PY2020 Interim Framework Home Assistance Program Evaluation Report

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SUBMITTED TO:
Independent Electricity System Operator

SUBMITTED BY:
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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.

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Acronyms

Acronym	Definition
AC	Air Conditioner
AFT	Affordability Fund Trust
AV	Audiovisual
CDM	Conservation and Demand Management
CE Tool	Cost-Effectiveness Tool
CEF	Combined Energy Factor
CF	Correction Factor
CFF	Conservation First Framework
CI	Confidence Interval
DHW	Domestic Hot Water
DSM	Demand Side Management
EM&V	Evaluation Measurement and Verification
ES QPL	ENERGY STAR Qualified Product List
EUL	Effective Useful Life
FAST	Field Audit Support Tool
FTE	Full-time equivalent
HAP	Home Assistance Program
HOU	Hours of Use
IDI	In-depth Interview
IESO	Independent Electricity System Operator
IF	Interim Framework
IO	Input-Output
ISR	In-Service Rate
kW	Kilowatt
kWh	Kilowatt-hours
LDC	Local Distribution Company
LEAP	Low-Income Energy Assistance Program
LED	Light-emitting Diode
LPM	Liters Per Minute
LUEC	Levelized Unit Electricity Costs
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
PIA	Prescriptive Input Assumption
PPS	Probability Proportional to Size
PY	Program Year
RR	Realization Rate
StatCan	Statistics Canada

Acronym	Definition
SUPC	Supply and Use Product Classification
SUT	Supply and Use Table
TRC	Total Resource Cost Test
TRM	Technical Reference Manual

Executive Summary

NMR Group, Inc. (NMR), in partnership with subcontractor, Nexant, Inc., (collectively, "the NMR team") and under contract to the Independent Electricity System Operator (IESO), performed an evaluation of the Home Assistance Program (HAP) for Program Year 2020 (PY2020).

Program Description

HAP is a centrally delivered program administered by the IESO. The program provides eligible low-income residential customers and eligible non-profit housing providers with the opportunity to receive energy-efficient solutions that aim to help reduce energy consumption and costs while also improving the home's comfort, look, and feel. Income-qualified homeowners and tenants in both non-profit and private rental housing are eligible, as are building owners and managers of non-profit housing. The program offers free in-home audits, health and safety upgrades, and energy-efficiency measures at no cost to participants. Measures installed during the home audit or as part of a follow-up visit may include ENERGY STAR® light-emitting diodes (LEDs), smart power strips, thermostats, high-efficiency showerheads, aerators, drying racks, energy-efficient refrigerators, window air conditioners, attic/basement insulation, and weather-stripping around doors and windows.

Evaluation Goals and Objectives

The HAP evaluation sought to address several research goals and objectives in PY2020, including the following:

- Verify energy and demand savings;
- Estimate realization rates (RRs). HAP has a deemed value of 1 for Net-to-Gross (NTG) since it is a low income program;
- Conduct cost-effectiveness analyses;
- Estimate the avoided greenhouse gas (GHG) emissions;
- Perform a limited process evaluation; and
- Analyze job impacts for the program.

RESULTS

The impact evaluation results for the HAP program are displayed in Table 1. The overall RR for PY2020 is 97% for energy savings and 94% for demand savings. The overall program results are compared to previous program years in Section 3.3.

Table 1: HAP PY2020 Results

Metric	Units	Evaluated
Participation	Projects	11,440
Participation	Homes	11,402
Reported Energy Savings	MWh	12,117
Reported Demand Savings	MW	1.24
Gross Energy RR	MWh	0.97
Gross Demand RR	MW	0.94
Gross Verified Energy Savings	MWh	11,765
Gross Verified Demand Savings	MW	1.16
Net-to-Gross Ratio (NTGR)	--	1.00
Net Verified Annual Energy Savings (First Year)	MWh	11,765
Net Verified Annual Demand Savings (First Year)	MW	1.16
Net Verified Annual Energy Savings (PY2022)	MWh	11,765
Net Verified Annual Demand Savings (PY2022)	MW	1.16

KEY FINDINGS AND RECOMMENDATIONS

The following section summarizes the PY2020 evaluation key findings and recommendations. Section 8 presents these key findings and recommendations in greater detail. Please note that given the nature of findings 12 through 14, the team does not provide related recommendations.

Finding 1: **The HAP program saw the largest amount of participation and the largest amount of net verified savings in PY2020 since before 2016.** In 2020, the HAP program completed 11,440 projects in 11,402 homes. The increase in participation highlights the efforts and successes of the program in maintaining its offerings for eligible participants despite the COVID-19 global pandemic. The program achieved first year net verified energy savings of 11,765 (MWh) and 1.16 MW of first year net verified demand savings. Verified savings on a per-project basis increased in PY2020 by 19% from PY2019 (from 866 kWh to 1,028 kWh per project) despite shrinking baselines, such as those associated with lighting end-uses which contribute to the majority of HAP savings.

> **Recommendation 1.** Continue to promote and deliver deeper savings measures to HAP participants like weatherization, appliances, and smart power bars, especially in historically underserved areas.

Finding 2: PY2020 weatherization projects increased in quantity and deepened in savings compared to PY2019. Gross verified savings for weatherization measures were higher on a per-unit basis in PY2020 compared to PY2019 (2,400 kWh in PY2020 vs. 1,939 kWh in PY2019). This is in part due to increased savings associated with weatherization measures on a per-project basis (3,669 kWh in PY2020 vs. 3,240 kWh in PY2019). The savings from weatherization measures increased by nearly 800,000 kWh from PY2019.

> **Recommendation 2.** Weatherization upgrades can provide important savings opportunities and health upgrades for participants. It will be important for the program to emphasize and implement weatherization upgrades to participants as savings from lighting measures 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 3: Clearly communicating measure eligibility is critical. Of the 6% of surveyed participants who offered recommendations for improving the program, the most common recommendations were to ensure customers receive all measures they are told they will receive (24%) and to relax the eligibility requirements for specific upgrades (22%).

> **Recommendation 3.** Accurately set participants' expectations regarding upgrades. Clearly communicate with the customer about eligibility requirements for upgrades prior to the audit and ensure that auditors are trained to clearly communicate eligibility requirements as well. Help customers to understand why they may not be eligible for certain measures depending on their fuel type. Train auditors to not overpromise on measures for which customers may not be eligible. Help customers understand the differences between HAP and other programs offered in the market.

Finding 4: Additional program promotion opportunities exist. Common program barriers identified by IESO program staff, program delivery vendor staff, and auditors and contractors were the relatively minimal marketing and a reported lack of program awareness for HAP.

> **Recommendation 4a.** Consider additional ways to market and promote the program, such as through potential collaborations with gas utilities or increased province-wide marketing (such as through social media campaigns, targeted advertisements).
>
> **Recommendation 4b.** Include a variety of customer testimonials in marketing materials offering materials in multiple languages, and collaborating with local community-based organizations to help address concerns about the program's legitimacy.

Finding 5: Savings attributed to lighting measures are decaying over time. Gross verified savings for lighting measures were lower on a per-unit basis in PY2019 and PY2020 due to deemed savings values (also referred to as substantiation sheet adjustments throughout the report). These adjustments included lowered baseline wattage values, lowered hours of use (HOU), and the application of in-service rate (ISR) results from participant surveys. The proportion of HAP program savings attributed to lighting end-uses decreased from 67% to 54% of total program savings in PY2020.

> **Recommendation 5.** As savings from lighting measures continue to decay over time, the program will need to reallocate resources to push alternative cost-efficient measures and focus on deep-energy savings. These may include weatherization measures (as noted in Recommendation 2), smart power bars, smart thermostats, and clothes drying racks.

Finding 6: Project costs remained generally well below the program cap. Sixty-six percent of the projects in PY2020 had an incentive less than $1,000 and 89% of the projects had an incentive less than $2,000, while the program's total measure cost cap per home was $13,000. This observation mirrors what was found for PY2019 projects (including PY2019 true ups). Sixty-seven percent of PY2019 projects had an incentive less than $1,000 and 90% had an incentive less than $2,000. Since the program provides all eligible measures that each participant will accept, this finding suggests that there may be additional savings opportunities for measures not currently offered by the program

> **Recommendation 6.** Consider expanding the measures offered by the program, as this may provide deeper savings per home. Recommendations 2, 5 and 9 provide insight on new measures or services to consider adding to the program.

Finding 7: Energy-efficiency education activities are likely resulting in savings. Just under two-thirds (65%) of all responding participants said their auditor discussed additional ways to save energy at the time of the audit or left educational materials behind (66% and 57%, respectively), and of these participants, two-thirds (69%) said they had tried at least one of the additional ways to save energy since having the audit performed.

> **Recommendation 7.** Consider ways to analyze and quantify the energy savings resulting from the program's energy education activities.

Finding 8: Participants, auditors, and contractors recommended offering additional equipment through the program. Nearly one-half (45%) of surveyed participants provided a total of 415 recommendations for additional energy-efficiency equipment or services for inclusion in HAP.

> **Recommendation 8.** Consider offering additional types of equipment, such as clothes washers and dryers, windows, doors, heating and cooling equipment (such as air source heat pumps), and water heating equipment. Refer to Recommendations 2, 5 and 6 for additional insight on equipment considerations.

Finding 9. Participants recommended offering higher-quality products and offering replacements when issues arise. Offering higher quality products was mentioned by one-fifth (17%) of participants with improvement recommendations.

> **Recommendation 9.** Provide higher-quality products through the program where feasible and replace products when issues arise. Ensure customers are well-trained on proper use of equipment received through the program and that they are aware of the process for requesting replacements of faulty measures. Doing so will help address customer experience issues and will help ensure that persistence of program savings is achieved over time.

Finding 10: 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 no longer delivered by the HAP program. In addition, there were no demand savings reported for smart power bars, which prevented a demand RR from being calculated for smart power bars. These discrepancies were also observed in PY2019.

> **Recommendation 10.** 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 energy savings values are applied to the correct measure.

Finding 11. HAP had direct, positive impacts to employment in Ontario from PY2020 activities. The analysis estimated that HAP will create 212 total jobs in Canada, of which 194 will be in Ontario. One-hundred four (104) of these jobs would be direct, with indirect and induced job impacts propagating throughout the economy under normal economic circumstances.

> **Recommendation 11.** Continue using the Statistics Canada (StatCan) Input-Output (IO) model in concert with in-depth surveying to understand the impacts on job creation from PY2021 activities.

Finding 12: The overall program RR for energy savings was driven by lighting measures. Lighting savings accounted for over one-half (54%) of the overall program gross energy savings. Given the volume of energy savings attributed to lighting, the lower RR for lighting measures (76%) lowered the RR of the program. Other measures, such hot water pipe insulation, indoor clothes drying racks, aerators, and showerheads, also contributed to the lower RR. High RRs for weatherization measures, appliances, and smart power bar end-uses alleviated some of the impacts on program savings.

Finding 13: Discrepancies in reported demand savings that were observed in PY2019 were largely corrected in PY2020. The primary driver for the low demand savings RR in PY2019 was the use of connected demand savings values instead of the evaluation measurement and verification (EM&V) peak demand savings values for reported demand savings for some measures. In PY2020, these discrepancies have largely been corrected in the reported savings, with the exception of certain measures, such as weatherization and smart power bars.

Finding 14: Participant were largely satisfied with the program and its elements. Participants reported high satisfaction with the program overall (average rating of 4.4 on a scale

from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied”) as well as with the professionalism of their auditor (average rating of 4.7). While energy savings from the upgrades had the lowest average satisfaction rating, this aspect of the program still had a relatively high rating, at 4.2.

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Introduction

The Independent Electricity System Operator (IESO) retained NMR Group, Inc. (NMR), in partnership with subcontractor, Nexant, Inc., (collectively, "the NMR team") to conduct an evaluation of its Low Income, First Nations, and Residential Local programs and pilots offered under the Interim Framework (IF). This report includes results, findings, and recommendations for the Program Year 2020 (PY2020) evaluation and is specific to the Home Assistance Program (HAP).

1.1 Evaluation Goals and Objectives

The evaluation sought to address several research goals and objectives in PY2020, including the following:

- Verify energy and demand savings with a 90% level of confidence at 10% precision for the program;
- Estimate realization rates (RRs) . HAP has a deemed value of 1 for Net-to-Gross (NTG) since it is a low income program;
- Conduct cost-effectiveness analyses;
- Estimate the avoided greenhouse gas (GHG) emissions from electricity savings using the IESO Cost Effectiveness Tool;
- Conduct a limited process evaluation by addressing key research questions of interest to the program; and
- Conduct a jobs impact analysis to estimate the number of direct and indirect jobs attributable to the program.

1.2 Program Description

HAP provides eligible low-income residential customers and eligible non-profit housing providers with the opportunity to receive energy-efficient solutions that aim to help reduce energy consumption and costs while also improving the home's comfort, look, and feel. Income-qualified homeowners and tenants in both non-profit and private rental housing are eligible, as are building owners and managers of non-profit housing. The program offers free in-home audits, health and safety upgrades, and energy-efficiency measures at no cost to participants.

1.2.1 Delivery

Under the IF, HAP is a centrally managed program that is 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 that performs in-home energy audits and installations of program-eligible equipment, and other daily program management activities. During the energy

audits, the program participants receive educational materials and tips on saving energy, as well as any necessary training about the upgrades installed.

1.2.2 Eligibility

To be eligible to participate in the program, the participant must (1) be a resident of an eligible non-profit 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 limit;
- 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; and
- Qualified to participate in a natural gas low-income Demand Side Management (DSM) program during the past 12 months.

1.2.3 Measures

The measures offered by HAP are classified into one of three tracks based on the type of measures in the project. The basic track encompasses measures that are easily installed on site by the HAP 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 additional follow-up actions, such as confirmation of appliance delivery, and are not 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 each track are listed in Figure 1.

Figure 1: Program Measures by Program Track

Track	Program Measures	Electric DHW Only	Electric Heat Only
Basic Measures	• Efficient showerheads	●	
	• Efficient aerators	●	
	• Block heater timer		
	• Indoor clothes drying rack		
	• Power bar		
	• Hot water pipe insulation	●	
	• Hot water tank wrap	●	
	• ENERGY STAR qualified LED light bulbs		
Extended Measures	• Dehumidifier replacement		
	• Window air conditioner replacement		
	• Refrigerator replacement		
	• Freezer replacement		
	• Programmable thermostat		●
	• Smart thermostat		●
Weatherization	• Attic insulation		●
	• Basement Insulation		●
	• Wall Insulation		●
	• Air Sealing		●
Health and Safety	Health and safety measures. The program can make repairs to prepare for an installation of a program eligible measure or to make an upgrade that would promote energy efficiency and alleviate any health and safety concerns. The values of such repairs and upgrades is limited to $750.		

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Methodology

A summary of the impact evaluation, process evaluation, 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 PY2020 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 practices are a standard way to compare evaluated savings with reported savings.

The following subsections provide context about each impact evaluation activity. A detailed description of the impact sampling methodology is provided in Appendix A.1.

An additional component of the PY2020 evaluation included accounting for projects that were completed in PY2019 but had not been finalized before the PY2019 evaluation occurred. These are considered PY2019 true-up projects. The methods and results for the PY2019 true up projects are reported in Section 3.5.

2.1.1 Program Tracking Database Review

The NMR team analyzed the participant database and conducted a cross-cutting assessment to identify the evaluation priorities and to develop a sampling plan. The NMR team assigned priorities based on the following metrics:

- Measures that accounted for the largest share of savings
- Measures that have the most uncertainty around their estimated savings
- The amount of evaluation work done for each measure in previous evaluations

The NMR team also conducted a comprehensive review of the HAP tracking database in order to identify key measures, savings discrepancies, and other issues that impact the accuracy of reported savings. The 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.[3] The NMR team also leveraged the database to

[1] See "Secondary Data Review of TRMs" (Section 2.1.2) in Methodology section of PY2019 HAP Evaluation. Appendix A 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.
[3] 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.

calculate gross and verified net savings for the entire population. Equation 1 shows the program tracking data correction factor calculation, which aligned reported savings with the updated 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 1: Program Tracking Data Correction Factor

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

2.1.2 In-Service Rate (ISR) and Hours of Use (HOU) Analysis

As in PY2019, the NMR team surveyed HAP participants to verify the number of measures installed and in use on their premises. The NMR team applied the PY2020 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. For measures that did not achieve this threshold, the NMR team applied an ISR that averaged PY2019 and PY2020 results.[4]

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. Self-reported HOU in PY2020 did not align with PY2019 self-reported values either. In PY2019, survey respondents reported using lighting twice as much as metered results from various other evaluations.

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 PY2020 reported aerator HOU between two and five times greater than those documented in IESO substantiation sheets. A similar difference was observed in PY2019, though that survey did not distinguish between types of aerators (e.g., bathroom or kitchen) when prompting survey participants with the question.

Block heater timers. The NMR team updated block heater timer HOU based on combined PY2019 and PY2020 survey results after comparing them with the block heater substantiation sheet values, which established HOU based on self-reported survey responses from the PY2017 block heater timer pilot evaluation. Survey respondents reported less usage than the levels documented in IESO substantiation sheets, including fewer days per year, fewer baseline operating hours (before timer), and more efficient operating hours (after timer).

Dehumidifiers. The NMR team updated two values determining dehumidifier usage – hours per day and days per year – based on combined PY2019 and PY2020 survey results. Survey respondents reported usage greater than the levels documented in IESO substantiation sheets.

[4] Window air conditioners were the only measure that did not achieve 90/10 precision.

The alignment in self-reported survey data over two years are appropriate in the absence of metered usage data.

Showerhead. The NMR team updated two values determining showerhead usage – showers per day and minutes per shower – based on combined PY2019 and PY2020 survey results. Survey respondents reported taking fewer showers per day than documented in IESO substantiation sheets, but taking more time per shower. Like dehumidifiers, the alignment of self-reported survey data over two years are an appropriate substitute for metered usage data if that is unavailable.

The results for the ISR and HOU aspects of the participant surveys are discussed in Section 3.4 and Appendix B.2, respectively.

2.1.3 Engineering Desk Reviews

The engineering desk reviews consisted of a review of a sample of 229 projects that the NMR team selected as part of the program tracking database review process. The 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.

2.1.3.1 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 2 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 1), 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 1).
- **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, 97% 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 2: Gross Verified Savings – Prescriptive Measures

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

2.1.3.2 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.[5] The NMR team compared savings results from the desk review to the reported savings to determine an 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.[6] Equation 3 shows the gross verified savings calculation for weatherization measures.

Equation 3: Gross Verified Savings – Weatherization Measures

$$Gross\ Verified\ Savings = Reported\ Savings \times Realization\ Rate$$

2.1.3.3 Net Verified Energy and Demand Savings

The NMR team applied a net-to-gross ratio (NTGR) value of 1.0 to maintain consistency with previous program year evaluations of HAP. This method is also consistent with other low-income, direct installation programs in other jurisdictions. The NTGR of 1.0 indicates that participants would not have installed the energy-efficiency measures without program intervention. Note that due to a NTGR of 1.0, the gross verified savings are equivalent to the net first year savings for the program.

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 *CDM Energy Efficiency Cost Effectiveness Guide*[7] and using IESO's *CDM Energy Efficiency 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.2.

[5] During the desk reviews, auditors discovered that there were five weatherization projects that conducted comprehensive draft proofing (also known as air sealing) on the project in which the documentation indicated a reduction in air leakage in the home. However, the auditors noticed that the HOT2000 model indicated negative savings for these projects, despite the only change in the home being a reduction in air infiltration. The NMR team looked into this to determine what was driving the issue, such as a bug related to a specific version of the software, but was unable to determine the exact reason. To account for this in gross verified savings calculations, the NMR team took a different approach for these five project. The NMR team recalculated reported savings based on the factor that air infiltration (in ACH50) was reduced by. The NMR team applied the air infiltration reduction factor to reported savings.

[6] The PY2019 evaluation report did not include demand savings for weatherization projects. The NMR team accounted for demand savings for evaluated PY2019 projects in the PY2019 true-up process. Details on the methods and the results can be found in Section 3.5.

[7] *Conservation & Demand Management Energy Efficiency Cost Effectiveness Guide*, Independent Electricity System Operator, April 1,2019, http://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation/EMV/2019/IESO-CDM-Cost-Effectiveness-Test-Guide.pdf?la=en

2.3 PROCESS EVALUATION METHODOLOGY

2.3.1 Sampling, Interviews, and Surveys

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 conclusions.

For each respondent type, Table 2 shows the survey methodology, the total population that the NMR team invited to participate in the survey or interviews, the total number of completed surveys, and the sampling error at the 90% CI.

Table 2: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Completed	Population	90% CI Error Margin
HAP IESO Staff and Program Delivery Vendor Staff	Phone In-depth Interviews (IDIs)	2	2	0%
HAP Auditors and Contractors	Web	49	64	5.7%
HAP Participants	Web	682	4,194	2.9%
HAP Social Housing Provider	Phone	2	2	0%

The following subsections provide context about each group interviewed or surveyed. A detailed description of the process evaluation methodology is provided in Appendix A.2.

2.3.2 IESO and Program Delivery Vendor Staff Interviews

The NMR team completed one IDI with one IESO staff member and one IDI with four program delivery vendor staff members to obtain a detailed understanding of HAP in PY2020. To complete these interviews, the IESO EM&V staff sent a notification e-mail to the appropriate IESO staff and program delivery vendor staff about the interview request, and then the NMR team followed up directly to schedule and complete the interviews. Interview topics for the IESO staff and program delivery vendor staff addressed program roles and responsibilities, program design and delivery, marketing and outreach, market actor engagement, program strengths and weaknesses, and suggestions for improvement.

2.3.3 Auditor and Contractor Survey

The NMR team e-mailed 64 unique auditors and contractors in the sample to request their participation in the survey. Forty-nine auditors and contractors responded to this request and completed the survey. The NMR team developed the sample list used to complete these HAP auditor and contractor surveys using an abbreviated list of contacts provided by the program delivery vendor staff. Survey topics for the auditors and contractors addressed role in the

program, firmographics, the application process, training and education received, outreach and marketing to customers, program barriers, suggestions for program improvement, and job impacts.

2.3.4 Participant Survey

The NMR team e-mailed 4,194 unique participants in the sample to request their participation in the survey. A total of 682 HAP participants responded to this request and completed the survey. The NMR team developed the survey 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. Survey topics for participants addressed 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 actions that participants implemented; satisfaction with various aspects of the program process; suggestions for program improvement, including additional equipment or services to consider; job impacts; and demographics.

2.3.5 Social Housing Provider Survey

The NMR team completed two IDIs with participating social housing provider staff members to obtain a detailed understanding of HAP in PY2020. The NMR team developed the sample list used to complete these HAP auditor and contractor surveys using an abbreviated list of contacts provided by the program delivery vendor staff. Interview topics for the social housing provider staff addressed program roles and responsibilities, awareness and motivations, program experiences, satisfaction, barriers, program strengths and weaknesses, and suggestions for improvement.

2.4 JOBS IMPACT ANALYSIS METHODOLOGY

The analysis of job impacts utilized the Statistics Canada[8] (StatCan) Input-Output (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. When an energy-efficiency program such as HAP 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 detailed description of the job impact analysis methodology is provided in Appendix A.4.

The model output generated three types of job impact estimates:

Direct impacts: jobs created during the initial round of spending from the exogenous shock. For the demand shock for energy-efficient products and services, direct impacts would be from firms adding employees to perform audits, install measures, and handle administrative duties. For the

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

household expenditure shock, direct impacts would be from jobs created due to additional household spending.

Indirect impacts: job impacts due to inter-industry purchases as firms respond to the new demands of the directly affected industries. These include jobs created up supply chains due to the demand created by the energy-efficiency program—such as in the manufacturing of goods or the supply of inputs.

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

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

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

Model run results are presented in terms of the above job impact types (direct, indirect, and induced) and also the type of job (total jobs vs. FTEs). These results—along with the model input shock values—are presented and discussed in Section 7.1.

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. Additional impact-related results, including the true-up component, can be found in Section 3.5.

3.1 High-Level Results

The gross verified savings for HAP have a NTG ratio of 1.0 applied to them, meaning gross verified and net verified savings are equal (Section 2.1.3.3). The results presented in this section refer to the gross verified savings and can be considered equivalent to net verified first year savings.

3.1.1 Gross Verified Energy Savings Key Results

- The overall program RR is 97% for energy savings in PY2020.
- Lighting measures achieved an RR of 76%[9]; however, these measures accounted for most of the HAP savings in PY2020 (54%).
- Weatherization measures achieved an RR of 120% and accounted for nearly 9% of total program savings, a sizeable increase over PY2019.
- Hot water pipe insulation measures had a low RR (15%); however, these measures accounted for less than 1% of gross verified savings.
- Indoor clothes drying racks had an RR of 85% and represented 5.4% of total gross verified savings for the program.
- Smart power bars had extremely high RRs (5,980%) due to the use of a reported savings value associated with power bar timers, a measure no longer delivered by the HAP program. This discrepancy was also observed in the PY2019 evaluation.
- The appliance end-use category had an RR of 122% and attributed 7.7% to total program savings.

3.1.2 Gross Verified Demand Savings Key Results

- The overall program RR is 94% for demand savings in PY2020.
- Lighting measures had an RR of 80% for demand savings; however, these measures represented about 37% of total program demand savings.
- Indoor clothes drying racks achieved an RR of 85% and achieved nearly 37% of total demand savings for HAP in PY2020.

[9] The RR for lighting was driven by the PY2019 substantiation sheet updates which lowered baseline wattage and HOU values, as well as an ISR value of 97%. Lighting measures achieved a 76% realization rate in PY2019 as well.

- Indoor clothes drying racks accounted for the largest proportion of demand savings (37%), followed by 11W LED A-line light bulbs (30%) and smart power bars (5%).
- Appliances had a 119% RR and accounted for over 13% of program savings.
- Weatherization projects had higher RRs (603%) due to application of different peak demand factors, demand savings assumptions, and 64 of the 425 weatherization measures in the program tracking data not reporting any demand savings.
- All smart power bars had no demand savings reported in the tracking data (a total of 8,166 records, accounting for 9,733 smart power bars). A measure-level RR could not be calculated for smart power bars.

3.2 Gross Verified and Reported Savings Assessment

The gross verified energy savings for HAP were dominated by lighting end-use measures, which covered a little more than one-half (54%) of total program savings (Figure 2). The proportion of lighting savings compared to overall program savings is less than the PY2019 HAP evaluation, which was 67% of total program gross verified savings.[10] Smart power bars, miscellaneous, and weatherization were the next largest end-use categories for PY2020. Building shell upgrades – insulation and air-sealing – accounted for 8.7% of gross verified savings for HAP, which is almost a 6% increase from the proportion of gross verified savings from PY2019 (or 1,020,024 kilowatt-hours [kWh]/year vs. 226,804 kWh/year).

[10] http://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation/EMV/2017/2017-Home-Assistance-Program-Evaluation-Report.pdf?la=en

Figure 2: Percent of PY2020 HAP Gross Verified Energy Savings by End-Use (kWh/year)

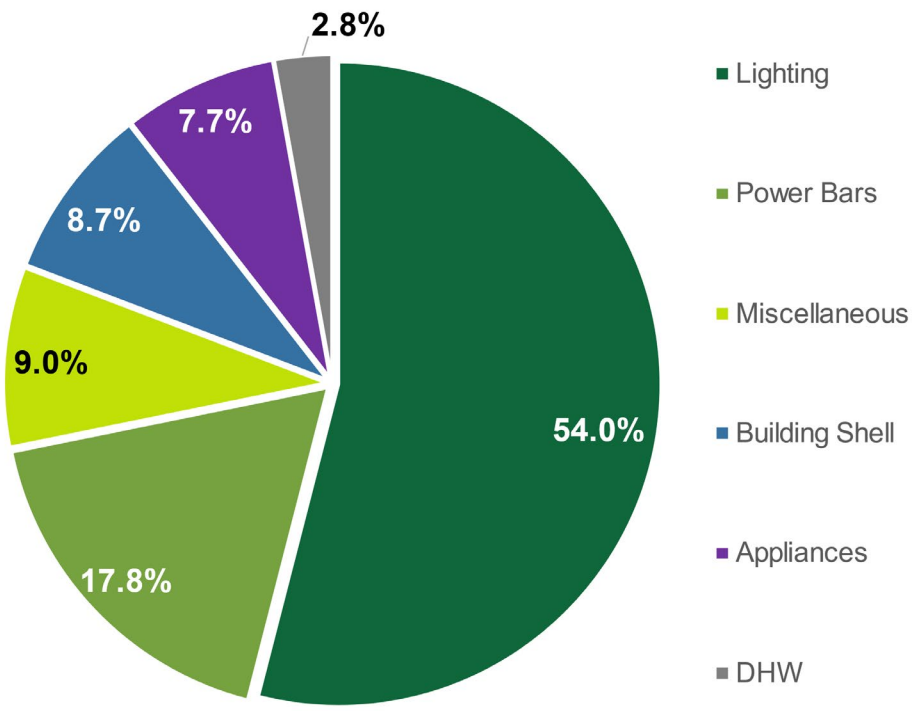
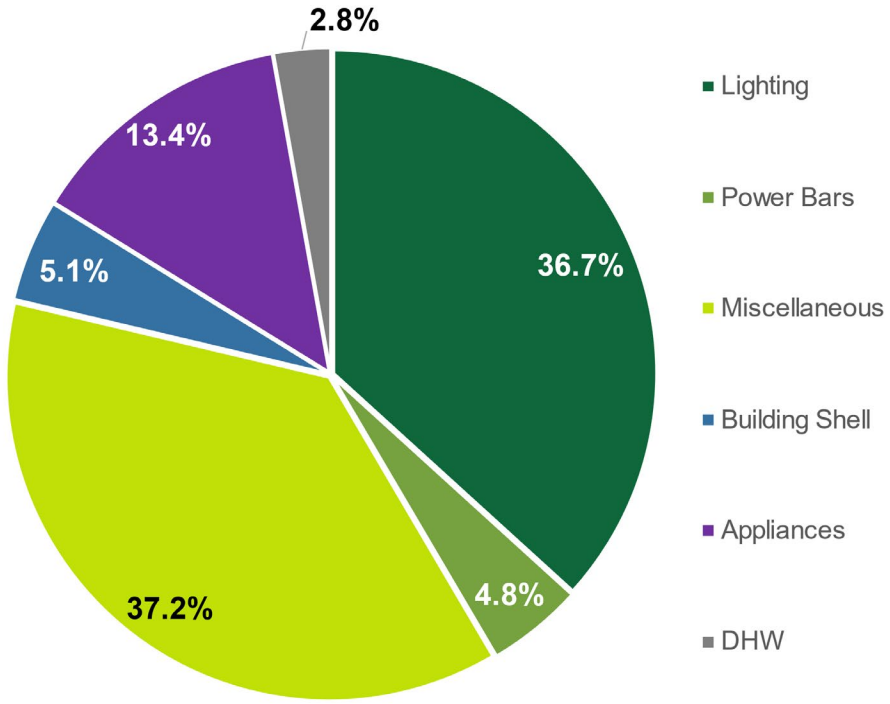


Figure 3 displays the proportion of gross verified demand savings by end-use category for HAP. The gross verified demand savings were primarily attributed to miscellaneous measures, specifically indoor clothes drying racks and lighting end-use categories (37.2% and 36.7%, respectively). The appliance end-use category covered another 13.4% of gross verified demand savings for HAP.

Figure 3: Percent of PY2020 HAP Gross Verified Demand Savings by End-Use (kW/year)



3.2.1 Program Level Savings

Table 3 presents reported, gross verified, and net first year energy and demand savings for the entire HAP program for PY2020. The program gross verified RR is 97% for energy savings and 94% for demand savings. As described above, the NTG ratio is assumed 1.0 for the HAP program. Measure level impacts for both energy and demand savings are detailed in the subsections below. The verified net first year savings was the highest amount it has been since 2016.

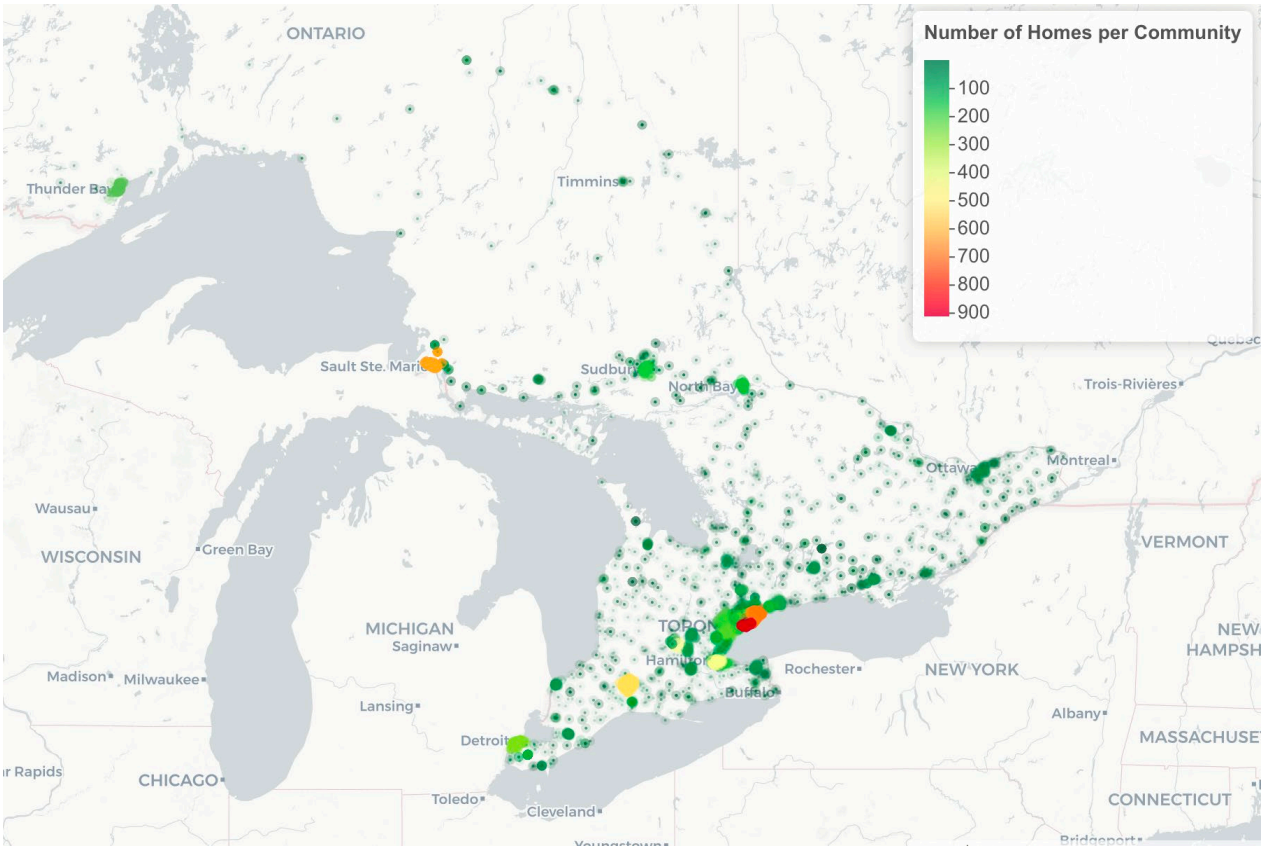
Table 3: Program Level Reported, Gross Verified, and Net First Year Savings

Metric	Units	Evaluated
Reported Energy Savings	MWh	12,117
Reported Demand Savings	MW	1.24
Gross Energy RR	MWh	0.97
Gross Demand RR	MW	0.94
Gross Verified Energy Savings	MWh	11,765
Gross Verified Demand Savings	MW	1.16
Net-to-Gross Ratio (NTGR)	--	1.00
Net Verified Annual Energy Savings (First Year)	MWh	11,765
Net Verified Annual Demand Savings (First Year)	MW	1.16
Net Verified Annual Energy Savings (PY2022)	MWh	11,765
Net Verified Annual Demand Savings (PY2022)	MW	1.16

Figure 4 shows the geographic distribution of evaluated PY2020 HAP project homes across Ontario.[11] Green dots represent buildings where there are few other HAP participant projects within the same community, while red dots represent higher densities of participant homes.[12] The Greater Toronto and Hamilton Area was a hot spot for PY2020 HAP participation, indicated by the high concentration of red and orange dots in the map below. Toronto, Scarborough, Sault Ste. Marie, and London are the four communities whose building counts surpass 500. For the participant projects within these four communities, 53% are single-family and 47% are multifamily properties. Between these communities, Toronto has the largest share of multifamily participant projects (89%) followed by London (43%), Scarborough (33%), and Sault Ste. Marie (4%).

[11] There were 11,402 unique building addresses for the 11,440 projects. This value represents the physical addresses in the tracking data and is referred to as the HAP participant program home count.
[12] Note that within the figure there are small green dots within a shaded bubble (this may require zooming in on the document to 150% view clearly). These indicate a very small number of projects, and the bubbles that are more fully filled in indicate more projects within the range identified in the figure's scale.

Figure 4: PY2020 HAP Program Participant Home Distribution across Ontario



3.2.2 Measure-Level Results Summary

The measure-level impact evaluation results are presented by end-use category in the following subsections. Aggregated impact results, substantiation sheet updates, effective useful life (EUL) updates, and incremental cost updates are provided by measure in Appendix B.

3.2.2.1 Lighting

Table 4 presents the reported and gross verified energy savings for lighting measures offered by HAP. 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%. The lower RR was a result of savings adjustments to the PY2019 substantiation sheet review, which lowered the delta between baseline wattage and efficient wattage values and adjusted HOU values in the savings equation. In addition, the NMR team applied the PY2020 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 (54%) of total verified savings for the program.

The lighting end-use category is dominated by A-line type bulbs. The 11-watt A-line bulb contributes to 44% of the program savings, while the 23-watt A-line bulb contributes 4.5% of

program savings.[13] 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 HAP participant home (i.e., candelabra shaped bulbs in a chandelier-type fixture or a reflector shaped installed into a recessed fixture).

Table 4: PY2020 Lighting Energy Savings

Lighting	Reported Savings (kWh)	Gross Verified Savings (kWh)	RR	Proportion of Verified HAP Savings
<=11W ENERGY STAR Qualified LED A Shape	7,040,759	5,180,977	74%	44.0%
<=11W ENERGY STAR Qualified LED MR 16	58,227	49,956	86%	0.4%
<=14W ENERGY STAR Qualified LED A Shape	96,980	71,685	74%	0.6%
<=16W ENERGY STAR Qualified LED PAR 20	56,503	48,465	86%	0.4%
<=16W ENERGY STAR Qualified LED PAR30 & PAR38	150,024	128,603	86%	1.1%
<=23W ENERGY STAR Qualified LED A Shape	551,761	530,888	96%	4.5%
<=23W ENERGY STAR Qualified LED PAR	73,603	63,050	86%	0.5%
<=6W ENERGY STAR Qualified LED MR 16 / PAR 16	236,454	202,646	86%	1.7%
ENERGY STAR® LED Wet Location Rated PAR lamp ≤ 23 Watt (minimum 1100 Lumen output)	87,674	75,224	86%	0.6%
LED Downlight with Light Output >600 and <800 lumens	2,345	1,268	54%	<0.1%
LED Downlight with Light Output >800 lumens	266	140	52%	<0.1%
Lighting Total	**8,354,596**	**6,352,902**	**76%**	**54.0%**

Table 5 displays the reported and gross verified demand savings for lighting end-uses. The RR for lighting demand savings was 80% due to adjustments from the PY2019 substantiation sheet review and the PY2020 ISR results. The RR was much higher in PY2020 than in PY2019 due to corrections on reported demand savings, which now applied summer peak demand savings

[13] During the PY2021 evaluation, the evaluation team recommends reviewing the substantiation sheet inputs for lighting end-uses, with an eye for approaches to lighting end-use savings in other jurisdictions with low-income direct install programs, and the HAP data collection forms to identify potential approaches to understand whether there are additional savings opportunities. Although the lighting market is evolving quickly overall, it is worth further research and consideration for HAP.

values rather than connected demand savings that were observed in the PY2019 program tracking data.

Table 5: PY2020 Lighting Demand Savings

Lighting	Reported Savings (kW)	Gross Verified Savings (kW)	RR	Proportion of Verified HAP Savings
<=11W ENERGY STAR Qualified LED A Shape	442.8	347.0	78%	30.0%
<=11W ENERGY STAR Qualified LED MR 16	3.3	3.3	103%	0.3%
<=14W ENERGY STAR Qualified LED A Shape	6.1	4.8	78%	0.4%
<=16W ENERGY STAR Qualified LED PAR 20	3.7	3.2	88%	0.3%
<=16W ENERGY STAR Qualified LED PAR30 & PAR38	10.6	8.6	81%	0.7%
<=23W ENERGY STAR Qualified LED A Shape	36.0	35.6	99%	3.1%
<=23W ENERGY STAR Qualified LED PAR	5.6	4.2	76%	0.4%
<=6W ENERGY STAR Qualified LED MR 16 / PAR 16	18.8	13.6	72%	1.2%
ENERGY STAR® LED Wet Location Rated PAR lamp ≤ 23 Watt (minimum 1100 Lumen output)	6.6	5.0	76%	0.4%
LED Downlight with Light Output >600 and <800 lumens	0.2	0.1	97%	<0.1%
LED Downlight with Light Output >800 lumens	<0.1	<0.1	97%	<0.1%
Lighting Total	**533.7**	**425.6**	**80%**	**36.7%**

3.2.2.2 Appliances

The NMR team verified the savings for appliances using the project file data and equipment-specific information collected by HAP 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. RRs for energy savings were generally high among appliances (122%), particularly with freezers. Appliances accounted for 7.7% of total program gross verified energy savings (Table 6).

Table 6: PY2020 Appliance Energy Savings

Appliance	Reported Savings (kWh)	Gross Verified Savings (kWh)	RR	Proportion of Verified HAP Savings
Dehumidifier Replacement (ENERGY STAR Qualified 14.2 – 21.2 l/day)	126,499	155,760	123%	1.3%
Dehumidifier Replacement (ENERGY STAR Qualified 21.3 – 25.4 l/day)	3,970	5,569	140%	<0.1%
Dehumidifier Replacement (ENERGY STAR Qualified 25.5 – 35.5 l/day)	5,124	7,189	140%	0.1%
Freezer Replacement (ENERGY STAR Qualified 12-14.4 cu ft)	83,920	184,163	219%	1.6%
Freezer Replacement (ENERGY STAR Qualified 14.5 – 16.0 cu ft)	51,603	104,425	202%	0.9%
Freezer Replacement (ENERGY STAR Qualified 7 – 12.0 cu ft)	2,365	2,360	100%	<0.1%
Refrigerator Replacement (ENERGY STAR Qualified 10.0 – 12.5 cu ft)	111,780	110,565	99%	0.9%
Refrigerator Replacement (ENERGY STAR Qualified 15.5 – 16.9 cu ft)	104,345	105,589	101%	0.9%
Refrigerator Replacement (ENERGY STAR Qualified 17.0 – 18.4 cu ft)	243,724	224,857	92%	1.9%
Window Air Conditioner Replacement (ENERGY STAR Qualified 10,000 – 12,000 BTU/hr)	754	459	61%	<0.1%
Window Air Conditioner Replacement (ENERGY STAR Qualified 6,000 – 7,999 BTU/hr)	1,640	133	8%	<0.1%
Window Air Conditioner Replacement (ENERGY STAR Qualified 8,000 – 9,999 BTU/hr)	3,828	1,882	49%	<0.1%
Appliances Total	**739,552**	**902,952**	**122%**	**7.7%**

The demand RRs were slightly lower than the energy RRs for appliances but accounted for 13% of the program gross verified demand savings (Table 7).

Table 7: PY2020 Appliance Demand Savings

Appliance	Reported Demand (kW)	Gross Verified Demand (kW)	RR	Proportion of Verified HAP Savings
Dehumidifier Replacement (ENERGY STAR Qualified 14.2 – 21.2 l/day)	40.6	48.1	118%	4.2%
Dehumidifier Replacement (ENERGY STAR Qualified 21.3 – 25.4 l/day)	1.3	1.8	140%	0.2%
Dehumidifier Replacement (ENERGY STAR Qualified 25.5 – 35.5 l/day)	1.7	2.3	140%	0.2%
Freezer Replacement (ENERGY STAR Qualified 12-14.4 cu ft)	11.2	25.9	231%	2.2%
Freezer Replacement (ENERGY STAR Qualified 14.5 – 16.0 cu ft)	7.0	14.1	201%	1.2%
Freezer Replacement (ENERGY STAR Qualified 7 – 12.0 cu ft)	0.3	0.3	112%	<0.1%
Refrigerator Replacement (ENERGY STAR Qualified 10.0 – 12.5 cu ft)	14.9	14.5	98%	1.3%
Refrigerator Replacement (ENERGY STAR Qualified 15.5 – 16.9 cu ft)	13.7	13.9	101%	1.2%
Refrigerator Replacement (ENERGY STAR Qualified 17.0 – 18.4 cu ft)	32.4	31.1	96%	2.7%
Window Air Conditioner Replacement (ENERGY STAR Qualified 10,000 – 12,000 BTU/hr)	0.9	0.5	61%	<0.1%
Window Air Conditioner Replacement (ENERGY STAR Qualified 6,000 – 7,999 BTU/hr)	2.0	0.2	8%	<0.1%
Window Air Conditioner Replacement (ENERGY STAR Qualified 8,000 – 9,999 BTU/hr)	4.6	2.2	49%	0.2%
Appliances Total	**130.6**	**155.1**	**119%**	**13.4%**

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. Refrigerators accounted for 441,011 kWh in energy savings and 59.5 kW in demand savings.

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. 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. Freezers accounted for 290,948 kWh in energy savings and 40.4 kW in demand savings.

Dehumidifiers. Typically, the NMR team limited the data used to verify savings for dehumidifiers to the project 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 made adjustments to the HOU for dehumidifiers based on the responses from the PY2020 participant survey. Participants indicated that they were using dehumidifiers more frequently and for a longer duration than deemed savings values suggested. Dehumidifiers accounted for 168,518 kWh in gross verified savings and 52.2 kW in gross verified demand savings.

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. However, the lower RR was due to a combination of the application of ISR values and the fact that existing window ACs were replaced with larger capacity systems. These larger window air conditioners were more efficient than what existed prior to the new appliance, but the increased capacity drives energy consumption higher, ultimately impacting the overall energy savings. It should be noted that while replacing smaller and less efficient window air conditioners with larger capacity, higher-efficiency units reduces overall savings compared to replacement with a higher-efficiency unit of the same size, there is likely an increase in occupant comfort that results from the larger system serving more of the home. Window air conditioners accounted for 2,474 kWh in gross verified energy savings and 2.9 kW in gross verified demand savings.

3.2.2.3 Weatherization – Building Shell

The RR for weatherization measures was 120% (Table 8). This represents an increase from the PY2019 HAP evaluation (108%). In addition, the gross verified savings increased from 227 megawatt-hours (MWh) in PY2019 to 1,020 MWh in PY2020, a 349% increase. There were 278 weatherization projects completed in PY2020 compared to 70 in PY2019. This represents an increase in the savings per participant that received weatherization upgrades and highlights that a continued effort to increase the size, scale, and frequency of weatherization projects administered by HAP in future years will provide long-term savings for the program as it looks for savings opportunities beyond lighting measures.

The NMR team calculated verified savings with the HOT2000 energy modeling tool that is used by HAP auditors to input the shell details of the participant building. Shell upgrades are only offered to participants with electric heat. HAP 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 the modeled energy usage of the initial and final energy models, which the NMR team replicated to verify savings.

Table 8: PY2020 Building Shell Energy Savings

Shell Component	Reported Savings (kWh)	Gross Verified Savings (kWh)	RR	Proportion of Verified HAP Savings
Air Sealing / Draft Proofing	351,088	396,766	113%	3.4%
Attic Insulation	258,485	296,832	115%	2.5%
Basement Insulation	142,453	171,116	120%	1.5%
Wall Insulation	96,449	155,311	161%	1.3%
Building Shell Total	**848,475**	**1,020,024**	**120%**	**8.7%**

The demand savings for PY2020 weatherization projects are presented in Table 9. 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).[14] The high RRs are a function of reported savings applying a different summer peak demand factor or assumed demand savings value, and 64 of the 425 weatherization measures not reporting any demand savings. Note that PY2019 weatherization projects have been adjusted in the comparison and PY2019 true-up sections below to account for verified demand savings, which were not included in the PY2019 HAP evaluation report.

Table 9: PY2020 Building Shell Demand Savings

Shell Component	Reported Demand (kW)	Gross Verified Demand (kW)	RR*	Proportion of Verified HAP Savings
Air Sealing / Draft Proofing	4.0	23.0	571%	2.0%
Attic Insulation	3.1	17.2	562%	1.5%
Basement Insulation	1.5	9.9	659%	0.9%
Wall Insulation	1.2	9.0	745%	0.8%
Building Shell Total	**9.8**	**59.1**	**603%**	**5.1%**

*Note that gross verified demand savings are calculated by applying a summer demand factor to the gross verified energy savings values. Due to inconsistencies with reported demand savings for weatherization measures the RR for weatherization measures are very high.

[14] As documented in the PY2020 HAP evaluation plan, the NMR team and the IESO determined that, in PY2020, 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.

3.2.2.4 Smart Power Bars

Table 10 presents the gross verified savings results for smart power bars. The smart power bar includes a more sophisticated infrared or occupancy sensor that shuts off the equipment based on occupant behaviour. 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 the HAP program in PY2020. The NMR team also observed this in the PY2019 evaluation. In addition, the NMR team updated the smart power bar savings values as a part of the PY2019 prescriptive savings review.[15]

Table 10: PY2020 Power Bar Energy Savings

Component	Reported Savings (kWh)	Gross Verified Savings (kWh)	RR	Proportion of Verified HAP Savings
Smart Power Bar	35,039	2,095,320	5980%	17.8%
Power Bar Total	**35,039**	**2,095,320**	**5980%**	**17.8%**

There were no reported demand savings for smart power bars (9,733 units) in the tracking data. Due to this issue in the tracking data, the NMR team could not calculate an RR. The NMR team corrected demand savings for power bars in the verification process and accounted for 4.8% of the program's gross verified demand savings (Table 11).

Table 11: PY2020 Power Bar Demand Savings

Component	Reported Demand (kW)	Gross Verified Demand (kW)	RR	Proportion of Verified HAP Savings
Smart Power Bar	--	55.4	N/A	4.8%
Power Bar Total	**--**	**55.4**	**N/A**	**4.8%**

3.2.2.5 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. 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 three. The NMR team updated the deemed savings values for pipe wrap, aerators, and showerheads during the PY2019 substantiation sheet review.

[15] Smart power bar savings values reflect tier 2 advanced power bars, which are installed with audiovisual (AV) equipment. The NMR team confirmed in the PY2019 evaluation this product and installation scenario with the program delivery vendor staff.

Table 12 displays the impact results for DHW end-use measures. The overall RR for this end-use category was low (62%), and only accounts for 2.8% of gross verified savings for HAP.

Table 12: PY2020 DHW Energy Savings

DHW Measure	Reported Savings (kWh)	Gross Verified Savings (kWh)	RR	Proportion of Verified HAP Savings
Efficient Aerators (bathroom) < 3.8 litres per minute (Lpm)	36,211	23,656	65%	0.2%
Efficient Aerators (kitchen) < 5.7 Lpm	102,032	102,776	101%	0.9%
Efficient Showerhead (handheld) < 4.8 Lpm	150,269	96,831	64%	0.8%
Efficient Showerheads (standard) < 4.8 Lpm	88,105	85,205	97%	0.7%
Hot Water Tank Pipe Wrap - ½" (per foot)	128,331	18,329	14%	0.2%
Hot Water Tank Pipe Wrap - ¾ " (per foot)	28,257	5,488	19%	<0.1%
Hot Water Tank Wrap – Fiberglass R10	3,968	2,736	69%	<0.1%
DHW Total	**537,172**	**335,021**	**62%**	**2.8%**

Table 13 presents the reported and gross verified demand savings for the DHW end-use measures. The reported savings were consistent in PY2020 for DHW measures. The adjustment to hot water pipe wrap were drivers for the low RRs. In addition, the PY2019 updates on measure savings are driving some additional impact on the RRs. Overall, the demand savings RR for hot water end-uses was 62%.

Table 13: PY2020 DHW Demand Savings

DHW Measure	Reported Demand (kW)	Gross Verified Demand (kW)	RR	Proportion of Verified HAP Savings
Efficient Aerators (bathroom) < 3.8 Lpm	3.7	2.3	63%	0.2%
Efficient Aerators (kitchen) < 5.7 Lpm	9.8	10.0	103%	0.9%
Efficient Showerheads (handheld) < 4.8 Lpm	14.8	9.4	64%	0.8%
Efficient Showerheads (standard) < 4.8 Lpm	8.7	8.3	96%	0.7%
Hot Water Tank Pipe Wrap - ½" (per foot)	13.3	1.9	14%	0.2%
Hot Water Tank Pipe Wrap - ¾ " (per foot)	2.8	0.5	19%	<0.1%
Hot Water Tank Wrap – Fiberglass R10	0.4	0.3	75%	<0.1%
DHW Total	**53.4**	**32.8**	**61%**	**2.8%**

3.2.2.6 Miscellaneous Measures

Table 14 displays the results for the remaining measures offered by HAP. Like hot water measures, the NMR team verified savings for the miscellaneous measures 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. The RR for block heater timers is directly correlated with the ISR and HOU findings from the participant survey, which found that block heater timers were not used as frequently and for a shorter duration than assumed in the substantiation sheet value. The indoor clothes drying racks and programmable line voltage thermostat savings values were updated as a part of the PY2019 prescriptive measure review that resulted in a reduction of prescribed savings. Smart thermostats were offered as a measure for HAP participants in PY2020. 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.

Table 14: PY2020 Miscellaneous Measures Energy Savings

Measure	Reported Savings (kWh)	Gross Verified Savings (kWh)	RR	Proportion of Verified HAP Savings
Block Heater Timer (just timer)	363,432	68,115	19%	0.6%
Indoor Clothes Drying Rack	749,616	637,534	85%	5.4%
Programmable Thermostat – Line Voltage	175,479	96,317	55%	0.8%
Programmable Thermostat – Low Voltage	59,463	56,264	95%	0.5%
Smart Thermostat – Line Voltage	227,039	176,506	78%	1.5%
Smart Thermostat – Low Voltage	26,839	24,228	90%	0.2%
Total	**1,601,868**	**1,058,964**	**66%**	**9.0%**

Table 15 presents the reported and gross verified demand savings for the miscellaneous measure category. 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. The PY2020 RR is not as high as in PY2019 due to more consistent application of reported demand savings for the clothes drying racks. 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.

Table 15: PY2020 Miscellaneous Measures Demand Savings

Measure	Reported Demand (kW)	Gross Verified Demand (kW)	RR	Proportion of Verified HAP Savings
Block Heater Timer (just timer)	--	--	--	--
Indoor Clothes Drying Rack	502.3	426.5	85%	36.8%
Programmable Thermostat – Line Voltage	--	--	--	--
Programmable Thermostat – Low Voltage	--	--	--	--
Smart Thermostat – Line Voltage	--	--	--	--
Smart Thermostat – Low Voltage	8.0	4.2	52%	0.4%
Total	**510.3**	**430.6**	**84%**	**37.2%**

3.3 Comparison of Impact Results with Previous Evaluation Years

Table 16 presents the results of HAP activities over the past few years.[16] The program participation has ramped up over time, but that has not always resulted in more verified energy savings on an annual basis. However, PY2020 saw the largest amount of net first year savings since PY2016.

The primary reason for the decay of savings over time is adjustments for lighting measures and adjustments to other measures delivered by HAP that often result in reduced energy and demand savings due to increased baselines that reduce the savings associated with the installed efficiency measure. However, the amount of verified energy savings attributed to weatherization projects increased by nearly 800 MWh in PY2020 compared to PY2019, with more projects with weatherization projects completed in PY2020. Weatherization projects have a longer EUL than other measures in the HAP program and can drive lifetime savings higher. In addition, the HAP program transitioned from delivering power bar with timers to smart power bars, which contributed to increased savings on a per project basis.

Additional factors that impacted net verified first year savings include updated gross verified per-unit savings (based on the PY2019 substantiation sheet updates), the correction of smart power bar savings (using historic power bar with timer savings values), and ISR and HOU updates.

The program participation values in Table 16 are reflective of the number of unique Application IDs (also known as projects) identified in the program's Tracking Data. In PY2020, there were 16 instances where the same single-family household had more than one Application ID; because of this, these households are represented twice in the Program Participation total. A participant may receive more than one Application ID if a second site visit is required to the same household. Given this, a total of 11,402 unique households completed participation in the program in PY2020.

It should be noted that Table 16 includes results from two different frameworks: the Conservation First Framework (CFF) which covers the PY2016-PY2018 time period and the Interim Framework

[16] The program administered a limited impact evaluation in PY2018.

(IF) which covers PY2019-PY2021 time period. There are additional true-up projects from the CFF that were evaluated in 2019 and 2020 but are not included with the results associated with the IF columns in the table.

Table 16: Comparison of Program Performance over Time

Framework	CFF					IF	
Program Metric	PY2016	PY2017	PY2018[a]	PY2019[b]	PY2020	PY2019[b]	PY2020
Program Participation (Projects)	5,066	6,910	4,609	8,739	334	9,988	11,440
Program Reported Energy Savings (MWh)	10,485	15,136	10,842	12,485	679	10,067	12,117
Program Reported Demand Savings (MW)	4.68	7.84	165	79.4	0.05	4.20	1.24
Program RR, Energy	0.72	0.54	0.65	0.65	0.65	0.86	0.97
Program RR, Demand	0.18	0.15	0.01	0.02	1.36	0.22[c]	0.94
NTGR	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Program Net First Year Energy Savings (MWh)	7,590	8,241	7,047	8,140	443	8,647	11,765
Program Net First Year Demand Savings (MW)	0.83	1.20	0.99	1.75	0.06	0.91[c]	1.16
Net Verified Lifetime Energy Savings (MWh)	125,109	149,839	N/A	N/A	N/A	117,753	155,310

[a] PY2018 was a limited impact evaluation that leveraged previous years' evaluations to develop RRs for net verified first year savings.
[b] PY2019 true-up results are not included in this table.
[c] Weatherization measures did not include demand savings in the PY2019 evaluation. The values in this table reflect adjustments made to account for weatherization demand savings, which added a total of 14.4 kW in demand savings.

Figure 5 and Figure 6 show how the net verified first year savings and net verified first year demand have changed at the participant level over time. Values are derived by taking the aggregated verified net first year savings values over the number of participant projects for each year and each category. The different frameworks are presented separately within the figures. All categories have seen increases in PY2020 from PY2019 for the IF (the current framework).

Figure 5: Verified First Year Net Energy Savings Per Participant (kWh/year)

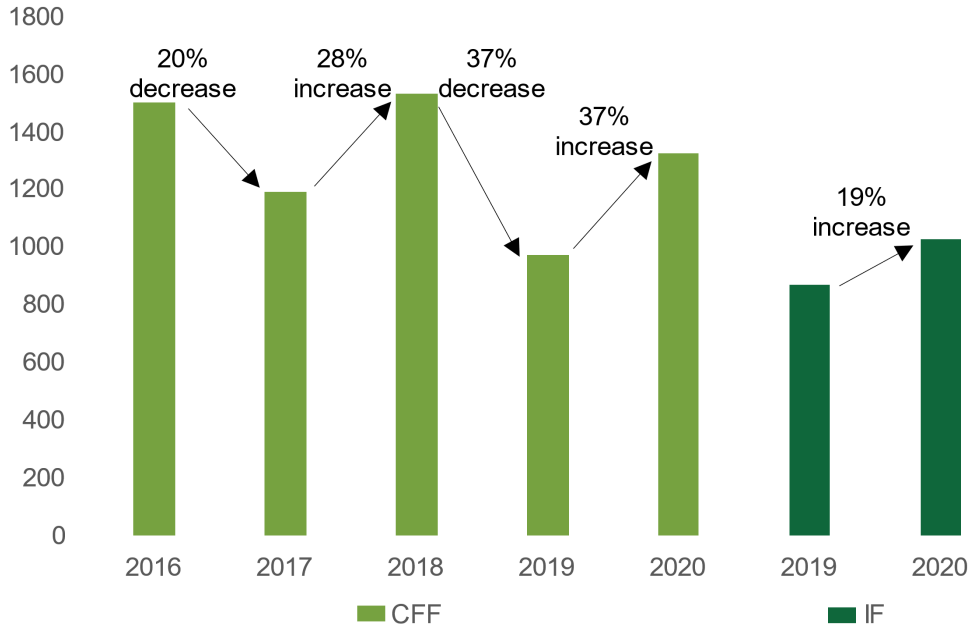


Figure 6: Verified First Year Net Demand Savings per Participant (kW/Year)

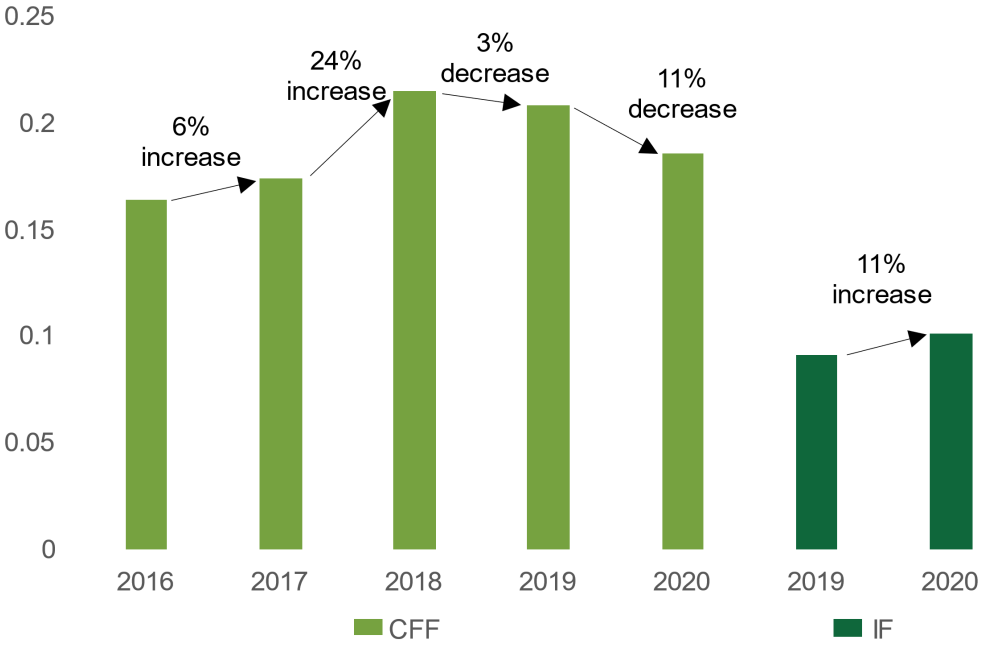
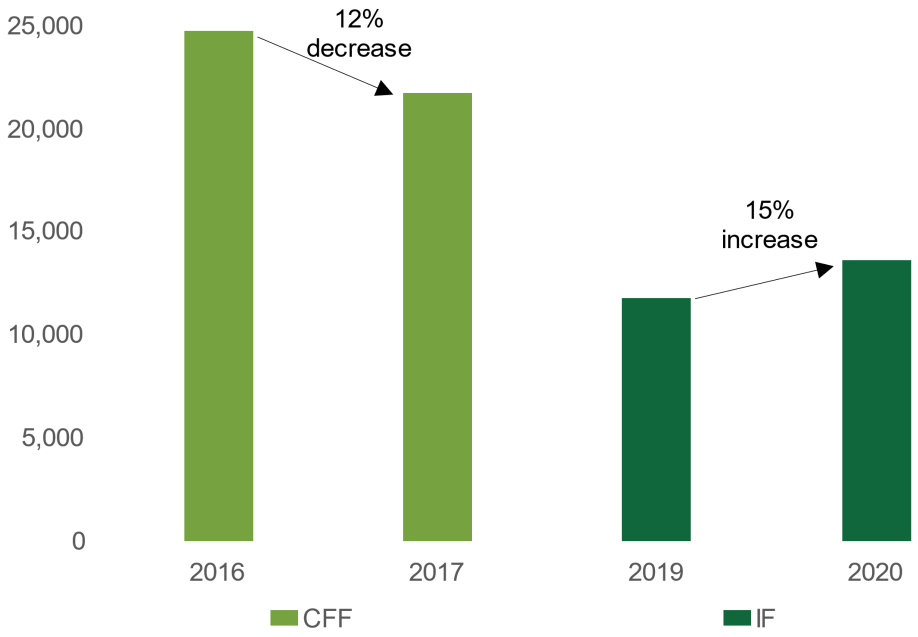


Figure 7 shows the net verified lifetime energy savings per participant. Note that lifetime savings values are not included after 2017 due to limited information on lifetime savings amounts. Lifetime savings for the IF increased by 15% in PY2020.

Figure 7: Net Verified Lifetime Energy Savings Per Participant (kWh)



3.4 In-Service Rates

Figure 8 displays the energy-efficiency upgrades respondents confirmed receiving. Most respondents (80%) received LEDs; on average, respondents received 19 LEDs. Additionally, most respondents received a power bar (71%) and/or a drying rack (68%). Nearly two-fifths (38%) of respondents received a refrigerator.

Figure 8: Energy-Efficiency Upgrades that Program Participants Received (n=846)

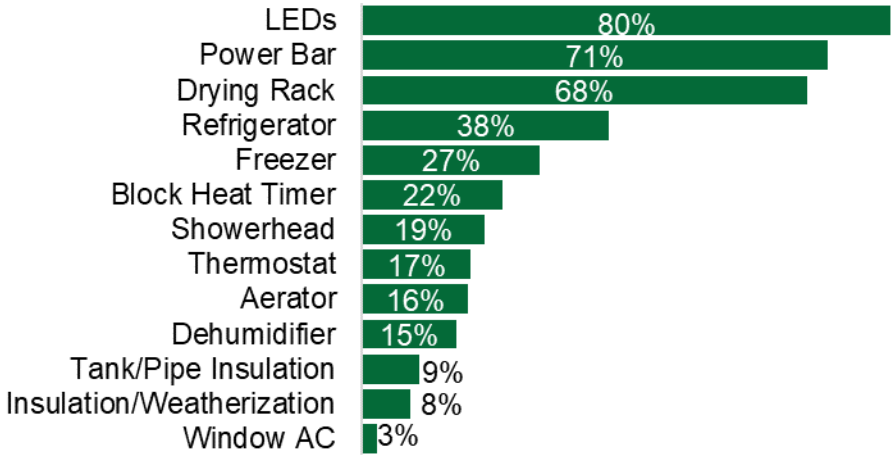


Figure 9 displays the ISRs for respondents' upgrades. Nearly all of the refrigerators (99%), thermostats (98%), freezers (98%), dehumidifiers (98%), and LEDs (97%) respondents received were still installed and functional at the time of the survey. Only two upgrades had ISRs less than 90%: window ACs (89%) and block heat timers (87%).

Figure 9: Energy-Efficiency Upgrade ISRs

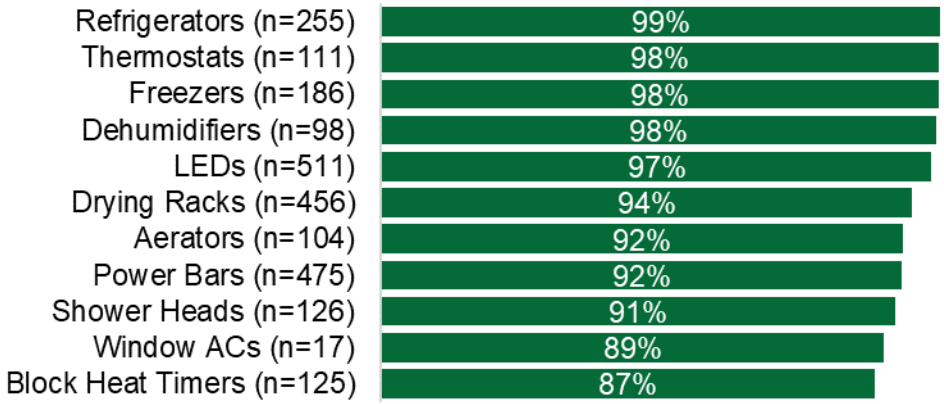


Figure 10 compares the PY2019 and PY2020 ISRs. The PY2020 ISRs are within three percentage points of the PY2019 ISRs for most measures. The exceptions are aerators and drying racks, for which the ISRs increased by five percentage points between PY2019 and PY2020.

Figure 10: Comparison of PY2017 and PY2019 ISRs

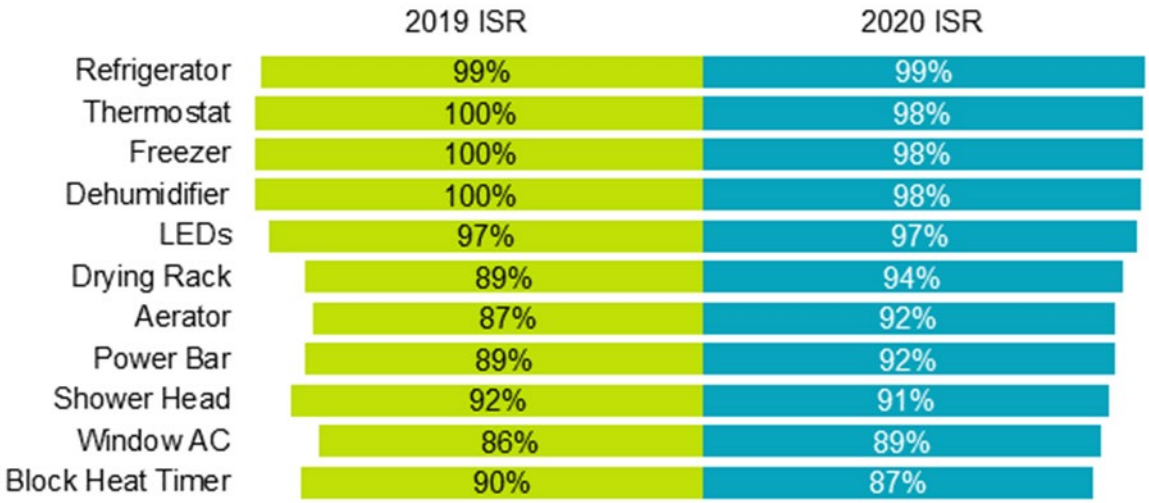
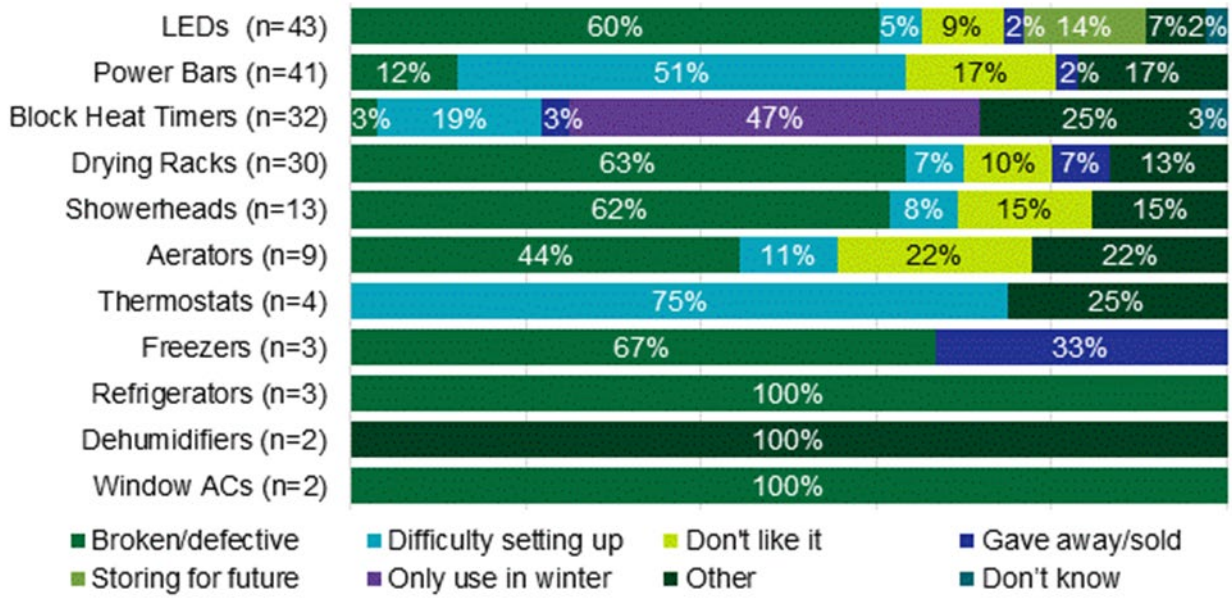


Figure 11 displays the reasons respondents gave for uninstalling or removing upgrades. The most common reason for uninstalling or removing LEDs (60%), drying racks (63%), showerheads (62%), aerators (44%), freezers (67%), refrigerators (100%), and window ACs (100%) was that they were broken or defective. Fourteen percent of respondents who uninstalled or removed LEDs were storing them for future use. Over one-half (51%) of respondents who uninstalled or removed power bars had difficulty setting them up. Almost one-half (47%) of respondents who uninstalled or removed block heat timers did so because winter had passed. Around one-fifth of respondents who uninstalled or removed power bars (17%), aerators (22%), or showerheads (15%) simply did not like them.

Figure 11: Reasons Respondents Uninstalled or Removed Upgrades



3.5 TRUE-UP PROJECTS

As a part of the PY2020 evaluation, the NMR team conducted a true-up for PY2019 projects that had not officially been reported before the PY2019 evaluation occurred but were installed and completed in PY2019.[17] The NMR team calculated the gross and net verified savings for the PY2019 true-up projects based on the evaluated PY2019 RRs. The NMR team applied the measure-level RRs or the exact savings values to the PY2019 true-up gross savings values.

The NMR team used two primary methods to calculate the gross and net verified savings for the PY2019 true-up projects due to different reported savings values between the program tracking data:

1. Exact savings method: The NMR team applied the exact savings method to measures with prescribed savings values (i.e., non-weatherization measures). This method accounted for different reported savings values between the PY2019 evaluated project

[17] Note that additional PY2019 projects, which were not available for the PY2020 evaluation and reporting timeline, will be included in the PY2021 evaluations true-up process along with PY2020 projects.

and PY2019 true-up project data sets, which resulted in different verified savings values when RRs were applied. This method ensured that evaluated savings values aligned between the PY2019 evaluation and the PY2019 true-up projects.

2. RR method: The NMR team applied the evaluated PY2019 RRs to all weatherization projects and to measures that were not covered in the PY2019 evaluation (i.e., smart thermostats and freezers <12 cubic feet). This method allowed verified savings calculations for the weatherization projects, which have custom savings based on project-specific characteristics.

The implications of applying these two methods essentially create a consistent result when comparing between evaluated PY2019 projects and the PY2019 true-up projects. For example, an 11-watt LED A-line light bulb has the same prescribed savings value between both scenarios.

The results from the PY2019 true-up projects are presented in Table 17. There were a total of 743 PY2019 true-up projects that occurred in 738 homes. The results have been aggregated with the evaluated PY2019 projects in Table 18.

Table 17: PY2019 True-Up Project Results

Program Metric	Energy (MWh)	Demand (MW)
PY2019 True-Up Reported	1,119	0.12
PY2019 True-Up Gross Verified Savings	1,088	0.11
RR	97%	93%

Table 18: HAP PY2019 Evaluated and PY2019 True-Up Aggregated Results

Metric	Units	PY2019 Evaluated	True Ups	Aggregated PY2019 results
Participation	Projects	9,988	743	10,731
	Homes	9,968	738	10,706
Reported Savings	MWh	10,067	1,119	11,186
	MW	4.20	0.12	4.33
Gross RR	MWh	0.86	0.97	0.87
	MW	0.22	0.93	0.24
Gross Verified Savings	MWh	8,647	1,088	9,735
	MW	0.91	0.11	1.03
NTGR	--	1.00	1.00	1.00
Net Verified Annual Savings (First Year)	MWh	8,647	1,088	9,735
	MW	0.91	0.11	1.03
Net Verified Annual Savings (PY2022)	MWh	8,647	1,088	9,735
	MW	0.91	0.11	1.03

In addition, for the true-up process, the NMR team adjusted the demand savings for weatherization projects that were evaluated in PY2019. The previous evaluation did not include savings from weatherization projects; however, this has been adjusted and accounted for as a

part of the true-up process. The results of the additional demand savings from these projects are included in Table 19. Demand savings for weatherization projects are a function of the energy savings. To calculate verified demand savings for the PY2019 weatherization projects, the NMR team applied the weatherization end-use load profile to the verified energy savings values. This accounted for no reported demand savings for these projects in the PY2019 program tracking data. Note that the previous year comparison (Section 3.3) includes the above adjusted weatherization demand savings but does not incorporate the true-up results from the PY2019 projects.

Table 19: PY2019 Verified Demand Savings Adjustment to Weatherization Projects

Program Metric	Energy (MWh)	Demand (MW)
PY2019 Weatherization Adjusted Reported	N/A	0.00
PY2019 Weatherization Adjusted Gross Verified and Net First Year Savings	N/A	0.0144
RR	N/A	N/A

Cost-Effectiveness Evaluation

The cost-effectiveness results are presented in Table 20. The program did not pass the Total Resource Cost (TRC) test nor did it pass the Program Administrator Cost (PAC) test because both tests had benefits less than their respective costs. This is consistent with findings for low income programs in other jurisdictions. Additionally, regulations in other jurisdictions commonly do not require low income programs to meet cost effectiveness.[18]

Table 20: Program Level Cost-Effectiveness Key Metrics

Cost-Effectiveness Test	PY2019	PY2020	PY2019 and PY2020
TRC			
TRC Costs ($)	7,767,042	13,818,653	21,585,695
TRC Benefits ($)	4,469,614	6,315,723	10,785,337
TRC Net Benefits ($)	-3,297,428	-7,502,930	-10,800,358
TRC Net Benefit (Ratio)	0.58	0.46	0.50
PAC			
PAC Costs ($)	10,377,767	13,818,653	24,196,420
PAC Benefits ($)	3,481,016	5,093,366	8,574,381
PAC Net Benefits ($)	-6,896,751	-8,725,288	-15,622,039
PAC Net Benefit (Ratio)	0.34	0.37	0.35
Levelized Delivery Cost			
$/kWh	0.12	0.13	0.13
$/kW	1,225.96	1,308.53	1,271.79

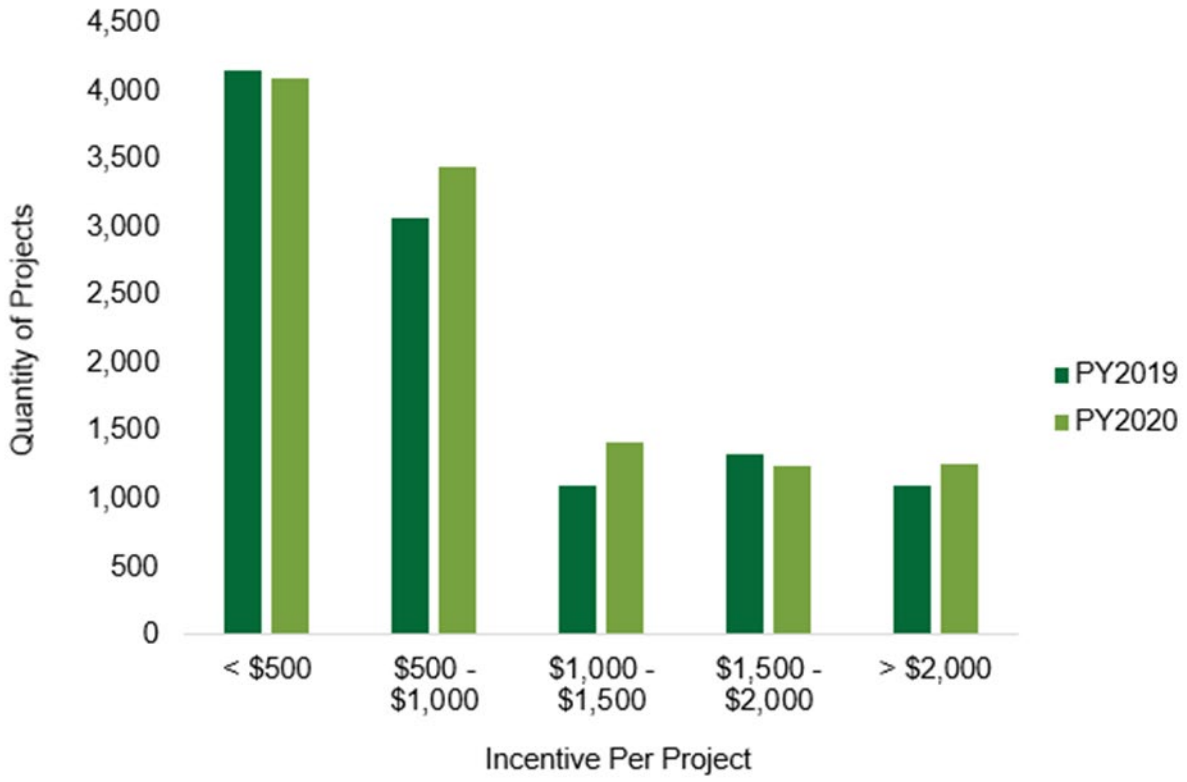
Between PY2019 and PY2020, TRC costs went up by 78% and benefits went up by 41%, indicating that the benefits have not stayed in line with the corresponding costs. A potential factor in this discrepancy is the larger quantity of weatherization and appliance measures in PY2020 which have TRC ratios below 1.0. For example, freezers and refrigerators, which have measure level TRC ratios of less than 0.2, had increases in measure quantities of 48% and 28%, respectively, between PY2019 and PY2020.

Figure 12 compares the frequency of incentive level per project in PY2019 and PY2020, in categories of $500 increments. In PY2020, 66% of the projects had an incentive less than $1,000 and 89% of the projects had an incentive less than $2,000, which indicates that it was common

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

for project costs to be much lower than the cap for the program of $13,000 per home. This is closely matched by the PY2019 incentive data, where 67% of the projects had an incentive less than $1,000 and 90% of the projects had an incentive less than $2,000. With the program having fixed costs to operate, regardless of participation volume or depth of savings per site (e.g., program-level administration or technician cost per site), the relatively low incentive amount per site may indicate that there is still opportunity for deeper savings to be achieved at more homes. Since the program implements all applicable measures that the program offers and customers will accept, this may be an opportunity for the program to offer new additional measures.

Figure 12: Frequency of Incentive Amount Per Project in PY2019 and PY2020



Avoided Greenhouse Gas Emissions

The NMR team used the IESO's *CDM Energy Efficiency 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 21 presents the results of these calculations for both PY2019 and PY2020.

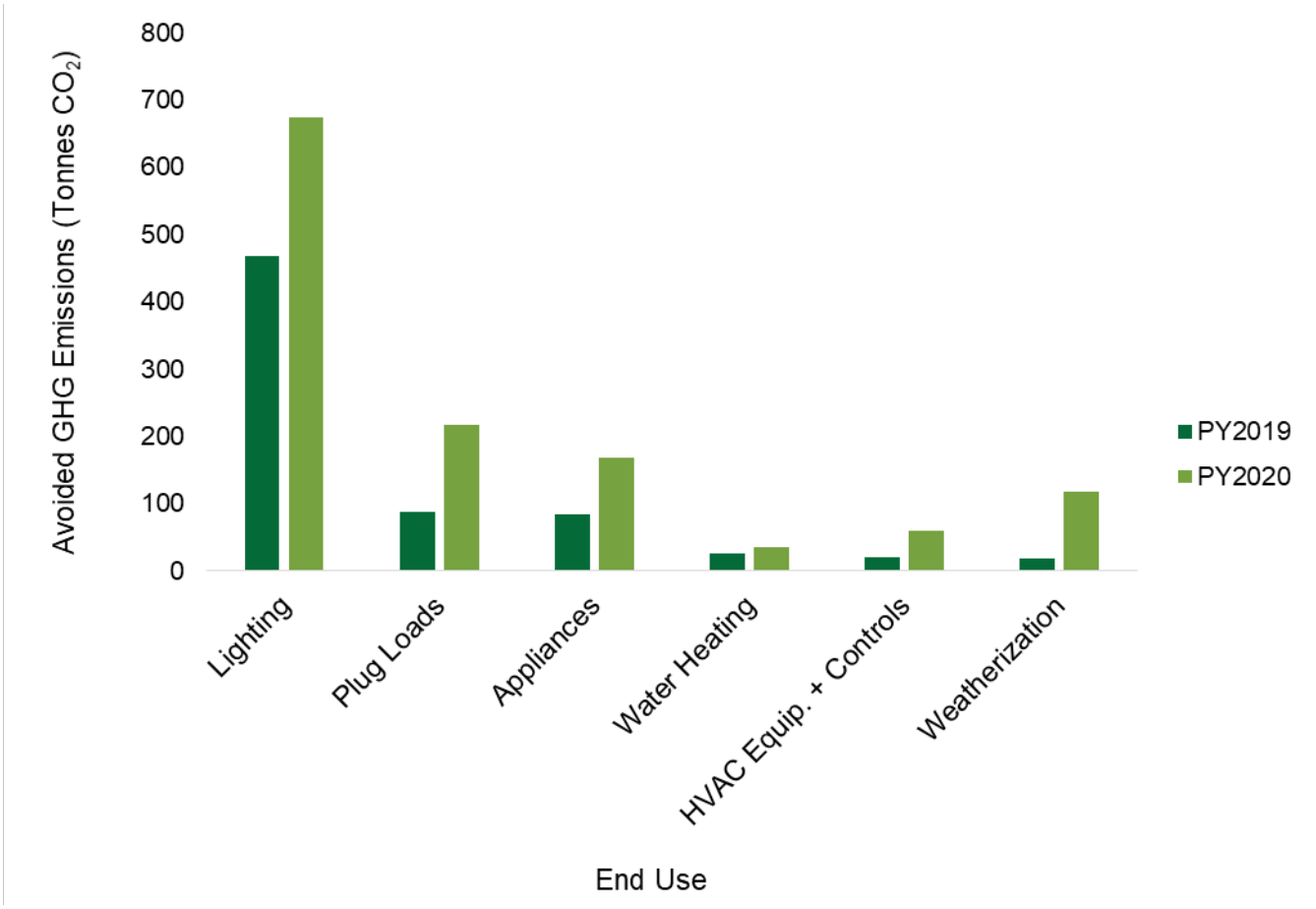
Table 21: Avoided GHG Emissions in PY2019 and PY2020

Avoided (Tonnes CO_2 equivalent)	PY2019	PY2020
First Year	706	1,274
Lifetime	16,470	22,718

Figure 13 compares avoided GHG emissions by end use and program year. Each end use produced an increase in GHG emissions reductions between PY2019 and PY2020. The largest relative increases between program years were building shell (557% of PY2019), and power bar (267% of PY2019).

Building shell's large increase in avoided GHG emissions is a function of its much larger savings contribution to the program in PY2020. As indicated in Section 3.2.2.3, the weatherization measure quantity in PY2020 was almost four times that of the weatherization measure quantity in PY2019. Similarly, the plug load end use experienced a significant increase in avoided GHG emissions due to the dramatic increase in installed smart power bars. In PY2019, 1,068 smart power bars were installed, while in PY2020, there were 9,733 installed.

Figure 13: Comparison of Avoided GHG Emissions by End Use and Program Year



6

Process Evaluation

This section outlines the process evaluation results. Details regarding the process methodology can be found in Section 2.2 and Appendix A.2.

6.1 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 HAP in PY2020.

6.1.1 High-Level Results

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

- Both the IESO and the program delivery vendor staff indicated that the overall goals and design of the program was the same as years before but included an additional focus related to overcoming the barriers that the COVID-19 pandemic imposed.
- Program delivery vendor staff reported relatively high levels of customer engagement during PY2020, exceeding their target enrollments due to their effective response to the COVID-19 pandemic and the increased demand for energy savings.
- Besides program deployment and accessibility issues stemming from the COVID-19 pandemic, common program barriers identified by staff were the relatively limited marketing budget and in turn, a potential lack of program awareness for HAP.
- Program improvement suggestions mentioned by staff included finding meaningful ways to collaborate with gas utilities and to address gaps in marketing resources and program awareness.

6.1.2 Program Engagement and Delivery

Program delivery vendor and IESO staff indicated that the overall goal of the program was the same as years before but included an additional focus related to overcoming the barriers that the COVID-19 pandemic imposed.

Both program delivery vendor and IESO staff reported a relatively smooth and successful response to the COVID-19 pandemic. Staff described the COVID-19 pandemic inhibiting program delivery and effectiveness, limiting in-person deliveries and in-home visits, and causing temporary program suspensions early in the year as well as later in the fall when lockdowns were in place.

Despite this, program delivery vendor staff reported strong program results with no significant changes to enrollment in comparison to PY2019, including surpassing their enrollment target. Program delivery vendor staff attributed this success to a well-executed response to the COVID-19 pandemic, including taking steps to mitigate risks. These pivots included managing enrollment by phone and e-mail, creating a waitlist during lockdown, developing safety protocols for in-person visits, additional safety training for auditors and contractors, and reacting to the heightened customer demand for electricity savings.

IESO and program delivery vendor staff utilized a variety of quality assurance procedures to ensure the program was delivered effectively. For IESO, these procedures included data validation checks for the participant database (e.g., to make sure incentive checks are correct) during entry as a part of an automated process and at the end for anomalous values. For program delivery vendors, these procedures included risk assessment, customer satisfaction, and contractor surveys; post-audit checks of all files; post-assessments for homes; and consultations with infectious disease experts to develop public safety protocols.

6.1.3 Program Strengths

IESO staff indicated that one of the greatest strengths of the program is that it provides no-cost energy-efficiency opportunities to customers in Ontario. They also noted that HAP has been a steadying force in the market over the last several years for installation services and the energy-efficiency industry (e.g., with respect to auditors, contractors, and supply chain actors), especially as policies have changed over time.

Additionally, both IESO and delivery vendor staff stressed that the program's ability to quickly respond to the changing conditions imposed by the COVID-19 pandemic was a great strength. They praised strong communication methods and channels to the program's success.

Program delivery vendor staff also stressed the benefit of the program in reducing hydro and electricity bills for customers, especially during the COVID-19 pandemic, as well as providing access to upgrades for aging homes. The program allowed customers to be able to retrofit their homes quickly to immediately realize the benefits of long-term savings. Program delivery vendor staff also found that the program aligned with the customer segment in supplying energy-efficiency offerings to the high demand for energy savings.

IESO staff reported that the program delivery vendor was very effective in terms of ensuring they had enough auditor and contractor resources to mobilize to all corners of the province as needed.

6.1.4 Program Barriers and Opportunities

IESO and program delivery vendor staff discussed some common program barriers with the primary among those being the COVID-19 pandemic. Commonly reported was skepticism amongst participants about the safety of in-home visits even with the assurance of safety and public health protocols. However, that unease surrounding the pandemic dissipated as time passed. Another barrier that later became less significant was the need to develop new procedures and protocols to deal with the pandemic (e.g., developing additional training and guidance for auditors and contractors).

Another pandemic-related barrier noted by IESO staff was that initial enrollments were delayed, causing a delay in appliance delivery and weatherization, which affected the ability to complete projects as planned. The program eventually caught up on many of the delayed audits and installations as restrictions eased around the province. There have also been ongoing supply chain interruptions and issues associated with some measures.

Additionally, IESO staff noted that many customers served by HAP had, and continue to have, competing priorities beyond energy efficiency, especially during the pandemic.

Another barrier reported by both IESO and program delivery vendor staff was the lack of marketing for HAP. Program delivery vendor staff indicated that there may be relatively low program awareness in the marketplace and pointed out that HAP has been relatively reliant on other programs to help it gain awareness. For example, they described how HAP has seen a decrease in enrollment following the end of the Affordability Fund Trust (AFT) program. To address marketing and program awareness, both IESO and delivery vendor staff indicated that the marketing budget may need to be examined moving forward, especially with the closure of AFT program.

Program delivery vendor staff also noted a challenge created by having multiple similar programs in the market (e.g., having separate CDM programs for natural gas and electricity). They report that this duplication of programs causes issues with cohesion and can lead to customer confusion. IESO staff indicated there may be an opportunity to collaborate with gas utilities in Ontario going forward, especially in urban areas that are nearly exclusively gas-heated in the winter.

6.2 Auditor and Contractor Perspectives

The following subsections highlight the feedback received from the HAP auditor and contractor survey.

6.2.1 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 very satisfied with the training and support provided by the program delivery vendor (average rating of 4.6 on a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “very satisfied”).
- Auditors and contractors did not find it difficult to perform blower door tests at customer sites (average rating of 4.5 on a scale from 1 to 5, where 1 meant “unduly difficult and complicated” and 5 meant “not difficult at all”).
- Auditors and contractors did not find it difficult to adhere to health and safety standards relevant to the crisis (average rating of 4.1 on a scale from 1 to 5, where 1 meant “unduly difficult and complicated” and 5 meant “not difficult at all”).
- Auditors and contractors perceived the greatest barriers to program participation to be skepticism among customers that the program is free (mentioned by 82% of respondents) and lack of awareness among customers that the program exists (mentioned by 80% of respondents).
- Auditors and contractors provided recommendations for program improvement with most of the recommendations relating to offering additional equipment or services. Specifically, respondents often suggested clothes washers/dryers, stoves, and air source heat pumps.

6.2.2 Auditor and Contractor Profile

Of the 49 respondents who completed the survey, 30 performed in-home energy audits (auditors), ten installed program-eligible equipment (contractors), and nine individuals both performed in-home energy audits and installed program-eligible equipment. Responding auditors and contractors indicated that they have an average of 2.8 full time employees and 1.3 part time employees working at their company. The average number of years respondent companies had been in business was 11.

6.2.3 Program Experience

Figure 14 displays the year respondents began working with the program. Around one-half (49%) of respondents had been working with the program since 2015 or earlier.

Figure 14: Year Began Working with HAP (n=49)

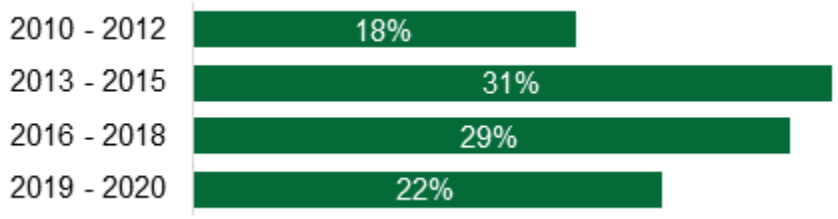


Figure 15 displays the number of projects respondents reported completing in PY2020 through HAP. Most respondents (44 of 49) worked on single-family homes, while just over one-third (18) of respondents worked on multifamily homes. Most respondents (75%) who worked on single-family homes completed between 100 and 500 single-family projects in PY2020, while most (78%) who worked on multifamily homes completed less than 100 multifamily projects in PY2020. Including both single-family and multifamily projects, auditors completed 259 projects on average, contractors completed 184 projects on average, and respondents who served both as an auditor and contractor completed 267 projects on average in PY2020.

Figure 15: Number of HAP Projects

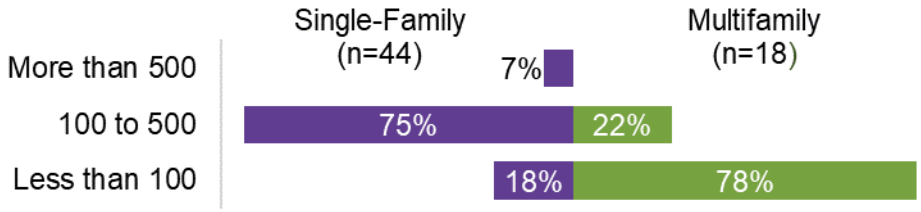
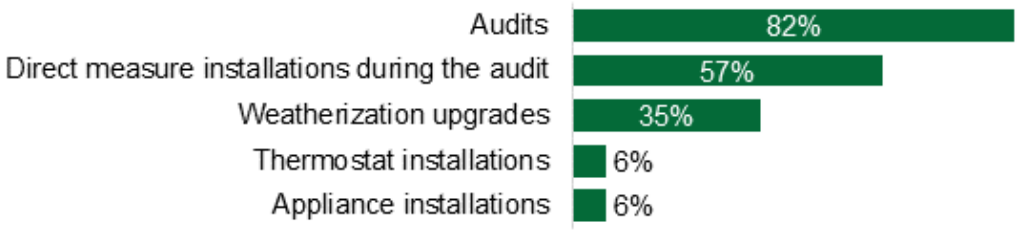


Figure 16 displays the type of work respondents performed for the program in PY2020. Most respondents (82%) conducted audits, over one-half (57%) performed direct measure installations during the audit, and about one-third (35%) performed weatherization upgrades. Very few respondents (6%) installed thermostats or appliances.

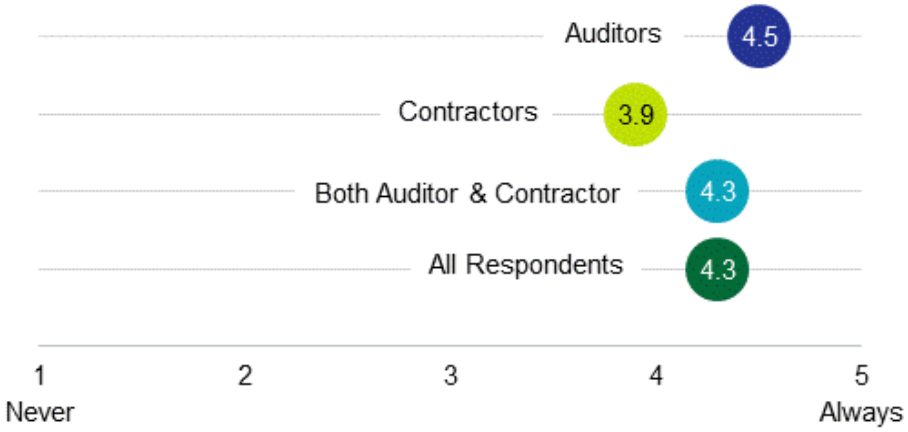
Figure 16: Type of Work Performed for HAP (n=49, Multiple Response)*



*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 17 displays the average rating among respondents by their role. The average rating among all respondents was 4.3, indicating that they inform customers about the program quite often. Auditors indicated that they inform customers about the program a little more often than contractors (4.5 compared to 3.9). Respondents who do not inform customers about the availability of the program said that they do not do so because they do not view it as their role (3 respondents) with one respondent noting that they encourage participating customers to discuss the program with their neighbours.

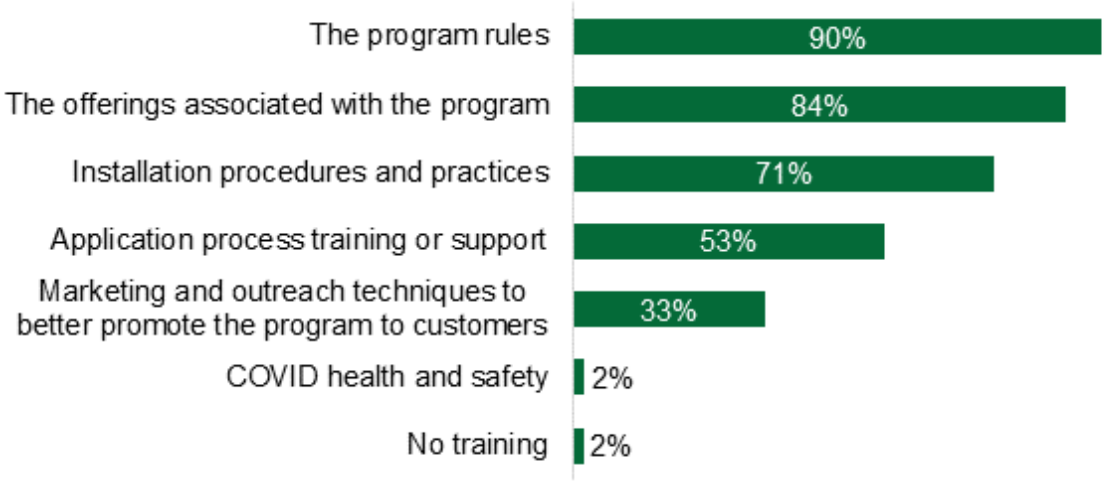
Figure 17: How Often Respondents Inform Customers about HAP (n=41)*



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

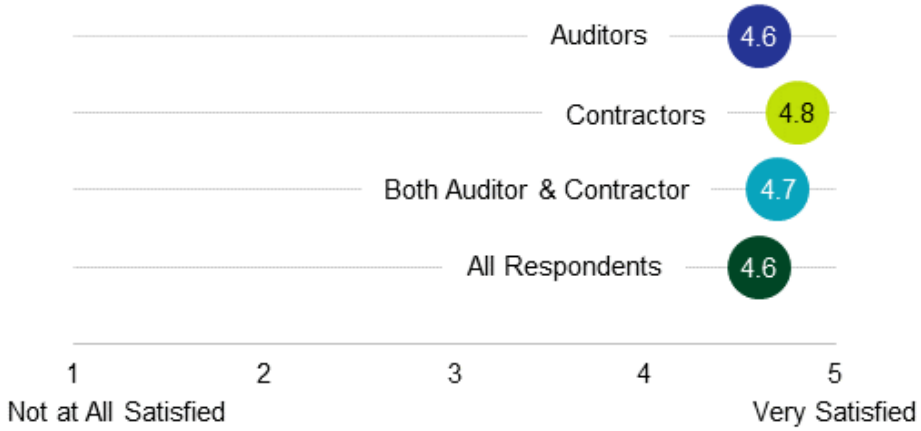
Figure 18 displays the types of training respondents received from the program delivery vendor. Most respondents received training on the program rules (90%), the offerings associated with the program (84%), and installation procedures and practices (71%). About one-half (53%) of respondents received training on the application process and one-third (33%) received training on marketing and outreach techniques.

Figure 18: Type of Training from Program Delivery Vendor (n=49, Multiple Response)



As shown in Figure 19, 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 4.6. One respondent reporting lower satisfaction with the training indicated they were dissatisfied with the changing rules and procedures.

Figure 19: Satisfaction with Training (n=48)*

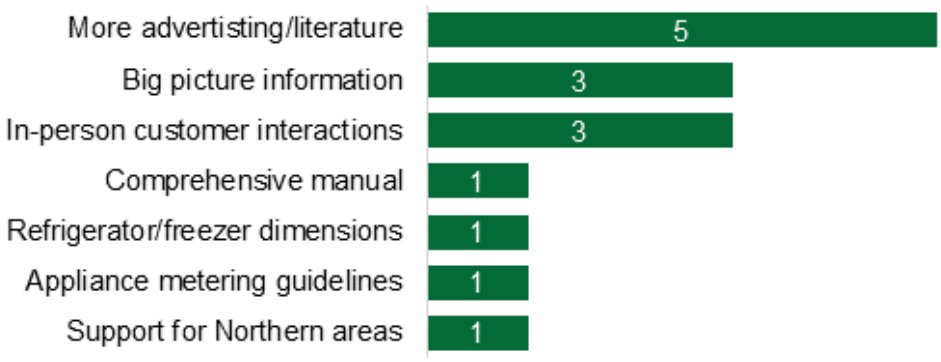


*One respondent is excluded from this figure due to reporting they did not receive training.

Eight respondents provided feedback on communications and support they had received for the program; all of the feedback was positive. Respondents said that staff had been supportive in areas such as being available for questions, providing answers in a timely fashion, providing clear instructions, and helping to coordinate bookings. Several respondents added comments commending staff, including, "The support from the program delivery vendor has been tremendous," and, "The program delivery vendor is a top tier company to deal with, great at communication when in need of fast responses in variety of situations."

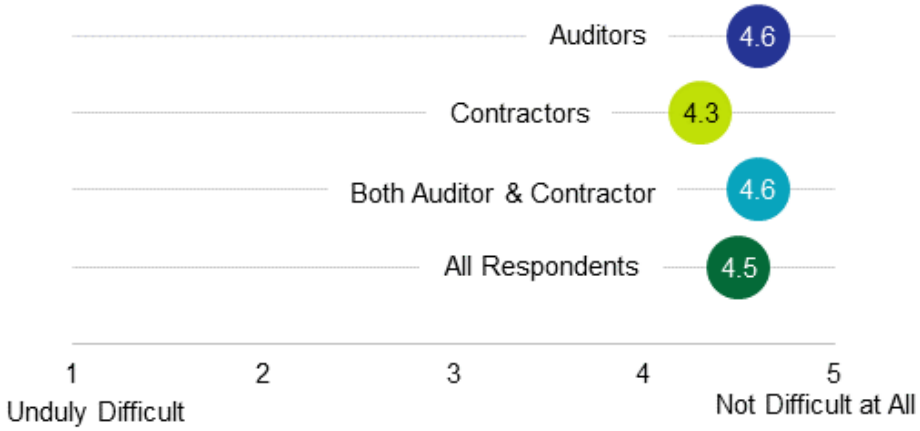
Fifteen of the 49 respondents suggested additional training or support HAP could provide to auditors and contractors. As shown in Figure 20, the most commonly suggested item (requested by five respondents) was more program advertising and/or printed literature. Additionally, three respondents requested more "big picture" information on the program, such as overall objectives, plans, and targets. Another three respondents requested additional training and support with in-person customer interactions.

Figure 20: Additional Training and Support (n=15)



Using a scale from 1 to 5, where 1 meant "unduly difficult and complicated" 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 21, the average rating among all respondents was 4.5, indicating that it was not difficult. Additionally, only 7% of respondents (all of whom were auditors) thought that the blower door test discouraged auditors or contractors from working with the HAP.

Figure 21: Difficulty of Performing Blower Door Test (n=41)*

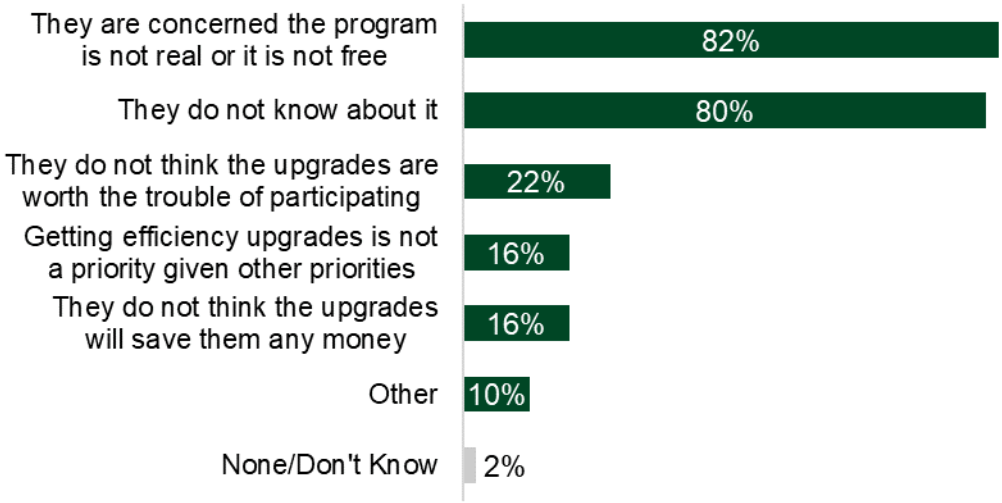


*Two respondents are excluded from this figure due to reporting they did not know how difficult to test was to perform.

6.2.4 Program Barriers

Figure 22 displays the barriers respondents thought prevent more households from participating in HAP. The most commonly identified barriers were skepticism that the program is not real or is not free (82%) and a lack of program awareness (80%). One respondent noted, "The program is gaining support, and people are becoming less skeptical due to being better informed." However, these results suggest there is still ample opportunity to increase HAP awareness and assurance among customers. It should be noted that the IESO has encountered a number of companies which purport to be affiliated with the IESO, other public agencies, or utilities, in order to mislead customers into making equipment purchases or signing up for services (e.g. hot water tank rentals). These misleading market actors likely increase the skepticism around HAP and other legitimate support programs.

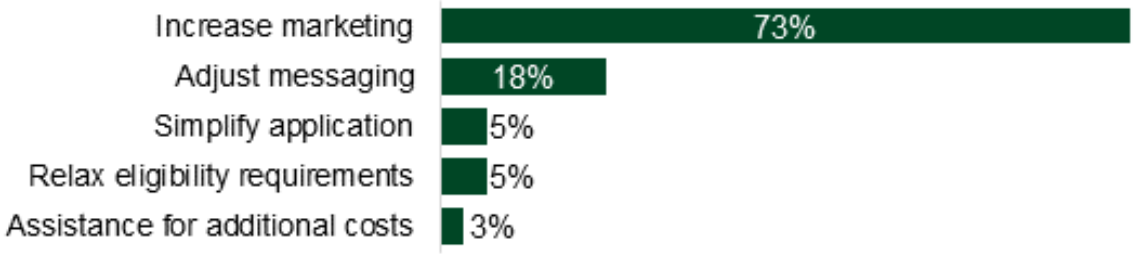
Figure 22: Barriers to HAP Participation (n=49, Multiple Response)*



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

Figure 23 displays respondents' recommendations for overcoming barriers to HAP participation, the most common of which was to increase marketing (suggested by 73% of respondents). Some respondents offered specific marketing suggestions, such as advertising the program in hydro bills, mail, radio, and social media. Around one-fifth (18%) of respondents offered suggestions for program messaging, in particular (1) emphasizing that the program is free and (2) providing more information regarding the effectiveness and cost saving potential of the upgrades.

Figure 23: Recommendations for Overcoming Barriers to Program Participation (n=40, Multiple Response)*

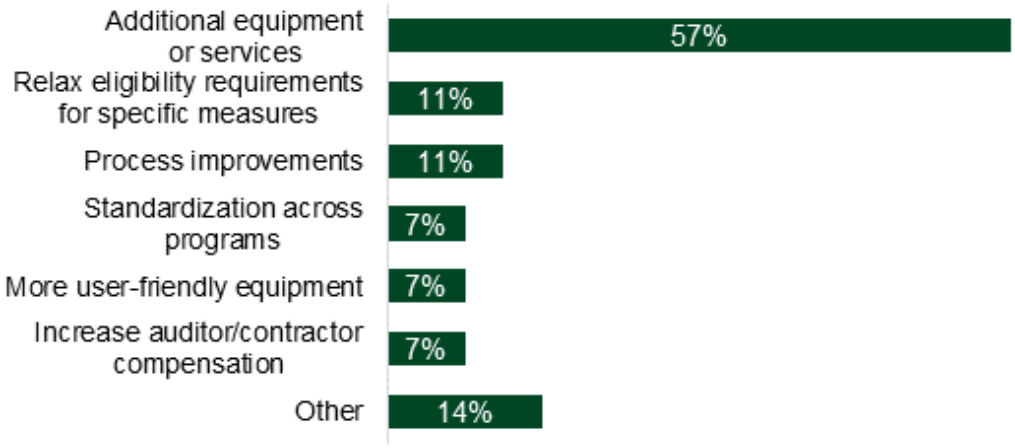


*Does not sum to 100% due to multiple response.

6.2.5 Recommendations for Program Improvement

Figure 24 displays respondents' recommendations for improving the program. Over one-half (57%) of respondents recommended additional equipment or services, including clothes washers/dryers, stoves, and air source heat pumps. Three respondents (11%) recommended relaxing eligibility requirements for specific measures like refrigerators and air conditioners, and another three respondents (11%) recommended process improvements, such as simplifying forms and increasing audit quality control efforts. A couple of respondents recommended standardizing the various programs available to residents (7%), making equipment (i.e., Hot2000) more user-friendly (7%), or increasing auditor/contractor compensation (7%).

Figure 24: Recommendations for Improving HAP (n=28, Multiple Response)*

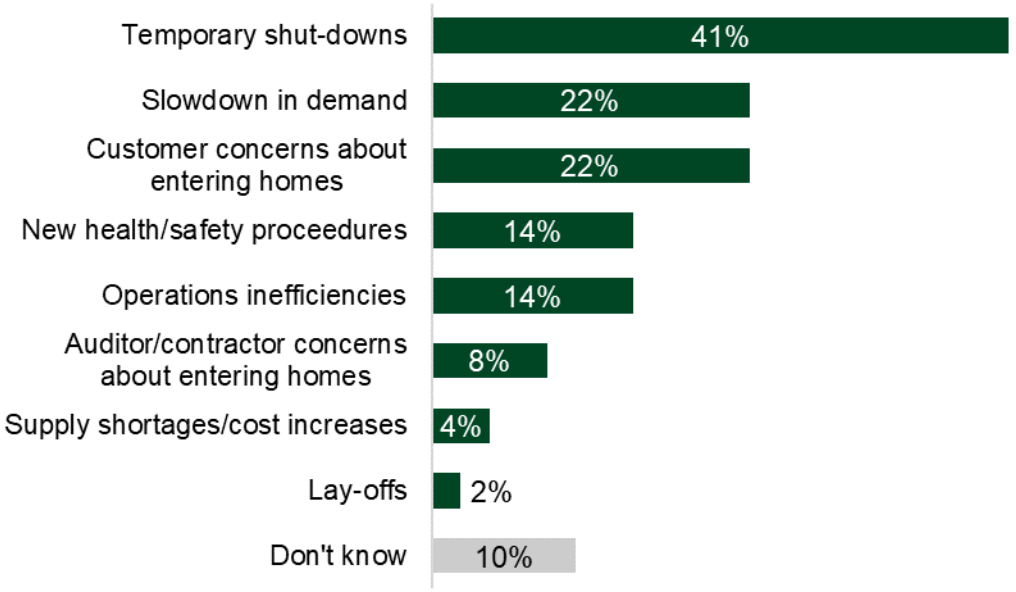


*Does not sum to 100% due to multiple response.

6.2.1 COVID-19 and Health/Safety

Figure 25 displays the impacts the COVID-19 pandemic had on auditors' and contractors' businesses. Around two-fifths (41%) of respondents experienced temporary shut-downs, while around one-fifth experienced a slowdown in demand (22%) or encountered customer concerns about having auditors and contractors enter their homes (22%). Over one in ten respondents implemented new health and safety procedures (14%) or encountered operations inefficiencies, such as having to reschedule work or spend additional time on site to adhere to health and safety guidelines (14%).

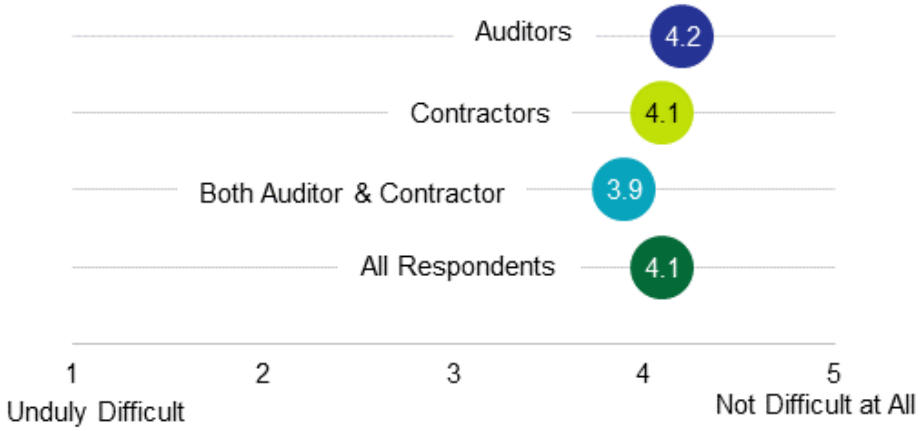
Figure 25: Impacts of COVID-19 on Business (n=49, Multiple Response)*



*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 26, the average rating among all respondents was 4.1, indicating that it was not very difficult. Six respondents suggested ways to make it easier for them to comply with relevant health and safety standards. Three respondents suggested requiring customers to wear masks and/or social distance, one suggested doing paperwork outdoors, one suggested using hand sanitizer instead of cumbersome rubber gloves, and one suggested spraying or wiping shoes instead of changing them between jobs.

Figure 26: Difficulty of Adhering to Health and Safety Standards (n=49)



6.3 PARTICIPANT PERSPECTIVES

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

6.3.1 High-Level Results

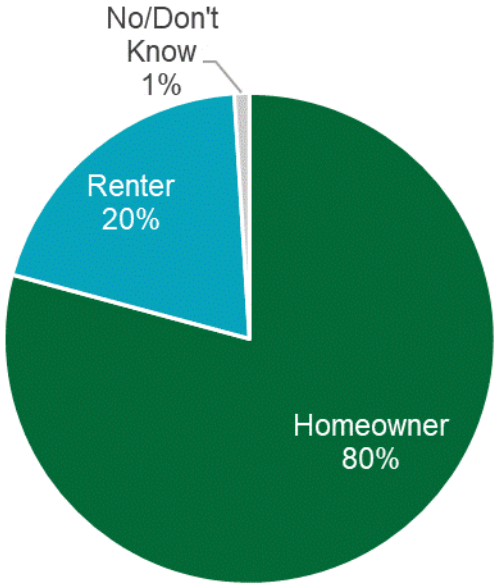
High-level results from the participant survey include the following:

- Most participants heard about the program through bill inserts (39%) or from friends/family (28%) and applied online (55%).
- Their primary motivation for applying was to save energy or lower energy bills (average rating of 4.7 on a scale from 1 to 5, where 1 meant the motivating factor played "no role at all" and 5 meant it played "a great role").
- Just under two-thirds (65%) of respondents said their energy auditor discussed additional ways to save energy at the time of the audit. Of these respondents, over two-thirds (69%) had tried at least one of them since having the audit performed.
- Respondents are largely satisfied with the program overall (average rating of 4.4 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 energy savings from the upgrades was the program aspect participants were least satisfied with, this was still rated highly (average rating of 4.2).
- Six percent of respondents offered recommendations for improving the program. The most common recommendations were to ensure customers receive all measures they are told they will receive (ten respondents) and to relax the eligibility requirements for specific upgrades (nine respondents).
- Nearly one-half (45%) of respondents provided a total of 415 recommendations for additional energy-efficiency equipment or services for inclusion in HAP. Participants often recommended stoves/ranges, clothes washers/dryers, windows, and doors for inclusion in the program.

6.3.2 Participant Profile

As shown in Figure 27, most respondents (80%) are homeowners, while 20% are renters.

Figure 27: Relationship to Home (n=682)*



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

Respondents' homes are predominantly primary residences (99%) that are occupied year-round (96%). Figure 28 and Figure 29 display characteristics of respondents' homes, including the type of dwelling and the year it was built. Over two-thirds (75%) of respondents' homes are single-family houses. One-half of respondents' homes (50%) were built prior to 1970. Close to one-third (31%) of respondents had between one and two bedrooms in their homes. The average number of bathrooms was 1.7.

Figure 28: Type of Home (n=682)

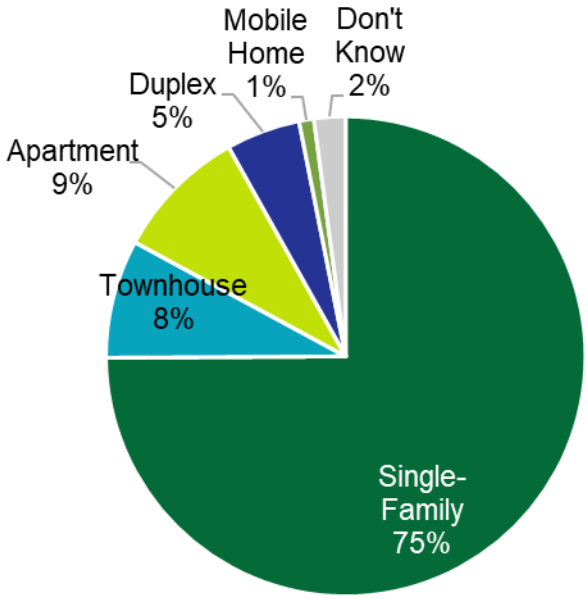


Figure 29: Year Home Built (n=682)

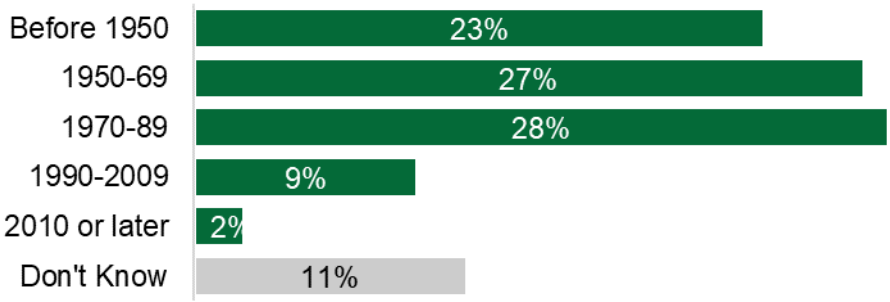


Figure 30 displays the number of occupants in the respondents' households. Almost one-third (29%) of respondents live alone. The average household size among respondents was 2.4.

Figure 30: Number of Occupants (n=682)

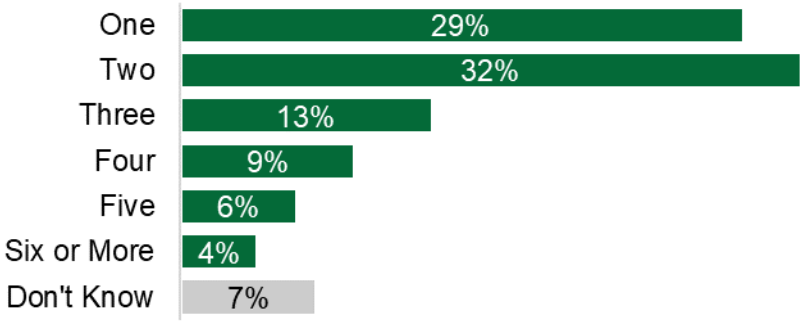
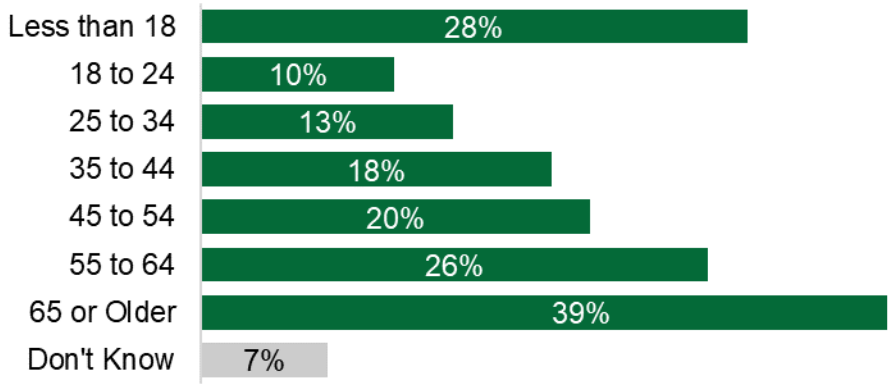


Figure 31 displays the percent of households with occupants of each age group. Children under the age of 18 reside in more than one-fourth (28%) of households and seniors aged 65 or older reside in approximately two-fifths of households (39%).

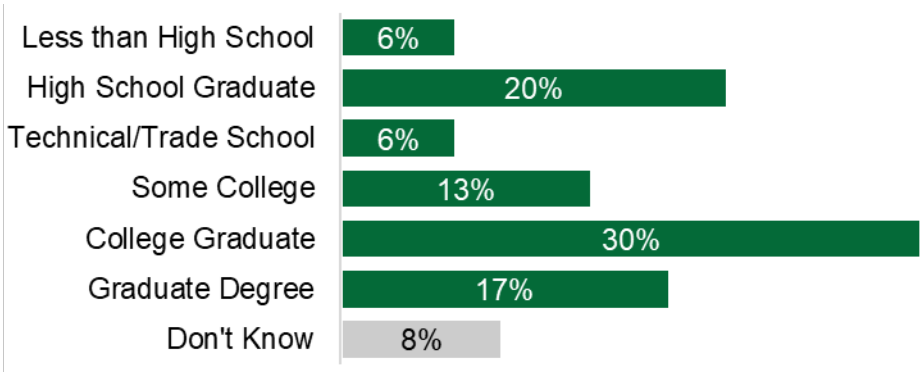
Figure 31: Households with Occupants of Each Age Group (n=682)*



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

Figure 32 displays respondents' highest education level. Around one-half (47%) of respondents have a college degree or higher.

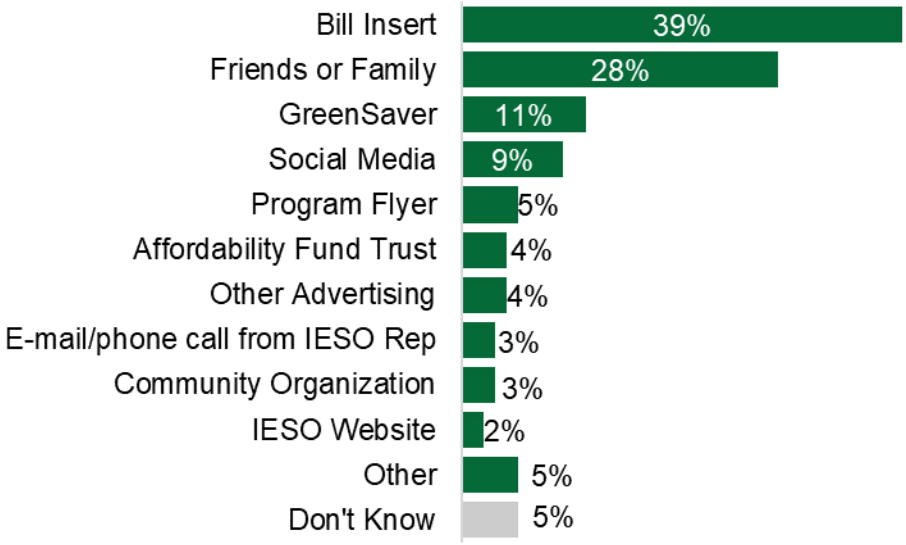
Figure 32: Highest Education Level (n=682)



6.3.3 Program Awareness and Motivation

Figure 33 and Figure 34 show how respondents heard about and applied to the program. Most respondents heard about the program through bill inserts (39%) or from friends or family (28%). Over one-half (55%) of respondents applied for the program online.

Figure 33: How Participants Heard about HAP (n=682; Multiple Response)*



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

Figure 34: How Participants Applied for HAP (n=682)

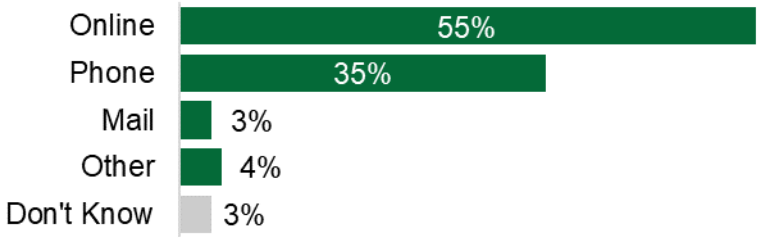
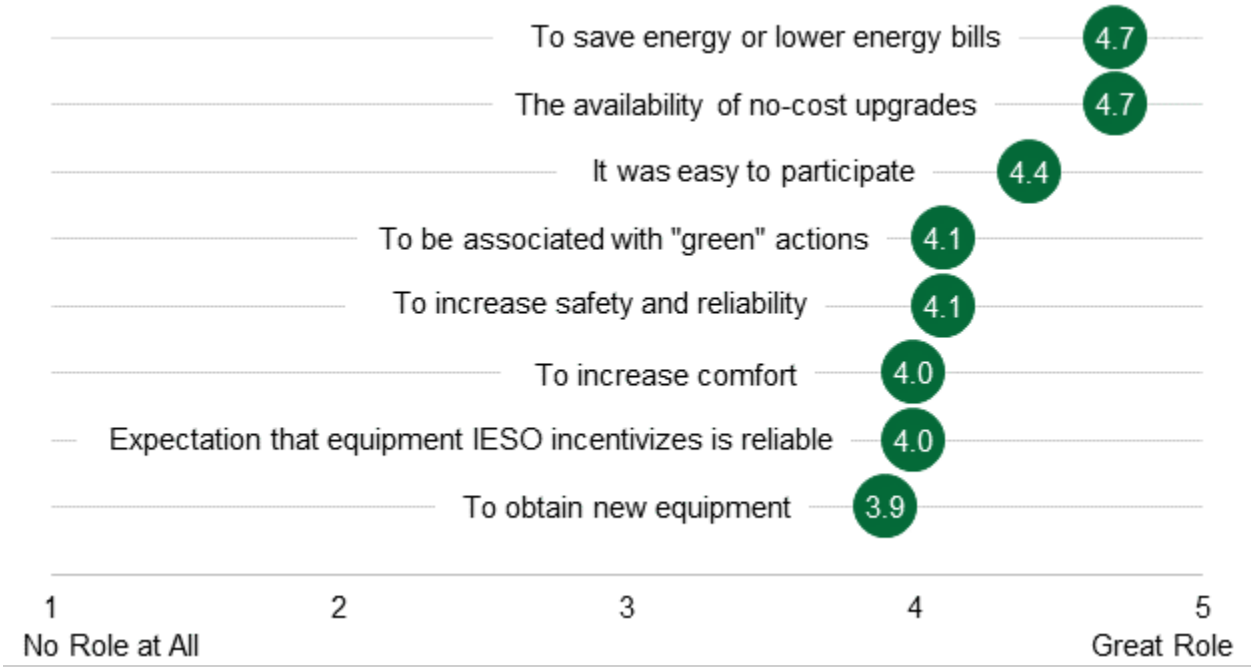


Figure 35 displays respondents' average ratings for the level of influence various factors had on their decision to participate in the program. Respondents rated the influence of each factor using a scale from 1 to 5, where 1 meant "no role at all" and 5 meant "a great role." The most influential factors were (1) to save energy or lower energy bills and (2) the availability of the no-cost upgrades, each with an average rating of 4.7. The ease of participating was also highly influential, with an average rating of 4.4.

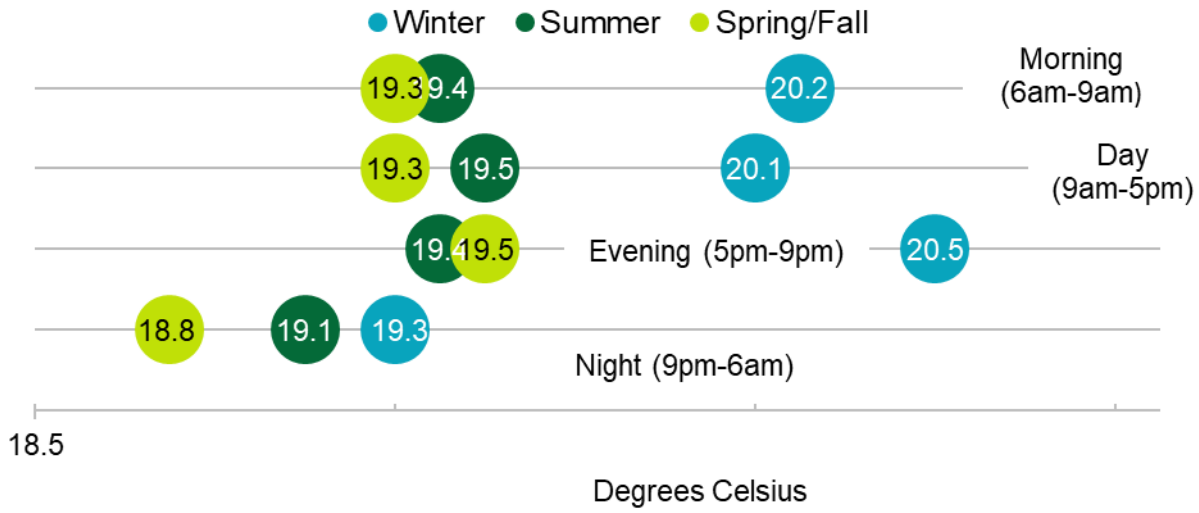
Figure 35: Factors Influencing HAP Participation (n=682)



6.3.4 Program Education and Behavioural Changes

Figure 36 displays the average temperature (in degrees Celsius) that respondents set their thermostats to during various times of the day and year. Not surprisingly, respondents set their thermostats lowest during the summer and highest during the winter. Additionally, respondents set their thermostats lowest at night (9pm-6am). During spring/fall and winter, respondents set their thermostats highest during the evening (5pm-9pm). During the summer, respondents set their thermostats highest during the day (9am-5pm).

Figure 36: Participant Thermostat Settings (n=664)*

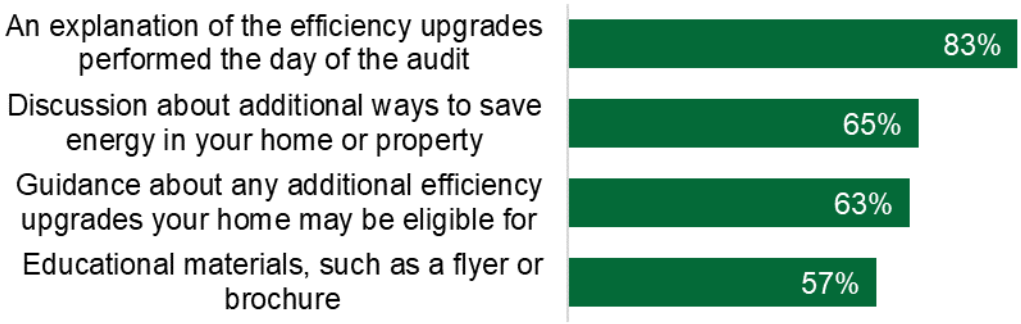


*Average n among temperature-time responses; excludes outliers.

Close to three-fifths (57%) of respondents said that at the time of the energy audit the staff person who performed the energy audit provided them with information on appropriate ranges to set their thermostat to in different seasons When asked if the contractor who installed the thermostat programmed the temperature settings or whether they did, over two-thirds (68%) of respondents said the contractor programmed them.

Energy auditors provided various resources to participants at the time of the audit. As shown in Figure 37, over four-fifths (83%) of respondents said the auditor explained the efficiency upgrades performed the day of the audit. Additionally, just under two-thirds (65%) of respondents said the auditor discussed additional ways to save energy. Nearly three-fifths of respondents said the auditor offered guidance about additional upgrades for which they may be eligible or provided education materials, such as flyers or brochures (63% and 57%, respectively). Respondents found these resources useful (the average rating was 4.3 on a scale from 1 to 5, where 1 meant "not at all useful" and 5 meant "very useful.")

Figure 37: Resources Provided by Energy Auditor (n=682; Multiple Response)*

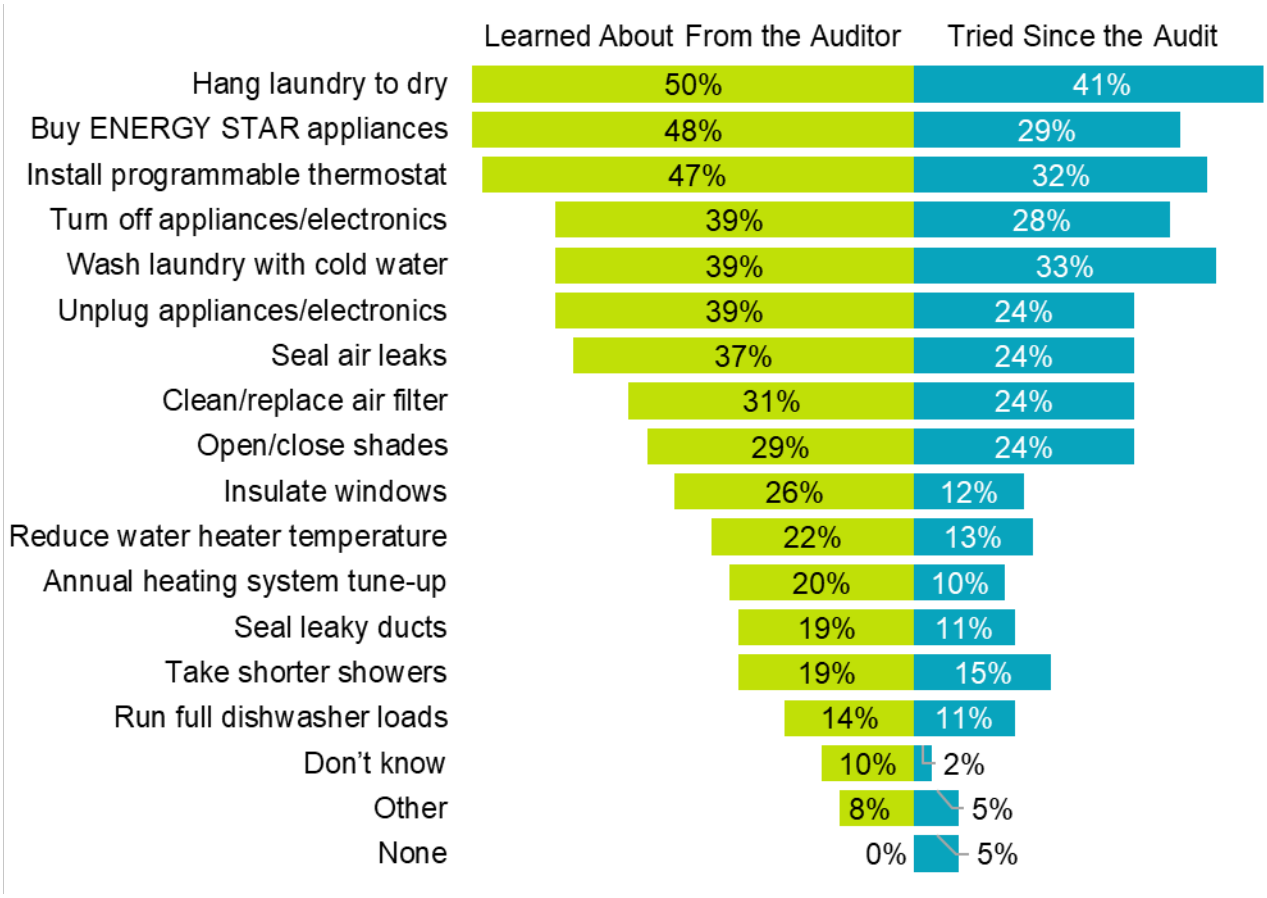


*Does not sum to 100% due to multiple response.

Figure 38 displays the additional energy-saving methods respondents said their auditor suggested. The most frequently suggested method was to hang laundry to dry: one-half (50%) of respondents said their auditor suggested this. Between one-third and one-half of respondents said their auditor suggested upgrading to ENERGY STAR appliances (48%), installing a programmable thermostat (47%), turning off or unplugging appliances and electronics (39% and 39%, respectively), washing laundry with cold water (39%), and sealing air leaks (37%).

Over two-thirds (69%) of respondents whose auditor discussed additional ways to save energy had tried at least one of them since having the audit performed. The most common energy saving actions respondents mentioned trying since the audit included hanging laundry to dry (41%), washing laundry with cold water (33%), and installing a programmable thermostat (29%).

Figure 38: Additional Ways to Save Energy (n=446)*



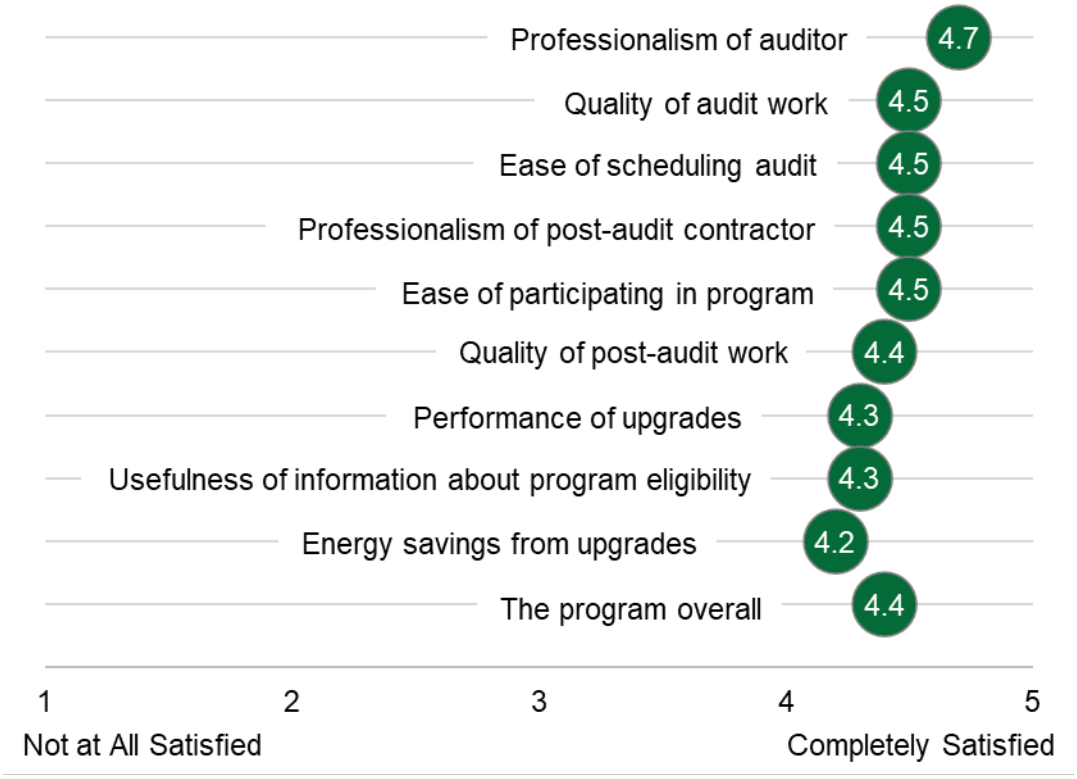
*Does not sum to 100% due to multiple response.

6.3.5 Program Satisfaction

Most respondents were satisfied with the program. Figure 39 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 4.4. Over four-fifths (90%) 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 energy savings from the upgrades had the lowest average satisfaction rating, this aspect of the program still had a relatively high rating, at 4.2.

Figure 39: Satisfaction with Program Aspects (n=682)



6.3.6 Recommendations for Program Improvement

Six percent of respondents (41 of 682) offered recommendations for improving the program, as shown in Figure 40.

The most common recommendation was to ensure customers receive all measures they were told they would receive. Ten respondents who offered improvement recommendations were disappointed that they did not qualify for freezers, larger refrigerators, and insulation. To illustrate, one respondent commented, "Very disappointed on not having insulation put in the attic." Another respondent said, "Also, it would've been nice if they had given us new appliances that we didn't yet HAVE, instead of only replacing old ones that we did have. For example, we got rid of an old freezer, then the inspector came and said we won't get a free one because we already threw away the old one. If we kept it, we'd get a new one."

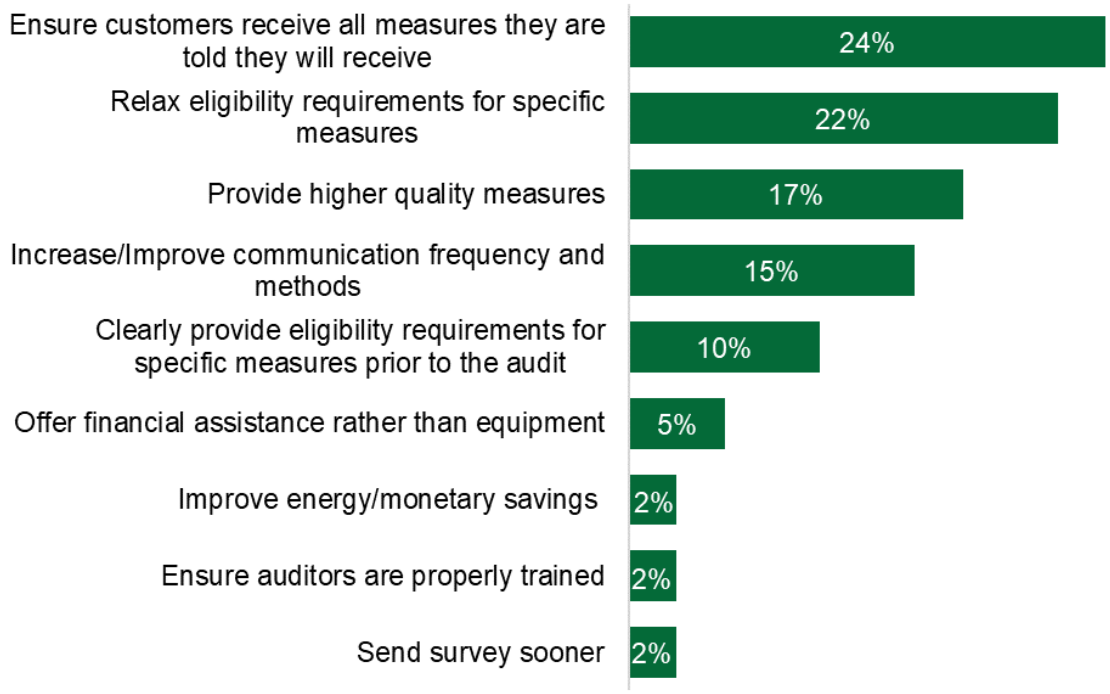
Nine respondents recommended relaxing eligibility requirements for specific measures. One respondent commented, “The program also refused to replace a 15 year old air conditioner and dehumidifier and a freezer from 1984!”

Ten respondents with improvement recommendations indicated that the program could do a better job at communicating, especially regarding eligibility requirements and setting expectations. A number of respondents felt they had been led to believe they would receive certain upgrades but were later told they were ineligible. For example, one respondent “felt very let down to find out my house which badly needs insulation and weatherstripping did not qualify.” Another respondent said, “Everything seems like a loophole.” Please note that, depending on their heating fuel type, some customers may not have been eligible to receive certain heating-related upgrades. Clearly communicating this to customers when this is the case may help address related customer concerns.

Respondents also recommended the program provide higher-quality upgrades. Seven separate participants commented that they were not satisfied with the measures they received, including their refrigerators, freezers, and power bars. One participant noted that “the refrigerator that was installed in my house had a continuous loud moaning noise that could be heard on multiple levels in the house, despite trying to get this rectified I was told basically as long as the fridge was functioning and cooling properly, I was stuck with it.” Another respondent stated that “The power bar had a surge and broke my television.” Given this feedback, there is an opportunity to ensure that customers know the process for seeking replacement of faulty equipment. There may also be an opportunity to ensure that customer concerns regarding equipment operation are fully evaluated to ensure customer satisfaction.

Six respondents with improvement recommendations commented on the high cost of the program, auditor training, and timing of the survey. Two of the respondents questioned the cost benefit of the program to the ratepayer, with one stating, “Just offer people in low incomes some assistance financially to upgrade.”

Figure 40: Recommendations for Program Improvement (n=41; Multiple Response)*

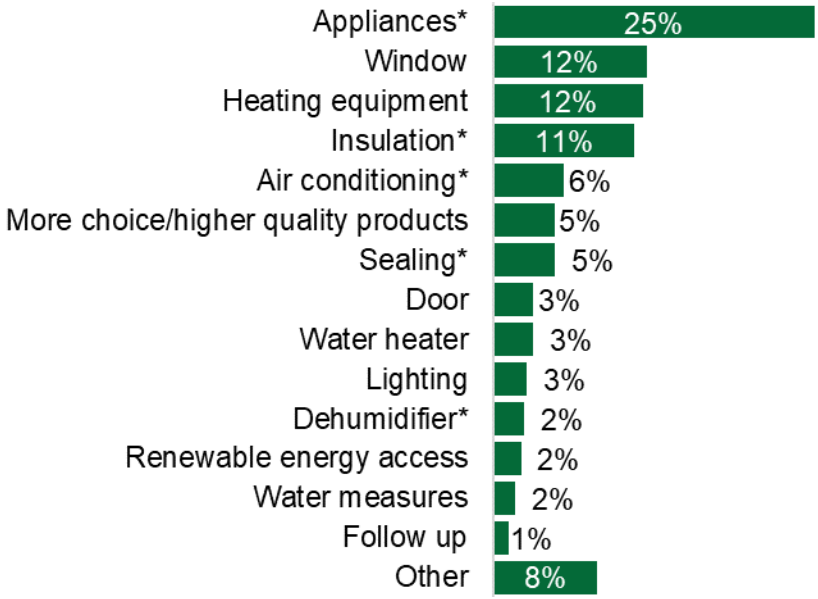


*Does not sum to 100% due to rounding.

Nearly one-half (45%) of respondents provided a total of 415 recommendations for additional energy-efficiency equipment or services for inclusion in HAP. Figure 41 displays the categories of additional equipment or services respondents recommended; asterisks denote whether some or all the upgrades in the category are already included in the program. One-half of the recommended upgrades are already included in the program, such as refrigerators, freezers, insulation, window ACs, weather stripping, thermostats, dehumidifiers, faucet aerators, low-flow showerheads, water heater insulation, and block heat timers. This suggests that respondents who recommended these measures were unaware of their inclusion, potentially because they were ineligible for them.

The most frequently mentioned type of additional equipment respondents recommended was appliances (35% of recommendations), including stove/ranges, clothes washers/dryers, refrigerators, freezers, dishwashers, and microwave ovens. Additional equipment respondents recommended that are not already offered by the program include windows (12% of recommendations), heating equipment (12%), doors (3%), and water heaters (3%).

Figure 41: Additional Equipment or Services (n=405; Multiple Response)**



*Some or all the upgrades in this category are already offered by the program.
**Does not sum to 100% due to multiple response.

6.3.7 COVID-19 and Health/Safety

Respondents rated the program energy auditors and contractors highly in terms of how they adhered to the relevant health and safety standards associated with the COVID-19 pandemic. The majority of respondents (79%) assigned a rating of 4 or 5 on a scale from 1 to 5, where 1 meant "did not adhere at all" and 5 meant "adhered completely" (Table 22). The average rating was 4.7.

Table 22: Adherence to Health and Safety Standards Associated with Covid-19 Pandemic (n=682)

Adherence to Health and Safety Standards	Percent of Respondents
5- Adhered completely	68%
4	11%
3	3%
2	1%
1- Did not adhere at all	1%
Don't know/Refused	17%
Average Rating	**4.7**

Suggestions about how to improve program energy auditor or contractor compliance with relevant health and safety standards associated with the COVID-19 pandemic included wearing personal protective equipment (PPE) (eight respondents), testing and vaccinating staff (one respondent), and increasing communication (one respondent).

6.4 Social Housing Perspectives

The following subsections highlight the feedback received from social housing providers about the design and delivery of HAP in PY2020.

6.4.1 High-Level Results

High-level results from social housing providers include the following:

- Overall, social housing providers indicated that the program has benefitted both tenants and social housing groups.
- Social housing providers report positive experiences with cost savings, communication, and increased tenant comfort.
- Common barriers reported include challenges from the COVID-19 pandemic in coordination, communication, and organization.
- Distinct barriers described include a cumbersome application process for large social housing groups, disorganized contact networks, and a lack of marketing and outreach.
- Recommendations suggested by social housing providers include developing an online portal for application submission, providing one application across all buildings,

simplifying the points of contact, and increasing outreach by partnering with social housing groups.

6.4.2 Program Awareness and Motivation

Interviewed social housing providers describe their roles at their organizations as being responsible for managing and developing projects, from managing project costs to implementing emissions and energy reduction projects. They recall being introduced to the program through the program delivery vendor's outreach and marketing (e.g., through a conference or expo). The housing providers interviewed had participated in the program in the past with some of their properties. They decided to participate again in PY2020 after having positive experiences with the program.

The social housing providers interviewed commonly reported being motivated to participate in the program by cost savings on utility bills. Costs savings, in turn, allow the social housing providers to redirect funds towards programs critical to the communities they serve. Other motivations mentioned included the benefits tenants would receive from increased comfort; the education provided to tenants on ways to save energy and money; prior experience participating in other programs, such as weatherization and appliance programs; and the fact that the program would help the social housing providers achieve emission and GHG reduction targets.

6.4.3 Experiences

Social housing providers described their experiences with the application procedures. They typically collect information on heating, number of units, number of tenants, incomes, and other information to populate the applications. They submit the completed application to the program delivery vendor who then follows up with audit scheduling and inspections.

The social housing providers interviewed indicated that the program delivery vendor was very communicative, frequently reaching out with information and answering any clarifying questions as needed. Social housing providers indicated that they typically did not interact with auditors or contractors as the program delivery vendor typically managed those relationships.

6.4.4 Barriers

Barriers and challenges reported by social housing providers varied from provider to provider.

The COVID-19 pandemic diverted many of the organizations' resources towards public health planning. It also led to some difficulties in coordination, communication, and organization related to the program, as well as supply chain backlogs on certain appliances.

The COVID-19 pandemic also complicated the audit and installation process, especially when bulk audits were being completed, sometimes resulting in unclear or changing protocols (e.g., whether to enter a unit if a tenant was unresponsive).

Another barrier to program participation mentioned by one social housing provider was the challenge of applying as a large organization. This social housing provider, who managed many facilities and buildings, recalled having to submit an application for every building, which meant completing dozens of applications. With each building requiring its own application, the application process took them months and involved multiple staff. Given that they felt the process was

cumbersome and an administrative burden to their workload, the social housing provider who mentioned this issue said they were considering not participating in the program again in the future.

One social housing provider also pointed to a complex network of contacts as being a barrier to participating in the program. They recalled having to interact with different contacts for each type of appliance installed at their facilities (e.g., unique contacts for refrigerators, thermostats, etc.) They also recalled having to interact with four to five contacts at the program delivery vendor.

One provider also detailed a lack of marketing and outreach as a barrier. That provider had only become aware of the program from an expo in 2019 and would have liked to have seen more promotion of the program.

6.4.5 Recommendations for Program Improvement

To address the barriers, social housing providers offered some recommendations for program improvement.

To help large organizations managing many buildings and facilities, social housing providers suggested providing one application that covers all buildings to streamline the application process, which currently asks applicants to provide one application per building. They also recommended an online portal to automate the process, making submitting materials and information easier.

To simplify the network of contacts, social housing providers recommended fewer points of contact and fewer people to reach out to. Similarly, with the program delivery vendor, providers indicated that only having to deal with two to three contacts rather than four to five contacts would make communication easier.

7

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.4.

7.1 High-Level Results

- The analysis used an input-output model which estimated that HAP will create 212 total jobs in Canada, of which 194 will be in Ontario.
- Most of the jobs stem from the demand created for energy-efficient products and services related to program delivery.

The analysis estimated that HAP will create 212 total jobs in Canada, of which 194 will be in Ontario. Of the 212 estimated total jobs, 104 were direct, 65 were indirect, and 43 were induced. In terms of FTEs the numbers are slightly less, with 154 FTEs created in Ontario and 170 in total across the country. Of these 170 FTEs, 86 were direct, 50 indirect, and 34 induced. In total, HAP job impacts were 10.0 jobs created per million dollars of investment (i.e. program budget).

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 behaviour and fixed expenditure shares relative to incomes.

Section 7.2 details the values of the inputs used as shock values for the model runs. Section 7.3 presents the analysis, including details of job impacts and assumptions. Section 7.4 discusses responses to the HAP auditor and contractor survey related to job impacts.

7.2 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 HAP and the other from the increased household expenditures due to bill savings (and net of program funding). Table 23 shows the input values for the demand shock representing the products and services related to HAP. Each measure installed as part of HAP 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, *Major appliances* had the highest total cost at $4.4 million and *Electric light bulbs and tubes* was second highest at $2.7 million. Each measure's cost was divided into labour and non-labour. *Electric light bulbs and tubes* and *Other miscellaneous manufactured products* did not have any assumed labour costs for measure installation. The *Non-metallic mineral products* category was mainly insulation, for which labour 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 23, *Office administrative services* included general overhead and administrative services associated with program delivery, such as program management and staffing, call centre operations, and IESO admin labour. The *Other professional, scientific and technical services* included the audits. The total demand shock represents the sum of the audit fees. The labour and non-labour amounts are not specified for these services, as the IO Model has assumptions incorporated for the relative proportions of each for these categories.

Table 23: Summary of Input Values for Demand Shock

Category Description	Non-Labour ($ Thousands)	Labour ($ Thousands)	Total Demand Shock ($ Thousands)
Major appliances	3,907	497	4,404
Electric light bulbs and tubes	2,663	0	2,663
Small electric appliances	780	780	1,561
Non-metallic mineral products	244	567	811
Other miscellaneous manufactured products	555	0	555
Switchgear, switchboards, relays and industrial control apparatus	181	124	305
Office administrative services	-	-	2,385
Other professional, scientific and technical services	-	-	2,562
Total			**15,246**

Table 24 shows the calculations and input value for the household expenditure shock.[19] 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) = $21.9 million) and the portion of all energy-efficiency programs funded by the residential sector (35%, or $7.4 million). The difference is $14.5 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 HAP process evaluation

[19] 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.

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 32% of household bill savings would be spent. Thus, the household expenditure shock would be $4.69 million, as shown in Table 24.

Table 24: Summary of Input Values for Household Expenditure Shock

Description	Demand Shock *($ Thousands)*
NPV of energy bill savings	21,908
Residential portion of program funding	(7,401)
Net bill savings to residential sector	**14,506**
Percent spent on consumption (vs. saved)	32%
Total Shock	**4,686**

7.3 Model Results

The StatCan IO Model generated results based on the input values detailed in Section 7.2. Table 25 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 153 total jobs (measured in person-years) in Canada, of which 142 will be in Ontario. Of the 153 jobs, 74 were direct, 43 were indirect, and 36 were induced. In terms of FTEs, the numbers are slightly less, with 117 FTEs created in Ontario and 126 in total across the country. Of these 126 FTEs, 64 were direct, 35 indirect, and 27 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 25: 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	64	64	74	74
Indirect	31	35	38	43
Induced	22	27	30	36
Total	**117**	**126**	**142**	**153**

Table 26 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 $4.7 million would yield 37 direct FTEs and 52 direct total jobs in Canada. Total jobs were 44 for direct and 59 in total for Canada.

Table 26: Job Impacts from Personal Expenditure Shock

Job Impact Type	FTE *(in person-years)* Ontario	FTE *(in person-years)* Total	Non-FTE *(in person-years)* Ontario	Non-FTE *(in person-years)* Total
Direct	22	22	30	30
Indirect	7	15	15	22
Induced	7	7	7	7
Total	**37**	**44**	**52**	**59**

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[20] without running the model. The multiplier is 4.2[21] (per $ million) and the NPV of decreased electricity bills (retail) was $21.9 million. Thus, the model would predict that the reduction in electricity production would cause a job loss of 92 person-years over the course of 20 years (the longest EUL in the portfolio of HAP 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.[22] HAP first year energy savings represented less than 0.01% of total demand in 2020. 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 27 shows the total estimated job impacts by type – combining Table 25 and Table 26. The majority (194 out of the 212 estimated total direct jobs were in Ontario. A slightly smaller share of the indirect and induced jobs was in Ontario, with 53 out of 65 indirect and 37 out of 43 induced total jobs within the province. The FTE estimates are slightly less, with a total of 154 FTEs (of all types) created in Ontario and 170 FTEs added throughout Canada. All direct FTEs were realized in Ontario, with this number representing 56% of the total FTEs added in Ontario and 51% of FTEs added in Canada.

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

Table 27: 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	86	86	104	104	4.9
Indirect	37	50	53	65	3.1
Induced	29	34	37	43	2.0
Total	**154**	**170**	**194**	**212**	**10.0**

Calculating relative performance as a function of jobs created per $1M of program budget is helpful in comparing the HAP program between years. In 2019, each $1M of program budget resulted in the creation of 10.6 total jobs; this year, each $1M investment resulted in the creation of 10.0 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 HAP 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 remains relatively consistent from year to year.

Table 28 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 83 jobs across Canada and 81 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 centre operations, program management, etc.). *Retail trade* added a total of 32 jobs across Canada and 30 in Ontario, the second most of any industry.

Table 28: 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	69	70	81	83
Retail trade	22	23	30	32
Accommodation and food services	8	9	11	14
Finance, insurance, real estate, rental and leasing and holding companies	10	11	11	13
Wholesale trade	10	12	10	12
Professional, scientific and technical services	6	7	8	10
Manufacturing	6	8	6	8
Other services (except public administration)	4	5	6	7
Transportation and warehousing	4	6	5	7
Health care and social assistance	3	3	5	5
Information and cultural industries	2	3	3	3
Arts, entertainment and recreation	1	2	3	3
Repair construction	2	3	3	3
Government education services	2	2	2	2
Non-profit institutions serving households	1	2	2	2
Crop and animal production	0	1	1	2
Other municipal government services	1	2	2	2
Educational services	1	1	1	1
Utilities	1	1	1	1
Government health services	1	1	1	1
Total	**154**	**169**	**193**	**212**

[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.

7.4 Survey Responses on Job Impact Questions

The HAP auditor and contractor survey contained job impact-related questions for auditors and contractors related to the impact of HAP 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 2020 Home Assistance Program help or hinder the growth of your business in any way? If so, please explain how.

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

   - *"Helped increase revenue. Made me feel that I was contributing to the greater good."*

- *"I was able to perform so many audits that I was able to quit my second job and focus entirely on HAP."*
- *"It provided work when I was not very busy."*
- *"It has allowed our advisors to continue to stabilize their income- many work part-time in more remote regions (win/win for us & IESO/Greensaver)."*
- *"For us it allowed me to hire more staff, which in turn helped us grow the business."*

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

- *"Difficult clients."*
- *"I found myself driving longer between appointments than the time spent actually working at times."*
- *"Extensive travel requirements."*

2. Did the 2020 Home Assistance 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:

- *"Yes, I had to hire 2 more employees to help complete more jobs through Greensaver."*
- *"Yes we had to hire an additional auditor"*
- *"I was able to employ 4 more full time staff."*
- *"Hired at least 3 people due to this program."*

Negative Impacts:

- *"Due to the requirements to have people trained to be CEA or REA certified it has made it difficult to hire anyone. If there was more demand for the program it would be easier to hire new people."*
- *"Compensation for assessments is quite low resulting in a hiring base of under qualified technicians."*
- *No I didn't hire anyone, although I should have."*

Responding auditors and contractors indicated that the program generally had allowed them to add personnel to meet the demand for new work from HAP, 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 potentially negative issues related to adding personnel primarily stated that long travel times and program requirements that presented a barrier to entry were the biggest hindrances. The negative issues could be examined further if there was a focus on redesigning certain aspects of the program to enhance job impacts.

Key Findings and Recommendations

The following section presents detailed key findings and recommendations for the PY2020 evaluation. Please note that given the nature of findings 12 through 14, the team does not provide related recommendations.

***Finding 1:* The HAP program saw the largest amount of participation and the largest amount of net verified savings in PY2020 since before 2016.** In 2020, the HAP program completed 11,440 projects in 11,402 homes. The increase in participation highlights the efforts and success of the program in maintaining its offerings to eligible participants despite the COVID-19 global pandemic. The program achieved first year net verified energy savings of 11,765 (MWh) and 1.16 MW of first year net verified demand savings. Verified savings on a per-project basis increased in PY2020 by 19% from PY2019 (from 866 kWh to 1,028 kWh per project) despite shrinking baselines, such as those associated with lighting end-uses which contribute to the majority of HAP savings.

> **Recommendation 1.** Continue to promote and deliver deeper savings measures to HAP participants like weatherization, appliances, and smart power bars, especially in historically underserved areas. There may be an opportunity for the HAP program to conduct a postal code analysis to determine if the HAP program 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 HAP to deliver energy-efficiency products and improvements to participant homes while maximizing savings on a per-project basis.

Finding 2: PY2020 weatherization projects increased in quantity and deepened in savings compared to PY2019. Gross verified savings for weatherization measures were higher on a per-unit basis in PY2020 compared to PY2019 (2,400 kWh in PY2020 vs. 1,939 kWh in PY2019). This is in part due to increased savings associated with weatherization measures on a per-project basis (3,669 kWh in PY2020 vs. 3,240 kWh in PY2019). The savings from weatherization measures increased by nearly 800,000 kWh from PY2019.

> **Recommendation 2.** Weatherization upgrades can provide important savings opportunities and health upgrades for participants. It will be important for the program to emphasize and implement weatherization upgrades to participants as savings from lighting measures 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 3: Clearly communicating measure eligibility is critical. Of the 6% of surveyed participants who offered recommendations for improving the program, the most common recommendations were to ensure customers receive all measures they are told they will receive (24%) and to relax the eligibility requirements for specific upgrades (22%). Depending on their

heating fuel type, some customers may not have been eligible to receive certain heating-related upgrades. Additionally, program delivery vendor staff noted that multiple similar programs exist in the market (e.g., there are separate CDM programs for natural gas and electricity). These two issues are likely to lead to customer confusion about measure eligibility in some instances.

> **Recommendation 3.** Accurately set participants' expectations regarding upgrades. Clearly communicate with the customer about eligibility requirements for upgrades prior to the audit and ensure that auditors are trained to clearly communicate eligibility requirements as well Help customers to understand why they may not be eligible for certain measures depending on their fuel type. Train auditors to not overpromise on measures for which customers may not be eligible. Help customers understand the differences between HAP and other programs offered in the market.

Please note that a similar recommendation to Recommendation 5 was included in the PY2019 evaluation. In response to the recommendation in PY2019, the IESO indicated that they understood that expectation-setting with participants was important and that they would continue to work with the program delivery vendor to ensure expectations were being managed appropriately while also communicating the benefits of the program. A similar recommendation is provided again in PY2020 with an additional emphasis on helping customers to understand which measure they are eligible for given their fuel type as well as the differences between HAP and other similar programs in the market.

Finding 4: Additional program promotion opportunities exist. Common program barriers identified by IESO program staff, program delivery vendor staff, and auditors and contractors were the relatively minimal marketing and a reported lack of program awareness for HAP. Auditors and contractors reported that the greatest barriers to program participation were lack of awareness that the program exists and skepticism that the program is indeed free. Some auditors and contractors offered specific marketing suggestions, such as advertising the program in hydro bills, mail, radio, and social media. Program improvement suggestions mentioned by IESO and program delivery vendor staff included finding meaningful ways to collaborate with gas utilities and addressing gaps in marketing resources and program awareness.

> **Recommendation 4a.** Consider additional ways to market and promote the program, such as through potential collaborations with gas utilities or increased province-wide marketing (such as through social media campaigns, targeted advertisements).
>
> **Recommendation 4b.** Include a variety of customer testimonials in marketing materials, offering materials in multiple languages, and collaborating with local community-based organizations to help address concerns about the program's legitimacy.

Please note that a similar recommendation to Recommendation 6 was included in the PY2019 evaluation. In response to the recommendation in PY2019, the IESO indicated that they would continue to explore the most effective methods to promote the program and its key messages, and to reach those customers most in need of support. Given that minimal marketing and lack of program awareness were common barriers highlighted again in PY2020, this recommendation is provided again to ensure that it continues to be considered in future program years.

Finding 5: Savings attributed to lighting measures are decaying over time. Gross verified savings for lighting measures were lower on a per-unit basis in PY2019 and PY2020 due to deemed savings values (also referred to as substantiation sheet adjustments throughout the report). These adjustments included lowered baseline wattage values, lowered hours of use (HOU), and the application of in-service rate (ISR) results from participant surveys. The proportion of HAP program savings attributed to lighting end-uses decreased from 67% to 54% of total program savings in PY2020.

> **Recommendation 5.** As savings from lighting measures continue to decay over time, the program will need to reallocate resources to push alternative cost-efficient measures and focus on deep-energy savings. These may include weatherization measures (as noted in Recommendation 2), smart power bars, smart thermostats, and clothes drying racks.

Please note that a similar recommendation to Recommendation 3 was included in the PY2019 evaluation. In response to the recommendation in PY2019, the IESO indicated that they would continue to prioritize identifying viable weatherization projects and had noted that weatherization projects were under-represented in the PY2019 program due to a limited window of activity in that program year. This recommendation is provided again in PY2020 to ensure that all cost-effective measures that may provide deeper savings continue to be considered in future program years.

Finding 6: Project costs remained generally well below the program cap. Sixty-six percent of the projects in PY2020 had an incentive less than $1,000 and 89% of the projects had an incentive less than $2,000, while the program's total measure cost cap per home was $13,000. This observation mirrors what was found for PY2019 projects (including PY2019 true ups). Sixty-seven percent of PY2019 projects had an incentive less than $1,000 and 90% had an incentive less than $2,000. Since the program provides all eligible measures that each participant will accept, this finding suggests that there may be additional savings opportunities for measures not currently offered by the program.

> **Recommendation 6.** Consider expanding the measures offered by the program, as this may provide deeper savings per home. Recommendations 2, 5 and 9 provide insight on new measures or services to consider adding to the program.

Please note that a similar recommendation to Recommendation 7 was included in the PY2019 evaluation. In response to the recommendation in PY2019, the IESO indicated that projects with limited scope or fewer measures were more likely to be represented in the PY2019 participant data, thus skewing the average per-project expenditure lower. Given that project costs remained generally well below the program cap in PY2020, this recommendation is provided again in PY2020 to ensure that it continues to be considered in future program years.

Finding 7: Energy-efficiency education activities are likely resulting in savings. Just under two-thirds (65%) of all responding participants said their auditor discussed additional ways to save energy at the time of the audit or left educational materials behind (66% and 57%, respectively), and of these participants, two-thirds (69%) said they had tried at least one of the additional ways to save energy since having the audit performed.

Recommendation 7. Consider ways to analyze and quantify the energy savings resulting from the program's energy education activities.

Please note that a similar recommendation to Recommendation 8 was included in the PY2019 evaluation. In response to the recommendation in PY2019, the IESO indicated that they would consider how these additional savings and benefits could be analyzed and quantified. Given that participant feedback to the PY2020 survey indicates that the educational components of HAP are again likely resulting in savings and given that it is our understanding that the IESO has not yet instituted a systematic way of quantifying these resulting savings and benefits, this recommendation is provided again in PY2020 to ensure that it continues to be considered in future program years.

Finding 8: Participants, auditors, and contractors recommended offering additional equipment through the program. Nearly one-half (45%) of surveyed participants provided a total of 415 recommendations for additional energy-efficiency equipment or services for inclusion in HAP. Participants most often recommended various appliances (35% of recommendations), such as clothes washers/dryers, refrigerators, and freezers; windows (12%); heating equipment (12%); doors (3%); and water heaters (3%). Over one-half (57%) of auditors and contractors recommended additional equipment or services, including clothes washers/dryers, stoves, and air source heat pumps.

Recommendation 8. Consider offering additional types of equipment, such as clothes washers and dryers, windows, doors, heating and cooling equipment (such as air source heat pumps), and water heating equipment. Refer to Recommendations 2, 5 and 6 for additional insight on equipment considerations.

Please note that a similar recommendation to Recommendation 9 was included in the PY2019 evaluation. In response to the recommendation in PY2019, the IESO indicated that they had reviewed opportunities to expand the HAP measure composition and had considered the inclusion of the equipment listed in the PY2019 recommendation. They noted that IESO had added new smart thermostat measures in late 2019 but otherwise determined that the HAP measure composition was appropriate. Given that offering additional equipment through the program was still a common improvement suggestion mentioned by the PY2020 participants, auditors, and contractors, and given that some additional measures, such as air source heat pumps, were mentioned with more frequency, this recommendation is provided again in PY2020 in case new opportunities exist to consider additional equipment types for program inclusion.

Finding 9. Participants recommend offering higher-quality products and offering replacements when issues arise. Offering higher quality products was mentioned by one-fifth (17%) of participants with improvement recommendations. Several participants who received refrigerators, freezers, and power bars commented that they were not satisfied with the measures they received, with one participant noting that their request for a replacement or repair of their program-installed refrigerator was denied.

Recommendation 9. Provide higher-quality products through the program where feasible and replace products when issues arise. Ensure customers are well-trained on proper use of equipment received through the program and that they are aware of the process for

requesting replacements of faulty measures. Doing so will help address customer experience issues and will help ensure that persistence of program savings is achieved over time.

Please note that a similar recommendation to Recommendation 10, which focused more specifically on providing higher-quality drying racks and LEDs, was included in the PY2019 evaluation. In response to the recommendation in PY2019, the IESO indicated that the LED bulbs and drying racks provided through the program were high-quality and warrantied. They also stated that there was an opportunity for the IESO to ensure customers were further educated on proper use of equipment and that they were made aware of the process for seeking replacements of faulty measures given that the overall proportion of LEDs and drying racks reported as being faulty was less than 0.01%. Given that offering higher-quality products was still a common improvement suggestion mentioned by the PY2020 participants and given the importance of ensuring persistence of savings of program measures over time, this recommendation is provided again in PY2020 with additional emphasis on the importance of training customers on proper use of the program equipment and ensuring they are aware of the process for requesting replacements.

Finding 10: 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 no longer delivered by the HAP program. In addition, there were no demand savings reported for smart power bars, which prevented a demand RR from being calculated for smart power bars. These discrepancies were also observed in PY2019.

Recommendation 10. 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 energy savings values are applied to the correct measure.

Please note that a similar recommendation to Recommendation 4 was included in the PY2019 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 PY2020 to ensure that it continues to be considered in future program years.

Finding 11. HAP had direct, positive impacts to employment in Ontario from PY2020 activities. These impacts would propagate to other provinces and across a broader set of industries in a normal economy. The analysis estimated that HAP will create 212 total jobs in Canada, of which 194 will be in Ontario. Of the 212 estimated total jobs, 104 were direct, 65 were indirect, and 43 were induced. All of the 104 direct jobs were in Ontario. A slightly smaller share of the indirect and induced jobs was in Ontario, with 53 out of 65 indirect and 37 out of 43 induced total jobs within the province. This indicates that under normal economic conditions (i.e., without the disruptions from COVID-19), one would expect the impacts from the program to propagate through the economy via indirect and induced effects—and have positive job impacts outside of Ontario.

Recommendation 11. Continue using the Statistics Canada (StatCan) Input-Output (IO) in concert with in-depth surveying to understand the impacts on job creation and compare from year to year. The benefits of using macroeconomic models often lie in the users' ability to compare across different time periods or different shocks—and not simply in the one-time point estimate of impacts. Using the recommended approach would allow a continued comparison across program years.

Please note that a similar recommendation to Recommendation 11 was included in the PY2019 evaluation. In response to the recommendation in PY2019, the IESO indicated that they would work with the evaluator to continue exploring methods such as in-depth surveying to understand the job impacts of COVID-19 in PY2020. Please note that as part of the PY2020 evaluation surveys, the team included additional questions to provide further context about the impact of COVID-19 on the participants, auditors, and contractors. Given the benefits of comparing job creation from year to year, this recommendation of continuing to use the StatCan IO model is provided again in PY2020 to ensure that it continues to be considered in future program years.

Finding 12: The overall program RR for energy savings was driven by lighting measures. Lighting savings accounted for over one-half (54%) of the overall program gross energy savings. Given the volume of energy savings attributed to lighting, the lower RR for lighting measures (76%) lowered the RR of the program. Other measures, such hot water pipe insulation, indoor clothes drying racks, aerators, and showerheads, also contributed to the lower RR. High RRs for weatherization measures, appliances, and smart power bar end-uses alleviated some of the impacts on program savings.

Finding 13: Discrepancies in reported demand savings that were observed in PY2019 were largely corrected in PY2020. The primary driver for the low demand savings RR in PY2019 was the use of connected demand savings values instead of the evaluation measurement and verification (EM&V) peak demand savings values for reported demand savings for some measures. In PY2020, these discrepancies have largely been corrected in the reported savings, with the exception of certain measures, such as weatherization and smart power bars.

Finding 14: Participant were largely satisfied with the program and its elements. Participants reported high satisfaction with the program overall (average rating of 4.4 on a scale from 1 to 5, where 1 meant "not at all satisfied" and 5 meant "completely satisfied") as well as with the professionalism of their auditor (average rating of 4.7). While energy savings from the upgrades had the lowest average satisfaction rating, this aspect of the program still had a relatively high rating, at 4.2.

Appendix A Detailed Methodology

This appendix summarizes the methodology applied for various components of the HAP 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 2.

A.1.1 Impact Sampling

The NMR team sampled HAP at the project level to generate data for the desk reviews (Table 29). 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 21% and 80% of total distributed savings) and low savers (projects whose summed measure savings were in the lowest 20% 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. Using the projects from the top 20%, NMR then used the probability proportional to size (PPS) technique to develop the sample, resulting in a final sample size of 229. This number includes a roughly 10% buffer in case of sample attrition (e.g., projects that later need to be removed from the sample for non-evaluation reasons). PPS allows the chance of project selection to be in proportion with the projects deemed savings, ensuring that the desk review sample includes the most program savings possible.

Table 29: Desk Review Sample Summary

n	Avg. # of Measures per Project	Avg. kWh Deemed Savings per Project
229	8	3,996

A.2 Cost-Effectiveness Methodology

The cost-effectiveness analysis was completed using IESO's *CDM Energy Efficiency Cost Effectiveness Tool* and in accordance with the IESO *CDM Energy Efficiency Cost Effectiveness Guide.*[23] The tool was populated with the following key information from the evaluation:

- First year energy and demand savings in kWh and kW, respectively
- EUL

[23] *Conservation & Demand Management Energy Efficiency Cost Effectiveness Guide*, Independent Electricity System Operator, April 1,2019, http://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation/EMV/2019/IESO-CDM-Cost-Effectiveness-Test-Guide.pdf?la=en

- End use load profile
- Incremental equipment and installation cost
- Net to gross ratios for energy savings and demand savings
- Savings for natural gas and water
- Adjustments in savings over the life of the program

Where directed by IESO, inputs reflected the current IESO MAL default values and not the updated values recommended by this evaluation to replace the default values. These inputs included EUL, end use profile, incremental cost, and non-electricity savings.

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

- Program administrative costs
- Incentive payments

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 be directly presented in this report are as follows:

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

A.3 PROCESS 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, contractors, and participating social housing providers (Table 30). 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 PY2020 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, the program delivery vendor staff, and the social housing provider staff using in-house staff (rather than through a survey lab). The NMR team fielded HAP participant and HAP auditor and contractor surveys as web-based surveys in partnership with the Nexant survey lab based in Toronto. The NMR team designed the survey instruments and developed the sample lists. The Nexant survey

lab then programmed and distributed the surveys using Qualtrics survey software. The NMR team worked closely with the Nexant survey lab to test the programming of each survey and to perform quality checks on all data collected.

Table 30: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Fielding Firm	Completed	Population	90% CI Error Margin
HAP IESO Staff and Program Delivery Vendor Staff	Phone IDIs	NMR Staff	2	2	0%
HAP Auditors and Contractors	Web	Nexant Survey Lab	49	64	5.7%
HAP Participants	Web	Nexant Survey Lab	682	4,194	2.9%
HAP Social Housing Provider	Phone IDIs	NMR Staff	2	2	0.0%

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

A.3.1 IESO Staff and Program Delivery Vendor Staff Interviews

The NMR team completed one interview with one IESO staff member and one interview with four program delivery vendor staff members to gain a detailed understanding of HAP in PY2020 (Table 31). 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 April 22 to May 10 of 2021.

Table 31: HAP IESO Staff and Program Delivery Vendor Staff Interview Disposition

Disposition Report	Count
Completes	2
Screened Out	0
Unsubscribed	0
Partial Complete	0
Bad Contact Info (No Replacement Found)	0
No Response	0
Total in Population	2

A.3.2 Auditor and Contractor Survey

The NMR team surveyed 49 HAP auditors and contractors from a sample of 64 auditors and contractors (Table 32). The purpose of the survey was to better understand HAP 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, program barriers, suggestions for program improvement, and job impacts.

The NMR team developed the survey sample with support from the program delivery vendor, who provided a contact list of six auditors and 58 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 Nexant survey lab using Qualtrics survey software. Survey implementation was conducted between March 30 and April 26 of 2021. The survey took an average of 17 minutes to complete after removing outliers.[24] The NMR team sent weekly e-mail reminders to non-responsive contacts over the course of web survey fielding.

Table 32: HAP Auditor and Contractor Survey Disposition

Disposition Report	Count
Completes	49
Screened Out	2
Unsubscribed	0
Partial Complete	5
Bad Contact Info (No Replacement Found)	0
No Response	8
Total Invited to Participate	64

A.3.3 Participant Survey

The NMR team surveyed 682 HAP participants from a sample of 4,194 unique contacts (Table 33). The purpose of the survey was to better understand HAP 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; satisfaction with various aspects of the program process; suggestions for program improvement, including additional equipment or services to consider; job impacts; and demographics.

The NMR team developed the sample from program records provided by the IESO EM&V staff. Given the large number of program participants, the NMR team randomly selected a subset of participants for inclusion in the survey sample.

The NMR team delivered the survey over the web in partnership with the Nexant survey lab using Qualtrics survey software. The NMR team conducted survey implementation between April 6 and

May 3 of 2020. The survey took an average of 18 minutes to complete after removing outliers.[24] The NMR team sent weekly e-mail reminders to non-responsive contacts over the course of web survey fielding.

Table 33: HAP Participant Survey Disposition

Disposition Report	Count
Completes	682
Screened Out	226
Unsubscribed	0
Partial Complete	90
Bad Contact Info (No Replacement Found)	22
No Response	3,856
Total Invited to Participate	4,194

A.3.3.1 Participant Sampling Plan

The NMR team sampled HAP 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 PY19 approach, 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 21% and 80% of total distributed savings) and low savers (participants whose summed measure savings were in the lowest 20% of total distributed savings). The NMR team used these savings bins as the sampling strata and refer to them as the 20/60/20 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[25] to optimally sample projects from each of the 20/60/20 strata given the overall number of sample points desired. After initially drawing the sample by the 20/60/20 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. 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 projects with aerators, block heaters, showerheads, thermostats, and window air conditioners. Likewise, the NMR team verified that sampled projects provided adequate coverage of the different IESO regions surveyed. Table 34 shows the original sample plan. As seen in Table 33, the survey response was very successful, resulting in 682 survey completes. Table 35 compares the number of program participants in the population that installed

[24] 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.
[25] See Chapter 11 of the Uniform Methods Project for examples of Neyman Allocation in evaluation. https://www.nrel.gov/docs/fy17osti/68567.pdf

each measure category with the number of participants contacted for the survey, and who completed the survey.

Table 34: HAP Participant Sample Plan Summary

Project Strata	Project Count	Measure Count	90% Error Margin
Top 20% of Savings	47	3,149	31.3%
Mid 60% of Savings	427	2,434	5.0%
Bottom 20% of Savings	135	405	3.1%

Table 35: HAP Participant Survey Project Counts and Completes by Measure Category

Measure Category	Projects in Population	Invited to Participate	Completed Survey
Lighting	9,703	3,285	542
Dehumidifiers	498	180	98
Freezers	1,142	432	185
Refrigerators	1,833	703	256
Window Air Conditioners	98	65	18
Weatherization – Building Shell	277	114	52
Smart Power Bars	7,728	2,988	478
Aerators	945	416	111
Showerheads	846	359	129
Pipe / Tank Wrap	540	212	62
Block Heater Timers	1,417	677	146
Indoor Clothes Drying Racks	6,744	2,883	458
Thermostats	664	324	113

A.3.4 Social Housing Provider Interviews

The NMR team interviewed two participating social housing provider staff members to gain a detailed understanding of HAP in PY2020 (Table 36). The purpose of the survey was to better understand HAP social housing provider perspectives related to program experience.

The interview topics included program roles and responsibilities, awareness and motivations, program experiences, satisfaction, barriers, 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 30 minutes to complete. The NMR team conducted IDIs via phone with the social housing provider staff members from April 12 to May 12 of 2021.

Table 36: HAP Social Housing Providers Interview Disposition

Disposition Report	Count
Completes	2
Screened Out	0
Unsubscribed	0
Partial Complete	0
Bad Contact Info (No Replacement Found)	0
No Response	0
Total in Population	2

A.4 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 HAP 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.4.1 Statistics Canada IO Model

The Industry Accounts Division of StatCan maintains two versions of a Canadian IO model: a national, and an interprovincial model [26]. The models are classical Leontief-type open-IO models[27], 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 2016. The model has been used to model employment impacts from a wide range of economic shocks, including structural changes

[26] Statistics Canada - Industry Accounts Division System of National Accounts; (2009). User's Guide to the Canadian Input-Output Model. Statistics Canada. Ret
[27] Ghanem, Ziad; (2010). The Canadian and Inter-Provincial Input-Output Models: The Mathematical Framework. Statistics Canada – Industry Accounts Division.

to the Canadian economy[28], the bovine spongiform encephalitis (BSE) crisis in the early-mid 2000's[29], and the construction of hydropower projects[30].

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.4.2 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 HAP.
3. Ran the model and interpreted the results.

The following sections cover each step in more detail.

A.4.2.1 Developed Specific Research Questions

The first step in modeling the job impacts from HAP was to determine which specific research questions (RQs) the model would answer. In a scenario without the existence of HAP, customers receive electricity from IESO and pay for it via the monthly billing process. Delivering HAP 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 HAP 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 centre operations, and

[28] Gera, S & Masse, P; (1996). Employment Performance in the Knowledge-Based Economy, Gouvernement du Canada - Industrial Organization 14, Gouvernement du Canada - Industry Canada.
[29] 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.
[30] Desrochers, R. et al.; (2011). Job Creation and Economic Development Opportunities in the Canadian Hydropower Market. Canadian Hydropower Association.

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.4.3 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 labour versus non-labor. For the product categories, we used the labour 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 labour versus overhead (non-labour).

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[31] (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]
   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. **HAP 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[32]. The

[31] The net-to-gross ratio for HAP is 1, so the net energy savings are the same as gross savings.
[32] Annual Planning Outlook – A view of Ontario's electricity system needs; 2020. IESO.

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.4.3.1 Run Model and Interpret Results

Determining the total job impacts from HAP 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 HAP.

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.

Appendix B Additional Impact Evaluation Results

This appendix includes additional results associated with the impact evaluation activities.

B.1 Detailed Impact Results

Table 37 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 PY2020 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 HAP. RRs for energy and demand are displayed in the following tables.

Table 37: Aggregate Measure-Level Energy and Demand Savings

Measure	Quantity Installed*	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	Verified Savings - Energy (kWh)	Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
=11W ENERGY STAR Qualified LED A Shape	147,605	7,040,759	442.8	5,180,977	347.0	44.0%	30.0%
=11W ENERGY STAR Qualified LED MR 16	1,631	58,227	3.3	49,956	3.3	0.4%	0.3%
=14W ENERGY STAR Qualified LED A Shape	2,046	96,980	6.1	71,685	4.8	0.6%	0.4%
=16W ENERGY STAR Qualified LED PAR 20	1,231	56,503	3.7	48,465	3.2	0.4%	0.3%
=16W ENERGY STAR Qualified LED PAR30 & PAR38	2,660	150,024	10.6	128,603	8.6	1.1%	0.7%
=23W ENERGY STAR Qualified LED A Shape	9,001	551,761	36.0	530,888	35.6	4.5%	3.1%
=23W ENERGY STAR Qualified LED PAR	1,394	73,603	5.6	63,050	4.2	0.5%	0.4%
=6W ENERGY STAR® Qualified LED MR 16 / PAR 16	6,272	236,454	18.8	202,646	13.6	1.7%	1.2%
Attic Insulation	216	351,088	4.0	396,766	23.0	3.4%	2.0%
Basement insulation	61	258,485	3.1	296,832	17.2	2.5%	1.5%
Block Heater Timer (just timer)	1,520	363,432	-	68,115	-	0.6%	-

Measure	Quantity Installed*	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	Verified Savings - Energy (kWh)	Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
Air sealing/ Comprehensive Draft proofing	134	142,453	1.5	171,116	9.9	1.5%	0.9%
Dehumidifier Replacement (ENERGY STAR Qualified 14.2 - 21.2 l/day)	521	126,499	40.6	155,760	48.1	1.3%	4.2%
Dehumidifier Replacement (ENERGY STAR Qualified 21.3 - 25.4 l/day)	20	3,970	1.3	5,569	1.8	<0.1%	0.2%
Dehumidifier Replacement (ENERGY STAR Qualified 25.5 - 35.5 l/day)	28	5,124	1.7	7,189	2.3	0.1%	0.2%
Efficient Aerators (bathroom) < 3.8 Lpm	736	36,211	3.7	23,656	2.3	0.2%	0.2%
Efficient Aerators (kitchen) < 5.7 Lpm	813	102,032	9.8	102,777	10.0	0.9%	0.9%
Efficient Showerhead (handheld) < 4.8 Lpm	643	150,269	14.8	96,831	9.4	0.8%	0.8%
Efficient Showerheads (standard) < 4.8 Lpm	377	88,105	8.7	85,205	8.3	0.7%	0.7%
ENERGY STAR® LED Wet Location Rated PAR lamp = 23 Watt	1,648	87,674	6.6	75,224	5.0	0.6%	0.4%
Freezer Replacement (ENERGY STAR Qualified 12-14.4 cu ft)	800	83,920	11.2	184,163	25.9	1.6%	2.2%

Measure	Quantity Installed*	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	Verified Savings - Energy (kWh)	Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
Freezer Replacement (ENERGY STAR Qualified 14.5 – 16.0 cu ft)	501	51,603	7.0	104,425	14.1	0.9%	1.2%
Freezer Replacement (ENERGY STAR Qualified 7-12.0 cu ft)	43	2,365	0.3	2,360	0.3	<0.1%	<0.1%
Hot Water Tank Insulation - Fiberglass R10	40	3,968	0.4	2,736	0.3	<0.1%	0.2%
Hot Water Tank Pipe Insulation - ½" (per foot)	2,668	128,331	13.3	18,329	1.9	0.2%	<0.1%
Hot Water Tank Pipe Insulation - ¾ " (per foot)	393	28,257	2.8	5,488	0.5	<0.1%	<0.1%
Indoor Clothes Drying Rack	7,728	749,616	502.3	637,534	426.5	5.4%	36.8%
LED Downlight with Light Output >600 and <800 lumens	38	2,345	0.2	1,268	0.1	<0.1%	<0.1%
LED Downlight with Light Output >800 lumens	3	266	<0.1%	140	<0.1%	<0.1%	<0.1%
Programmable Thermostat – Line Voltage	1,436	175,479	-	96,317	-	0.8%	-
Programmable Thermostat – Low Voltage	45	59,463	-	56,264	-	0.5%	-
Refrigerator Replacement (10.0 – 12.5 cu ft)	621	111,780	14.9	110,565	14.5	0.9%	1.3%

Measure	Quantity Installed*	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	Verified Savings - Energy (kWh)	Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
Refrigerator Replacement (ENERGY STAR Qualified 15.5 – 16.9 cu ft)	509	104,345	13.7	105,589	13.9	0.9%	1.2%
Refrigerator Replacement (ENERGY STAR Qualified 17.0 – 18.4 cu ft)	1,118	243,724	32.4	224,857	31.1	1.9%	2.7%
Smart Power Bar	9,733	35,039	-	2,095,320	55.4	17.8%	4.8%
Smart Thermostat – Line Voltage (connected unit)	928	172,840	-	134,370	-	1.1%	-
Smart Thermostat – Line Voltage (controller unit)	291	54,199	-	42,135	-	0.4%	-
Smart Thermostat – Low Voltage	16	13,420	4.0	12,114	2.1	0.1%	0.2%
Smart Thermostat – Low Voltage (with C-wire)	16	13,420	4.0	12,114	2.1	0.1%	0.2%
Wall Insulation	14	96,449	1.2	155,311	9.0	1.3%	0.8%
Window Air Conditioner Replacement (ENERGY STAR Qualified 10,000 – 12,000 BTU/hr)	10	754	0.9	459	0.5	<0.1%	<0.1%
Window Air Conditioner Replacement (ENERGY STAR Qualified 6,000 – 7,999 BTU/hr)	40	1,640	2.0	133	0.2	<0.1%	<0.1%
Window Air Conditioner Replacement (ENERGY	66	3,828	4.6	1,882	2.2	<0.1%	0.2%

Measure	Quantity Installed*	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	Verified Savings - Energy (kWh)	Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
STAR Qualified 8,000 – 9,999 BTU/hr)							
Program Total	**1,053,664**	**12,116,702**	**1,238**	**11,765,183**	**1,159**	**100%**	**100%**

Table 38 displays the PY2020 HAP per-unit measure-level results for reported and verified energy savings (kWh). The per-unit verified energy savings values include the adjustments made during the tracking data review, desk reviews, and ISR and HOU adjustments. These values also reflect the adjustments made during the PY2019 TRM review.

Table 38: PY2020 Reported and Verified Gross Energy Savings

Measure	Per-Unit Energy Savings - PY2020 Reported	Per-Unit Energy Savings -PY2020 Verified	Energy RR (kWh)
=11W ENERGY STAR Qualified LED A Shape	47.7	35.1	73.6%
=11W ENERGY STAR Qualified LED MR 16	35.7	30.6	85.8%
=14W ENERGY STAR Qualified LED A Shape	47.4	35.0	73.9%
=16W ENERGY STAR Qualified LED PAR 20	45.9	39.4	85.8%
=16W ENERGY STAR Qualified LED PAR30 & PAR38	56.4	48.3	85.7%
=23W ENERGY STAR Qualified LED A Shape	61.3	59.0	96.2%
=23W ENERGY STAR Qualified LED PAR	52.8	45.2	85.7%
=6W ENERGY STAR® Qualified LED MR 16 / PAR 16	37.7	32.3	85.7%
Attic Insulation	1,625.4	1,836.9	113.0%
Basement insulation	4,237.5	4,866.1	114.8%
Block Heater Timer (just timer)	239.1	44.8	18.7%
Air Sealing / Comprehensive Draft proofing	1,063.1	1,277.0	120.1%
Dehumidifier Replacement (ENERGY STAR Qualified 14.2 - 21.2 l/day)	242.8	299.0	123.1%
Dehumidifier Replacement (ENERGY STAR Qualified 21.3 - 25.4 l/day)	198.5	278.5	140.3%

Measure	Per-Unit Energy Savings - PY2020 Reported	Per-Unit Energy Savings -PY2020 Verified	Energy RR (kWh)
Dehumidifier Replacement (ENERGY STAR Qualified 25.5 - 35.5 l/day)	183.0	256.8	140.3%
Efficient Aerators (bathroom) < 3.8 Lpm	49.2	32.1	65.3%
Efficient Aerators (kitchen) < 5.7 Lpm	125.5	126.4	100.7%
Efficient Showerhead (handheld) < 4.8 Lpm	233.7	150.6	64.4%
Efficient Showerheads (standard) < 4.8 Lpm	233.7	226.0	96.7%
ENERGY STAR® LED Wet Location Rated PAR lamp = 23 Watt	53.2	45.6	85.8%
Freezer Replacement (ENERGY STAR Qualified 12-14.4 cu ft)	104.9	230.2	219.5%
Freezer Replacement (ENERGY STAR Qualified 14.5 – 16.0 cu ft)	103.0	208.4	202.4%
Freezer Replacement (ENERGY STAR Qualified 7-12.0 cu ft)	55.0	54.9	99.8%
Hot Water Tank Insulation - Fiberglass R10	48.1	6.9	14.3%
Hot Water Tank Pipe Insulation - ½" (per foot)	71.9	14.0	19.4%
Hot Water Tank Pipe Insulation - ¾ " (per foot)	99.2	68.4	69.0%
Indoor Clothes Drying Rack	97.0	82.5	85.0%
LED Downlight with Light Output >600 and <800 lumens	61.7	33.4	54.1%
LED Downlight with Light Output >800 lumens	88.7	46.6	52.5%
Programmable Thermostat – Line Voltage	122.2	67.1	54.9%
Programmable Thermostat – Low Voltage	1,321.4	1,250.3	94.6%
Refrigerator Replacement (10.0 – 12.5 cu ft)	180.0	178.0	98.9%
Refrigerator Replacement (ENERGY STAR Qualified 15.5 – 16.9 cu ft)	205.0	207.4	101.2%
Refrigerator Replacement (ENERGY STAR Qualified 17.0 – 18.4 cu ft)	218.0	201.1	92.3%
Smart Power Bar	3.6	215.3	5980.0%
Smart Thermostat – Line Voltage (connected unit)	186.3	144.8	77.7%
Smart Thermostat – Line Voltage (controller unit)	186.3	144.8	77.7%
Smart Thermostat – Low Voltage	838.7	757.1	90.3%
Smart Thermostat – Low Voltage (with C-wire)	838.7	757.1	90.3%
Wall Insulation	6,889.2	11,093.7	161.0%
Window Air Conditioner Replacement (ENERGY STAR Qualified 10,000 – 12,000 BTU/hr)	75.4	45.9	60.9%

Measure	Per-Unit Energy Savings - PY2020 Reported	Per-Unit Energy Savings -PY2020 Verified	Energy RR (kWh)
Window Air Conditioner Replacement (ENERGY STAR Qualified 6,000 – 7,999 BTU/hr)	41.0	3.3	8.1%
Window Air Conditioner Replacement (ENERGY STAR Qualified 8,000 – 9,999 BTU/hr)	58.0	28.5	49.2%

Table 39 displays the PY2020 HAP per-unit measure-level results for reported and verified demand savings (kW). The per-unit verified demand savings values include any adjustments made during the tracking data review, desk reviews, and ISR and HOU adjustments. These values also reflect the adjustments made during the PY2019 TRM review.

Table 39: PY2020 Reported and Verified Gross Demand Savings

Measure	Per-Unit Energy Savings - PY2020 Reported	Per-Unit Energy Savings - PY2020 Verified	Demand RR (kW)
=11W ENERGY STAR Qualified LED A Shape	0.0030	0.0024	78.4%
=11W ENERGY STAR Qualified LED MR 16	0.0020	0.0021	102.6%
=14W ENERGY STAR Qualified LED A Shape	0.0030	0.0023	78.2%
=16W ENERGY STAR Qualified LED PAR 20	0.0030	0.0026	87.9%
=16W ENERGY STAR Qualified LED PAR30 & PAR38	0.0040	0.0032	81.0%
=23W ENERGY STAR Qualified LED A Shape	0.0040	0.0040	98.8%
=23W ENERGY STAR Qualified LED PAR	0.0040	0.0030	75.8%
=6W ENERGY STAR® Qualified LED MR 16 / PAR 16	0.0030	0.0022	72.2%
Attic Insulation	0.0186	0.1063	571.5%**
Basement insulation	0.0502	0.2817	561.6%**
Block Heater Timer (just timer)	-	-	-
Air Sealing / Comprehensive Draft proofing	0.0112	0.0739	659.0%**
Dehumidifier Replacement (ENERGY STAR Qualified 14.2 - 21.2 l/day)	0.0780	0.0924	118.4%

Measure	Per-Unit Energy Savings - PY2020 Reported	Per-Unit Energy Savings - PY2020 Verified	Demand RR (kW)
Dehumidifier Replacement (ENERGY STAR Qualified 21.3 - 25.4 l/day)	0.0640	0.0898	140.3%
Dehumidifier Replacement (ENERGY STAR Qualified 25.5 - 35.5 l/day)	0.0590	0.0828	140.4%
Efficient Aerators (bathroom) < 3.8 Lpm	0.0050	0.0031	62.7%
Efficient Aerators (kitchen) < 5.7 Lpm	0.0120	0.0123	102.7%
Efficient Showerhead (handheld) < 4.8 Lpm	0.0230	0.0147	63.8%
Efficient Showerheads (standard) < 4.8 Lpm	0.0230	0.0220	95.8%
ENERGY STAR® LED Wet Location Rated PAR lamp = 23 Watt	0.0040	0.0031	76.4%
Freezer Replacement (ENERGY STAR Qualified 12-14.4 cu ft)	0.0140	0.0324	231.4%
Freezer Replacement (ENERGY STAR Qualified 14.5 – 16.0 cu ft)	0.0140	0.0282	201.1%
Freezer Replacement (ENERGY STAR Qualified 7-12.0 cu ft)	0.0070	0.0078	112.0%
Hot Water Tank Insulation - Fiberglass R10	0.0050	0.0007	14.1%
Hot Water Tank Pipe Insulation - ½" (per foot)	0.0070	0.0013	18.8%
Hot Water Tank Pipe Insulation - ¾ " (per foot)	0.0100	0.0075	75.0%
Indoor Clothes Drying Rack	0.0650	0.0552	84.9%
LED Downlight with Light Output >600 and <800 lumens	0.0040	0.0039	97.0%
LED Downlight with Light Output >800 lumens	0.0060	0.0058	97.0%
Programmable Thermostat – Line Voltage	-	-	-
Programmable Thermostat – Low Voltage	-	-	-
Refrigerator Replacement (10.0 – 12.5 cu ft)	0.0240	0.0234	97.6%
Refrigerator Replacement (ENERGY STAR Qualified 15.5 – 16.9 cu ft)	0.0270	0.0274	101.4%

Measure	Per-Unit Energy Savings - PY2020 Reported	Per-Unit Energy Savings - PY2020 Verified	Demand RR (kW)
Refrigerator Replacement (ENERGY STAR Qualified 17.0 – 18.4 cu ft)	0.0240	0.0234	97.6%
Refrigerator Replacement (ENERGY STAR Qualified 15.5 - 16.9 cu ft)	0.0270	0.0274	101.4%
Refrigerator Replacement (ENERGY STAR Qualified 17.0 – 18.4 cu ft)	0.0290	0.0278	95.8%
Smart Power Bar	-	0.0057	-No reported demand savings*
Wall Insulation	-	-	-
Window Air Conditioner Replacement (ENERGY STAR Qualified 10,000 – 12,000 BTU/hr)	-	-	-
Window Air Conditioner Replacement (ENERGY STAR Qualified 6,000 – 7,999 BTU/hr)	0.2500	0.1297	51.9%
Window Air Conditioner Replacement (ENERGY STAR Qualified 8,000 – 9,999 BTU/hr)	0.2500	0.1297	51.9%

*No demand savings were reported in the program tracking data for these measures and the NMR team was not able to calculate an RR. The overall program RR for demand savings includes the verified demand values for these measures.

**Weatherization demand savings have high realization rates due to inconsistent application of demand savings factors (based on end-use load profiles) and some projects not reporting any demand savings.

B.2 HOURS OF USE

The participant survey collected HOU information for several upgrades that homeowners received through the program in PY2020.

Figure 42 and Figure 43 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 4.0 bulbs) and the highest hours per day of use occurred in kitchens (average of 4.8 hours).

Figure 42: Number of LEDs Installed by Room Type

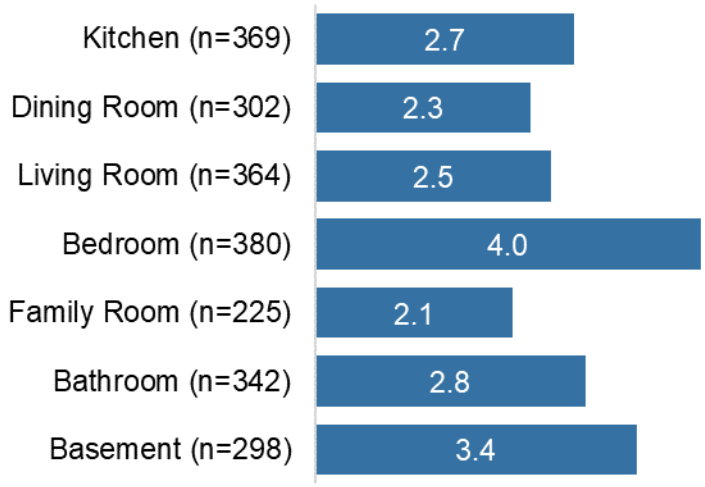
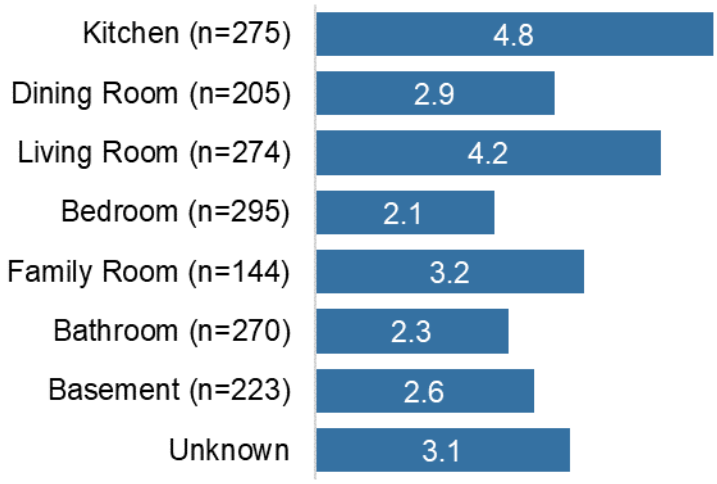


Figure 43: Hours per Day LEDs in Use by Room Type



On average, respondents took 7.7 showers per week. The average duration of each shower was 12.3 minutes. Figure 44 and Figure 45 display the distribution of shower frequency and duration among respondents.

Figure 44: Showers per Week (n=107)

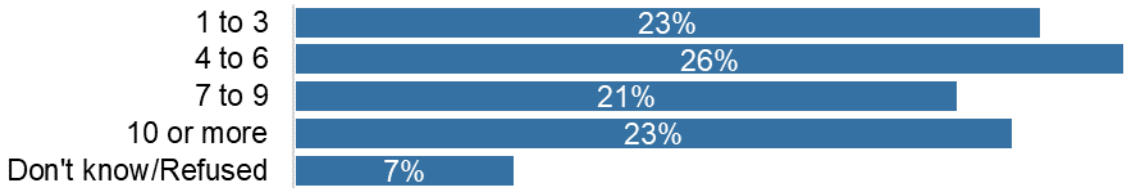


Figure 45: Minutes per Shower (n=98)*

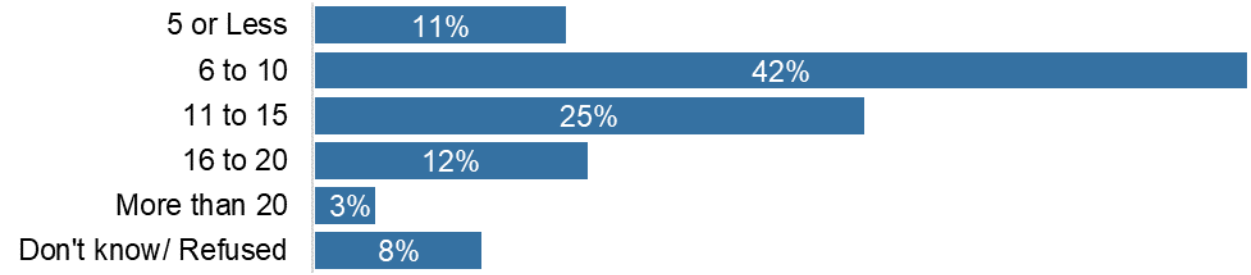
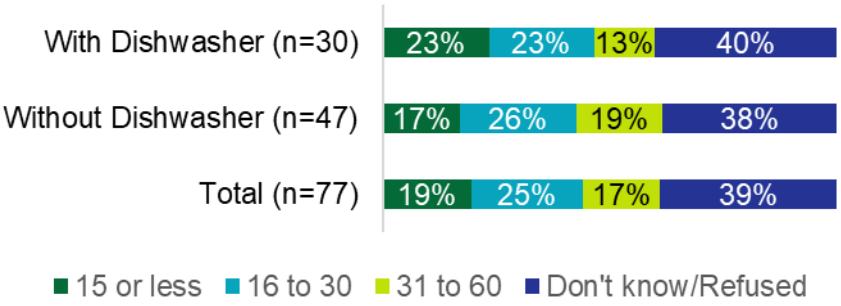


Figure 46 displays the minutes per day respondents with and without dishwashers used their kitchen aerators. Around one-fifth (19%) of respondents used their aerators for 15 minutes per day or less. On average, respondents used their aerators for 28.8 minutes per day.

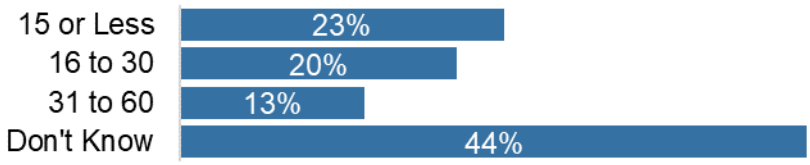
Figure 46: Minutes per Day Kitchen Aerator in Use*



*Does not sum to 100% due to rounding.

Figure 47 displays the minutes per day respondents used their bathroom aerators. Around one-fourth (23%) of respondents used their aerators for 15 minutes per day or less. On average, respondents used their aerators for 24.0 minutes per day.

Figure 47: Minutes per Day Bathroom Aerator in Use (n=29)



On average, respondents used their dehumidifiers for 5.5 months of the year, 6.2 days per week, and15.8 hours per day. Figure 48, Figure 49, and Figure 50 display the distribution of months per year, days per week, and hours per day respondents used their dehumidifiers.

Figure 48: Months per Year Dehumidifier in Use (n=95)

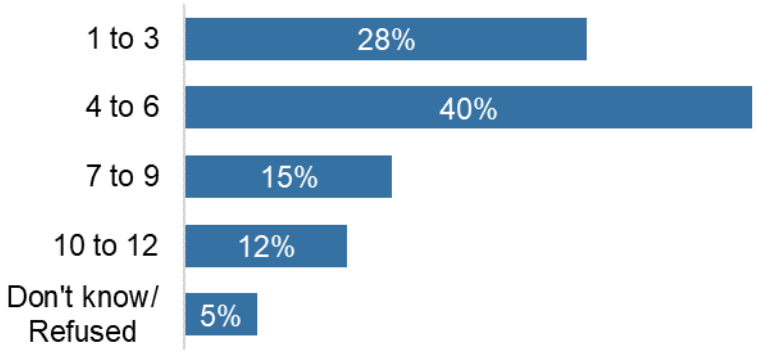


Figure 49: Days per Week Dehumidifier in Use (n=95)

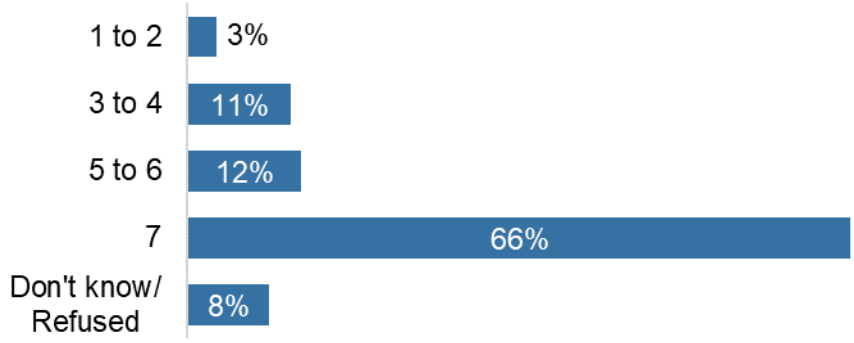
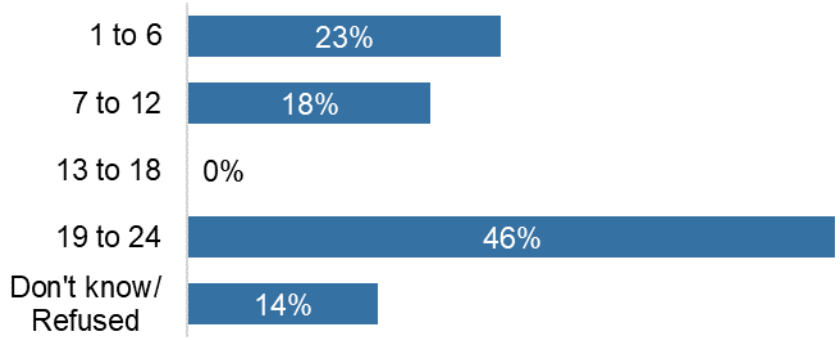


Figure 50: Hours per Day Dehumidifier in Use (n=80)*



*Does not sum to 100% due to rounding.

Before receiving the block heater timers provided by the program, respondents used their block heaters for 6.4 hours per day on average. After installing the block heat timers, respondents used their block heaters for an average of 4.3 hours per day. Figure 51 displays the distribution of hours per day that respondents used their block heaters before and after receiving the block heat timers.

Figure 51: Hours per Day Block Heater in Use (n=109)