2021-2024 CDM Framework: PY2021 Energy Affordability Program Evaluation Report

August 18, 2022

SUBMITTED TO:
Independent Electricity System Operator

SUBMITTED BY:
NMR Group, Inc. in partnership with Resource

NMR Group, Inc.

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Acknolwedgements

The NMR team would like to thank the hundreds of participants that supported the NMR team's surveys. Their cooperation with the NMR team's efforts has produced high quality data that will serve Ontario conservation efforts for years to come.

The NMR team would also like to thank all the staff of the program delivery vendors, auditors, and contractors that the NMR team interviewed. Their insights have been invaluable to the NMR team's efforts to improve the Conservation Programs.

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Acronyms

Acronym	Definition
AC	Air Conditioner
AFT	Affordability Fund Trust
AV	Audiovisual
CDM	Conservation and Demand Management
CF	Correction Factor
CI	Confidence Interval
DHW	Domestic Hot Water
DSM	Demand Side Management
EAP	Energy Affordability Program
EM&V	Evaluation Measurement and Verification
EUL	Effective Useful Life
FTE	Full-time equivalent
HAP	Home Assistance Program
HOU	Hours of Use
IDI	In-depth Interview
IESO	Independent Electricity System Operator
IO	Input-Output
ISR	In-Service Rate
kW	Kilowatt
kWh	Kilowatt-hours
LEAP	Low-Income Energy Assistance Program
LED	Light-emitting Diode
LPM	Liters Per Minute
MAL	Measures and Assumptions List
MW	Megawatt
MWh	Megawatt-hour
NPV	Net Present Value
NTGR	Net-to-Gross Ratio
OESP	Ontario Electricity Support Program
PAC	Program Administrator Cost Test
PY	Program Year
RR	Realization Rate
StatCan	Statistics Canada
SUPC	Supply and Use Product Classification
SUT	Supply and Use Table
TRM	Technical Reference Manual

Executive Summary

NMR Group, Inc. (NMR), in partnership with subcontractor, Resource Innovations, Inc (formerly Nexant)., (collectively, "the NMR team") and under contract to the Independent Electricity System Operator (IESO), performed an evaluation of the Energy Affordability Program (EAP) for Program Year 2021 (PY2021).

1.1 Program Description

EAP provides support to income-eligible electricity consumers by helping them to lower their monthly electricity costs and to increase their home comfort through energy-saving upgrades. EAP offers two service tiers to eligible participants which is determined by the participant's level of income:

Tier 1 offers free, comprehensive home energy needs assessment conducted by a trained energy professional who will help identify energy-efficient upgrades available for the homes. The upgrades may be installed during or after an in-home visit. The program is targeted towards low-income consumers, providing full program offerings with professional measure installation and removal/disposal of replaced equipment.

Tier 2 provides free, tailored Energy Saving Kits that are customized to meet the needs of the customer. The program is targeted to moderate income consumers, providing a more limited program offering.

1.2 Evaluation Objectives

The EAP evaluation sought to address several research objectives in PY2021, including the following:

- Verify gross energy and demand savings;
- Estimate realization rates (RRs);
- Estimate net-to-gross (NTG) for Tier 2 moderate income offering. Tier 1 has a deemed value of 1.0 for NTG since it is a direct install low-income offering;
- Conduct cost-effectiveness analyses;
- Estimate the avoided greenhouse gas (GHG) emissions;
- Perform a process evaluation;
- Conduct a non-energy benefits (NEBs) analysis, and
- Analyze job impacts for the program.

1.3 SUMMARY OF RESULTS

The impact evaluation results for EAP are displayed in Table 1. The overall RR for PY2021 is 97% for energy savings and 91% for demand savings.

Table 1: EAP PY2021 Results

Metric	Units	Evaluated
Participation	Projects	8,132
Participation	Homes	8,096
Reported Energy Savings	MWh	6,359
Reported Demand Savings	MW	0.62
Gross Energy RR	MWh	0.97
Gross Demand RR	MW	0.91
Gross Verified Energy Savings	MWh	6,176
Gross Verified Demand Savings	MW	0.57
Tier 1 Net-to-Gross Ratio (NTGR)	--	1.00
Tier 2 Net-to-Gross Ratio Energy (NTGR)	MWh	0.86
Tier 2 Net-to-Gross Ratio Demand (NTGR)	MW	1.06
Net Verified Annual Energy Savings (First Year)	MWh	6,154
Net Verified Annual Demand Savings (First Year)	MW	0.57
Net Verified Persisting Energy Savings to PY2026	MWh	6,154
Net Verified Persisting Demand Savings to PY2026	MW	0.57
Program Administrator Cost (PAC) Test Ratio	--	0.31
Levelized Delivery Cost (Energy)	$/kWh	0.12
Levelized Delivery Cost (Demand)	$/kW	1,300

1.4 KEY FINDINGS AND RECOMMENDATIONS

The following section summarizes the PY2021 evaluation key findings and recommendations. Section 8 presents these key findings and recommendations in greater detail.

Finding 1: **Only 20 Weatherization projects occurred in the EAP program for PY2021 which accounted for nearly 83,000 kWh (1.3%) and 4.5 kW (0.8%) of gross verified savings for the program.** Gross verified savings for weatherization measures on a per-unit basis accounted for over 4,100 kWh per project in PY2021. This highlights that savings associated with weatherization measures on a per-project basis provide substantial savings over the course of their measure life.

> **Recommendation 1.** Emphasize and increase the implementation of weatherization upgrades for participants in subsequent program years. The program may consider pushing shell insulation, especially attic insulation, to increased levels of efficiency to further deepen savings and increase occupant comfort.

Finding 2: EAP Tier 2 kits were distributed to 177 participants and accounted for nearly 164,000 kWh of gross verified savings. These kits provide an average of 925 kWh in gross verified savings per participant. While the average gross verified savings for Tier 1 participants were approximately 756 kWh. However, participants are of moderate income and have a NTGR applied to account for net verified savings, which reduced savings down to 141,000 kWh, which brings the net-verified savings per participant closer to the Tier 1 participant levels (797 kWh). Regardless, this highlights a potential opportunity for the EAP program to cost-effectively increase program savings in subsequent program years.

Recommendation 2. Continue to promote and consider expanding marketing communication and outreach channels to help raise awareness for potential Tier 2 participants. If the program is not already doing so, providing installation instructions, such as pictures, links to tutorial videos, or written guidance for measures that are not commonly installed (e.g., aerators, power bars). This may encourage greater installation rates of measures delivered through mailed kits. Installation rates were not assessed in the PY2021 evaluation for Tier 2 participants but will be in PY2022. It should be noted that low measure installation rates could impact future savings potential, so the program should consider the education tactics mentioned above to ensure high installation rates.

Finding 3: **EAP program tracking data includes completed projects and installed measures along with unique identifiers for each. However, the tracking data does not typically include key characteristics that are collected during audits such as building or equipment type.** This information can be used to better estimate savings impacts and to provide insights for future program offerings. These data points are often collected and included in the data collection forms that are used during in-home audits. However, only in some cases is this information captured in the program tracking data. The program tracking data did include completed projects and installed measures, including variables to identify unique projects and measures. These unique identifying variables are critical for impact accounting over multiple years in a framework.

Recommendation 3a. Continue to include variables that can be used to identify unique projects and measures within the tracking data. If possible, limit the annual program tracking data to projects that are fully completed.

Recommendation 3b. Work with program staff, program delivery vendors, auditors and contractors to incorporate additional details into the tracking data such as building type and mechanical equipment (e.g., type and fuel) and any additional data that are collected on-site (e.g., equipment efficiency, capacity).

Finding 4: Participants, auditors, contractors, and delivery vendor staff recommended offering additional equipment through the program. Nearly one-half (47%) of surveyed participants provided recommendations for additional energy-efficiency equipment or services for inclusion in EAP. These participants most often recommended air sealing (26%), windows (20%), and stoves (20%). Over three-fourths (77%) of auditors and contractors recommended additional equipment or services, including heat pumps (29%), kitchen equipment such as dishwashers and stoves (29%), washers and dryers (21%), insulation and air sealing (17%), and heating equipment

(13%). Delivery vendor staff also recommended that the program consider the feasibility of offering heat pumps and generally revisit eligible measure offerings more frequently.

Recommendation 4a. Consider offering additional types of equipment, such as heat pumps, kitchen equipment, washers and dryers, additional insulation and air sealing, and heating equipment.

Recommendation 4b. Further consider the relative cost effectiveness (CE) of these potential new measures. Appliances offered in the program have yielded the lowest measure-level CE ratios of all measures (0.05 to 0.33 PAC ratios). Building shell measures performed relatively better, being at or above the program's median measure-level PAC ratio (0.56 to 0.75 PAC ratios).

Recommendation 4c. Revisit eligible measure offerings more frequently.

1

Introduction

The Independent Electricity System Operator (IESO) retained NMR Group, Inc. (NMR), in partnership with subcontractor, Resource Innovations, Inc. (formerly Nexant), (collectively, "the NMR team") to conduct an evaluation of the Program Years (PY) 2021-2022 of the 2021-2024 Conservation and Demand Management Framework (CDM) low-income program. This report includes results, findings, and recommendations for the Program Year 2021 (PY2021) evaluation and is specific to the Energy Affordability Program (EAP).

1.1 Program Description

EAP provides support to income-eligible electricity consumers by helping them lower their monthly electricity costs and increase their home comfort through energy-saving upgrades. EAP offers two service tiers to eligible participants, determined by the participant's level of income:

Tier 1 offers free, comprehensive home energy needs assessment conducted by a trained energy professional. The upgrades may be installed during or after an in-home visit. The program is targeted towards low-income consumers, providing full program offerings with professional measure installation and removal/disposal of replaced equipment.

Tier 2 provides free, customized Energy Saving Kits. The program is targeted to moderate income consumers, providing a more limited program offering.

1.1.1 Delivery

Under the CDM Framework, EAP is a centrally managed program designed and administered by the IESO. A program delivery vendor under contract with the IESO is responsible for managing the program's delivery, including marketing and outreach, managing and training an energy auditor and installation contractor network for in-home energy audits and program-eligible equipment installations (Tier 1), overseeing the procurement and distribution of the Tier 2 Energy Saving Kits, and other daily program management activities. During audits, the Tier 2 program participants receive educational materials and tips on saving energy and any necessary training.

1.1.2 Eligibility

To be eligible to participate in the program as a Tier 1 participant, the participant must (1) be a resident of an eligible social housing property or (2) be an individual who owns, rents, or leases their residence; is listed as the primary or secondary utility account holder; and meets one of the following criteria:

- Has an annual household income for the previous year that does not exceed the program eligibility limits;
- Received assistance from an eligible assistance program in the past 12 months;
- Received a Low-Income Energy Assistance Program (LEAP) grant or was part of the Ontario Electricity Support Program (OESP) in the past 12 months; or

- Qualified to participate in a natural gas low-income Demand Side Management (DSM) program during the past 12 months.

To be eligible to participate in the program as a Tier 2 participant, the participant must (1) be an individual who owns, rents, or leases a residence in Ontario listed as the primary or secondary utility account holder, (2) not meet the eligibility for Comprehensive Support, and (3) have an annual household income for the previous year that does not exceed the program eligibility limits.

1.1.3 Measures

The measures offered by EAP to Tier 1 participants are classified into one of three tracks. The basic track encompasses measures that are easily installed on-site by the EAP auditor. However, basic measures that conserve water usage and insulate water heater piping and storage tanks are only provided to customers with electric water heaters. The extended track includes measures that require follow-up, such as confirmation of appliance delivery, and may not be completed in the duration of the initial audit. The weatherization track indicates that some form of weatherization to the building shell has occurred; this track is only available for homes that are electrically heated. The program may also improve the health and safety of the home through the installation of measures such as insulation.

The measures offered by EAP to Tier 2 participants are provided as part of an Energy Saving Kit, which may include free energy-saving measures for self-installation like energy-saving light bulbs, efficient shower heads, faucet aerators, and/or clothes drying lines. The contents of the Energy Saving Kit are dependent on the household needs and eligibility and customized for each home. If the home and/or the hot water are heated by electricity, the participant may qualify for energy-saving water measures and/or weather-stripping. Additionally, the Energy Saving Kit may include a block heater timer.

1.2 Evaluation Objectives

The evaluation sought to address several research objectives in PY2021, including the following:

- Verify gross energy and demand savings with a 90% level of confidence at 10% precision for the program;
- Estimate realization rates (RRs). EAP Tier 1 has a deemed value of 1 for Net-to-Gross (NTG) since it is a low-income program; while Tier 2 includes moderate income participants and has a calculated NTGR;
- Conduct cost-effectiveness analyses;
- Estimate the avoided greenhouse gas (GHG) emissions from electricity savings using the IESO Cost Effectiveness Tool;
- Perform a process evaluation by addressing key research questions of interest to the program;
- Estimate non-energy benefits (NEBs) using results from participant surveys; and
- Conduct a jobs impact analysis to estimate the number of direct and indirect jobs attributable to the program.

2

Methodology

A summary of the impact evaluation, process evaluation, NEBs estimation, and jobs impact analysis methodologies is presented in this section. Detailed descriptions of these methodologies are provided in Appendix A.

2.1 Impact Evaluation Methodology

To complete the PY2021 impact evaluation, the NMR team performed various evaluation activities, including a review of the program tracking data, an analysis of in-service rates (ISRs) and hours of use (HOU) using data from participant surveys, and engineering desk reviews. The NMR team also incorporated results from the PY2019 review of technical reference manuals (TRMs) from other jurisdictions[1] to calculate RRs.[2] These are standard practices to compare evaluated savings with reported savings.

The results from the tracking data review and the desk reviews were used to calculate the RRs for the EAP Tier 1 participants. For EAP Tier 2 participants, the RRs were calculated based on a review of the Energy Saving Kit contents, which included a review of the savings values applied for each measure distributed in the mailed Energy Saving Kit.

A detailed description of the impact sampling methodology, activities, and process to calculate gross verified savings are provided in Appendix A.1.

2.1.1 Net Verified Energy and Demand Savings

For the Tier 1 offering, the NMR team applied a NTGR value of 1.0 to maintain consistency with other low-income, direct installation programs in other jurisdictions. The NTG of 1.0 indicates that participants would not have installed the measures without program intervention. The 1.0 NTG value also indicates that the installation of these measures were 100% influenced by the program. In addition, the net persisting savings for 2026 are a key metric for EAP, which signifies the amount of savings that persist to the end of the Framework.

For the Tier 2 offering, to calculate the net verified savings, the NMR team calculated the portion of gross verified savings attributable to EAP. The NMR team determined the net verified savings by multiplying the gross verified savings by the NTG ratio, as shown in Equation 1.

[1] See “Secondary Data Review of TRMs” (Appendix A.1.3) in the Detailed Methodology section of PY2019 HAP Evaluation. Appendix B of the same report contains additional details on adjusted measure-level inputs and savings parameters.

[2] Note that PY2019 adjustments also included measure-level updates to effective useful life (EUL) and incremental costs, which are presented in the Appendix B.3 of the PY2019 HAP evaluation report. The PY2020 evaluation applied the updated EULs and incremental costs that resulted from the PY2019 evaluation.

Equation 1: Net Verified Savings

$$Savings_{\text{net}} = Savings_{\text{verified}} \times NTGR$$

Where:

$\text{Savings}_{\text{net}}$ = Net savings impact (kW or kWh)

$\text{Savings}_{\text{verified}}$ = Verified savings (kW or kWh)

NTGR = Net-to-gross Ratio

To estimate the direct influence of the Tier 2 offering in generating net verified energy savings, the NMR team implemented attribution surveys to collect inputs used to calculate free-ridership (FR), spillover (SO), and NTGR. FR refers to the program savings attributable to free riders, who are program participants who would have implemented a program measure or practice in the program's absence. SO represents installations influenced by the participant's experience with the program, completed without receiving any program incentives or other financial support. The NTG ratio is defined by Equation 2, where FR is the participant FR percentage, and SO is the participant SO percentage.

Equation 2: Net-to-gross Ratio

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

The NMR team calculated the FR and SO for a single project for each sampled participant and then combined these results to develop overall FR, SO, and NTGR values. Additional details regarding the NTG evaluation methodology can be found in Appendix A.2.

2.2 COST-EFFECTIVENESS EVALUATION

The NMR team completed the cost-effectiveness analysis in accordance with the IESO requirements as set forth in the IESO *Cost-Effectiveness Guide for Energy Efficiency*[3] and using IESO's *Cost-Effectiveness Tool*. The energy and demand savings results from the impact evaluation were inputs into the IESO *Cost-Effectiveness Tool*, as was administrative cost and incentive information supplied from IESO. A more detailed description of the cost-effectiveness methodology is provided in Appendix A.3.

2.3 PROCESS EVALUATION METHODOLOGY

The process evaluation focused on program design and delivery. The NMR team evaluated program processes through interviews and surveys with relevant program actors, including the IESO staff, program delivery vendor staff, auditors, contractors, and participants. For each respondent type, the NMR team developed a customized interview guide or survey instrument to ensure responses produced comparable data and to allow the NMR team to draw meaningful

[3] *Cost Effectiveness Guide for Energy Efficiency Version 4*, Independent Electricity System Operator, January 20 2021, https://www.ieso.ca/-/media/Files/IESO/Document-Library/EMV/CDM_CE-TestGuide.ashx

conclusions. For each respondent type, Table 2 shows the survey methodology, the total number of completed surveys, the total population that the NMR team invited to participate in the survey or interviews and the sampling error at the 90% CI. A detailed description of the process evaluation methodology is provided in Appendix A.4.

Table 2: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Completed	Population	90% CI Error Margin
EAP IESO Staff and Program Delivery Vendor Staff	Phone In-depth Interviews (IDIs)	2	2	0%
EAP Auditors and Contractors	Web	31	71	11.3%
EAP Participants	Web	595*	3,820**	3.1%

*569 Tier 1 and 26 Tier 2; **3,659 Tier 1 and 161 Tier 2

2.4 NON-ENERGY BENEFITS METHODOLOGY

The NEBs methodology for the PY2021 EAP followed the same methodology as the 2021 NEBs Phase II study, which assessed the NEBs from energy-efficiency projects funded by the IESO over 2017 – 2019.[4] The NEBs were calculated using the relative scaling approach and the willingness to pay approach to determine the value of NEBs that program participants realized by installing program measures. All survey respondents were asked to value all NEBs using both techniques. The data collected from these questions was then used to quantify the NEBs. Additional detail regarding NEBs methodology can be found in Appendix A.5.

2.5 JOBS IMPACT ANALYSIS METHODOLOGY

The NMR team quantified the number of full time equivalent (FTE) net job impacts as well as total net job impacts (both direct and indirect jobs) resulting from the investment and activities of each program. We relied on primary and secondary data collection and Statistics Canada[5] (StatCan) Input-Output (IO) modeling to quantify net jobs impacts. IO models are used to analyze the propagation of exogenous economic shocks throughout an economy. The models represent relationships, or flows, of inputs and outputs between industries. When an energy-efficiency program such as EAP is funded and implemented, it creates a set of "shocks" to the economy, such as demand for specific products and services, and additional household expenditures from energy bill savings. The shocks and their impacts can be measured variables economic output and employment. A detailed description of the job impact analysis methodology is provided in Appendix A.6.

[4] 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

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

3

Impact Evaluation

The following subsections outline the impact evaluation results. Details regarding the impact methodology can be found in Section 2 and Appendix A.1. Detailed impact results, rationale and drivers of realization rates, and general insights from the impact evaluation activities by measure category can be found in Appendix B.1.

3.1 High-Level Results

3.1.1. Program Level Savings

Table 3 presents reported, gross verified, net first-year, and net-persisting energy and demand savings for the entire EAP for PY2021. The program gross verified RR is 97% for energy savings and 91% for demand savings.

The gross verified savings for EAP Tier 1 participant measures have a NTG ratio of 1.0 applied to them, meaning gross verified and net verified savings are equal. For Tier 1 of the program, the results presented in this section refer to the gross verified savings and can be considered equivalent to net verified first year savings.

For EAP Tier 2, a NTG ratio was applied to the results. Details on the NTG calculations are provided in Section 3.3. Gross verified savings values include the realization rate calculated from the tracking data review and the net verified first year savings apply the NTG ratio for Tier 2 participants.

It should also be noted that all measure lifetimes and the associated net savings persist beyond 2026. Net persisting savings to 2026 is a key metric to assess EAP performance compared to the savings targets established for EAP in the CDM Framework.

Table 3: Program Level Reported, Gross Verified, and Net First Year Savings

Metric	Units	Evaluated
Reported Energy Savings	MWh	6,359
Reported Demand Savings	MW	0.62
Gross Energy RR	MWh	0.97
Gross Demand RR	MW	0.91
Gross Verified Energy Savings	MWh	6,176
Gross Verified Demand Savings	MW	0.57
Tier 1 Net-to-Gross Ratio (NTGR)	--	1.00
Tier 2 Net-to-Gross Ratio Energy (NTGR)	MWh	0.86
Tier 2 Net-to-Gross Ratio Demand (NTGR)	MW	1.06
Net Verified Annual Energy Savings (First Year)	MWh	6,154
Net Verified Annual Demand Savings (First Year)	MW	0.57
Net Verified Persisting Energy Savings to PY2026	MWh	6,154
Net Verified Persisting Demand Savings to PY2026	MW	0.57

3.1.2. Gross Verified Energy Savings Key Results

The overall energy realization rate for the program is 97% for energy savings. Table 4 highlights the gross verified energy savings for each measure-category. Key drivers that influenced the RR are also summarized for each category. Smart power bars have a notably high RR (5,901%) due to the use of a reported savings value associated with a legacy value used for power bar timers, which is not delivered by EAP. Miscellaneous measures include: block heater timers, indoor clothes drying racks, programmable thermostats, and smart thermostats.

Impacts for both energy and demand savings are detailed at the measure level in Appendix B.

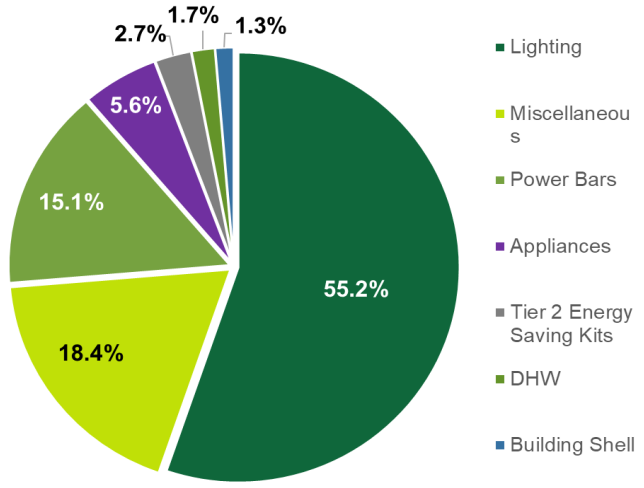
Table 4: Gross Verified Energy Savings Results by Measure Category (kWh)

Measure Category	Reported Savings - Energy (kWh)	Verified Savings - Energy (kWh)	RR - Energy	Drivers of RR
Lighting end-use total	4,462,717	3,411,514	76%	• PY2019 savings updates which lowered baseline wattage and HOU values • ISR of 96%
Miscellaneous measures	1,171,019	1,136,456	97%	• Thermostat savings adjustments for homes without cooling • Indoor clothes rack savings updates (PY2019) and ISRs
Appliance end-use total	307,333	343,253	112%	• model-specific energy consumption lookup, • replacing appliances that were smaller capacity than the assumed midpoint, • in some cases replacing appliances with a new size category

Measure Category	Reported Savings - Energy (kWh)	Verified Savings - Energy (kWh)	RR - Energy	Drivers of RR
Domestic hot water (DHW) end-use total	174,438	108,063	62%	• PY2019 savings updates for showerheads, aerators, and pipe wrap • Low RR for pipe wrap due to misalignment between tracking data quantities (1 foot) and deemed savings value (3 feet).
Building shell end-use	78,308	82,825	106%	• Updates to building energy model inputs based on desk reviews
Power bar end-use	15,764	930,191	5,901%	• Application of legacy measure savings value (power bar with timer)
Tier 2 kits	149,591	163,814	110%	• Kit measures and quantities calculated with substantiated values
Total	**6,359,170**	**6,176,116**	**97%**	• Substantiation sheet updates (PY2019), ISR, and HOU updates • High RR for smart power bars offsets lower RR for lighting

The gross verified energy savings for EAP were dominated by lighting end-use measures, which covered a little more than one-half (55.2%) of total program savings (Figure 1). Miscellaneous measures, appliances, and power bars measures were the next largest end-use categories for PY2021. Energy Saving Kits that are distributed to Tier 2 participants accounted for 2.7% of gross verified savings. Building shell upgrades – insulation and air-sealing – accounted for only 1.3% of gross verified savings for EAP.

Figure 1: PY2021 EAP Gross Verified Energy Savings by End-Use



3.1.3. Gross Verified Demand Savings Key Results

The overall energy realization rate for the program is 91% for demand savings. Table 5 highlights the gross verified demand savings for each measure-category. Key drivers that influenced the RR are also summarized for each category. Power bars do not have a realization rate due to no reported demand savings in the program tracking data, however the NMR team accounted for smart power bar demand savings in the verification process.

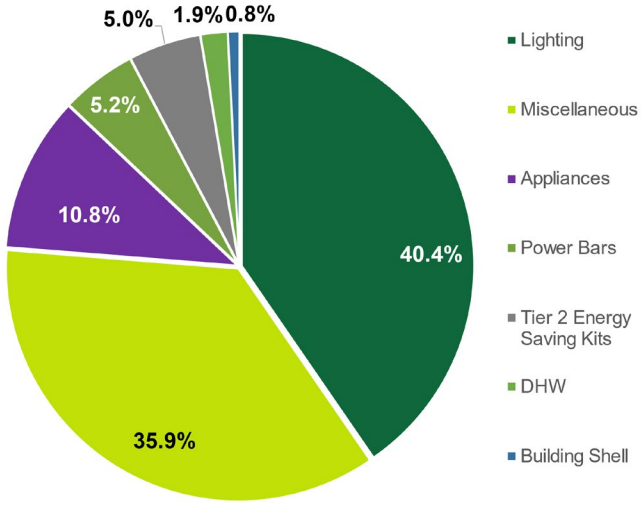
Table 5: Gross Verified Demand Savings Results by Measure Category (kW)

Measure Category	Reported Savings - Demand (kW)	Verified Savings - Demand (kW)	RR - Demand	Drivers of RR
Lighting end-use total	285.73	228.57	80%	• PY2019 savings updates which lowered baseline wattage and HOU values • ISR of 96%
Miscellaneous measures[6]	241.49	202.84	84%	• Thermostat savings adjustments for homes without cooling (no demand savings) • Indoor clothes rack savings updates (PY2019) and ISRs
Appliance end-use total	55.78	60.95	109%	• Model-specific energy consumption lookup • Replacing appliances that were smaller capacity than the assumed midpoint • In some cases, replacing appliances with a new size category
Domestic hot water (DHW) end-use total	17.29	10.57	61%	• PY2019 savings updates for showerheads, aerators, and pipe wrap
Building shell end-use	1.07	4.53	424%	• Updates to building energy model inputs based on desk reviews • Application of different weatherization demand factor
Power bar end-use	-	29.67	N/A	• No reported demand savings in the program tracking data • No RR calculated
Tier 2 kits	18.05	28.46	158%	• Kit measures and quantities calculated with substantiated values
Total	**619.42**	**565.60**	**91%**	• Substantiation sheet updates (PY2019), ISR, and HOU updates

[6] Miscellaneous measures include: block heater timers, indoor clothes drying racks, programmable thermostats, and smart thermostats.

Figure 2 displays the proportion of gross verified demand savings by end-use category for EAP. The gross verified demand savings were primarily attributed to miscellaneous measures, specifically indoor clothes drying racks and lighting end-use categories (35.4% and 40.4%, respectively). The appliance end-use category covered another 10.8% of gross verified demand savings for EAP. Energy Saving Kits accounted for 5.3% of gross verified demand savings for EAP.

Figure 2: PY2021 EAP Gross Verified Demand Savings by End-Use

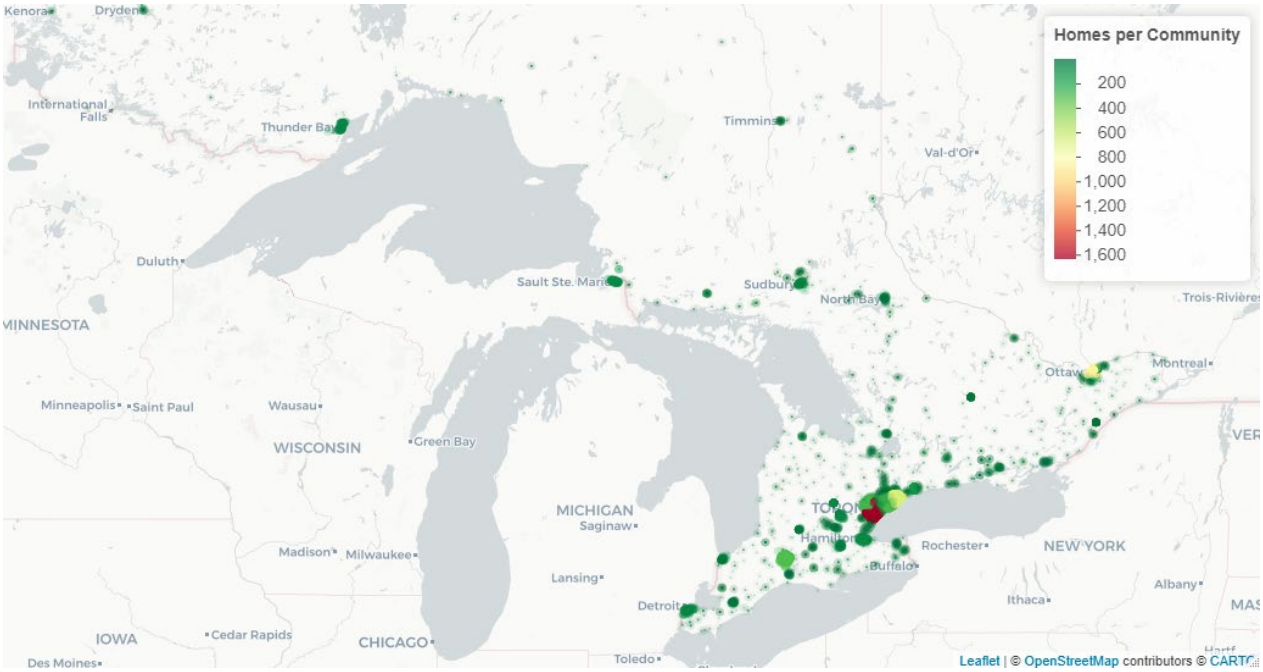


3.1.4. Geographic Distribution of EAP Participant Projects

Figure 3 shows the geographic distribution of evaluated PY2021 EAP project homes across Ontario.[7] Green dots represent buildings where there are few other EAP participant projects within the same community, while red dots represent higher densities of participant homes. The Greater Toronto Area and Ottawa were hot spots for PY2021 EAP participation, indicated by the high concentration of red and yellow dots in the map below. Mississauga, Ottawa, Scarborough, London, and Toronto are the top five communities by building count. For the participant projects within these five communities, 47% are single-family and 53% are multifamily properties. Mississauga has the largest share of multifamily participant projects (81%), followed by Ottawa (71%). Shares of multifamily participant projects were only a fraction of that for Toronto (25%), London (2%), and Scarborough (2%).

[7] There were 8,093 unique building addresses for the 8,096 projects. This value represents the physical addresses in the tracking data and is referred to as the EAP participant program home count.

Figure 3: PY2021 EAP Participant Home Distribution across Ontario



3.2 NET-TO-GROSS EVALUATION

Table 4 presents the results of the NTG evaluation for EAP Tier 2 participants. The NMR team targeted and achieved confidence and precision levels of 90% and 10% when calculating NTG. Tier 2 participant feedback indicates moderately high levels of FR at 25.0%. Twelve percent (three respondents) of participants stated they would have done the "exact same upgrade" in the program's absence, indicating higher FR for these respondents. Over three-fifths (62%, or 16 respondents) showed no indication of free-ridership since they said they would have put off the upgrade for at least one year (five respondents) or cancelled their upgrade all together (11 respondents) if the program had not been available to them. Other respondents were considered partial free riders if they reported that they would have scaled back on the size, efficiency, or scope of their project (12%, or three respondents) or if they did not know what they would have done in the absence of the program (15% or four respondents). Participation in the program resulted in a relatively high SO at 11.2%. SO savings were primarily driven by the installation of new appliance and lighting measures. Additional analyses performed to assist in the interpretation of these values can be found in in Appendix B.4. The net verified results for Tier 2 Energy Saving Kits are described in further detail in Section B.1.7.

Table 6: NTG Results

Unique Participants	NTG Responses	Savings Weighted FR	SO, Energy	SO, Summer Demand	NTG, Energy	NTG, Summer Demand	Energy Precision
159	26	25.0%	11.2%	30.9%	86.2%	105.9%	± 10.1%

Cost-Effectiveness Evaluation

This section outlines the cost-effectiveness evaluation results. Details regarding the cost-effectiveness methodology can be found in Section 2.2 and Appendix A.3.

The cost-effectiveness results are presented in Table 5. The program did not pass the Program Administrator Cost (PAC) test because benefits were less than their respective costs. This is consistent with findings for low-income programs in other jurisdictions, and specifically EAP's predecessor, the Home Assistance Program (HAP), which had PAC ratios of 0.34 in PY 2019 and 0.37 in PY 2020. Additionally, regulations in other jurisdictions commonly do not require low-income programs to meet cost effectiveness.[8]

Table 7: Program Level Cost-Effectiveness Key Metrics

Cost-Effectiveness Test	PY2021
PAC	
PAC Costs ($)	6,935,726
PAC Benefits ($)	2,130,816
PAC Net Benefits ($)	-4,804,910
PAC Net Benefit (Ratio)	0.31
Levelized Delivery Cost	
$/kWh	0.12
$/kW	1,300

Measure level PAC ratios show a range of 0.05 to 2.93. The seven measures with the highest PAC ratios, all with PAC ratios above 2.0, were the Energy Savings Kits provided to Tier 2 participants. Within the direct install measures of Tier 1 participants, the highest PAC ratios were derived from measures with relatively low up-front cost and little labor required to install, such as faucet aerators, programmable and smart thermostats, hot water pipe wrap, and low-flow showerheads. All of these measures yielded PAC ratios of 1.0 or greater.

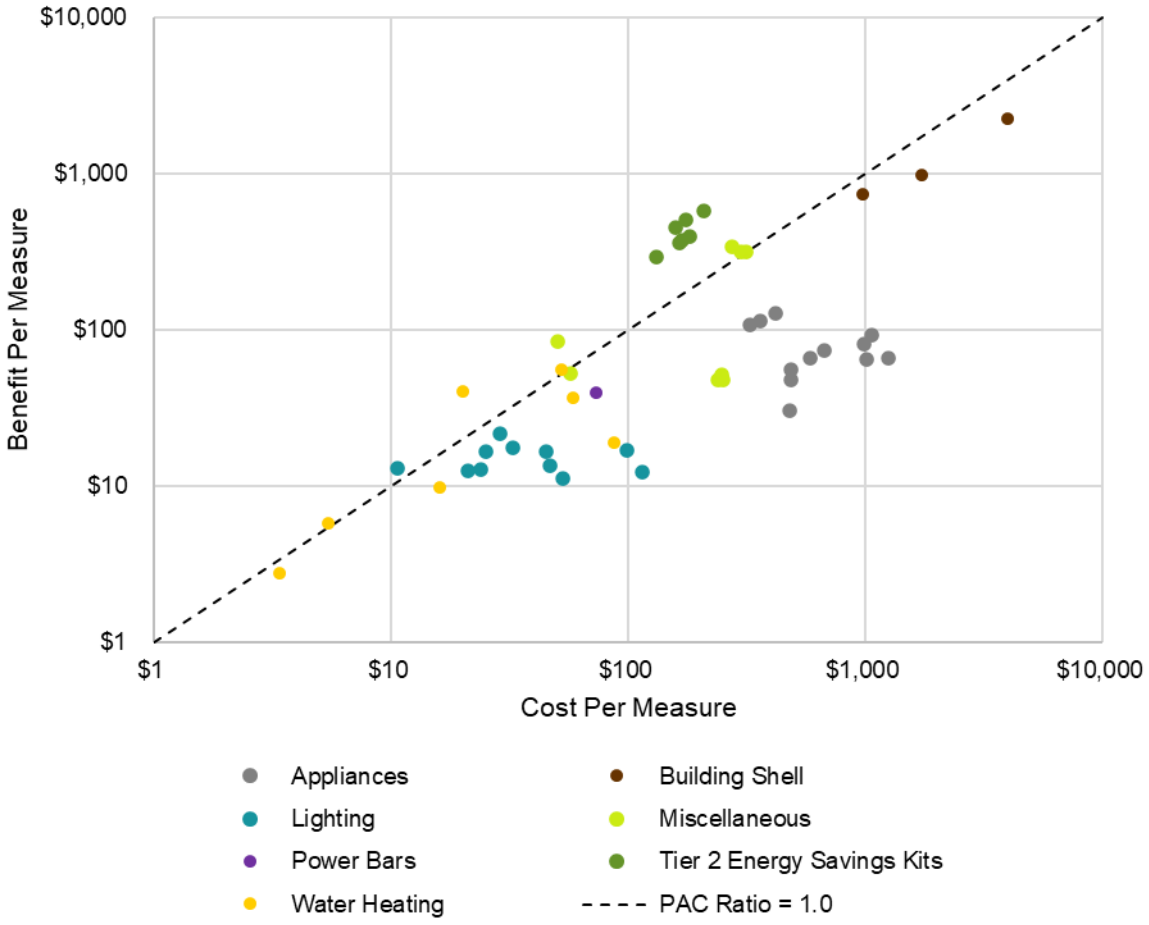
Measures producing very low PAC ratios, 0.11 or less, included all freezer, refrigerator, and room air conditioner measures. A factor contributing to the low PAC ratios is the relatively high cost of these measures, in that these nine measures (three size categories for each freezer, refrigerator, and room air conditioner measure) were the nine highest cost measures.

[8] *Guidelines for Low-Income Energy Efficiency Programs,* American Council for an Energy-Efficient Economy, https://database.aceee.org/state/guidelines-low-income-programs

Despite having the highest PAC ratios, all combined Energy Savings Kits measures only contributed 2% of the program's savings. Direct install measures that had PAC ratios of 1.0 or greater contributed 51% of the program's energy savings. This means that the remaining 47% of program savings were contributed by measures with less than 1.0 PAC ratios. Of these low PAC ratio measures, ENERGY STAR Qualified 17.0-18.4 cubic foot refrigerators had by far the largest influence, contributing 19% of the PAC costs while only contributing 2% of the program's energy savings.

Figure 4 below more generally presents the relative costs and benefits by end use. We observe that while household appliances offer good benefits, their costs are by far the highest, pulling down their PAC ratio. Clustered below approximately $100 in cost each are water heating, power bars, lighting and two miscellaneous (block heater timer and indoor clothes drying rack) measures. While these measures are low cost and generally have the best measure-level PAC ratios, they provide relatively smaller benefits per measure.

Figure 4: PAC Benefits vs. Costs by End Use*



*Note: x and y axes use a logarithmic scale

5

Process Evaluation

The following subsections outline the process evaluation results. Details regarding the process methodology can be found in Section 2.2 and Appendix A.4 and additional results can be found in Appendix C.

5.1 IESO and Program Delivery Vendor Staff Perspectives

The following subsections highlight the feedback received from the IESO and program delivery vendor staff about the design and delivery of EAP in PY2021.

5.1.1. High-Level Results

High-level results from the IESO and program delivery vendor staff IDIs include the following:

- The program met both the IESO staff and delivery vendor staff's expectations for the year despite barriers associated with the COVID-19 pandemic, rising costs, and program saturation challenges. IESO staff indicated that customers appreciated the no-cost element and straightforward participation process.
- Supply chain disruptions have had major impacts on program measure costs, especially for appliances and weatherization. A more periodic review of program measure-related cost caps, including additional market research and cost evaluations of relevant program measures, was recommended by the program delivery vendor to help identify necessary cost cap updates.
- Delivery vendor staff recommended the program further consider how heat pumps could be included in future program years.
- Delivery vendor staff stressed the importance of additional marketing of the program in future years, especially to help promote the Energy Saving Kits which saw lower demand than expected in PY2021 and to address concerns customers may have about the program's legitimacy.

5.1.2. Design and Delivery

IESO staff and delivery vendor staff both indicated that the program met their expectations in PY2021 despite the continued challenges associated with the COVID-19 pandemic. Delivery vendor staff indicated that having a single delivery vendor oversee program delivery across the entire province as they did in PY2021 was very effective. This delivery approach granted purchasing power to the delivery vendor, led to reduced program confusion, and created a strong contractor network that was able to deliver a high-volume of measures in a timely manner. The delivery vendor staff also stated that they found the types and amounts of resources available through the program to largely be reasonable, though they noted that the recent supply chain issues have made it challenging to procure equipment at reasonable costs.

5.1.3. Customer Engagement

The delivery vendor staff reported that the program's eligible measures were well-aligned to meet customer needs. They indicated that customers typically participate to reduce their energy costs, likely exaggerated by higher home energy consumption during pandemic lockdowns when more people remained home. IESO staff noted that customers appreciate the no-cost element as well as the quality of customer service provided. Delivery vendor staff reported that the process to participate is not overly complicated, which helped to engage and retain participants. Delivery vendor staff also noted that community-focused outreach that IESO has recently undertaken has been effective in terms of further legitimizing the program to customers.

5.1.4. Barriers and Opportunities

The pandemic continued to present challenges to energy-efficiency programming in PY2021. For EAP, this resulted in many customer putting applications on hold, moving away, or wanting to delay or cancel their assessments. The delivery vendor staff reported developing even more stringent health and safety protocols to help protect customers and program delivery partners.

Both the IESO staff and delivery vendor staff indicated that the Energy Saving Kits were not as successful as anticipated in PY2021. IESO staff indicated that there is a narrow band of customers who are eligible for Tier 2 given different level of income across the province. Additionally, delivery vendor staff stated that a prior program not offered by IESO called the Affordability Fund Trust (AFT) had already serviced many moderate income customers in prior years, which likely had an impact on the uptake of the Energy Saving Kits. Additional program marketing may have also helped to increase uptake of the Energy Saving Kits, according to program delivery staff.

Both IESO staff and delivery vendor staff stated that supply chain disruptions associated with the pandemic have led to delays in measure availability as well as increased manufacturer costs for many program measures, such as appliances and weatherization. They both noted a more periodic review of program measure-related cost caps is needed to meet rising costs, with IESO staff indicating that they may consider doing so on a bi-annual basis. Delivery vendor staff recommended that the IESO consider performing market research and cost evaluations of relevant program measures to help identify necessary cost cap updates.

Delivery vendor staff recommended further considering how heat pumps could be included in future program years, noting that they had been very well received when they had been offered as part of the AFT. IESO staff indicated that they try to ensure that the program is as flexible as possible to meet customer needs while still ensuring they can manage program costs.

IESO staff reported that there are still many eligible customers who have not yet been served by the program, but, given that a version of this program and others like it (such as the AFT) have been in market for many years, many homes have already been served, and those remaining homes are likely harder to reach. IESO staff have introduced new initiatives to overcome these challenges including a roundtable forum of sector experts called the Energy Affordability Roundtable that meets quarterly. IESO's recent collaborations with gas utilities and community organizations like the Omega Foundation have also increased program awareness and participant leads. Additionally, IESO staff suggested that mapping the communities where

previous participants in the HAP program were located could also be helpful in identifying additional communities and customers to engage in EAP.

Delivery vendor staff stressed the important of continuing to increase program visibility through additional marketing and outreach in future program years, especially for the Tier 2 offering.

5.2 AUDITOR AND CONTRACTOR PERSPECTIVES

The following subsections highlight the feedback received from the auditor and contractor survey. Additional results can be found in Appendix C.1.

5.2.1 High-Level Results

High-level results from the auditor and contractor survey include the following:

- Auditors and contractors nearly always informed customers about the program (average rating of 4.3 on a scale of 1 to 5, where 1 meant “never” and 5 meant “always”).
- Auditors and contractors were satisfied with the training and support provided by the program delivery vendor (average rating of 4.4 on a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “very satisfied”).
- Auditors and contractors perceived the greatest barriers to program participation to be lack of awareness (mentioned by 71% of respondents) and concerns whether the programs were real (mentioned by 61% of respondents).
- Over one-fourth (26%) of respondents reported that the program’s measure eligibility criteria (e.g., restrictions on appliance sizes, equipment age, equipment variety, insulation variety, fuel sources, metering requirements for certain equipment) have led to decreases in the frequency with which measures are installed, with appliances and insulation most often mentioned as being negatively impacted.
- Close to one-third (32%) of respondents shared recommendations for changes to the measure-related cost caps in case cost increases due to the COVID-19 pandemic continue, with most recommending insulation cost cap adjustments and as well as taking travel costs into account as fuel costs increase.
- Auditors and contractors provided recommendations for program improvement with most of the recommendations relating to improving the outreach and marketing of the program as well as increasing the funding of the program.

5.2.2 Auditor and Contractor Profile

Of the 31 respondents who completed the survey, 17 performed in-home energy audits (auditors), 13 installed program-eligible equipment (contractors), and one individual did both. Responding auditors and contractors indicated that they have an average of 19.6 full time employees and 1.4 part time employees working at their company. The average number of years respondent companies had been in business was 12.

5.2.3 Program Barriers

Barriers to Participation	
Unaware of the program	✓
Concern about program legitimacy	✓
Did not think upgrades were worth the trouble of participating	✓
Did not prioritize getting efficiency upgrades given other priorities	✓
Income qualification requirement	✓
COVID-19	✓
Other work required to prior to making program upgrades	✓
Did not think upgrades would save them money	✓

The most commonly identified barriers to program participation as reported by the surveyed auditors and contactors were low program awareness among customers (71%), followed by skepticism of the program's legitimacy (e.g., distrust that the program is real or is free) (61%). Over one-fourth of respondents (29%) noted that they believe customers do not think the upgrades are worth the trouble of participating. For example, one respondent mentioned that several customers almost did not participate after they were informed upon signing up that a mandatory hole would be drilled into their walls to verify the insulation levels for the weatherization assessments. The most common recommendations for overcoming barriers to program participation was to increase marketing (suggested by 51% of respondents). Some respondents offered specific marketing and outreach suggestions, such as including community organizations or volunteers into the marketing and outreach. Over one-tenth (13%) of respondents recommended providing more information to customers like the effectiveness and cost-saving potential. A full list of program barriers and recommendations to address barriers can be found in Figure 35 and in Figure 36 in Appendix C.1.3.

5.2.4 Measure Eligibility Criteria

Surveyed auditors and contractors shared their perspectives on how the program's measure eligibility criteria affected the frequency with which program measures were installed, with approximately one-third of respondents (11 out of 31) providing feedback.

Three respondents reported that the program's eligibility criteria have had a positive impact on the frequency of measure installations. One respondent indicated that the program's measure eligibility criteria help the auditors and contractors focus on serving homes that have the least efficient or oldest equipment rather than serving homes that may have newer appliances.. The other two respondents noted that additional appliance models are now covered by the measure eligibility criteria, which has led to additional appliance installations.

However, most of these respondents (eight out of 11), reported that measure eligibility criteria have decreased the frequency with which program measures are installed (e.g., restrictions on appliance sizes, equipment age, equipment variety, insulation variety, fuel sources, metering requirements for certain equipment), with appliances and insulation most often mentioned as being negatively impacted. One respondent noted that the measure eligibility requirements for refrigerators and freezers related equipment age mean that many customers are ineligible for these upgrades even though the equipment is often close to 20 years old. Additional feedback about the measures affected by the measure eligibility criteria can be found in Table 25 in Appendix C.1.4

Over two-fifths of respondents (13 out of 31) suggested adjustments to measure eligibility criteria for program to consider in future years. The most common suggestion was to relax the requirement for cooling equipment (three respondents) by allowing equipment with lower EER ratings to qualify. One respondent noted, "The current EER rating [for air conditioners] excludes most or all [of them]. In the more than 4,000 assessments I have done, I believe I have only seen about five [air conditioners] that met the criteria". Additional feedback about suggestions for adjusting the measure eligibility criteria can be found in Table 26 in Appendix C.1.4

5.2.5 Measure-Related Cost Caps

Surveyed auditors and contractors shared recommendations for changes to the measure-related cost caps in case cost increases due to the COVID-19 pandemic continue, with close to one-third providing feedback (ten out of 31). Most of these respondents (7 respondents) recommended adjustments to the cost caps for insulation, with one respondent noting that "the material cost of insulation is rising faster than the program caps". Three respondents recommended that the program take travel costs into account as fuel costs increase. One respondent also suggested the cost caps for appliances be reviewed as many newer appliances are being left out. Additional feedback recommendations for measure related cost caps can be found in Table 27 in Appendix C.1.5.

Measure Cost Cap Recommendations	
Adjust insulation cost caps	✓
Account for fuel travel costs	✓
Review appliance cost caps	✓
Increase cost caps	✓
Lower cost caps	✓
Review air sealing cost caps to ensure they cover blower door tests and thermal cameras	✓
Review cost caps every six months	✓

5.2.6 Recommendations for Program Improvement

Over three-fourths (24 of 31) of respondents provided recommendations for energy-efficient equipment or services that they would like to see included in the program, with one-third (33%) of these respondents recommending heat pumps, respondents noted air-source heat pumps, cold climate air source heat pumps, and ground source heat pumps. Less than one-third (29%) of respondents recommended kitchen equipment such as dishwashers and stoves. Respondents also recommended washers and dryers (21%), insulation and air sealing (17%), and heating equipment (13%) such as boilers and baseboards. Additional feedback on recommendations for additional program equipment or services be found in Figure 37 in Appendix C.1.6.

Over one-half (17 of 31) of respondents provided recommendations for improving the program. Of these, six respondents (35%) recommended increased outreach and marketing, and two respondents each (12%) recommended increasing the funding to pay auditors and contractors more fairly and to avoid switching service providers. Respondents also recommended better training, improvements in the program software, and including more qualification questions in the customer screening process, among others. Additional feedback on recommendations for additional program equipment or services be found in Table 28 in Appendix C.1.6.

Program Improvement Recommendations	
Improve outreach and marketing	✓
Increase funding for auditors and contractors	✓
Avoid switching service providers	✓
Implement better training	✓
Improve program software	✓
Include more qualification questions in the screening process	✓
Remove blower door service	✓
Change metrics for energy saving	✓
Cap the number of audits per day	✓
Better prepare clients for site visits	✓

5.3 PARTICIPANT PERSPECTIVES

The following subsections highlight the feedback received from the participant survey. Results are presented either as percentages or counts, depending on sample size.

5.3.1 High-Level Results

High-level results from the participant survey include the following:

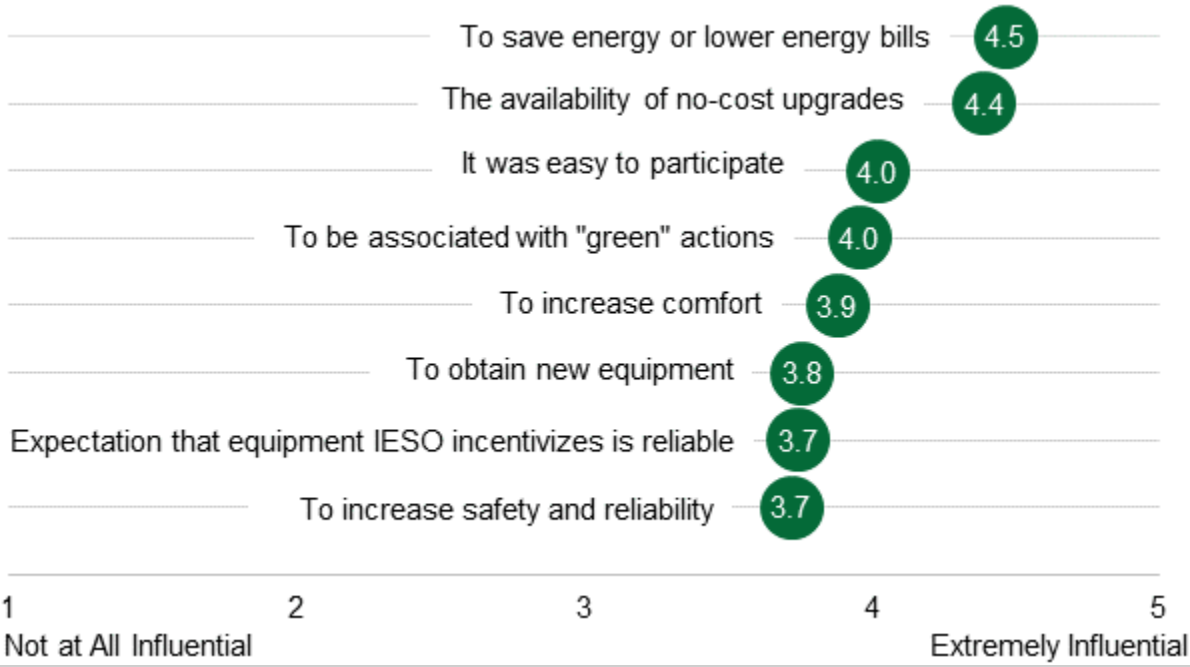
- The primary motivation for applying was to save energy or lower energy bills (average rating of 4.5 on a scale from 1 to 5, where 1 means the motivating factor played “no role at all” and 5 means it played “a great role”).
- Over one-half (56%) of Tier 1 respondents said their energy auditor discussed additional ways to save energy at the time of the audit. Of these respondents, most (93%) had tried at least one of them since having the audit performed.
- Respondents are largely satisfied with the program overall (average rating of 4.3 on a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied”). They were especially satisfied with the professionalism of their auditor (average rating of 4.7). While participants were least satisfied with the program’s perceived energy affordability improvements, this was still rated highly (average rating of 4.1).
- One-fifth (20%) of respondents offered recommendations for improving the program. The most common recommendations were to provide more energy savings products and/or tips (23%) and to relax the eligibility requirements (20%).
- One-tenth (10%) of respondents offered recommendations for improving the quality of the products and upgrades. The most common recommendation (25%) was to offer more sizes and options for appliances.

- One-half (50%) of respondents provided recommendations for additional energy-efficiency equipment or services for inclusion in the program. The most frequently mentioned type (44%) was weatherization upgrades, including air sealing, windows, and doors.

5.3.2 Program Awareness and Motivation

Most respondents heard about the program through bill inserts (35%), from friends or family (21%), or social media (15%). Nearly two-thirds (65%) of respondents applied for the program online. Additional feedback on how participants heard about and applied to the program can be found in Figure 46 and Figure 47 in Appendix C.2.2. Figure 4 displays respondents' average ratings for the level of influence various factors had on their decision to participate in the program. Respondents rated the influence of each factor using a scale from 1 to 5, where 1 meant "not at all influential" and 5 meant "extremely influential." The most influential factors were (1) to save energy or lower energy bills and (2) the availability of the no-cost upgrades, with average ratings of 4.5 and 4.4, respectively.

Figure 5: Factors Influencing Program Participation (n=595)

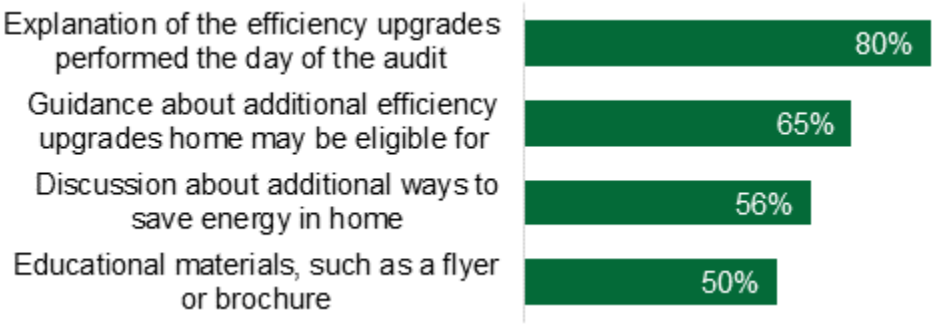


5.3.3 Program Education and Behavioral Changes

Energy auditors provided various resources to Tier 1 participants at the time of the audit. As shown in Figure 5, four-fifths (80%) of respondents said the auditor explained the efficiency upgrades performed on the day of the audit. Additionally, just under two-thirds (65%) said the auditor offered guidance about additional upgrades for which they may be eligible. One-half or more said the auditor discussed additional ways to save energy in the home (56%) or provided

education materials, such as flyers or brochures (50%). Respondents found these resources moderately useful: the average rating was 3.8 on a scale from 1 to 5, where 1 meant “not at all useful" and 5 meant "extremely useful”.

Figure 6: Resources Provided by Energy Auditor (n=556; Multiple Response)*



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

Responding Tier 1 participants provided feedback about the additional energy-saving methods that their auditor suggested. The most frequently suggested method was to install a programmable thermostat: over one-half (52%) of respondents said their auditor suggested this. Between one-third and one-half said their auditor suggested upgrading to ENERGY STAR appliances (49%), sealing air leaks (46%), hanging laundry to dry (45%), and adjusting the thermostat to a lower temperature in the winter and a higher temperature in summer (35%). Most respondents whose auditor discussed additional ways to save energy had tried at least one of them since having the audit performed; only 7% said they had tried none. The most common energy saving actions respondents mentioned trying since the audit included installing a programmable thermostat (37%) and hanging laundry to dry (35%). Additional feedback on other energy-saving methods suggested and tried can be found in Figure 48 in Appendix C.2.2.

5.3.4 Program Satisfaction

Most respondents were satisfied with the program. Figure 6 displays respondents’ average satisfaction ratings with various aspects of the program and the program overall on a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied.” The average rating for the program overall was 4.3. Over four-fifths (91%) of respondents said they were likely to recommend the program to others.

The program aspect that respondents were most satisfied with was the professionalism of the auditor: the average rating was 4.7. While perceived household energy affordability improvements had the lowest average satisfaction rating, it was still relatively high rating at 4.1.

Figure 7: Satisfaction with Program Aspects (n=595)

Tier 2 respondents rated the usefulness of the products they received in their Energy Saving Kits on a scale from 1 to 5, where 1 meant "most useful" and 5 meant "least useful". Tier 2 respondents found the LED bulbs to be the most useful, with average ratings of 2.1 for 11W LEDs and 2.2 for 23W LEDs. Tier 2 respondents found the block heater timer to be the least useful item in the Energy Saving Kits, providing an average rating of 4.0. Additional feedback on the usefulness of the Energy Saving Kits can be found in Figure 49 in Appendix C.2.4.

5.3.5 Recommendations for Program Improvement

Twenty percent of respondents (117 of 595) offered recommendations for improving the program. Figure 7 shows that the most common recommendation was to offer more energy savings products and/or tips, mentioned by 23% of the 117 respondents, followed by relaxing eligibility requirements for the program and/or specific measures (20%), and ensuring auditors and contractors are properly trained (15%).

Figure 8: Recommendations for Program Improvement (n=117; Multiple Response)*

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

Ten percent of respondents (60 of 595) offered suggestions about improving the quality of products and upgrades they received. The most common suggestion, mentioned by one-fourth (25%) of the 60 respondents, was more sizes and options for appliances. Respondents also suggested cleanup and repainting after insulation installation (17%), better set-up and/or instructions for thermostats and power bars (15%), and better-quality refrigerators and/or freezers (12%). Additional feedback on these recommendations can be found in Figure 49 in Appendix C.2.5.

Forty-seven percent of respondents (280 of 595) provided recommendations for additional energy-efficiency equipment or services for inclusion in the program. The most frequently mentioned type was weatherization upgrades: 26% of the 280 respondents recommended air sealing, 20% recommended windows, and 9% recommended doors. Four percent of the 280 respondents recommended heat pumps for cooling, and four percent recommended heat pumps for heating. Additional feedback on these recommendations can be found in Figure 51 in Appendix C.2.5.

6

Other Energy-Efficiency Benefits

6.1 Avoided Greenhouse Gas Emissions

The NMR team used the IESO's *Cost Effectiveness Tool* to calculate avoided GHG emissions. The NMR team calculated avoided GHG emissions for the first year and for the lifetime of the measures. Table 6 presents the results of these calculations for PY2021.

Table 8: Avoided GHG Emissions in PY2021

Avoided (Tons CO_2 equivalent)	PY2021
First Year	662
Lifetime	14,227

Table 7 presents the average cost per ton of avoided GHG emissions by end use. Individual measures within each end use were weighted by their energy savings contribution to their end use's total energy savings. At the lower end of average cost per ton are weatherization measures, such as insulation and air sealing. Average plug load costs are also very low, but only include block heater timer and smart power strip measures, which are limited in their contribution due to their relatively small savings per measure. At the opposite end, the largest cost per ton are HVAC equipment and controls, with room air conditioners contributing the most to the high cost. Average cost per ton of appliances was similarly brought up by predominately freezer measures. This observation that room air conditioners and freezers require the most cost per ton of avoided GHG emissions mirrors the observation from the CE analysis, which found that freezers and room air conditioners yielded the lowest PAC ratios.

Table 9: Average Cost Per Ton Avoided GHG Emissions by End Use

End Use	Average Cost Per Ton Avoided GHG Emissions
Weatherization	0.3
Plug Loads	2.2
Lighting	94.3
Water Heating	316.9
Appliances	692.8
HVAC Equip. + Controls	717.9

6.2 Non-Energy Benefits

The following subsection discusses the NEBs from EAP in PY2021. Additional detail regarding NEBs methodology and results can be found in Appendix D. Please note that the PY2021 NEB results are presented in this section for informational purposes only. The team used the Phase II study NEBs values within the PY2021 Cost Effectiveness calculator rather than the PY2021 NEBs study values per IESO request. This will allow the team to collect additional NEBs data in future evaluation years.[9]

6.2.1. Key Findings

Key findings from the NEBs analysis include the following:

- Using the **hybrid, minimum approach**, the PY2021 NEBs values were $0.22/kWh for thermal comfort, $0.15/kWh for reduced financial stress, and $0.04/kWh for improved air quality.

6.2.2. Quantified NEBs Values

The PY2021 EAP participant survey included 328 participants who had experienced at least one NEB from the measures installed through the program. The EAP participant survey asked about participant experiences with three NEBs:

- **Thermal comfort:** Improvement in ability for building to maintain a comfortable temperature.
- **Reduced financial stress:** Reduced stress related to making bill payments or reduced worries about shut-offs due to bill non-payment.
- **Improved indoor air quality:** Reduction in air pollutants in indoor environment.

Approximately three-fifths (59%) of PY2021 participants experienced NEBs from improved thermal comfort, nearly three-fifths (59%) experienced NEBs from reduced financial stress, and nearly one-fifth (17%) experienced NEBs from improved indoor air quality (Figure 8).

[9] The team estimated the PY2021 Cost-Effectiveness using the Phase II study NEBs values ($/kWh), which were substantially higher for EAP (55% adder) than the equivalent adder used for the Interim Framework programs (15% adders).

Figure 9: Participant Observation of NEBs, Phase II & PY2021

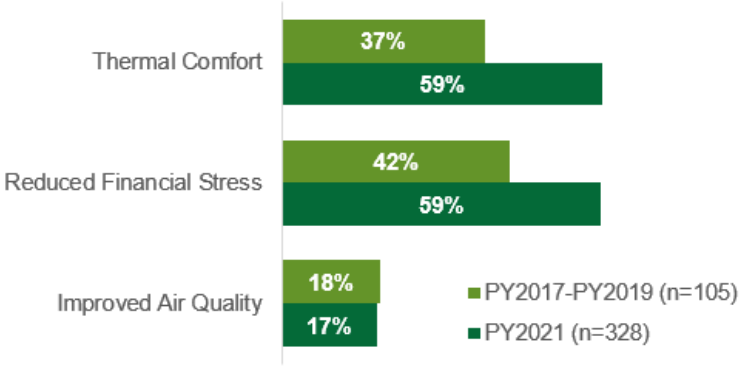


Table 8 shows quantified NEBs values for Phase II and PY2021 based on the hybrid, minimum ($/kWh) valuation, the approach recommended by the Phase II study.[10] In PY2021, thermal comfort was valued highest by EAP respondents ($0.22/kWh) followed by reduced financial stress ($0.15/kWh), and improved air quality ($0.04/kWh).

This feedback corresponds to the NEBs auditors and contractors reported their customers might have experienced due to their participation in EAP, where the majority (87%) indicated that their customers experienced improved thermal comfort, three-fourths (74%) indicated their customers had experienced reduced financial stress, and just under one-half (45%) indicated their customers had experienced improved air quality. To see all contractor feedback associated with the NEBs, refer to Figure 53 in Appendix D.

Table 10: Quantified NEBs ($/kWh), PY2021 & Phase II

NEB	PY2021	Phase II
Thermal comfort	$0.22	$0.08
Reduced financial stress	$0.15	$0.09
Improved indoor air quality	$0.04	$0.02

The Phase II study found that program participants placed a great deal of value on NEBs. In many cases, the value of the NEBs exceeded the value of the participant energy savings. This was also the case in PY2021, with most respondents reporting NEBs having an equal or higher value on a yearly basis than the amount of their electricity bill or savings. Furthermore, when asked if they had to pay for a certain benefit, independently from the energy savings, one-half (50%) of participant estimates were of an equal or higher value per year than the amount of their electricity bill or savings. This highlights that there are factors beyond energy savings that may motivate participation in energy efficiency or contribute to positive customer experiences with programs.

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

6.3 JOBS IMPACT ANALYSIS

This section outlines the jobs impact analysis results. Details regarding the jobs impact analysis methodology can be found in Section 2.4 and Appendix A.6 and additional results can be found in Appendix D.**High-Level Results**

- The analysis used an input-output model which estimated that EAP will create 87 total jobs in Canada, of which 79 will be in Ontario.
- Most of the jobs stem from the demand created for energy-efficient products and services related to program delivery.
- The EAP program is estimated to create approximately 13 jobs per $1M of program spend.

6.3.2. Input Values

The model was used to estimate the impacts of two economic shocks – one representing the demand for energy-efficient products and services from EAP and the other from the increased household expenditures due to bill savings (and net of program funding). Table 9 shows the input values for the demand shock representing the products and services related to EAP. Each measure installed as part of EAP was categorized according to the StatCan IO Supply and Use Product Classifications (SUPCs).

Table 11: Summary of Input Values for Demand Shock

Category Description	Non-Labor ($ Thousands)	Labor (S Thousands)	Total Demand Shock ($ Thousands)
Electric light bulbs and tubes	1,418	0	1,418
Major appliances	1,236	157	1,393
Non-metallic mineral products, n.e.c.	4	8	12
Other miscellaneous manufactured products	315	0	315
Small electric appliances	234	234	468
Switchgear, switchboards, relays and industrial control apparatus	281	193	474
Other professional, scientific and technical services	-	-	1,452
Office administrative services	-	-	1,403
Total			**6,936**

Table 10 shows the calculations and input value for the household expenditure shock.[11] This shock represents the net additional amount that households would inject back into the economy

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

through spending. Additional background and details about the household expenditure shock inputs can be found in Appendix E.

Table 12: Summary of Input Values for Household Expenditure Shock

Description	Demand Shock *($ Thousands)*
NPV of energy bill savings	10,086
Residential portion of program funding	(2,428)
Net bill savings to residential sector	**7,659**
Percent spent on consumption (vs. saved)	36%
Total Shock	**2,743**

6.3.3. Model Results

Impacts from the StatCan I-O model are generated separately for each shock and added together to calculate overall program job impacts. In the case of EAP, this means that two different sets of job impacts are combined into the overall jobs impacts. Table 11 shows the total estimated job impacts by type – combining the impacts from the demand and household reinvestment shocks. The majority (79 out of the 87 estimated total jobs) were in Ontario. All the direct jobs created were created in Ontario. A slightly smaller share of the indirect and induced jobs was in Ontario, with 26 out of 28 indirect and 16 out of 21 induced total jobs within the province. The FTE estimates are slightly less, with a total of 62 FTEs (of all types) created in Ontario and 64 FTEs added throughout Canada. Calculating relative program performance as a function of jobs created per $1M of program budget is helpful in comparing different program years. The EAP program was estimated to create 12.6 total jobs per $1M of investment in 2021.

Table 13: 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	30	30	37	37	5.3
Indirect	19	24	26	28	4.1
Induced	13	14	16	21	3.1
Total	**62**	**68**	**79**	**87**	**12.6**

A more detailed write up of the model impacts, including a breakout of impacts by industry and verbatims from program contractors, can be found in Appendix E.

Key Findings and Recommendations

The following section presents detailed key findings and recommendations for the PY2021 evaluation. Please note that given the nature of findings 16 and 17, the team does not provide related recommendations.

Finding 1: Only 20 weatherization projects occurred in the EAP program for PY2021 which accounted for nearly 83,000 kWh (1.3%) and 4.5 kW (0.8%) of gross verified savings for the program. Gross verified savings for weatherization measures on a per-unit basis accounted for over 4,100 kWh per project in PY2021. This highlights that savings associated with weatherization measures on a per-project basis provide substantial savings over the course of their measure life. In addition, this highlights that the initial weatherization projects are pushing upgrades to cover more area of the home or projects are incorporating multiple weatherization measures at one site. Savings for the weatherization projects administered through EAP have increased when compared to the average per-project savings attributed to weatherization projects in HAP (3,669 kWh in PY2020 and 3,240 kWh in PY2019). However, the number of weatherization projects that occurred over these years were substantially higher with 278 occurring in PY2020 and 70 in PY2019. It should be noted that as the program cycle matures, more weatherization projects are likely to be executed.

> **Recommendation 1.** Weatherization upgrades can provide important savings opportunities and health upgrades for participants. It will be important for the EAP program to emphasize and increase implementation of weatherization upgrades for participants in subsequent program years. This will be especially important as savings from lighting measures will likely continue to diminish over time. The program may consider pushing shell insulation, especially attic insulation, to increased levels of efficiency to further deepen savings and increase occupant comfort.

Finding 2: EAP Tier 2 kits were distributed to 177 participants and accounted for nearly 164,000 kWh of gross verified savings. These kits provide an average of 925 kWh in gross verified savings per participant. While the average gross verified savings for Tier 1 participants were approximately 756 kWh. However, participants are of moderate income and have a NTGR applied to account for net verified savings, which reduced savings down to 141,000 kWh. , which brings the net-verified savings per participant closer to the Tier 1 participant levels (797 kWh). Regardless, this highlights a potential opportunity for the EAP program to cost-effectively increase program savings in subsequent program years.

> **Recommendation 2.** Continue to promote and consider expanding marketing communication and outreach channels to help raise awareness for potential Tier 2 participants. If the program is not already doing so, providing installation instructions, such as pictures, links to tutorial videos, or written guidance for measures that are not commonly installed (e.g., aerators, power bars). This may encourage greater installation rates of measures delivered through mailed kits. Installation rates were not assessed in the PY2021 evaluation for Tier 2

participants but will be in PY2022. It should be noted that low measure installation rates could impact future savings potential, so the program should consider the education tactics mentioned above to ensure high installation rates.

Finding 3: EAP program tracking data includes completed projects and installed measures along with unique identifiers for each. However, the tracking data does not typically include key characteristics that are collected during audits such as building or equipment type. This information can be used to better estimate savings impacts and to provide insights for future program offerings. These data points are often collected and included in the data collection forms that are used during in-home audits. However, only in some cases is this information captured in the program tracking data. For example, 29% of EAP participant records were missing building type information and no mechanical equipment details are included in the data. As the EAP program evolves, additional measures such as cold-climate heat pumps or heat pump water heaters may be offered through the program. Having these additional data points will be valuable for program staff, vendors, and the evaluation team to assess the impacts of any new measures. The program tracking data did include completed projects and installed measures, including variables to identify unique projects and measures. These unique identifying variables are critical for impact accounting over multiple years in a framework.

Recommendation 3a. Continue to include variables that can be used to identify unique projects and measures within the tracking data. If possible, limit the annual program tracking data to projects that are fully completed.

Recommendation 3b. Work with program staff, program delivery vendors, auditors contractors to incorporate additional details into the tracking data such as building type and mechanical equipment (e.g., type and fuel) and any additional data that are collected on-site (e.g., equipment efficiency, capacity).

Finding 4: Participants, auditors, contractors, and delivery vendor staff recommended offering additional equipment through the program. Nearly one-half (47%) of surveyed participants provided recommendations for additional energy-efficiency equipment or services for inclusion in EAP. These participants most often recommended air sealing (26%), windows (20%), and stoves (20%). Over three-fourths (77%) of auditors and contractors recommended additional equipment or services, including heat pumps (29%), kitchen equipment such as dishwashers and stoves (29%), washers and dryers (21%), insulation and air sealing (17%), and heating equipment (13%). Delivery vendor staff also recommended that the program consider the feasibility of offering heat pumps and generally revisit eligible measure offerings more frequently.

Recommendation 4a. Consider offering additional types of equipment, such as heat pumps, kitchen equipment, washers and dryers, additional insulation and air sealing, and heating equipment.

Recommendation 4b. Further consider the relative cost effectiveness (CE) of these potential new measures. Appliances offered in the program have yielded the lowest measure-level CE ratios of all measures (0.05 to 0.33 PAC ratios). Building shell measures performed relatively

better, being at or above the program's median measure-level PAC ratio (0.56 to 0.75 PAC ratios).

Recommendation 4c. Revisit eligible measure offerings more frequently.

Note that a similar recommendation to Recommendation 4a was included in the PY2019 and PY2020 HAP evaluations. In response to the recommendation in PY2020, the IESO indicated that they had reviewed opportunities to expand the program measure composition and had considered the inclusion of the equipment listed in the PY2020 recommendation. They noted that, following this review, IESO had determined that the HAP measure composition was appropriately balanced in providing participants with attractive measures and impactful energy savings while meeting program and policy objectives and managing costs. Offering additional equipment through the program was still a common participant suggestion from PY2021 EAP participants, auditors, and contractors, and additional measures, such as heat pumps, were mentioned more commonly. Therefore, this recommendation is provided again in PY2021 in case new opportunities exist to consider additional equipment types for program inclusion.

***Finding 5:* EAP participation in the first year includes 8,132 projects accounting for 6,154 MWh and 0.62 MW in net verified savings.** In PY2021, the RR for gross verified energy savings was 97% and was 91% for gross verified demand savings. While the EAP program still relies heavily on savings from lighting measures, there are opportunities to diversify program savings by focusing on weatherization measures, appliances, smart power bars, and various other measure offerings in future years.

Recommendation 5. Continue to promote and deliver deeper savings measures to EAP participants like weatherization, appliances, and smart power bars, especially in historically underserved areas. There may be an opportunity for EAP to conduct a postal code analysis to determine if EAP is effectively serving communities that are historically underserved, and in homes that may provide greater opportunities for savings on a per-project basis. This analysis may help inform targeted efforts by EAP to deliver energy-efficiency products and improvements to participant homes while maximizing savings on a per-project basis.

Finding 6: Program FR was moderately high in PY2021 for the Tier 2 participants at 25.0%. The program's NTG was moderate in PY2021 at 86.2%%. FR was found to be moderately high at 25.0% and SO was relatively high SO at 11.2%. About one-tenth (12% of participants) stated they would have done the "exact same upgrade" in the program's absence, which is indicative of higher FR for these participants. Over three-fifths (62% of participants) showed no indication of FR since they said they would have put off the upgrade for at least one year or cancelled their upgrade all together if the program had not been available to them. Other participants were considered partial free riders if they reported that they would have scaled back on the size, efficiency, or scope of their project (12% participants) or if they did not know what they would have done in the absence of the program (15% of participants).

Recommendation 6a: Maintain focus on minimizing FR. Key areas include:

- identifying and targeting homeowners that would be unlikely to make upgrades without program support, and

- encouraging all participants to complete the evaluation surveys to ensure that the FR results are as representative of the true population of program participants as possible.

Recommendation 6b: Encourage participants to install additional energy-efficient equipment or services beyond what is covered through the program if it is feasible for them to do so (for example, identifying additional opportunities during initial site visits). Doing so may lead to increases in the program's spillover (SO), which may in turn help offset FR and lead to improved net-to-gross (NTG).

Finding 7: Additional program promotion opportunities exist. Common program barriers identified by IESO program staff, delivery vendor staff, and auditors and contractors were the relatively minimal marketing and a reported lack of awareness for the program. Auditors and contractors reported that the greatest barriers to program participation were lack of awareness that the program exists among customers (mentioned by 71% of respondents) and concerns among customers about whether the programs is real (mentioned by 61% of respondents). Program improvement suggestions identified by IESO staff and delivery vendor staff included continuing collaborations with the roundtable of sector experts and community-based groups, identifying partnership opportunities with gas utilities, and addressing gaps in marketing, especially related to the new Energy Saving Kits offered to Tier 2 customers.

Recommendation 7a. Continue collaborations with sector roundtable and community-based organizations to help promote the program and address concerns about the program's legitimacy.

Recommendation 7b. Identify potential partnership opportunities with gas utilities.

Recommendation 7c. Consider additional ways to market and promote the program, especially for the Tier 2 Energy Saving Kit offering (refer to Recommendation 4).

Please note that a similar recommendation to Recommendation 7a was included in the PY2019 and PY2020 HAP evaluations. In response to the recommendation in PY2020, the IESO indicated that program awareness-building and marketing campaigns were underway as part of the new framework and that these campaigns would be testing effective ways of reaching prospective participants in a targeted and cost-efficient manner. The IESO also indicated they would continue to engage local agencies and community organizations directly. They noted that the IESO established the Energy Affordability Roundtable to help build credibility and drive participation in the new program and build relationships within the sector, and said that the IESO also intends to collaborate with Enbridge Gas to more effectively reach shared customers. Given that minimal marketing and lack of program awareness were common barriers highlighted again in PY2021, a similar recommendation to prior years is provided again to ensure that it continues to be considered in future program years.

Finding 8: Measure eligibility criteria is leading to decreases in installation frequency for some measures, especially appliances and insulation. Over one-fourth (26%) of auditors and contractors reported that the program's measure eligibility criteria have led to decreases in the frequency with which measures are installed, with appliances and insulation most often mentioned as being negatively impacted. Delivery vendor staff also reported that the criteria for age of

appliances sometimes impacts customers' ability to receive an upgrade, but also noted that IESO is often open to exceptions, depending on the measure and the situation.

Recommendation 8. Consider revisiting measure eligibility criteria, especially for appliances and insulation, to ensure the program is appropriately meeting customer needs.

Finding 9: Continued supply chain disruptions may require that the program revisit its measure-related cost cap. As a result of COVID-19 and other economic conditions, supply chain disruptions have had major impacts on program measure costs in recent years. The delivery vendor staff recommended completing more periodic reviews of program measure-related cost caps, including additional market research and cost evaluations of relevant program measures. Close to one-third (32%) of auditors and contractors shared recommendations for changes to the measure-related cost caps, with most recommending insulation cost cap adjustments as well as taking travel costs into account as fuel costs increase.

Recommendation 9. Increase the frequency of program measure-related cost caps reviews, including additional market research and cost evaluations of relevant program measures (e.g., appliances, insulation). Consider ways to incorporate travel costs as fuel costs increase.

Finding 10: Energy-efficiency education activities are likely resulting in savings. Just over one-half (56%) of Tier 1 participants said the auditor discussed additional ways to save energy in the home, and of these participants, nearly all (93%) said they had tried at least one of the additional ways to save energy since having the audit performed.

Recommendation 10. Encourage more auditors to discuss additional ways to save energy with participants.

Finding 11. Participants are generally satisfied with the quality of the products and services. Only 10% of participants offered suggestions about improving the quality of products and services they received. Of these, the most common suggestion was to offer more sizes and options for appliances (25%), followed by cleanup and repainting after insulation installation (17%), and better set-up and/or instructions for thermostats and power bars (15%).

Recommendation 11a. Consider offering a wider variety of sizes and options (e.g., colors) for appliances.

Recommendation 11b. Accurately set customers' expectations regarding insulation upgrades. Ensure that customers are informed of any cleanup or repainting that will be required and whom will be responsible for it (the contractor or the customer).

Recommendation 11c. Remind auditors to assist customers with thermostat and power bar set-up and, in addition, leave behind reference materials when possible.

Note that a somewhat different recommendation to Recommendation 11, which focused more specifically the importance of training customers on proper use of the program equipment and ensuring they are aware of the process for requesting replacements, was included in the PY2020 HAP evaluation. In response to the recommendation in PY2020, the IESO indicated that their Customer Satisfaction surveys, "quality" of appliance measures are often noted as an opportunity

for improvement by participants. Given that participants provided new feedback in PY2021, new recommendations are provided for PY2020 on this topic.

Finding 12: Power bar measures had extremely high RRs. The NMR team found discrepancies with smart power bar savings values. The reported energy savings for smart power bars applied a savings value associated with the power bar with timer measure, which is not delivered by the EAP. In addition, there were no demand savings reported for smart power bars, which prevented a demand RR from being calculated for smart power bars.

> **Recommendation 12.** Ensure that auditors are installing the tier-2 smart power bars with audiovisual (AV) equipment (or include installation location in the data collection form). Verify that the correct reported energy savings values are applied to the correct measure.

Please note that a similar recommendation to Recommendation 12 was included in the PY2019 and PY2020 HAP evaluation. In response to the recommendation in PY2019, the IESO indicated that they would work with the program delivery vendor to ensure that Tier-2 power bars were installed with AV equipment. Given the persistence of the issue across program years, this recommendation is provided again in PY2021 to ensure that it continues to be considered in future program years.

Appendix A Detailed Methodology

This appendix summarizes the methodology applied for various components of the EAP evaluation: impact, cost-effectiveness, avoided GHG emissions, process, and jobs impacts.

A.1 IMPACT METHODOLOGY

This section provides additional details about the impact evaluation methodology. A summary of the methodology was provided in Section 3.1.

A.1.1 Impact Sampling

The NMR team sampled EAP at the project level to generate data for the desk reviews (Table 11). Initially, the projects were examined to determine what measures and combination of measures were most common across projects to ensure that strata could be created without excluding any measure categories. Projects were then binned based on the level of deemed gross savings for the entire project. These bins were the high-savers (projects whose summed measure savings were in the top 20% of savings), medium-savers (projects whose summed measure savings were in-between 33% and 80% of total distributed savings) and low-savers (projects whose summed measure savings were in the lowest 33% of total distributed savings). The NMR team used the projects that resulted in the top 20% of program savings to sample from for the desk review. Initial allocations did not yield enough sample points to obtain the desired confidence levels for some of the critical measures of interest. To address these deficiencies, the NMR team re-ran the allocation, oversampling low-incidence projects with dehumidifiers, pipe insulation, and thermostats, and window air conditioners. These steps resulted in a final sample size of 229.This approach balanced competing needs, that the desk review sample include the most program savings possible while covering as many low-incidence measures as possible.

Table 14: Desk Review Sample Summary

n	Avg. # of Measures per Project	Avg. kWh Deemed Savings per Project
229	6.3	2,206

A.1.2 Program Tracking Database Review

The NMR team review checked for consistency between measures and the Measures and Assumptions List (MAL) values and verified the accuracy of reported savings calculations based on the IESO substantiation sheet algorithms for prescriptive measures that were updated as a part of the PY2019 HAP impact evaluation.[12] The NMR team also leveraged the database to calculate gross and verified net savings for the entire population. Equation 3 shows the program tracking data correction factor calculation, which aligned reported savings with the updated

[12] Note that weatherization measures do not have prescribed values in the MAL and the NMR team evaluated savings for these measures on a case-by-case basis during the desk reviews.

PY2019 evaluation substantiation sheet savings values. Note that if there were no errors or inconsistencies in the reported savings calculations, the correction factor would equal one.

Equation 3: Program Tracking Data Correction Factor

$$Tracking\ Data\ Correction\ Factor\ (CF) = Deemed\ savings\ value\ (PY2019\ Updated\ Substantiation\ Sheet\ Savings) \div Reported\ Saving$$

A.1.3 In-Service Rate (ISR) and Hours of Use (HOU) Analysis

The NMR team surveyed EAP participants to verify the number of measures installed and in use on their premises. The NMR team applied the PY2021 ISR findings to verified savings calculations for all measures that achieved the desired sampling error (10%) at the 90% confidence interval (CI) based on the participant survey.[13]

The NMR team also surveyed participants to determine HOU for measures more directly impacted by occupant usage. Unlike the ISR analysis, only select measures received HOU adjustments, detailed below:

Lighting. The NMR team determined that further evaluation would be necessary to consider the self-reported lighting usage values as valid for substituting into substantiation sheets and/or calculating verified lighting savings. The substantiation sheets source values from studies that logged actual lighting usage in residential settings. However, it should be noted that the PY2021 survey results and the substantiation sheet HOU were aligned at 3 hours per day for the overall household.

Aerators. The NMR team determined that further evaluation would be necessary to consider the self-reported aerator usage values as valid for substituting into substantiation sheets and/or calculating verified aerator savings. Survey respondents in PY2021 reported aerator usage between five and ten times greater than those documented in IESO substantiation sheets.

Block heater timers. The NMR team did not update block heater timer HOU due to limited survey responses.

Dehumidifiers. The NMR team updated two values determining dehumidifier usage – hours per day and days per year – based on PY2021 survey results. Survey respondents reported usage greater than the levels documented in IESO substantiation sheets.

Showerhead. The NMR team did not apply HOU updates to showerheads due to limited survey responses and the uncertainty surrounding household water usage.

The results for the ISR and HOU aspects of the participant surveys are discussed in Section 3.2 and Appendix B.2, respectively.

A.1.4 Engineering Desk Reviews

The engineering desk reviews consisted of a review of a sample of 230 projects that the NMR team selected as part of the program tracking database review and sampling process. The

[13] Block heater timers and window air conditioners did not have an ISR adjustment due to low sample sizes.

program delivery vendor provided the NMR team with documentation for the sampled projects. The NMR team conducted a thorough review of the detailed project documents, which consisted of application forms, invoices, appliance shipment confirmation, energy models, photos, and auditor data collection forms.

A.1.5 Prescriptive Measures

The NMR team assessed prescriptive measure quantities and measure descriptions based on the documentation provided for the sampled projects. The NMR team conducted additional research to determine the actual nominal energy usage for appliance measures based on existing and new equipment model numbers (when available) to reflect savings estimates more accurately from these measures. The NMR team used the program tracking data review, the PY2019 review of other TRM's, and the desk review to calculate measure-specific RRs, which the NMR team then applied to the population. The NMR team generated measure specific ISR values from participant survey results and then applied them to gross savings calculations. In addition, some measures received HOU adjustments as a result of the participant surveys. Equation 4 shows the gross verified savings calculation for prescriptive measures. Note that if there were no corrections as a result of the program tracking data review nor adjustments made during the PY2019 substantiation sheet savings review (Equation 3), the RR would only reflect any discrepancies found during the desk review (i.e., quantity discrepancies or installed measure inconsistencies).

The inputs for the equation are described below:

- **Gross verified savings:** The evaluated savings after all evaluation activities—outside of net-to-gross—are conducted.
- **Desk review RR:** This is determined based on the project file documentation. For example, some measures have discrepancies in quantities or types and are included in the tracking data but not verified in the project file documentation.
- **Adjusted TRM CF:** A general evaluation process to ensure the reported savings align with deemed savings values that are defined in the substantiation sheets (outlined in Equation 3).
- **ISR:** measure specific in-service rates are determined from the participant surveys and are applied to savings to account for some measures that are distributed to participants that are not used. For example, 96% of lightbulbs that were distributed by the program are still in use which is then applied to the savings value for the measure.
- **HOU adjustment:** Hours of use adjustments impact the amount of savings for a given measure. The HOU influence the degree of savings that are calculated. This is generally one or two variables within the algorithm defined by the measure's substantiation sheet.
- **Measure quantity:** The number of measures that a participant received. For example, a participant received 20 lightbulbs would have the per-unit savings value multiplied by 20.

Equation 4: Gross Verified Savings – Prescriptive Measures

$$Gross\ Verified\ Savings = Desk\ Review\ RR \times Adjusted\ TRM\ CF \times ISR \times HOU\ adjustment\ X\ Measure\ Quantity$$

A.1.6 Weatherization Measures

The NMR team verified weatherization measures – which include installation of insulation in attics, basements, and walls, as well as air sealing – through a review of HOT2000 energy model files, photo verification, and audit documentation. Savings for the weatherization measures are generally calculated from pre- and post-retrofit upgrades with HOT2000 energy modeling software. The NMR team performed a more detailed and comprehensive engineering analysis of the weatherization measures by reviewing the HOT2000 files and recalculating the savings based on the weatherization upgrades outlined in the project documentation. The NMR team compared savings results from the desk review to the reported savings to determine a RR, which we then applied to the reported savings for the population of weatherization projects. Note that demand savings from weatherization projects are calculated based on an end-use load profile (also referred to as a summer peak demand factor) that was applied to the gross verified kWh savings. Equation 5 shows the gross verified savings calculation for weatherization measures.

Equation 5: Gross Verified Savings – Weatherization Measures

$$\boldsymbol{Gross\ Verified\ Savings = Reported\ Savings \times Realization\ Rate}$$

A.2 Net-to-Gross Evaluation Methodology

This section provides additional details about the NTG evaluation methodology. A summary of the methodology was provided in Section 2.1.1.

The following sub-sections provides detail on the sampling plans for collecting NTG data for the Tier 2 offering, the instruments used to assess FR and SO, the implementation of the data collection, and the analysis methods. Please note that for the Tier 1 offering, the NMR team applied an NTG value of 1.0 to maintain consistency with other low-income, direct installation programs in other jurisdictions. The NTG of 1.0 indicates that participants would not have installed the energy-efficiency measures without program intervention.

The NMR team developed an effective questionnaire to assess FR and SO for the Tier 2 offering. The approach has been used successfully in many previous evaluations. The NTG is defined as follows (Equation 6).

Equation 6: NTGR

$$\boldsymbol{NTG = 100\% - FR + SO}$$

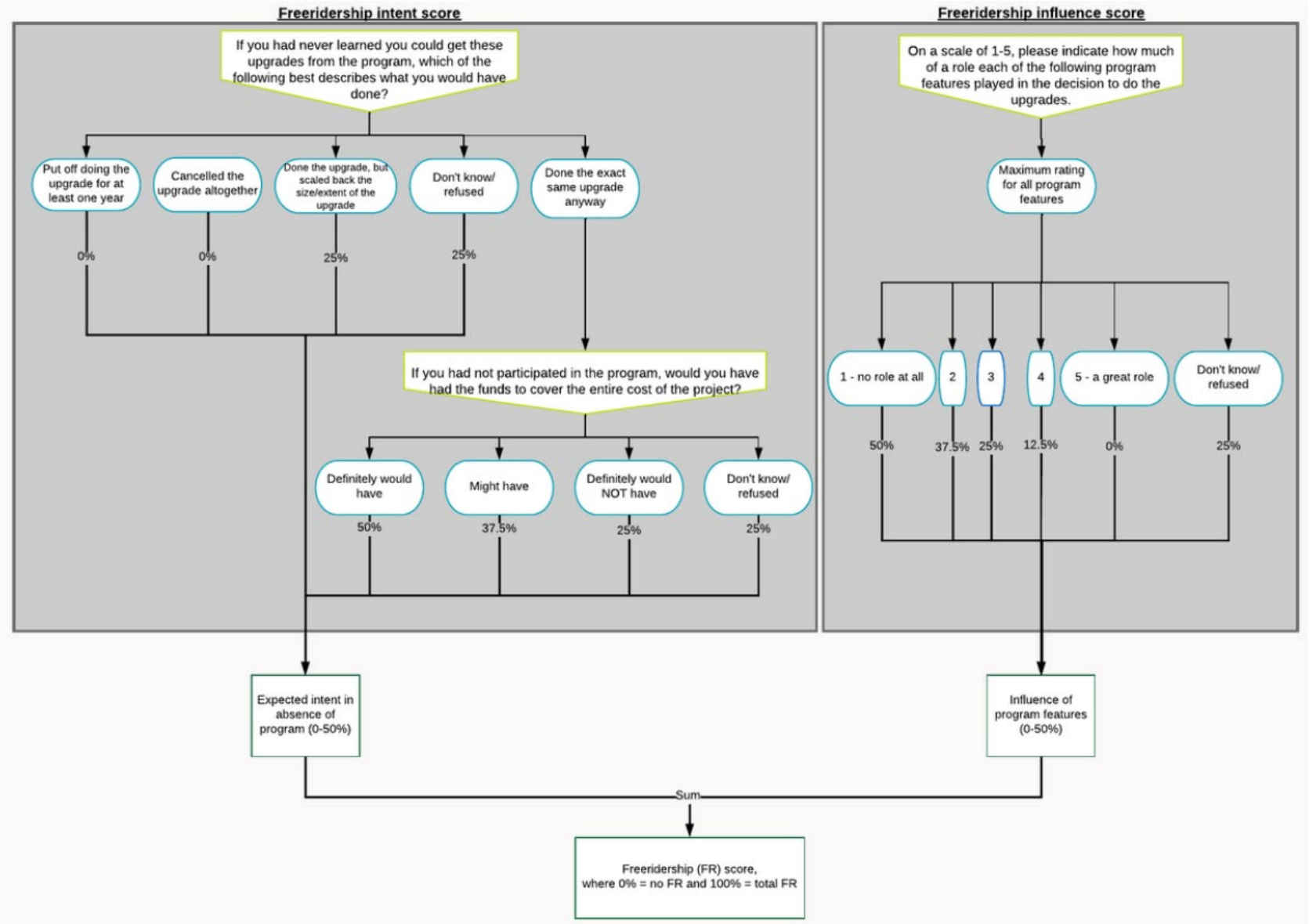
A.2.1 Free-Ridership Methodology

The survey addressed the attribution of savings for each sampled Tier 2 project or type of equipment through two main components:

- Intention of the expected behavior in the absence of the program; and
- Influence of various program features, such as the availability of the upgrades at no cost, program marketing and outreach, and any information or recommendations provided by an IESO representative.

Each component produces scores ranging from 0 to 50. The two components are summed to produce a total FR score ranging from 0 (not a free rider) to 100 (complete free rider). The total score is interpreted as a percentage (0% to 100%) to calculate the mean FR level for a given program. Figure 9 illustrates the FR methodology.

Figure 10: FR Methodology



Intention Component

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

> Question 1: If you had never learned you could get these upgrades through the Energy Affordability Program, which of the following best describes what you would have done? You 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 on the efficiency
> 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 participated in the Energy Affordability Program, would you say you definitely would have, might have, or definitely would NOT have had the funds to cover the cost of the upgrades?
>
> 1. Definitely would have
> 2. Might have
> 3. Definitely would NOT have
> 4. Don't know
> 5. Refused

Table 12 indicates the possible intention scores a respondent could have received depending on their responses to these two questions.

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

The second question asks the participants who had said they would have done the exact same project if they definitely would have, might have, or definitely would not have had the funds to cover the cost of the upgrades if they had not received them from the program. If the respondent answered 1 (definitely would have had the funds), the respondent would receive a score of 50% (associated with high FR). If the respondent answered 2 (might have had the funds), they would receive a slightly lower FR score of 37.5%. If the respondent answered 3 (definitely would not

have had the funds) or did not know or refused the question, the respondent would receive an FR intention score of 25% (associated with moderate FR).

Table 15: Key to FR 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)

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

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

Influence Component

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

- Availability of the upgrades at no cost to you Information or recommendations provided to you by an IESO representative
- Information or recommendations provided from auditors or contractors associated with the program
- Marketing materials or information provided by IESO about the program (email, direct mail, etc.)
- Information or resources from IESO's website
- Information or resources from IESO's social media

- Previous experience with any energy saving program
- Others (identified by the respondent)

Table 13 indicates the possible influence scores a respondent could receive depending on how they rated the influence factors above. For each respondent, the program influence is set equal to the maximum influence rating that a respondent reports across the various influence factors. For example, suppose the respondent provided a score of 5 (extremely influential) to at least one of the influence factors. In that case, the program is considered to have had a great influence in their decision to do the upgrade, and the influence component of FR is set to 0% (not a free rider).

Table 16: Key to FR Influence Score

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

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

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

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

A.2.2 Spillover Methodology

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

- ENERGY STAR® appliance
- ENERGY STAR® LED
- Lighting controls (lighting timers, occupancy sensors)
- High efficiency heating, cooling, or water heating equipment (central air conditioning, furnace, boiler, water heater)
- Weatherstripping around doors and windows
- Programmable or smart thermostat
- Smart power bar
- Low-flow showerhead
- Faucet aerator
- Others (identified by the respondent): description of upgrade, size, quantity, hours of operation

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

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

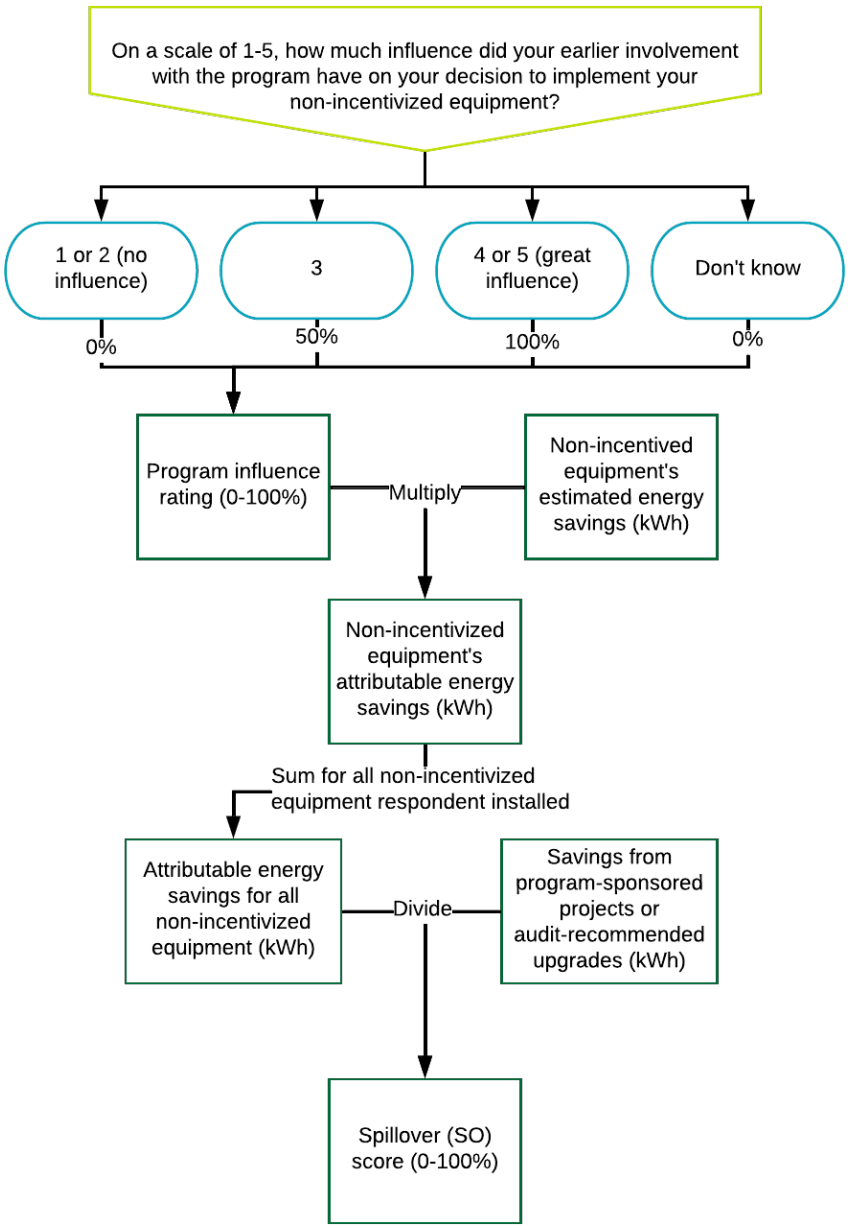
- Maximum rating of 1 or 2 (no influence) = 0%
- Maximum rating of 3 = 50%
- Maximum rating of 4 or 5 (great influence) = 100%
- Respondent does not know how much influence any factor had = 0%

The NMR team used the following procedure 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 10 illustrates the SO methodology.

Figure 11: SO Methodology



A.2.3 Other Survey Questions

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

- Whether the respondent is the person primarily involved in decisions about upgrading equipment. If the respondent is not the appropriate contact, they are asked to forward the survey weblink on to the appropriate contact.
- Whether the respondent was the homeowner or tenant.
- When the respondent first learned about the program, relative to the upgrade in question (before planning; after planning, but before implementation).
- How the respondent learned about the program.

The responses to these questions are not included the algorithms for calculating FR or SO but do provide additional context. The first question ensures that the appropriate person responded to the survey. The other questions provide feedback about responsibility for the relationship of the respondent to the property where the upgrade was performed, and how and when program influence occurs.

A.2.4 Net-to-gross Survey Implementation

The NMR team implemented the NTG survey over the web as part of a larger survey that collected NTG, impact, and process-related feedback from participants. The NMR team assumed that all contacts who responded were the appropriate contacts to answer the questions. The introductory text in the survey asked the respondent to forward the survey weblink to the appropriate contact to fill it out if they were not the appropriate contact to do so.

A.3 COST-EFFECTIVENESS METHODOLOGY

This section provides additional details about the cost-effectiveness methodology. A summary of the methodology was provided in Section 2.2.

The cost-effectiveness analysis was completed using IESO's *Cost Effectiveness Tool* and in accordance with the IESO *Cost Effectiveness Guide for Energy Efficiency.*[14] The tool was populated with the following key information from the evaluation:

- First year energy and demand savings
- EUL
- End use load profile
- Incremental equipment and installation cost
- Net to gross ratios for energy savings and demand savings

[14] *Cost Effectiveness Guide for Energy Efficiency Version 4*, Independent Electricity System Operator, January 20 2021, https://www.ieso.ca/-/media/Files/IESO/Document-Library/EMV/CDM_CE-TestGuide.ashx

- Adjustments in savings over the life of the program

Additionally, the IESO provided the following information for use in the cost-effectiveness calculation:

- Program administrative costs
- Incentive amounts

The IESO Cost Effectiveness Tool provides many outputs and varying levels of granularity. While the NMR team leveraged various outputs to develop findings and recommendations, the key outputs the team selected to directly present in this report are as follows:

- PAC test costs, benefits, and ratio
- Levelized delivery cost by kWh and kW

A.4 PROCESS EVALUATION METHODOLOGY

This section provides additional details about the process evaluation methodology. A summary of the methodology was provided in Section 2.2.

During the process evaluation, the NMR team collected primary data from key program actors, including the IESO staff, the program delivery vendor staff, participants, auditors, and contractors. (Table 14). The NMR team collected the data using different methods, depending on what was most suitable for a particular respondent group (e.g., web surveys or telephone-based-IDIs). This data, when collected and synthesized, provides a comprehensive understanding of the delivery of the PY2021 program.

The NMR team directly carried out or managed all process evaluation data collection activities and developed all survey instruments, interview guides, and sample files for use in the interviews and surveys. The survey instruments and interview guides were approved by the IESO EM&V staff, and the data used to develop the sample files came from program records supplied either by the IESO EM&V staff or the program delivery vendor.

The NMR team conducted the in-depth telephone interviews with the IESO staff and the program delivery vendor staff using in-house staff (rather than through a survey lab). The NMR team fielded EAP participant and EAP auditor and contractor surveys as web-based surveys in partnership with the Resource Innovations survey lab based in Toronto. The NMR team designed the survey instruments and developed the sample lists. The Resource Innovations survey lab then programmed and distributed the surveys using Qualtrics survey software. The NMR team worked closely with the Resource Innovations survey lab to test the programming of each survey and to perform quality checks on all data collected.

Table 17: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Fielding Firm	Completed	Population	90% CI Error Margin
EAP IESO Staff and Program Delivery Vendor Staff	Phone IDIs	NMR Staff	2	2	0%
EAP Auditors and Contractors	Web	Resource Innovations Survey Lab	31	71	11.3%
EAP Participants	Web	Resource Innovations Survey Lab	595*	3,820**	3.1%

*569 Tier 1 and 26 Tier 2

**3,659 Tier 1 and 161 Tier 2

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

A.4.1 IESO Staff and Program Delivery Vendor Staff Interviews

The NMR team completed one interview with two IESO staff members and one interview with three program delivery vendor staff members to gain a detailed understanding of EAP in PY2021 (Table 15). The purpose of the interviews was to better understand program design, delivery, and barriers, and solicit suggestions for improvement.

The interview topics included program roles and responsibilities, program design and delivery, marketing and outreach, market actor engagement, program strengths and weaknesses, and suggestions for improvement.

The NMR team identified the appropriate staff to interview in consultation with the IESO EM&V staff. Each interview took approximately sixty minutes to complete. The NMR team conducted IDIs via phone with the IESO staff and the program delivery vendor staff from late March to early May 2022.

Table 18: EAP IESO Staff and Program Delivery Vendor Staff Interview Disposition

Disposition Report	Count
Completes	2
Emails Bounced	-
Bad Contact Info (No Replacement Found)	-
Unsubscribed	-
Partial Complete	-
Screened Out	-
No Response	-
Total Invited to Participate	2

A.4.2 Auditor and Contractor Survey

The NMR team surveyed 71 EAP auditors and contractors from a sample of 31 auditors and contractors (Table 16). The purpose of the survey was to better understand EAP auditor and contractor perspectives related to program delivery.

The interview topics included role in the program, firmographics, the application process, training and education received, outreach and marketing to customers, measure eligibility criteria, measure-related cost caps, program barriers, satisfaction, suggestions for program improvement, including additional equipment or services to consider, impacts of COVID-19, NEBs, and job impacts.

The NMR team developed the survey sample with support from the program delivery vendor, who provided a contact list of 46 auditors and 19 contractors. The NMR team employed a census-based approach to reach the largest number of respondents possible given the small number of unique contacts.

The NMR team delivered the survey over the web in partnership with the Resource Innovations survey lab using Qualtrics survey software. Survey implementation was conducted between March 24 and April 13 of 2022. The survey took an average of 18 minutes to complete after removing outliers.[15] The NMR team sent weekly e-mail reminders to non-responsive contacts over the course of web survey fielding.

Table 19: EAP Auditor and Contractor Survey Disposition

Disposition Report	Count
Completes	31
Emails Bounced	-
Bad Contact Info (No Replacement Found)	-
Unsubscribed	-
Partial Complete	3
Screened Out	1
No Response	36
Total Invited to Participate	71

A.4.3 Participant Survey

The NMR team surveyed 595 EAP participants from a sample of 3,820 unique contacts (Table 17). The purpose of the survey was to better understand EAP participant perspectives related to program experience.

The survey topics included ISRs; HOU; how participants learned about and applied to the program; motivations for doing the upgrades; education and materials provided by the energy auditor; suggested energy-saving methods that participants implemented; Energy Saving Kits usefulness; satisfaction with various aspects of the program process; suggestions for program

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

improvement, including additional equipment or services to consider; NEBs, job impacts; and demographics.

The NMR team developed the sample from program records provided by the IESO EM&V staff. Given the measure-level survey completion goals, the NMR team developed a stratified random sample of a subset of participants for inclusion in the survey sample.

The NMR team delivered the survey over the web in partnership with the Resource Innovations survey lab using Qualtrics survey software. The NMR team conducted survey implementation between April 11 and April 28 of 2022. The survey took an average of 19 minutes to complete after removing outliers.[16] The NMR team sent weekly e-mail reminders to non-responsive contacts over the course of web survey fielding.

Table 20: EAP Participant Survey Disposition

Disposition Report	Count
Completes	595
Emails Bounced	52
Bad Contact Info (No Replacement Found)	-
Unsubscribed	-
Partial Complete	199
Screened Out	151
No Response	2,823
Total Invited to Participate	3,820

A.4.3.1 Participant Sampling Plan

The NMR team sampled EAP participants using individual projects as the sampling unit. The project-level allocation of sample weighted the data at the measure level to ensure that the results accurately reflected measure categories across projects. Following the PY2019 and PY2020 approaches developed for HAP, NMR initially binned projects by their level of deemed gross savings. These bins included high savers (participants whose summed measure savings were in the top 20% of savings), medium savers (participants whose summed measure savings were in-between 33% and 80% of total distributed savings) and low savers (participants whose summed measure savings were in the lowest 33% of total distributed savings). The NMR team used these savings bins as the sampling strata and refer to them as the high-, medium-, and low-savings strata. Sampling by these strata ensures that participants across the binned savings categories would be proportionately represented in the sample.

The NMR team used Neyman Allocation[17] to optimally sample projects from each of the three strata given the overall number of sample points desired. After initially drawing the sample by the savings strata based on the project-level savings, NMR then examined the selected sample to assess how well they represented the population of measures installed across the projects.

[16] Note that the survey was designed to allow the respondent to come back to the survey at a later time to complete it if they preferred. The average survey time was calculated with this in mind and assumed that any survey that took 40 minutes or more to complete was likely completed by a respondent who took a break before completing the survey.
[17] See Chapter 11 of the Uniform Methods Project for examples of Neyman Allocation in evaluation. https://www.nrel.gov/docs/fy17osti/68567.pdf

Ideally, NMR wanted the sample for each measure to be large enough to include at least 70 completions for each measure. However, this assessment revealed that the initial allocations did not yield enough sample points to obtain the desired confidence levels for HOU and ISR for some of the critical measures of interest. To address these deficiencies, the NMR team re-ran the allocation, oversampling low-incidence projects with aerators, showerheads, thermostats, window air conditioners, and specific types of insulation. Likewise, the NMR team verified that sampled projects provided adequate coverage of the different IESO regions surveyed. Table 18 shows the original sample plan. As seen in Table 17, the survey response was very successful, resulting in 595 survey completes. Table 19 compares the number of program participants in the population that installed each measure category with the number of participants contacted for the survey, and who completed the survey.

Table 21: EAP Participant Sample Plan Summary

Project Strata	Project Count	Measure Count	90% Error Margin
Top 20% of Savings	185	2,686	5.8%
Middle 47% of Savings	668	2,573	3.0%
Bottom 33% of Savings	435	840	3.8%

Table 22: EAP Participant Survey Project Counts and Completes by Measure Category

Measure Category	Projects in Population	Invited to Participate	Completed Survey
Lighting	6,709	3,350	473
Dehumidifiers	288	242	56
Freezers	430	353	80
Refrigerators	908	702	151
Window Air Conditioners	21	17	1
Weatherization – Building Shell	20	17	6
Smart Power Bars	3,576	2,677	361
Aerators	348	240	21
Showerheads	298	222	21
Pipe / Tank Wrap	241	190	19
Block Heater Timers	778	666	18
Indoor Clothes Drying Racks	3,539	2,867	383
Thermostats	639	125	25

A.5 Non-Energy Benefits Methodology

This section provides additional details about the NEBs estimate methodology. A summary of the methodology was provided in Section 2.4.

A.5.1 Participant Survey

The *Non-Energy Benefits Study: Phase II* assessed the NEBs from energy efficiency projects funded by the IESO over the 2017-2019 period.[18] The PY2021 evaluation applied the same methodology as the Phase II study to assess NEBs, using two different types of questions to determine the value of NEBs that program participants realized by installing program measures:

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

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

A.5.2 NEBs Quantification

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

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

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

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

[18] 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

Table 23: Quantified NEBs by Participant and by Savings, PY2021 & Phase II

NEB	Test	PY2021 Average (per participant)	PY2021 Average (Overall)	Phase II (per participant)	Phase II Average (Overall)
Reduced financial stress	Hybrid (min approach) ($/kWh)	0	0.15	0.13	0
Thermal comfort	Hybrid (min approach) ($/kWh)	0.34	0.22	0.14	0.08
Improved indoor air quality	Hybrid (min approach) ($/kWh)	0.05	0.04	0.04	0.02
Reduced financial stress	Hybrid (RS-priority) ($/kWh)	0.57	0.33	0.18	0.09
Thermal comfort	Hybrid (RS-priority) ($/kWh)	0.64	0.4	0.17	0.09
Improved indoor air quality	Hybrid (RS-priority) ($/kWh)	0.23	0.11	0.04	0.02

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

A.6 JOBS IMPACT METHODOLOGY

This section provides additional details about the job impact methodology. A summary of the methodology was provided in Section 2.4.

The analysis of job impacts utilized the StatCan IO model to estimate direct and indirect 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. A system of linear equations represents how certain industries' outputs become the inputs for other industries, while other outputs become consumer goods. When an energy-efficiency program such as EAP is funded and implemented it creates a set of "shocks" to the economy, such as demand for specific products and services, and additional household expenditures from energy bill savings. The shocks propagate throughout the economy and their impacts can be measured in terms of variables such as economic output and employment.

A.6.1 Statistics Canada IO Model

The Industry Accounts Division of StatCan maintains two versions of a Canadian IO model: a national, and an interprovincial model[19]. The models are classical Leontief-type open-IO models[20], where some production is consumed internally by industries, while the rest is consumed externally. The models provide detailed information on the impact of exogenous demands for industry outputs. The impacts are quantified in terms of production, value-added components (such as wages and surplus), expenditures, imports, employment, energy use, and pollutant emissions by industry. The StatCan IO Model is composed of input, output, and final demand tables. IO tables are published annually with a lag of approximately three years, so the model used for this analysis represents the Canadian economy from 2018. The model has been used to model employment impacts from a wide range of economic shocks, including structural changes to the Canadian economy[21], the bovine spongiform encephalitis (BSE) crisis in the early-mid 2000's[22], and the construction of hydropower projects[23].

The supply and use tables (SUTs) for the Canadian IO model break the economy down into 240 industries and 500 SUPCs. They represent the economic activity of a specific Canadian province, or of the whole country. The SUTs show the structure of the Canadian economy, with goods and services flowing from production or import (supply tables) to intermediate consumption or final use (use tables). Intermediate consumption refers to domestic industries using goods and services to produce other products and services. Final use includes consumption of products by households, non-profit institutions serving households, and governments; capital formation; changes in inventory; and exports. Provincial SUTs are similar to national SUTs, but for the addition of interprovincial trade to go along with the international imports and exports.

StatCan offers the IO Model as a service but not as a product. StatCan economists work with researchers to develop the data and inputs to develop and answer specific research questions using the model. The end product is a set of outputs from running the model.

A.6.2 Approach

The process for using the StatCan IO model followed three steps:

1. Developed specific set of research questions to address with the IO model, reflecting the exogenous shocks caused by the program.
2. Developed model inputs, which consisted of exogenous shock values (in dollars) to simulate the effects of EAP.
3. Ran the model and interpreted the results.

The following sections cover each step in more detail.

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[19] Statistics Canada - Industry Accounts Division System of National Accounts; (2009). User's Guide to the Canadian Input-Output Model. Statistics Canada. Ret
[20] Ghanem, Ziad; (2010). The Canadian and Inter-Provincial Input-Output Models: The Mathematical Framework. Statistics Canada – Industry Accounts Division.
[21] Gera, S & Masse, P; (1996). Employment Performance in the Knowledge-Based Economy, Gouvernement du Canada - Industrial Organization 14, Gouvernement du Canada - Industry Canada.
[22] Samarajeewa, S. et al.; (2006). Impacts of BSE Crisis on the Canadian Economy: An Input-Output Analysis. Prepared for the Annual Meeting of the Canadian Agricultural Economics Society.
[23] Desrochers, R. et al.; (2011). Job Creation and Economic Development Opportunities in the Canadian Hydropower Market. Canadian Hydropower Association.

A.6.2.1 Developed Specific Research Questions

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

1. **What are the job impacts from new demand for energy-efficient measures and related program delivery services?** Funds collected for EAP generate a demand for efficient equipment and appliances. They also generate a demand for services related to program delivery, such as audits at customer premises, call center operations, and general overhead for program implementation and staffing. This demand creates jobs among firms that supply these products and services.
2. **What are the job impacts from household energy bill savings?** Once energy-efficient equipment is installed in households, the customers realize annual energy savings for the useful life of the measures. Households can choose to put this money into savings or to spend it on goods and services in the economy. This additional money and the decision to save or spend has implications for additional job creation. For instance, additional household spending on goods and services generates demand that can create jobs in other sectors of the economy.
3. **What are the job impacts from funding the energy-efficiency program?** IESO energy-efficiency programs are funded via volumetric bill charges for all customers – both residential and non-residential. This additional charge can reduce the money that households have for savings and for spending on other goods and services. It also impacts non-residential customers. This additional bill charge results in a negative impact on jobs in the Canadian economy.
4. **What are the job impacts from reduced electricity production?** The energy-efficient measures will allow households to receive the same benefit while using less electricity. The program as a whole will reduce the demand for electricity in the residential sector. This reduced demand could have upstream impacts on the utility industry (e.g., generation) and related industries, such as companies in the generator fuel supply chain.

A.6.3 Developed Model Inputs

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

1. **Demand for energy-efficient measures and related program delivery services.** The StatCan IO Model divides the Canadian economy into 240 industry classifications and 500 SUPCs. Each measure installed as part of the program was classified into one of the SUPCs. The dollar value for each product-related demand shock was calculated using the measure cost and quantity data from the impact evaluation (see Section 2.4).

Services that were part of the delivery process were also classified into SUPCs. The vast majority of these services were either audits or program administrative services. Customer audits had flat fees for calculating the value of the demand shock and the value of administrative services was obtained from program budget actuals.

It was necessary to specify the amount of each demand shock attributed to labor versus non-labor. For the product categories, we used the labor versus non-labor cost estimate proportions from the measure research conducted as part of the cost-effectiveness analysis. For the service categories, the IO model contained underlying estimates that defined the portion of labor versus overhead (non-labor).

2. **Household energy bill savings.** This value was calculated for the model as the net present value (NPV) of the discounted future stream of energy bill savings by participants. It was calculated by multiplying net energy savings[24] (in kWh) in each future year by that future year's retail rate ($/kWh). This calculation was performed for each future year through the end of the measure's expected useful life (EUL). Savings beyond the EUL were assumed to be zero. Measure-level energy saving estimates were obtained from the impact evaluation. The other calculation parameters (discount rate, measure EULs, and retail rate forecast) align with the cost-effectiveness analysis.

   Customers' intentions for whether to spend or save the money saved on energy bills was obtained via a short section on the customer surveys. The percentages that indicated what the customers would do with the bill savings were obtained from the participant surveys through the following two questions:

   J1. What do you anticipate you will do with the money saved on electricity bills from the energy-efficient equipment upgrades?

   1. Pay down debt or put the money into savings
   2. Purchase more goods and/or services
   3. Split – put some money into savings/debt payments and use some money to purchase more goods/services
   4. Other. Please specify.
   98. Don't know
   99. I'd rather not answer

   [BASE: IF RESPONDENT WILL SPLIT MONEY SAVED IN VARIOUS WAYS (J1=3)]

   J2. Approximately what would be the split between savings/debt payments and purchasing more goods/services? [ALLOW MULTIPLE RESPONSE OPTION]

   1. Percent saved or used to pay down debt [NUMERIC RESPONSE BETWEEN 0 and 100]

[24] The net-to-gross ratio for HAP is 1, so the net energy savings are the same as gross savings.

2. Percent used to purchase more goods and services [NUMERIC RESPONSE BETWEEN 0 and 100]
98. Don't know
99. I'd rather not say

For estimating job impacts, the key input value was the amount of bill savings that customers would spend—as opposed to save.

3. **EAP funding.** IESO energy-efficiency programs are funded by a volumetric charge on electricity bills and, volumetrically, residential customers accounted for 35 percent of consumption and non-residential customers accounted for 65 percent in 2019[25]. The overall program budget was distributed between these two customer classes by these percentages.
4. **Reduced electricity production.** The NPV of retail savings (estimated as part of RQ2) was also the input for examining a potential impact of producing less electricity.

A.6.3.1 Run Model and Interpret Results

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

1. Demand shock as outlined in RQ1, representing the impact of the demand for energy-efficient products and services due to EAP.

2. Household expenditure shock representing the net amount of additional spending that the residential sector will undertake. This was estimated by taking the NPV of energy bill savings and subtracting the residential contribution to program funding. Thus, the model run combined RQ2 with the residential component of RQ3.

The model output generated three types of job impact estimates: direct, indirect, and induced impacts – as described in Section 2.4.

[25] Annual Planning Outlook – A view of Ontario's electricity system needs; 2020. IESO.

Appendix B Additional Impact Evaluation Results

This appendix includes additional results associated with the impact evaluation activities. Higher-level results were provided in the Impact Evaluation section above.

B.1 Detailed Impact Results

Table 21 presents the detailed measure-level results of the impact evaluation. The savings values in the table represent the measure-level savings for the entire population. The quantity of measures installed in PY2021 is also included. The proportion of total program savings is also included to show the representative impact of each measure's energy and demand savings on EAP. RRs for energy and demand are displayed in the table.

Table 24: Total Gross Verified Savings by Measure Type

Measure	Quantity Installed	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	RR - Energy	RR - Demand	Gross Verified Savings - Energy (kWh)	Gross Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
Lighting end-use									
=11W ENERGY STAR® Qualified LED A Shape (60W) (minimum 600 Lumen output) (Formerly: 7W – 11W ENERGY	72,620	3,463,917	217.86	74%	78.4%	2,550,087	170.86	41.3%	30.2%
=11W ENERGY STAR® Qualified LED MR 16 (minimum 400 Lumen output) (Formerly: 7W – 12W ENERGY STAR® Qu	1,008	35,986	2.02	85%	101.9%	30,661	2.05	0.5%	0.4%
=14W ENERGY STAR® Qualified LED A Shape (75W) (minimum 800 Lumen output) (Formerly:10W – 14W ENERGY	5,696	269,990	17.09	73%	77.7%	198,194	13.28	3.2%	2.3%
=16W ENERGY STAR® Qualified LED PAR 20 (minimum 600 Lumen output) (Formerly: 8W – 12W ENERGY STAR® Q	1,309	60,083	3.93	74%	76.1%	44,577	2.99	0.7%	0.5%
=16W ENERGY STAR® Qualified LED PAR30 & PAR38 (minimum 600 Lumen output) (Formerly: 8W – 12W ENERGY	1,122	63,281	4.49	85%	80.4%	53,872	3.61	0.9%	0.6%
=23W ENERGY STAR® Qualified LED A Shape (100W) (minimum 1600 Lumen output) (Formerly: 17W – 23W ENER	5,164	316,553	20.66	96%	98.1%	302,479	20.27	4.9%	3.6%

Measure	Quantity Installed	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	RR - Energy	RR - Demand	Gross Verified Savings - Energy (kWh)	Gross Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
=23W ENERGY STAR® Qualified LED PAR (minimum 1100 Lumen output) (Formerly: 14W – 18W ENERGY STAR® Qu	1,199	63,307	4.80	85%	75.2%	53,857	3.61	0.9%	0.6%
=6W ENERGY STAR® Qualified LED MR 16 / PAR 16 (minimum 250 Lumen output) (Formerly:7W – 10W ENERGY S	4,073	153,552	12.22	96%	81.1%	147,841	9.91	2.4%	1.8%
ENERGY STAR® LED Wet Location Rated PAR lamp = 23 Watt (minimum 1100 Lumen output)	633	33,676	2.53	85%	75.9%	28,675	1.92	0.5%	0.3%
LED Downlight with Light Output >600 and <800 lumens (Retrofit Measure List)	37	2,283	0.15	54%	55.5%	1,225	0.08	<0.1%	<0.1%
LED Downlight with Light Output >800 lumens (Retrofit Measure List)	1	89	0.01	52%	51.6%	46	0.00	<0.1%	<0.1%
Lighting Total	**92,862**	**4,462,717**	**285.73**	**76%**	**80%**	**3,411,514**	**228.57**	**55.2%**	**40.4%**
Appliances									
Dehumidifier Replacement (ENERGY STAR Qualified 14.2 - 21.2 l/day)	266	64,585	20.75	99%	98.7%	63,942	20.49	1.0%	3.6%
Dehumidifier Replacement (ENERGY STAR Qualified 21.3 - 25.4 l/day)	31	6,154	1.98	128%	127.4%	7,889	2.53	0.1%	0.4%
Dehumidifier Replacement (ENERGY STAR Qualified 25.5 - 35.5 l/day)	7	1,281	0.41	155%	153.9%	1,983	0.64	<0.1%	0.1%
Freezer Replacement (ENERGY STAR Qualified 12-14.4 cu ft)	314	32,939	4.40	197%	200.8%	65,001	8.83	1.1%	1.6%
Freezer Replacement (ENERGY STAR Qualified 14.5 – 16.0 cu ft)	78	8,034	1.09	175%	174.6%	14,038	1.91	0.2%	0.3%

Measure	Quantity Installed	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	RR - Energy	RR - Demand	Gross Verified Savings - Energy (kWh)	Gross Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
Freezer Replacement (ENERGY STAR Qualified 7-12.0 cu ft)	50	2,750	0.35	155%	165.4%	4,263	0.58	0.1%	0.1%
Refrigerator Replacement (10.0 – 12.5 cu ft)	160	28,800	3.84	126%	124.8%	36,431	4.79	0.6%	0.8%
Refrigerator Replacement (ENERGY STAR Qualified 15.5 – 16.9 cu ft)	118	24,190	3.19	128%	127.7%	30,940	4.07	0.5%	0.7%
Refrigerator Replacement (ENERGY STAR Qualified 17.0 – 18.4 cu ft)	630	137,340	18.27	85%	84.5%	117,370	15.44	1.9%	2.7%
Window Air Conditioner Replacement (ENERGY STAR Qualified 10,000 – 12,000 BTU/hr)	5	377	0.45	102%	101.8%	383	0.45	<0.1%	0.1%
Window Air Conditioner Replacement (ENERGY STAR Qualified 6,000 – 7,999 BTU/hr)	6	246	0.29	135%	133.5%	332	0.39	<0.1%	0.1%
Window Air Conditioner Replacement (ENERGY STAR Qualified 8,000 – 9,999 BTU/hr)	11	638	0.76	107%	111.7%	681	0.85	<0.1%	0.1%
Appliance Total	**1,676**	**307,333**	**55.78**	**112%**	**109%**	**343,253**	**60.95**	**5.6%**	**10.8%**
Building Shell Measures									
Attic Insulation	32,305	32,305	0.45	100%	414.0%	32,194	1.87	0.5%	0.3%
Basement insulation	32,349	32,349	0.45	98%	413.8%	31,760	1.87	0.5%	0.3%
Comprehensive Draftproofing	13,654	13,654	0.16	138%	480.7%	18,872	0.79	0.3%	0.1%
Building Shell Total	**78,308**	**78,308**	**1.07**	**106%**	**424%**	**82,825**	**4.53**	**1.3%**	**0.8%**
Power Bars									
Smart Power Bars	4,379	15,764	-	5,901%	N/A	930,191	29.67	15.1%	5.2%
Power Bar Total	**4,379**	**15,764**	**-**	**5,901%**	**N/A**	**930,191**	**29.67**	**15.1%**	**5.2%**

Measure	Quantity Installed	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	RR - Energy	RR - Demand	Gross Verified Savings - Energy (kWh)	Gross Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
DHW									
Efficient Aerators (bathroom) < 3.8 liters per minute (Lpm)	236	11,611	1.18	69%	66%	7,983	0.78	0.1%	0.1%
Efficient Aerators (kitchen) < 5.7 Lpm	284	35,642	3.41	112%	114%	39,875	3.89	0.6%	0.7%
Efficient Showerhead (handheld) < 4.8 Lpm	207	48,376	4.76	54%	54%	26,330	2.57	0.4%	0.5%
Efficient Showerheads (standard) < 4.8 Lpm	131	30,615	3.01	82%	81%	24,994	2.44	0.4%	0.4%
Hot Water Tank Pipe Wrap - ½" (per foot)	20	1,984	0.20	92%	100%	1,824	0.20	<0.1%	<0.1%
Hot Water Tank Pipe Wrap - ¾" (per foot)	735	35,354	3.68	14%	14%	4,920	0.50	0.1%	0.1%
Hot Water Tank Wrap – Fiberglass R10	151	10,857	1.06	20%	19%	2,136	0.20	<0.1%	<0.1%
DHW Total	**1,764**	**174,438**	**17.29**	**62%**	**61%**	**108,063**	**10.57**	**1.7%**	**1.9%**
Miscellaneous									
Block Heater Timer (just timer)	779	186,259	--	100%	--	186,236	--	3.0%	--
Indoor Clothes Drying Rack	3,673	356,281	238.74	84%	84%	299,426	200.30	4.8%	35.4%
Programmable Thermostat – Line Voltage	962	117,556	--	152%	--	178,676	--	2.9%	--
Programmable Thermostat – Low Voltage	292	385,849	--	92%	--	356,544	--	5.8%	--
Smart Thermostat – Line Voltage (connected unit)	450	83,813	--	92%	--	77,447	--	1.3%	--
Smart Thermostat – Line Voltage (controller unit)	172	32,035	--	92%	--	29,602	--	0.5%	--
Smart Thermostat – Low Voltage	6	5,032	1.50	92%	92%	4,650	1.39	0.1%	0.2%
Smart Thermostat – Low Voltage (with C-wire)	5	4,194	1.25	92%	92%	3,875	1.16	0.1%	0.2%
Miscellaneous Total	**6,339**	**1,171,019**	**241.49**	**97%**	**84%**	**1,136,456**	**202.84**	**18.4%**	**35.9%**

Measure	Quantity Installed	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	RR - Energy	RR - Demand	Gross Verified Savings - Energy (kWh)	Gross Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
Tier 2 - Energy Saving Kits									
Energy Savings Kits (Pre-set) - Option 1 (B)	105	76,513	9.66	110%	116%	84,202	11.25	1.4%	2.0%
Energy Savings Kits (Pre-set) - Option 2 (B+EHW)	32	33,773	3.97	106%	111%	35,783	4.42	0.6%	0.8%
Energy Savings Kits (Pre-set) - Option 3 (B+W)	1	766	0.09	117%	421%	895	0.39	0.0%	0.1%
Energy Savings Kits (Pre-set) - Option 4 (B+BHT)	8	7,360	0.74	113%	116%	8,328	0.86	0.1%	0.2%
Energy Savings Kits (Pre-set) - Option 5 (B+EHW+W)	24	23,218	2.78	111%	352%	25,784	9.81	0.4%	1.7%
Energy Savings Kits (Pre-set) - Option 6 (B+EHW+BHT)	4	4,485	0.46	109%	111%	4,882	0.52	0.1%	0.1%
Energy Savings Kits (Pre-set) - Option 8 (All Measures)	3	3,476	0.35	113%	352%	3,940	1.23	0.1%	0.2%
Tier 2 Energy Savings Kit Total	**177**	**149,591**	**18.05**	**110%**	**158%**	**163,814**	**28.46**	**2.7%**	**5.0%**
EAP Total (All Tiers)	**185,505**	**6,359,170**	**619**	**97%**	**91%**	**6,176,116**	**565.60**	**100%**	**100%**

B.1.1 Lighting

The NMR team verified the savings for lighting measures using the project file data and lighting specific information collected by the EAP auditors. There are various light bulb products that are offered by the program for direct installation based on the replaced bulb type. The overall energy RR for lighting measures was 76%. In addition, the NMR team applied the PY2021 ISR results from the participant survey to the gross verified savings. The impact of adjustments to lighting measures represents a primary driver to the programs overall RR as lighting measures account for over one-half (55%) of total verified energy savings for the program.

The lighting end-use category is dominated by A-line type bulbs. The 11-watt A-line bulb contributes to 41% of the program savings, while the 23-watt A-line bulb contributes 4.9% of program savings. A-line bulbs are very common bulb shapes in residential settings, often used in both hard-wired and plug-in fixtures. In addition, A-line bulbs are easily swapped out, whereas other bulb shapes are common in certain fixture types that may not be common in the EAP participant home (i.e., candelabra shaped bulbs in a chandelier-type fixture or a reflector shaped installed into a recessed fixture). The RR for lighting demand savings was 80% due to adjustments from the PY2019 substantiation sheet review and application of the ISR.

B.1.2 Appliances

The NMR team verified the savings for appliances using the project file data and equipment-specific information collected by EAP auditors. The NMR team applied model number lookups to incorporate project-specific values into the desk reviewed savings calculations – instead of default reported savings input assumptions – for the installed equipment and, where possible, the existing equipment. This model-specific data typically included the size or capacity of the equipment and its annual energy consumption. During the desk reviews, the NMR team found that 11% of the appliances replaced were not the same size as their replacement. In these cases, the appliance was aligned with the corresponding size category to calculate the proportion of energy savings that are associated with replace on failure (i.e., associated with the verified baseline size rather than the existing equipment's). For example, if an 18 cubic foot refrigerator replaced one that was 15 cubic feet, the baseline energy usage would be calculated using the 15 cubic foot (existing) energy consumption for a portion of the equipment life (typically represents one third of the savings) and using the 18 cubic foot (replace on failure baseline) energy consumption to determine the remaining two-thirds of energy savings.

RRs for energy savings were generally high among appliances (112%), particularly with freezers. Appliances accounted for 5.6% of total program gross verified energy savings. The demand RRs (109%) were slightly lower than the energy RRs for appliances but accounted for 10.8% of the program gross verified demand savings.

Refrigerators. The NMR team calculated verified savings based on project-specific annual energy consumption derived from model number lookups for the installed refrigerators and the existing equipment, while the reported savings used the minimum requirements for meeting the ENERGY STAR efficiency specifications. The application of actual annual energy consumption values provides a more accurate savings estimate that does not rely solely on using the minimum ENERGY STAR specifications. During the desk reviews, the NMR team observed that some of

the EAP documentation included metered energy usage for the primary refrigerator. However, metered data was not consistently documented, and in many cases where it was documented the metered time was less than one hour.[26]

Refrigerators accounted for 184,741, kWh in energy savings (97% RR) and 24.3 kW in demand savings (96% RR). The slightly lower RR is a result of replacing existing refrigerators that were slightly more efficient than the baseline default savings value.

Freezers. The NMR team calculated verified savings for freezers in a similar way to refrigerators, leveraging model numbers to look up annual energy consumption and comparing it against the ENERGY STAR minimum values used in deemed savings.

Freezers accounted for 83,302 kWh in energy savings (191% RR) and 11.3 kW in demand savings (194% RR). The high RRs for freezers seem to be partially due to the fact that the specific models offered by the program are on the low end of the size categories that freezers are grouped into, and therefore have lower energy consumption than the midpoint of each category, which is used to calculate the prescribed savings. In addition, the model number look up for specific annual energy consumption of existing appliances attributed to the high RR.

Dehumidifiers. Typically, the NMR team limited the data used to verify savings for dehumidifiers to the specific capacity of the equipment (liters per day). The efficiency of the dehumidifiers offered by the program was consistent with the minimum ENERGY STAR specifications, so verified savings were relatively consistent with deemed savings. However, the NMR team adjusted the HOU for dehumidifiers based on the responses from the PY2021 participant survey. Participants indicated that they were using dehumidifiers more frequently and for a longer duration than deemed savings values suggested. Dehumidifiers accounted for 73,815 kWh in gross verified savings (102% RR) and 23.7 kW in gross verified demand savings (102% RR).

Window Air Conditioners. Like other appliances, the NMR team calculated verified savings for window air conditioners by looking up the capacity and efficiency of the installed equipment. These metrics were relatively consistent with the ENERGY STAR minimum specifications used in deemed savings. Window air conditioners accounted for a minimal amount of program savings, with only 1,396 kWh (111% RR) in gross verified energy savings and 1.7 kW in gross verified demand savings (113% RR).

B.1.3 Weatherization – Building Shell

There were 20 weatherization projects completed in PY2021. The NMR team calculated verified savings with the HOT2000 energy modeling tool that is used by EAP auditors to input the shell details of the participant building. Shell upgrades are only offered to participants with electric heat. EAP auditors create two models of the home: (1) an initial model that represents the existing conditions of the home observed during the initial audit and (2) the final model that includes the values from air sealing and insulation improvements as a result of the program. The tool compares

[26] The NMR team notes that there may be an opportunity to conduct additional secondary research to determine whether using one hour of metered usage data in place of the annual energy usage (based on the model number) or the default substantiation value can be supported in evaluated savings calculations. This would involve searching for evidence on the average 24-hour load profile of refrigerators to determine the level of variation that occurs throughout the day.

the modeled energy usage of the initial and final energy models, which the NMR team replicated to verify savings.

Weatherization measures accounted for 82,825 kWh of gross verified energy savings (RR of 106%) and 4.5 kW in gross verified demand savings (RR of 424%). Weatherization demand savings are a function of the energy savings and are calculated based on an end-use load profile (also referred to a summer peak demand factor).[27] The high RRs are a function of reported savings applying a different summer peak demand factor or assumed demand savings value.

B.1.4 Smart Power Bars

The smart power bar includes a sophisticated infrared or occupancy sensor that shuts off the equipment based on occupant behavior. Smart power bars accounted for 930,191 kWh (RR of 5,901%). The high RR for the smart power bar is due to the reported savings for smart power bars applying the power bar with timer measure savings value, a legacy measure that is no longer delivered by EAP in PY2021. The NMR team also observed this reported savings value in other residential IESO programs that no longer deliver power bars with timers. In addition, the NMR team updated the smart power bar savings values as a part of the PY2019 prescriptive savings review.[28]

There were no reported demand savings for smart power bars (4,379 units) in the tracking data. Due to this issue in the tracking data, the NMR team could not calculate a gross verified demand RR. The NMR team accounted for demand savings for smart power bars in the verification process, amounting to 29.7 kW, representing 5.2% of the program's gross verified demand savings.

B.1.5 Domestic Hot Water

Domestic hot water (DHW) measures are only offered to participants with electric water heating systems. The NMR team primarily verified savings for water heating measures by confirming the water heater fuel-type and that the measure types and quantities in the project files matched the program tracking data.

DHW measures accounted for 108,063 kWh of gross verified energy savings (RR of 62%) and the gross verified demand savings were 10.6 kW (RR of 61%). The NMR team updated the deemed savings values for pipe wrap, aerators, and showerheads during the PY2019 substantiation sheet review. The lower RRs for pipe wrap measures were due to reported savings calculations referencing the total linear feet of insulation installed, which is standard data collection practice by auditors in the field, while the input assumption for reported savings values is in three feet increments. This resulted in an overestimation of reported savings by a multiple of

[27] As documented in the EAP evaluation plan, the NMR team and the IESO determined that demand savings from weatherization projects will need to be calculated and verified as the energy modeling software HOT2000 does not provide demand savings and the program tracking data does not consistently include demand savings. The verified demand savings are based on an end-use load profile that was recommended by IESO staff and reviewed by the NMR team.

[28] Smart power bar savings values reflect Tier 2 advanced power bars, which are installed with audiovisual (AV) equipment. The NMR team confirmed this product and installation scenario occurred in PY2021 with the program delivery vendor staff.

three. While these were drivers to lower RRs for this end-use category, DHW measures only represented 1.7% of gross verified energy savings and 1.9% of gross verified demand savings.

B.1.6 Miscellaneous Measures

The NMR team verified savings for the miscellaneous measure category by confirming the measure type and the quantity installed matched between the project files and the program tracking data, as well as through the substantiation sheet reviews. During the desk review, the NMR team determined that the correct heating system was applied for line (electric baseboards) and low (electric furnaces) thermostats. In addition, the NMR team adjusted the savings associated with homes that did not have permanent cooling to reflect only savings from the heating system. Programmable and smart thermostats were only offered to participants with electric heat.

Miscellaneous measures accounted for 1,136,456 kWh of gross verified energy savings (RR of 97%) and the gross verified demand savings were 202.8 kW (RR of 84%). Most measures in this end-use category do not claim demand savings, with the exception of indoor clothes drying racks and low voltage smart thermostats. The RR for drying racks reflects the PY2019 substantiation adjustment. As noted above, during the desk review, the NMR team removed the savings associated with cooling for homes without permanent cooling as they were not applicable. This also impacted demand savings for this measure as demand savings occur during the summer months.

B.1.7 Tier 2 Energy Saving Kits

The NMR team verified calculated gross verified savings based on the substantiated values and the quantities distributed in each kit. The Energy Saving Kits did not have ISR or HOU adjustments from the participant survey, however the NTGR was calculated based on survey results for EAP (see Table 22).

Table 25: EAP Tier 2 Gross and Net Verified Savings

Measure	Gross Verified Savings - Energy (kWh)	Gross Verified Savings - Demand (kW)	NTGR - Energy (kWh)	NTGR - Demand (kW)	Net Verified Energy Savings	Net Verified Demand Savings
Energy Savings Kits (Pre-set) - Option 1 (B)	84,202	11.25	0.86	1.06	72,603	11.92
Energy Savings Kits (Pre-set) - Option 2 (B+EHW)	35,783	4.42	0.86	1.06	30,854	4.68
Energy Savings Kits (Pre-set) - Option 3 (B+W)	895	0.39	0.86	1.06	772	0.41
Energy Savings Kits (Pre-set) - Option 4 (B+BHT)	8,328	0.86	0.86	1.06	7,181	0.91
Energy Savings Kits (Pre-set) - Option 5 (B+EHW+W)	25,784	9.81	0.86	1.06	22,233	10.39

Measure	Gross Verified Savings - Energy (kWh)	Gross Verified Savings - Demand (kW)	NTGR - Energy (kWh)	NTGR - Demand (kW)	Net Verified Energy Savings	Net Verified Demand Savings
Energy Savings Kits (Pre-set) - Option 6 (B+EHW+BHT)	4,882	0.52	0.86	1.06	4,209	0.55
Energy Savings Kits (Pre-set) - Option 8 (All Measures)	3,940	1.23	0.86	1.06	3,398	1.30
Tier 2 Program Total	**163,814**	**28.46**	**0.86**	**1.06**	**141,249**	**30.15**

B.2 In-Service Rate

Figure 11 displays the energy-efficiency upgrades Tier 1 respondents confirmed receiving. Most respondents (83%) received LEDs; on average, respondents received 18 LEDs. Additionally, most respondents received a drying rack (67%) and/or a power bar (63%). Just over one-fourth (27%) of respondents received a refrigerator.

Figure 12: Energy-Efficiency Upgrades that Tier 1 Participants Received (n=569)

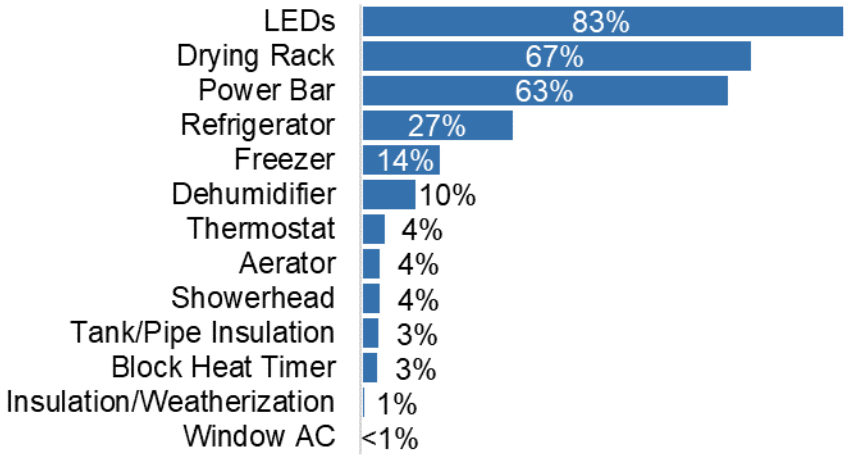


Figure 12 displays the ISRs for respondents' upgrades. All (100%) of the aerators, dehumidifiers, freezers, and refrigerators respondents received were still installed and functional at the time of the survey. Only block heater timers (67%) had an ISR below 90%.

Figure 13: Energy-Efficiency Upgrade ISRs

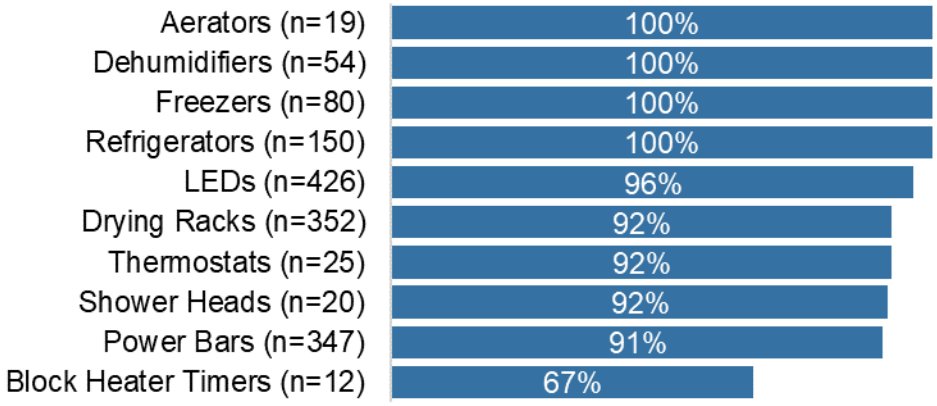
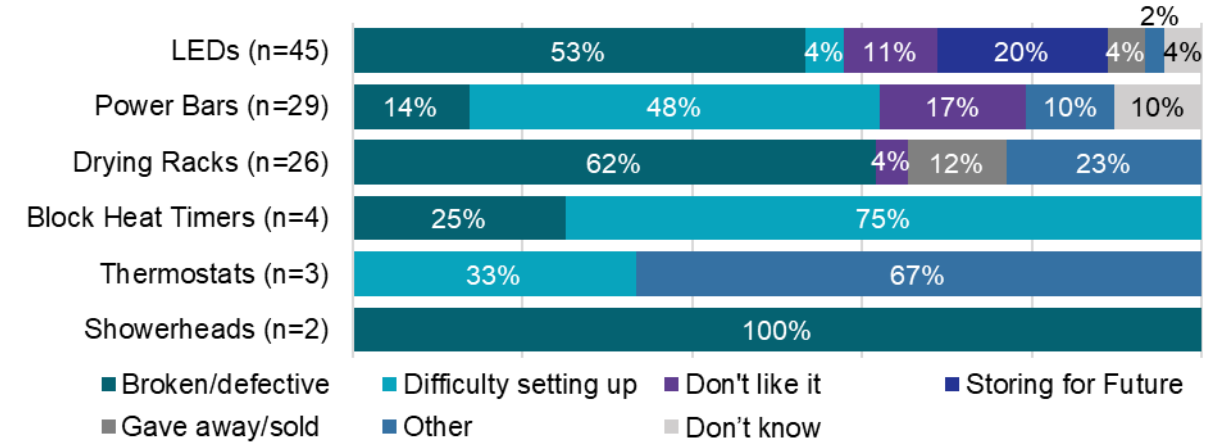


Figure 13 displays the reasons respondents gave for uninstalling or removing upgrades. The most common reason for uninstalling or removing LEDs (53%), drying racks (62%), and showerheads (100%) was that they were broken or defective. One-fifth (20%) of respondents who uninstalled or removed LEDs were storing them for future use. Around one-half (48%) of respondents who uninstalled or removed power bars and three-fourths (75%) who uninstalled or removed block heater timers had difficulty setting them up.

Figure 14: Reasons Respondents Uninstalled or Removed Upgrades



*May not sum to 100% due to rounding.

B.3 Hours of Use

The participant survey collected HOU information for several upgrades that homeowners received through the program in PY2021.

Figure 14 and Figure 15 display the average number of program-provided LEDs installed by room type and the average hours per day respondents used their LEDs. The highest number of LEDs installed occurred in bedrooms (average of 3.8 bulbs) and the highest hours per day of use occurred in kitchens (average of 4.2 hours).

Figure 15: Number of LEDs Installed by Room Type

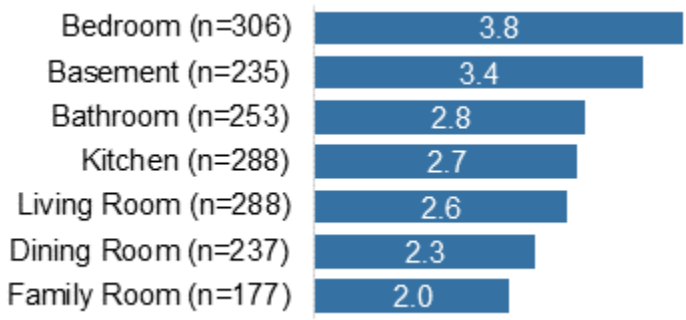
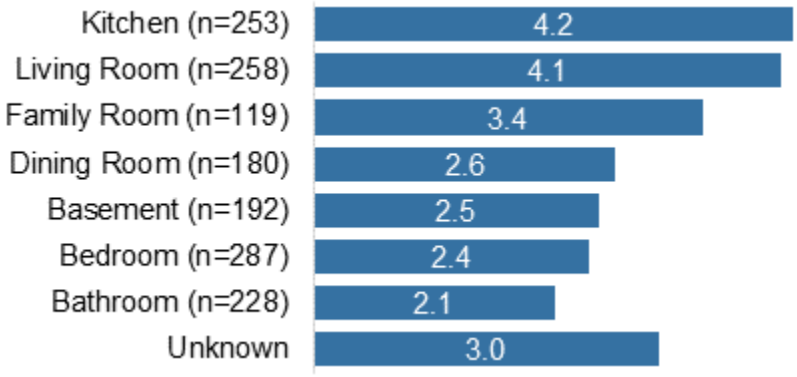
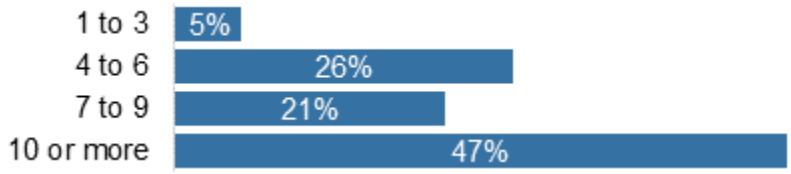


Figure 16: Hours per Day LEDs in Use by Room Type



On average, respondents took 10.4 showers per week. The average duration of each shower was 15 minutes. Figure 16 and Figure 17 display the distribution of shower frequency and duration among respondents.

Figure 17: Showers per Week (n=19)*



*Does not sum to 100% due to rounding.

Figure 18: Minutes per Shower (n=16)

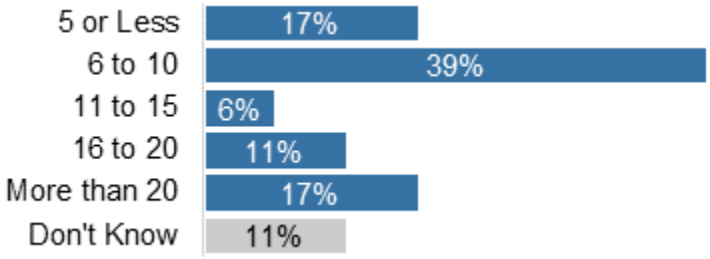
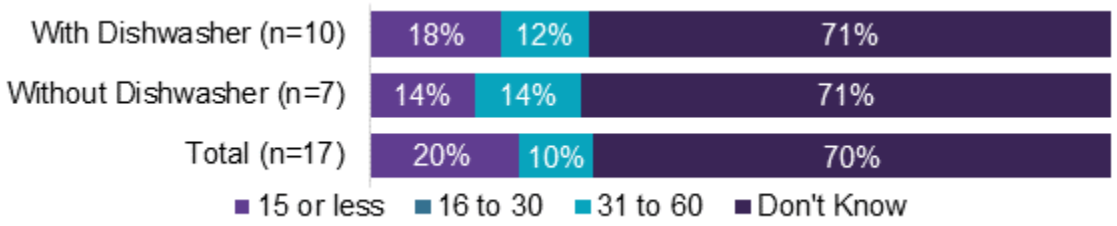


Figure 18 displays the minutes per day respondents with and without dishwashers used their kitchen aerators. One-fifth (20%) of respondents used their aerators for 15 minutes per day or less. On average, respondents used their aerators for 26 minutes per day.

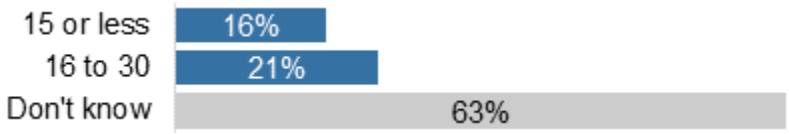
Figure 19: Minutes per Day Kitchen Aerator in Use*



*Does not sum to 100% due to rounding.

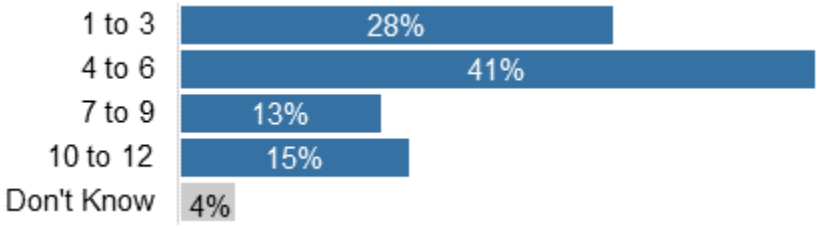
Figure 19 displays the minutes per day respondents used their bathroom aerators. On average, respondents used their aerators for 19 minutes per day.

Figure 20: Minutes per Day Bathroom Aerator in Use (n=19)



On average, respondents used their dehumidifiers for 5.6 months of the year, 5.8 days per week, and 14.9 hours per day. Figure 20, Figure 21, and Figure 22 display the distribution of months per year, days per week, and hours per day respondents used their dehumidifiers.

Figure 21: Months per Year Dehumidifier in Use (n=54)*



*Does not sum to 100% due to rounding.

Figure 22: Days per Week Dehumidifier in Use (n=54)

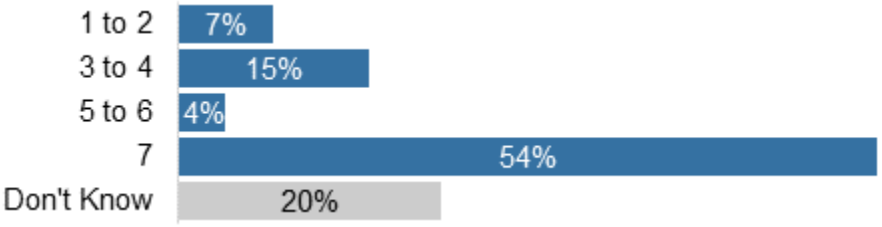
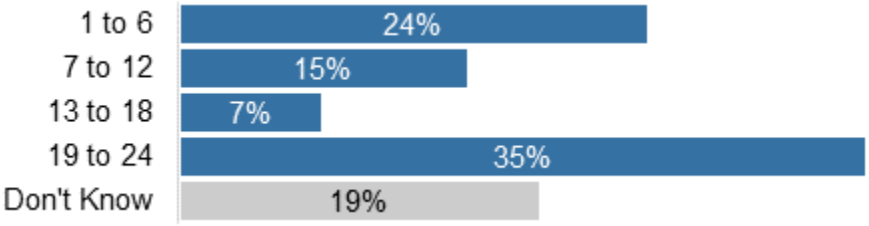
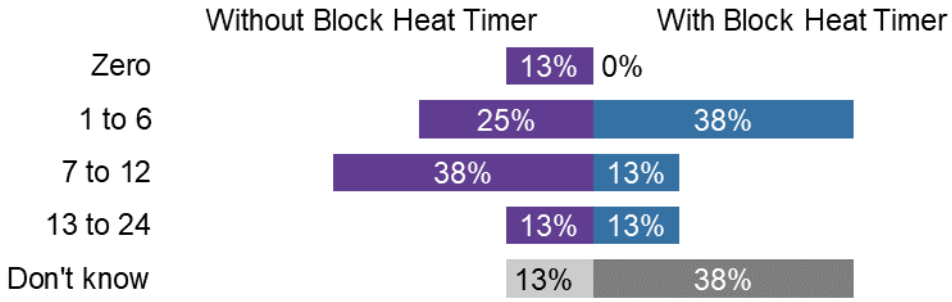


Figure 23: Hours per Day Dehumidifier in Use (n=54)



Before receiving the block heater timers provided by the program, respondents used their block heaters for 8.7 hours per day on average. After installing the block heat timers, respondents used their block heaters for an average of 7.8 hours per day. Figure 23 displays the distribution of hours per day that respondents used their block heaters before and after receiving the block heat timers.

Figure 24: Hours per Day Block Heater in Use (n=8)*



*Does not sum to 100% due to rounding.

B.4 Detailed Net-to-Gross Results

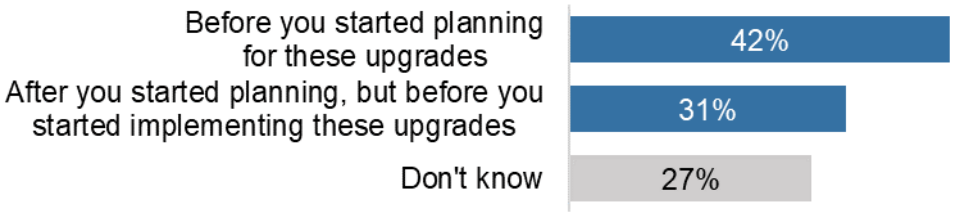
This section includes detailed FR and SO results associated with the NTG for the EAP Tier 2 participants. Higher-level results were provided in Section 3.3.

B.4.1 Free-ridership

The NMR team assessed the extent of FR within the program by surveying EAP Tier 2 participants to understand their experiences and plans before learning about the program, what they would have done in the program's absence, and how influential the program was on their decision to implement the energy-efficient upgrades.

Around two-fifths (42%) of Tier 2 respondents stated that they first learned about EAP before they started planning for the upgrades (Figure 24). Around one-third (31%) learned about EAP after they started planning, but before they started implementing the upgrades. While responses to this question did not directly impact the FR score, they provided additional context for understanding the point during the process when participants became aware of the program.

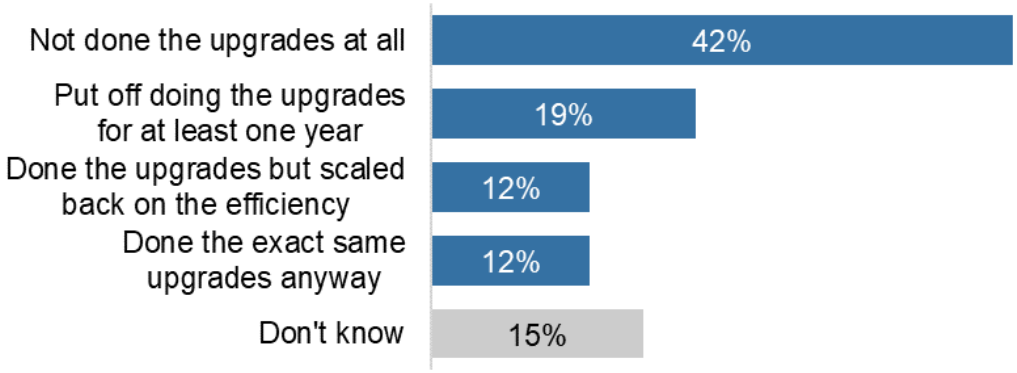
Figure 25: When Participants First Learned About the Program (n=26)



Respondents provided feedback about what they would have done in the program's absence (Figure 25). Forty-two percent (11 respondents) would not have done the upgrades at all, 19% (five respondents) would have put off the upgrades for at least a year, and 12% (three respondents) would have done the upgrades but scaled back on the efficiency. Of the three who would have scaled back on efficiency, one said by "a small amount," one said by "a moderate amount," and one did not know by how much they would have reduced the efficiency. Twelve percent (three respondents) said they would have done the exact same upgrades anyway.

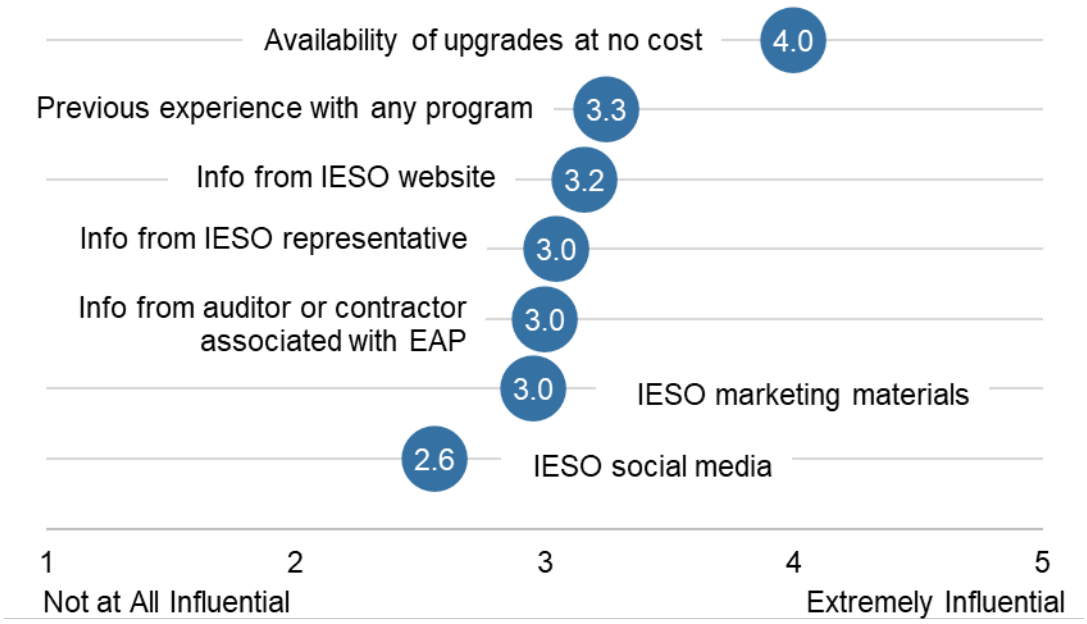
However, two of those three said they "might have" had the funds, and one said they "definitely would not have" had the funds to cover the costs of the upgrades. Fifteen percent of respondents did not know what they would have done in the absence of the program (4 respondents). Responses from this participant intent question were factored into the FR analysis.

Figure 26: Actions in Absence of Program (n=26)



Respondents rated how influential various program features were on their decision to do the upgrades (Figure 26). They rated each feature's influence on a scale from 1 to 5, where 1 meant it was "not at all influential" and 5 meant it was "extremely influential". The highest-rated response was the availability of the upgrades at no cost, with an average rating of 4.0. The least influential feature was IESO social media, with an average rating of 2.6. The NMR team used this question, which focuses on the program's influence, along with the prior questions about customer intentions, to estimate the FR score.

Figure 27: Influence of Program Features on Participation (n=26)



B.4.2 Spillover

To estimate SO, Tier 2 participants provided feedback about whether they had installed any energy-efficient equipment for which they did not receive an incentive following their participation in EAP. Around one-third (35%) reported installing new equipment. Table 23 displays the types of non-incentivized equipment participants installed after participating in EAP. Some survey respondents installed multiple types of equipment. Respondents rated the level of influence their participation in EAP had on their decision to install additional energy-efficient equipment. Participants rated the program's influence on a scale from one 1 to 5, where 1 meant the program had "no influence at all" and 5 meant the program had "great influence". As indicated in Table 23, the average influence score for most equipment types was at or above a 3-rating, which suggests the program was influential on respondents' additional equipment installations.

Table 26: Program Influence on Efficient Equipment Installed Outside the Program (n=9, Multiple Response)*

Type of Equipment Installed	Count of Respondents	Average Influence Score
ENERGY STAR appliance	2	3.0
ENERGY STAR LED	5	3.0
Lighting controls (lighting timers, occupancy sensors)	3	3.3
Weatherstripping around doors and windows	4	3.5
Smart power bar	3	2.7
Low-flow showerhead	3	3.7
Faucet aerator	2	3.5

*Does not sum to 9 due to multiple response.

The survey then asked participants who indicated they installed the program-influenced non-incentivized equipment a series of follow-up questions (i.e., capacity, efficiency, quantity, and annual hours of operation). Table 24 presents additional detail regarding the participant SO results collected as part of the participant survey. These details are used within the NTG algorithm to attribute SO savings to each equipment installation. SO savings were primarily driven by the installation of six new appliances and 23 ENERGY STAR LEDs.

Table 27: Detailed SO Results (n=9; Multiple Response)

Type of Equipment Installed	Count of Respondents with Spillover Projects	Number Installed
ENERGY STAR Refrigerator	2	3
ENERGY STAR Dishwasher	1	1
ENERGY STAR Clothes washer	1	1
ENERGY STAR Clothes dryer	1	1
ENERGY STAR LED (10 Watts or less)	2	19
ENERGY STAR LED (21 - 30 Watts)	1	4
Lighting timers	2	2
Smart power bar	2	2

Type of Equipment Installed	Count of Respondents with Spillover Projects	Number Installed
Low-flow showerhead	3	4
Faucet aerator	2	2

*Does not sum to 9 due to multiple response.

Appendix C Additional Process Evaluation Results

This section provides additional Process evaluation results. Higher level results were provided in the Process Evaluation section.

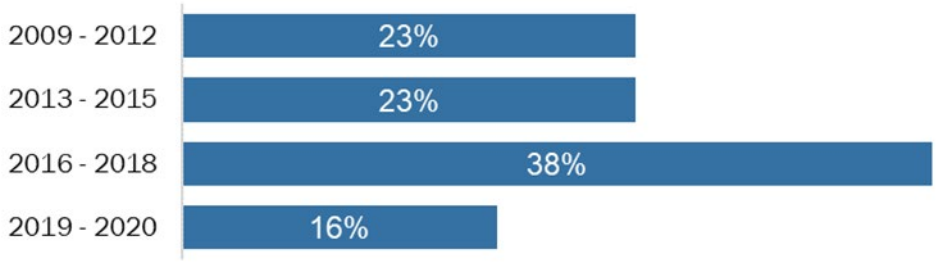
C.1 Additional Auditor and Contractor Results

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

C.1.1 Program Experience

Figure 27 displays the year respondents began working with the either the Energy Affordability Program or the Home Assistance Program (HAP), the predecessor to EAP. Less than one-half (46%) of respondents had been working with the program since 2015 or earlier.

Figure 28: Year Began Working with EAP or HAP (n=31)*



*Does not sum to 100% due to rounding.

Figure 28 displays the number of projects respondents reported completing in PY2021 through both HAP and EAP. Most (29 of 31) worked on single-family homes, while just under one-half (14 of 31) worked on multifamily homes. Over one-half (56%) who worked on single-family homes completed between 100 and 500 single-family projects. Most who worked on multifamily homes (70%) completed less than 100 multifamily projects. On average, auditors completed 418 projects, contractors completed 1,226 projects, and respondents who served as both completed 155 projects.

Figure 29: Number of HAP and EAP Projects

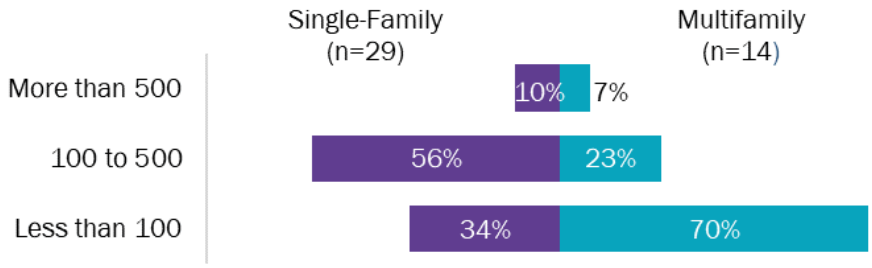
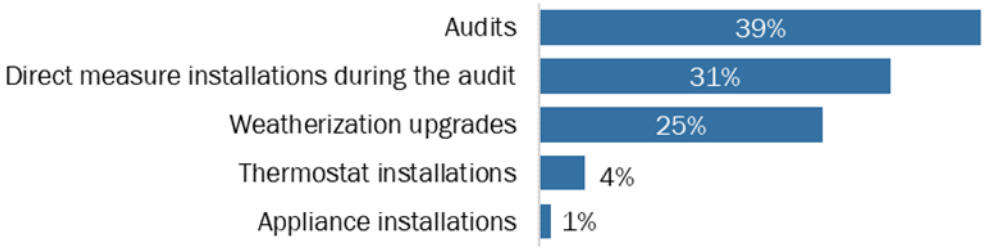


Figure 29 displays the type of work respondents performed for the program in PY2021. Most respondents (39%) conducted audits, under one-third (31%) performed direct measure installations during the audit, and one-fourth (25%) performed weatherization upgrades. Very few respondents (4%) installed thermostats. Even fewer respondents installed appliances (1%).

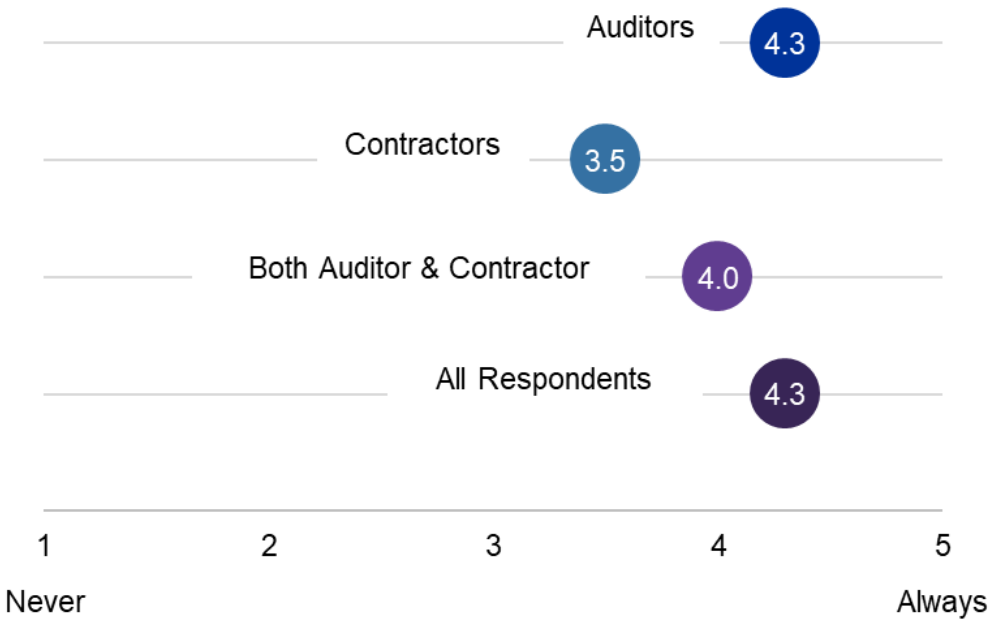
Figure 30: Type of Work Performed for EAP (n=31, Multiple Response)*



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

Using a scale from 1 to 5, where 1 meant “never” and 5 meant “always,” respondents indicated how often they inform customers about the program. Figure 30 displays the average rating among respondents by their role. The average rating among all respondents was quite high at 4.3. Auditors indicated that they inform customers about the program a little more often than contractors (4.3 compared to 3.5). Respondents who do not inform customers about the availability of the program said that they are not instructed or trained to do so, with one respondent noting that they encourage participating customers to reach out to their gas providers about qualifying programs.

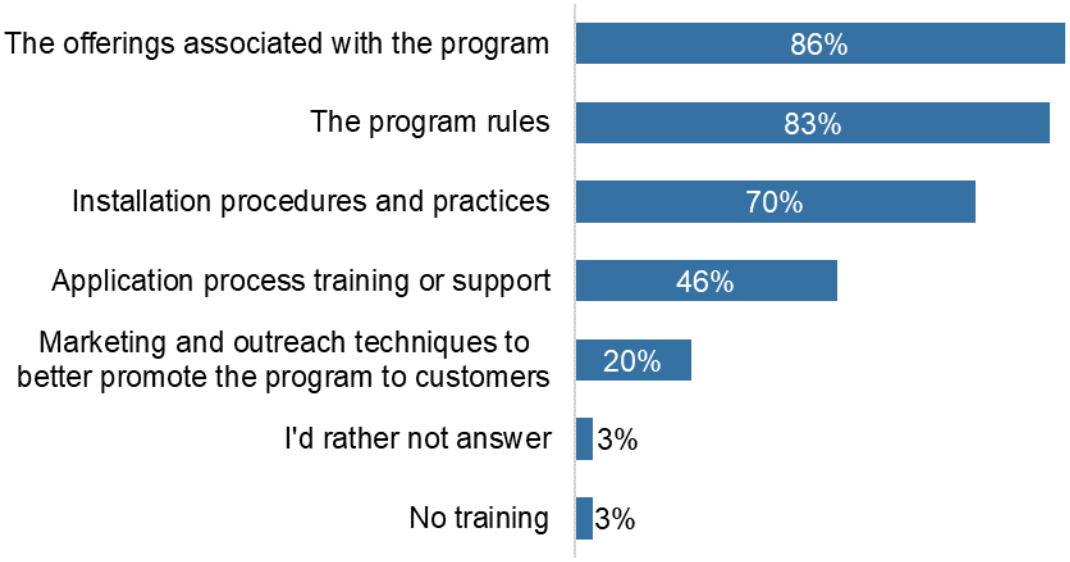
Figure 31: How Often Respondents Inform Customers about EAP (n=28)*



*Three respondents are excluded from this figure due to reporting the question was not applicable to them.

Figure 31 displays the types of training respondents received from the program delivery vendor. Most respondents received training on the offering associated with the program (86%), the program rules (83%), and installation procedures and practices (70%). Less than one-half (46%) of respondents received training on the application process and one-fifth (20%) received training on marketing and outreach techniques.

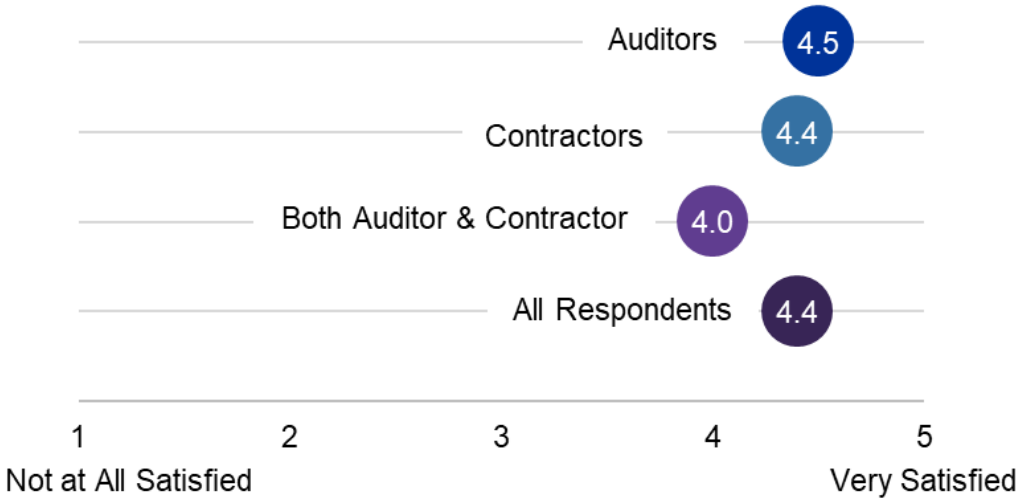
Figure 32: Type of Training from Program Delivery Vendor (n=31, Multiple Response)



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

As shown in Figure 32, respondents were very satisfied with the training they received from the program delivery vendor. On a scale from 1 to 5, where 1 meant "not at all satisfied" and 5 meant "very satisfied," the average satisfaction rating among all respondents was 4.4.

Figure 33: Satisfaction with Training (n=29)*



*Two respondents are excluded from this figure due to reporting they did not receive training.

Over one-fourth of respondents (26%, or 8 of the 31) suggested additional training or support HAP could provide to auditors and contractors. As shown in Table 33, the most common recommendation (mentioned by three respondents) was to increase the funding for the program.

Additionally, two respondents requested additional training and information on the program, such as overall objectives, plans, and targets. Respondents also requested increased marketing and audit training, more clarity on the rules for replacing appliances, informational materials on the industry, and better communication of the expectations.

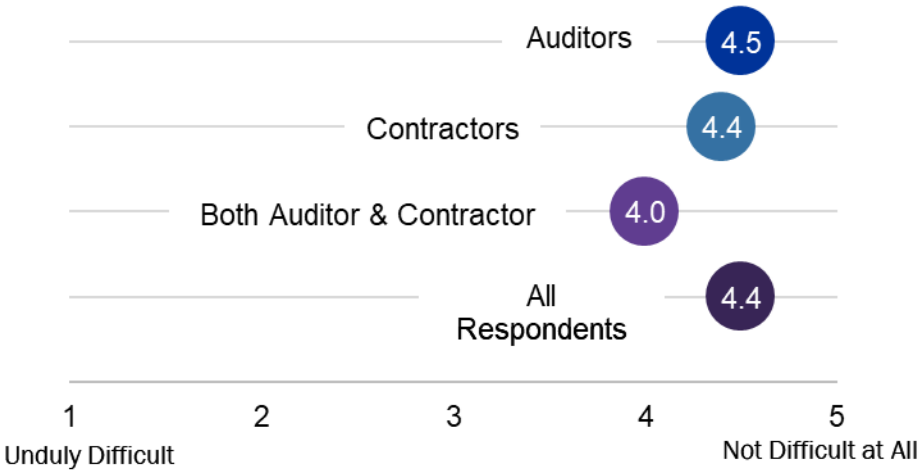
Table 34: Additional Training and Support (n=8)*

Recommendations	Respondents
Increased funding	3
Additional trainings and information	2
Increased marketing	1
Audit Training	1
Clarify rules for replacing appliances	1
Informational materials on the industry	1
Better communication of the expectations	1

*Does not sum to 8 due to multiple response.

Using a scale from 1 to 5, where 1 meant "unduly difficult" and 5 meant "not difficult at all," respondents indicated how difficult it was to perform the blower door test at customer sites. As shown in Figure 34, the average rating among all respondents was 4.4, indicating that it was not difficult. Additionally, only 6% of respondents thought that the blower door test discouraged auditors or contractors from working with EAP. One respondent noted that "blower doors are not necessary for every home" and two respondents believed the blower door test discourages more auditors or contractors from working with the program.

Figure 35: Difficulty of Performing Blower Door Test (n=19)*

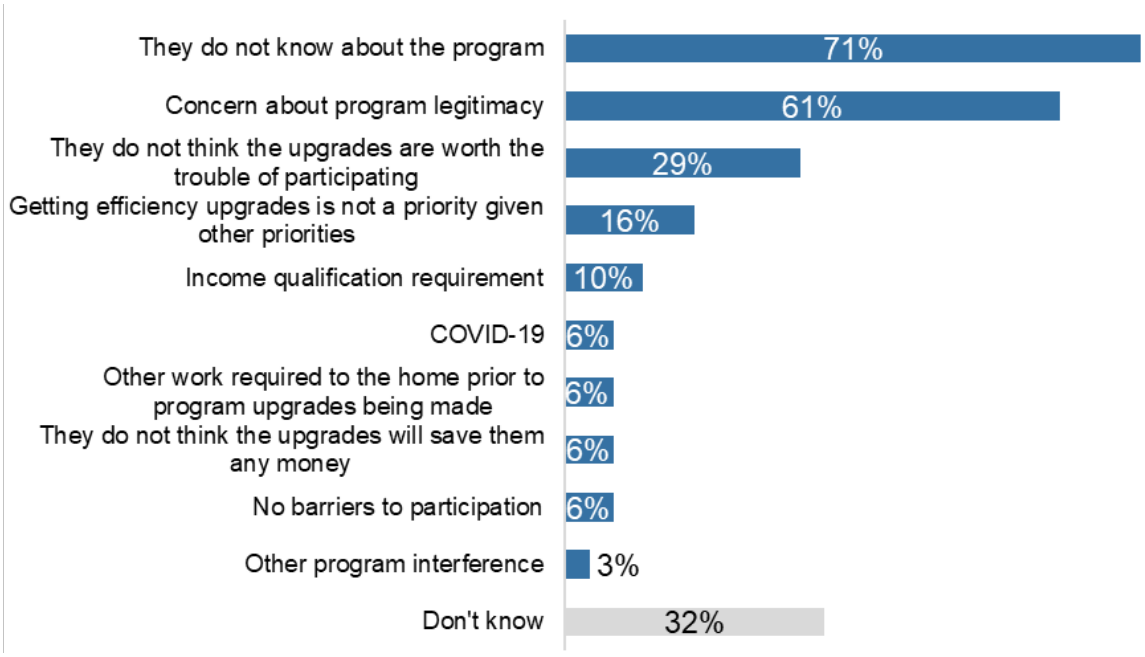


*Two respondents are excluded from this figure due to reporting they did not know how difficult the test was to perform. Ten respondents noted that they do not perform blower door tests.

C.1.2 Program Barriers

Figure 35 displays the barriers respondents thought prevented households from participating in EAP. The most commonly identified barriers were low program awareness among customers (71%). Section 5.2.2 includes more discussion around barriers.

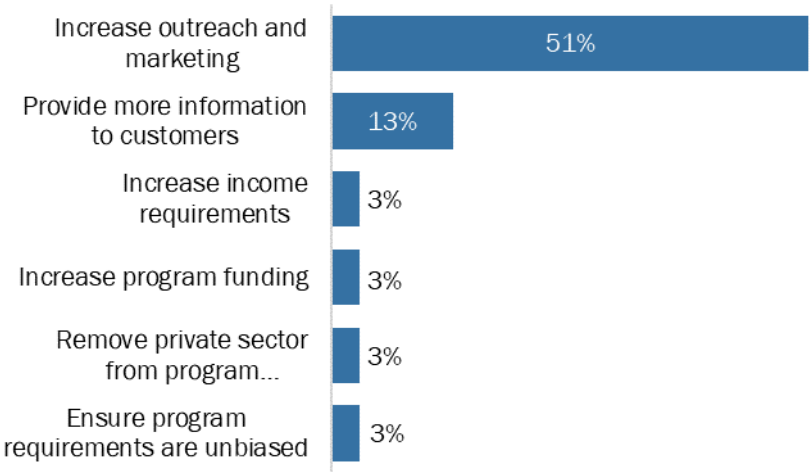
Figure 36: Barriers to EAP Participation (n=31, Multiple Response)*



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

Figure 36 displays respondents' recommendations for overcoming barriers to EAP participation, the most common of which was to increase marketing (suggested by 51% of respondents). Section 5.2.2 includes more discussion around recommendations to address barriers.

Figure 37: Recommendations for Overcoming Barriers to Program Participation (n=31, Multiple Response)*



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

C.1.3 Measure Eligibility Criteria

Table 25 displays respondent perspectives on how the program's measure eligibility criteria affected the frequency with which program measures were installed. Section 5.2.3 includes more discussion around measures affected by the eligibility criteria.

Table 28: Measures Affected by Measure Eligibility Criteria (n=11; Multiple Response)

Measures	Increased Installation Frequency (n=3)	Decreased Installation Frequency (n=8)
Air conditioners	-	1
Aerators and showerheads	-	1
Appliances	2	3
Insulation	-	3
Lighting	-	2
All measures	1	-

*Does not sum to 11 due to multiple response.

As shown in Table 26, Over two-fifths of respondents (13 out of 31) suggested adjustments to measure eligibility criteria for the Energy Affordability Program to consider in future years with the most commonly suggested request being to relax the requirement for cooling equipment (three respondents) by allowing equipment with lower EER ratings to qualify. Section 5.2.3 includes more discussion around recommended measures eligibility criteria adjustments.

Table 29: Recommended Adjustments to Measure Eligibility Criteria (n=13; Multiple Response)*

Recommendations	Respondents
Relax requirement for cooling equipment	3
Review appliance age requirements	1
Add more appliance types and models	1
Allow more fuel sources (e.g., oil, propane, wood)	1
Include thermal barriers for spray foam insulation	1
Offer a wider variety of smart power fridges and freezers	1
Proper sized appliances	1
Remove metering requirements for fridges and freezers	1
Remove showerhead offering	1
Consider heat pumps	1
Consider induction stoves	1
Stricter eligibility in general	1

*Does not sum to 13 due to multiple response.

C.1.4 Measure-Related Cost Caps

Table 27 displays respondents' recommendations for changes to the measure-related cost caps in case cost increases due to the COVID-19 pandemic continue. Most of the respondents providing feedback recommended adjustments to the cost caps for insulation. Section 5.2.4 includes more discussion around recommendations for measure-related cost caps.

Table 30: Recommendations for Measure-Related Cost Caps (n=10; Multiple Response)*

Recommendations	Respondents
Adjust insulation cost caps to account for increased costs	7
Take into account fuel travel costs	3
Appliance cost cap review	1
Increase cost caps in general	1
Lower cost caps generally	1
Review air sealing cost caps to ensure they cover blower door tests and thermal cameras	1
Review cost caps every six months	1

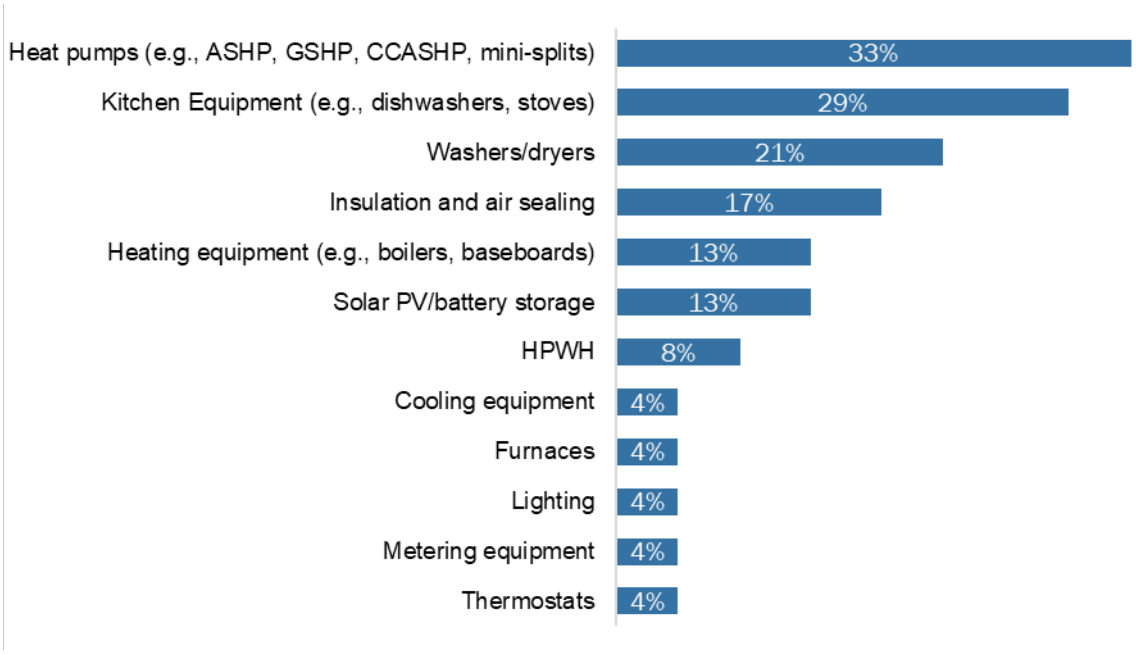
*Does not sum to 10 due to multiple response.

C.1.5 Recommendations for Program Improvement

Figure 37 displays respondents' recommendations for energy-efficient equipment or services that they would like to see included in the program. The most frequently recommended equipment

type was heat pumps (33%). Section 5.3.5 includes more discussion around recommendations for equipment and services.

Figure 38: Recommendations for Additional Equipment or Services (n=24, Multiple Response)*



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

Table 28 displays respondents' recommendations for improving the program, with over one-half (55%) providing recommendations. Outreach and marketing was recommendation most frequently (6 respondents). Section 5.3.5 includes more discussion around recommendations for the program.

Table 31: Recommendations for Improving Program (n=17, Multiple Response)*

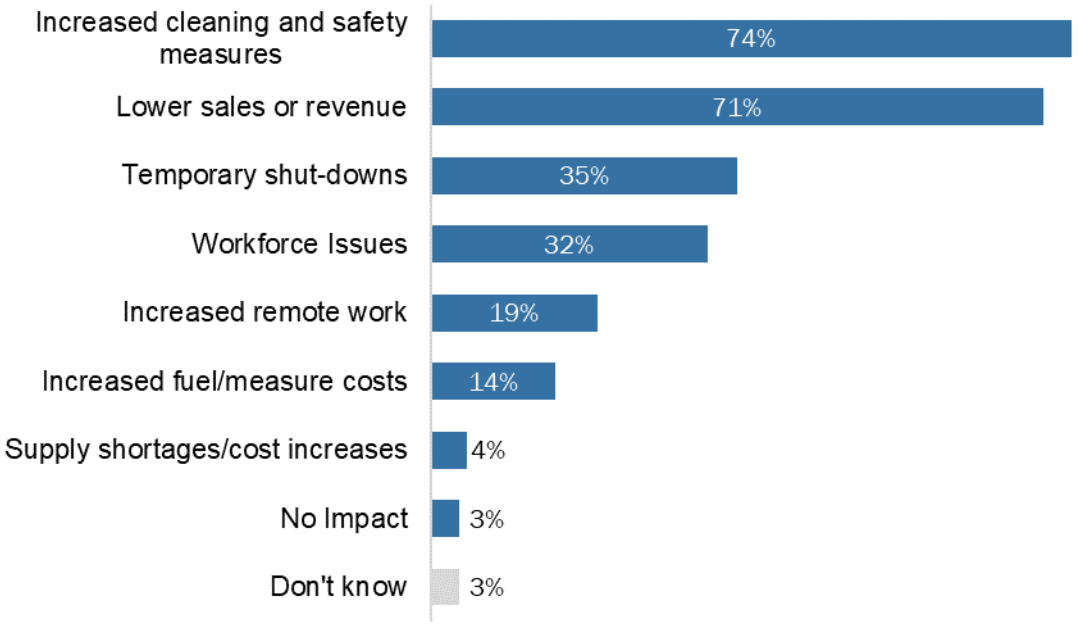
Recommendations	Respondents
Outreach and marketing	6
Increase funding for auditors and contractors	2
Avoid switching service providers	2
Better training	1
Improve program software	1
Include more qualification questions in the screening process	1
Remove blower door service	1
Change metrics for energy saving	1
Cap the number of audits per day	1
Better prepare clients for site visits	1

*Does not sum to 17 due to multiple response.

C.1.6 COVID-19 Impacts

Figure 38 displays the impacts the COVID-19 pandemic had on auditors' and contractors' businesses. Around three-fourths (74%) of respondents increased their cleaning and safety measures, while over two-thirds of respondents (71%) experienced a slowdown in demand causing lower sales and revenue. Over one-third of respondents each experienced temporary shutdowns (35%) or workforce issues (32%). Nearly one-fifth (19%) of respondents experienced an increase in remote work, while less than one-sixth (14%) of respondents dealt with an increase in fuel and/or measure costs.

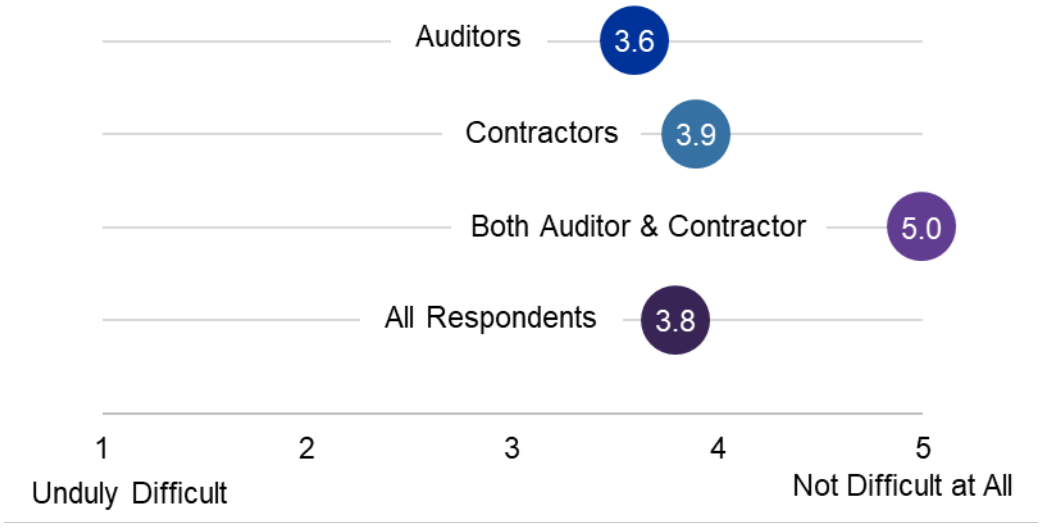
Figure 39: Impacts of COVID-19 on Business (n=31, Multiple Response)*



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

Using a scale from 1 to 5, where 1 meant "unduly difficult" and 5 meant "not difficult at all," respondents indicated how difficult it was to adhere to health and safety standards relevant to the COVID-19 pandemic. As shown in Figure 39, the average rating among all respondents was 3.8, indicating that it was not very difficult. Nine respondents suggested ways to make it easier for them to comply with relevant health and safety standards, with three suggesting enforcements of local requirements, two suggesting dropping all health and safety standards associated with COVID-19 crisis, one suggesting keeping the mask requirement, and one suggesting additional trainings and rewards for following protocols.

Figure 40: Difficulty of Adhering to Health and Safety Standards (n=31)



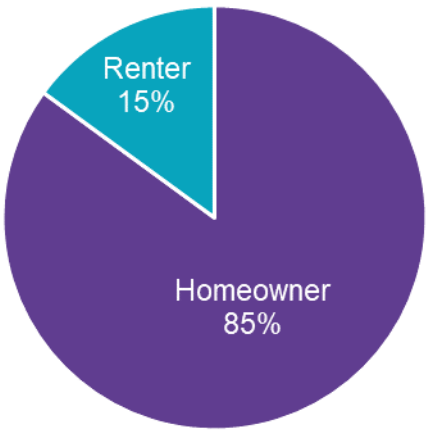
C.2 Additional Participant Results

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

C.2.1 Participant Profile

As shown in Figure 40, most respondents (85%) are homeowners, while 15% are renters.

Figure 41: Relationship to Home (n=595)



Respondents' homes are predominantly primary residences (98%) that are occupied year-round (94%). Figure 41 and Figure 42 display characteristics of respondents' homes, including the type of dwelling and the year it was built. Over two-thirds (71%) of respondents' homes are single-family houses. Around one-half of respondents' homes (46%) were built prior to 1970.

Figure 42: Type of Home (n=595)

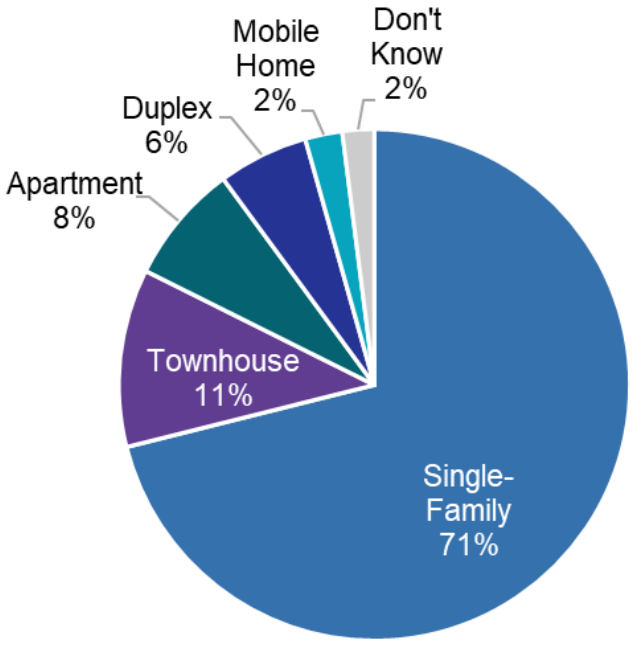
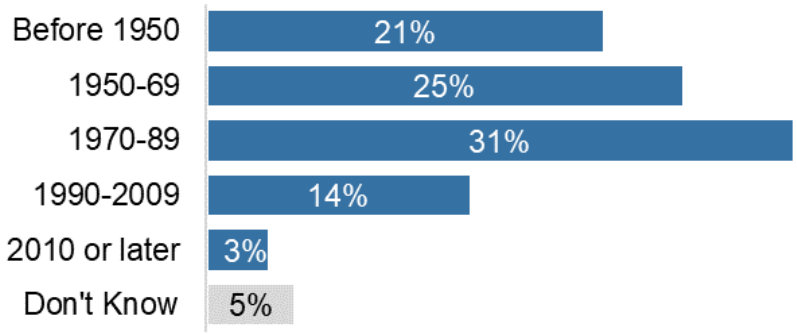


Figure 43: Year Home Built (n=595)*



*Does not sum to 100% due to rounding.

Figure 43 displays the number of occupants in the respondents' households. Over two-fifths (43%) of respondents live alone. The average household size among respondents was 1.9.

Figure 44: Number of Occupants (n=595)

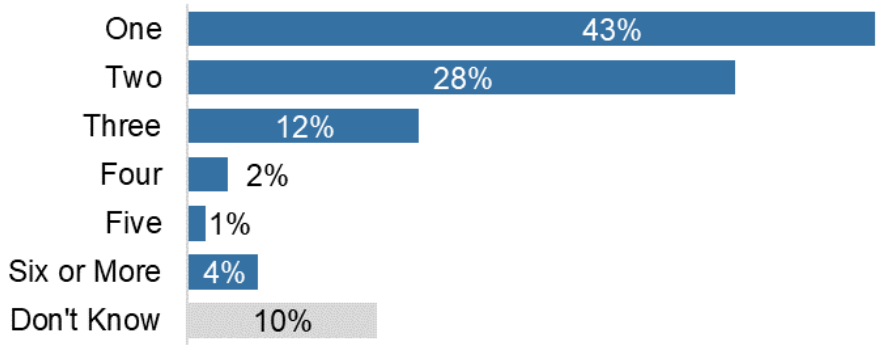
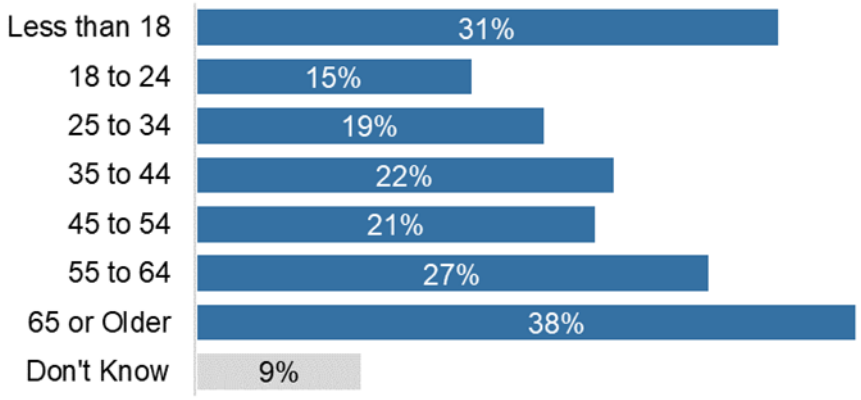


Figure 44 displays the percent of households with occupants of each age group. Children under the age of 18 reside in more than one-fourth (31%) of households and seniors aged 65 or older reside in approximately two-fifths of households (38%).

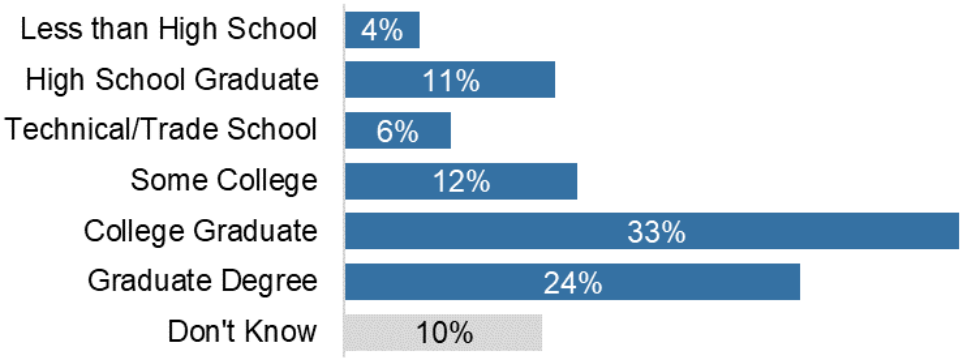
Figure 45: Households with Occupants of Each Age Group (n=595; Multiple Response)*



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

Figure 45 displays respondents' highest education level. Over one-half (57%) of respondents have a college degree or higher.

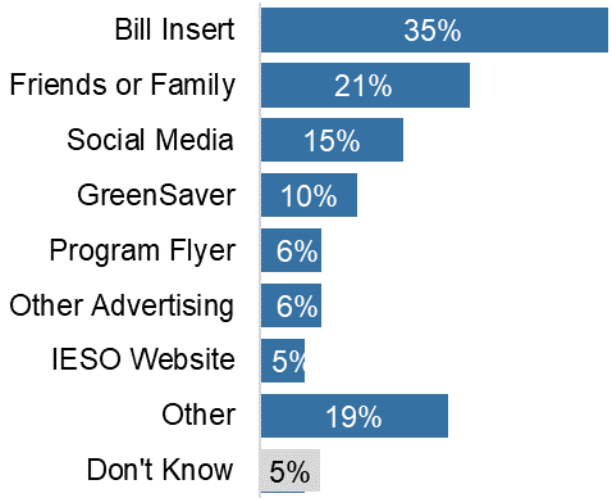
Figure 46: Highest Education Level (n=595)



C.2.2 Program Awareness and Motivation

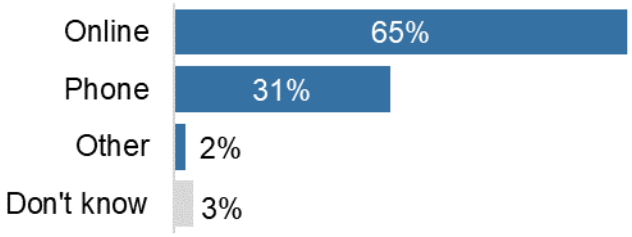
Figure 46 and Figure 47 show how respondents heard about and applied to the program. Most respondents heard about the program through bill inserts (35%) and nearly two-thirds (65%) of respondents applied for the program online. Section 5.3.2 includes more discussion around how participants heard about and applied to the program.

Figure 47: How Participants Heard about Program (n=595; Multiple Response)*



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

Figure 48: How Participants Applied for Program (n=595)*

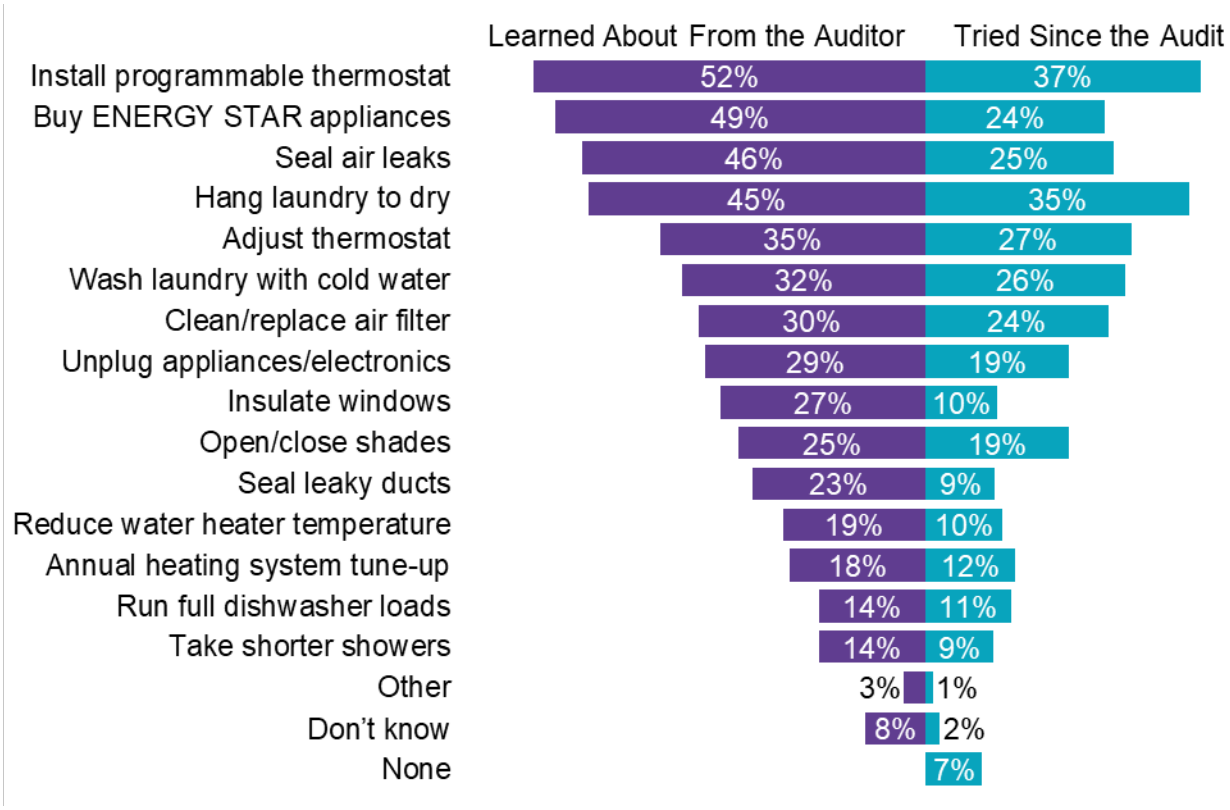


*Does not sum to 100% due to rounding.

C.2.3 Program Education and Behavior Change

Figure 48 displays the additional energy-saving methods Tier 1 respondents said their auditor suggested. The most frequently suggested method was to install a programmable thermostat: over one-half (52%) of respondents said their auditor suggested this. Section 5.3.3 includes more discussion around the additional ways to save energy that were recommended and tried.

Figure 49: Additional Ways to Save Energy (n=336)*

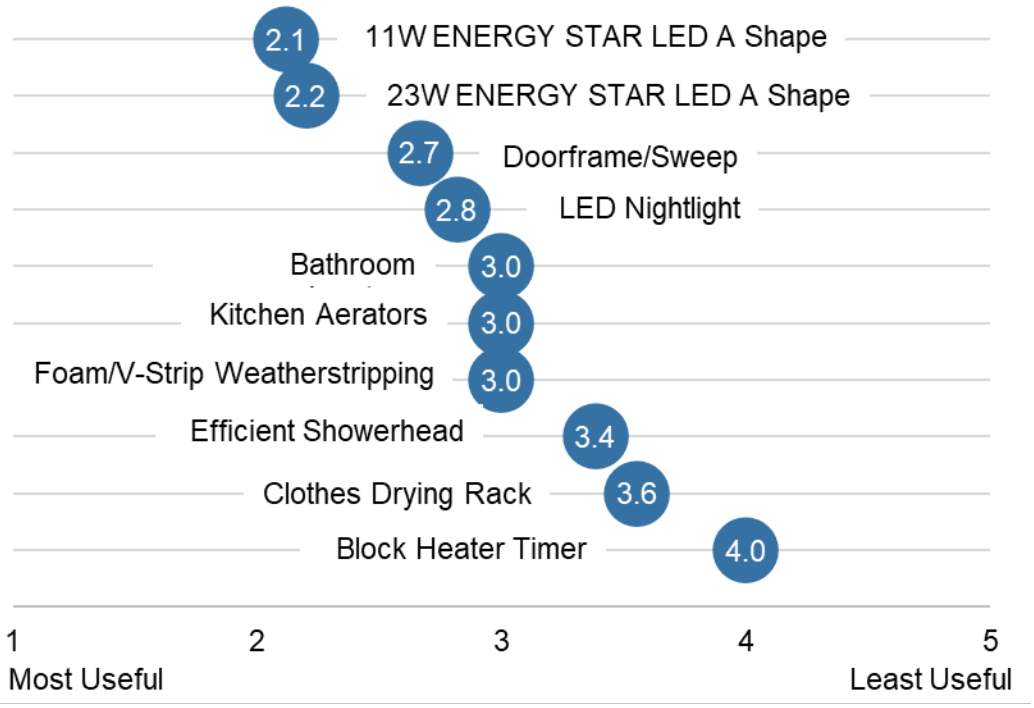


*Does not sum to 100% due to multiple response.

C.2.4 Program Satisfaction

Figure 49 displays the average usefulness ratings for the various items in the Energy Saving Kits as reported by Tier 2 participants. Respondents provided their ratings on a scale from 1 to 5, where 1 meant "most useful" and 5 meant "least useful". Tier 2 respondents found the LED bulbs to be the most useful, with average ratings of 2.1 for 11W LEDs and 2.2 for 23W LEDs. Section 5.3.4 includes more discussion around the usefulness of the Energy Saving Kits.

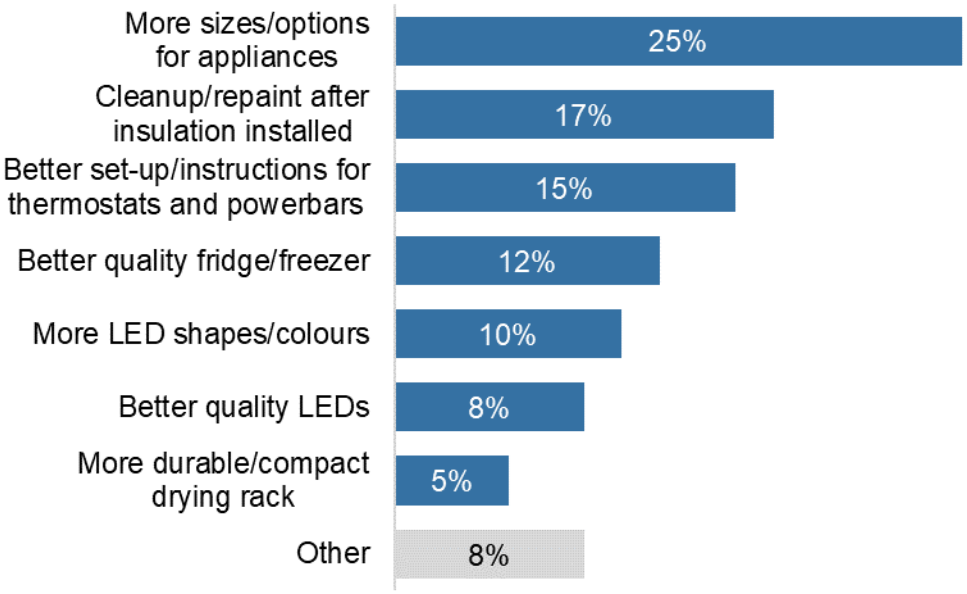
Figure 50: Usefulness of Products in Energy Saving Kit (n=26)



C.2.5 Recommendations for Program Improvement

Figure 50 provides a list of suggestions offering by 10% of responding participant (60 out of 595) for improving the quality of the products and upgrades participants received through the program. Section 5.3.5 includes more discussion around these suggestions.

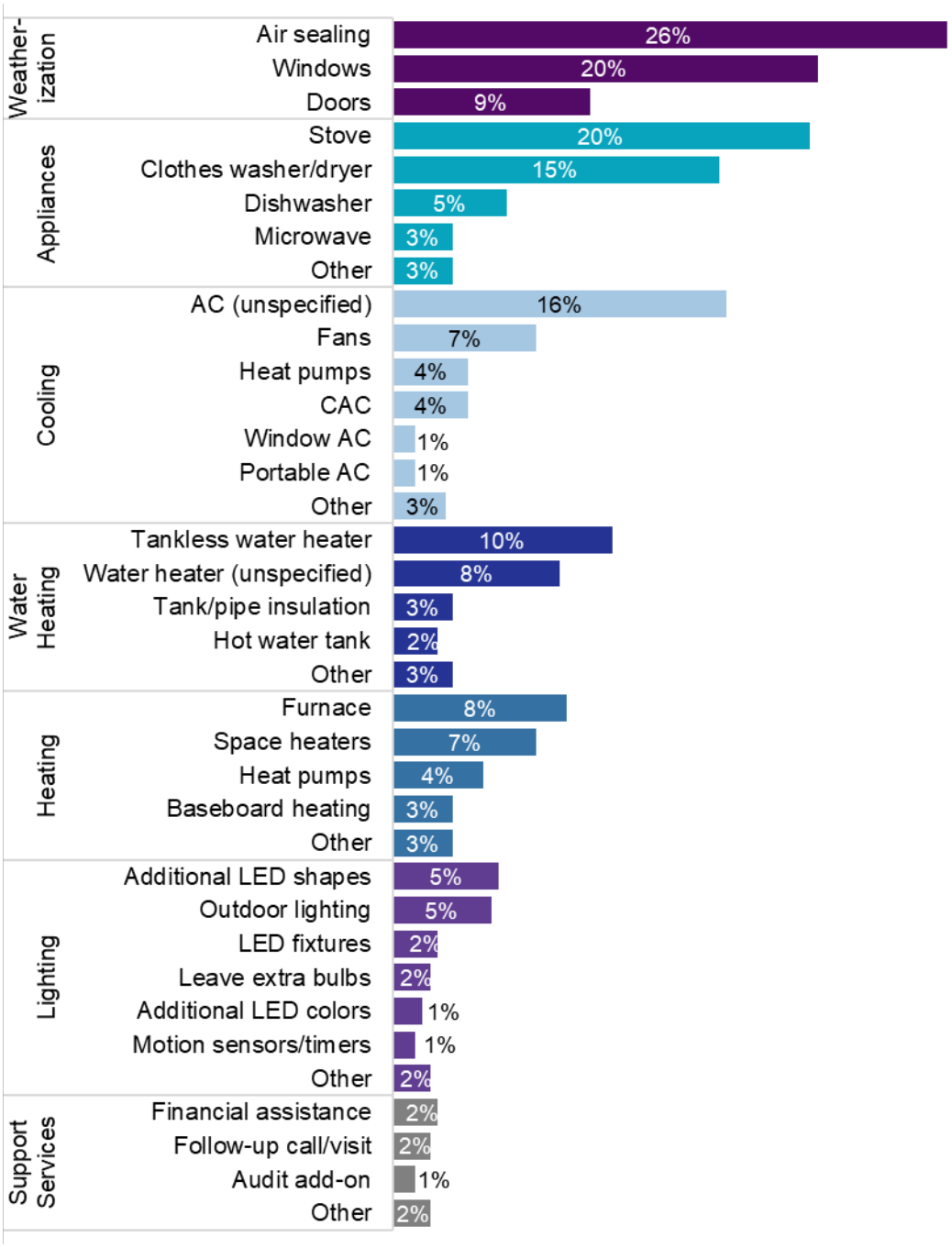
Figure 51: Suggestions for Improving Quality of Products and Upgrades (n=60, Multiple Response)*



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

Figure 51 provides a list of recommendations offered by close to one-half (47%) of responding participants for additional energy-efficiency equipment or services for inclusion in the program. Section 5.3.5 includes more discussion around these suggestions.

Figure 52: Additional Equipment or Services (n=280; Multiple Response)*

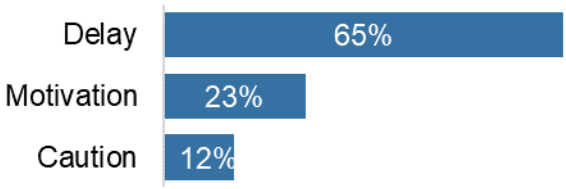


*Does not sum to 100% due to multiple response.

C.2.6 COVID-19 Impacts

Twelve percent of respondents (69 of 595) indicated that the COVID-19 pandemic had impacted their ability to participate in EAP (Figure 52 SEQ Figure * ARABIC). The most mentioned impact (65%) was experiencing delays and needing to reschedule appointments. In addition, nearly one-fourth (23%) said the pandemic caused them financial hardship which, in turn, served as motivation to participate to save on energy bills. Some of these respondents said they lost their jobs and thus became eligible to participate and/or able to have auditors come because they were at home. Around one in ten (12%) of the 69 respondents said the pandemic led them to be more cautious about letting auditors into their homes.

Figure 53: Impact of COVID-19 on Ability to Participate in EAP (n=69)



Appendix D Additional Non-Energy Benefits Results

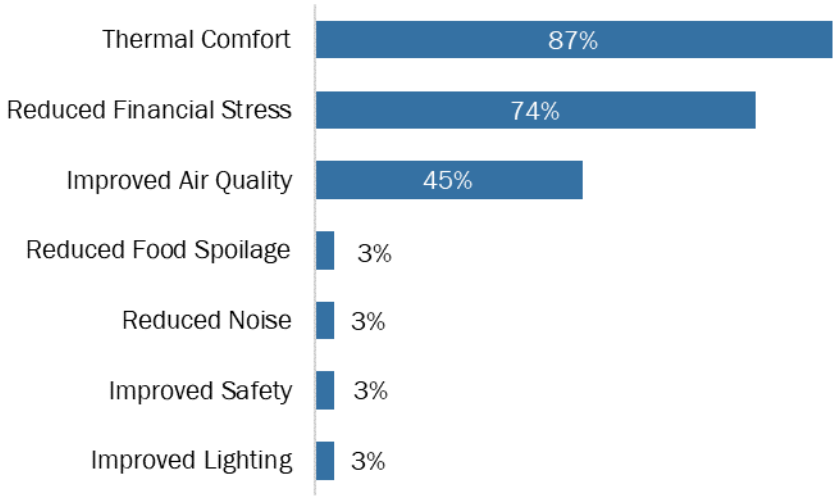
This section provides additional NEBs results. Higher level results were provided in Section 6.2.

D.1 Auditor and Contractor Non-Energy-Benefits Results

Approximately nine-tenths (87%) of auditors and contractors reported that participants experienced NEBs from improved thermal comfort, nearly three-fourths (74%) experienced NEBs from reduced financial stress and just under one-half experienced NEBs from improved air quality (45%) as a result of their participation in EAP (Figure 53). One contractor mentioned that "in some cases people are now able to complete a bedroom in the basement or are now able to use the space as productive space." Auditors and contractors also reported that participants experienced NEBs related with reduced food spoilage, reduced noise, improved safety, improved comfort, and improved lighting.

When asked to rank the importance of various NEBs to their customers, a majority (61%) of contractors ranked reduced financial stress as the most important NEB, followed by thermal comfort (48%).

Figure 54: Auditors and Contractors Observation of NEBs (n=31)*



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

Appendix E Additional Jobs Impact Results

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

E.1 Input Values

The model was used to estimate the impacts of two economic shocks – one representing the demand for energy-efficient products and services from EAP and the other from the increased household expenditures due to bill savings (and net of program funding). Table 30 shows the input values for the demand shock representing the products and services related to EAP. Each measure installed as part of EAP was categorized according to the StatCan IO Supply and Use Product Classifications (SUPCs).

The first six rows of the table contain the categories corresponding to products, which were the measures installed in homes. The last two rows contain the services. Of the six product measures, Electric light bulbs and tubes had the highest total cost at just over $1.4 million and Major appliances was second highest at just under $1.4 million. Each measure's cost was divided into labor and non-labor. Electric light bulbs and tubes and Other miscellaneous manufactured products did not have any assumed labor costs for measure installation. The Non-metallic mineral products category was mainly insulation, for which labor represented 70 percent of the total cost. Small electric appliances included thermostats, which had installation costs around 50% of the total. The installation cost for the Major appliances category was roughly 11%.

For the two service categories in Table 30, Office administrative services included general overhead and administrative services associated with program delivery, such as program management and staffing, call center operations, and IESO admin labor. The Other professional, scientific and technical services included the audits. The total demand shock represents the sum of the audit fees. The labor and non-labor amounts are not specified for these services, as the IO Model has assumptions incorporated for the relative proportions of each for these categories.

Table 32: Summary of Input Values for Demand Shock

Category Description	Non-Labor ($ Thousands)	Labor ($ Thousands)	Total Demand Shock ($ Thousands)
Electric light bulbs and tubes	1,418	0	1,418
Major appliances	1,236	157	1,393
Non-metallic mineral products, n.e.c.	4	8	12
Other miscellaneous manufactured products	315	0	315
Small electric appliances	234	234	468
Switchgear, switchboards, relays and industrial control apparatus	281	193	474
Other professional, scientific and technical services	-	-	1,452
Office administrative services	-	-	1,403
Total			**6,936**

Table 31 shows the calculations and input value for the household expenditure shock.[29] This shock represents the net additional amount that households would inject back into the economy through spending. The model does not distinguish between participants and non-participants in the residential sector, so the net amount of additional money households (as a whole) would have available is the difference between the bill savings (Net Present Value (NPV) = $10.1 million) and the portion of all energy-efficiency programs funded by the residential sector (35%, or $2.4 million). The difference is $7.7 million and represents the additional money that households could either spend on goods and services or save, pay off debt, or otherwise not inject back into the economy. The surveys administered to participants as part of the EAP process evaluation included several questions about what households would do with the money that they saved on their electricity bills. From the survey responses, we estimated that 36% of household bill savings would be spent. Thus, the household expenditure shock would be $2.74 million.

Table 33: Summary of Input Values for Household Expenditure Shock

Description	Demand Shock *($ Thousands)*
NPV of energy bill savings	10,086
Residential portion of program funding	(2,428)
Percent spent on consumption (vs. saved)	36%
Total Shock	**2,743**

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

E.2 MODEL RESULTS

The StatCan IO Model generated results based on the input values detailed in Table 30. Table 32 shows the results of the model run for the demand shock for products and services. This shock represented the majority of the job impacts. As the two right columns show, the model estimated that the demand shock will result in the creation of 65 total jobs (measured in person-years) in Canada, of which 60 will be in Ontario. Of the 65 jobs, 26 were direct, 23 were indirect, and 16 were induced. In terms of FTEs, the numbers are slightly less, with 48 FTEs created in Ontario and 52 in total across the country. Of these 52 FTEs, 22 were direct, 19 indirect, and 11 induced. As the table shows, the direct job impacts were realized exclusively in Ontario. As we move to indirect and induced jobs, impacts are dispersed outside of the province.

Table 34: 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	22	22	26	26
Indirect	16	19	21	23
Induced	10	11	13	16
Total	**48**	**52**	**60**	**65**

Table 33 shows the results of the model run for the household expenditure shock. This shock is actually run off a normalized $1 million bundle of extra household spending, which can then be scaled by the actual household expenditure shock. The extra household spending of $2.7 million would yield 14 direct FTEs and 16 direct total jobs in Canada. Total jobs were 19 for direct and 22 in total for Canada.

Table 35: Job Impacts from Household Expenditure 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	8	8	11	11
Indirect	3	5	5	5
Induced	3	3	3	5
Total	**14**	**16**	**19**	**22**

The other factors included in the research questions were the impact of program funding on the non-residential sector and the impact from reduced electricity consumption. Assuming that businesses absorb the increases in electricity costs to fund the program, there would be no impact on jobs. There would be an impact on direct GDP (value-added), equivalent to the profit loss resulting from the increase in electricity bills from program funding. The StatCan IO Model has production functions that cannot be adjusted, so electricity price changes would be modeled by making the assumption that surplus would be reduced by the extra amount spent on electricity.

The economic impact of the reduction of electricity production as a result of the increase in energy efficiency must be examined closely. Technically speaking, it can be estimated using StatCan

Input-Output multipliers[30] without running the model. The multiplier is 4.9[31] (per $ million) and the NPV of decreased electricity bills (retail) was $10.1 million. Thus, the model would predict that the reduction in electricity production would cause a job loss of 50 person-years over the course of 20 years (the longest EUL in the portfolio of EAP measures). However, the IO model is linear, and not well suited to model small decreases in electricity production. Total electricity demand has been increasing over time and is projected to continue increasing.[32] EAP first year energy savings represented less than 0.01% of total demand in 2021. This relatively small decrease in overall consumption may work to slow the rate of consumption growth over time but would likely not result in actual job losses in the utility industry or upstream suppliers. The linearity of the IO model means that it will provide estimates regardless of the size of the impact. Given the nature of electricity production, it is reasonable to conclude that the linear IO multiplier is not appropriate for estimating job impacts. This analysis assumes that job losses from decreased electricity production are negligible.

Table 34 shows the total estimated job impacts by type – combining Table 32 and Table 33. The majority (79 out of the 87 estimated total jobs) were in Ontario. All the direct jobs created were created in Ontario. A slightly smaller share of the indirect and induced jobs was in Ontario, with 26 out of 28 indirect and 16 out of 21 induced total jobs within the province. The FTE estimates are slightly less, with a total of 62 FTEs (of all types) created in Ontario and 64 FTEs added throughout Canada. All direct FTEs were realized in Ontario, with this number representing 48% of the total FTEs added in Ontario and 44% of FTEs added in Canada.

Table 36: 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	30	30	37	37	5.3
Indirect	19	24	26	28	4.1
Induced	13	14	16	21	3.1
Total	**62**	**68**	**79**	**87**	**12.6**

Calculating relative performance as a function of jobs created per $1M of program budget is helpful in comparing the EAP program between years. This year, each $1M investment resulted in the creation of 12.6 jobs. Programs can increase in effectiveness—in terms of jobs created per $1M of budget—when the incentives catalyze spending by participants on EE measures. Given that the EAP incentives cover 100% of measure costs, the relative proportion of participant spending is removed as a driver of variability, and as such the number of jobs per $1M investment is expected to remain relatively consistent from year to year.

[30] Table 36-10-0595-01. The relevant industry is Electric power generation, transmission and distribution [BS221100].
[31] Statistics Canada. Table 36-10-0595-01 Input-output multipliers, provincial and territorial, detail level
DOI: https://doi.org/10.25318/3610059501-eng
[32] Annual Planning Outlook – A view of Ontario's electricity system needs; 2021. IESO.

Table 35 shows the job impacts in more detail, with jobs added by type and by industry category. Industries are sorted from top to bottom by those with most impacts to least, with industries that showed no impacts not included in the table. The table shows that the industry with the largest impacts was *Administrative and support, waste management and remediation services*, which added 31 jobs across Canada and 30 jobs in Ontario. This category is large and non-specific, and reflects the need to hire individuals to fill a large range of roles based on program need (e.g. office administration, call center operations, program management, etc.). *Retail trade* added a total of 12 jobs, the second most of any industry- all 12 realized jobs were created in Ontario.

Table 37: Job Impacts by Industry

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
Administrative and support, waste management and remediation services	25	25	30	31
Retail trade	8	9	12	12
Wholesale trade	5	6	5	6
Accommodation and food services	3	4	5	6
Finance, insurance, real estate, rental and leasing and holding companies	4	4	4	5
Professional, scientific and technical services	3	4	5	5
Manufacturing	3	4	3	4
Transportation and warehousing	2	3	2	3
Other services (except public administration)	2	2	3	3
Health care and social assistance	1	1	2	2
Arts, entertainment and recreation	1	1	1	1
Information and cultural industries	1	1	1	1
Repair construction	1	1	1	1
Government education services	1	1	1	1
Non-profit institutions serving households	1	1	1	1
Crop and animal production	0	0	0	1
Other municipal government services	1	1	1	1
Educational services	0	0	1	1
Total	**61**	**68**	**78**	**86**

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

E.3 Survey Responses on Job Impact Questions

The EAP auditor and contractor survey contained job impact-related questions for auditors and contractors related to the impact of EAP on their firms and employment levels. Two questions in particular were informative to understand the nature of the impacts to respondents, which would be considered direct impacts. These two questions are below, with relevant illustrative verbatim survey responses included:

1. Did the 2021 Energy Affordability 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:

   - *"Increased jobs and filled in schedules for employees."*
   - *"The assessments were typically very positive and the customers were very thankful to receive the benefits of the program. Many times the customers would pass on word of the program to other family and neighbors to help further the program participation."*
   - *"The program helped with growth during our slow periods."*
   - *"Larger volume of sales."*
   - *"More people noticed our trucks on the road."*

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

   - *"The program hindered growth when we show up to jobs and were unable to complete them, due to inaccurate notes from the auditor or the customers not being ready."*
   - *"Slow payment times impact our profitability."*
   - *"It did not hinder but because of the amount of assessment it did prevent me from doing other work."*

2. Did the 2021 Energy Affordability 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:

   - *"We hired 6 employees for the program."*
   - *"Hired two more people to handle more out of town business."*
   - *"Our company has grown a lot. Not sure how many are a result of the program but at least a few hires."*
   - *"We didn't really add staff but we didn't have to lay off any during the pandemic. The program helped in this."*

   Negative Impacts:

   - *"Unfortunately with the end of the program on our end we let them go."*

- *"I had to let one person go."*
- *"I don't hire people."*

Responding auditors and contractors indicated that the program generally had allowed them to add personnel to meet the demand for new work from EAP, as well as providing a steady revenue source during times when other revenue streams were depressed. The direct job gains estimated by the model are generally supported by the responses, which reveal the nature of the actual impact on firms. The respondents that indicated loss of personnel did not give reasons for these negative responses, with the exception of one respondent who indicated that the reason for the job loss was due to no longer being involved in the program. The negative issues could be examined further if there was a focus on redesigning certain aspects of the program to enhance job impacts.