-16: Net Energy Savings Persistence



4.5 Key Impact Evaluation Findings

This section provides key impact findings related to all evaluated measure tracks.

4.5.1 Prescriptive Lighting Measures

4.5.1.1 750-Watt HID lamp/ T8 HO Measure Assumptions

The prescriptive lighting stratum contributes to almost 38% (153,842 MWh) and 68% (25,988 kW) of the gross reported energy and demand savings for the entire PY2023 Retrofit program. Out of the 153,842 MWh gross reported population energy savings, 84,438 MWh (55%) consisted of projects that had a reported base-case measure of "Average 750-watt HID lamp/T8 HO". During the evaluation, 79 Prescriptive Lighting projects were randomly sampled, which contributed to 35,526 MWh of gross sample reported energy savings. Of these 79 projects, 46 consisted of the reported "Average 750-watt HID lamp/T8 HO" base-case measure. These 46 projects contributed to 22,134 MWh (62%) of sampled Prescriptive Lighting reported energy savings. Through site visits and desk reviews, the evaluation team determined that most of these projects consisted of a mixture of lower HID lamp wattages or T5 High Output (HO) lamps instead of the reported "Average 750-watt HID lamp/T8 HO."

Table 4-9: 750-watt HID lamp/ T8 HO Base Case Measure Contributions

Average 750 watt HID lamp/ T8 HO	Sample Reported Savings (MWh)	Sample Verified Savings (MWh)	Measure Realization Rate	Percentage Measure Contribution – Sample	Percentage Measure Contribution – Population
PY2021	187	302	161.5%	1.0%	2.9%
PY2022	12,316	10,269	83.4%	59.5%	44.1%
PY2023	22,134	11,175	50.5%	62.3%	54.9%

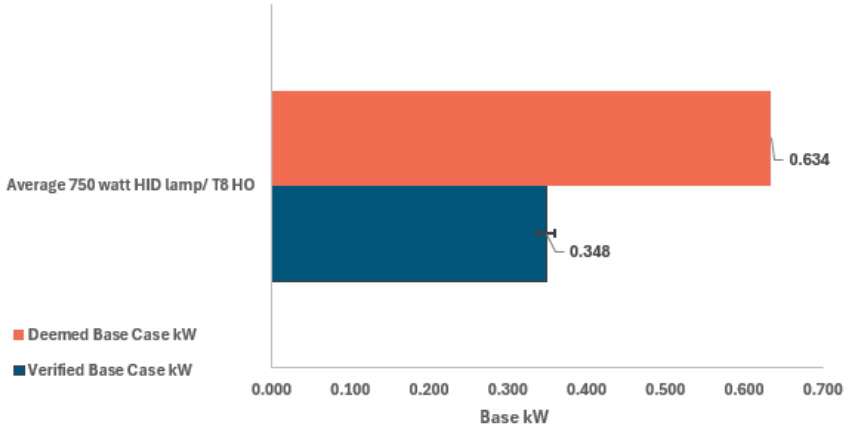
As such, the average verified base case wattage was lower than the reported base case wattage, resulting in a PY2023 measure realization rate of 50.5% (11,175 MWh gross verified savings) for this base-case measure. Owing to the prescriptive lighting stratum's significant contribution to the overall program's reported energy and demand savings, this strongly impacted the overall Retrofit program's realization rate.

Table 4-9 shows the year over year 750-watt HID lamp/ T8 HO base case measure contributions. In PY2022, prescriptive lighting sampled projects which consisted of the reported "Average 750-watt HID lamp/T8 HO" base-case measure contributed to 12,316 MWh and resulted in a measure realization rate of 83.38% (10,269 MWh gross verified

savings). The evaluation team determined a 51% higher average verified HOU for the PY2022 projects for this measure when compared to a 32% higher average HOU for the PY2023 projects, thereby offsetting a more significant negative impact on the prescriptive lighting stratum and overall program realization rate. Additionally, in PY2021, there were only two projects which consisted of the reported "Average 750-watt HID lamp/T8 HO" base-case measure in the prescriptive lighting sample which contributed to 187 MWh. One of these two projects contributed 86% of the reported savings and had a significantly high realization rate to due higher verified hours of use thereby resulting in a measure realization rate of 161.55% (302 MWh gross verified savings).

The evaluation team compared average verified base case wattage estimates from the PY2023 impact sample projects to Measure and Assumptions List (MAL) deemed values for the "Average 750-watt HID lamp/ T8 HO" measure. The PY2023 average verified base case wattage was found to be 0.348 kW compared to the MAL deemed values of 0.634 kW and resulted in a low precision sufficient to support this finding (Figure 4-17).

Figure 4-17: Deemed vs Verified Base Case kW



4.5.1.2 Deemed Conservation Case Wattages

The evaluation team reviewed deemed conservation-case wattage values for all sampled lighting measures, comparing average verified conservation-case wattage estimates from impact sample projects to MAL-deemed values. Three conservation cases that provided samples and low precision sufficient to support a finding:

- LED HIGH-BAY FIXTURE >= 20,100 Lumens & < 305W[8]

[8] Refer to Section 9 for Progress Update.

- 2' x 4' LED troffer/4' LED linear ambient fixture (>= 3000 Lumens)[9]
- and 1' x 4' LED troffer/4' LED linear ambient fixture (>= 1500 Lumens)

This finding only highlights the 1' x 4' LED troffer/4' LED linear ambient fixture (>= 1500 Lumens) fixture, as the findings related to the other two measures were addressed during the PY2022 evaluation cycle. Additionally, the evaluation team compared average verified conservation case wattage estimates incorporating a rolling population of PY2021, PY2022, and PY2023 projects for the 1' x 4' LED troffer/4' LED linear ambient fixture (>= 1500 Lumens). Table 4-10 presents the average deemed and verified values for conservation case wattages for the "1' x 4' LED troffer/4' LED linear ambient fixture (>= 1500 Lumens)" in the PY2023 and PY2021-PY2023 rolling population.

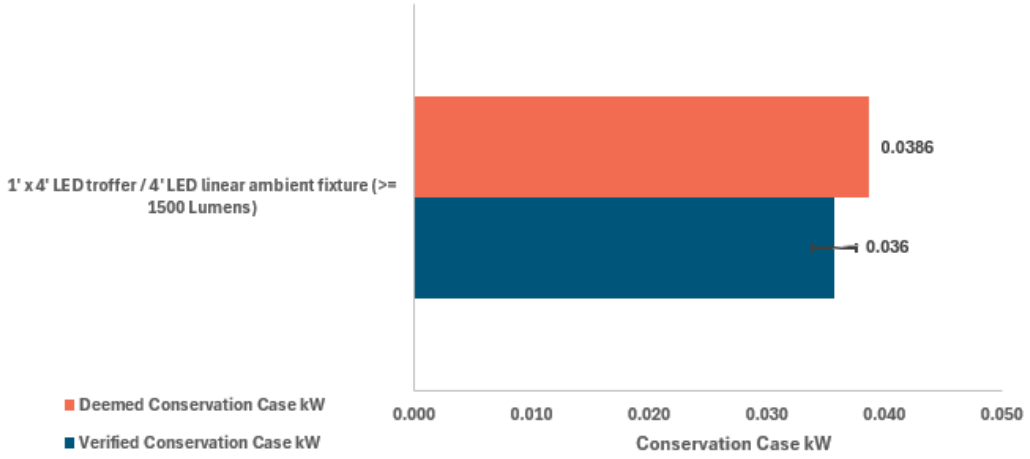
Table 4-10: Comparison of Conservation Case Wattages by Measure Type

Conservation Measure	PY23 Avg Deemed Conservation kW	PY23 Avg Verified Conservation kW	PY23 Sample Precision	PY21 to 23 Avg Verified Conservation kW	PY21 to 23 Sample Precision
1' x 4' LED troffer / 4' LED linear ambient fixture (>=1500 Lumens)	0.0386	0.035	5.29%	0.036	5.19%

Figure 4-18 displays the error bounds of average verified wattage estimates for the rolling population of PY2021 to PY2023 projects for the 1' x 4' LED troffer/4' LED linear ambient fixture (>= 1500 Lumens).

[9] A recommendation to consider updating the MAL conservation case wattage for the "2' x 4' LED troffer/4' LED linear ambient fixture (>= 3000 Lumens)" was included in the PY2022 evaluation. In response to the recommendation in PY2022, the IESO indicated conservation case wattages had been updated in the February 2024 *draft* MAL. The evaluation team can confirm that this update is reflected in the February 2024 *draft* MAL

Figure 4-18: Deemed vs. Verified Conservation Case kW



While the evaluation results presented in the table above present verified parameters with strong precision, they are very close to the deemed conservation case value and fell just outside the error bounds. As such, the evaluation team will continue to monitor and gather additional data over the coming years for the 1' x 4' LED troffer/4' LED linear ambient fixture (>= 1500 Lumens) and provide a recommendation if future results vary from the deemed values.

4.5.2 Prescriptive Non-Lighting Measures

4.5.2.1 In-Suite Temperature Controls

In-Suite Temperature Controls measure contributes 54% of verified net energy savings of the Prescriptive HVAC projects savings and has the highest verified net energy savings per project (186 MWh) among Prescriptive HVAC projects. Participation in this measure drastically increased compared to PY2022 as 27 ISTC projects were implemented in PY2023 compared to only three ISTC projects during PY2022. During the PY2023 evaluation, nine out of the 27 ISTC projects were evaluated.

Only one of the evaluated projects had both electric space heating and cooling, as required by the measure eligibility criteria. Six projects had electric space heating without cooling, and two projects had electric space cooling with gas heating. Additionally, ISTC measure assumptions provide energy and demand savings for each thermostat or ISTC installed controlling the entire conditioned space heating and cooling load. However, in the evaluated applications with only space heating, an average of 2.4 thermostats were installed per multi-residential unit, and in applications with only space cooling, an average of 1.2 thermostats were installed per multi-residential unit.

4.5.2.2 Prescriptive Variable Frequency Drive Deemed Assumptions and Delivery.

The VFD measures contributed 49% of verified net energy savings for Prescriptive Process projects and were the most prevalent measure, making up 53% of all PY2023 installed measures in the Prescriptive Process track. Current measure eligibility criteria only require that a VFD is installed to control a 1-100 hp motor and that the system must operate a minimum of 2,000 hours per year. The measure assumptions used to calculate deemed savings only apply to VFDs controlling centrifugal fans and pumps. These measure assumptions rely on affinity laws, which only apply to the hydraulic flow of fluids (liquids and gasses). As such, the deemed savings assumptions are not appropriate for all end-uses installing a VFD.

During the PY2023 evaluation, 22 VFD projects were evaluated and seven of those projects were VFDs installed on end-uses that were not appropriate applications of IESO Prescriptive assumptions, resulting in inaccurate savings estimates for these projects. These end-uses included VFDs on conveyor belts, and injection molding machines. The energy and demand realization rate for projects verified with end-uses other than pumps or fans were 74.43% and 137.09% respectively. These projects impacted the Prescriptive Process energy and summer peak demand realization rates by -3.7% and +5.2%, respectively. The low energy realization rate is attributed to two of the evaluated projects where the VFDs were retrofit onto single speed HVAC chillers, converting them to variable speed where the deemed measure assumptions used to calculate the reported energy savings were inaccurate. The high demand realization rate is attributed to the same two chiller projects where the verified summer peak demand savings utilized the IESO cooling chillers load profile which has a higher peak demand factor than the commercial HVAC fans and pumps load profile resulting in higher verified demand savings than IESO assumptions for prescriptive VFD applications. Overall, VFD measures contributed positively, +2.4% and +7.6% to the Prescriptive Process energy and summer peak demand realization rates primarily due to higher average verified annual operating hours.

4.5.2.3 Variable Speed Drive and Variable Displacement Compressed Air Prescriptive Energy and Demand Savings.

Compressed Air Variable Displacement (VD) and Compressed Air VSD measures combined contributed 23% of verified net energy savings for Prescriptive Process projects in the population and were the second most prevalent measure of PY2023 Prescriptive Process track. The Measure Substantiation Sheet (MSS) for these measures state Variable Displacement savings is assumed to be 80% of the VSD Compressor savings. However, the prescriptive energy and demand savings table within the MSS, shows VSD Compressor savings to be 80% of the Variable Displacement compressor savings. During the PY2023

evaluation, 12 Prescriptive Compressed Air projects were evaluated, and the evaluation team accounted for this error and accurately determined the energy and demand savings.

4.5.3 Prescriptive Lighting–Greenhouse Measures

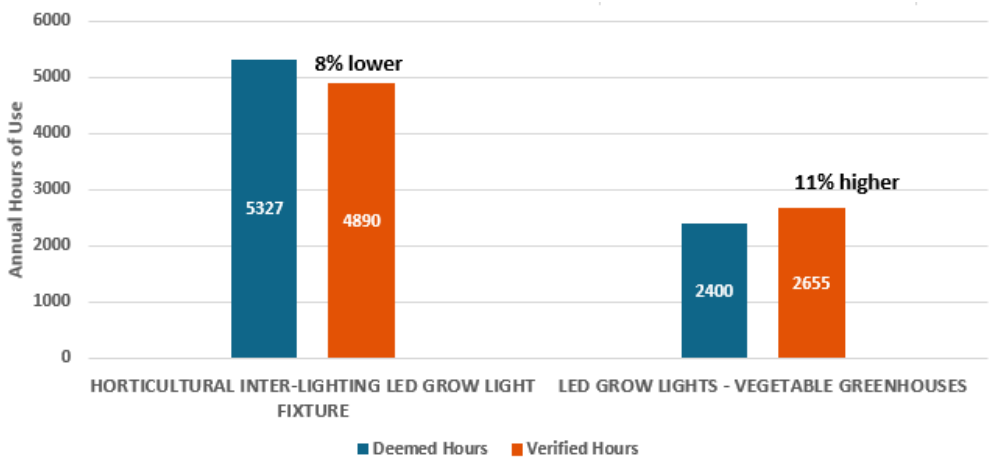
As mentioned in Section 1.3.1, Prescriptive Lighting–Greenhouse measures contributed 49% (133,434 MWh) and 6% (1,611 kW) of total net verified first-year energy and summer peak demand savings, respectively, in PY2023. The Prescriptive Lighting–Greenhouse track accounted for the highest variation (-22.6%) from the overall program's sampled reported energy savings. Six prescriptive lighting greenhouse projects that were part of two participants' portfolio of projects had low average energy realization rates of 54% and 53%. These projects made up 40% of the PY2023 sample prescriptive lighting greenhouse reported energy savings. The low realization rates were primarily due to lower verified hours of use (HOU) and higher conservation case wattages verified at these facilities through visual inspections and data collected during the evaluation site visits. These six projects contributed to over half (-13.4%) of the energy savings variation from the overall program's sampled reported energy savings. Consistent with PY2022 evaluation results, verified demand savings for greenhouse projects are significantly higher than reported due to the evaluation team validating in PY2023 that inter-lighting LED grow light fixtures are used for extended times during the IESO summer peak demand period.

Analysis of Operating Hours and Conservation Case Wattages based by Measure Type

The differences between average deemed and verified annual hours of use (HOU) and conservation case wattages across all greenhouse projects are the main drivers of the realization rates in this stream and consequently the overall Retrofit program's realization rate. To obtain a comprehensive understanding, the evaluation team combined results from PY2021 through PY2023 to verify operating hours and conservation case wattages for each horticultural lighting measure type.

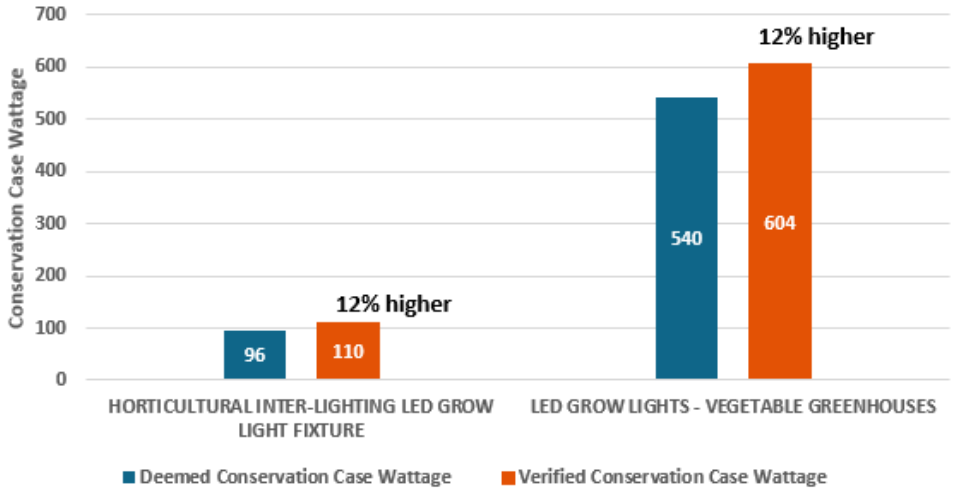
Verified HOU from the combined PY2021 through PY2023 projects for Inter-lighting LED grow light fixtures were 8% lower than deemed hours. Conversely, HOU for LED grow lights–vegetable greenhouses were verified to be 11% higher than deemed hours for this measure. Figure 4-19 illustrates the difference between the deemed annual HOU and verified annual HOU for the PY2021 through PY2023 data for both Inter-lighting fixtures and LED grow lights – vegetable greenhouses.

Figure 4-19: Deemed vs Verified HOU for Horticultural Lighting Measures



Additionally, the verified conservation case wattage from the PY2021 through PY2023 projects for both Inter-lighting LED grow-light fixtures and LED grow lights–vegetable greenhouses exceeded the deemed values, with increases of 12% for both measures. Figure 4-20 illustrates the difference between the deemed conservation case wattages and verified conservation case wattages for the PY2021 through PY2023 data for both Inter-lighting LED grow light fixtures and LED grow lights – vegetable greenhouses.

Figure 4-20: Deemed vs Verified Retrofit Case Wattage for Horticultural Lighting Measures



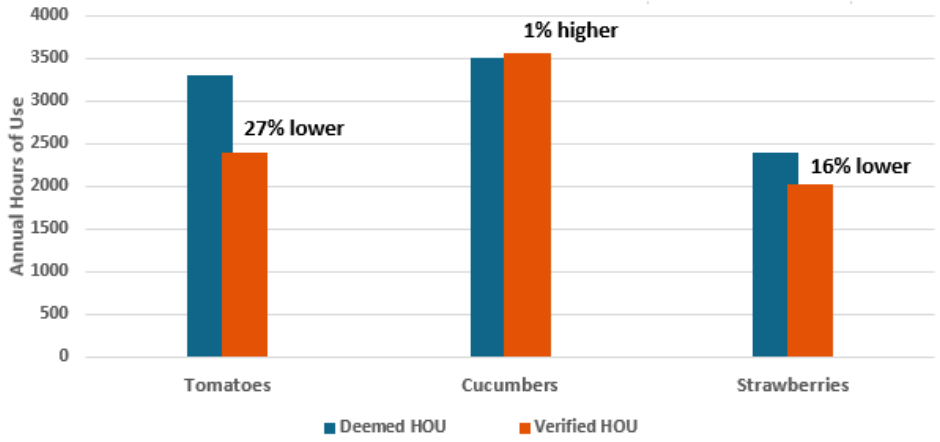
Analysis of Operating Hours and Conservation Case Wattages for different Crop Types

Using crop data collected during site visits and desk reviews, the evaluation team conducted an analysis of deemed and verified annual HOU based on crop types. The IESO deemed HOU for different crop types were obtained from the Advanced Lighting Controls

measure in the Measure Substantiation Sheet (MSS) which lists deemed HOU per crop type. Overall, the verified HOU from the PY2023 projects for tomatoes and strawberries were 27% and 16% lower than the deemed hours. However, the verified HOU for cucumbers were 1% higher than the deemed hours.

Figure 4-21 illustrates the difference between the deemed annual HOU and verified annual HOU for the PY2023 projects for various crop types.

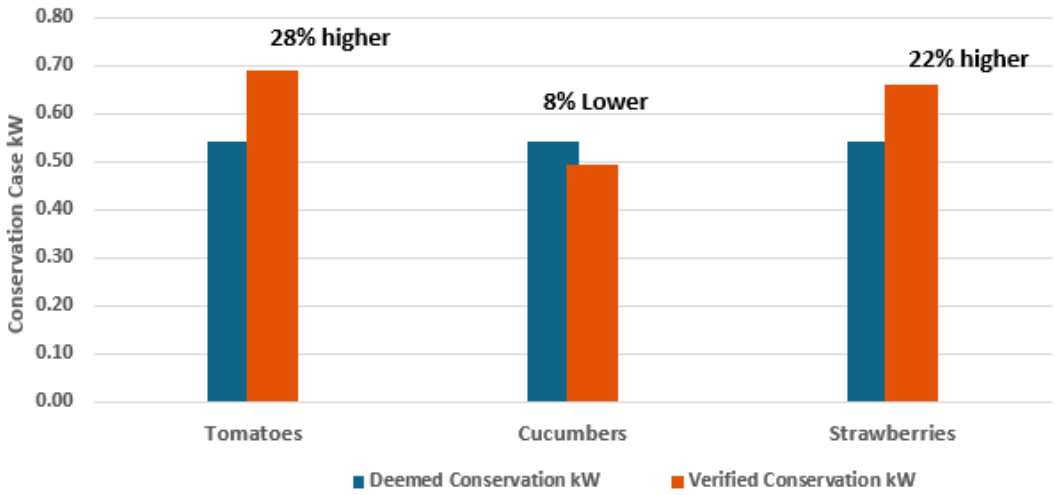
Figure 4-21: Hours of Use by Crop Type (PY2023 data)



The evaluation team also conducted an analysis of deemed and verified conservation case wattages based on crop types. The IESO deemed conservation case wattages for different crop types were obtained based on the measure type installed at these facilities. The verified conservation case wattages for PY2023 LED grow light fixtures installed for tomatoes and strawberries were 28% and 22% higher than the deemed conservation case wattages (0.54 kW). However, the verified conservation case wattages for cucumbers were 8% lower than the deemed conservation case wattages.

Figure 4-22 illustrates the difference between the deemed and verified conservation case wattages for tomatoes, cucumbers, and strawberries.

Figure 4-22: Conservation Case Wattage by Crop Type (PY2023 data)



4.5.4 Custom Measures

In PY2023, the Custom track allowed the implementation of lighting and non-lighting projects. Custom lighting projects were the most common, accounting for 84% of custom projects. Custom non-lighting projects accounted for the remaining 16%. Together, they contributed 5% and 8% of total program net verified first-year energy and summer peak demand savings, respectively.

4.5.4.1 Custom Lighting

The Custom lighting track accounted for -2.4% and -1.9% variation from the Custom stream's reported energy and demand savings. Three Custom lighting projects which made up 19% of the PY2023 sample Custom lighting reported energy savings had energy realization rates of 84%, 71% and 85%. The low realization rates were primarily due to lower verified hours of use (HOU) compared to the reported HOU. With respect to the demand savings, three other Custom lighting projects which made up 11% of the PY2023 sample Custom lighting reported demand savings had realization rates of 54%, 70% and 48%. These low realization rates were primarily due to the lights not being utilized during the entirety of the IESO summer peak demand hours[10].

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

4.5.4.2 Custom Non-Lighting

The Custom Non-lighting track accounted for -4.2% and -7.7% variation from the Custom stream's reported energy and demand savings. Two Custom Non-lighting projects which made up 19% of the PY2023 sample reported energy savings had energy realization rates of 87% and 71%. The lower realization rates were due to changes in equipment and operating conditions that were determined during the evaluation site visits. These two projects also played a role in a lower Custom Non-lighting demand realization rate due to similar changes in operating conditions along with varying demand calculation assumptions.

4.6 Net-to-Gross Evaluation

4.6.1 Prescriptive Track

Table 4-11 presents the results of the PY2023 Retrofit Program Prescriptive stream NTG evaluation. The evaluation team targeted and achieved 90% confidence and 10% precision levels in the savings results. Appendix D.3 provides additional analyses performed to assist in interpreting these values.

Table 4-11: Retrofit – Prescriptive Stream NTG 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
1,450	226	22.7%	0.8%	1.2%	78.1%	78.5%	± 4.7%

As the table shows, participant feedback indicated moderate FR levels at 22.7%.[11] Over one-fourth of participants (26%) stated they would have done the "exact same upgrade" in the program's absence, indicative of higher FR for these respondents. Nearly two-fifths of respondents (37%) showed no indication of FR as they stated they would have put off the upgrade for at least one year (23%) or would have cancelled their upgrade altogether (14%). Other respondents were considered partial free riders if they reported that they would have scaled back on their project's size, efficiency, or scope (26%), if they did not know what they would have done in the program's absence, or if they declined to answer (12%). The team combined these responses, with results indicating moderate FR levels for the surveyed participants. Program participation resulted in low SO at 0.8%, with the

[11] Recent historical results included a FR value of 8.0% in PY2022 at the province-wide level.

installation of CFLs and LED linear lighting measures primarily driving SO savings. Appendix D.3 provides additional analyses performed to assist in interpreting these values.

4.6.2 Greenhouse Track

Table 4-12 presents the results of the PY2023 Retrofit Program Greenhouse stream NTG evaluation. The evaluation team targeted and achieved 90% confidence and 10% precision levels in the savings results. Appendix D.5 provides additional analyses performed to assist in interpreting these values.

Table 4-12: Retrofit – Greenhouse Stream NTG 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
33	15	2.2%	0%	0%	97.8%	97.8%	± 2.2%

As the table shows**,** participant feedback indicated low FR levels at 2.2%. Six respondents showed no indication of FR since they stated they would have put off the upgrade for at least one year (4 respondents) or would have cancelled their upgrade altogether (2) had the program not been available to them. Eight of 15 respondents would have scaled back on the size, scope, or efficiency of their project in the absence of the program. These respondents, along with those who did not know what they would have done in the program's absence or declined to answer (1 respondent), were considered partial free riders. The evaluation team combined these responses, with results indicating low FR levels for the surveyed participants. Program participation resulted in no SO at 0%. Appendix D.5 provides additional analyses performed to assist in interpreting these values.

4.6.3 Custom Stream

Table 4-13 presents the results of the PY2023 Retrofit Program Custom stream NTG evaluation. Though the evaluation team targeted 90% confidence and 10% precision levels for the Custom stream, these were not achieved due to low project volumes and relatively homogenous levels of savings represented by each project. Instead, 85% confidence and 15% precision levels were achieved when calculating NTG for the Custom stream. Appendix D provides additional analyses performed to assist in interpreting these values.

Table 4-13: Retrofit – Custom Stream NTG 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 85% Confidence
191	53	32.5%	0.8%	0.3%	68.3%	67.8%	± 6.5%

As the table shows, participant feedback indicates moderate FR levels at 32.5%.[12] One-fourth of participants (25%) stated they would have done the "exact same upgrade" in the program's absence, indicative of higher FR for these respondents. Nearly one-half of respondents (45%) showed no indication of FR as they stated they would have put off the upgrade for at least one year (21%) or would have cancelled their upgrade altogether (25%) had the program not been available to them. Other respondents were considered partial free riders if they reported that they would have scaled back on their project's size, efficiency, or scope (19%) or if they did not know what they would have done in the program's absence or declined to answer (11%). The evaluation team combined these responses, with results indicating moderate FR levels for the surveyed participants. Program participation resulted in low SO at 0.8%, with the installation of LED linear lighting measures primarily driving SO savings. Appendix D.4 provides additional analyses performed to assist in interpreting these values.

[12] Recent historical results include a FR value of 8.0% in PY2022 at the province-wide level.

5 Cost-Effectiveness Evaluation

Cost-effectiveness for the Retrofit program was conducted using IESO's CE Tool V9.1. Table 5-1 presents the results. The PY2023 Retrofit program achieved a Program Administrator Cost (PAC) ratio of 3.01, exceeding the 1.00 target threshold (designed to determine if a program proves cost-effective).

Table 5-1: PY2023 Retrofit Program Cost-Effectiveness Results

PAC Test	PY2023	PY2022	PY2021
PAC Costs ($)	$56,930,596	$39,876,640	$15,590,964
PAC Benefits ($)	$171,529,334	$145,967,491	$28,188,957
PAC Net Benefits ($)	$114,598,738	$106,090,851	$12,597,993
PAC Net Benefit (Ratio)	3.01	3.66	1.81
Levelized Unit Energy Cost (LUEC)	**PY2023**	**PY2022**	**PY2021**
$/kWh	$0.02	$0.01	$0.02
$/kW	$217.09	$129.99	$125.57

The PY2023 CDM Framework Retrofit program passed the PAC test, with benefits exceeding their respective costs with a PAC ratio of 3.01 and a levelized unit energy cost of $0.02 per kWh and $217.09 per kW. The PY2023 CDM Framework Retrofit cost-effectiveness results were slightly lower than the PY2022 CDM Framework Retrofit cost-effectiveness results, where the PY2022 Retrofit Program achieved a PAC ratio of 3.66 and a levelized unit energy cost of $0.01 per kWh and $129.99 per kW. The slight PAC decrease can be attributed to the lower realization rate of the Prescriptive Lighting – Greenhouse measures in PY2023. The Agricultural sector contributed to 43% of the PAC net benefits at a PAC ratio of 2.58, followed by the Industrial and Commercial sector at 27% and 22% with a PAC ratio of 4.68 and 3.29, respectively.

5.1 Prescriptive Measures

Table 5-2 presents the cost-effectiveness results for Prescriptive measures in the Retrofit program. The PY2023 Prescriptive measures, consisting of Prescriptive Lighting and Non-Lighting projects, passed the PAC test, with benefits exceeding their respective costs, at a PAC ratio of 3.72, and a levelized unit energy cost of $0.02 per kWh and $103.24 per kW. Overall, Prescriptive measures produced the highest PAC ratio when compared to Greenhouse and Custom measures.

Table 5-2: Prescriptive Track Cost-Effectiveness Results

PAC Test	PY2023
PAC Costs ($)	$23,113,973
PAC Benefits ($)	$85,913,165
PAC Net Benefits ($)	$62,799,192
PAC Net Benefit (Ratio)	3.72
Levelized Unit Energy Cost (LUEC)	**PY2023**
$/kWh	$0.02
$/kW	$103.24

Measure-level cost-effectiveness analysis showed that lighting measures, such as LED High-Bay fixtures and Network Lighting Controls (NLC), had higher-than-average PAC ratios of 6.4[13] and 5.7[13] LED High-Bay fixtures contributed the second-highest PAC net benefits to the PY2023 Retrofit program, at $43,496,064. As discussed in Section 4.3.1, High-Bay measures achieved the greatest share of total lighting net verified energy and summer peak demand savings at 67% and 70%, respectively. NLC, however, contributed only 3% and 4% of total lighting, net verified, energy and summer peak demand savings.

Inversely, Refrigerated Display Case LEDs and LED Recessed Downlight fixtures produced lower-than-average PAC ratios of 0.7[13] and 1.6[13]; they contributed to 1.3% and 0.01% of total lighting net verified energy savings. Prescriptive non-lighting measures, such as VFDs and ISTC, achieved the highest PAC ratios of 4.2[13] and 3.5[13]. These measures contributed 28% and 23% of total prescriptive non-lighting net verified energy savings, respectively. Contrarily, Chillers and High-Volume low-speed fans had lower-than-average PAC ratios of 2.4[13] and 2.0[13] due to high-cost contributions to the overall Retrofit program. These measures contributed to 3% and 5% of total Prescriptive non-lighting net verified energy savings.

5.2 Greenhouses Measures

As discussed in Section 4.3.2, the Greenhouse track consists of Standard Greenhouse projects and Targeted Greenhouse projects. Table 5-4 presents the cost-effectiveness results for all Greenhouse measures in the PY2023 Retrofit program. Targeted Greenhouse

[13] Measure-level benefit-to-cost ratios do not include program administrative costs. Administrative costs are included in the tables, showing overall program- and track-level cost-effectiveness results. Track-level cost-effectiveness results are directional in nature and should be used for comparison purposes.

projects cost-effectiveness results are specifically detailed in the "Targeted Greenhouse" memo submitted to the IESO. Greenhouse measures passed the PAC test, with benefits exceeding their respective costs, with a PAC ratio of 2.60, and a levelized unit energy cost of $0.02 per kWh and $1,635.13 per kW[14]. The high $/kW LUEC is due to the low summer peak demand savings resulting from the Greenhouse projects. Incentives provided for these measures are serving additional local capacity supply constraints and provide additional value which is not directly captured in below benefits due to variation between local peak demand definition where Greenhouse projects are typically implemented and provide-wide definition.

Table 5-3: Greenhouse Track Cost-Effectiveness Results

PAC Test	PY2023
PAC Costs ($)	$30,052,615
PAC Benefits ($)	$78,183,933
PAC Net Benefits ($)	$48,131,318
PAC Net Benefit (Ratio)	2.60
Levelized Unit Energy Cost (LUEC)	**PY2023**
$/kWh	$0.02
$/kW	$1,635.13

LED Grow Lights at vegetable greenhouses and Horticultural Inter-Lighting contributed the greatest PAC net benefits to PY2023 Retrofit program, at $45,644,003 and $5,088,187, respectively. These two measures produced high PAC ratios of 3.01[15] and 5.14[15], respectively; combined, they contributed nearly 48% of the total Retrofit program's net verified energy savings and 6% of the total net verified summer peak demand savings. Conversely, Greenhouse Advanced Lighting Controls and LED Grow Lights at cannabis warehouses contributed only $104,027 and $65,201 PAC net benefits, with lower-than-average PAC ratios of 1.7[15] and 1.6[15], respectively.

[14] The $/kW LUEC for Greenhouse measures is based on province wide-peak demand definition (June 1st to Aug 31st from 1:00 PM to 7:00 PM) and does not reflect the local South-West region peak demand benefits.
[15] Measure-level benefit to cost ratios do not include program admin costs. Admin costs are included in the tables showing overall program and track level CE results. Track-level CE results are directional in nature and to be used for comparison purposes.

5.3 Custom Measures

Table 5-3 presents the cost-effectiveness results for Custom measures in the Retrofit program. The PY2023 Custom measures, consisting of custom lighting and non-lighting projects, passed the PAC test, with benefits exceeding their respective costs, with a PAC ratio of 1.97, and a levelized unit energy cost of $0.03 per kWh and $188.50 per kW.

Table 5-4: Custom Track Cost-Effectiveness Results

PAC Test	PY2023
PAC Costs ($)	$3,764,008
PAC Benefits ($)	$7,432,236
PAC Net Benefits ($)	$3,668,228
PAC Net Benefit (Ratio)	1.97
Levelized Unit Energy Cost (LUEC)	**PY2023**
$/kWh	$0.03
$/kW	$188.50

Custom Lighting projects contributed a total of $2,110,269 Net Benefits to the overall PY2023 Retrofit program, with a PAC ratio of 2.7[16]. Custom Lighting projects had a minimal contribution to the overall program, with only 2.8% and 4.9% of the program's overall net verified energy and summer peak demand savings. Custom non-lighting projects contributed a total of $1,935,157 net benefits, with a PAC ratio of 2.03[16]. Custom non-lighting projects also provided a minimal contribution to the overall program, with only 2.2% and 3.5% of the overall program's net verified energy and summer peak demand savings.

[16] Measure-level benefit-to-cost ratios do not include program administrative costs. Administrative costs are included in the tables to show overall program- and track-level cost-effectiveness results. Track-level cost-effectiveness results are directional in nature and should be used for comparison purposes.

6 Process Evaluation Results

The evaluation team performed a process evaluation to better understand the Retrofit program's design and delivery. The team interviewed IESO and delivery vendor staff and completed applicant representative, contractor, and participant surveys to gather primary data for supporting this evaluation. In the following sections, if fewer than 20 respondents answered a question, counts are shown rather than percentages. These results should be considered directional, given the small number of respondents.

6.1 IESO Staff and Program Delivery Vendor Staff Perspectives

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

6.1.1 Key Findings

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

- Significant modifications were made to the program in PY2023, changing it from a Prescriptive-only delivery model in May 2023 when a Custom track was added. Incentives for non-lighting equipment on the Prescriptive track increased in October, and lighting measures were moved to a midstream program in December.
- IESO staff and delivery vendors reported that the program's delivery was generally well executed, even with the many changes that occurred.
- All three delivery vendors considered the return of the Custom track a major benefit for the program. The Custom track helped engage customers with large or complex projects that did not fit the Prescriptive track and who may not have otherwise participated.
- Given the many program changes that occurred in PY2023, IESO's marketing and outreach activities increased to ensure customers were aware of these changes. These activities typically focused on offering additional webinars, newsletters, and digital promotional tactics.
- When asked what sectors would most likely opt for non-lighting upgrades if the program targeted outreach to them more directly, delivery vendors frequently mentioned industrial applications, multi-unit residential, or larger commercial buildings. VFDs, motors, pumps, heat pumps, cooling systems, and highly specialized, sector-specific non-lighting equipment were noted as typically being of interest to these sectors.

- IESO staff and delivery vendors indicated that contractors greatly affected customers' decisions to install program equipment, noting that most contractors can adequately explain the benefits of energy-efficient equipment to motivate their customers, but that some can use more training in this area.
- Suggestions for equipment and services to consider adding to the program included the following: energy audits and energy management systems, especially for industrial facilities or for large commercial customers; solar; controls; and additional HVAC equipment.
- Common barriers cited included paperwork required to apply to the program, the Retrofit Portal, low program awareness among non-lighting market actors, continued supply chain delays, and some challenges in communicating the many program changes that occurred in PY2023.
- Program improvement suggestions included increasing non-lighting market actor awareness (i.e., developing a centralized market actor network), increasing customer awareness (i.e., developing additional case studies and testimonials that feature more business sectors and equipment types), engaging with organizations associated with eligible business sectors, contractor training on equipment with which they are less familiar, ensuring that Prescriptive and Custom tracks remain equally attractive to customers, and cross-promoting other programs for which customers may qualify.

6.1.2 Design and Delivery

As in prior years, the IESO was responsible for the program's administration and design in PY2023, and three delivery vendors were responsible for the program's delivery. Significant modifications occurred to the program in PY2023, changing it from a Prescriptive-only delivery model in May, when a Custom track was added for lighting and non-lighting equipment. Incentives for non-lighting equipment through the Prescriptive track increased in October. Another major change came in December 2023 when lighting, which had been a major component of the Retrofit program, was moved to a midstream program. Additionally, one of three delivery vendors joined the program in PY2023 and worked to ramp up quickly with support from IESO.

The IESO staff and delivery vendors reported that the program's delivery was generally well executed despite the many changes. All three delivery vendors considered the return of the Custom track as a major benefit for the program. One delivery vendor noted that many projects did not easily fit the Prescriptive track and adding the Custom stream helped engage customers with large projects who may not have otherwise participated.

IESO staff and delivery vendors indicated that project volumes were typically higher than expected, especially prior to the transition from lighting. Another delivery vendor stressed that addition of the Custom track helped northern areas of the province, where projects do

not as readily fit within the Prescriptive stream. Most delivery vendors and IESO staff did not believe that the incentive increase for Prescriptive projects impacted the Custom stream negatively. One delivery vendor said some customers changed from Custom to Prescriptive when the Prescriptive increase occurred. This resulted in some projects claiming fewer savings than they might have through the Custom track, according to this delivery vendor.

6.1.3 Outreach and Marketing

IESO staff noted that in recent years, marketing was relatively limited for the Retrofit program. With lighting moving to a midstream program, the Custom track's reintroduction, and increased Prescriptive incentives), more marketing resources were dedicated in PY2023 to ensure customers were aware of the changes. IESO staff noted that its marketing primarily relied on digital promotional tactics. For example, IESO uses its own Save on Energy-branded social media channels to engage customers. It also sponsors content on social media aiming to drive traffic to the Save on Energy website, where customers can learn about the program and initiate their applications. IESO also provided webinars and sent newsletters in PY2023, especially as program changes occurred.

Delivery vendors noted that the most effective marketing typically involved sharing case studies from past participants or word of mouth from other satisfied customers. IESO staff agreed and noted that their messaging has shifted from explaining the nuts and bolts of the program to showcasing and profiling businesses across the province that have taken advantage of the program. IESO staff said they are working to develop direct relationships with relevant organizations associated with various business sectors eligible for the program (e.g., chambers of commerce, business improvement associations, trade groups that may advocate on behalf of certain sectors). Delivery vendors also noted that their organizations support the program in many ways (e.g., cold calls, visiting eligible businesses in-person, attending industry events).

6.1.4 Equipment and Services

The delivery vendors reported that equipment and services offered generally met customer needs. One delivery vendor said they encountered some issues with heat pumps frequently not meeting the program's efficiency standards. One IESO staff member thought there may be a need for more engineering assistance in the future upon installations of more complex heating systems.

When asked what sectors would most likely opt for non-lighting upgrades if the program targeted outreach to them more directly, delivery vendors frequently mentioned industrial applications, multi-unit residential, or larger commercial buildings. VFDs, motors, pumps, heat pumps, cooling systems, and highly specialized, sector-specific non-lighting

equipment were cited as typically being of interest to these sectors. IESO staff noted a recent change to the Retrofit Portal related to standardizing addresses will provide helpful data points that the IESO may be able to use in identifying sector-level participation gaps.

All three delivery vendors believed that contractors greatly affected customers' decisions to install equipment, noting that most contractors can adequately explain the benefits of energy-efficient equipment to motivate their customers, but some can use more training in this area. Relatedly, IESO staff noted that whether a contractor can adequately explain equipment benefits to their customers depends on their comfort level with the equipment; for newer non-lighting equipment, the expertise level in the market may be relatively low.

Delivery vendors noted that the shift to offering lighting through a midstream delivery model in PY2024 diminished applicant representative and contractor program roles. Some applicant representatives and contractors indicated to delivery vendors that they were unhappy with this change. One delivery vendor reported that some contractors, who have traditionally supported lighting installations through the program, are considering whether to pivot to offer non-lighting equipment, such as VFDs and controls.

IESO staff and delivery vendors offered various suggestions for equipment and services to consider adding to the program. These included energy audits and energy management systems, especially for industrial facilities or for large commercial customers; solar; controls; and additional HVAC measures.

6.1.5 Barriers and Opportunities

IESO staff and delivery vendors identified several common program barriers and opportunities for improvement. Delivery vendors noted that participants are required to submit a great deal of information in the pre- and post-approval processes and that it can be time-consuming to secure all the documents. In turn, this can deter customers, especially those with smaller projects, who may not find it worth the time or effort required to participate. IESO staff stressed they are continuously working to identify ways to ease paperwork requirements. One IESO staffer noted that moving lighting to a midstream program in 2024 will remove paperwork requirements for customers with lighting projects. Another said moving the entire program (or even just Prescriptive equipment) to a midstream delivery model could further assist in addressing this barrier.

One delivery vendor reported that the Retrofit Portal continues to challenge some customers, though they noted they work closely with customers to help guide them through the portal, if necessary. IESO staff indicated that they are continuously making enhancements to the portal to address issues and to improve it. One IESO staffer recommended that the program consider developing a centralized market actor network to

better communicate program changes and to more easily generate feedback from these market actors. Similarly, another IESO staffer said further outreach to market actors in the non-lighting sector (e.g., contractors, distributors, manufacturers) posed the most important improvement that the program must make.

IESO staff indicated that some challenges arose in communicating the many program changes that occurred in PY2023 to the marketplace. Delivery vendors stressed the continued importance of customer education and awareness building in informing them of the program and its recent changes. They noted that, in addition to informational webinars, case studies and video testimonials have been very effective and recommended developing more of this content, featuring additional business sectors and equipment types. They also suggested more cross-promotional marketing, so customers who participate in the Retrofit program know of other programs for which they may qualify. One delivery vendor recommended that IESO's program messaging push the connection between sustainability and energy efficiency as they believed this was not always obvious to customers.

To minimize the risk of missed savings opportunities, one delivery vendor suggested identifying ways to make the Prescriptive and Custom tracks equally attractive to customers. Another delivery vendor recommended sharing information about the next program framework as soon as possible so customers can make longer-term decisions. Two delivery vendors indicated that the supply chain remained somewhat erratic, which can lead to slower project completion timelines. Finally, a delivery vendor stressed that a primary focus in the years ahead will be determining how to best increase the number of non-lighting projects as well as methods to bring in larger projects with deeper savings.

6.2 Applicant Representative and Contractor Perspectives

The following subsections highlight feedback received from the applicant representative and contractor survey. Appendix D.1 provides additional results.

6.2.1 Key Findings

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

- One-half (50%) of respondents worked as both an applicant representative and a contractor for clients who received their incentive through the program in 2023. Slightly fewer (46%) worked only as an applicant representative, and 4 percent worked only as a contractor.
- Close to three-fourths of respondents (73%) reported that customers learned of the Retrofit Program through respondents' companies contacting them directly.

- The most-requested training and education topics include offerings associated with the program (40%), application process training or support (35%), and program rules and the application process (33%).
- Some respondents said they would be interested in additional qualifications, certifications, or credentials, such as IESO-specific certifications for applicant representatives (4%), energy audit training (2%), and energy modeling software packages (2%).
- Respondents commonly said that barriers preventing more customers from participating in the program included customers not perceiving the upgrades to be worth the trouble of participation (40%), customers not viewing upgrades as a priority (31%), and customers not knowing about the program (23%).
- To address barriers and increase customer participation, respondents suggested making the application/approval process easier (25%), improving and increasing marketing to increase awareness (19%), and expanding eligible measures (11%).
- The highest-rated program aspect was the program worksheets and materials (77% with a rating of four or five on a scale of one to five, where one indicates "not satisfied at all" and five indicates "completely satisfied"). The lowest-rated program aspect was program marketing and outreach (33% with a rating of four or five).
- Respondents' suggestions on how to improve the program going forward included reinstating lighting incentives (15%) and streamlining the overall process (15%). Other common responses included delivering the program regionally through customers' utilities (12%) and making the Retrofit Portal more user friendly (12%).
- Nearly three-fourths (69%) of respondents indicated that their customers typically could install all equipment that interested them through the Retrofit Program.

6.2.2 Program Awareness

Applicant representatives and contractors most commonly became aware of the program through their current or previous job (25%) or through outreach from IESO (25%). Respondents also learned about the program from outreach by delivery vendors (13%) and through their prior experience with a Save on Energy program (13%). When asked for the primary way *their customers* learned of the program, they most commonly reported that their company contacted customers about the program (73%). Less than one-tenth (8%) said customer awareness came from contractors or equipment vendors (6%) or from previous participation in other Save on Energy programs (6%). Figure D-4 and in Appendix D.1 provide additional details regarding program awareness.

Applicant representatives and contractors most often (52%) reported that outreach from contractors or equipment vendors proved the most effective marketing or outreach activity in terms of generating customer awareness of the program. This was followed by previous experience participating in other Save on Energy programs (35%) and the Save on Energy

website for the program (33%). Figure D-6 in Appendix D.1 provides a full list of effective marketing and outreach activities.

When asked what type of businesses or business sectors would be most interested in non-lighting upgrades if marketing and/or outreach were specifically directed to them, applicant representatives and contractors most commonly reported commercial and industrial (11 of 13 respondents), multifamily residential (five respondents), food/agricultural (four respondents), and municipal (four respondents) sectors. When asked what type of energy-efficient equipment would interest to these businesses or business sectors, respondents most frequently cited HVAC upgrades for the commercial/industrial sector (eight respondents), the multifamily residential sector (four respondents), and the municipal sector (two respondents). Ventilation upgrades were most frequently mentioned (three respondents) for the food/agricultural sector. Table D-2 in Appendix D.1 provides additional details.

6.2.3 Training and Education

Nearly two-thirds (65%) of respondents received training or education to support their work with the Retrofit Program. Nearly one-half (44%) received training on the program rules and application process, and nearly two-fifths (38%) received training on the Retrofit Portal (38%). When asked about *additional* training or education that would help support their future work with the program, respondents most often suggested that training and education cover offerings associated with the program (40%), application process training or support (35%), and program rules and the application process (33%). Figure D-7 and Figure D-8 in Appendix D.1 provide additional details.

When asked whether IESO could offer qualifications, certifications, or credentials to help applicant representatives better serve customers, some respondents said they would be interested in IESO-specific certifications for applicant representatives (4%), energy audit training (2%), and energy modeling software packages (2%). Figure D-9 in Appendix D.1 provides additional details regarding the types of qualifications, certifications, or credentials that would help applicant representatives and contractors better serve customers.

When asked if there was energy-efficient equipment for which benefits were difficult to explain to customers, four out of the five respondents who answered mentioned lighting or lighting controls. Other energy-efficient equipment types cited were VFDs (two respondents), boilers (one respondent), and HVAC equipment (one respondent).

6.2.4 Incentives and Project Costs

Respondents were asked which non-lighting measures customers often did not install due to concerns related to their associated incentive levels. Of eight respondents who provided an answer, refrigeration (three respondents) and motors (two respondents) were cited most frequently. Table D-3 in Appendix D.1 provides additional details. Respondents were asked what percentage of project costs for various non-lighting measure categories were covered by the program. On average, measure categories with the greatest project costs covered by the program were agribusiness (35%), programmable thermostats (35%), and VFDs (34%). Table D-4 in Appendix D.1 provides additional details.

6.2.5 Activity Level

Of four-fifths of applicant representatives and contractors who reported they had completed projects in 2022 (83%), two-fifths (40%) said they completed more projects in 2023, one-fourth (25%) said they completed fewer projects in 2023, and nearly one-fourth (23%) said they completed about the same number of projects in 2022 and 2023. Respondents who said they completed more projects in 2023 commonly said this was due to better incentives (four respondents), higher budgets (two respondents), and the reintroduction of the Custom stream (two respondents). The most common reasons for respondents completing fewer projects in 2023 than in 2022 included COVID-related challenges, the new program proved unappealing, budget constraints, and fluctuations in demand (two respondents each). Figure D-10, Table D-5, and Table D-6 in Appendix D.1 provide additional details.

6.2.6 Program Experience and Improvement Suggestions

Respondents were asked to rate how much influence they thought they had on their customers' decision-making in regard to efficient equipment purchases on a scale of one to five, where one indicates "not at all influential" and five indicates "extremely influential." Nearly three-fourths (71% with a rating of four or five) said they were very or extremely influential on their customers' decision-making. Figure D-11 in Appendix D.1 provides additional details.

Respondents were asked why customers who were initially interested in energy-efficiency equipment ultimately chose not to install it at the time they completed their Retrofit projects. The most commonly cited reasons were incentives being too low (48%) and budget constraints (23%). Figure D-12 in Appendix D.1 provides additional details.

When asked to identify barriers that prevented more customers from participating in the program, respondents most commonly said customers did not perceive the upgrades to be worth the trouble of participation (40%), customers did not view upgrades as a priority

(31%), and customers did not know about the program (23%). Figure D-13 in Appendix D.1 provides additional details.

When asked what the program could do to overcome customer participation barriers, respondents most commonly suggested making the application process easier (25%), improving or increasing marketing to increase awareness (19%), expanding eligible measures (13%), and increasing incentive amounts (13%). Figure D-14 in Appendix D.1 provides additional details.

Respondents were asked to rate their satisfaction with different aspects of the Retrofit Program on a scale of one to five, where one indicates "not satisfied at all" and five indicates "completely satisfied." The highest-rated program aspect compared to other aspects was program worksheets and materials (77% with a rating of four or five). The lowest rated aspect compared to other aspects was program marketing and outreach (33% with a rating of four or five). Figure D-15 in Appendix D.1 provides additional details.

Respondents were asked for suggestions on how to improve the program going forward. The most common suggestions included reinstating lighting incentives (15%) and streamlining the overall process (15%). Table D-7 in Appendix D.1 provides additional details.

6.2.7 Equipment and Service Offerings

When asked applicant representatives and contractors if participants typically could install all equipment that interested them through the program, the majority (69%) indicated that participants could do so. Just over one-tenth (13%) indicated that participants could not do so. A full list of the types of energy-efficient equipment or models that participants were interested in but were not able to install through the program can be found in Table D-8 in Appendix D.1. Respondents were also asked what additional efficient equipment or services they would recommend for inclusion in the program. The most common recommendations were exterior lighting (32%), batteries (14%), other lighting (14%), and heat pumps (10%). Table D-9 in Appendix D.1 additional details.

6.2.8 Custom Stream

Respondents were asked why they thought some customers chose not to complete their projects through the Custom stream. More than one-half (53%) reported that the Custom stream required too much information and/or time. Respondents asked why they thought customers chose not to complete their project through the Prescriptive stream, with close to one-third (31%) stating that the prescriptive stream did not include all equipment or services of interest. Figure D-16 and Figure D-17 in Appendix D.1 provide additional details.

6.3 Retrofit Participant Perspectives

The following subsections highlight the feedback received from the participant survey. Additional results can be found in Appendix D.6.

6.3.1 Key Findings

Key findings from participants' responses include the following:

- Most respondents (88%) indicated that participation in the program was easy (ratings of three and above). Of these respondents, more than one-half (57%) stated that a Save on Energy representative, contractor, vendor, or supplier made it easy to participate in the process.
- Two-fifths of respondents (40%) who indicated that it was not very easy or not at all easy to participate in the program commonly reported that the paperwork was lengthy and complex.
- Over one-fourth of respondents (27%) reported that they decided not to install all energy-efficient equipment initially of interest to them as part of their program project. Respondents most commonly mentioned lighting (37%), building automation systems or energy management systems (22%), and lighting controls (21%) as equipment of interest that they ultimately decided not to install.
- More than one-third of respondents (35%) reported insufficient program incentives as the main reason for not installing all energy-efficient equipment initially of interest to them. A lack of resources and funding (13%) and the equipment not qualifying for an incentive (10%) were other common reasons mentioned.
- Close to one-third of respondents who completed a non-lighting Prescriptive project (30%) and more than one-third of respondents who completed a non-lighting custom project (35%) reported that 1-10% of their non-lighting upgrades were covered by the program.
- Nearly two-fifths of respondents (39%) offered recommendations for additional energy-efficient equipment or services for inclusion in the Retrofit Program. Most commonly, these recommendations included HVAC equipment (35%), heat pumps (14%), automation systems/controls (11%), and solar PV/wind (11%).
- Respondents' most frequent suggestions for improving the Retrofit Program included simplifying the overall process (33%), improving the application process (13%), and improving the Save on Energy website and online portal (13%).

6.3.2 Program Awareness

Most respondents (58%) learned of the program through a contractor or equipment vendor. Respondents also commonly heard about the program through previous participation in

another Save on Energy program (24%), the IESO website (12%), and colleagues or competitors (9%). Figure D-56 in Appendix D.6 provides additional details.

When asked about the ease of participating in the program, respondents used a scale of one to five, where one meant "not at all easy" and five meant "extremely easy." More than one-half of respondents (56%) rated their program participation as a four or five. Figure D-57 in Appendix D.6 provides additional details.

Respondents who indicated it was somewhat, very, or extremely easy to participate in the program were asked which program aspects made participation easy. More than one-half (57%) said that a Save on Energy representative, contractor, vendor, or supplier facilitated the process. Respondents also commonly cited the Save on Energy website and online portal (14%) and the application process (12%) as factors that made participation easier. Figure D-60 in Appendix D.6 provides additional details.

Respondents who found it not very easy or not at all easy to participate in the program were asked which program aspects impaired participation. Two-fifths (40%) reported that the paperwork was lengthy and complex. Respondents also commonly mentioned the length of the overall process (27%) and the application (23%) as aspects that made participation more difficult. Figure D-61 in Appendix D.6 provides additional details.

6.3.3 Decision to Not Install Additional Energy-Efficient Equipment or Services

More than one-fourth of respondents (27%) decided not to install all equipment initially of interest to them. Respondents commonly reported deciding not to install lighting (37%), building automation systems and energy management systems (22%), and lighting controls (21%). Figure D-58 in Appendix D.6 provides additional details.

More than one-third of respondents (35%) reported that low incentives were a reason for not installing equipment of interest. Respondents also commonly mentioned a lack of resources and funding (13%) and that the equipment did not qualify for the incentive (10%) as reasons for not installing this equipment. Figure D-59 in Appendix D.6 provides additional details.

Of respondents who decided not to install all equipment initially of interest to them, more than four-fifths stated their contractor typically could help them install efficient equipment of interest to them (88%) and that their contractor could explain the benefits of that equipment (90%). This indicates that contractors were typically not responsible for respondents deciding not to install all equipment initially of interest to them.

6.3.4 Non-Lighting Project Costs Covered by the Program

The survey asked respondents who completed a prescriptive or custom project what percentage of their non-lighting project costs were covered by the incentive received through the program upon completing a non-lighting project. More than one-half (53%) reported not having completed any non-lighting projects. Over-one fifth (21%) reported completing a non-lighting project through the prescriptive stream, and of those, close to one-third (30%) estimated that 1% to 10% of these project costs were covered by the incentive they received through the program. Similarly, of the small number (7%) who reported completing a non-lighting project through the Custom stream, over one-third (35%) estimated that 1% to 10% of these project costs were covered by the incentive they received through the program. Table D-30 in Appendix D.6 provides additional details.

6.3.5 Custom Stream

Respondents who participated in the Prescriptive stream and not the Custom stream were asked if they knew that the program offered Custom stream incentives that covered up to 50% of the cost for approved custom energy-efficiency projects. Almost three-fifths (59%) said they were not aware of the Custom stream, and almost one-third (29%) said that they knew of the Custom Stream. Figure D-62 in Appendix D.6 includes additional details. Respondents who indicated they were aware of the Custom stream were asked why their company chose not to complete any Custom projects. Over one-fifth of respondents (21%) said the Custom stream required too much information and/or time. Figure D-63 in Appendix D.6 provides additional details.

Respondents who participated in the Custom stream and not the Prescriptive stream were asked if they knew that the program offered Prescriptive stream incentives for commonly used equipment and services. Almost three-fifths (58%) said they were not aware of the Prescriptive stream, and one-fourth (25%) said that they were aware of the Prescriptive stream. Figure D-64 in Appendix D.6 includes additional details. The nine respondents who were aware of the Prescriptive stream were asked why their company chose not to complete projects through that stream. Reasons mentioned included their contractor advising them to complete their projects through the Custom stream instead, their company's project was too large or complex, or the Custom stream offered a higher incentive for their project (one respondent each). Figure D-65 in Appendix D.6 provides additional details.

6.3.6 Recommendations for Program Improvements

Nearly two-fifths of respondents (39%) offered recommendations for additional energy-efficient equipment or services to consider for inclusion in the program. Most commonly, these recommendations included HVAC equipment (35%), heat pumps (14%), automation

systems/controls (11%), and solar PV/wind (11%). Figure D-66 in Appendix D.6 provides additional details. Almost one-third of respondents (28%) provided recommendations to improve the program. The most common suggestions included simplifying the overall process (33%), improving the application process (13%), and improving the Save on Energy website and online portal (13%). Figure D-67 in Appendix D.6 provides additional details.

7 Other Energy-Efficiency Benefits

7.1 Avoided Greenhouse Gas Emissions

Using the IESO CE Tool V9.1, the evaluation team calculated avoided GHG emissions for the first year, along with the measures' lifetime savings for PY2023. Table 7-1 shows the results of these avoided GHG emissions calculations. First-year avoided GHG emissions from electricity savings were reduced by the increase in GHG consumption resulting from the gas-heating penalty, resulting in 45,487 Tonnes of CO2 reduced in the first year. PY2023 Retrofit program projects are expected to achieve a total of 613,571 Tonnes of avoided GHG throughout the EUL of the installed measures. All GHG emissions shown are in Tonnes of CO2 equivalent, unless otherwise noted.

Table 7-1: PY2023 Retrofit Program Avoided GHG 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
58,369	(12,882)	45,487	814,431	(200,859)	613,571

*Interactive gas heating penalty.

7.2 Non-Energy Benefits

The following subsection discusses NEBs from the PY2023 Retrofit Program. Appendix G provides additional details regarding the NEB methodology and results. Note that the evaluation team presents these PY2023 NEBs results only for informational purposes. Per the IESO's request, the team used Phase II study NEBs values within the PY2023 cost-effectiveness calculator rather than the PY2023 NEBs participation evaluation survey values. This allows the IESO to collect additional NEB data in future evaluation years.

7.2.1 Key Findings

The NEBs analysis included the following key findings:

- Using the **hybrid, minimum approach,** PY2023 NEB values were $0.04/kWh for reduced building and equipment operations and maintenance (O&M), $0.02/kWh for thermal comfort, $0.001/kWh for improved air quality, and $0.004/kWh for reduced spoilage.

7.2.2 Quantified NEBs Values

The PY2023 Retrofit participant survey included 125 participants that experienced at least one NEB from measures installed through the Retrofit Program. The Retrofit participant survey asked about participants' experiences with four NEBs:

- **Reduced building and equipment O&M:** Reduced labour or other costs associated with reduced operations and maintenance to maintain building systems.
- **Thermal comfort:** Improving the building's ability 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 of PY2023 participants (86%) experienced NEBs from reduced building and equipment O&M. Over one-fourth (26%) experienced NEBs from improved thermal comfort, nearly one-tenth (9%) experienced NEBs from improved indoor air quality, and three participants (2%) experienced NEBs from reduced spoilage, as shown in Figure 7-1.

Figure 7-1: Participant Observation of NEBs, Phase II, PY2021, PY2023 and PY2022

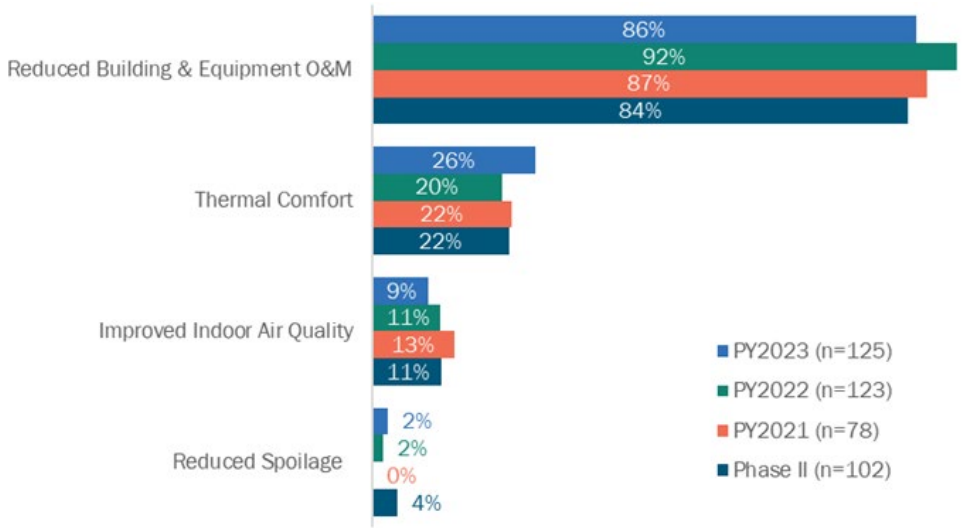


Table 7-2 presents quantified NEBs values for Phase II, PY2021, PY2022, and PY2023, based on the hybrid, minimum ($/kWh) valuation—the approach recommended by the Phase II study.[17] Note that quantified NEBs from the Phase II study combined participants from the

[17] 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

Retrofit and Small Business Lighting programs, but the PY2021, PY2022, and PY2023 results only included Retrofit Program participants.

As in the previous studies, Retrofit participants in PY2023 assigned the highest values to reduced building and equipment O&M NEBs ($0.04/kWh), followed by thermal comfort ($0.02/kWh), improved air quality ($0.001/kWh), and reduced spoilage ($0.004/kWh).

This participant feedback proved similar to NEBs that contractors reported their customers might have experienced due to participation in the Retrofit Program. Over three-fourths of contractors (79%) indicated that their customers experienced reduced building and equipment O&M, and almost all ranked this as the most important NEB to their customers. More than two-fifths of contractors (43%) indicated their customers experienced improved thermal comfort. Figure G-1 in Appendix G.2 provides all contractor feedback associated with the NEBs.

Table 7-2: Quantified NEBs ($/kWh), Phase II, PY2021-P1, & PY2022

NEB	PY2023 (Retrofit Only)	PY2022 (Retrofit Only)	PY2021 (Retrofit Only)	Phase II (Retrofit & SBL)
Reduced building and equipment O&M	$0.04	$0.05	$0.20	$0.08
Thermal comfort	$0.02	$0.02	$0.07	$0.05
Improved indoor air quality	$0.001	$0.01	$0.02	$0.007
Reduced spoilage	$0.004	$0.0005	-	$0.0002

The Phase II study found that program participants placed significant value on NEBs. In many cases, NEBs' value exceeded the value of participants' energy savings. This also took place in PY2023, with most respondents reporting NEBs having an equal or higher value on an annual basis than their electricity bill or savings. Furthermore, when asked if they would be willing to pay for a certain benefit independently from the energy savings, nearly two-fifths (39%) 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 energy-efficiency participation or contribute to customers' positive experiences with such programs.

7.3 Job Impacts

7.3.1 Key Findings

The PY23 Jobs Impacts approach included the following key findings:

- The analysis used an input-output model, which estimated that the CF Retrofit will create 3,423 total jobs in Canada, 3,062 of which will be in Ontario.
- $1M in program investments resulted in the creation of 60.1 jobs, compared to 81.6 jobs in PY22.
- 202 out of 3,423 (5.9%) of jobs impacts were realized in the first year – 104 of the 202 first year jobs impacts were due to first year savings.

7.3.2 Input Values

The evaluation team used the model to estimate the impacts from three economic shocks:

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

Table 7-4 displays input values for the demand shock, representing products and services related to the Retrofit program. The team categorized each measure installed through the program to the StatCan IO Supply and Use Product Classifications (SUPCs).

Table 7-4: Summary of Input Values for Demand Shock

Category Description	Non-Labour *($ Thousands)*	Labour *($ Thousands)*	Total Demand Shock *($ Thousands)*
Lighting fixtures	81,416	47,164	128,580
Heating and cooling equipment (except household refrigerators and freezers)	18,036	9,712	27,748
Switchgear, switchboards, relays and industrial control apparatus	17,343	9,540	26,882
Electric light bulbs and tubes	9,077	5,194	14,271
Metalworking machinery and industrial moulds	7,254	3,906	11,160
Pumps and compressors (except fluid power)	2,734	1,472	4,206

Category Description	Non-Labour *($ Thousands)*	Labour *($ Thousands)*	Total Demand Shock *($ Thousands)*
Industrial and commercial fans, blowers and air purification equipment	1,800	969	2,769
Non-metallic mineral products, n.e.c.	1,785	961	2,747
Major appliances	213	115	327
Measuring, control and scientific instruments	94	50	144
Boilers, tanks and heavy gauge metal containers	50	27	77
Other miscellaneous manufactured products	45	24	70
Agricultural, lawn and garden machinery and equipment	22	12	34
Turbines, turbine generators, and turbine generator sets	15	8	23
Subtotal	139,883	79,154	219,038
Office Administrative Services	-	-	9,903
Total			**228,940**

The business reinvestment shock was the second shock modelled using the IO Model. This shock represented the amount that businesses would reinvest and thus inject back into the economy. The amount was split over various industries to properly model the demand shock. Business reinvestment shock totaled $388.3 million over 30 different industries. Appendix F provides more detail on the business reinvestment shock, along with reinvestment values by industry.

The household expenditure shock provided the third model input.[18] This shock represented incremental increases in electricity bills to the residential sector due from funding the program. The approach assumed that IESO programs were funded by all customers in

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

proportion to the overall consumption of electricity. Thus, the residential funding portion was 35% of the $56.9M program budget or $19.9M.

7.3.3 Model Results

Generally, StatCan I-O model impacts were generated separately for each shock and added together to calculate overall program job impacts. In the case of Retrofit, this meant three different sets of job impacts were combined into the overall job impacts. Table 7-5 shows total estimated job impacts by type, combining impacts from the demand, business reinvestment, and household expenditure shocks.

Table 7-5: Total Job Impacts by Type

Job Impact Type	FTE *(in person-years)* Ontario	FTE *(in person-years)* Total	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total	Total Jobs per $1M Investment *(in person-years)*
Direct	1,544	1,592	1,708	1,759	30.9
Indirect	607	756	706	873	15.3
Induced	490	600	648	792	13.9
Total*	**2,640**	**2,948**	**3,062**	**3,423**	**60.1**

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

The majority of estimated total jobs (3,062 out of the 3,423) occurred in Ontario, with 1,708 of 1,759 direct jobs created across Canada created in Ontario. A slightly smaller proportion of indirect and induced jobs occurred in Ontario, with 706 of 873 indirect jobs and 648 of 792 induced jobs estimated to be created within the province. FTE estimates were slightly lower overall than total jobs, with a total of 2,640 FTEs (of all types) created in Ontario and 2,948 FTEs added nationwide. Almost all direct FTEs (1,544 of 1,592) were added in Ontario, with this number representing approximately 58% of the total FTEs added in Ontario and 52% of all FTEs created across Canada. In 2023, each $1M of program spending resulted in creating 60.1 total jobs, compared to 81.6 jobs per $1M in 2022.

Appendix F provides a more detailed write up of model impacts, including a breakout of impacts by industry, impacts due to first-year savings, and verbatim responses from program contractors.

8 Key Findings and Recommendations

Finding 1: Lighting measures base case MAL-assumed wattages. The evaluation team compared the average verified base case wattage estimates from the impact sample projects to MAL-deemed values for PY21 through PY23. The "Average 750-watt HID lamp/ T8 HO" base measure provided sufficient samples and low precision to support a finding. Table 8-1 presents the average deemed and verified values for the "Average 750-watt HID lamp/ T8 HO "base case wattages in the PY2023 and PY2021-PY2023 rolling population. The deemed base case wattage for this measure fell outside of the error bounds of the verified base case wattage estimates. The error bounds of the verified estimate for PY2021 to PY2023 rolling population and PY2023 population ranged from 0.34 kW to 0.40 kW and 0.32 kW to 0.38 kW respectively.

Table 8-1: Comparison of Base Case Wattages by Measure Type

Measure Type	PY23 Avg Deemed Base Case kW	PY23 Avg Verified Base Case kW	PY23 Sample Precision	PY21 to 23 Avg Verified Base Case kW	PY21 to 23 Sample Precision
Average 750-watt HID lamp/ T8 HO	0.63	0.35	8%	0.37	8%

- **Recommendation 1:** Consider updating the base case wattage MAL assumption for the "Average 750-watt HID lamp/ T8 HO" to better align with the evaluation verified base case wattages.

Finding 2: Conservation case wattages for horticultural lighting measures. The differences between deemed and verified conservation case wattages are drivers of the low average realization rate for Lighting greenhouse measures. To obtain a comprehensive understanding, the combined results from PY2021, PY2022, and PY2023 were utilized to verify the conservation case wattages for each horticultural lighting measure. The average deemed and verified values for conservation case wattages in the PY2023 and PY2021-PY2023 rolling population with their respective precision values (at 90% confidence) are presented in Table 8-2 below. Analysis results do not include the LED grow lights - cannabis warehouses measure due to their limited sample size. The deemed conservation wattage for vegetable LED grow lights fell outside of the error bounds of the verified conservation wattage estimate. The error bounds of the verified estimate for LED grow lights—vegetable greenhouses, range from 0.57 kW to 0.64 kW.

Table 8-2: Comparison of Conservation Case Wattage by Measure Type

Measure Type	PY23 Avg Deemed Conservation Case kW	PY23 Avg Verified Conservation Case kW	PY23 Sample Precision	PY 21 to 23 Avg Verified Conservation Case kW	PY21 to 23 Sample Precision
LED GROW LIGHTS – VEGETABLE GREENHOUSES	0.54	0.59	6.1%	0.60	5.7%

While inter-lighting LEDs exhibited a similar trend, their sample error bounds are not sufficient to support a recommendation. In PY2023, verified inter-lighting LEDs conservation case measures fell within the sample error bound (i.e. wide precision bound of 23%). The evaluation team will continue to monitor and gather additional data over the coming years for the inter-lighting LED grow light fixtures and provide recommendations, appropriately.

- **Recommendation 2:** It is recommended to review and consider updating the conservation case assumptions for the LED grow lights–vegetable greenhouses horticultural lighting measure to better align with verified data presented in Table 8-2.

Finding 3: An opportunity exists to increase uptake and savings by deepening relationships with key sectors interested in non-lighting equipment. IESO staff explained that they were working to develop direct relationships with relevant organizations associated within the various business sectors eligible for the program. IESO staff, delivery vendors, and applicant representatives and contractors suggested that the commercial and industrial sectors (11 applicant representatives and contractors; one delivery vendor) and multifamily residential sectors (five applicant representatives and contractors; one delivery vendor) would be most interested in non-lighting equipment. In addition, four applicant representatives mentioned the food/agricultural sector and the municipal sectors. Applicant representatives and contractors thought the commercial/industrial and multifamily residential sector might be most interested in HVAC upgrades (eight and four respondents, respectively), ventilation upgrades (three respondents) for the food/agricultural sector, HVAC upgrades (two respondents), and insulation (two respondents) for the municipal sector. One delivery vendor mentioned that VFDs, motors, pumps, heat pumps, cooling systems, and highly specialized, sector-specific non-lighting equipment might be of interest to these sectors.

- **Recommendation 3a**: As part of these relationship-building efforts with key business sectors and associated organizations, further explore which non-lighting measures most interest them and what program participation barriers they may face.
- **Recommendation 3b**: Analyze participation data to identify any sector-level participation gaps that could be addressed by targeted marketing or outreach. For

example, the recent address standardization update within the Retrofit Portal may make it easier to cross-check participants against population data (e.g., sector-specific lists of hospitals, institutions, etc.) to reveal sectors that show the most uptake potential.

- **Recommendation 3c**: Consider consumer-to-consumer outreach and marketing strategies to encourage past participants to help promote the program to their peers. An example of this may be to create an e-mail template or social media post describing the program that the participant could easily share with their networks (e.g., other businesses in their sector, sector-related organizations, other business groups). Participants could be encouraged to customize the e-mail or post to indicate which upgrades they completed, or savings achieved.

Finding 4. Additional IESO-supported training as well as assistance with qualifications and certifications could make applicant representatives and contractors even better resources for participants. IESO staff and delivery vendors said contractors greatly impacted customers' decisions to install equipment, and that most contractors could adequately explain the benefits to customers. However, they noted that some could use more training and suggested specific training on equipment less familiar to contractors (i.e., heat pumps). Most participants (58%) heard about the program through a contractor or equipment vendor and indicated that the information or recommendations they received from a contractor, vendor, or supplier was an "extremely influential" or "very influential" factor on their company's decision to do the upgrades (66% for Prescriptive, 72% for Custom). Nearly one-third (31%) of applicant representatives and contractors did not receive any training. Of those that received training, only 44% said they were "completely satisfied" or "somewhat satisfied" with the program training and education. They often suggested further training on offerings associated with the program (40%) and the application process (35%), and program rules (33%). Some said they would be interested in additional qualifications, certifications, or credentials, such as IESO-specific certifications for applicant representatives (4%), energy audit training (2%), and energy modeling software packages (2%). One IESO staff member recommended a centralized market actor network to better communicate program changes and to more easily generate feedback. Similarly, another IESO staff member said further outreach to market actors in the non-lighting sector would be the most important improvement the program could make.

- **Recommendation 4a**: Identify opportunities to support applicant representatives and contractors in pursuing additional qualifications, certifications, or credentials that may interest them (e.g., IESO-specific certifications for applicant representatives, energy audit training, or training on and/or support in purchasing energy modeling software packages).
- **Recommendation 4b**: Consider developing a centralized market actor network to ensure contractors, distributors, suppliers, and manufacturers are well informed

about the program and any changes, receive the training they may need, and facilitate quicker and easier communication. This network could be supported by an online portal where market actors, delivery vendors, and IESO are the users. The portal could serve as a repository of information that is shared, including materials from trainings and other communications.

Finding 5. Increased prescriptive incentives may be leading some customers to choose the Prescriptive track over the Custom track. The program experienced several significant modifications in PY2023. Two of these changes included the following: (1) shifting from a Prescriptive-only delivery model in May, when a custom track was added for lighting and non-lighting equipment; and (2) increasing incentives for non-lighting equipment through the prescriptive track in October. Most delivery vendors and IESO staff did not believe that incentive increase for prescriptive projects impacted the Custom track negatively. One delivery vendor said some customers changed their projects from Custom to Prescriptive when the Prescriptive increase occurred; they indicated that this, in turn, resulted in some projects claiming fewer savings than might have been realized through the Custom track. The Prescriptive track offering a higher incentive was mentioned by a relatively small percentage of applicant representative and contactors (13%) and participants (13%) as a reason for participants not completing projects through the Custom track. To minimize the risk of missed savings opportunities, a delivery vendor suggested identifying ways to ensure the Prescriptive and Custom tracks were equally attractive to customers.

- **Recommendation 5**: Continue monitoring the balance between Prescriptive and Custom incentives such that each stream is attractive to potential participants while being cost-effective.

Finding 6. Additional equipment and services were suggested to help increase non-lighting applications. Nearly three-fourths of applicant representatives and contractors (69%) indicated their customers could typically install all equipment in which they displayed interest. These respondents, however, also provided numerous suggestions for additional non-lighting equipment and support services, including batteries (14%), controls and sensors (9%), solar PV (9%), hiring additional technical reviewers (5%), building automation systems (5%), and energy management systems (5%). Nearly two-fifths of participants (39%) provided non-lighting equipment suggestions, including additional HVAC equipment (35%), additional types of heat pumps (14%), automation systems/controls (11%), and solar PV/wind (11%). IESO and delivery vendor staff suggested including energy audits and energy management systems (especially for industrial facilities or large commercial customers); solar; controls; and additional HVAC equipment.

- **Recommendation 6:** Explore the feasibility of incorporating additional non-lighting Prescriptive incentives for equipment that aligns with program goals and cost-effectiveness targets. Refer to **Recommendation 3a** which suggests exploring which non-lighting measures would be of the most interest to business sectors with the most potential for increased uptake and savings.

Finding 7: In Suite Temperature Controls (ISTC) deemed assumptions and delivery. During the PY2023 evaluation, nine out of the 27 ISTC projects were evaluated. Only one evaluated project had electric space heating and cooling, as required by the measure eligibility criteria. Six projects had electric space heating without cooling, and two projects had electric space cooling with gas heating. Additionally, ISTC measure assumptions provide energy and demand savings for each thermostat or ISTC installed controlling the entire conditioned space heating and cooling load. However, in the evaluated applications with only space heating, an average of 2.4 thermostats were installed per multi-residential unit, and in applications with only space cooling, an average of 1.2 thermostats were installed per multi-residential unit.

- **Recommendation 7**: Consider limiting the available participant incentive to one programmable thermostat and/or occupancy sensor per multi-residential unit.

Note: a recommendation to ensure delivery agents and technical reviewers are aware of measure eligibility criteria and program rules was included in the PY2022 evaluation. In response to the recommendation in PY2022, this has been addressed with vendors, and they have been informed to enforce the measure eligibility criteria.

Finding 8: Variable Speed Drive and Variable Displacement Compressed Air Prescriptive Energy and Demand Savings. The MSS for these measures state "Variable Displacement savings is assumed to be 80% of the VSD Compressor." However, the Prescriptive energy and demand savings table shows VSD Compressor savings to be 80% of the Variable Displacement compressor savings.

- **Recommendation 8**: Consider updating the Prescriptive energy and demand savings of the Compressed Air VD/VSD measures to correct for the error, so VD Compressor savings are 80% of VSD Compressor savings, as intended.

Finding 9: The current equipment offerings generally meet the needs of most greenhouse customers, though some suggestions were provided for consideration. Suggestions for additional energy-efficient equipment to consider including in the Greenhouse Stream varied and included offering broader types of DER measures (one IESO staff member), adding programmable light fixtures with customizable color rendering (one IESO staff member), expanding the lighting offerings beyond the DesignLights

Consortium's (DLC) greenhouse qualified products list (one IESO staff member), expanding the solar panels with battery storage offering to more areas in the province (one delivery vendor and one surveyed participant), co-generation (one IESO staff member and one surveyed participant), sand batteries (one surveyed participant), and including a solar-only offering for customers who cannot afford or do not want to install the battery component (one delivery vendor).

- **Recommendation 9a:** Explore the feasibility of incentivizing additional equipment recommended by interviewees and survey respondents (e.g., broader DER measures, programmable light fixtures with customizable color rendering, expanding the lighting offerings beyond the DLC greenhouse qualified products list, sand batteries).
- **Recommendation 9b:** Explore the feasibility of expanding the solar panel with battery storage offering to other areas in Ontario that are experiencing or may soon experience grid constraint.
- **Recommendation 9c:** Conduct additional research around grower interest in adding a solar-only offering alongside the Greenhouse Stream's current solar panel with battery storage offering.

Finding 10: A hesitancy to adopt new equipment among greenhouse customers is likely impacting program participation. Two IESO staff member reported that many growers are risk averse and hesitant to adopt new equipment even if they know it will save them energy given concerns about the potential for negative impacts that new equipment may have on their produce in terms of color, taste, or texture. One IESO staff member noted that the related manufacturers have done a lot of their own testing to prove that different lighting offerings would not have a negative impact on a variety of produce.

- **Recommendation 10:** Increase educational efforts around current program offerings to ease customer hesitancy around trying new equipment. For example, this may include working with manufacturers to communicate the results of the lighting demonstrations they have conducted on a variety of produce or expanding the catalogue of case studies to include greenhouse participants who grow different product types.

Finding 11: Horticultural lighting measures annual HOU. The deemed annual HOU for horticultural lighting measures in the Measure Substation Sheets are inconsistent with the deemed annual HOU observed in the Greenhouse Advanced Lighting Control measure. For instance, deemed HOU for horticultural inter-lighting is assumed to be 5,327 hours, while the deemed HOU in the greenhouse advanced lighting control measure assumptions is assumed to be 2,848 hours for lights serving tomatoes, 3,339 hours for lights serving peppers and 2,784 hours for lights serving cucumbers.

- **Recommendation 11a:** Consider updating horticultural lighting measures annual HOU to be consistent with other greenhouse lighting measures to ensure consistency.
- **Recommendation 11b:** Review and consider updating the prescriptive application worksheet to a quasi-prescriptive approach in which the participant is asked to input the crop type served by the lighting as well as the conservation case wattage into the application. This would allow for a more accurate determination of the appropriate annual HOU for projects with varying crop types, and thereby increase the likelihood that the deemed energy savings will more accurately represent actual realized energy savings.

Finding 12: Photon flux baseline assumptions. The current LED grow lights baseline uses a 1,000-watt high-pressure sodium (HPS) fixture for the LED grow lights in vegetable greenhouses. Studies indicate that the photon flux of an HPS fixture can be approximated to be 1.3 to 1.7 times its wattage, resulting in an expected baseline photon flux of 1,300 to 1,700 µmol/s. However, the verified photon flux for the conservation case fixtures is approximately 2,700 µmol/s. This discrepancy indicates that facilities are installing fixtures that can provide more lighting output than needed through an HPS. This also further explain the higher verified conservation case wattage as discussed in **Finding 2**. The photon flux should remain consistent between the baseline and conservation case lighting.

- **Recommendation 12a:** Review and consider updating the algorithm used to calculate the baseline photon flux based on fixture wattage. The combined results of EM&V from multiple years can be utilized to determine the appropriate calculation methodology, as they involve the collection and analysis of actual data during the evaluation of horticultural measures
- **Recommendation 12b:** Review and consider updating the prescriptive application worksheet to a quasi-prescriptive approach in which the participant is asked to input the photon flux (umol/s) and conservation case wattage into the application. This would allow for a more thorough and accurate review of the correlation between photon flux and fixture wattage and adjust the algorithm used to calculate the baseline photon flux as suggested above.

Finding 13: Some customers would be interested in an offering for ground solar panels with battery storage. When asked if they believe that including ground solar panels with battery storage as an offering would drive additional interest, one IESO staff member said that the opportunity cost for growers is high given that it is often more profitable for them to use their ground space for growing products. Another IESO staff member thought that the lack of an incentive for ground solar panels may be a barrier to participation for some customers who may prefer that option due to lack of roof space. This same respondent noted, however, that there may be challenges to ground solar installation

if the land is zoned as agricultural. Five out of thirteen surveyed participants reported interest in a potential ground solar with battery storage option. Surveyed participants who were not interested in this option most frequently mentioned cost-related issues (six respondents) and the related projects requiring too much land space (two respondents) as reasons for disinterest[19].

Finding 14: The Greenhouse Stream incentive delivery approach appears to be working well for most participants. Surveyed participants were asked whether they would have been willing to accept a slightly lower incentive or a significantly lower incentive if the Greenhouse Stream had provided it to them at the time they purchased the eligible equipment, as opposed to waiting for the incentive until after the work was complete (which aligns with the current approach). Over one-half of participants (7 out of 13) indicated that they would not have accepted a lower incentive if it were offered immediately upon purchasing the eligible equipment. A smaller portion (three respondents) expressed a willingness to accept a slightly lower incentive under these circumstances, and the remainder (three respondents) did not know what they would have done. This feedback may suggest that the current downstream incentive delivery approach may be working well for most customers[20].

[19] The Evaluation Team had originally intended to provide a recommendation to consider including a ground solar panel with battery storage offering in addition to the existing rooftop solar panel with battery storage offering. However, no recommendation is provided given that the Evaluation Team has learned from the IESO that the program has since allowed participating customers to install ground solar panels with battery storage on a case-by-case basis. To do so, the participant is required to have municipal approval and to site the solar equipment next to the structure it supplies energy to and not on agricultural land.

[20] The Evaluation Team does not provide a recommendation for this key finding since most surveyed participants found the Greenhouse Stream's downstream incentive approach to be working well from their perspective. However, if the program would like to explore other delivery approaches for the Greenhouse Stream, more research into participant, contractor, and delivery vendor perspectives would be warranted.

9 Progress Updates on Previous Recommendations

This section provides progress updates on common process evaluation research topics. These topics have typically been included as Key Findings and Recommendations in previous year's evaluation reports. As monitoring these topics may be of continued interest, they are included here for additional consideration.

Process Progress Update 1: While recent non-lighting incentive changes have helped generate additional participation, incentives levels still limit the scope of upgrades completed for some customers. More than one-fourth of participants (27%) decided not to install energy-efficient equipment that was initially of interest to them. Participants most frequently decided not to install building automation and energy management systems, air conditioners, and motor/pump upgrades. More than one-third of participants (35%) reported insufficient program incentives as the main reason for not installing all energy-efficient equipment initially of interest to them. Less than one-fifth of applicant representatives and contractors (17%) indicated there were non-lighting measures, such as refrigeration and motors, that customers often did not install due to concerns related to their associated incentive levels. About one-third of participants who completed non-lighting prescriptive and non-lighting custom projects (30% and 35%, respectively) reported that only 1-10% of their non-lighting upgrades were covered by the program. Applicant representatives and contractors reported that fan motors, chillers, HVAC controls, industrial machinery, and refrigeration had the lowest average program project cost coverage (ranging from 5% to 7% of project costs covered).

- **Improvement Opportunity 1:** Continue to monitor incentive levels, rising costs, and the average percentage of project costs covered by the program for key non-lighting measures of interest to ensure they are not limiting, leading to significant constraints to the scope of customer projects.

Process Progress Update 2: Continued opportunities exist to expand program marketing and outreach. Given the many program changes that occurred in PY2023, IESO staff reported that marketing and outreach activities increased to ensure customers remained aware of these changes. These activities typically focused on offering additional webinars, newsletters, and digital promotional tactics, though IESO staff noted that they also worked to develop direct relationships with relevant organizations associated within the various business sectors eligible for the program. According to close to three-fourths of applicant representatives and contractors (73%), the most common way that customers learned of the program was through their companies contacting them directly. Applicant representatives and contractors also provided the lowest satisfaction rating to program marketing and outreach (33% with a rating of four or five on a scale of one to five, where one indicates "not satisfied at all" and five indicates "completely satisfied"). Delivery vendors

stressed the continued importance of customer education and awareness building. They noted that, in addition to informational webinars, case studies and video testimonials have been very effective, and they recommended developing more of this content, featuring additional business sectors and equipment types. Similarly, one-fifth of application representatives and contractors (19%) recommended improving and increasing IESO's marketing.

- **Improvement Opportunity 2:** Consider increasing the variety and frequency of marketing efforts across different mediums (e.g., social media; paid digital advertisements; mass media tactics [radio, TV, billboards]; in-person events).

Impact Progress Update 3: Conservation case MAL update for *"LED HIGH BAY FIXTURE >= 20,100 Lumens & < 305W."* During the PY2022 evaluation, a recommendation to consider updating the MAL conservation case wattage for the "LED HIGH BAY FIXTURE >= 20,100 Lumens & < 305W" from 0.194 kW to 0.161 kW was included in the report. In response to that recommendation, the IESO indicated conservation case wattages had been updated in the February 2024 *draft* MAL. On review of the February 2024 *draft* MAL, however, the conservation case kW for the "LED HIGH BAY FIXTURE >= 20,100 Lumens & < 305W" still reflected the original deemed value of 0.194 kW. Given that similar findings of a downward trend in this fixture's conservation wattage was observed in PY2023, the evaluation team compared average verified efficient case wattage estimates incorporating a rolling population of PY2021, PY2022 and PY2023 projects, as presented in Table 8-5.

Table 9-1: Comparison of Conservation Case Wattages by Measure Type

Conservation Measure	PY23 Avg Deemed Conservation kW	PY22 Avg Verified Conservation kW	PY23 Avg Verified Conservation kW	PY23 Sample Precision	PY21 to 23 Avg Verified Conservation kW	PY21 to 23 Sample Precision
LED High-Bay Fixture >= 20,100 Lumens & < 305W	0.194	0.161	0.168	4%	0.165	3%

- **Improvement Opportunity 3**: Ensure the conservation case wattage assumption for the "LED HIGH BAY FIXTURE >= 20,100 Lumens & < 305W" measure is updated in the latest MAL and consider updating it to 0.165 kW instead of 0.161 kW, as supported by additional data in PY2023.

Appendix A Impact Evaluation Methodology

A.1 Sample Plan

Independently verifying energy and demand savings and attributing these savings first requires selecting sample projects representing the program's population. 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 0.5 coefficient of variation (CV).

A.2 Project Counts

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

- Application identification (ID)
- Stream type (Custom, Prescriptive, Greenhouses)
- 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, the evaluation team completed project audits representing the entire Retrofit population. Sampled projects received Level 1 audits, consisting of desk reviews of project documentation from the program delivery vendor. These documents included project applications, equipment specification sheets, notes on equipment installed, invoices for equipment, and any other documentation submitted to the program.

Evaluation of the Retrofit program often included Level 2 audits, using on-site visits and metering to estimate equipment HOU and operational loads. A subset of sampled projects

received Level 2 audits, where a Resource Innovations engineer visited the facility to confirm equipment installation, gather metering/trend data, and interview participants to confirm key details of the project, operating patterns, and schedules.

A.4 Reported Savings

Gross reported savings were energy and summer peak demand savings derived from information submitted on participant applications. They reflected 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 were verified for all sampled projects and relied on data collected and verified during the project audit. This information was evaluated utilizing analytical tools to determine savings attributable to each project. For a specific stratum, verified savings were compared to reported savings to define the stratum realization rate. This realization rate was 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

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

Where:

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

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

Total verified savings reflected the program's operations' direct energy and demand impacts. However, these savings did 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 were 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 consumed less energy. It was understood, however, that the equipment's energy consumption in an enclosed space could not 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 benefits provided by the program. Examining cross-system interactions provides a comprehensive view of building-level energy changes, rather than limiting analysis to the energy change that directly relates to the modified equipment. The IESO 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 changes in the operation of HVAC equipment due to lower heat loss from energy-efficient lighting equipment.

A.7 Lifetime Savings

When performing the impact evaluation, total savings had to be considered over the retrofitted equipment's lifetime, given that energy savings, demand savings, avoided energy costs, and other benefits continued to accrue each year that the equipment remained in service. Equation A-2 presents the method for calculating lifetime energy savings of a measure level.

Equation A-2: Lifetime Energy Savings

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

Where:

EUL = Estimated useful life of the retrofitted equipment

Appendix B Net-to-Gross Methodology

This appendix provides detail on the sampling plans for collecting NTG data, the instruments used to assess FR and SO, the implementation of the data collection, and the analysis methods.

The evaluation team developed an effective questionnaire to assess FR and SO, an approach 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.

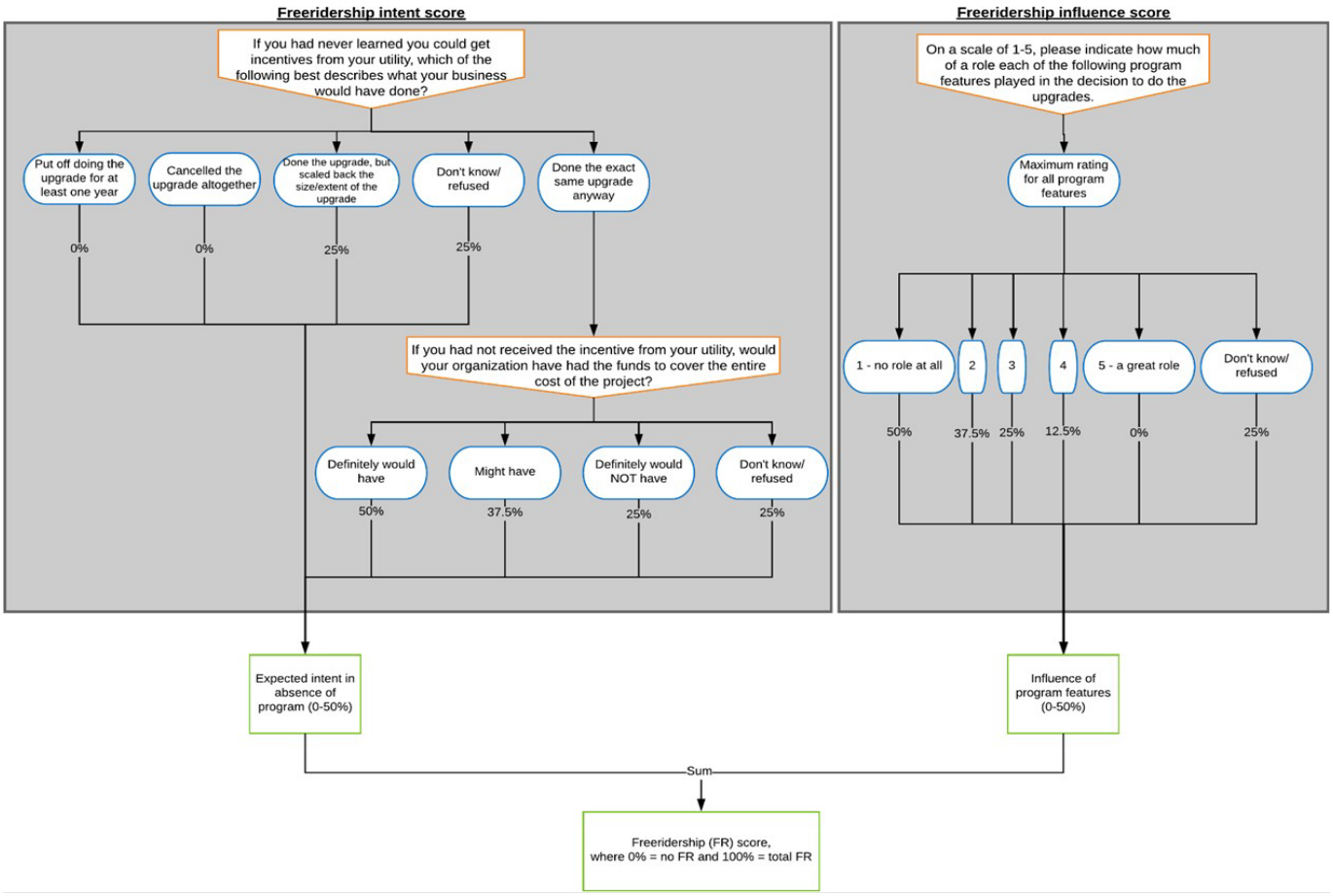
B.1 Free-Ridership Methodology

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 produced scores ranging from 0 to 50. The two components were summed to produce a total FR score ranging from 0 (not a free-rider) to 100 (complete free-rider). The total score was 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 asked participants how the evaluated project would have differed in the program's absence. Two key questions determined the intention score:

> 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 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 received 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 the respondent answered 3 (would have done the project but scaled back the size or extent) or stated did not know or refused the question, the respondent received an FR intention score of 25% (associated with moderate FR). If the respondent answered 4 (would have done the exact same project anyway), they were asked the second question before an FR intention score could be assigned.

The second question asked participants whether 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 received an FR intention score of 25% (associated with moderate FR).

The bullet points below display the same FR intention scoring approach as a list. As noted, an intention score was calculated for each respondent, ranging from 0% to 50%, based on the respondent's report of how the project would have changed in the program's absence:

- 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 asked each respondent to rate how much of a role various potential program-related influence factors had on their decision to do the upgrades in question. Influence was reported using a scale from one to five, where one indicates "it played no role at all" and five indicates "it played a great role." The potential influence included 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, 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 (e.g., email, direct mail)
- 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 was 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 was considered to have had a great role in their decisions to do upgrades, and the influence component of FR was 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 following bullet points display the same FR Influence scoring approach in a list form. As discussed, for each project, a program influence score was calculated, ranging from 0% to 50%, based on the highest influence rating given among 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%

Intention and program influence scores were summed for each project to generate an FR score ranging from 0 to 100. The scores were 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 performed without a program incentive following their participation in the program. Equipment-specific details assessed follow:

- ENERGY STAR Appliance: type and quantity
- Fan: type, size, quantity
- HVAC: air conditioner replacement, above code minimum: tonnage and quantity
- Lighting: type, quantity, wattage, HOU, location, and fixture length
- Lighting—controls: type of control, type and quantity of lights connected to control, HOU, and percentage of time the timer turned 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 upgrades, sizes, quantities, HOU

For each equipment type the respondent reported installing without a program incentive, the survey instrument asked about the extent of influence that earlier involvement in the program had on their decisions to carry out upgrades. Influence was reported using a scale from one to five, where one indicated "it played no role at all" and five indicated "it played a great role." If the influence score was between 3 and 5 for a particular equipment type, the survey instrument solicited details about 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:

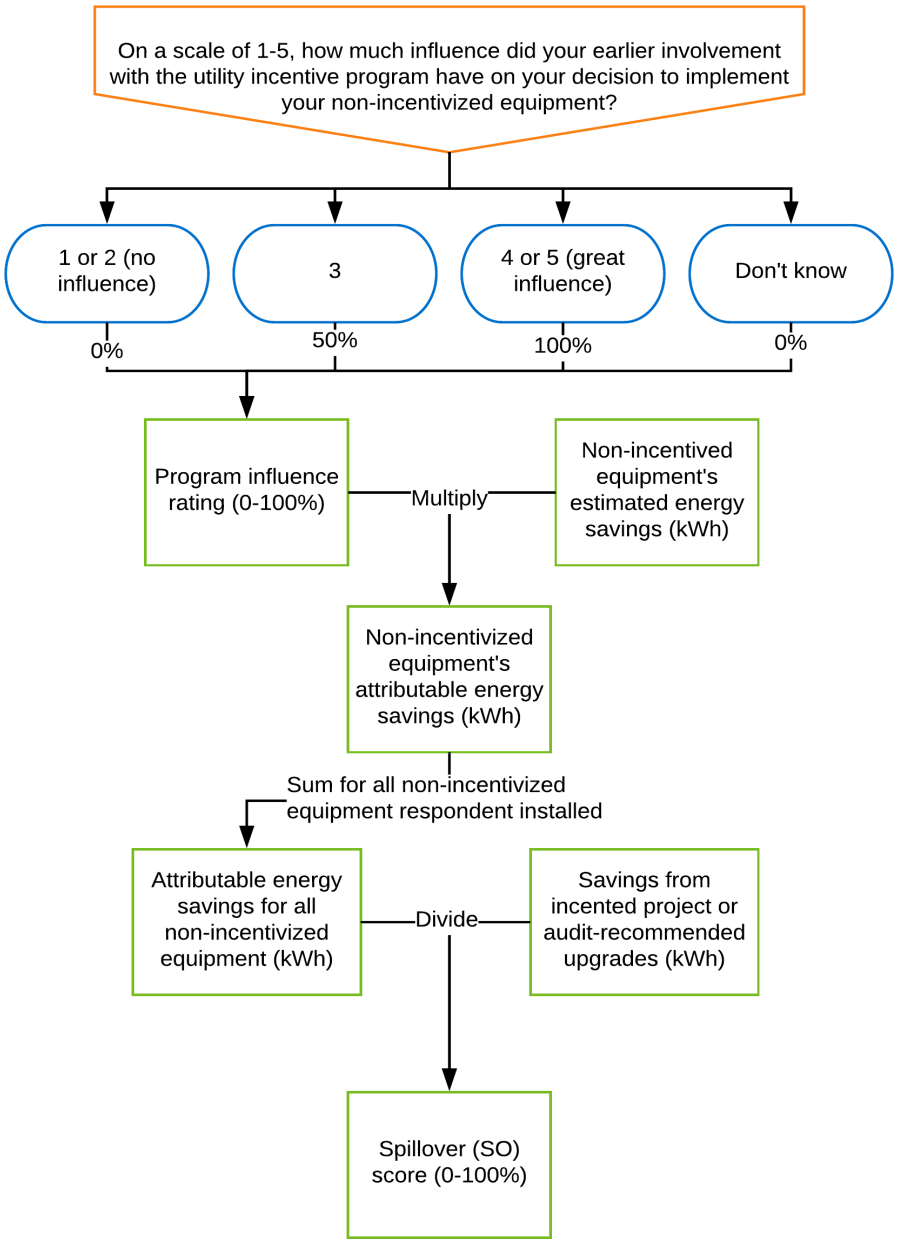
- Maximum rating of 1 or 2 (no influence) = 0%
- Maximum rating of 3 = 50%
- Maximum rating of 4 or 5 (great influence) = 100%
- Respondent does not know how much influence any factor had = 0%

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 projects completed through the Retrofit Program during the program year. This approach allowed for applying the respondent's

NTG value across all the projects they completed during the program year rather than a single 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 was an employee of the company. If the person was not an employee of the company, they were asked to forward the survey web link to someone at the company who is able to respond.
- Whether the respondent had primary or shared responsibility for the budget or expenditure decisions for program-incentivized work completed at their company.
- The respondent's job title.
- When the respondent first learned about program incentives relative to the upgrade in question (i.e., 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 work was started or completed, if applicable.
- How the respondent learned about the program.

Responses to these questions were not included in the algorithms for calculating FR or SO, but they provided additional context. The first question ensured that the appropriate person responded to the survey. The other questions provided feedback about the 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 responded to the web survey or deactivating the respondent's survey web link if they 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 their organizations. If the contact was not involved in decisions about upgrading equipment, the interviewer asked to be

transferred to or to receive 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 details about the process evaluation methodology. Section 3.2 summarizes the methodology.

C.1 Research Question Development

Table C-1 provides a list of key research questions and data sources used to investigate each of these. The research questions were developed at the beginning of the PY2023 evaluation period, in January and February 2024. They were written in consultation with the IESO program and the IESO EM&V staff and were finalized after reviewing the timing of 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 Questions 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?		✓		
What strategies implemented by the IESO were effective in terms of driving participation, increasing program awareness, and avoiding free-ridership?		✓		
What program marketing and outreach occurred in support of the program? How did participants become aware of the program? What specific marketing or outreach activities show the most opportunity?		✓	✓	✓

Research Questions	Document and Program Records Review	IESO & Delivery Vendor Staff Interviews	Participant Surveys	Applicant Representative & Contractor Surveys
What were the experiences of applicant representatives and contractors in participating in the program?				✓
What are the program strengths, barriers, and areas of improvement?		✓	✓	✓
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 sectors/businesses are most likely to express interest in non-lighting upgrades if marketing and outreach were specifically targeted to them? Which measures are these sectors/businesses most interested in (including but not limited to non-lighting measures IESO already offers) and which measures would be the most valuable to promote to them?		✓	✓	✓
For non-lighting measures, what incentive levels would be appropriate to drive additional uptake and demand savings while remaining cost effective?		✓		✓
Has lighting and non-lighting contractor engagement increased or decreased over time, and if so, why?		✓		✓
What tactics were the most successful at engaging app reps?		✓		✓
Past surveys have suggested applicant representatives and contractors would benefit from more training on the offerings associated with the program. What offerings specifically would they be interested in learning more about (e.g. measures that are eligible)?				✓
What are the reasons for decisions not to install energy-efficient equipment above code minimums (e.g., lack of qualified HVAC contractors or types of measures to install above code minimum)?			✓	✓
What is the impact of contractors on the participant's decision to install or not install energy efficient equipment (e.g. do they have the appropriate qualifications and technical trainings? Are they able to explain the benefits of efficient equipment)? If there is a gap in qualifications and technical training, what gaps exist and what tactics could be employed to bridge these gaps?	✓	✓	✓	✓

Research Questions	Document and Program Records Review	IESO & Delivery Vendor Staff Interviews	Participant Surveys	Applicant Representative & Contractor Surveys
What additional equipment types or models would be suggested to increase non-lighting applications? How does IESO's prescriptive measures list compare to other jurisdictions?				✓
Has the increase to Prescriptive incentives had an impact on Custom stream uptake? Is there a risk of cannibalization? If so, is this the case for certain measures/ types of measures only, or across the board?		✓	✓	✓
Which additional horticultural measures and incentives could be added to the program in the future? What is the awareness of rooftop solar panel offerings? Is there interest in ground solar panels?		✓	✓	✓
Would horticultural sector participants be willing to provide additional data from their energy management systems for EM&V purposes?			✓	
Are participants aware of the DER measure? If yes, what do they think about it (either positive or negative)? If reception of DERs are negative, what barriers exist and how could they be addressed? Are the DER offerings valuable to the marketplace?			✓	
Does participation fluctuate by season? Is seasonality, particularly project size and wait time, a barrier for participants?		✓	✓	✓
Do participants make their budgeting decisions at a specific time every year? If so, when?			✓	
Would participants be more interested in participating if the incentive was upstream, and delivered to them immediately?			✓	
How many participants primarily derive their power from generators? How many are expected to connect to the grid at a later date? Should these customers be eligible to participate?			✓	

C.2 In-Depth Interview and Survey Methodology

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

telephone surveys, or telephone based IDIs, depending on that most suitable for a particular respondent group. When collected and synthesized, these data provide a comprehensive understanding of the program.

All process evaluation data collection activities were carried out or managed by the evaluation team. The team developed all survey instruments, interview guides, and sample files for interviews and surveys. IESO EM&V staff approved the survey instruments and interview guides. The data used to develop the sample files were retained from program records, supplied either by 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 Staff	Phone IDIs	7	7	100%	0%
Program Delivery Vendor Staff	Phone IDIs	3	3	100%	0%
Applicant Representatives and Contractors	Web Survey	314	48	15%	11%
Participants[21]	Web and Phone Survey	1,623	254[22]	16%	10.5%

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

IESO STAFF AND PROGRAM DELIVERY VENDOR STAFF INTERVIEWS

IDIs were completed with seven members of IESO's staff and three staff from the program delivery vendor, as shown in Table C-3. The interviews sought to better understand the perspectives of the IESO program and of program delivery vendor staff related to the program design and delivery.

[21] This includes participants from the Prescriptive stream (n=205), Custom stream (n=36), and Greenhouse stream (n=13). Note that the total number of participants by stream is greater than the total number of participants overall since some participants completed projects in multiple streams.

[22] The NTG evaluation included more respondents (n=279) than the process evaluation (n=254) as 25 respondents did not fully answer the process evaluation survey questions.

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

Disposition Report	IESO Staff	Program Delivery Vendor Staff	Total
Completes	7	3	10
No Response	0	0	0
Partial Complete	0	0	0
Bad Contact Info (No Replacement Found)	0	0	0
Total Invited to Participate	7	3	10

Interview topics included program roles and responsibilities, program design and delivery, applicant representative and contractor engagement, marketing and outreach, customer participation, horticultural measures, market impact, program strengths and weaknesses, and improvement suggestions.

The appropriate staff to interview were identified in consultation with IESO EM&V staff. Telephone IDIs were conducted with IESO staff and program delivery vendor staff using in-house staff (rather than a survey lab). The interviews were completed between April 29 to May 22, 2024. Each interview took approximately one hour to complete.

APPLICANT REPRESENTATIVE AND CONTRACTOR SURVEY

A total of 48 application representatives and contractors were surveyed from a sample of 314 unique applicant representatives and contractors, as shown in Table C-4. The survey's purpose was to better understand the applicant representatives' and contractors' perspectives on program delivery.

Table C-4: Applicant Representative and Contractor Survey Disposition

Disposition Report	Total
Completes	48
Emails bounced	15
Bad Contact Info (No Replacement Found)	0
Unsubscribed	0
Partial Complete	18
Screened Out	2
No Response	224
Total Invited to Participate	314

Survey topics included firmographics, program roles and responsibilities, how customers learned about the program, effective marketing and outreach activities, businesses or business sectors most interested in non-lighting upgrades, training and education, customer decision-making, participation barriers, equipment customers expressed interest in but could not install, percent of non-lighting category costs covered by the program, satisfaction with various program aspects, equipment offering feedback, changes in contractor engagement, program improvement suggestions, FR and SO, job impacts, and NEBs perspectives.

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.

NMR staff delivered the survey over the web, using Qualtrics survey software. Survey implementation was conducted between April 9 and May 2, 2024. The survey took an average of 17 minutes to complete after removing outliers.23 Weekly e-mail reminders were sent to non-responsive contacts through web survey fielding.

PARTICIPANT SURVEY

A total of 279 participants were surveyed from a sample of 1,623 unique contacts, as shown in Table C-5. The survey's purpose was to better understand the participants' perspectives related to the program experience.

Table C-5: Participant Survey Disposition

Disposition Report	Web	Phone
Completes	178	71
Emails bounced	47	-
Partial complete	28	2
Screened out	-	-
Unsubscribed	62	-
Voicemail	-	348
Callback	-	96
Agreed to complete online	-	85
Hard refusal	-	53

[23] The survey was designed to allow a respondent to complete at a later time 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.

Disposition Report	Web	Phone
Not available	-	36
Non-working number	-	31
No eligible respondent	-	31
Wrong number	-	8
Busy	-	4
No response	1,308	91
Total invited to participate	1,623	210

Survey topics included firmographics, how customers heard about the program, ease of participation, percent of non-lighting project costs covered by the program, equipment customers expressed interest in but decided not to install and reasons for not installing, contractor ability to install equipment of interest and explain the benefits of energy efficiency equipment, equipment recommendations, program improvement recommendations, FR and SO, and NEBs perspectives.

The sample was developed from program records provided by 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 phone and the web in partnership with Resource Innovations' survey lab, using Qualtrics survey software. NMR staff worked closely with Resource Innovations' survey lab to test the survey's programming and to perform quality checks on all data collected.

Survey implementation was conducted between April 10 and May 10, 2024. The survey took an average of 19 minutes to complete after removing outliers.[24] Weekly e-mail reminders were sent to non-responsive contacts through web survey fielding.

[24] The survey was designed to allow the respondent to come back to it at a later time if they preferred. The average survey time was calculated with this in mind and assumed 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 Additional Applicant Representative and Contractor Process Results

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

FIRMOGRAPHICS

As presented in Figure D-1, one-half (50%) of respondents worked as both an applicant representative and contractor for clients receiving their incentive in 2023. Nearly one-half of respondents (46%) worked only as applicant representatives and 4% worked only as contractors for clients who received their incentive in 2023.

Figure D-1: Respondents' Role in Retrofit Program (n=48)

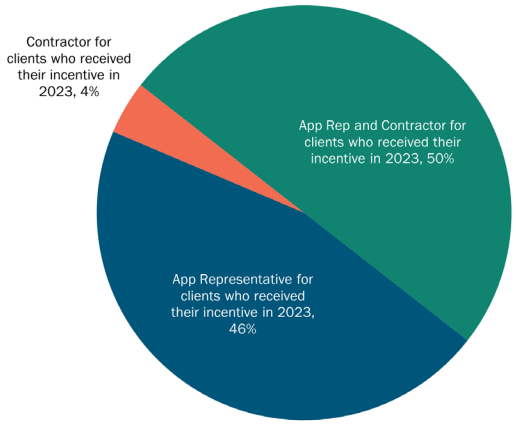


Table D-1 displays the number of full- and part-time employees at the respondents' companies. More than one-fifth (21%) were affiliated with companies with between one and five full-time positions, and nearly one-fifth (16%) were affiliated with companies that had 21 to 50 full-time positions. More than one-third of respondents (37%) reported that their

company had part-time positions. Over one-fourth of respondents (28%) were affiliated with companies with one to five part-time positions.

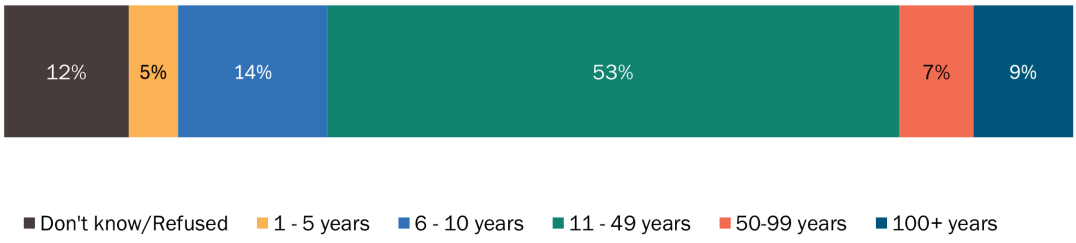
Table D-1: Respondents' Full- and Part-time Employees (n=43)*

Number of Employees	Full-Time*	Part-Time
1-5	21%	28%
6-10	9%	5%
11-20	5%	2%
21-50	16%	0%
51-100	7%	0%
101+	5%	2%

*Does not sum to 100% due to rounding.

The breakdown of the respondents' company age is presented in Figure D-2. Less than one-fifth (19%) were affiliated with companies that have been in business for ten or fewer years and close to three-fourths (70%) were affiliated with companies that have been in business for 11 years or more.

Figure D-2: Respondents' Company Age (n=43)*

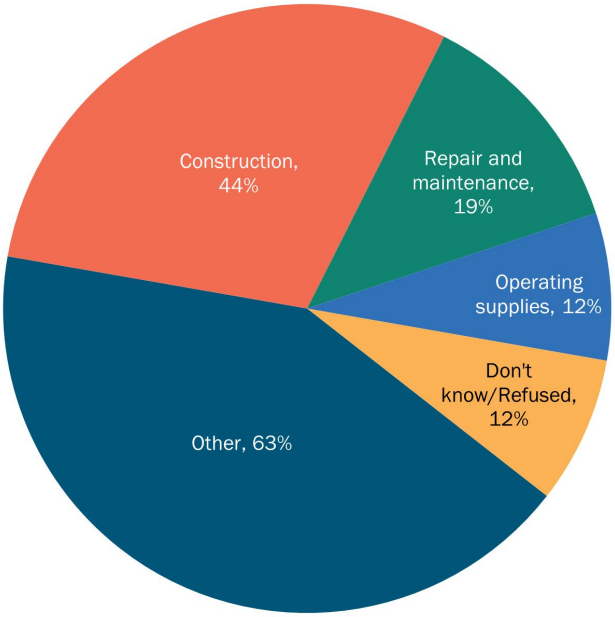


*Does not sum to 100% due to rounding.

Respondent business categories varied, as presented in Figure D-3. Nearly one-half (44%) worked in construction, close to one-fifth (19%) worked in repair and maintenance, and less than one-fifth (12%) worked in operating supplies. Most respondents (63%) indicated that their company was better represented by "other" business categories, such as electric wholesale and distribution, lighting retrofits, HVAC retrofits, sales and manufacturing, and renewable energy and conservation.

Figure D-3: Respondents' Business Category

(Open-ended and multiple responses allowed; n=43)*



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

PROJECT BACKGROUND

Applicant representatives and contractors were asked to provide background information about the projects they completed through the Retrofit Program.

Applicant Representatives

Of 46 responding applicant representatives, 36 provided estimates on the number of clients they assisted with applications. In total, applicant representatives reported representing 1,443 clients, with an average of 13 clients per respondent.[25]

Contractors

Fifteen responding contractors completed a total of 832 retrofit projects in 2023. Of these, contractors reported that over one-third (a total of 301, or 36%) were completed through

[25] One respondent who reported representing 1,000 clients was excluded. Including this respondent, applicant representatives represented an average of 40 clients each.

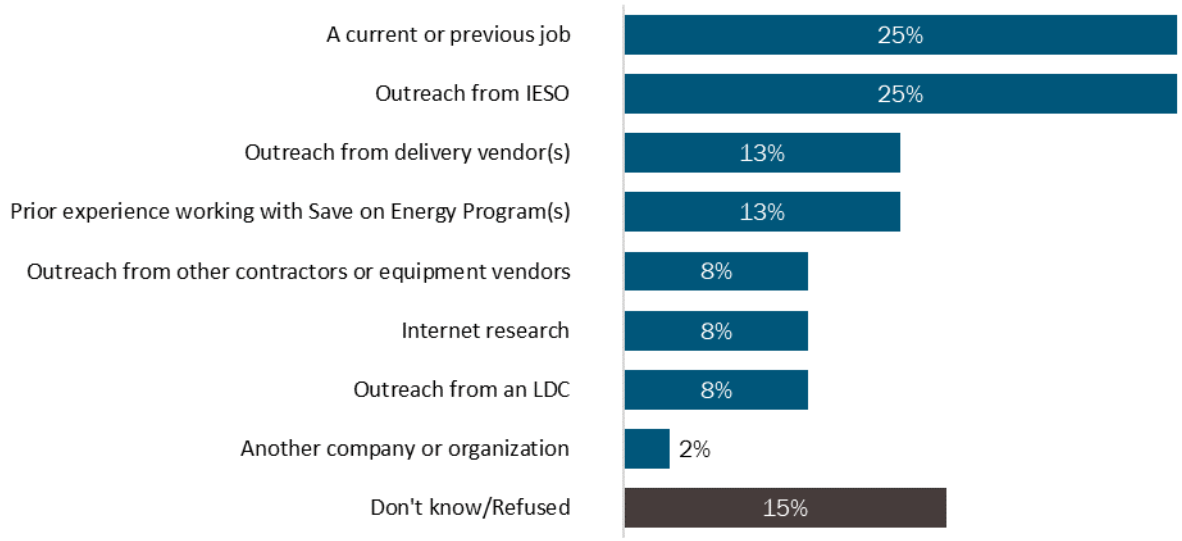
the Retrofit Program. On average, 41% of total sales went through the Retrofit Program and 33% of invoiced project costs were for labor.

PROGRAM AWARENESS

Applicant representatives and contractors reported how they became aware of the Retrofit Program (Figure D-4). Respondents most commonly learned of the program from their current or previous job (25%) or through outreach from IESO (25%). Respondents also learned about the program from outreach by delivery vendors (13%) and prior experience with a Save on Energy program (13%). Less commonly, respondents learned about the Retrofit Program from other contractors or equipment vendors (8%), their own Internet research (8%), outreach from an LDC (8%), or from another company or organization (2%). Section 6.2.2 includes an additional discussion regarding applicant representative and contractor program awareness.

Figure D-4: Applicant Representative and Contractor Awareness of the Program

(Open-ended and multiple responses allowed; n=48)*



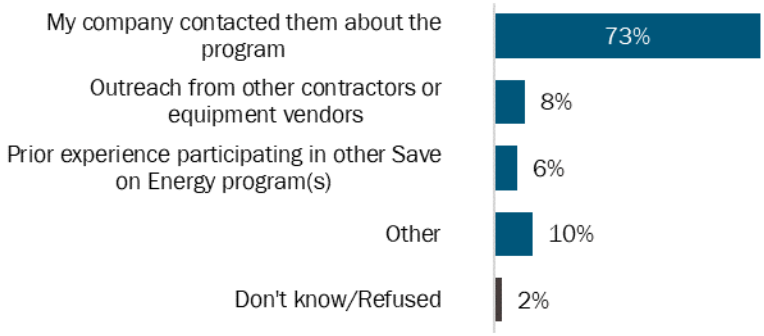
*Does not sum to 100% due to multiple responses.

Respondents reported the primary ways that their customers learned about the Retrofit Program (Figure D-5). Nearly three-fourths of respondents (73%) reported their company contacted customers about the program. Less than one-tenth (8%) of respondents said customers became aware of the program through contractors or equipment vendors (6%) or through previous participation in other Save on Energy programs (6%). Other responses included outreach from Save on Energy representatives, the Save on Energy website for the program, Save on Energy social media, a colleague or competitor, and other energy-

efficiency advertising (2% each). Section 6.2.2 includes an additional discussion regarding customer awareness.

Figure D-5: Customer Awareness of the Program

(Open-ended and multiple responses allowed; n=48)*

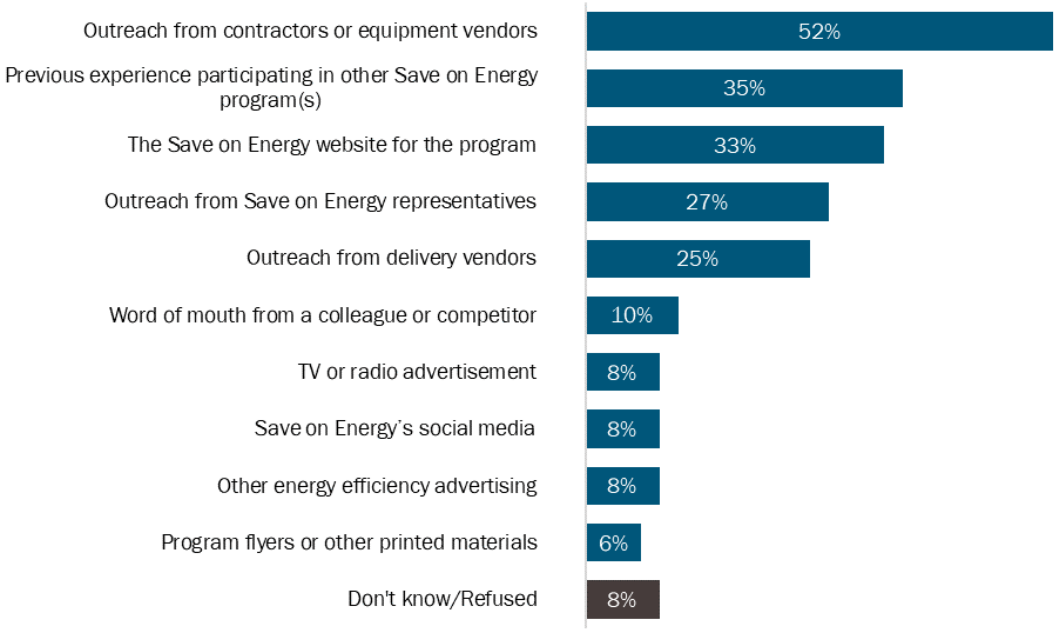


*Does not sum to 100% due to multiple responses.

Respondents were asked which marketing or outreach activities most effectively generated customer awareness of the Retrofit Program. As shown in Figure D-6, most respondents (52%) said outreach from contractors or equipment vendors proved most effective, followed by previous experience with a Save on Energy program (35%) and the Save on Energy website for the program (35%). Respondents also mentioned outreach from Save on Energy representatives (27%) and outreach from delivery vendors (25%). Less commonly, respondents cited word of mouth from a colleague or competitor (10%), a TV or radio advertisement (8%), messaging form Save on Energy social media (8%), other energy efficiency advertising (8%), and program flyers or printed materials (6%). Section 6.2.2 includes an additional discussion regarding marketing and outreach effectiveness.

Figure D-6: Most Effective Marketing and Outreach Activities

(Open-ended and multiple responses allowed; n=48)*



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

Respondents were asked to identify the types of businesses or business sectors that would be most interested in non-lighting upgrades if marketing and/or outreach were specifically directed to them, and which specific upgrades might interest them, as shown in Table D-2. Section 6.2.2 includes additional discussion regarding the types of businesses or business sectors likely to be most interested in non-lighting upgrades.

Table D-2: Business Sectors Potentially Interested in Non-Lighting Upgrades

(Open-ended and multiple responses allowed; n=16)

Suggested Businesses/ Business Sector	Suggested Non-Lighting Upgrades	Respondents
Commercial/ Industrial (n=11)	HVAC	8
	Refrigeration	2
	Lighting	1
	Ventilation	1
	Automation	1
	Batteries	1
	Cogeneration	1
	Heat Pumps	1
	Kitchen equipment	1

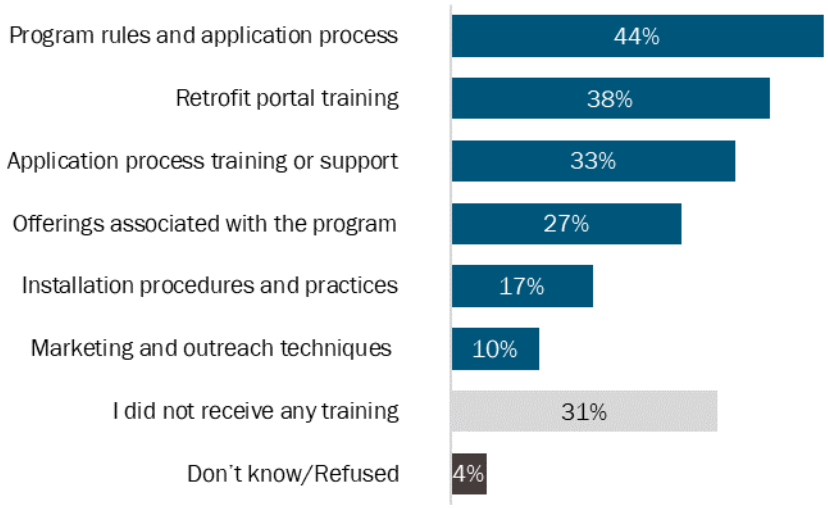
Suggested Businesses/ Business Sector	Suggested Non-Lighting Upgrades	Respondents
	Variable Frequency Drives	1
	Don't know	2
Multifamily Residential (n=5)	HVAC	4
	Lighting controls	2
	Heat Pumps	1
	Smart Thermostats	1
	Don't know	1
Food/ Agriculture (n=4)	Ventilation	3
	Batteries	1
	Food processing	1
	HVAC	1
	Refrigeration	1
Municipal (n=4)	HVAC	2
	Insulation	2
	Existing Building Commissioning	1
	Rooftop units	1
Educational (n=2)	HVAC	2
	Existing Building Commissioning	1
	Heat Pumps	1
Energy Services/ LDCs (n=2)	HVAC	1
	Insulation	1
	Don't know	1
Retail (n=2)	Automation	1
	HVAC	1
	Refrigeration	1
Electric Vehicles (n=1)	Energy Management Systems	1
	Solar	1
Hospitals (n=1)	Heat Pumps	1
	HVAC	1
Real Estate (n=1)	Heat Pumps	1
	HVAC	1
Residential (n=1)	HVAC	1
	Lighting	1
Banking (n=1)	HVAC	1
Pharmaceutical (n=1)	HVAC	1
Data Centers (n=1)	Don't know	1
Shopping Centers (n=1)	Don't know	1
Sports Centers (n=1)	Don't know	1

TRAINING AND EDUCATION

Most respondents (65%) reported receiving some type of training and education in support of the Retrofit Program. Nearly one-half (44%) of respondents received training on offerings associated with the program rules and application process and with the Retrofit portal (38%), as shown in Figure D-7. Nearly one-third (31%) of respondents indicated they had not received any training at all. Section 6.2.3 includes an additional discussion regarding training and education.

Figure D-7: Types of Training Received

(Open-ended and multiple responses allowed; n=54)*

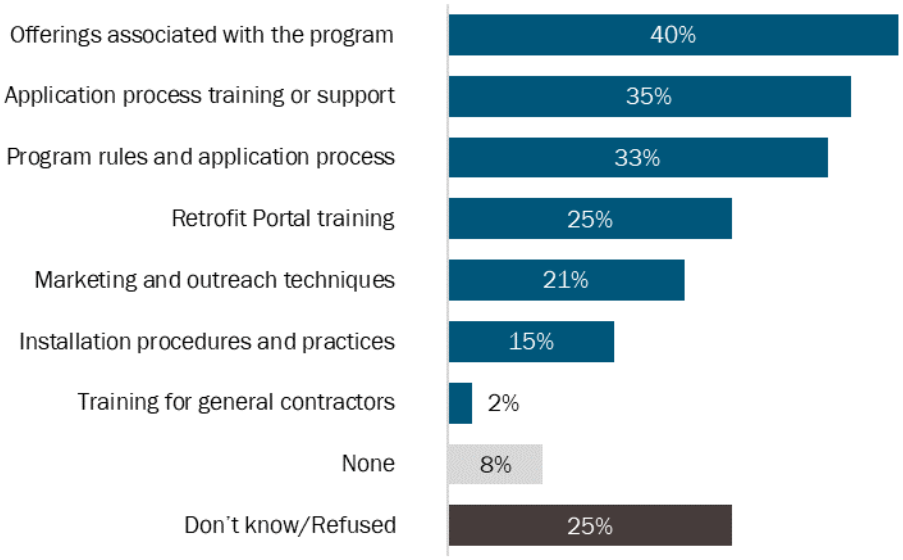


*Does not sum to 100% due to multiple responses.

When asked about what type of additional training or education would help support their future work with the Retrofit Program, over two-thirds of applicant representatives and contractors (67%) responded, as shown in Figure D-8. Respondents most often suggested that training and education covered the offerings associated with the program (40%), the application process training or support (35%), and the program rules and application process (33%). Respondents also mentioned the Retrofit Portal (25%), marketing and outreach (21%), installation procedures and practices (15%), and general contractor-specific topics (2%). Section 6.2.3 includes an additional discussion regarding training and education.

Figure D-8: Recommended Training and Education Topics

(Open-ended and multiple responses allowed; n=48)*

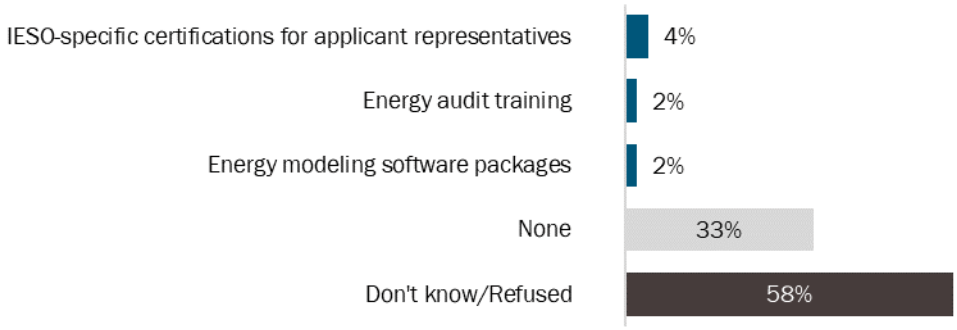


*Does not sum to 100% due to multiple responses.

When asked whether the IESO could offer any qualifications, certifications, or credentials to help applicant representatives better serve customers, some respondents expressed interest in IESO-specific certifications for applicant representatives (4%), energy audit training (2%), and energy modeling software packages (2%), as shown in Figure D-9. Most respondents did not have suggestions (33%) or did not know or refused to answer (58%). Section 6.2.3 includes additional discussion regarding the types of qualifications, certifications, or credentials that would help applicant representatives and contractors better serve customers.

Figure D-9: Recommended Qualifications, Certifications, or Credentials

(Open-ended and multiple responses allowed; n=48)*



*Does not sum to 100% due to rounding.

INCENTIVES AND PROJECT COSTS

Respondents were asked to identify which non-lighting measures customers often did not install equipment due to concerns related to their associated incentive levels, as shown in Table D-3. Respondents most frequently mentioned refrigeration (three respondents) and motors (two respondents). Section 6.2.4 includes additional discussion regarding non-lighting measures that customers often forgo installing.

Table D-3: Non-Lighting Measures Customers Forgo Due to Incentive-Level Concerns

(Open-ended and multiple responses allowed; n=8)*

Non-Lighting Measure	Respondents
Refrigeration	3
Motors	2
Batteries	1
Boilers	1
Cycling dryers	1
Dewpoint monitors	1
HVAC	1
PTACs	1
VFDs	1
Ventilation	1

As shown in Table D-4, respondents were asked what percentage of their project costs for various non-lighting measure categories were covered by the Retrofit Program. On average, the measure categories with the greatest percentage of project costs covered by the program were agribusiness (35% of project costs covered by the program), programmable

thermostats (35%), and VFDs (34%). Section 6.2.4 includes additional discussion regarding project costs for non-lighting measures covered by the Retrofit Program.

Table D-4: Project Costs Covered by Retrofit Program for Non-Lighting Measure Categories

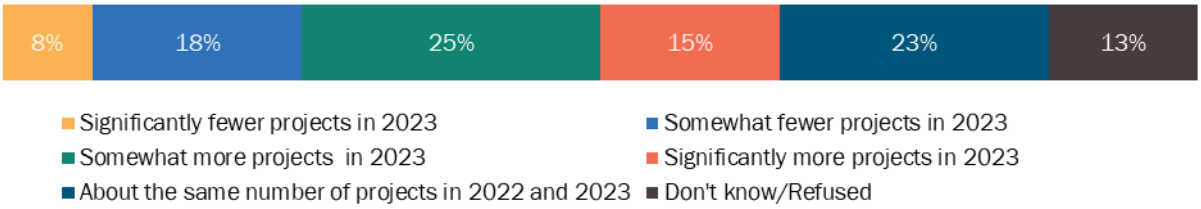
Non-Lighting Measure Category	n	Average Project Costs Covered by the Program (%)	Minimum Project Costs Covered by the Program (%)	Maximum Project Costs Covered by the Program (%)
Agribusiness	2	35	20	50
Programmable thermostats	1	35	35	35
Variable frequency drives	9	34	5	100
Motors	5	29	4	100
Compressed air	3	28	15	35
Cooling equipment	7	19	5	50
Fan motors	6	17	5	50
Chillers	7	14	4	30
HVAC controls	6	13	5	30
Industrial machinery	2	11	7	15
Refrigeration	2	5	5	5

ACTIVITY LEVEL

When asked whether they completed any projects through the Retrofit Program in 2022, most applicant representatives and contractors (83%) reported having had done so. Of respondents who said they had completed projects, two-fifths (40%) said they completed more projects in 2023, and one-fourth (25%) said they completed fewer projects in 2023, as shown in Figure D-10. Nearly one-fourth (23%) of respondents said they completed about the same number of projects in 2022 and 2023. Section 6.2.5 includes an additional discussion regarding applicant representative and contractor changes in the number of completed projects.

Figure D-10: Number of Projects Completed in 2023 Compared to 2022

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



The survey asked respondents why the number of projects completed in 2023 decreased or increased. Table D-5 and Table D-6 provide detailed responses to this question. Section 6.2.5 includes an additional discussion around reasons why the number of projects completed changed in 2023.

Table D-5: Reasons for Completing Fewer Projects in 2023 than 2022

(Open-ended and multiple responses allowed; n=10)*

Reasons for Decrease in Number of Projects	n
COVID-19 related challenges	2
New program was unappealing	2
Budget constraints	2
Fluctuation in demand	2
Desired equipment became more affordable, so program incentive was not worth it	1
Taught customers how to apply themselves	1

Table D-6: Reasons for Completing More Projects in 2023 than 2022

(Open-ended and multiple responses allowed; n=16)*

Reasons for Increase in Number of Projects	n
Higher incentives	4
Higher budget	2
Re-introduction of the Custom Stream	2
More national account participants	1
More time available to complete upgrades	1
Fluctuation in demand	1
Incentives were too low	1
Better internal support for participating in incentive programs	1
Don't know/refused	3

PROGRAM EXPERIENCE AND IMPROVEMENT SUGGESTIONS

Figure D-11 provides a full breakdown of results associated with applicant representatives' and contractors' reported influence on their customer's decision-making regarding energy-efficiency purchases. Section 6.2.6 includes an additional discussion regarding applicant representative and contractor influence on customer decisions to purchase energy-efficient equipment.

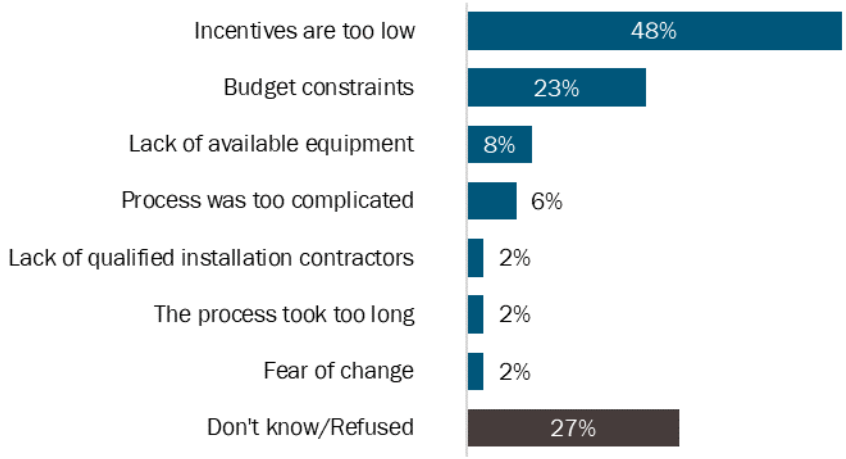
Figure D-11: Influence on Customer's Decision-Making

(Open-ended and multiple responses allowed; n=48)

Figure D-12 provides a full list of reasons why customers decided not to install energy-efficient equipment through their Retrofit project, as reported by applicant representatives and contractors. Section 6.2.6 includes an additional discussion regarding reasons for not installing energy-efficient equipment.

Figure D-12: Reasons why Customers Decide Not to Install Energy-Efficient Equipment

(Open-ended and multiple responses allowed; n=48)*

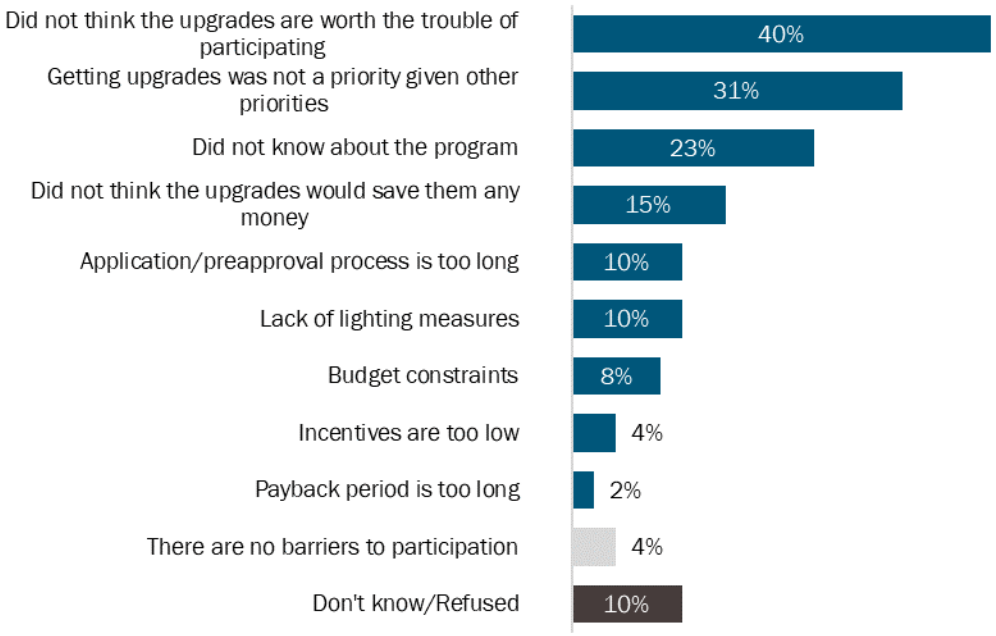


*Does not sum to 100% due to multiple responses.

Figure D-13 provides a full list of customer participation barriers, as reported by applicant representatives and contractors. Respondents most commonly said that customers did not perceive the upgrades to be worth the trouble of participation (40%), customers did not view upgrades as a priority (31%), and customers did not know about the program (23%). Respondents also reported that customers did not think the upgrades would save them any money (15%), the application/preapproval process took too long (10%), the lack of lighting measures (10%), and budget constraints (8%). Less commonly, respondents mentioned that incentives were too low (4%) and payback periods too long (2%). Section 6.2.6 includes an additional discussion regarding program barriers.

Figure D-13: Barriers to Customer Participation

(Open-ended and multiple responses allowed; n=48)*



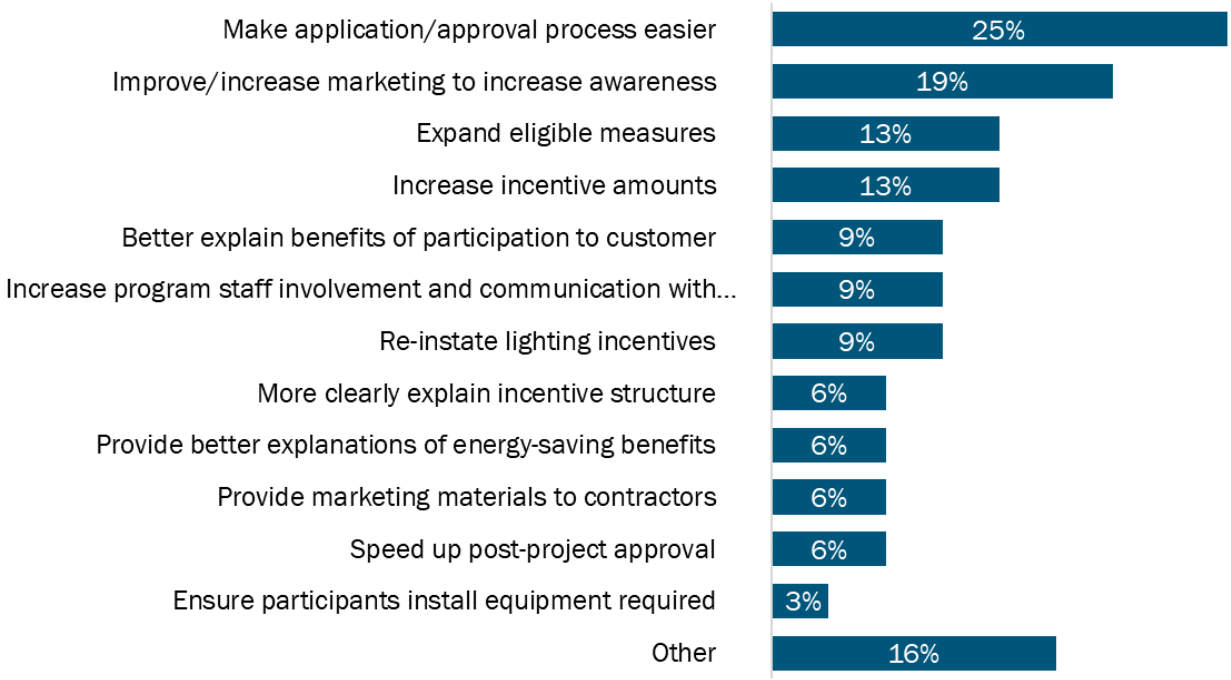
*Does not sum to 100% due to multiple responses.

Figure D-14 provides a full list of suggestions to overcome participation barriers, as reported by applicant representatives and contractors. Respondents most commonly suggested making the application process easier (25%), improving or increasing marketing to increase awareness (19%), expanding eligible measures (13%), and increasing incentive amounts (13%). Other common suggestions included better explaining participation benefits to customers, increasing program staff involvement and communication with customers, and reinstating the lighting measures (each with 9% of respondents). Other responses included improving the Retrofit Portal, making the Instant Discount offering

easier to implement, expediting the pre-approval process, setting up a pre-approval process for projects that achieve pre-determined project costs, and keeping the custom track in place (each mentioned by one respondent). Section 6.2.6 includes an additional discussion around overcoming customer barriers.

Figure D-14: Suggestions to Overcome Participation Barriers

(Open-ended and multiple responses allowed; n=32)*

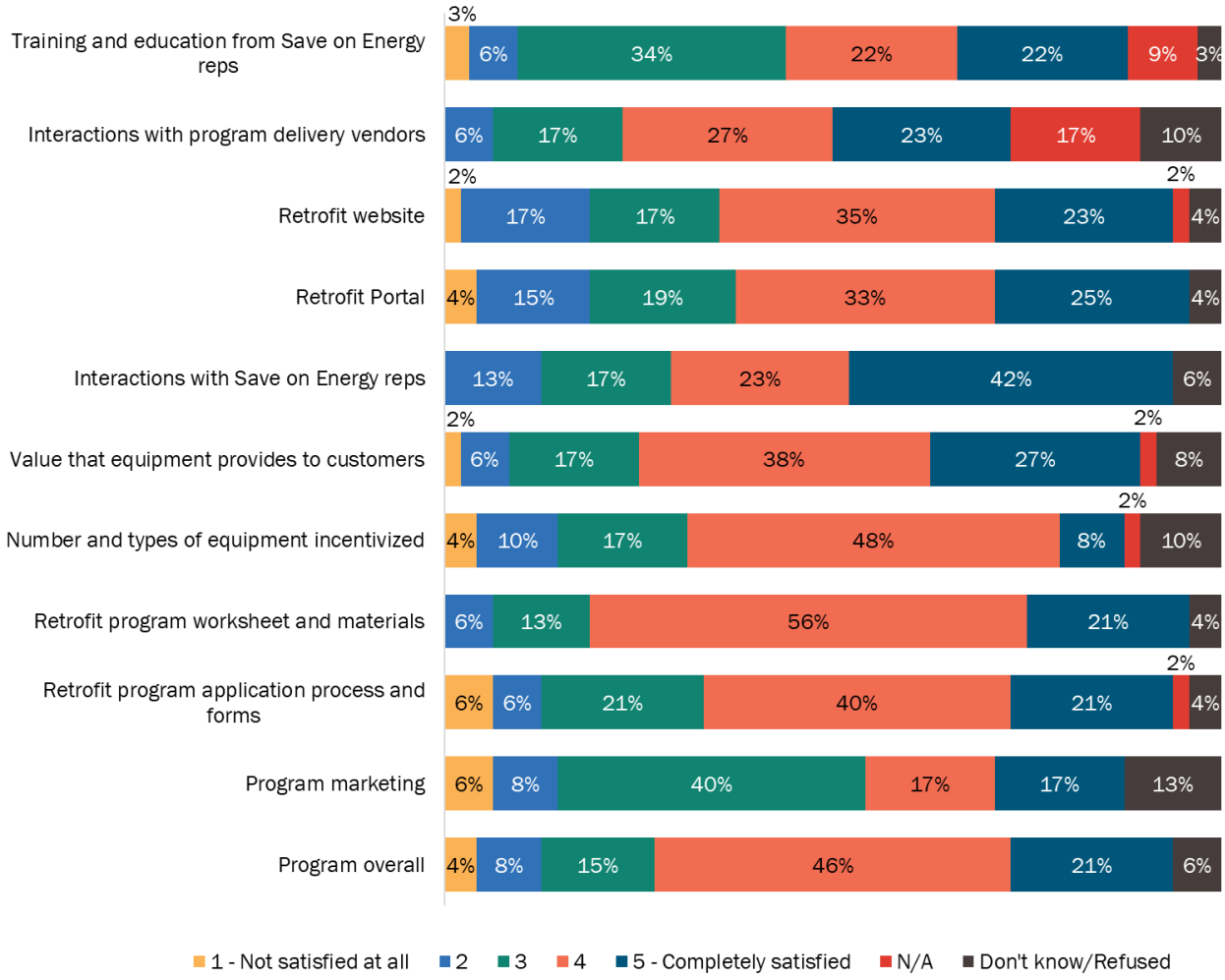


*Does not sum to 100% due to multiple responses.

Figure D-15 provides a full breakdown of results associated with applicant representatives' and contractors' satisfaction with various Retrofit Program aspects. Section 6.2.6 includes an additional discussion regarding satisfaction.

Figure D-15: Satisfaction with Aspects of the Retrofit Program (n=48)*

(Rating on a scale from 1 to 5)



*May not sum to 100% due to multiple response. For "Training and education from Save on Energy representatives" n=32 as this was only asked of respondents indicating they had received training.

The survey asked respondents for suggestions on how to improve the program going forward, as shown by the varied responses in Table D-7. The most common suggestions included reinstating lighting incentives (15%) and streamlining the overall process (15%). Other common responses included delivering the program regionally through the customers' utilities (12%) and making the Retrofit portal more user friendly (12%). Section 6.2.6 includes an additional discussion around program improvement suggestions.

Table D-7: Suggested Improvements for Retrofit Program Overall

(Open-ended and multiple responses allowed; n=26)*

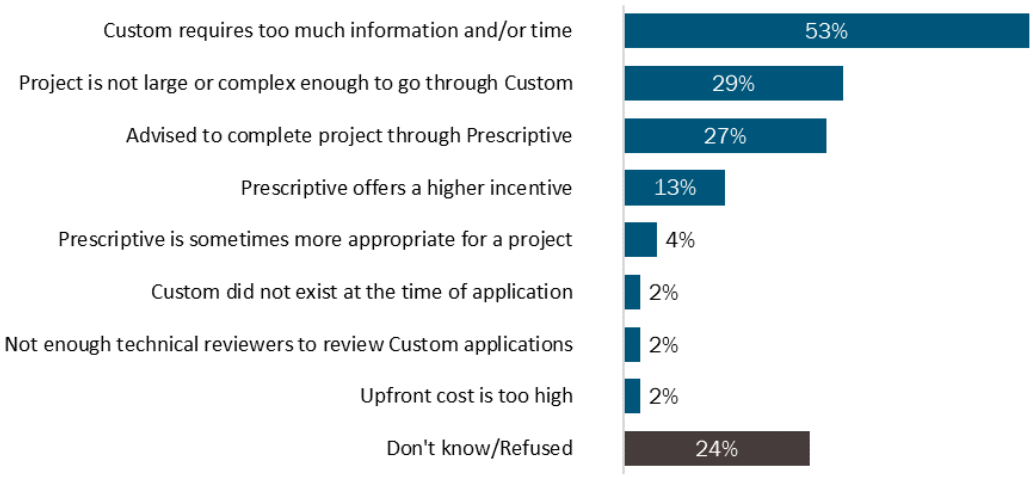
Retrofit Program Overall Improvements	Respondents
Reinstate lighting incentives	15%
Streamline overall process	15%
Deliver program regionally through customers' utility	12%
Make Retrofit portal more user friendly	12%
Allow applicant representatives to submit application on customers' behalf	8%
Compensate applicant representatives	8%
Increase incentive amounts	8%
Offer additional application support	8%
Redesign the program	8%
Add more technical reviewers	4%
Conduct market research studies to inform marketing/outreach efforts	4%
Include metering studies in program	4%
Offer a paper application	4%
Offer wider array of incentives	4%

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

CUSTOM STREAM

Respondents were asked why they thought some customers chose not to complete their projects through the Custom stream, as shown in Figure D-16. More than one-half (53%) reported that the Custom stream required too much information and/or time. Respondents also commonly mentioned that their projects were either not large or complex enough to complete through the Custom stream (29%); they were advised to go through the Prescriptive stream (27%), and the Prescriptive stream offered a higher incentive (13%). Section 6.2.8 includes an additional discussion around reasons for not completing Custom stream projects.

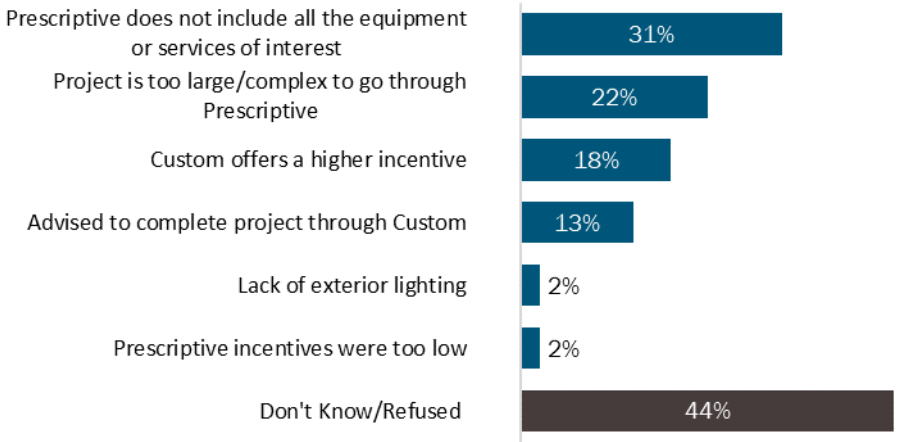
Figure D-16: Reasons for not Completing Projects through Custom Stream (n=45)*



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

Respondents were asked why they thought some customers chose not to complete their projects through the Prescriptive stream, as shown in Figure D-17. Close to one-third of respondents (31%) stated that the Prescriptive stream did not include all equipment or services of interest. Respondents also mentioned projects were too large or complex to go through the Prescriptive stream (22%), the Custom stream offered a higher incentive (18%), and they were advised to complete their project through the Custom stream (13%). Section 6.2.8 includes an additional discussion around reasons for not completing prescriptive stream projects.

Figure D-17: Reasons for not Completing Projects through Prescriptive Stream (n=45)*



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

EQUIPMENT OFFERINGS

Respondents were asked if participants typically could install all equipment that interested them through the program. Just over one-tenth (13%) of respondents indicated that customers were *not* able to do so. These respondents were asked what types of energy-efficient equipment or models that participants expressed interest in but could not install through the program. Respondents mentioned equipment trade-ins, discontinued equipment, exterior lighting, and sub-metering (one response each), as shown in Table D-8. Section 6.2.7 includes an additional discussion regarding equipment of interest to participants that they were unable to install.

Table D-8: Equipment of Interest to Participants that They Were Unable to Install (n=4)

Ineligible Equipment	Respondents
Equipment trade-ins	1
Discontinued equipment	1
Exterior Lighting	1
Sub-metering	1

Respondents were asked what additional energy-efficient equipment or services they would recommend for inclusion in the Retrofit Program. Table D-9 includes the full list of equipment recommended for inclusion in the Retrofit Program, as reported by applicant representatives and contractors. Other responses included additional technical reviewers, building automation systems, energy management systems, EV chargers, expanding the Existing Building Commissioning (EBCx) program, fuel-switching, heat pump water heaters, high-volume low-speed (HVLS) fans, kitchen equipment, modular chillers, motor controls, sign lighting, sub-metering, and variable refrigerant flow (VRF) packaged terminal air conditioner (PTAC) units (mentioned by one respondent each). Section 6.2.7 includes an additional discussion regarding equipment or service offerings.

Table D-9: Suggestions of Equipment or Services to Consider Adding to Program

(Open-ended and multiple responses allowed; n=35)*

Equipment Recommendation	Respondents
Exterior lighting	32%
Batteries	14%
Lighting	14%
Heat pumps (e.g., larger capacity air source heat pumps)	10%
Controls and sensors	9%
Solar PV	9%
Additional technical reviewers	5%
Building automation system	5%
Energy management systems	5%
EV chargers	5%
Expand EBCx program	5%
Fuel-switching	5%
Heat pump water heaters	5%
HVLS fans	5%
Kitchen equipment	5%
Modular chillers	5%
Motor control	5%
Sign lighting	5%
Sub-metering	5%
VRF PTAC units	5%

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

D.2 Additional Participant Net-to-Gross Results

This section includes detailed FR and SO results associated with the NTG for CDM Retrofit Program participants, stratified by program stream.

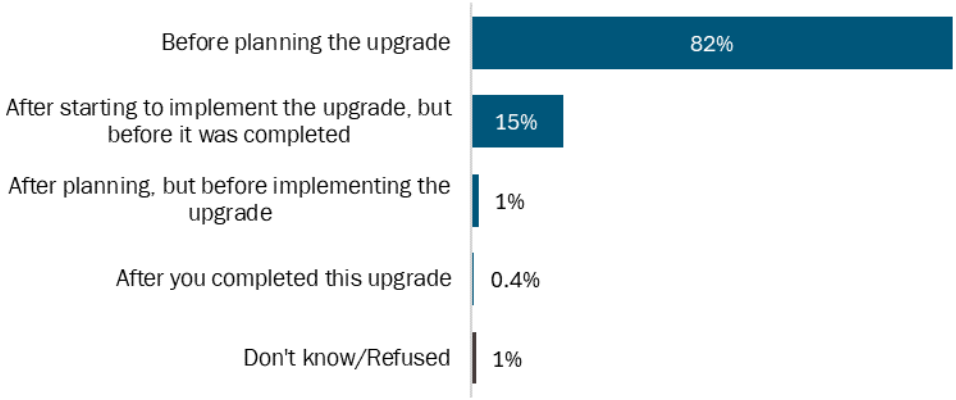
D.2.1 Prescriptive Stream

FREE-RIDERSHIP

The extent of FR within the program was assessed by surveying Retrofit Program participants to understand their experiences and plans before they learned of the program, what they would have done in the program's absence, and how influential the program was on their decision to implement the energy-efficient upgrades.

Over four-fifths of respondents (82%) reported learning they could receive energy-efficiency incentives through the Retrofit Program before starting to plan upgrades, as shown in Figure D-18. This may suggest the program influenced many of these respondents' decisions to begin the project. Nearly one-fifth of respondents (15%) learned about the program after starting to implement the upgrade, but before completing it. The remainder reported learning about the program either after planning, but before implementing the upgrade (1%), or after having completed the upgrade (0.4%). Two respondents (1%) were unsure when they learned about the program or refused to answer. While responses did not directly impact the FR score, they provided additional context for understanding participants' decision-making processes.

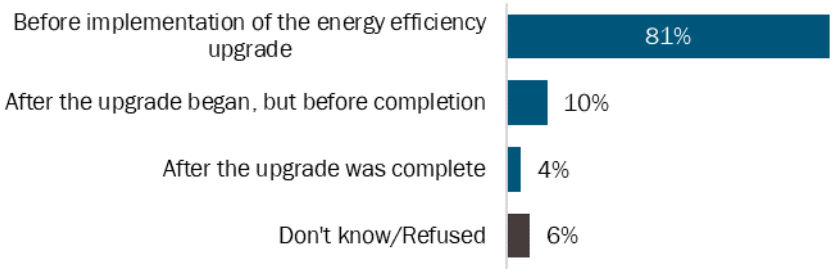
Figure D-18: When Participants First Learned about the Program (n=226)*



*Does not sum to 100% due to rounding.

The survey asked participants about the timing of their program application in relation to the start of their energy-efficient upgrades, as shown in Figure D-19. The majority of respondents (81%) indicated they applied before their company began implementing the upgrade, suggesting most participants applied to the program as intended. One-tenth (10%) 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 (6%). Much like the previous question, this question was not used to calculate the FR score yet provided additional context regarding participant intentions.

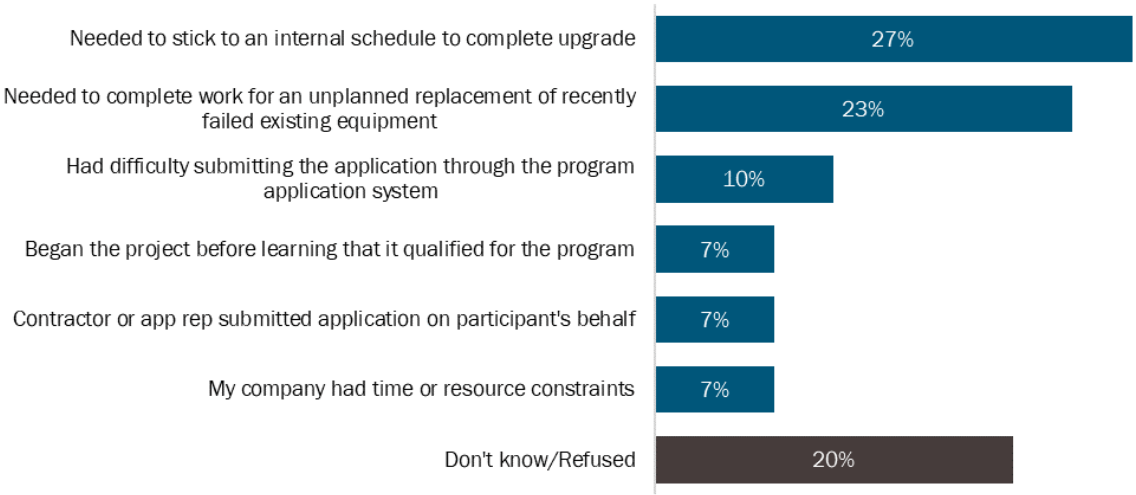
Figure D-19: Timing of Program Application (n=226)*



*Does not sum to 100% due to rounding.

Respondents whose companies submitted a Retrofit Program application after starting an energy-efficiency upgrade were asked their reasons for doing so, as shown in Figure D-20. The most common reasons provided were the need to stick to an internal schedule (27%) and the need to complete an unplanned replacement for failed equipment (23%). These responses suggest that some respondents would have applied earlier, had it been possible. Three respondents (10%) indicated that they experienced difficulty in submitting their application through the website. 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-20: Reason for Submitting After Starting Upgrade (n=30)*

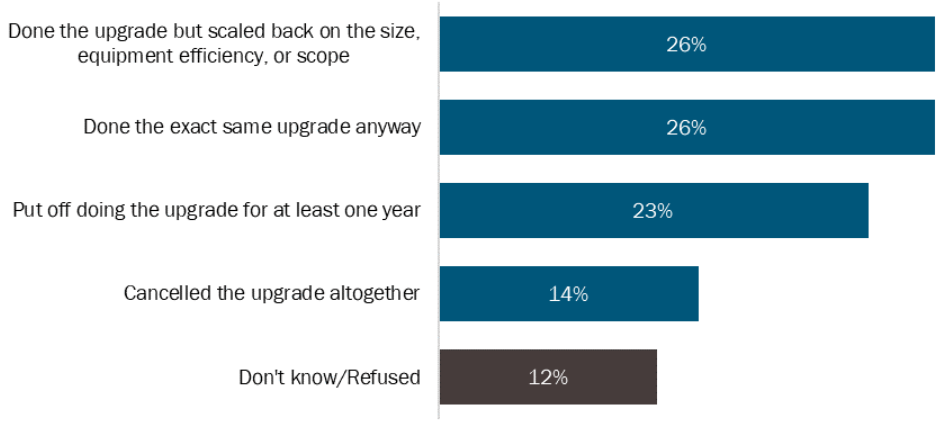


*Does not sum to 100% due to rounding.

Respondents were asked what they would have done in the program's absence, as shown in Figure D-21. Over one-fourth of respondents (26%) would have done the "exact same

upgrade" anyway, indicative of higher FR for these respondents. Nearly two-fifths of respondents (37%) showed no indication of FR as they stated they would have put off the upgrade for at least one year (23%) or cancelled their upgrade altogether (14%) had the program not been available to them. Other respondents were considered partial FRs if they reported they would have scaled back on the size, efficiency, or scope of their project (26%), if they did not know what they would have done in the program's absence, or it they declined to answer (12%). The evaluation team factored responses from this participant intent question into the FR analysis.

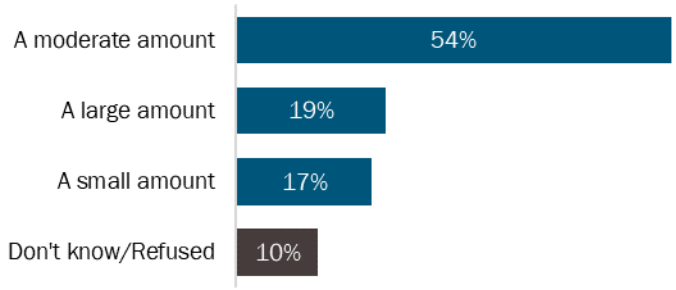
Figure D-21: Actions in the Absence of Program (n=226)*



*Does not sum to 100% due to rounding.

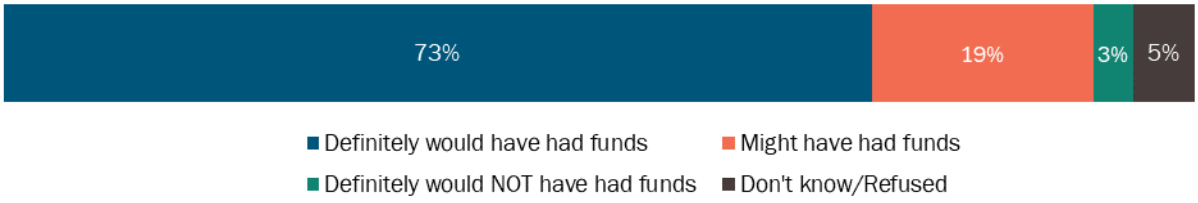
Respondents who indicated that they would have installed less energy-efficient or less expensive equipment were asked to describe how much they would have reduced the project's size, scope, or efficiency, as shown in Figure D-22. Over one-half of these respondents (54%) would have scaled it back by a moderate amount, and nearly one-fifth of respondents would have scaled it back by a large amount (19%) or a small amount (17%). These results indicated that the program allowed these participants to increase their project's size and/or extent beyond what they would have achieved on their own. This question was not used to calculate the FR score, though it provided additional context for participant intentions.

Figure D-22: Scaled Back Size or Extent of Upgrade in Absence of Program Incentives (n=59)



Respondents who stated they would have done the "exact same upgrade" in the program's absence were asked if they would have had funds to cover the project's entire cost without program funding, as shown in Figure D-23. Nearly three-fourths of respondents (73%) stated they definitely would have had funds to cover all project costs, indicating higher FR for these respondents. Nearly one-fifth of respondents (19%) indicated they might have had the funds to cover all project costs. 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 do independently. Only 3% of respondents said they definitely would not have had funds to cover all project costs. This participant intent question was factored into the FR analysis.

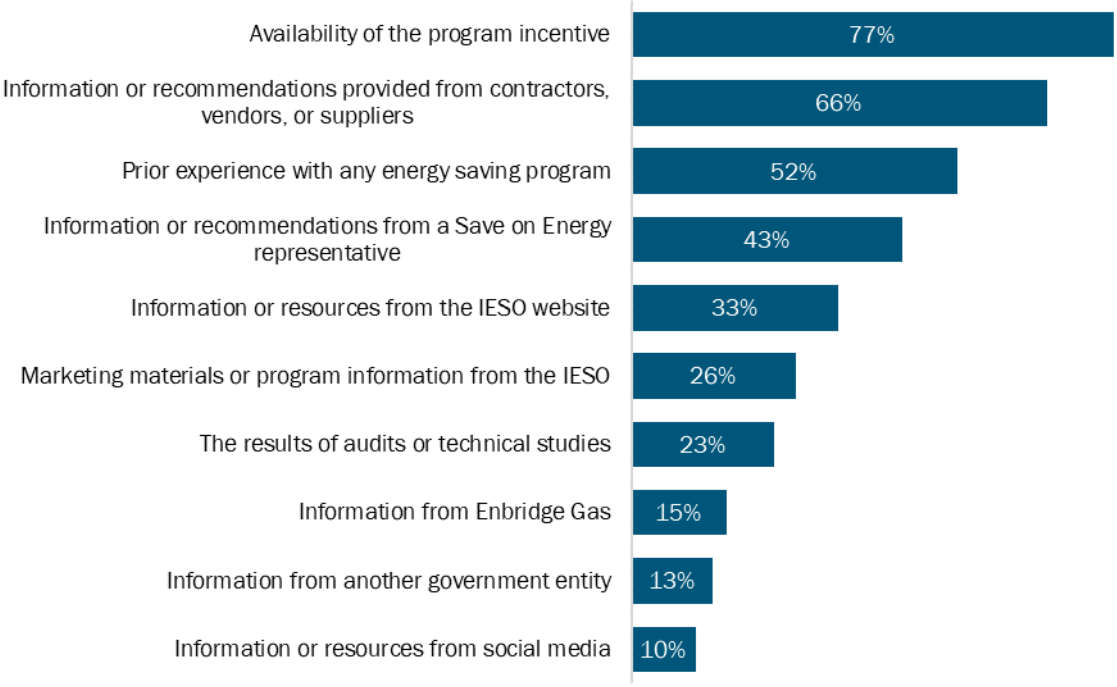
Figure D-23: Availability of Funds in Absence of Program Incentives (n=59)



Respondents were asked how influential various program features were on their decisions to install energy-efficient equipment, as shown in Figure D-24. They rated each feature's influence on a scale from one to five, 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 (77% with a rating of four or five for each response) and information or recommendations from contractors, vendors, or suppliers (66% with a rating of four or five). The least influential program feature was information or resources on social media (10% with a rating of four or five). This question, which focused on the program's influence and on prior questions about customer intentions, was used to estimate the FR score.

Findings from this question emphasized the contractor, vendor, and supplier networks' strength in driving Retrofit Program engagement. Their interactions with customers were valuable on their own, but, more generally, they helped familiarize customers with energy-saving programs and could influence future participation beyond the Retrofit Program.

Figure D-24: Influence of Program Features on Participation (n=226)*
(Rating of 4 or 5 on a scale from 1 to 5)



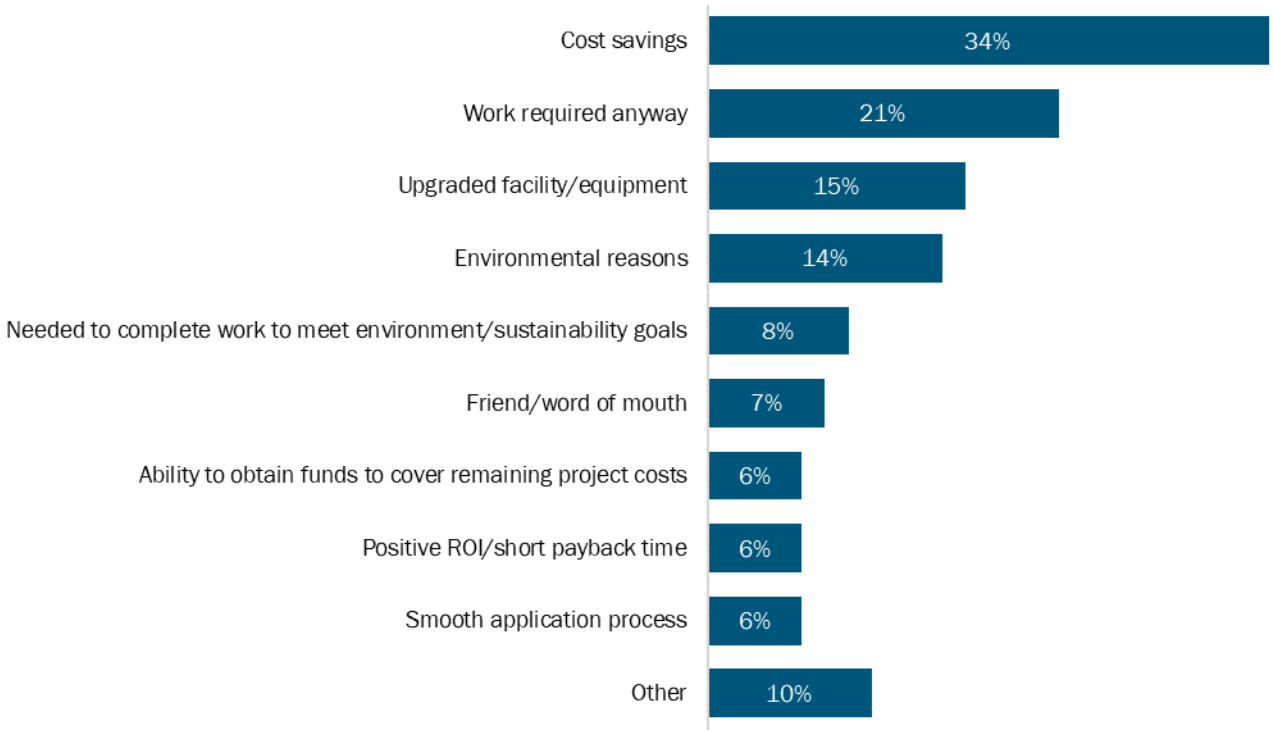
*Does not sum to 100% due to multiple responses.

Respondents were asked whether other factors played "a great role" in influencing their organization to install energy-efficient equipment, as shown in Figure D-25. More than one-third of respondents (34%) reported cost savings as an influential factor in their upgrade decisions. Other common responses included a need to complete work required anyway (21%), a desire to upgrade their facility or equipment (15%), and a desire to reduce environmental harm (14%). Responses categorized under "Other" included:

- Agreement with tenant
- Energy savings and/or efficiency
- Higher incentives
- Increasing their company's productivity
- New product and availability
- New programs

Figure D-25: Other Influential Factors on Upgrade Decision

(Open-ended and multiple responses allowed; n=71)*

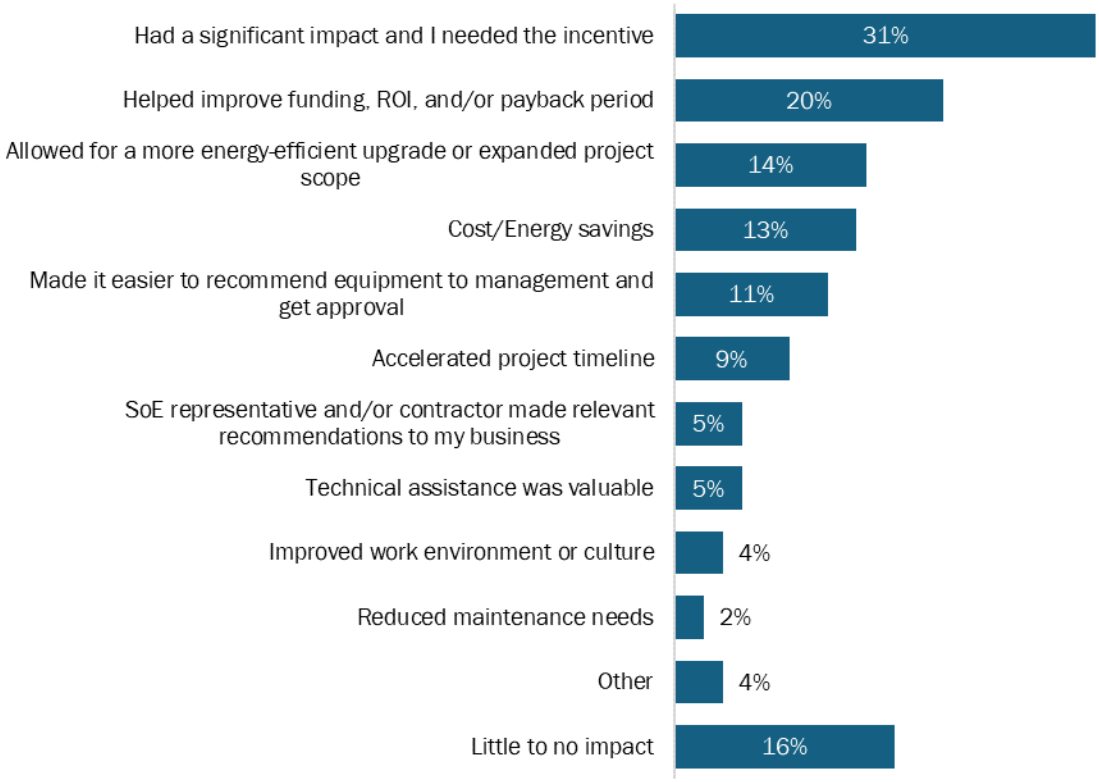


*Does not sum to 100% due to multiple responses.

The survey asked respondents to explain, in their own words, what impact (if any) the financial support or technical assistance they received from the program had on their decisions to install the program-incentivized equipment when they did, as shown in Figure D-26. The most common responses included the program playing a great role and needing the incentive (31%) and helping their funding, ROI, or payback period (20%). Other common responses included the program allowed a more energy-efficient upgrade or an expanded project scope (14%) and the cost and/or energy savings (13%).

Figure D-26: Program Impact on Decision to Install Equipment

(Open-ended and multiple responses allowed; n=141)*

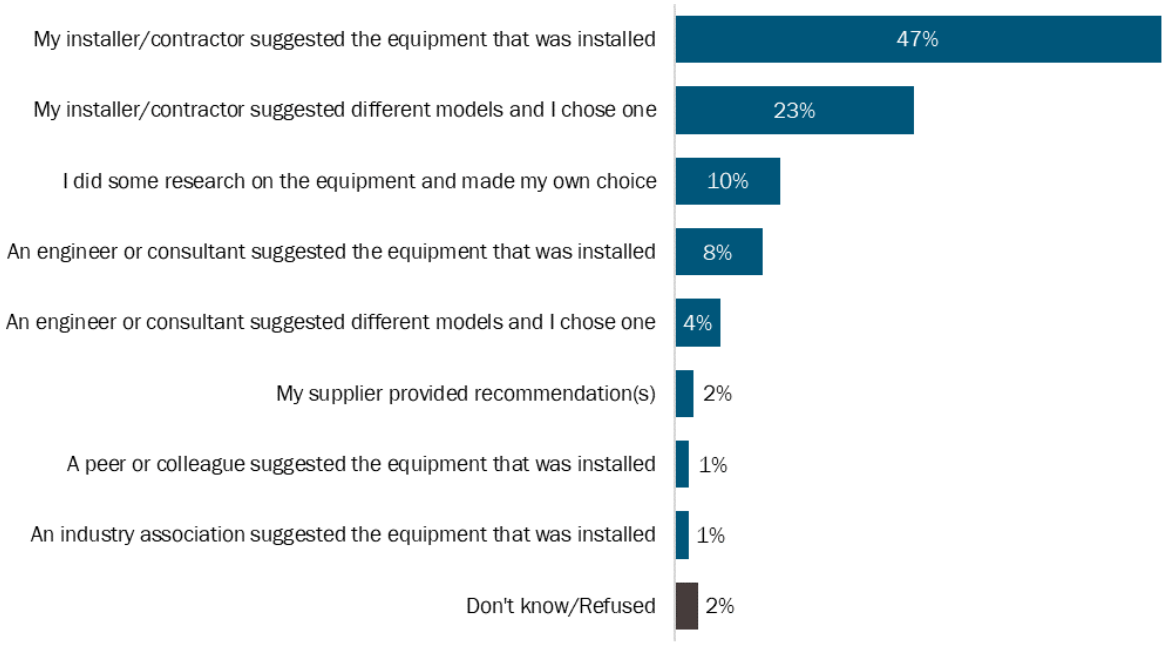


*Does not sum to 100% due to multiple responses.

As shown in Figure D-27, close to one-half (47%) of respondents chose their equipment based on their installer's or contractor's suggestions, more than twice the number of participants who chose from a shortlist of equipment models provided by their installer or contractor (23%). Respondents also commonly did their own research (10%) and followed an engineer's or consultant's suggestion (8%). This reinforces the importance of contractors' role in helping drive customers to efficient equipment decisions.

Figure D-27: Equipment Selection Process

(Open-ended and multiple responses allowed; n=224) *



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

SPILLOVER

To estimate the SO rate, the survey asked participants if they installed any energy-efficient equipment in PY2023 for which they did not receive an incentive, following their Retrofit Program participation. Nearly one-fifth of respondents (17%) reported installing new equipment. Table D-10 displays the types of non-incentivized equipment that companies installed after completing their Retrofit projects. Over one-tenth of respondents (11%) installed lighting, more than three times the number reported by any other equipment type.

Table D-10: Types of Upgrades Installed after Program Participation

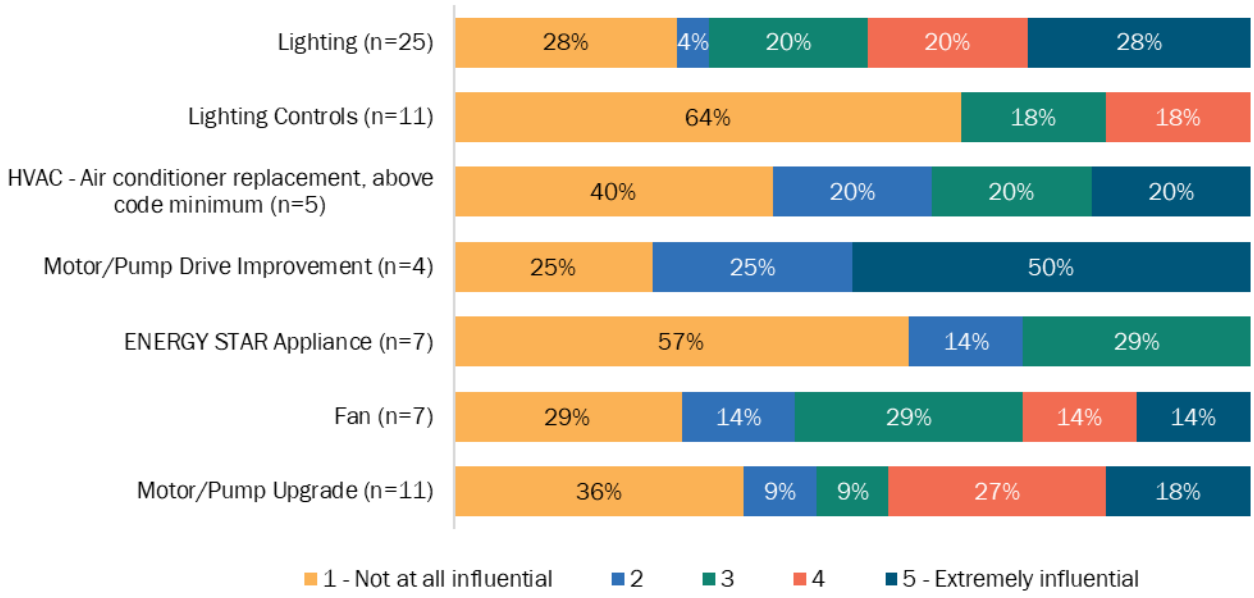
(Open-ended and multiple responses allowed; n=226)*

Spillover Equipment	Respondents	Average Influence Score(s)
Motor/Pump Drive Improvement	2%	3.3
Lighting	11%	3.2
Motor/Pump Upgrade	5%	2.8
Fan	3%	2.7
HVAC - Air conditioner replacement, above code minimum	2%	2.4
Lighting Controls	5%	1.9
ENERGY STAR Appliance	3%	1.7

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

The team then asked respondents what influence level their Retrofit Program participation had on their decision to install additional energy-efficient equipment. Participants rated the program's influence on a scale from one to five, where one indicates the program was "not at all influential" and five indicates the program was "extremely influential." Responses varied, with some respondents indicating the program was influential in their decision to install energy-efficient equipment (ratings of 3.0 and above), as shown in Figure D-28.

Figure D-28: Program Influence on Equipment Installed Outside the Program (n=39)*



*May not sum to 100% due to rounding.

Participants who indicated that they installed program-influenced, non-incentivized equipment were then asked a series of follow-up questions addressing capacity, efficiency, and annual HOU. Table D-11 through Table D-22 present the results of these detailed questions, which were used within the NTG algorithm to attribute SO savings for each equipment installation. SO savings were primarily driven by installations of 1,069 CFLs and 1,014 new linear LEDs.

Table D-11: Type of ENERGY STAR® Appliance Installed (n=2)

Spillover Appliance	Respondents	Quantity
Clothes Washer	1	5
Refrigerator	1	1

Table D-12: Diameter of Fans Installed (n=4)

Respondents	Diameter (ft)	Quantity Installed
1	Less than 1 foot	2
1	2-3.99 feet	6
1	4-7.99 feet	7
1	8+ feet	2

Table D-13: Air Conditioner Sizes (n=2)

Respondents	Air Conditioning size	Quantity	Max Installed
2	Less than 5.4 Tons (65,000 Btuh)	100	99

Table D-14: Type of Lighting Installed

(Multiple responses allowed; n=18)

Spillover Lighting	Respondents
LED linear	9
LED exterior	5
Compact fluorescent (CFL)	5
Linear fluorescent	3
LED screw base	3

Table D-15: LED Screw Base Wattage (n=3)

3	Respondents	Quantity Installed
< 10 watts	1	100
21 - 30 watts	1	5
31+ watts	1	31

Table D-16: Quantity of CFL Lamps (n=4)

Respondents	Bulb Quantity Installed	Max Installed
4	1,069	1,000

Table D-17: LED Exterior Lighting Mount (n=5)

Location	Respondents	Quantity Installed
Pole Mount	3	36
Against building	1	10
Under Canopy	1	30

Table D-18: Type and Quantity of Linear Fluorescents (n=3)

Type	Respondents	Installed in High Ceilings	Lamps per Fixture	Quantity of Fixtures Installed	Max Installed
T5	2	No	2	200	100
T8	1	Yes	6	48	48

Table D-19: Quantity of Linear LED Lamps (n=9)

Respondents	Fixture Quantity	Max Installed
9	1,014	631

Table D-20: Lighting Controls and Lighting Type (n=4)

Location	Respondents
Timer	3
Occupancy Sensor	1

Table D-21: End Uses of Motor/Pump Upgrades (n=6)

Motor/Pump End Use	Respondents	Motor Horsepower	Efficiency	Quantity Installed	Max Installed
HVAC Fan	2	15.1 - 30.0 hp	Premium	12	10
HVAC water pump	1	1.1 – 5.0 hp	Standard	2	2
	1	5.1 – 15.0 hp	Premium	2	2
	1	15.1 – 30.0 hp	Premium	5	5
	1	30.1 – 50.0 hp	Standard	2	2

Table D-22: Size of Motor/Pump Drive Improvements Installed (n=6)

Type of Drive Improvement	Size (hp)	Respondents	Equipment
Variable speed drive/Variable frequency drive (VFD)	5.1 - 15.0	1	5
Variable speed drive/ Variable frequency drive (VFD)	15.1 - 30.0	1	2

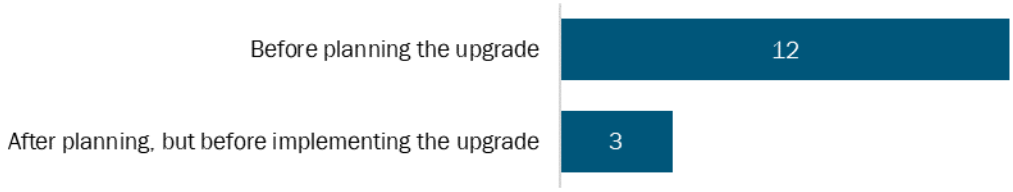
D.2.2 Greenhouse Stream

FREE-RIDERSHIP

The extent of FR within the program was assessed by surveying Retrofit Program participants to understand their experiences and plans before they learned of 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.

Twelve of 15 respondents reported learning they could receive energy-efficiency incentives through the Retrofit Program before starting to plan upgrades, as shown in Figure D-29. This may suggest the program influenced many of these respondents' decisions to begin the project. Three respondents learned about the program after their planning started but before implementing the upgrade. While responses did not directly impact the FR score, they provided additional context for understanding participants' decision-making processes.

Figure D-29: When Participants First Learned about the Program (n=15)*

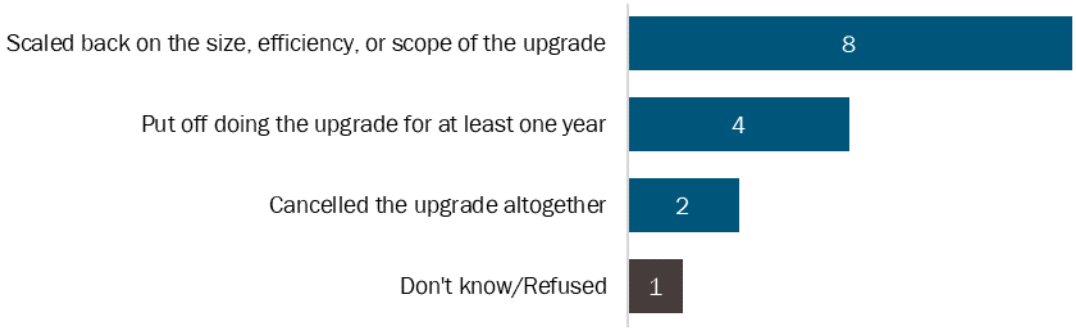


*Counts displayed rather than percentage due to small n.

The survey then asked participants about the timing of their program application in relation to the start of their energy-efficient upgrades. All respondents indicated that they applied before their company began implementing the upgrade, suggesting participants applied to the program as intended. Similarly to the previous question, this question was not used to calculate the FR score, yet it provided additional context regarding participant intentions.

Respondents were asked what they would have done in the program's absence, as shown in Figure D-40. Eight of 15 respondents would have scaled back on the size, scope, or efficiency of their project in the absence of the program. These respondents, along with those who did not know what they would have done in the program's absence or declined to answer (one respondent), were considered partial free-riders. Six respondents showed no indication of FR as they stated they would have put off the upgrade for at least one year (four respondents) or cancelled their upgrade altogether (two respondents) had the program not been available to them. The evaluation team factored responses from this participant intent question into the FR analysis.

Figure D-30: Actions in the Absence of Program(n=15)*

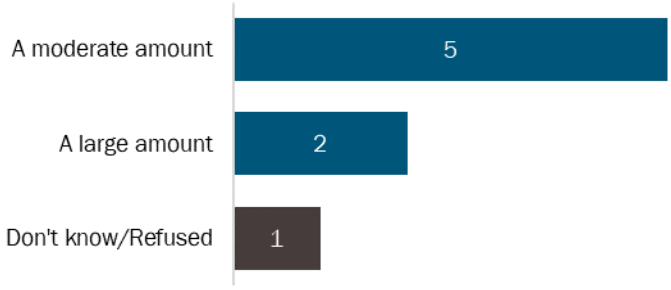


*Counts displayed rather than percentage due to small n.

Respondents who indicated that they would have installed less energy-efficient or less expensive equipment were asked to describe how much they would have reduced the project's size, scope, or efficiency, as shown in Figure D-41. Five of these respondents

would have scaled it back a moderate amount, and two respondents would have scaled it back by a large amount. 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. This question was not used to calculate the FR score, though it provided additional context for participant intentions.

Figure D-31: Scaled Back Size or Extent of Upgrade in Absence of Program Incentives (n=8)*



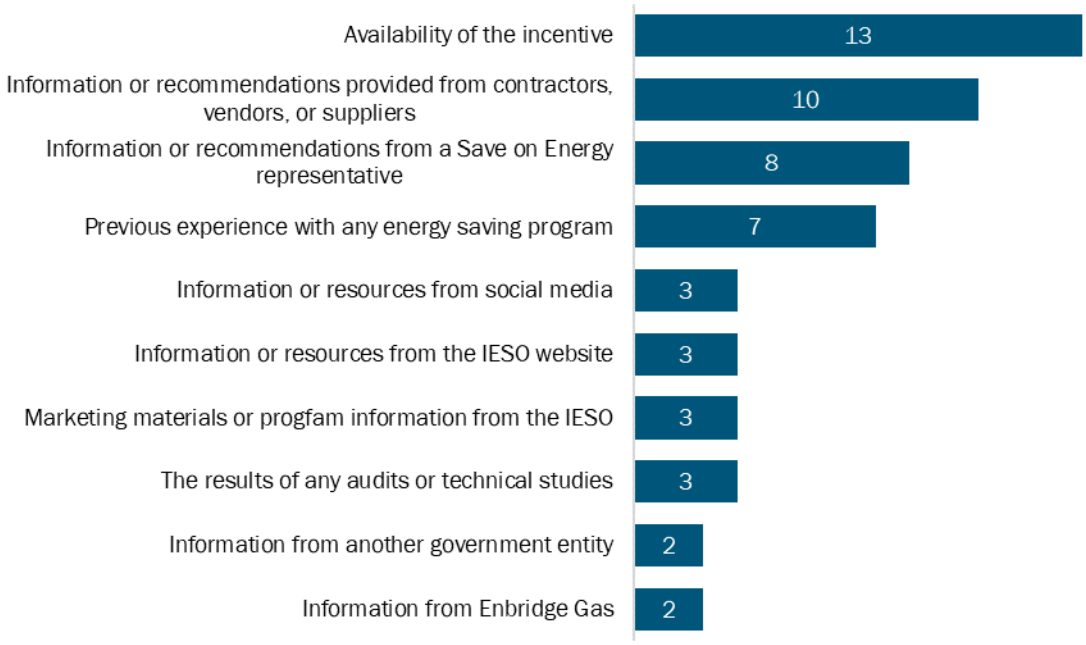
*Counts displayed rather than percentage due to small n.

Respondents were asked how influential various program features were on their decisions to install energy-efficient equipment, as shown in Figure D-42. They rated each feature's influence on a scale from one to five, 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 (13 with a rating of four or five for each response) and recommendations from contractors, vendors, or suppliers (ten with a rating of four or five). The least influential program features were information from another government entity (two with a rating of four or five) and information from Enbridge Gas (two with a rating of four or five). This question, which focused on the program's influence and prior questions about customer intentions, was used to estimate the FR score.

Findings from this question emphasized the contractor, vendor, and supplier networks' strength in driving Retrofit Program engagement. Their interactions with customers were valuable on their own, but, more generally, they helped familiarize customers with energy-saving programs and could influence future participation beyond the Retrofit Program.

Figure D-32: Influence of Program Features on Participation (n=15)*

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



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

Respondents were asked whether any other factors played "a great role" in influencing their organization to install energy-efficient equipment, as shown in Figure D-43. Three respondents reported that a desire to upgrade their facility or equipment was an influential factor on their decision to make upgrades. Other common responses included cost savings (two respondents) and hearing about the program from a friend or by word of mouth (two respondents).

Figure D-33: Other Influential Factors on Upgrade Decision

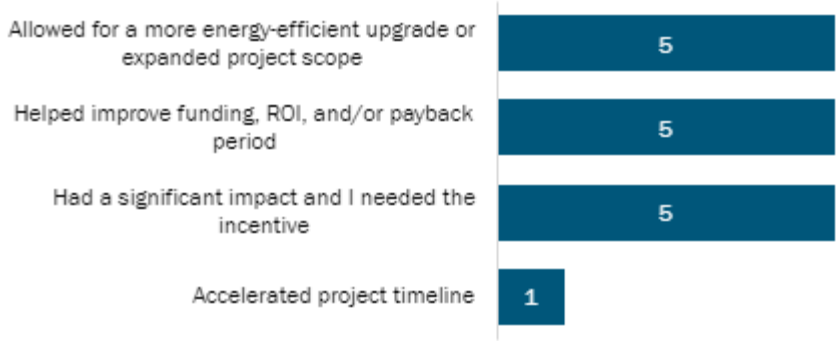
(Open-ended and multiple responses allowed; n=7)*

*Does not sum to 7 due to multiple responses.

The survey asked respondents to explain, in their own words, what impact (if any) the financial support or technical assistance they received from the program had on their decisions to install the program-incentivized equipment when they did, as shown in Figure D-44. The most common responses included that the program allowing for a more energy-efficient upgrade or expanded project scope; helping their funding, ROI, or payback period; and playing a great role and that they needed the incentive (each mentioned by five respondents).

Figure D-34: Program Impact on Decision to Install Equipment

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

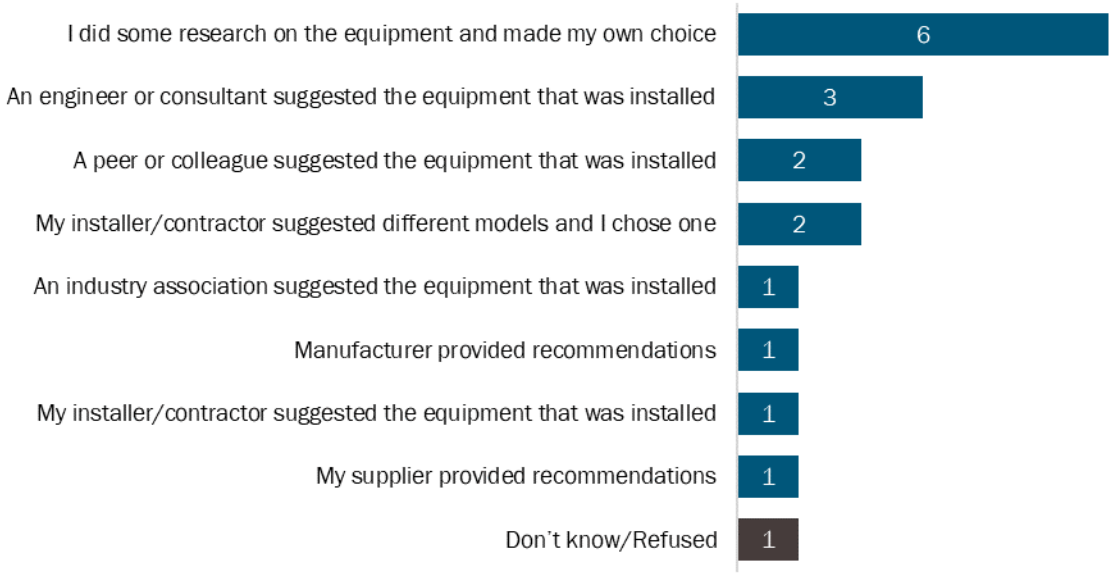


*Counts displayed rather than percentage due to small n. Does not sum to 15 due to multiple response.

As shown in Figure D-45, six respondents chose their equipment based on their own research, which was twice the number of participants who chose based on suggested equipment models provided by an engineer or consultant (three respondents). Respondents also commonly chose equipment that a peer or colleague suggested (two respondents), or from a shortlist of equipment models provided by their installer or contractor (two respondents).

Figure D-35: Equipment Selection Process

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



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

SPILLOVER

To estimate the SO rate, the survey asked participants if they installed any energy-efficient equipment in PY2023 for which they did not receive an incentive following their Retrofit Program participation. Two respondents reported installing non-incentivized equipment after completing their Retrofit projects, as shown Table D-23. Some survey respondents installed multiple equipment types, with motor/pump upgrade the most common equipment installed (two respondents).

The team then asked respondents what influence level their participation in the Retrofit Program had on their decision to install additional energy-efficient equipment. Participants rated the program's influence on a scale from one to five, where one indicates the program was "not at all influential" and five indicates the program was "extremely influential." Table D-23 displays that the program was not influential on their decision to install the additional energy-efficient equipment.

Table D-23: Types of Upgrades Installed after Program Participation

(Open-ended and multiple responses allowed; n=2)*

Spillover Equipment	Respondents	Average Influence Score(s)
Lighting	1	1.0
ENERGY STAR Appliance	1	1.0
Motor/Pump Upgrade	2	1.0
Fan	1	1.0

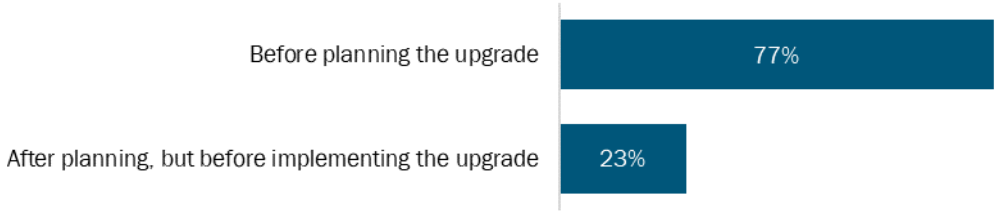
D.2.3 Custom Stream

FREE-RIDERSHIP

The extent of FR within the program was assessed by surveying Retrofit Program participants to understand their experiences and plans before they learned of the program, what they would have done in the program's absence, and how influential the program was on their decision to implement the energy-efficient upgrades.

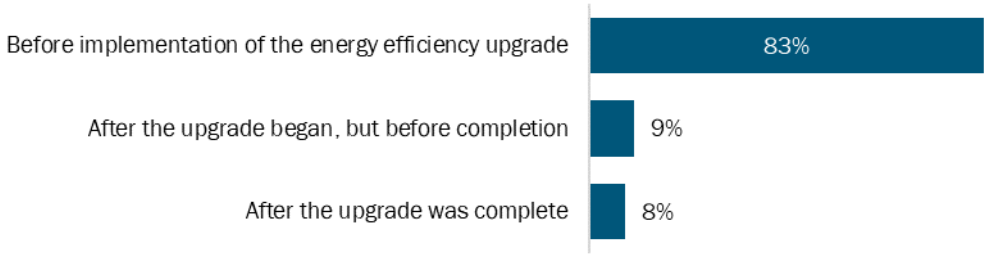
Over three-fourths of respondents (77%) reported learning that they could receive energy-efficiency incentives through the Retrofit Program before starting to plan upgrades, as shown in Figure D-29. This may suggest the program influenced many of these respondents' decisions to begin their projects. Nearly one-fourth of respondents (23%) learned about the program after their planning started but before implementing the upgrade. While these responses did not directly impact the FR score, they provided additional context for understanding participants' decision-making processes.

Figure D-36: When Participants First Learned about the Program (n=53)



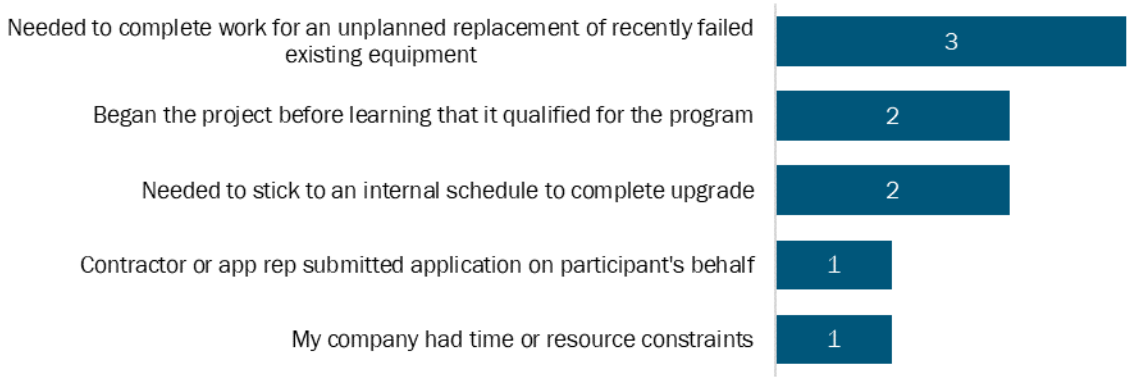
The survey then asked participants about the timing of their program application in relation to the start of their energy-efficient upgrades, as shown in Figure D-30. The majority of respondents (83%) indicated they applied before their company began implementing the upgrade, suggesting most participants applied to the program as intended. Less than one-tenth (9%) did so after their energy-efficiency upgrade began but before its completion. The remainder did so after completing the upgrade (8%). Similar to the previous question, this question was not used to calculate the FR score, yet provided additional context regarding participant intentions.

Figure D-37: Timing of Program Application (n=53)



Respondents whose companies submitted a Retrofit Program application after starting an energy-efficiency upgrade were asked their reasons for doing so, as shown in Figure D-31. The most common reasons provided were needing to complete work for an unplanned replacement (three respondents), beginning the project before learning that it qualified for the program (two respondents), and sticking to an internal schedule (two respondents). Some responses suggest that many respondents would have applied earlier, had it been possible. While responses to this question did not directly impact the FR score, they provided additional context for understanding the participants' decision-making processes.

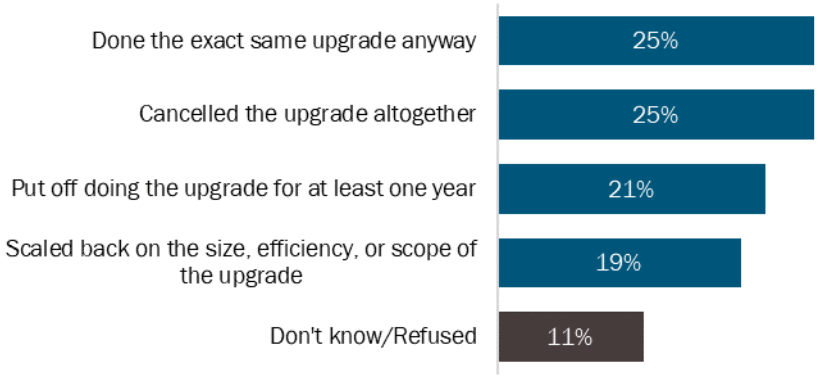
Figure D-38: Reason for Submitting After Starting Upgrade (n=9)*



*Counts displayed rather than percentage due to small n.

Respondents were asked what they would have done in the program's absence, as shown in Figure D-32. One-fourth of respondents (25%) would have done the "exact same upgrade," indicative of higher FR for these respondents. Nearly one-half of respondents (46%) showed no indication of FR as they stated they would have put off the upgrade for at least one year (21%) or cancelled their upgrade altogether (25%) had the program not been available to them. Other respondents were considered partial free-riders if they would have scaled back on the size, efficiency, or scope of their project (19%), they did not know what they would have done in the program's absence, or declined to answer (11%). The evaluation team factored responses from this participant intent question into the FR analysis.

Figure D-39: Actions in the Absence of Program (n=53)*

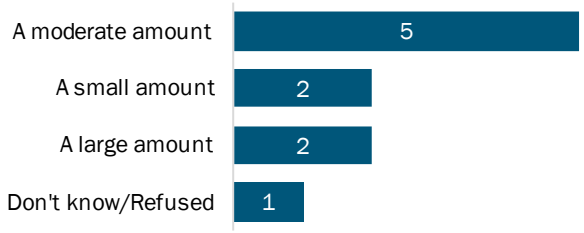


*Does not sum to 100% due to rounding.

Respondents who indicated that they would have installed less energy-efficient or less expensive equipment were asked to describe how much they would have reduced the

project's size, scope, or efficiency, as shown in Figure D-33. Five out of ten respondents would have scaled it back a moderate amount. 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. This question was not used to calculate the FR score, though it provided additional context for participant intentions.

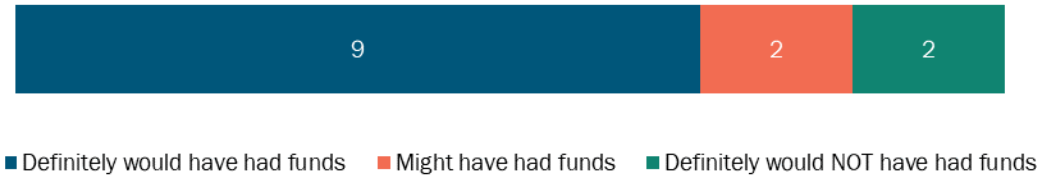
Figure D-40: Scaled Back Size or Extent of Upgrade in the Absence of Program Incentives (n=10)*



*Counts displayed rather than percentage due to small n.

Respondents who stated that they would have done the "exact same upgrade" in the program's absence were asked to confirm that they would have had funds to cover the project's entire cost without program funding, as shown in Figure D-34. Nine out of 13 respondents stated they definitely would have had the funds to cover all project costs. Two respondents might have had the funds, and two respondents definitely would not have had funds to cover all project costs. 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 do independently. This participant intent question was factored into the FR analysis.

Figure D-41: Availability of Funds in the Absence of Program Incentives (n=13)*



*Counts displayed rather than percentage due to small n.

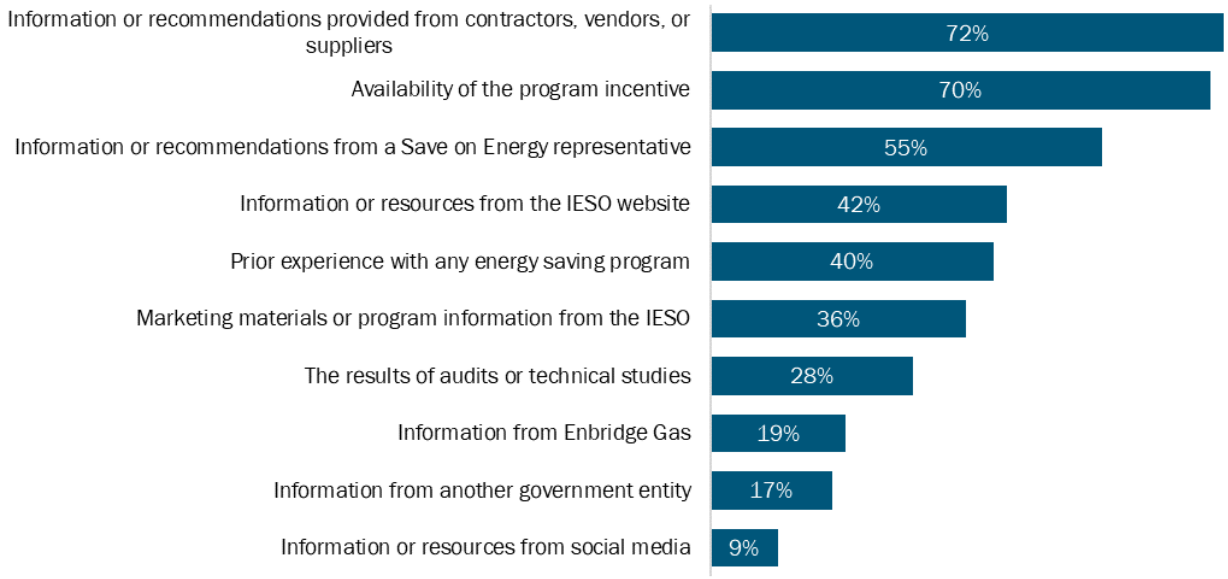
Respondents were asked how influential various program features were on their decisions to install energy-efficient equipment, as shown in Figure D-35. They rated each feature's influence on a scale from one to five, where one indicates it was "not at all influential" and five indicates it was "extremely influential." The highest-rated responses were recommendations from contractors, vendors, or suppliers (72% with a rating of four or five)

and the availability of the incentive (70% with a rating of four or five for each response). The least influential program feature was information or resources from social media (9% with a rating of four or five). This question, which focused on the program's influence and prior questions about customer intentions, was used to estimate the FR score.

Further, findings from this question emphasized the contractor, vendor, and supplier networks' strength in driving Retrofit Program engagement. Their interactions with customers were valuable on their own, but, more generally, they helped familiarize customers with energy-saving programs and could influence future participation beyond the Retrofit Program.

Figure D-42: Influence of Program Features on Participation (n=53)*

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

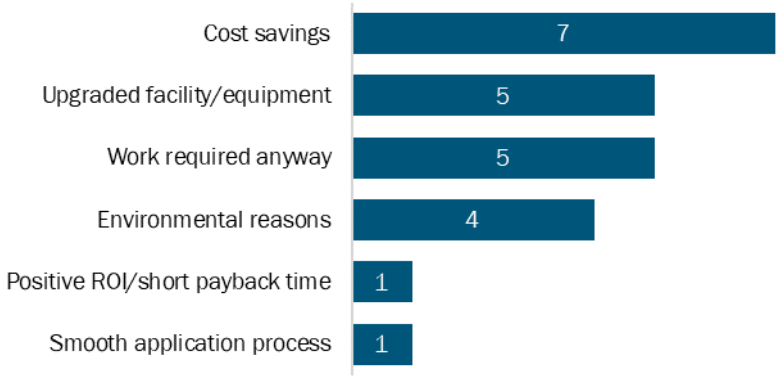


*Does not sum to 100% due to multiple responses.

Respondents were asked whether any other factors played "a great role" in influencing their organization to install energy-efficient equipment, as shown in Figure D-36. Seven out of 18 respondents reported cost savings as an influential factor on their upgrade decisions. Other common responses included a desire to upgrade their facility or equipment (five respondents), the fact that the work was required anyway (five respondents), and a desire to reduce environmental harm (four respondents).

Figure D-43: Other Influential Factors on Upgrade Decision

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



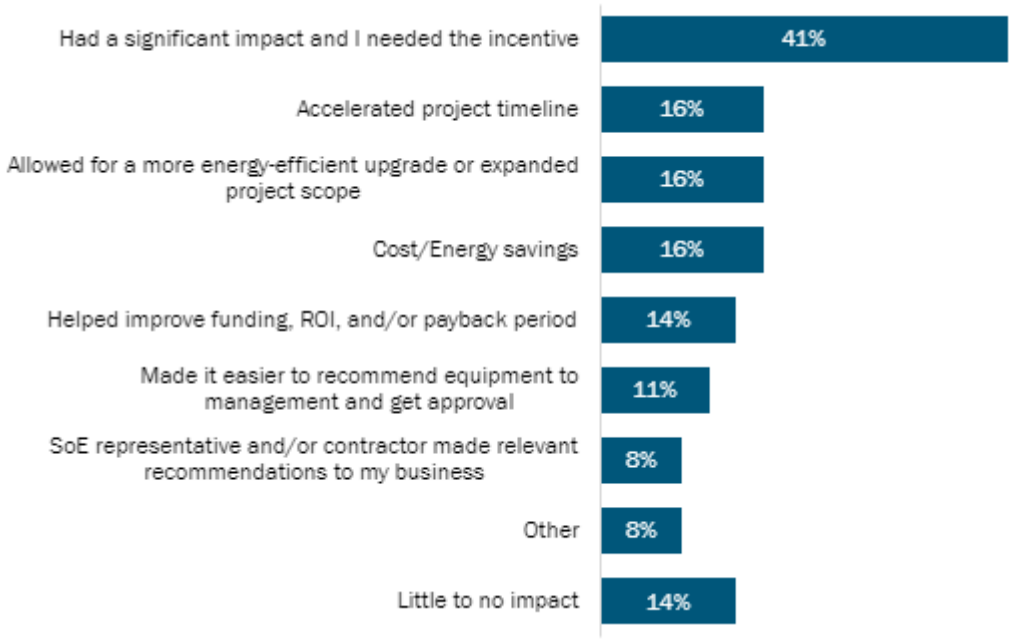
*Counts displayed rather than percentage due to small n.

The survey asked respondents to explain, in their own words, what impact (if any) the financial support or technical assistance they received from the program had on their decisions to install the program-incentivized equipment when they did, as shown in Figure D-37.

The most common response was that the program played a great role and that they needed the incentive (41%). Other common responses related to accelerating the project timeline (16%), the program allowing for a more energy-efficient upgrade or expanded project scope (16%), and achieving cost/energy savings (16%). Responses categorized under "Other" included improving their work environment and/or culture (3%), receiving helpful customer service from Save on Energy (6%), and receiving helpful technical assistance (6%).

Figure D-44: Program Impact on Decision to Install Equipment

(Open-ended and multiple responses allowed; n=37)*

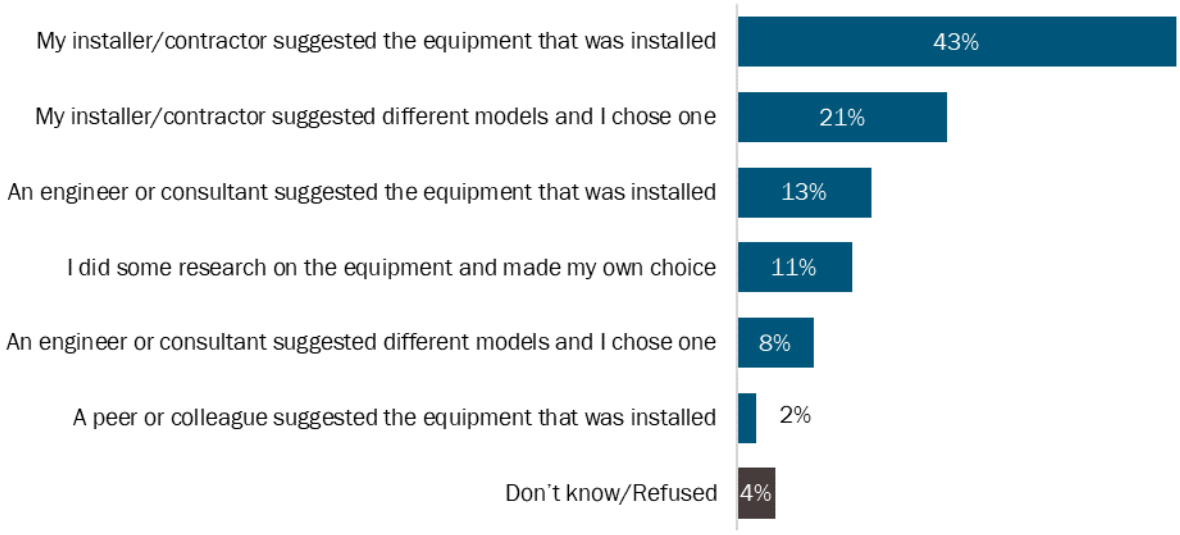


*Does not sum to 100% due to multiple responses.

As shown in Figure D-38, over two-fifths (43%) of surveyed participants selected equipment based on their installer's or contractor's suggestions, which was more than twice the number of participants who chose from a shortlist of equipment models provided by their installer or contractor (21%), followed by an engineer's or consultant's suggestions (13%), or did their own research (11%). This reinforces the importance of the contractors' role in helping drive customers to efficient equipment decisions.

Figure D-45: Equipment Selection Process

(Open-ended and multiple responses allowed; n=53)*



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

SPILLOVER

To estimate the SO rate, the survey asked participants if they installed any energy-efficient equipment in PY2023 for which they did not receive an incentive following their Retrofit Program participation. Over one-tenth of respondents (11%) reported installing new equipment. Table D-24 displays the types of non-incentivized equipment installed by companies after their Retrofit projects were completed. Some survey respondents installed multiple equipment types, with non-incentivized lighting the most common equipment installed. Almost one-tenth of respondents (9%) installed lighting.

The team then asked respondents what influence level their participation in the Retrofit Program had on their decision to install additional energy-efficient equipment. Participants rated the program's influence on a scale from one to five, where one indicates the program was "not at all influential" and five indicates the program was "extremely influential." Table D-24 displays that respondents offered varying answers regarding how important the program was in their decision to install additional energy-efficient equipment.

Table D-24: Types of Upgrades Installed after Program Participation

(Open-ended and multiple responses allowed; n=6)*

Spillover Equipment	Respondents	Average Influence Score(s)	Max Influence Score	Min Influence Score
Lighting	5	4.6	5.0	4.0
Lighting Controls	2	2.0	3.0	1.0
HVAC—Air conditioner replacement, above code minimum	1	1.0	1.0	1.0
ENERGY STAR Appliance	1	1.0	1.0	1.0
Motor/Pump Upgrade	1	1.0	1.0	1.0
Fan	1	1.0	1.0	1.0

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

Participants who indicated that they installed the program-influenced, non-incentivized equipment were then asked a series of follow-up questions addressing capacity, efficiency, and annual HOU. These detailed questions, displayed in Table D-25 through Table D-29 were used within the NTG algorithm to attribute SO savings to each equipment installation. SO savings were primarily driven by the installation of 335 new linear LEDs.

Table D-25: Type of Lighting Installed

(Multiple responses allowed; n=5)

Lighting Type	Respondents
LED linear	3
LED exterior	2
Compact fluorescent (CFL)	2

Table D-26: Quantity of CFL Lamps (n=2)

Respondents	Bulbs Quantity	Max Installed
2	29	28

Table D-27: LED Exterior Lighting Mount (n=2)

Location	Respondents	Quantity Installed	Max Installed
Pole Mount	2	16	15

Table D-28: Quantity of Linear LED Fixtures

(Multiple responses allowed; n=3)

Respondents	Equipment	Max Installed
3	335	265

Table D-29: Lighting Controls

(Multiple responses allowed; n=1)

Lighting Control Type	Respondents	Max Installed
Timer	1	1

D.3 Additional Participant Process Results

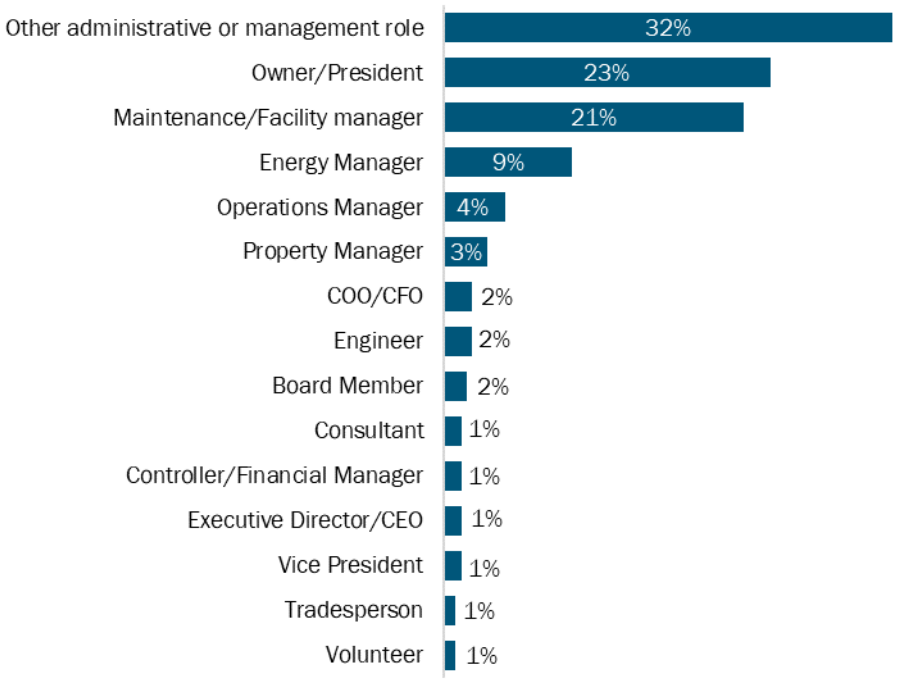
FIRMOGRAPHICS

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

As presented in Figure D-46, nearly all titles that respondents shared indicated they held either an administrative or managerial role. Nearly one-fourth of respondents (23%) were the company's owner and/or president, and over one-fifth of respondents (21%) were maintenance or facility managers. Close to one-third of respondents (32%) specified an administrative or management role other than those listed in the survey.

Figure D-46: Titles of Respondent

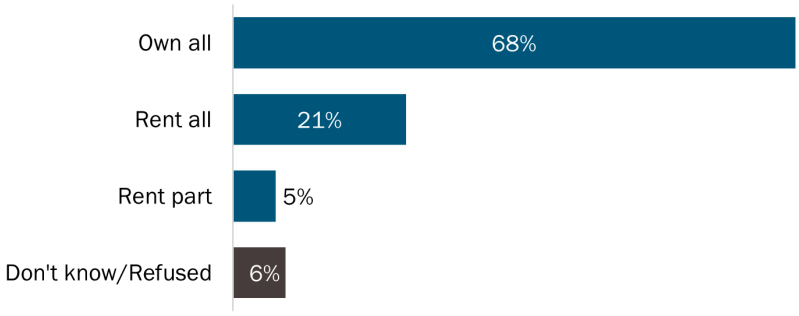
(Open-ended and multiple responses allowed; n=254)*



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

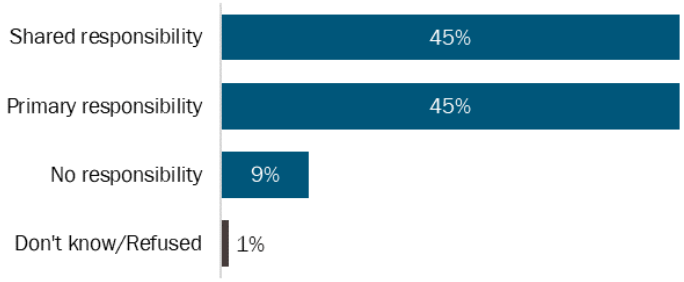
As shown in Figure D-47, more than two-thirds of respondents (68%) owned all the facilities where the program upgrades were made, more than one-fifth (21%) rented all the facilities, and 5% rented part of the facilities.

Figure D-47: Ownership Status (n=252)



Respondents specified whether they held primary or shared responsibility for the budget and/or expenditures related to the Retrofit Program project. More than two-fifths of respondents (45%) shared such responsibilities and 45% had primary responsibility, as shown in Figure D-48. A relative few (9%) stated they had no responsibilities for budget and/or expenditure decisions.

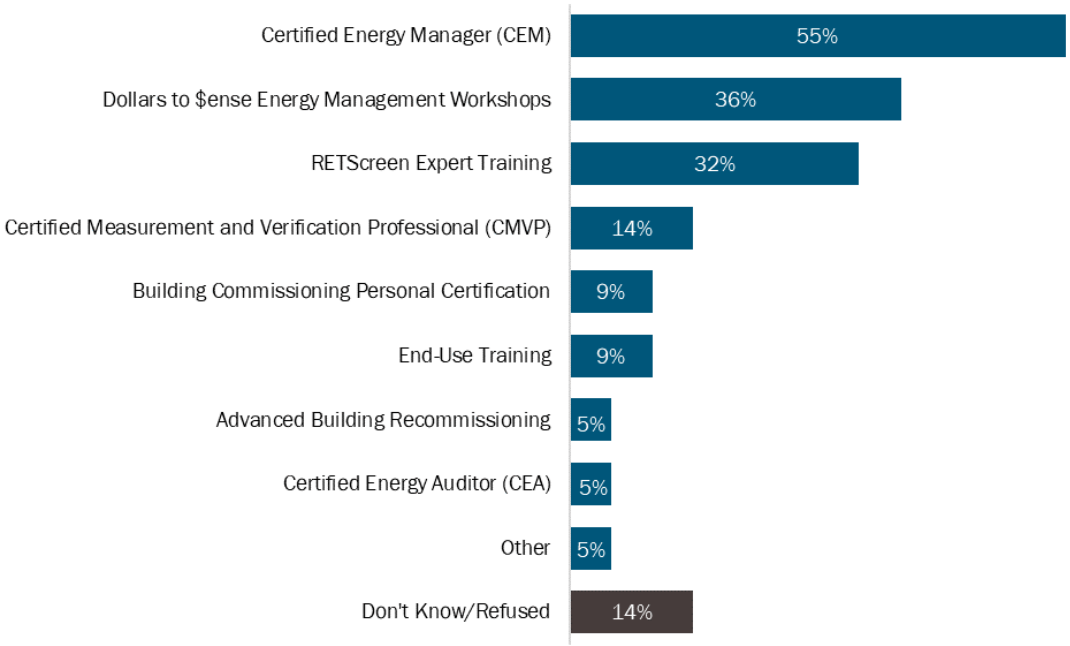
Figure D-48: Responsibility for Budget and Expenditures (n=254)



Less than one-tenth of respondents (9%) confirmed participating in the IESO's subsidized training programs. Of those with training experience, more than one-half (55%) stated they completed a Certified Energy Manager training, as shown in Figure D-49. Other commonly cited training programs included Dollars to $ense Energy Management Workshops (36%), RETScreen Expert Training (32%), and the Certified Measurement and Verification Professional training (14%).

Figure D-49: Participation in IESO-Subsidized Training

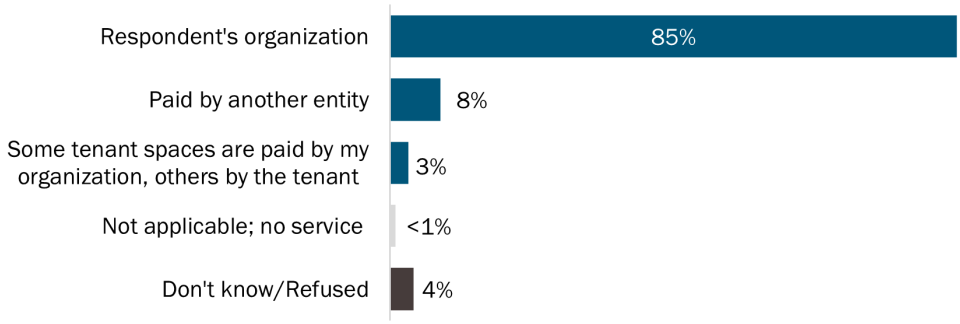
(Open-ended and multiple responses allowed; n=254)*



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

Most respondents (85%) indicated that their organization paid the electricity bills for the facilities where the program updates were made, as shown in Figure D-50. Less than one-tenth of respondents reported another entity (8%) or a mix of their organization and the tenant (3%) paid the electricity bills.

Figure D-50: Entity that Pays the Facility's Electricity Bills (n=252)*

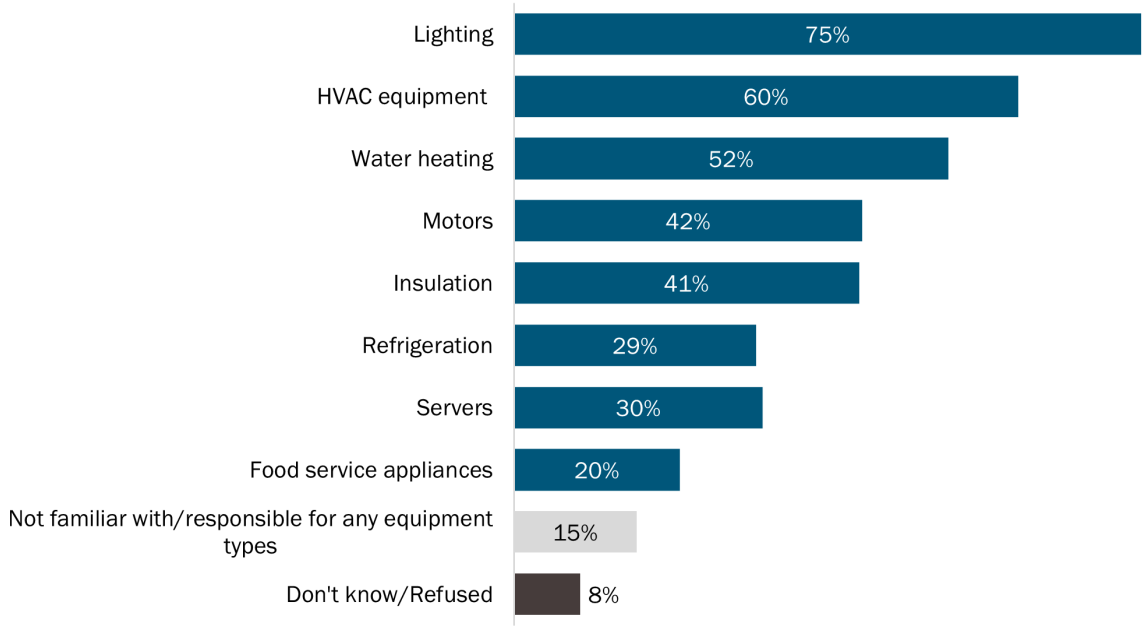


*Does not sum to 100% due to rounding.

As shown in Figure D-51, almost three-fourths of respondents (75%) were familiar with or responsible for lighting maintenance. Respondents also commonly reported that they were familiar with or responsible for HVAC equipment maintenance (60%), water-heating equipment (52%), motors (42%), and insulation (41%) at the facilities where the program upgrades were made. More than one-tenth of respondents (15%) were not familiar with or responsible for the maintenance of any equipment.

Figure D-51: Familiarity with or Responsibility for Equipment Maintenance

(Open-ended and multiple responses allowed; n=252)*

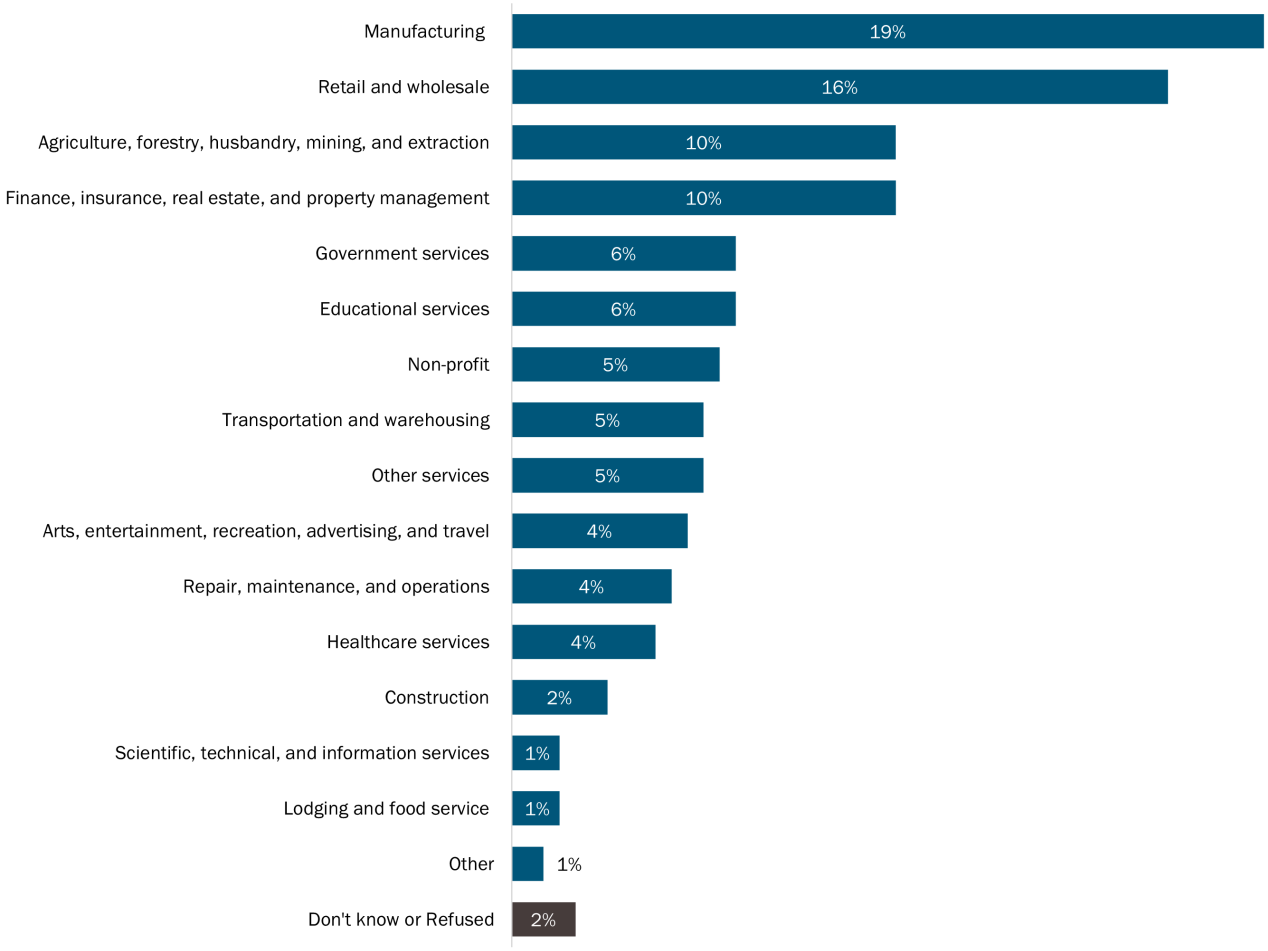


*Does not sum to 100% due to multiple responses.

Respondent business categories varied, as presented in Figure D-52. Almost one-fifth of respondents (19%) work in manufacturing and more than one-tenth of respondents (16%) work in retail and wholesale. One-tenth of respondents (10%) work in agriculture, forestry, husbandry, mining, or extraction, or in finance, insurance, real estate, and property management.

Figure D-52: Respondents' Business Category

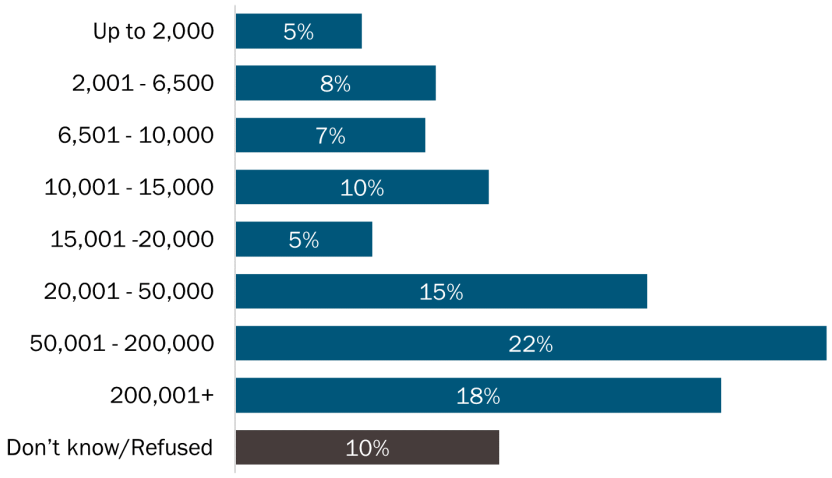
(Open-ended and multiple responses allowed; n=250)*



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

Participants were asked to provide their facilities' total area. Most frequently, facility sizes ranged between 50,000 to 200,000 sq. ft. (22%) and 200,001+ sq. ft. (18%), as shown in Figure D-53.

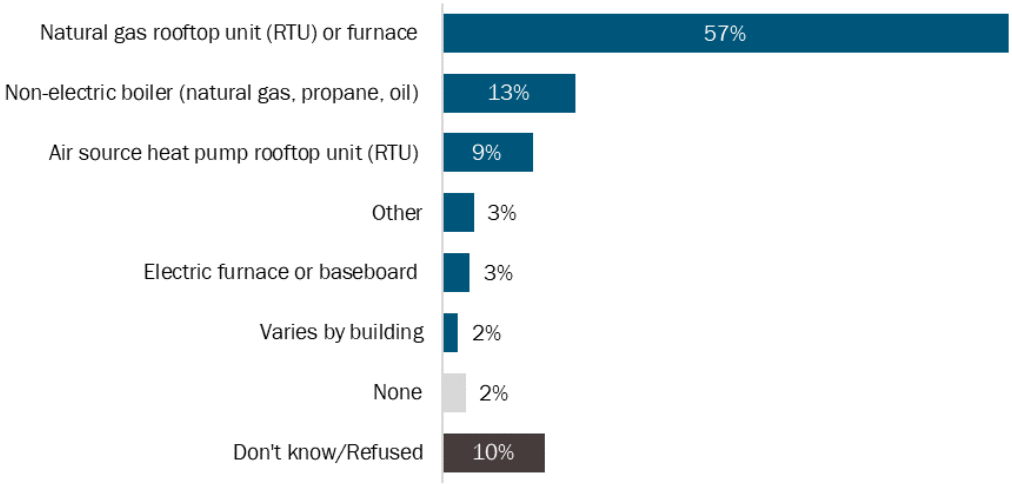
Figure D-53: Total Square Footage for All Buildings (n=252)



Nearly three-fifths of respondents (57%) reported a natural gas rooftop unit (RTU) or furnace as a primary heating source at their facilities, as shown in Figure D-54. More than one-tenth of respondents (13%) reported heating their facilities with a non-electric boiler.

Figure D-54: Facility Primary Heating System

(Open-ended and multiple responses allowed; n=252)*

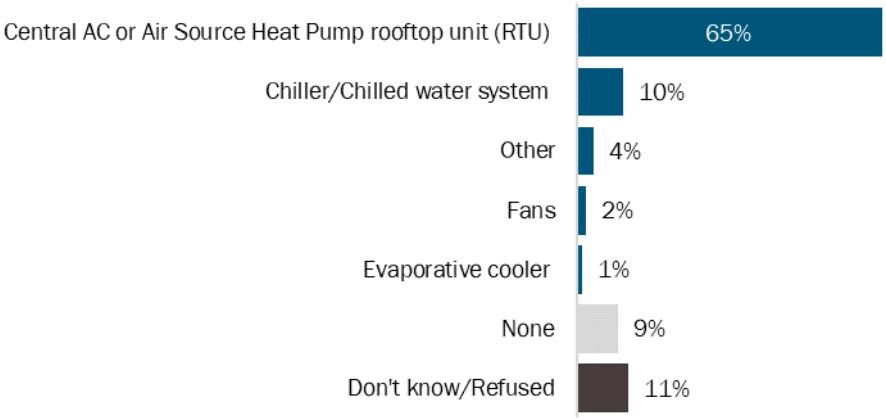


*Does not sum to 100% due to multiple responses.

On the cooling side, nearly two-thirds of respondents (65%) reported a central air conditioner or air-source heat pump RTU, followed by one-tenth (10%) with chiller systems, as shown in Figure D-55.

Figure D-55: Facility Primary Cooling System

(Open-ended and multiple responses allowed; n=252)*



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

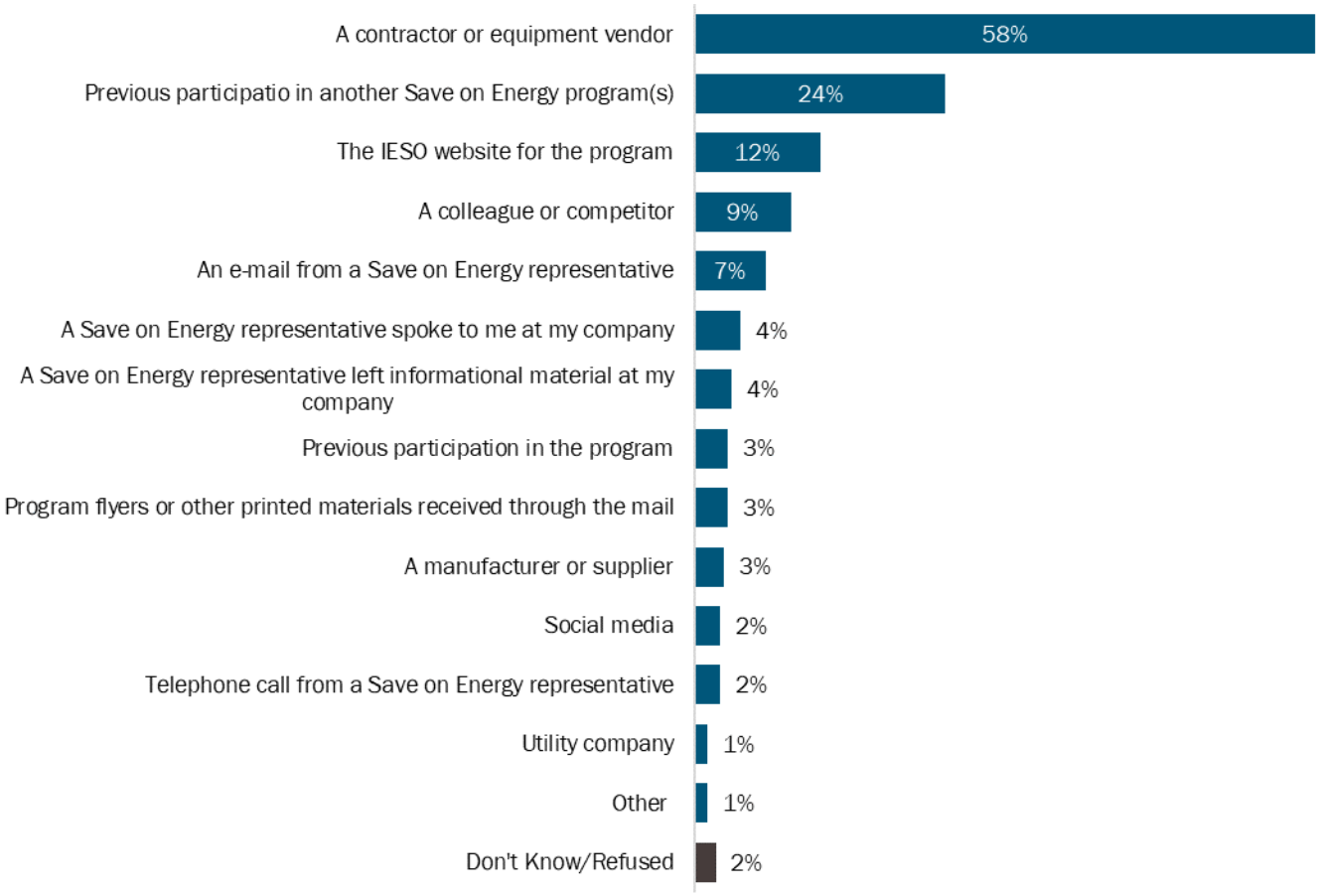
PROGRAM AWARENESS

How Respondents Heard About the Program

Figure D-56 lists ways that respondents heard about the program. Most commonly, respondents heard about the program through a contractor or equipment vendor (58%). Section 6.3.2 includes additional discussion about program awareness.

Figure D-56: Sources of Program Awareness

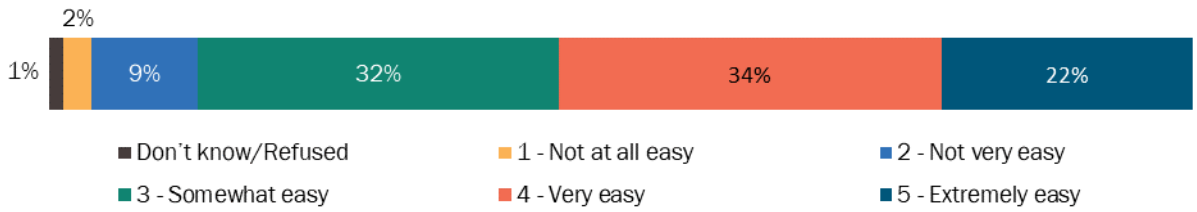
(Open-ended and multiple responses allowed; n=254)*



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

When asked about the ease of participating in the Save on Energy Retrofit Program (shown in Figure D-57), respondents used a scale of one to five, where one means "not at all easy" and five means "extremely easy." More than one-half of respondents (56%) rated their program participation as a four or five. One-third of respondents (32%) rated their program participation as a three, and just over one-tenth (11%) rated their program participation as a one or two. Section 6.3.2 includes additional discussion about program awareness.

Figure D-57: Ease of Program Participation (n=254)

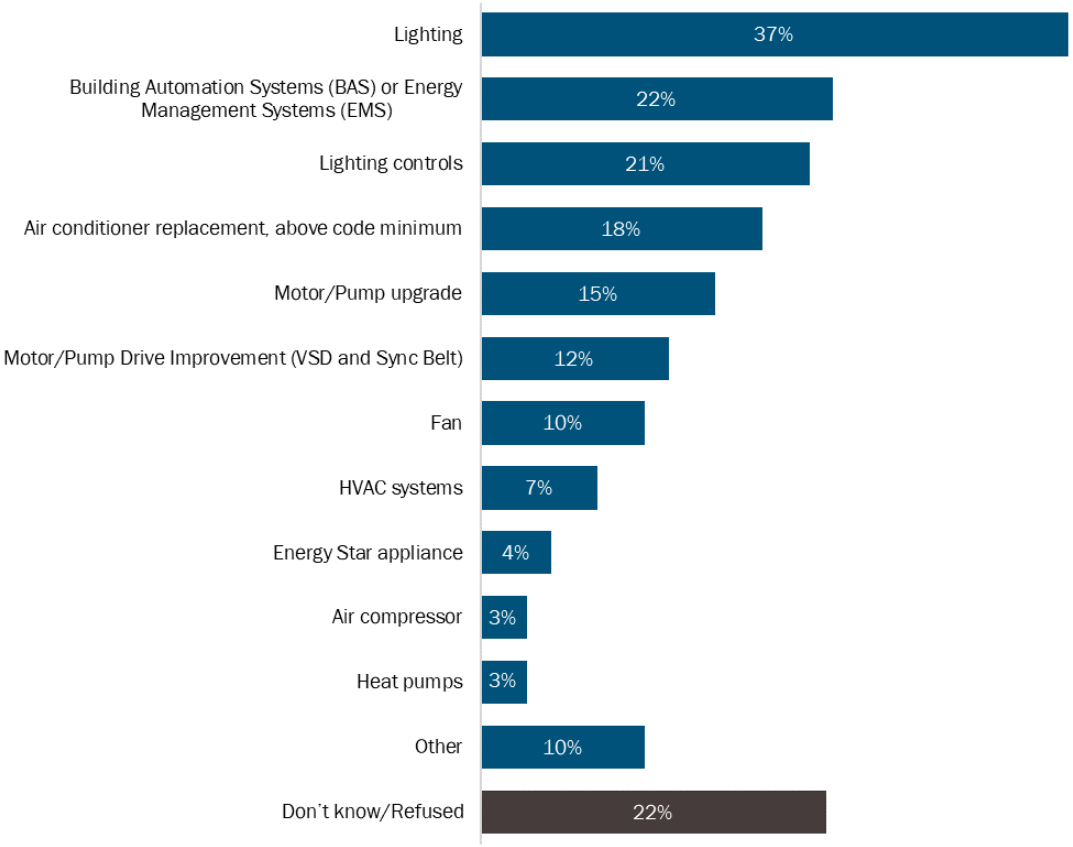


DECISION TO NOT INSTALL ADDITIONAL EQUIPMENT OR SERVICES

More than one-fourth of respondents (27%), upon completing the project, decided not to install energy-efficient equipment that initially interested them. These respondents were asked what, if any, energy-efficient equipment was initially of interest to their company but that they ultimately decided not to install. As shown in Figure D-58, respondents commonly reported deciding not to install lighting (37%), building automation systems and energy management systems (22%), and lighting controls (21%). Section 6.3.3 includes additional discussion about decisions to not install additional energy-efficient equipment.

Figure D-58: Energy Efficient Equipment not Installed

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

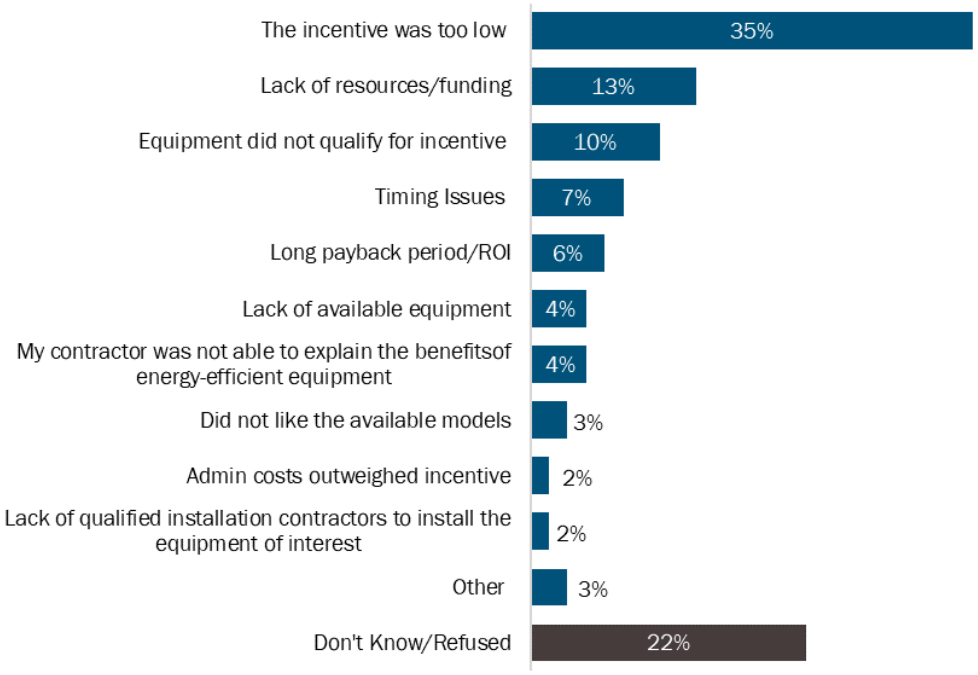


*Does not sum to 100% due to multiple responses.

The survey asked respondents why they decided not to install the energy-efficient equipment initially of interest to their company. As shown in Figure D-59, more than one-third of respondents (35%) reported that low incentives were a reason for not installing equipment of interest. Respondents also commonly mentioned a lack of resources and funding (13%), and that the equipment did not qualify for the incentive (10%). Section 6.3.3 includes additional discussion about decisions for not installing additional energy-efficient equipment.

Figure D-59: Reasons for Not Installing All Equipment Initially of Interest*

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



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

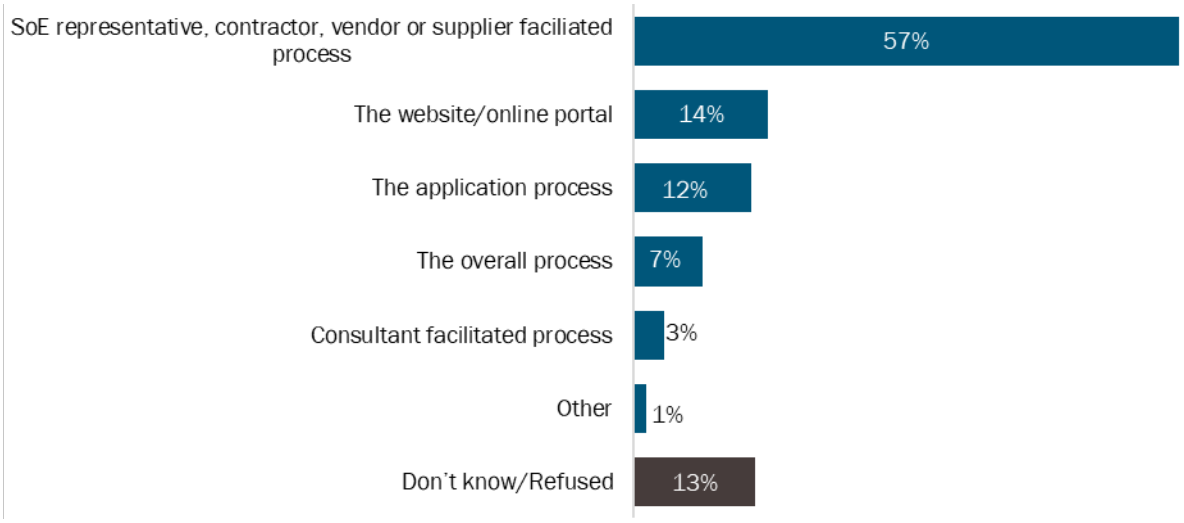
Of these respondents who decided not to install all energy-efficient equipment initially of interest to them, more than four-fifths stated that their contractor typically could help them install the energy-efficient equipment of interest to them (88%) and that their contractor could explain the benefits of that equipment (90%), indicating that the contractor was typically not the reason that respondents chose not to install all equipment initially of interest to them.

Aspects of the Save on Energy Retrofit Program that Made It Easy to Participate

Figure D-60 lists aspects that respondents named as facilitating their program participation. Most respondents (57%) reported that a Save on Energy representative, contractor, vendor, or supplier facilitated the process. Section 6.3.2 includes additional discussion about these aspects.

Figure D-60: Aspects that Facilitated Participation

(Open-ended and multiple responses allowed; n=221)*

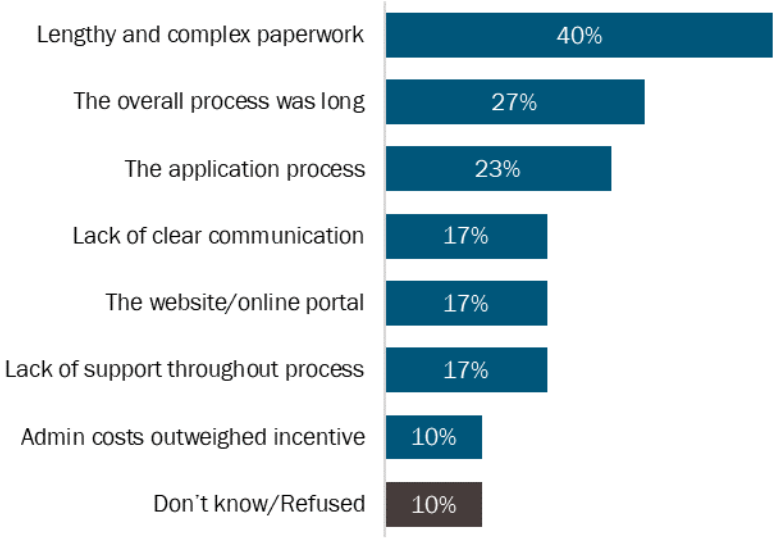


* Does not add to 100% due to multiple responses.

Figure D-61 lists aspects that respondents named as complicating their participation in the program. Paperwork, which some respondents found lengthy and complicated to complete, was most commonly cited. Section 6.3.2 includes additional discussion about these aspects.

Figure D-61: Aspects that Complicated Participation

(Open-ended and multiple responses allowed; n=30)*



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

PROJECT COSTS COVERED BY THE PROGRAM FOR NON-LIGHTING UPGRADES

Table D-30 includes a range of percentages of Prescriptive and Custom non-lighting projects costs covered by the program. Respondents most commonly mentioned that 1% to 10% of these project costs were covered by the incentive they received through the program. Section 6.3.4 includes additional discussion on this topic.

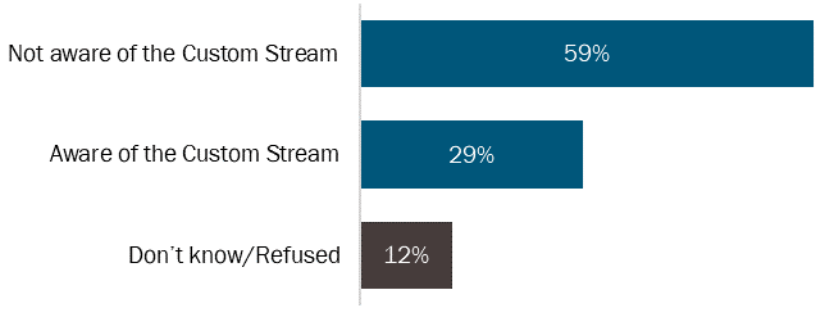
Table D-30: Percent of Non-Lighting Project Costs Covered by the Program
(Open-ended and multiple responses allowed; n=67)*

Percentage of Non-Lighting Project Costs Covered by the Program	Prescriptive (n=50)	Custom (n=17)
0	24%	29%
1-10	30%	35%
11-20	18%	12%
21-30	16%	6%
31-40	4%	6%
41-50	2%	6%
51-60	0%	6%
61-70	0%	0%

CUSTOM STREAM

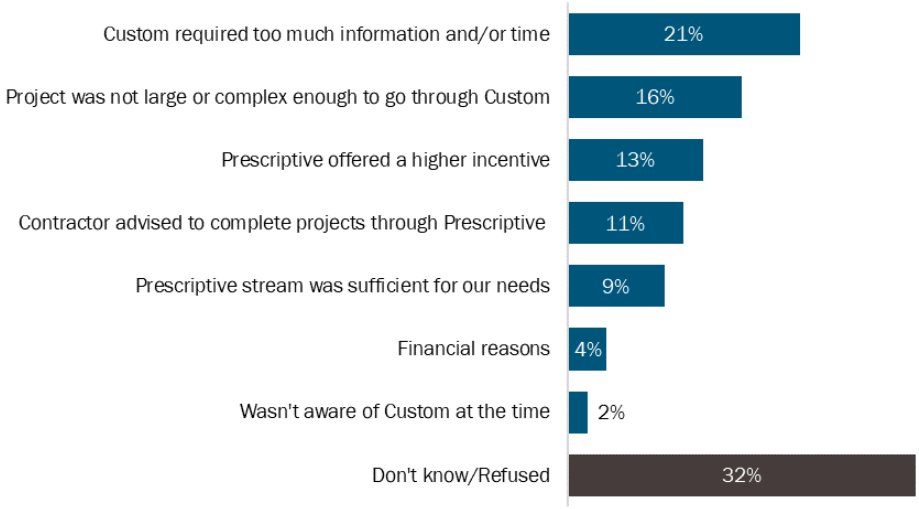
Respondents who participated in the Prescriptive stream and not the Custom stream were asked if they were aware that the Save on Energy Retrofit Program offers Custom stream incentives, which cover up to 50% of the cost of approved Custom energy-efficiency projects, as shown in Figure D-62. Almost three-fifths (59%) said that they were not aware of the Custom stream, and almost one-third (29%) said they were aware of the Custom Stream. Section 6.3.5 includes additional discussion on this topic.

Figure D-62: Awareness of the Retrofit Program Custom Stream (n=193)



Respondents who indicated that they were aware of the Custom stream were asked why their company chose not to complete any Custom projects, shown in Figure D-63. Over one-fifth of respondents (21%) said that the Custom stream required too much information and/or time. Over one-tenth each answered that their company's project was not large or complex enough to go through the Custom stream (16%), the Prescriptive stream offered a higher incentive than the Custom stream for their project (13%), or their contractor had advised their company to complete projects through the Prescriptive stream instead (11%). Section 6.3.5 includes additional discussion on this topic.

Figure D-63: Reasons for Not Completing Custom Stream Projects (n=56)*

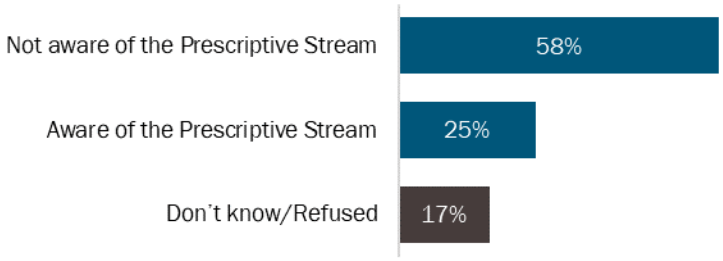


*Does not sum to 100% due to multiple responses.

Respondents who participated in the Custom stream and not the Prescriptive stream were asked if they were aware that the Retrofit Program offered Prescriptive stream incentives for commonly used equipment and services, as shown in Figure D-64. Almost three-fifths (58%)

said they were not aware of the Prescriptive stream, and one-fourth (25%) said they were aware of the Prescriptive stream. Section 6.3.5 includes additional discussion on this topic.

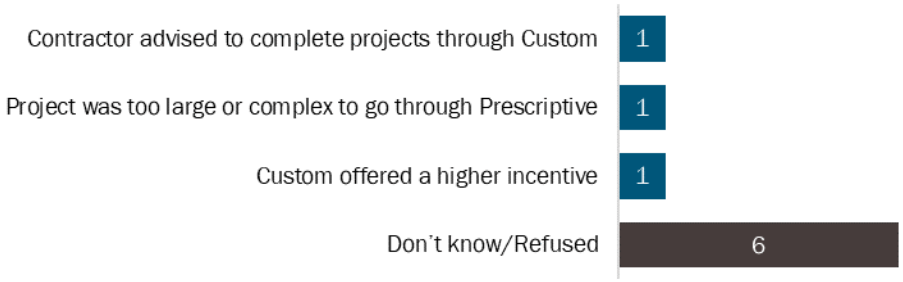
Figure D-64: Awareness of the Retrofit Program Prescriptive Stream (n=36)*



*Does not sum to 100% due to rounding.

The nine respondents who were aware of the Prescriptive stream were asked why their company chose not to complete projects through the Prescriptive stream, as shown in Figure D-65. One respondent said their contractor had advised their company to complete projects through the Custom stream instead, one respondent said their company's project was too large or complex, and one respondent said the Custom stream offered a higher incentive for their project. Most respondents either did not know or refused to answer (six respondents). Section 6.3.5 includes additional discussion on this topic.

Figure D-65: Reasons for Not Completing Prescriptive Stream Projects (n=9)



RECOMMENDATIONS FOR RETROFIT PROGRAM IMPROVEMENTS

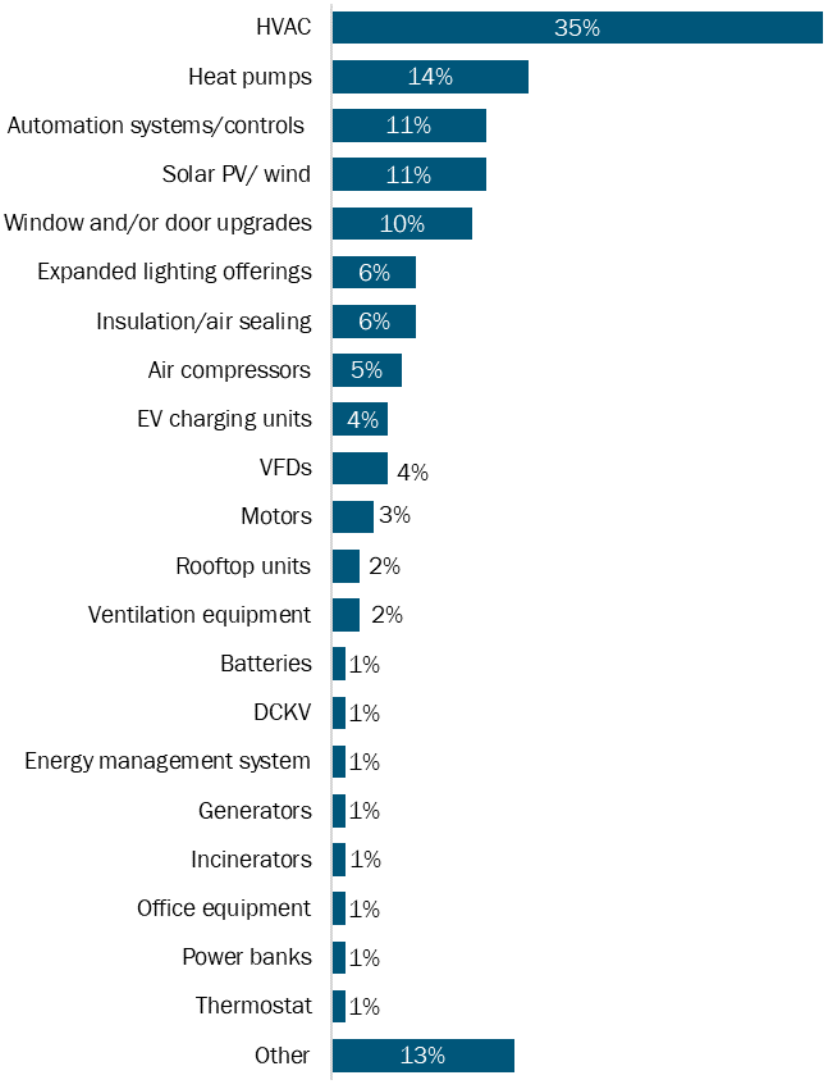
Recommended Equipment and Services

Figure D-66 includes a full list of additional energy-efficient equipment or services that respondents recommended for future inclusion in the Retrofit Program. Nearly two-fifths of respondents (39%) offered recommendations for additional energy-efficient equipment or services to consider for inclusion in the Retrofit Program. Most commonly, these

recommendations included HVAC equipment (35%), heat pumps (14%), automation systems/controls (11%), and solar PV/wind (11%). Responses in the other category included the following: water filtration systems, air cleaners, battery powered equipment, refrigeration equipment, dock shelters, climate control, energy curtains, power factor correction, incinerators, humidity control systems, and more energy-efficient appliances Section 6.3.6 includes additional discussion regarding these equipment recommendations.

Figure D-66: Recommended Energy-Efficient Equipment or Services to Improve the Retrofit Program

(Open-ended and multiple responses allowed; n=100)*



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

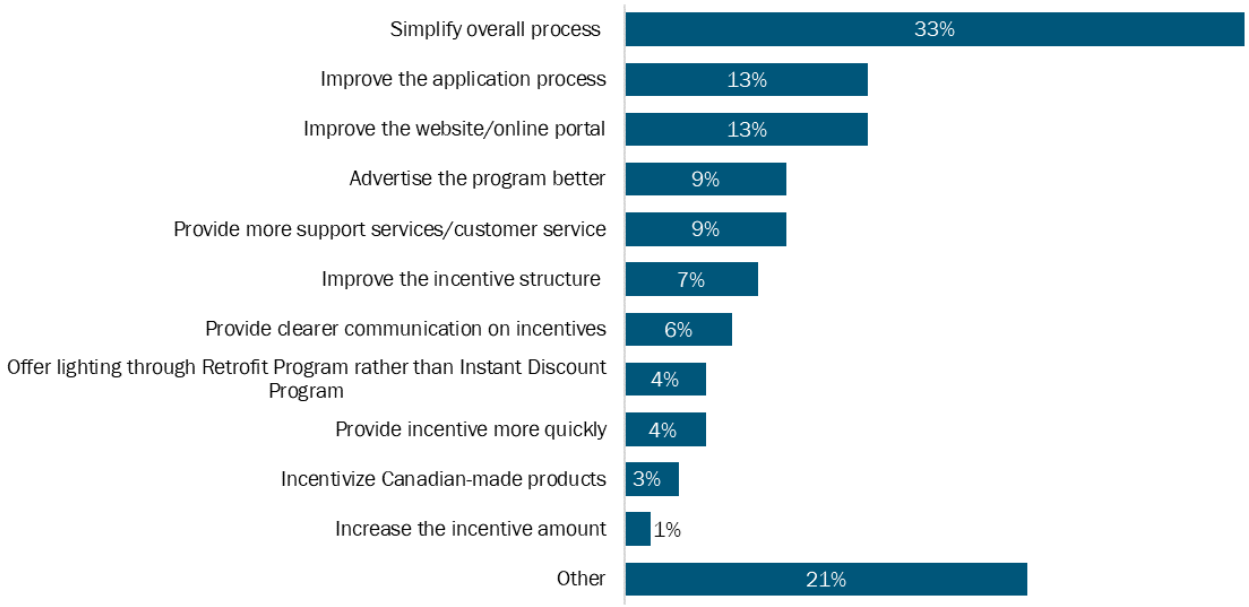
Additional Recommendations for Program Improvement

Figure D-67 includes a full list of recommendations that respondents provided to improve the Retrofit Program. Almost one-third of respondents (28%) provided recommendations to improve the Retrofit Program. The most common suggestions included simplifying the overall process (33%), improving the application process (13%), and improving the Save on Energy website and online portal (13%). Responses in the other category included the following: prioritizing agriculture, extending projects for more years, on-bill financing, a

deep energy retrofit path for older buildings, and a speedier approval process. Section 6.3.6 includes additional discussion regarding these responses.

Figure D-67: Recommendations to Improve the Retrofit Program

(Open-ended and multiple responses allowed; n=70)*



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

Appendix E Job Impacts Methodology

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

E.1 Developed Specific Research Questions

The first step in modeling the job impacts from the Retrofit program was to determine which specific research questions (RQs) the model would answer. In a scenario without the Retrofit program's existence, customers received electricity from the IESO and paid for it via the monthly billing process. Implementing the Retrofit program introduced a set of economic supply and demand shocks to different economy sector. The following four research questions illustrate these shocks:

1) **What job impacts arise from new demand for energy-efficiency measures and related program delivery services?** Funds collected for the Retrofit program generated demand for efficient equipment and appliances. Additionally, they generated demand for services related to program delivery, such as general overhead for program implementation and staffing. This demand created jobs among firms supplying these products and services. Third-party implementers collected funds from the IESO to cover portions of project costs, while participants covered the remainder of costs.

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

3) **What job impacts arise from funding the energy-efficiency program?** IESO energy-efficiency programs were funded via volumetric bill charges for all customers—both residential and nonresidential. This additional charge could reduce the money that households realized for savings and for spending on other goods and services, resulting in a negative impact on jobs in the Canadian economy.

4) **What job impacts arise from reduced electricity production?** The energy-efficient measures allowed businesses to receive the same benefit while using less electricity. As a whole, the program would reduce the electricity demand in the commercial sector. This reduced demand could have upstream impacts on the

utility industry (for example, generation) and related industries, such as companies in the generator fuel supply chain.

E.2 Developed Model Inputs

Modelling job impacts then moved to a second step: gathering data required for the StatCan IO model to answer each research questions. Model input data included dollar values of the exogenous shocks from program implementation. Data sources included the following:

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

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

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

3) The team identified customers' intentions regarding whether to reinvest, save, or distribute to owners/shareholders money saved on energy bills via the following **short** section of the participant surveys:

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

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

96. Other, please specify:

98. Don't know

99. Refused

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

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

98. Don't know

99. Refused

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

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

For estimating job impacts, the amount of bill savings that a business would reinvest served as the key input value rather than paying down debt or redistributing to shareholders.

4) **Retrofit funding:** the IESO fund its energy-efficiency programs through a volumetric charge on electricity bills; volumetrically, in 2023, residential customers accounted for 35% of consumption, and nonresidential customers accounted for 65%. The overall program budget, distributed between these two customer classes by these percentages, served as input values for the analysis.

5) **Reduced electricity production:** The NPV of retail savings (estimated as part of RQ2) also provided the input for examining potential impacts of producing less electricity.

E.3 Run Model and Interpret Results

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

1) Demand shock, as outlined in RQ1, representing the demand impact of energy-efficiency products and services resulting from the Retrofit program.

2) Business Reinvestment shock, representing the net amount of additional spending that the commercial sector would undertake, as described in RQ2. This was estimated by taking the NPV of energy bill savings and subtracting the amount of project costs covered by participants.

3) Household Expenditure shock, representing the portion of household funds captured by increased bill charges, thus acting as a negative shock to the economy (RQ3). The evaluation team estimated this by taking the portion of program funding paid for by increases to residential electricity bills.

The model output generated three types of job impact estimates:

Direct Impacts

Direct impacts are jobs created during the initial round of spending from the exogenous shocks. For the demand shock for energy-efficiency products and services, direct impacts resulted from adding employees to installed measures and handling administrative duties. For the business reinvestment shock, direct impacts could be internal jobs created by businesses reinvesting savings back into the company or jobs created by businesses buying additional goods and services using energy bill savings.

Indirect Impacts

Indirect impacts are job impacts due to interindustry purchases as firms respond to the new demands of directly affected industries. These include jobs created up supply chains due to

demand created by the energy-efficiency program, such as manufacturing goods or supplying inputs.

Induced Impacts

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

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

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

The evaluation team presents model run results in terms of the above job-impact types (i.e., direct, indirect, and induced) and the job type (total jobs vs. FTEs). These results—along with the model input shock values—are presented and discussed at a high level in Section 6.2, and in more detail in Appendix F.1.

Appendix F Detailed Job Impacts Inputs and Results

This section presents the detailed results of job impact analysis, as summarized in Section 6.2. Table F-1 presents total jobs impacts by type. As the fourth and fifth columns indicate, the analysis estimated that the Retrofit program would create 3,423 total jobs in Canada, with 3,062 jobs created in Ontario. Of 3,423 estimated total jobs, 1,759 are direct jobs, 873 are indirect jobs, and another 792 are induced. In terms of FTEs, numbers run slightly lower, with 2,640 FTEs created in Ontario and 2,948 FTEs created nationwide. Of the 2,640 FTEs, direct jobs account for 1,544 FTEs, indirect jobs account for 607 FTEs, and induced jobs account for 490 FTEs. In total, the Retrofit program created 60.1 jobs per million dollars of investment (i.e., the program budget).

Table F-1: Total Job Impacts by Type

Job Impact Type	FTE *(in person-years)* – Ontario	FTE *(in person-years)* – Total	Total Jobs *(in person-years)* – Ontario	Total Jobs *(in person-years)* – Total	Total Jobs per $1M Investment *(in person-years)*
Direct	1,544	1,592	1,708	1,759	30.9
Indirect	607	756	706	873	15.3
Induced	490	600	648	792	13.9
Total[1]	**2,640**	**2,948**	**3,062**	**3,423**	**60.1**

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

F.1 Model Inputs

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

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

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

The first 14 rows of Table F-2 contain categories corresponding to products (i.e., measures installed in businesses). The last row contains services. Lighting fixtures had the highest total cost among the product categories, accounting for $128.6 million of the overall program cost. The second largest product category—Heating and cooling equipment—had $27.7 million of 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. Labour costs were determined by examining a random sample of program invoices. The analysis used a sample size of 122 invoices that specified the portion of project costs for labour versus materials. Labour percentages were calculated and applied by measure type, based on when the project was completed in the year. Of 122 invoices examined, these projects had a weighted average labour percentage of 36%. Thus, demand shock for each SUPC was assumed to be 36% labour and 64% non-labour.

The table's single service category--office administrative services—included general overhead and administrative services associated with program delivery. The labour and non-labour amounts were not specified for this category, as the IO Model used built-in assumptions for this category.

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

Category Description	Non-Labour *($ Thousands)*	Labour *($ Thousands)*	Total Demand Shock *($ Thousands)*
Lighting fixtures	81,416	47,164	128,580
Heating and cooling equipment (except household refrigerators and freezers)	18,036	9,712	27,748
Switchgear, switchboards, relays and industrial control apparatus	17,343	9,540	26,882
Electric light bulbs and tubes	9,077	5,194	14,271
Metalworking machinery and industrial moulds	7,254	3,906	11,160
Pumps and compressors (except fluid power)	2,734	1,472	4,206
Industrial and commercial fans, blowers and air purification equipment	1,800	969	2,769
Non-metallic mineral products, n.e.c.	1,785	961	2,747
Major appliances	213	115	327
Measuring, control and scientific instruments	94	50	144
Boilers, tanks and heavy gauge metal containers	50	27	77
Other miscellaneous manufactured products	45	24	70
Agricultural, lawn and garden machinery and equipment	22	12	34
Turbines, turbine generators, and turbine generator sets	15	8	23
Subtotal	139,883	79,154	219,038

Office Administrative Services	-	-	9,902
Total			**228,940**

The second shock modelled through the IO Model was the business reinvestment shock. This shock represented the amount that businesses would reinvest and inject back into the economy. The net amount that businesses had available to reinvest, pay off debt, or distribute to owners/shareholders ($365.9 million) was the net of electricity bill savings (NPV = $547.8 million) and the portion of project costs not covered by incentives ($181.9 million). The portion of this $491.7 million reinvested was estimated using surveys administered to participants as part of the Retrofit Process Evaluation. The surveys included several questions about what businesses would do with money they saved on electricity bills and the business type. Overall, respondents indicated that 79% of bill savings would be reinvested ($289.0 million). Remaining savings would be used to pay off debt or disbursed to owners/shareholders.

To properly model the business reinvestment shock effects, the IO Model required reinvestment estimates by industry. Each industrial category had a production function in the model, and these functions were adjusted to account for the reinvestment shock. Table F-3 presents input values for the business reinvestment shock by industry. The total business expenditure shock would be $289.0 million over 29 industries, as shown.

Table F-3: Summary of Industries for Business Reinvestment Shock

Category Description	Business Reinvestment Shock *($ Thousands)*
Other	73,536
Crop and animal production	27,228
Educational services	27,228
Retail trade	19,949
Other municipal government services	10,406
Automotive and transportation	9,543
Wholesale trade	9,543
Arts, entertainment and recreation	9,004
Non-profit institutions serving households	8,464
Health care and social assistance	8,411
Primary and fabricated metal	7,602
Chemical, soap, plastic, rubber, and non-metallic minerals	7,009
Other services (except public administration)	7,009
Owner occupied dwellings	7,009
Repair, maintenance and operating and office supplies	7,009
Transportation and warehousing	7,009
Machinery	6,740

Category Description	Business Reinvestment Shock *($ Thousands)*
Finance, insurance, real estate, rental and leasing and holding companies	5,660
Crop, animal, food, and beverage	5,608
Accommodation and food services	4,206
Government health services	4,206
Other activities of the construction industry	3,126
Non-residential building construction	2,804
Other provincial and territorial government services	2,804
Engineering construction	1,402
Other federal government services	1,402
Professional, scientific and technical services	1,402
Support activities for agriculture and forestry	1,402
Forestry, logging, paper, and printing	1,132
Mining, quarrying, and oil and gas extraction	1,132
Total	**288,984**

The third model input was the household expenditure shock,[26] representing the incremental increase in electricity bills to the residential sector due to funding the program. The team assumed that the IESO programs were funded by all customers in proportion to overall electricity consumption. Thus, the residential funding portion was 35% of the $56.9M program budget or $19.9M.

F.2 Results

The StatCan IO Model generated results based on input values detailed in Sections 6.2.2 and Section F.1. Table F-4 shows the model run results for demand shock for products and services. This shock accounted for over one-half of job impacts. As the table's two right columns show, the model estimated that demand shock would result in the creation of 1,768 total jobs (measured in person-years) in Canada, 1,617 of which would be in Ontario. Of 1,768 jobs, 923 were direct, 410 indirect, and 434 induced. In terms of FTEs, the numbers were slightly lower; 1,395 FTEs were estimated to be created in Ontario and 1,525 in total across Canada. Of 1,525 FTEs, 829 were direct, 367 indirect, and 329 induced. Direct jobs impacts were realized exclusively in Ontario, as the table shows. As we move to indirect and induced jobs, impacts disperse outside of the province.

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

Table F-4: Job Impacts from Demand Shock

Job Impact Type	FTE *(in person-years)* Ontario	FTE *(in person-years)* Total	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total
Direct	829	829	923	923
Indirect	291	367	329	410
Induced	275	329	364	434
Total	**1,395**	**1,525**	**1,617**	**1,768**

Table F-5 shows the model run results for the business reinvestment shock. Job impacts generated by business investment equaled to 817 direct total FTEs and 909 direct total jobs. Overall, business investments were responsible for 1,522 FTEs and 1,786 total jobs across Canada.

Table F-5: Job Impacts from Business Reinvestment Shock

Job Impact Type	FTE *(in person-years)* Ontario	FTE *(in person-years)* Total	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total
Direct	766	817	854	909
Indirect	338	417	405	498
Induced	227	287	301	379
Total	**1,331**	**1,522**	**1,560**	**1,786**

The third shock was the reduction in household spending from the increase in electricity bills that funds the program. Table F-6 presents job impacts from the model run. This represents the number of jobs attributed to reduced household spending; this amount could have been spent in other sectors of the economy. Instead, it was spent on funding the Retrofit program. The model estimated a reduction of 99 FTEs and 131 total jobs across Canada due to decreased household spending.

Table F-6: Job Impacts from Residential Funding Shock

Job Impact Type	FTE *(in person-years)* Ontario	FTE *(in person-years)* Total	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total
Direct	51	55	69	73
Indirect	22	28	28	36
Induced	13	16	17	21

Total	**86**	**99**	**115**	**131**

The nonresidential sector also contributed to program funding. The StatCan IO Model did not adjust production functions for all industries experiencing marginally higher electricity price changes; so this portion of the shock would be modeled by assuming surplus would be reduced by the extra amount spent on electricity. The model captured 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 due to program funding.

Another potential economic shock was the economic impact of electricity production reduction as a result of increased in energy efficiency. Technically speaking, this could be estimated using StatCan Input-Output multipliers without running the model. As the IO model is linear and not well suited to modeling small decreases in electricity production. Total electricity demand has increased over time and is projected to continue increasing.[27] 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 IO model's linearity means it will provide estimates regardless of the impact size. Given the nature of electricity production, it was reasonable to conclude that the linear IO multiplier was not appropriate for estimating job impacts. Consequently, this analysis assumed job losses from decreased electricity production would be negligible.

Table F-7 shows total estimated job impacts by type, calculated by combining the jobs estimated in Table F-5, Table F-6, and Table F-7. Of 1,759 estimated total direct jobs, 1,708 were in Ontario. A slightly smaller proportion of indirect and induced jobs were in Ontario, with 706 out of 873 indirect jobs and 648 of 792 induced jobs estimated to be created within the province. FTE estimates were slightly lower overall than total jobs, with 2,640 FTEs (of all types) created in Ontario and 2,948 FTEs added nationwide. Almost all direct FTEs (1,544 of 1,592) were added in Ontario, with this number representing approximately 58% of total FTEs added in Ontario and 52% of all FTEs created across Canada.

In 2023, each $1M of program spending resulted in the creation of 60.1 total jobs, compared to 81.6 jobs per $1M in 2022. The decrease in the jobs created per $1M of program spend could have resulted due to decreases in customer reinvestment from year to year. The relative amount of money that customers save on reduced electrical bills and choose to reinvest can change from year to year, which influences the amount of money that is sunk back into the economy to purchase goods and services that otherwise would not

[27] *Annual Planning Outlook–A View of Ontario's Electricity System Needs*; 2022. IESO.

have been purchased. Decreased rates of reinvestment result in smaller amounts of job creation, which in turn drives the decrease in jobs created per $1M of program spend.

Table F-7: Total Job Impacts by Type

Job Impact Type	FTE *(in person-years)* Ontario	FTE *(in person-years)* Total	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total	Total Jobs per $1M Investment *(in person-years)*
Direct	1,544	1,592	1,708	1,759	30.9
Indirect	607	756	706	873	15.3
Induced	490	600	647	792	13.9
Total	**2,640**	**2,948**	**3,062**	**3,423**	**60.1**

Though the model did not provide year-by-year results for job impacts, the evaluation team made some estimates about the temporal nature of impacts. Table F-8 shows total jobs created due to program activities and energy savings in the first year versus those after the first year. The table assumes "first year activities" pose the initial demand shock for energy-efficiency 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 resulted from energy savings over the course of the measures' EULs. Job impacts from first-year activities made up roughly 5.9% of the total, representing 202 out of 3,423 person-years, with 104 of these person-years derived from first-year energy savings. The remaining 3,221 total job-years resulted from energy savings after the first year and reinvestment generated by the bill savings.

Table F-8: Job Impacts from First-Year Shocks

Job Impact Type	Total Jobs *(in person-years)*		
	From First Year Activities	From Bill Savings After First Year	Total
Direct	104	1,655	1,759
Indirect	52	821	873
Induced	47	745	792
Total*	**202**	**3,221**	**3,423**

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

Table F-9 shows job impacts in greater detail, with jobs added by type and industry category. The table sorts industries from top to bottom, from with the greatest impacts to

the least, with industries showing no impacts not included in the table. The table shows that the industry with the largest job impacts was administrative and support, waste management and remediation services, which added 1,028 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 (e.g., office administration, call centre operations, program management). Manufacturing and Retail trade were the industries with the next most added jobs, gaining 336 and 327 jobs, respectively.

Table F-9: Job Impacts by Industry

Output Industry Category	FTE *(in person-years)* Ontario	FTE *(in person-years)* Total	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total
Administrative and support, waste management and remediation services	894.9	909.2	1,009.2	1,028.4
Manufacturing	232.7	325.2	240.3	335.7
Retail trade	225.8	246.9	299.6	327.4
Non-residential building construction	260.2	260.2	295.2	295.2
Wholesale trade	232.7	272.6	236.4	278.0
Professional, scientific and technical services	153.9	188.6	187.6	229.4
Finance, insurance, real estate, rental and leasing and holding companies	124.1	145.4	152.5	178.1
Transportation and warehousing	82.8	104.0	99.7	123.7
Accommodation and food services	49.7	62.3	78.9	98.1
Government education services	77.1	78.7	87.7	89.6
Information and cultural industries	45.1	58.5	49.0	64.1
Other services (except public administration)	32.4	40.0	44.3	55.4
Engineering construction	51.2	51.2	49.0	49.0
Health care and social assistance	23.7	26.4	37.9	42.4
Repair construction	29.9	33.3	35.0	39.0
Residential building construction	24.5	24.5	32.0	32.0
Other federal government services	22.5	23.1	24.1	24.6

Output Industry Category	FTE *(in person-years)* Ontario	FTE *(in person-years)* Total	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total
Arts, entertainment and recreation	8.8	11.3	17.5	22.4
Non-profit institutions serving households	13.4	15.0	17.1	19.2
Crop and animal production	5.9	10.3	10.1	17.9
Educational services	6.6	7.4	16.2	17.9
Other municipal government services	14.5	16.3	15.3	17.2
Utilities	9.8	11.4	9.9	11.6
Government health services	7.5	8.9	8.1	9.5
Mining, quarrying, and oil and gas extraction	5.3	10.2	4.7	9.3
Other provincial and territorial government services	2.9	3.7	2.8	3.8
Support activities for agriculture and forestry	0.7	1.3	0.8	1.6
Other activities of the construction industry	0.5	0.7	0.9	1.2
Forestry and logging	0.5	1.1	0.5	1.2
Total*	**2,640**	**2,948**	**3,062**	**3,423**

*Columns may not add to totals due to rounding. Real values are rounded to the nearest whole number, and 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 supported the model results showing positive job impacts. The survey instrument contained questions for contractors and applicant representatives related to impacts of the Retrofit program on their firms and employment levels. Two questions in particular proved informative in understanding the nature of impacts to respondents, which would be considered direct impacts. Relevant illustrative verbatim responses follow:

1) Did the 2023 program help or hinder the growth of your business in any way? If so, please explain how:

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

   - *"Made projects affordable for end users, could upgrade projects to get the most out of their budgets."*
   - *"The incentives helped to sell more lighting."*

- *"Gives us work during our off-season."*
- *"Added a sense of urgency due to program termination and introduction of mid-market incentives. Some customers decided to implement, rather than miss the incentives. Some were persuaded to apply and defer implementation to 2024-2025. Many believed that there would be another program and they would decide then (status quo decision makers)."*
- *"Reducing ROI, especially for social housing."*

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

- "*By removing the traditional lighting program we were taken completely out of the lighting market since there are not applications to be prepared and most of our clients do not want to work with distributors because they are 1) distributors themselves, 2) getting better prices buying direct for the manufacturer, or 3) cannot pass along the price differential to the customers."*
- *"When applications were completed by us, more customers were interested in retrofitting. Point of sale has confused most customers because inconsistent from one distributor to the next."*
- "Did the 2023 program have an impact on the number of people you hired in the last year? Yes, the program impacted the number of people hired in the last year in the following ways:

Positive Impacts:

- *"One additional person."*
- *"The program takes considerable input hours to participate in. Increased demand for projects required additional electricians."*
- *"We did not hire new people but we could use full potential of our existing staff."*

Negative Impacts:

- *No negative impacts provided by respondents this year*

Respondents indicated that the program generally resulted in slight increases in overall staffing. 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 called out as a specific measure category that helped secure contracts. Contractor verbatims further supported the model's estimated direct job gains, with respondents indicating that additional staff had been hired due to the Retrofit program.

No respondents stated that program activities in PY2023 resulted in negative employment impacts. In general, responses revealed the potential for beneficial impacts the program could have on firms. Respondents indicating a negative effect on their businesses primarily stated that program changes served as the biggest drivers, particularly removing the traditional lighting program track. This issue could be examined further if parts of the program were redesigned to enhance job impacts.

Input-Output models produce informative results, useful in understanding the potential magnitude and dynamics of economic shocks created by policies and programs. While useful, the StatCan IO Model represents is a simplified vision of the Canadian economy and thus faces limitations. Based on the assumption of fixed technological coefficients, the model does not account for economies of scale, constraint capabilities, technological change, externalities, or price changes. This makes analyses less accurate in estimating 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 final demand tends to be overestimated. For household consumption, the model is based on assumptions regarding constant consumption behaviour and fixed expenditure shares relative to incomes.

Appendix G Detailed Non-Energy Benefits Methodology and Additional Results

This appendix provides additional detail about the NEB methodology as well as additional NEB results. Section 3.3.1 summarizes the methodology.

G.1 Methodology

PARTICIPANT SURVEY

The three previous studies—the *PY2022 and PY2021 Retrofit Evaluation Reports* and the *Non-Energy Benefits Study: Phase II*—assessed NEBs from energy-efficiency projects funded by the IESO over the 2017-2022 period.[28] The PY2023 evaluation applied the same methodology as previous studies in assessing NEBs, using two different question types to determine the NEBs' value that program participants realized by installing program measures:

- **Relative scaling:** Relative scaling questions asked 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 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 asked participants to assign the dollar value that they would be willing to pay for an 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. 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 total gross savings values across all participants. This was completed using both relative scaling and willingness-to-pay NEB values. Two hybrid approaches were calculated to better represent the sample:

[28] 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, relative scaling priority,** in which the team gave priority to the relative-scaling response value. Through this approach, the team only considered willingness-to-pay if the participant did not answer the relative scaling question.
- **Hybrid, minimum approach,** in which the team considered the lowest non-null response between relative scaling and the willingness-to-pay questions.

As a final step, the evaluation team calculated the average value ($/kWh) for each NEB, weighted by energy savings across all participants.

Table G-1 presents average NEB values, based on two different calculation approaches:

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

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

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

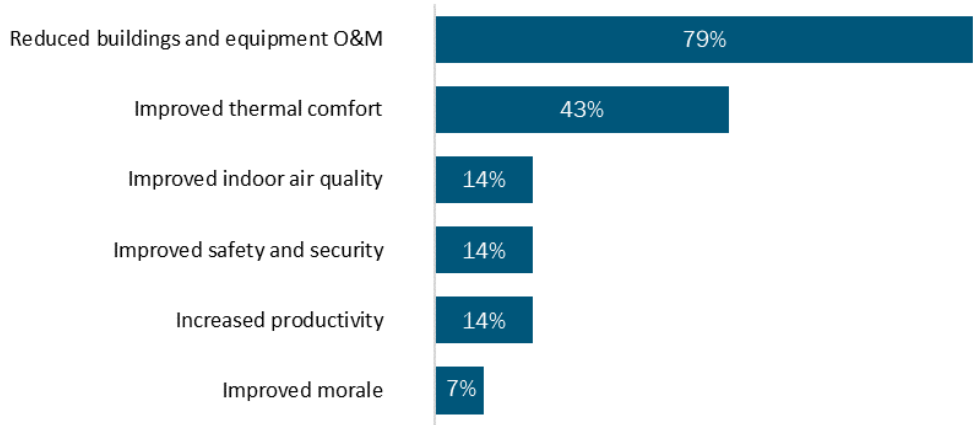
NEB Test	PY2023 (Retrofit)	PY2023 (Retrofit)	PY2022 (Retrofit)	PY2022 (Retrofit)	PY2021 (Retrofit)	PY2021 (Retrofit)	Phase II (Retrofit & SBL)	Phase II (Retrofit & SBL)
Hybrid (min approach) ($/kWh)	**Per participant**	**Overall**	**Per participant**	**Overall**	**Per participant**	**Overall**	**Per participant**	**Overall**
Reduced building & equipment O&M	$0.09	$0.04	$0.18	$0.05	$0.26	$0.20	$0.12	$0.08
Thermal comfort	$0.07	$0.02	$0.08	$0.02	$0.06	$0.07	$0.63	$0.05
Improved indoor air quality	$0.003	$0.001	$0.04	$0.01	$0.02	$0.02	$0.09	$0.01
Reduced spoilage	$0.0004	$0.004	$0.00	$0.00	$0.00	$0.00	$0.01	$0.00
Hybrid (RS-priority) ($/kWh)	**Per participant**	**Overall**	**Per participant**	**Overall**	**Per participant**	**Overall**	**Per participant**	**Overall**
Reduced building & equipment O&M	$0.55	$0.11	$0.50	$0.12	$0.31	$0.24	$0.72	$0.17
Thermal comfort	$0.09	$0.02	$0.29	$0.07	$0.19	$0.28	$0.65	$0.09

NEB Test	PY2023 (Retrofit)	PY2023 (Retrofit)	PY2022 (Retrofit)	PY2022 (Retrofit)	PY2021 (Retrofit)	PY2021 (Retrofit)	Phase II (Retrofit & SBL)	Phase II (Retrofit & SBL)
Improved indoor air quality	$0.01	$0.005	$0.10	$0.02	$0.08	$0.10	$0.10	$0.02
Reduced spoilage	$0.00	$0.01	$0.01	$0.01	$0.00	$0.00	$0.01	$0.00

G.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 believed their customers might have experienced due to their Retrofit Program participation, as shown in Figure G-1. Among contractors reporting NEBs, close to four-fifths (79%) indicated that their customers experienced reduced building and equipment O&M. More than two-fifths (43%) indicated that their customers experienced improved thermal comfort. When asked to rank the importance of various NEBs to their customers, almost all contractors (five of six) rated the time and costs for operations and maintenance as the most important elements.

Figure G-1: Contractor Reported Non-Energy Benefits
(Open-ended and multiple responses allowed; n=14)*



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