PY2016 Home Assistance Program Evaluation

October 2, 2017

Independent Electricity System Operator
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## Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym or Abbreviation</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>CFF</td>
<td>Conservation First Framework</td>
</tr>
<tr>
<td>cu. ft.</td>
<td>cubic feet</td>
</tr>
<tr>
<td>EUL</td>
<td>effective useful life</td>
</tr>
<tr>
<td>FAST</td>
<td>Field Audit Report Tool</td>
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<tr>
<td>HAP</td>
<td>Home Assistance Program</td>
</tr>
<tr>
<td>HES</td>
<td>Home Energy Solutions</td>
</tr>
<tr>
<td>HES–IE</td>
<td>Home Energy Solutions–Income Eligible</td>
</tr>
<tr>
<td>IESO</td>
<td>Independent Electricity System Operator</td>
</tr>
<tr>
<td>ISR</td>
<td>in-service rate</td>
</tr>
<tr>
<td>LDC</td>
<td>local distribution company</td>
</tr>
<tr>
<td>LEAN</td>
<td>Low-Income Energy Affordability Network</td>
</tr>
<tr>
<td>LEAP</td>
<td>Low-Income Energy Assistance Program</td>
</tr>
<tr>
<td>LUEC</td>
<td>Levelized Unit Electricity Delivery Costs</td>
</tr>
<tr>
<td>Lpm</td>
<td>litres per minute</td>
</tr>
<tr>
<td>NTG</td>
<td>net-to-gross</td>
</tr>
<tr>
<td>OESP</td>
<td>Ontario Energy Savings Program</td>
</tr>
<tr>
<td>PIA</td>
<td>prescriptive input assumption</td>
</tr>
<tr>
<td>PWC</td>
<td>People Working Cooperatively</td>
</tr>
<tr>
<td>PY</td>
<td>program year</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Offer Program</td>
</tr>
<tr>
<td>TRC</td>
<td>total resource cost test</td>
</tr>
<tr>
<td>TRM</td>
<td>technical reference manual</td>
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Executive Summary

The Independent Electricity System Operator (IESO) oversees the Home Assistance Program (HAP), marketed as the Save on Energy Home Assistance Program. The IESO contracted with Cadmus to evaluate the HAP for program years (PY) 2016 through PY2020. This report details the findings from the PY2016 (January 1, 2016, through December 31, 2016) process, impact and cost-effectiveness evaluations. For these evaluations, Cadmus followed the IESO’s Conservation First Framework (2015–2020) EM&V Protocols and Requirements.¹

For the PY2016 evaluation, Cadmus sought to accomplish the following:

- Determine gross and net annual energy savings, peak demand reduction and cost-effectiveness achieved by the HAP
- Assess the effectiveness of program design and delivery and identify opportunities for program improvements
- Evaluate customer satisfaction
- Identify the HAP’s non-energy impacts

Home Assistance Program Description

Through the HAP, the IESO provides energy efficiency upgrades free of charge to income-qualified Ontario homeowners, tenants and social and/or assisted housing providers. The LDC or a delivery agent contracted by the LDC determines and directly installs eligible efficiency measures identified through a detailed in-home energy assessment. Participants in electrically heated homes are eligible to receive weatherization measures, including air sealing and insulation. In addition to energy-efficient equipment, the LDC or delivery agent can install health and safety measures to mitigate immediate health and safety concerns in a residence. The LDC or delivery agent also provides HAP participants with education on managing their home energy use more effectively.

**Methodology**

To address the research objectives, Cadmus conducted an impact and a process evaluation, as well as a jurisdictional scan. We conducted several activities to determine net energy savings:

- Reviewed the PY2016 HAP project records and measure data
- Worked closely with the IESO to determine the final number of projects and measures installed
- Applied the measure savings values from the “Field Audit Report Support Tool” (FAST) to determine program-reported energy savings and demand reduction

Cadmus developed the unit energy savings at the measure level through a combination of secondary research and application of adjustment factors (e.g., in-service rates [ISRs]) obtained through participant surveys.

Finally, Cadmus multiplied the verified unit energy savings by the measure quantities to develop verified gross and net program-level savings. The net-to-gross (NTG) ratio for the program is 1.0, so the net savings equal gross savings. To assess cost-effectiveness, Cadmus used impact evaluation data and program cost data at the LDC level. We assessed performance through the Total Resource Cost (TRC) test, the Program Administrator Cost (PAC) test and the Levelized Unit Electricity Delivery Costs (LUEC).

To address the process evaluation objectives of assessing HAP effectiveness and the program’s overall operation and performance, Cadmus used a combination of primary and secondary research. First, we reviewed various program materials to understand the HAP and to identify specific questions to explore during primary research activities. We gathered primary data for the process evaluation through interviews with the IESO, delivery agent program staff and a self-delivering LDC, and conducted surveys with 311 program participants. Cadmus also conducted a jurisdictional scan to compare HAP to similar low-income efficiency initiatives in North America.

**Key Findings and Conclusions**

Cadmus verified the HAP gross energy savings and demand reduction. Table 1 provides an overview of the HAP PY2016 net impact results in comparison to the PY2015 results.

<table>
<thead>
<tr>
<th>Item</th>
<th>Units</th>
<th>PY2016</th>
<th>PY2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation</td>
<td>Number of Participants</td>
<td>5,066</td>
<td>16,526</td>
</tr>
<tr>
<td>Verified Savings</td>
<td>kWh/year</td>
<td>7,590,437</td>
<td>16,052,556</td>
</tr>
<tr>
<td></td>
<td>kW</td>
<td>827</td>
<td>2,438</td>
</tr>
<tr>
<td>Cost-Effectiveness</td>
<td>Total Resource Cost Test: Benefit/Cost Ratio</td>
<td>0.92</td>
<td>1.01</td>
</tr>
<tr>
<td></td>
<td>Program Administrator Cost Test: Benefit/Cost Ratio</td>
<td>0.80</td>
<td>0.88</td>
</tr>
<tr>
<td>Levelized Delivery Cost Test</td>
<td>$/kWh ratio</td>
<td>0.08</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Benefits (Present Value kWh)</td>
<td>77,161,479</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Overall participation and savings decreased significantly from PY2015, as did the number of LDCs offering the program. The decrease in program participation largely resulted from fewer LDCs offering the HAP in PY2016 and from higher costs for recruiting participants outside of the social housing segment, where the bulk of customers were recruited to the HAP during PY2013 to PY2015. Consequently, LDCs and delivery agents are changing their marketing and delivery strategies to recruit customers beyond the social housing market. PY2016 also had lower realization rates than PY2015, primarily due to discrepancies in reported data and assumptions used to estimate energy savings and demand reduction.

Measures contributing savings in PY2016 differed greatly from those contributing savings in PY2015. The measure mix contributing to program savings changed between years, with newly introduced LEDs accounting for 64% of total verified savings in PY2016. In PY2016, weatherization measures contributed only 2% of total verified savings, compared to 21% in PY2015.

Per-project verified energy savings and demand reduction continued to increase from PY2015. PY2016’s per project energy savings increased by 527 kWh and 0.013 kW over PY2015 due to the introduction of LEDs. Over 70% of PY2016 projects included LEDs, which contributed an average of 933 kWh and 0.64 kW to projects with LEDs.

HAP participants typically expressed satisfaction with program services and equipment, though they wanted more information about ways to save energy and lower their bills. HAP participants appreciated the services and equipment provided by the program: when asked about their satisfaction with the program overall, most respondents rated themselves as very satisfied. Most survey respondents were happy with the convenience, service and equipment received, but were less satisfied with the information provided on ways to save energy and with the actual electricity bill savings.

Delivery agents said that their auditors’ engagement with participants offers the most effective way to provide education. The IESO developed and provided LDCs with a flyer that included guidance on providing education to customers and a standard list of tips for saving energy. However, not all participants recalled receiving printed materials, and some expressed a desire for more information on how to save energy. Half of the participation survey respondents said the delivery agent left printed educational materials.

While most survey respondents said they did not perceive non-energy benefits, over one-quarter said they perceived positive non-energy impacts from energy efficiency improvements made to their homes. Participants most commonly highlighted improvements in comfort and lighting levels. Cadmus also investigated whether HAP affected the transiency of participants: almost 10% of survey respondents said the program encouraged them to stay in their home.

The HAP came very close to be cost-effective. The PY2016 HAP included LDC administrative expenses for LDC’s that did not have associated Conservation First Framework program savings. Additionally, 15 different measure descriptions claimed zero savings, but included associated incentive and measure costs. Excluding these costs would make the program cost-effective from the TRC test perspective.
Finally, refrigerator and freezer measures contributed high net costs to the TRC test that vastly exceeded the overall net benefit, thus reducing cost-effectiveness for the overall program.
1. Introduction

This report describes the evaluation of the Program Year 2016 (PY2016) Home Assistance Program (HAP). The IESO has offered the program since PY2011, and it has been evaluated annually. PY2016 is the first year the program has fully operated under the Conservation First Framework (CFF). Under CFF, local distribution companies (LDCs) determine whether to offer HAP to customers in their respective service territories. Thirty LDCs offered HAP in PY2016, while the other 41 LDCs assumed that HAP-eligible customers would be served by the province-wide Coupons Program (71 LDCs offer the Coupon Program).

1.1 Evaluation Objectives

The evaluation of HAP included the objectives listed below:

Impact Evaluation:

- Determine annual verified gross and net energy savings and demand reduction at the project track or measure category level
- Review and update input savings assumptions
- Calculate program-level cost effectiveness with the total resource cost test (TRC), program administrator cost (PAC) test and levelized unit electricity delivery costs (LUEC)

Process Evaluation:

- Assess participant and contractor satisfaction
- Assess improved comfort and health, net hardship\(^2\), transiency of participants and other ancillary benefits
- Understand and document program processes
- Develop recommendations for program improvement
- Determine whether previous evaluation recommendations were implemented and, if not, the reasons why they were not
- Conduct a jurisdictional scan to compare HAP to other similar low-income efficiency initiatives in North America.
- Determine geographic and demographic gaps in program offerings via a participation gap analysis (report to be published separately after July 2017)
- Determine economic impacts in terms of direct job impacts. This includes full-time equivalents from program spending on administrative staff and incentives and full economic impact assessment using input-output modeling (IMPLAN software and data for Ontario). (Report to be published separately after July 2017).

\(^2\) Health or financial hardships that may make it difficult to pay typical bills.
This remainder of this report is organized by each of these main evaluation components. Within each section, we provide the methodology and key findings.

1.2 Program Description

The IESO first offered the HAP in PY2011. Through the HAP, marketed as the Save on Energy Home Assistance Program, Ontario LDCs offer services to eligible homeowners and tenants, in both non-profit and private rental housing, to improve the energy efficiency of their homes and help them manage their energy use. The HAP is marketed and managed by the individual LDCs, and is delivered free of charge to participants. LDC-approved contractors determine and install the appropriate efficiency measures during an initial in-home energy assessment (energy audit). During the energy audit, participants receive tips on energy-saving behaviours, information regarding how time-of-use rates work and instructions regarding the use of any new energy-efficient equipment. Participants in electrically heated single-family homes may receive a more extensive weatherization audit to determine eligibility for additional air sealing and insulation upgrades.  

1.2.1 Eligibility

To be eligible, Ontario residents must have a household income for the previous year that is less than or equal to an after-tax low-income measure supported by proof of income, be an aboriginal living on First Nations and approved to be low-income by the LDC, receive government and/or utility assistance, have received a Low-Income Energy Assistance Program (LEAP) emergency financial assistance grant within the past 12-months or have qualified for a natural gas low-income demand-side management program within the past 12-months. Full details on HAP eligibility requirements are found in the PY2016 HAP Rules.

1.2.2 Measures

At no cost to the participant or building owner/manager, the LDC or implementation service provider conducts an energy audit to identify the most appropriate program measures to install. Program measures fall into three tracks: basic, extended and weatherization. With consent of the property owner, the delivery agent installs these measures, either during the audit or during a follow-up visit. The basic track includes measures such as block heater timers, aerators and lighting. Extended track measures include ENERGY STAR® appliances and thermostats. The weatherization track includes air sealing and insulation measures (attic, baseline and wall). In addition, the LDC contractor may make repairs to the residence to install eligible measures and implement health and safety upgrades when necessary. Table 2 provides a list of PY2016 HAP measures by measure track.


4 Ibid.
Table 2. PY2016 Home Assistance Program Measures

<table>
<thead>
<tr>
<th>Basic Track</th>
<th>Extended Track</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient Showerheads (standard) &lt; 4.8 litres per minute (Lpm)</td>
<td>Window Air Conditioner Replacement (ENERGY STAR 6,000–7,999 Btu/hr)</td>
</tr>
<tr>
<td>≤ 6-Watt ENERGY STAR LED MR20, PAR 30 and PAR38</td>
<td>Freezer Replacement (ENERGY STAR 12–14.4 cu. ft.)</td>
</tr>
<tr>
<td>Efficient Showerheads (handheld) &lt; 4.8 Lpm</td>
<td>Window Air Conditioner Replacement (ENERGY STAR 8,000–9,999 Btu/hr)</td>
</tr>
<tr>
<td>≤ 6-Watt ENERGY STAR LED MR16</td>
<td>Freezer Replacement (ENERGY STAR 14.5–16.0 cu. ft.)</td>
</tr>
<tr>
<td>Efficient Aerators (kitchen) &lt; 5.7 Lpm</td>
<td>Window Air Conditioner Replacement (ENERGY STAR 10,000–12,000 Btu/hr)</td>
</tr>
<tr>
<td>LED Downlight with Light Output &gt; 600 and &lt; 800 Lumens</td>
<td>Refrigerator Replacement (ENERGY STAR 15.5–16.9 cu. ft.)</td>
</tr>
<tr>
<td>Efficient Aerators (bathroom) &lt; 3.8 Lpm</td>
<td>Dehumidifier Replacement (ENERGY STAR 14.2–21.2 L/day)</td>
</tr>
<tr>
<td>LED Downlight with Light Output &gt; 800 Lumens</td>
<td>Refrigerator Replacement (ENERGY STAR 17.0–18.4 cu. ft.)</td>
</tr>
<tr>
<td>≤ 11-Watt ENERGY STAR LED A-Shape</td>
<td>Dehumidifier Replacement (ENERGY STAR 21.3–25.4 L/day)</td>
</tr>
<tr>
<td>ENERGY STAR LED Wet Location ≤ 23 Watt</td>
<td>Refrigerator Replacement (ENERGY STAR 10.0–15.5 cu. ft.)</td>
</tr>
<tr>
<td>≤ 14-Watt ENERGY STAR LED A-Shape</td>
<td>Dehumidifier Replacement (ENERGY STAR 25.5–35.5 L/day)</td>
</tr>
<tr>
<td>≤ 11-Watt ENERGY STAR-Qualified LED MR16</td>
<td>Programmable Thermostat</td>
</tr>
<tr>
<td>≤ 23-Watt ENERGY STAR LED A-Shape</td>
<td>Weatherization Track</td>
</tr>
<tr>
<td>Block Heater Timer</td>
<td>Comprehensive Draft Proofing</td>
</tr>
<tr>
<td>≤ 23-Watt ENERGY STAR-Qualified LED PAR</td>
<td>Wall Insulation</td>
</tr>
<tr>
<td>Indoor Clothes Drying Rack</td>
<td>Attic Insulation</td>
</tr>
<tr>
<td>Qualified LED MR16 / PAR16 - GU 10 Base</td>
<td>Basement Insulation</td>
</tr>
<tr>
<td>Hot Water Tank Pipe Insulation – 1/2-inch inside diameter</td>
<td>Health and Safety Measures</td>
</tr>
<tr>
<td>Power Bar</td>
<td>Various*</td>
</tr>
<tr>
<td>Hot Water Tank Pipe Insulation – 3/4-inch inside diameter</td>
<td>nst</td>
</tr>
</tbody>
</table>

The PY2016 HAP included many of the same measures as PY2015, except CFL measures, which the IESO dropped from the program after March 11, 2016 and replaced with LEDs. The other notable change in
PY2016 was the inclusion of health and safety measures. These measures permit delivery agents to: (a) make repairs to the residence where this enables additional eligible measures to be installed and (b) make health and safety upgrades to the residence where such upgrades promote energy efficiency and are reasonably required to mitigate an immediate health and safety concern in the residence. The cost of such repairs and upgrades is limited to $750 total or less.

### 1.2.3 Program Implementation

In the Conservation First Framework, the IESO provides funding to LDCs to deliver on their allocated energy savings target, a portion of which LDCs may allocate to HAP. LDCs choose to deliver the program through their own employees or through service providers known as delivery agents. LDCs and delivery agents partner with assistance agencies, non-profits and social and co-op housing providers, as well as natural gas and water utilities, to advertise the program and provide outreach to potential participants. A full description of program stakeholders and their interaction with the program is provided in the Program Design and Delivery subsection of this report.

Self-delivering LDCs, delivery agents and/or contractors for the program (referred to as “delivery agents” in remainder of report) start each in home customer engagement by conducting an energy audit in the home. With the energy audit, delivery agents aim to identify basic and extended measures that can be implemented to achieve energy savings. If the home is electrically heated, the audit is extended to include identifying weatherization measures. The delivery agents use an Excel workbook, called the “Field Audit Report Support Tool” (FAST), to record installed measures and verify that TRC minimum requirements are met. FAST files are ultimately compiled into the HAP project records and measure data.

Weatherization measures can either be entered in the project data via FAST or via HOT2000. HOT2000 is the Canadian energy simulation and design tool for evaluating the energy performance of single-family houses and low-rise multi-unit residential buildings. The software is developed and managed by the Office of Energy Efficiency at Natural Resources Canada. To enter a HAP project into HOT2000, delivery agents must conduct a blower door test. The blower door test provides results parameters modelled in HOT2000. The HOT2000 model produces output savings values that are entered into the HAP project records and measure data. The delivery agents used HOT2000 version 11.0 and FAST version 1.3 for PY2016 program delivery and data reporting.
2. Impact Evaluation

This section describes Cadmus’ methodology and findings for determining the HAP’s net verified energy savings and demand reduction and comparing the results to program-reported savings.

2.1 Methodology

The impact methodology consisted of four main steps.

1. Cadmus reviewed the program tracking data to determine the final number of projects and measures installed.
2. Cadmus applied unit savings values from the FAST to determine program reported energy savings and demand reduction.
3. Cadmus developed unit energy savings at the measure level through a combination of secondary research and application of adjustment factors (e.g., in-service rates [ISRs]) obtained through participant surveys.
4. Cadmus multiplied verified unit energy savings by measure quantities to develop verified gross and net program-level savings. The net-to-gross (NTG) ratio for HAP is deemed as 1, and is consistent with the PY2015 evaluation, as well as low-income direct install programs in other jurisdictions. Therefore, net savings equal gross savings.

2.1.1 Program Data Review and Analysis

Cadmus reviewed the program-tracking database (called “LDC Project Lists”) and worked with the IESO staff to resolve data discrepancies by:

- Zeroing out CFL savings for projects completed after March 11, 2016. The IESO discontinued CFLs as a HAP offering on March 11, 2016.
- Comparing and resolving data with different unique application IDs between the measure and project levels, resulting in different impact results at the measure and project levels.
- Removing duplicate records.
- Parsing legacy and true-up data from CFF PY2016 data. Legacy projects were installed under the previous framework (before CFF), and true-up projects were installed under CFF and during PY2015 but submitted to the IESO after March 2017, the cut-off date for reporting completed projects. Legacy and true-up projects are not included in the savings reported in the main body of this report. Legacy and true-up savings values are reported in the Legacy and True-Up Savings report section.
- Removing project savings for measures with no reported quantities.

2.1.2 Verified Savings

To determine verified savings, Cadmus used the following equation:

\[
\text{Verified Energy Savings (or Demand Reduction)} = \text{Unit Energy Savings (or Demand Reduction)} \times \text{ISR} \times \text{Quantity}
\]
After determining unit energy savings, Cadmus multiplied unit savings by the measure ISR and measure quantities from the project lists to obtain aggregated verified savings at the project, LDC and program levels.

Cadmus used participant surveys to determine ISRs (see details in the Measure In-Service Rate Results), to collect data on measure installation, retention and removal. Respondents confirmed the measure quantities they received and those that remained installed.

Cadmus also conducted an engineering analysis to calculate unit savings and to update prescriptive input assumptions (PIAs). PIAs are deemed inputs used to determine savings per measure. Cadmus reviewed the PIAs for all PY2016 HAP measures (shown above in Table 2) and compared them to the latest pertinent literature and research, including technical reference manuals (TRMs), Canadian and U.S. federal appliance standards and other secondary sources. Where warranted, Cadmus updated unit savings.

2.1.3 HOT2000 Review
Cadmus reviewed the HOT2000 modeling tool and project data used to estimate weatherization savings, and verified the HOT2000 inputs and fuel cost for consistency and reasonableness. Cadmus also tested the model where possible, running simulation models to check estimated savings.

2.1.4 Health and Safety Measures
PY2016 was the first year that the IESO offered health and safety measures through HAP, covering the costs of goods and labour for any repairs and health and safety upgrades to the residence, up to $750. Cadmus reviewed the installed health and safety measure projects to determine whether they also contributed energy savings. Table 3 displays the default health and safety measures included in the FAST.

<table>
<thead>
<tr>
<th>PY2016 Health and Safety Measures Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install bath fan</td>
</tr>
<tr>
<td>Add ventilation controls</td>
</tr>
<tr>
<td>Add ventilation ducts</td>
</tr>
<tr>
<td>Insulate existing ventilation ductwork</td>
</tr>
<tr>
<td>Air-seal garage/house wall</td>
</tr>
<tr>
<td>Conduct mould remediation</td>
</tr>
<tr>
<td>Add ground cover to foundation floor</td>
</tr>
<tr>
<td>Conduct electrical inspection</td>
</tr>
<tr>
<td>Vent dryer outdoors</td>
</tr>
<tr>
<td>Make electrical repairs</td>
</tr>
<tr>
<td>Isolate pot lights from insulation</td>
</tr>
<tr>
<td>Conduct vermiculite test</td>
</tr>
<tr>
<td>Install eavestroughs/downspouts</td>
</tr>
<tr>
<td>Make plumbing repairs</td>
</tr>
<tr>
<td>Conduct animal removal</td>
</tr>
<tr>
<td>Repair drywall</td>
</tr>
</tbody>
</table>

In addition to the measures listed in Table 3, delivery agents could submit costs for health and safety measures not on the list, provided they submit the appropriate documentation, including all receipts and verification that the installation was needed to enable installation of other program measures.
2.2 Findings

Table 4 summarizes the PY2016 HAP impact evaluation results and compares the net results to PY2015. Participation declined by 70% from PY2015 to PY2016.

<table>
<thead>
<tr>
<th>Measure Track</th>
<th>Number of Projects</th>
<th>Number of LDCs offering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>4,781</td>
<td>30</td>
</tr>
<tr>
<td>Extended</td>
<td>2,355</td>
<td>26</td>
</tr>
<tr>
<td>Weatherization</td>
<td>265</td>
<td>7</td>
</tr>
<tr>
<td>Health and Safety</td>
<td>275</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 4. PY2015 and PY2016 Home Assistance Program Savings and Participation

<table>
<thead>
<tr>
<th></th>
<th>PY2016 Gross</th>
<th>PY2016 Verified Gross</th>
<th>PY2016 Net</th>
<th>PY2015 Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant count</td>
<td>5,066</td>
<td>5,066</td>
<td>5,066</td>
<td>16,526</td>
</tr>
<tr>
<td>kW</td>
<td>4,682</td>
<td>827</td>
<td>827</td>
<td>2,438</td>
</tr>
<tr>
<td>kWh</td>
<td>10,485,408</td>
<td>7,590,437</td>
<td>7,590,437</td>
<td>16,052,556</td>
</tr>
</tbody>
</table>

2.2.1 Participation

The number of LDCs offering the program halved from PY2015 (n=59) to PY2016 (n=30). The number of HAP projects also greatly decreased from 16,526 in PY2015 to 5,066 in PY2016. Of the 30 LDCs offering HAP, four contributed over 86% of PY2016 net verified energy savings.

Table 5. PY2016 Total Net Verified Savings Contribution by LDC

<table>
<thead>
<tr>
<th>LDC</th>
<th>% of Total PY 2016 Net Verified Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro One</td>
<td>34%</td>
</tr>
<tr>
<td>London Hydro</td>
<td>28%</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>15%</td>
</tr>
<tr>
<td>Horizon</td>
<td>10%</td>
</tr>
<tr>
<td>All Other LDCs</td>
<td>13%</td>
</tr>
</tbody>
</table>

*Values do not sum due to rounding

In PY2015, program participation was more evenly distributed among LDCs. Nearly 60% of PY2015 savings were represented by the following five LDCs: Hydro One (25%), Toronto Hydro (12%), Hydro Ottawa (8%), Guelph Hydro (7%), London Hydro (6%).

Table 6 provides the PY2016 project count by measure track and number of LDCs who offered the measure track.

As in prior years, PY2016 lighting measures accounted for the largest share of energy savings. LEDs, new to the program in PY2016, contributed just over 64% of the program’s energy savings. CFLs were installed through March 11, 2016, and accounted for just over 4% of energy savings. Although LDCs
reported CFL measures installed after March 11, 2016, these measures were not counted (as they were ineligible). Before March 11, 12,176 program CFLs were installed.

For CFLs installed before March 11, 2016, Cadmus assumed second-year savings values from the PY2015 PIA list to determine savings, only doing so if measure savings persisted through PY2020.\(^5\) Table 7 lists CFLs effective useful life (EUL). In PY2015, all CFL measures included at least one step down after the first-year verified savings values, to reflect changing baselines. To maintain consistency with the verified savings from PY2015, Cadmus used PY2015’s estimated CFL savings in PY2016.

<table>
<thead>
<tr>
<th>Measure</th>
<th>EUL (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 W CFL Twister</td>
<td>8</td>
</tr>
<tr>
<td>20 W CFL Twister</td>
<td>8</td>
</tr>
<tr>
<td>25 W CFL Twister</td>
<td>8</td>
</tr>
<tr>
<td>3-Way CFL</td>
<td>6</td>
</tr>
<tr>
<td>23 W CFL PAR 30</td>
<td>7</td>
</tr>
<tr>
<td>26W CFL PAR 38, Indoor</td>
<td>4</td>
</tr>
<tr>
<td>26W CFL PAR 38, Outdoor</td>
<td>4</td>
</tr>
<tr>
<td>Covered A19 CFLs</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 7 shows CFL twisters, 3-Way CFLs, PAR 30 CFLs and Covered A19 CFLs persist through PY2020. The CFLs that do not contribute savings in PY2020 are the 26W CFL PAR 38, Indoor and Outdoor, therefore savings for these measures were not counted.\(^6\)

Figure 1 provides the percentage of overall kilowatt and kilowatt-hour savings represented by each measure group. Appendix A provides a complete list of HAP measures that fall into each measure group. Appendix C provides a complete list of kilowatt and kilowatt-hour savings by measure, including the number of unique participants who received the measure and the quantity of each measure.

---

\(^5\) That is, Cadmus only included CFLs with a measure life lasting until PY2020.

\(^6\) Per instruction of IESO staff savings that do not last until PY2020 are not counted as part of the evaluation.
Figure 1. Percentage of PY2015 and PY2016 Verified Savings by Measure Group*

* PY2015 “Lighting” includes CFLs. PY2016 “Lighting” includes CFLs and LEDs. “Other” measure category includes window ACs, block heater timers, programmable thermostats, clothes drying racks, dehumidifiers and smart power bars.

Weatherization savings and participation were significantly lower in PY2016 than in PY2015. In PY2016, 194 projects were completed with 73 kW and 183,319 kWh savings, compared to 960 projects with 1,407 kW and 3,833,178 kWh savings in PY2015. In PY2015 weatherization projects contributed 21% of verified annual savings in PY2016 they contributed only 2%. The decrease in the verified savings contribution of weatherization projects is due to LED introduction and to low realization rates for weatherization measures. Full detail on LED introduction is provided in the Annual Trends subsection and realization rate details are provided in the Measure Realization Rates subsection of this report.

Only 11 programmable thermostats were installed in PY2016. During in-depth interviews, program delivery agents said that the program’s reimbursement cost was too low to cover the installation by an electrician and therefore they did not pursue the measure. Delivery agents also said that appliance reimbursement levels were not always sufficient to cover the cost of ENERGY STAR certified refrigerators and freezers, and so they were not regularly installed in PY2016. Nevertheless, 1,777 refrigerators and 809 freezers were installed in PY2016.

Five LDCs—London Hydro, Bluewater Power, Peterborough, Festival Hydro and Horizon Utilities—offered health and safety measures. In PY2016, 894 health and safety measures were installed, with the majority being smoke and/or carbon monoxide detectors, cover plates, furnace filter replacements and

toilet leak tests performed. Cadmus found that none of these health and safety measures contributed to direct demand reduction or energy savings.

Appendix C presents a complete list of verified kilowatt and kilowatt-hour savings by measure, as well as the quantity of each measure.

2.2.2 Unit Savings

Cadmus reviewed and assessed the PIAs for calculating unit savings. We recommended making updates to the measures listed in Table 8 because better information is now available and/or the PIAs were not consistent across CFF programs.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Annual Gross Energy Savings per Unit (kWh)</th>
<th>Annual Gross Demand Reduction per Unit (Coincident Peak kW)</th>
<th>Effective Useful Life</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reported</td>
<td>Evaluated</td>
<td>Reported</td>
</tr>
<tr>
<td>Hot Water Tank Insulation - Fiberglass R10</td>
<td>270</td>
<td>99</td>
<td>0.3300</td>
</tr>
<tr>
<td>Compact Freezer &lt; 7.75 cu. ft.</td>
<td>633</td>
<td>41</td>
<td>0.0860</td>
</tr>
<tr>
<td>Non-compact Freezer ≥ 7.75 cu. ft.</td>
<td>633</td>
<td>51</td>
<td>0.0860</td>
</tr>
<tr>
<td>Dehumidifier Replacement (14.2-21.2 L/day)</td>
<td>485</td>
<td>197</td>
<td>0.146</td>
</tr>
<tr>
<td>Dehumidifier Replacement (21.3-25.4 L/day)</td>
<td>664</td>
<td>233</td>
<td>0.200</td>
</tr>
<tr>
<td>Dehumidifier Replacement (25.5-35.5 L/day)</td>
<td>934</td>
<td>278</td>
<td>0.281</td>
</tr>
<tr>
<td>Hot Water Pipe Wrap (pipe insulation)</td>
<td>38</td>
<td>35</td>
<td>0.0050</td>
</tr>
<tr>
<td>LED Measures*</td>
<td>Varies by Measure</td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>

* LED Measures include ≤ 11-Watt ENERGY STAR LED A-Shape; ≤ 16-Watt ENERGY STAR LED PAR20, PAR 30 and PAR38; ≤ 14-Watt ENERGY STAR LED A-Shape; ≤ 6-Watt ENERGY STAR LED MR16; ≤ 23-Watt ENERGY STAR LED A-Shape; LED Downlight with Light Output > 600 and < 800 Lumens; ≤ 23-Watt ENERGY STAR-Qualified LED PAR; LED Downlight with Light Output > 800 Lumens; Qualified LED MR16 / PAR16 - GU 10 Base; ENERGY STAR LED Wet Location ≤ 23 Watt and ≤ 11-Watt ENERGY STAR-Qualified LED MR16.

Full detail on suggested revisions and rationales for updating the measure(s) can be found in Appendix H.

Delivery agents have two paths to estimate savings for weatherization measures: (1) model the home in HOT2000 or (2) follow the prescriptive path by using FAST to apply a deemed multiplier per square foot. The prescriptive path requires the delivery agent to collect the square footage of installed insulation and
input the quantity in FAST. Cadmus could not determine weatherization savings entered through the HOT2000 path (full details follow in this subsection).

For projects with reported square footage, Cadmus applied weatherization PIAs to the savings. For projects without square footage quantities, we could not determine savings using HOT2000 modelling or using the prescriptive path. We therefore could not attribute savings to these projects. Cadmus determined which savings were entered as deemed and which measures were entered through the HOT2000 path. For the HOT2000 path, weatherization savings ranged up to 19,282 kWh and 7.62 kW. These savings values were substantially higher than those typical for homes of this size with installed insulation. Typical insulation savings fall below 1,750 kWh when two or more insulation measures have been installed.  

Via the HOT2000 path, Cadmus could not verify HOT2000 savings for projects. There is no requirement to keep pre-modelled HOT2000 files on record: as such, Cadmus did not have many full projects to model and/or created a base case model to compare with PY2016 HOT2000 HAP files. Cadmus reviewed the HOT2000 inputs and, for the few projects with pre-files, modelled the projects. Cadmus also attempted to model a few files by drawing a pre-file, but pre-files could not be accurately developed without pre-conditions. Additionally, several model files failed to open due to file format errors.

### 2.2.3 Measure In-Service Rate Results

Participant surveys conducted by Cadmus resulted in ISRs of less than 100%, with values ranging from 76% to 99%. Table 9 provides ISRs for all measures that were not 100%.

<table>
<thead>
<tr>
<th>Measure</th>
<th>In-Service Rate</th>
<th>Participants Surveyed</th>
<th>Measures Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Measures</td>
<td>89%</td>
<td>278</td>
<td>5,316</td>
</tr>
<tr>
<td>CFL Measures*</td>
<td>81%</td>
<td>10</td>
<td>137</td>
</tr>
<tr>
<td>Clothes Drying Racks</td>
<td>93%</td>
<td>142</td>
<td>132</td>
</tr>
<tr>
<td>Showerheads</td>
<td>91%</td>
<td>36</td>
<td>35</td>
</tr>
<tr>
<td>Aerators</td>
<td>76%</td>
<td>38</td>
<td>49</td>
</tr>
<tr>
<td>Dehumidifiers</td>
<td>79%</td>
<td>37</td>
<td>28</td>
</tr>
<tr>
<td>Refrigerators/Freezers</td>
<td>99%</td>
<td>182</td>
<td>198</td>
</tr>
<tr>
<td>Power Bars</td>
<td>88%</td>
<td>40</td>
<td>44</td>
</tr>
</tbody>
</table>

* The CFL ISR in PY2015 was 82%. Even though 10 participants is not significant in PY2016, Cadmus decided to use the 81% ISR because it was so similar to PY2015’s ISR.

---

Cadmus attempted to verify weatherization and pipe insulation measures through a series of questions to participants. Results indicated participants could not assess the amount of insulation or pipe wrap installed. Further, due to weatherization participant phone numbers not being captured in program data, the number of weatherization participant respondents was low. Therefore, these measures were defaulted to a 100% ISR.

Because the surveys were fielded in late spring, Cadmus could not capture ISRs for seasonal measures like window air conditioners and block heater timers. The survey respondents indicated that the measures were largely not installed out of season; therefore, Cadmus assumed a 100% ISR for these measures.

PY2016 was the first year LEDs were offered. The ISR for LED measures (89%) was higher in PY2016 than the CFL ISR in PY2016 (81%) and CFL ISR in PY2015 (82%). Most LEDs were installed by program participants or delivery agents, and very few were removed later. Most participant survey respondents who received LEDs (72%; n=264) said the delivery agent installed the bulbs, while 28% said they installed the bulbs themselves.

Most (83%) of the program LEDs were still installed at the time of the survey (n=259). In the participant survey, Cadmus asked why bulbs were removed, and participants (n=41) cited the following reasons: extra bulbs were left (68%), the participants changed the bulbs for better comfort (12%), bulbs failed (12%) and the bulbs were the wrong size (5%).

2.2.4 Measure Realization Rate Results

The PY2016 gross measure-level reported savings are 4,682 kW and 10,485,408 kWh. PY2016 gross and net measure-level savings are 827 kW and 7,590,437 kWh. Cadmus compared gross verified savings to the measure-and project-level gross savings to calculate realization rates at the project, LDC and program level. The realization rates decreased in PY2016 to 18% for demand reduction and 72% for energy savings (from 96% and 88%, respectively, in PY2015). There were five main reasons that realization rates decreased:

1. CFLs continued to be installed even when no longer being offered through the program (after March 11, 2016 for measures that savings persist to PY2020). The CFL savings were not counted for installations after March 11, 2017 for PY2016.
2. Program records where measure quantities were zero but savings were reported were not counted. This particularly impacted weatherization savings for 60 projects.
3. Connected demand reduction was reported for over 10% of measures instead of the coincident peak demand (affected only the demand realization rates).
4. Cadmus updated PIAIs based on our review, which lowered some unit savings values.
5. Less than 100% ISRs were applied for reported savings based on participant survey results that revealed ISRs ranging from 75% to 99%.
Four of the HAP measures achieved a 100% realization rate for energy (note there were none for demand) – programmable thermostats (line and low voltage), car block heater timers and refrigerator replacements (10.0–12.5 cu. ft.). Table 10 provides detail on measures with PY2016 realization rates below 100%. (10.0–12.5 cu. ft. refrigerators had a demand realization rate of 102 %.)

Table 10. PY2016 Home Assistance Program Realization Rates Below 100%

<table>
<thead>
<tr>
<th>Measure</th>
<th>Realization Rate</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kW</td>
<td>kWh</td>
</tr>
<tr>
<td>CFL Measures* (post March 11, 2017)</td>
<td>54%</td>
<td>76%</td>
</tr>
<tr>
<td>LED Measures**</td>
<td>9%</td>
<td>89%</td>
</tr>
<tr>
<td>Attic Insulation</td>
<td>36%</td>
<td>30%</td>
</tr>
<tr>
<td>Basement Insulation</td>
<td>13%</td>
<td>13%</td>
</tr>
<tr>
<td>Comprehensive Draft Proofing</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Wall Insulation</td>
<td>12%</td>
<td>9%</td>
</tr>
<tr>
<td>Dehumidifier Replacement (all sizes)</td>
<td>36%</td>
<td>35%</td>
</tr>
<tr>
<td>Freezer Replacement (ENERGY STAR-Qualified 12–14.4 cu. ft.)</td>
<td>2%</td>
<td>8%</td>
</tr>
<tr>
<td>Freezer Replacement (ENERGY STAR-Qualified 14.5–16.0 cu. ft.)</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Refrigerator Replacement (all sizes)</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>Kitchen and Bathroom Aerators</td>
<td>49%</td>
<td>66%</td>
</tr>
<tr>
<td>Showerheads</td>
<td>60%</td>
<td>80%</td>
</tr>
<tr>
<td>Pipe Wrap</td>
<td>75%</td>
<td>92%</td>
</tr>
<tr>
<td>Hot Water Tank Wrap</td>
<td>28%</td>
<td>37%</td>
</tr>
<tr>
<td>Room Air Conditioner</td>
<td>50%</td>
<td>95%</td>
</tr>
</tbody>
</table>

9 Cadmus updated the PIA values for refrigerator replacements (all sizes), and applied an ISR of 99% to all refrigerators. In the case of the 10.0–12.5 cu. ft. refrigerators, the PIA update increased deemed demand reduction above the reported demand reduction, resulting in realization rates that exceed 100%.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Realization Rate</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement</td>
<td>kW</td>
<td>should have been applied.</td>
</tr>
<tr>
<td>Clothes Drying Rack</td>
<td>n/a</td>
<td>94%</td>
</tr>
<tr>
<td></td>
<td>kWh</td>
<td>Cadmus applied an ISR.</td>
</tr>
<tr>
<td>Smart Power Bar</td>
<td>88%</td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cadmus updated PIAs (which lowered per unit values), and applied an ISR (which also lowered per unit values). Additionally, there were 260 projects that reported energy savings but did not reported demand savings. Thus, the sum of the verified kW savings was larger than the sum of the reported kW savings.</td>
</tr>
</tbody>
</table>

* CFL measures include 13-Watt CFL Twister; 23-Watt CFL Twister; 25-Watt CFL Twister; 3-Way CFL; Covered A19 CFL; 26-Watt CFL PAR 38, Indoor and 26-Watt CFL PAR 38, Outdoor.

** LED Measures include ≤ 11-Watt ENERGY STAR LED A-Shape; ≤ 16-Watt ENERGY STAR LED PAR20, PAR 30 and PAR38; ≤ 14-Watt ENERGY STAR LED A-Shape; ≤ 6-Watt ENERGY STAR LED MR16; ≤ 23-Watt ENERGY STAR LED A-Shape; LED Downlight with Light Output > 600 and < 800 Lumens; ≤ 23-Watt ENERGY STAR-Qualified LED PAR; LED Downlight with Light Output > 800 Lumens; Qualified LED MR16 / PAR16 - GU 10 Base; ENERGY STAR LED Wet Location ≤ 23 Watt and ≤ 11-Watt ENERGY STAR-Qualified LED MR16.

### 2.2.5 Annual Trends

Total program verified energy savings and demand reduction has been decreasing from PY2013 to PY2016, as shown in Figure 2. This decrease in savings largely resulted from declining participation.

**Figure 2. Home Assistance Program Verified Savings from PY2013 to PY2016**

The PY2016 per-project verified energy savings and demand reduction continued to increase from PY2013 (see Figure 3) The PY2015 increase was largely attributable to a change in the measure mix: the
PY2015 lighting measure savings contribution decreased due to the increased baseline efficiency resulting from Canada’s Energy Efficiency Regulations\(^\text{10}\). However, PY2015 projects had greater shares of energy savings coming from weatherization measures, refrigerators and freezers than earlier years, which counteracted decreases in the energy savings attributable to lighting measures.\(^\text{11}\) The increase in PY2016 per project energy savings over PY2015 is due to the introduction of LEDs. Over 70% of PY2016 projects included LEDs, which contributed an average of 933 kWh and 0.64 kW to projects with LEDs. LEDs contributed 64% of PY2016 HAP savings.

Figure 3. Home Assistance Program Per-Project Verified Savings from PY2015 to PY2016

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3. Process Evaluation

For the PY2016 process evaluation, Cadmus conducted several activities to provide timely and actionable recommendations for continuous program improvement:

- Identified opportunities for improving the program design and delivery
- Assessed potential behavioural impacts of HAP energy education and materials
- Assessed customer and contractor satisfaction
- Compared HAP offerings against those offered through other jurisdictions (included in the Jurisdictional Scan section of this report)
- Evaluated delivery agent involvement and effectiveness

3.1 Methodology

Cadmus used a combination of primary and secondary research to address the process evaluation objectives. First, Cadmus reviewed various program materials to understand the program and to identify specific questions to explore during primary research activities. Cadmus gathered primary data for the process evaluation through interviews with the IESO and delivery agent program staff and surveys with program participants, as shown in Table 11.

<table>
<thead>
<tr>
<th>Task</th>
<th>Audience</th>
<th>Completes</th>
</tr>
</thead>
<tbody>
<tr>
<td>IESO Staff Interviews</td>
<td>IESO program staff</td>
<td>2 interviews, 2 with 2 individuals</td>
</tr>
<tr>
<td>Participant Surveys</td>
<td>Program participants</td>
<td>311</td>
</tr>
<tr>
<td>Delivery Agent Interviews</td>
<td>Implementation contractors</td>
<td>4 interviews; some with 2 individuals</td>
</tr>
<tr>
<td></td>
<td>London Hydro program staff</td>
<td>1 interview with 2 individuals</td>
</tr>
</tbody>
</table>

See Appendix E, Appendix F and Appendix G for the data collection instruments.

3.1.1 Document Review

Cadmus reviewed program documents listed in Table 12, which were provided by the IESO on behalf of the LDCs, to inform the development of the data collection instruments.

<table>
<thead>
<tr>
<th>Document Type</th>
<th>Document Name, Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery Agent Protocols</td>
<td>CFF V 1.0 Low Income Program / Audit and Retrofit Protocols, April 2016</td>
</tr>
<tr>
<td>LDC Specific Marketing Materials</td>
<td>Suite of LDC-specific marketing materials</td>
</tr>
<tr>
<td>Program Rules</td>
<td>Save on Energy Home Assistance Program Rules, 2016</td>
</tr>
</tbody>
</table>
3.1.2 IESO Staff Interview
Cadmus conducted two telephone interviews with staff from the IESO: one with the former program manager and one with two members of the marketing staff. The program manager interview provided insight into how the program was designed and delivered. Specifically, Cadmus developed the program manager interview guide to accomplish the following:
- Gain a better understanding of HAPs design, delivery and marketing and communication processes
- Gather insights into areas that work well or that could be improved
- Review key program goals
- Identify topics of interest for evaluation

Cadmus developed the marketing interview guide to identify how LDC marketing differs from province-wide marketing, and to identify challenges and opportunities for the HAP marketing.

3.1.3 Market Actor In-Depth Interviews
Cadmus conducted four telephone interviews with delivery agent program managers and one with London Hydro, the LDC that delivers HAP directly. Interview topics included the following:
- Delivery agent relationship with LDCs and level of support provided by LDCs
- Delivery agent involvement in recruitment
- Barriers to recruitment and participation
- Program tracking data and quality assurance procedures
- Effects of changes in reimbursement levels for PY2016
- Proclivity to install health and safety measures
- Adequacy of cost cap for health and safety measures
- Perceived benefits of health and safety measures
- Economic impacts of the program
- Implementation of program education and training components
- Potential alternative program offerings and implementation strategies
- Satisfaction of delivery agents and participants

3.1.4 Participant Surveys
Cadmus completed phone surveys with 311 program participants. Most respondents were in either the basic track or extended track (95%, n=297), as phone numbers were not included for participants in the weatherization track. Cadmus designed the survey instrument to assess the following:
- Participant type (homeowner/renter/landlord) and demographics
- Source of program awareness and reasons for participating
- Satisfaction with program
- Challenges or areas for improvement
- Measure verification and ISRs
- Impact of education on participant behaviour
- Non-energy benefits of the program

Cadmus sorted participants by weighting LDC participant contribution. Cadmus then identified a random sample of basic and extended track participants from each LDC. The sample did not include Horizon Utilities as insufficient program data became available until after the survey had fielded. Additionally, Cadmus did not have phone numbers for most weatherization track participants, but completed reverse look-ups to gather phone numbers for weatherization participants and included them in the survey. Even with reverse look-ups, the weatherization track participant count was less than 100 participants. Cadmus placed at least two calls to each name on the weatherization sample, and spoke with 14 weatherization track participants. Table 13 provides the participant survey completes by LDC.

### Table 13. Participant Survey Respondents by LDC

<table>
<thead>
<tr>
<th>LDC</th>
<th>Number of Completes</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro One Networks Inc.</td>
<td>115</td>
<td>37%</td>
</tr>
<tr>
<td>London Hydro Inc.</td>
<td>65</td>
<td>21%</td>
</tr>
<tr>
<td>Toronto Hydro-Electric System Limited</td>
<td>50</td>
<td>16%</td>
</tr>
<tr>
<td>Enersource Hydro Mississauga Inc.</td>
<td>19</td>
<td>6%</td>
</tr>
<tr>
<td>Essex Powerlines Corporation</td>
<td>15</td>
<td>5%</td>
</tr>
<tr>
<td>Peterborough Distribution Incorporated</td>
<td>15</td>
<td>5%</td>
</tr>
<tr>
<td>Wellington North Power Inc.</td>
<td>7</td>
<td>2%</td>
</tr>
<tr>
<td>Thunder Bay Hydro Electricity Distribution Inc.</td>
<td>6</td>
<td>2%</td>
</tr>
<tr>
<td>Entegrus Powerlines Inc.</td>
<td>5</td>
<td>2%</td>
</tr>
<tr>
<td>Canadian Niagara Power Inc.</td>
<td>4</td>
<td>1%</td>
</tr>
<tr>
<td>E.L.K. Energy Inc.</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td>Westario Power Inc.</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Algoma Power Inc.</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Bluewater Power Distribution Corporation</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Oakville Hydro Electricity Distribution Inc.</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Tillsonburg Hydro Inc.</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Welland Hydro-Electric System Corp.</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>311</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

### 3.2 Findings

The following sections detail Cadmus’ findings based on program staff interviews and participant surveys. First, the section describes how the program has been designed and delivered, followed by program goals and recent changes. Findings follow related to participants’ motivation and behavioural changes, and related to both participants’ and delivery agents’ experience with the program. Finally,
Cadmus reviews the possibility for additional customer outreach and potential improvements to program delivery, and identifies some barriers cited by delivery agents for optimal levels of installation for some measures.

3.2.1 Program Design and Delivery
Most LDCs deliver HAP using delivery agents or pre-established relationships with low-income associations and non-profits. One exception is a southwestern Ontario LDC, which delivers the program directly. The IESO develops and revises the program rules with feedback from the LDCs, including reimbursement rates for specific measures, evaluates the effectiveness of the program and creates a HAP marketing flyer. Figure 4 shows the HAP program design and delivery processes.
IESO Defines program rules and best practices

LDCs
Set program targets, design and provide marketing materials and guidance to delivery agents, sometimes market directly to customers. May choose to deliver the program directly.

Delivery Agents
Design outreach and delivery strategy, market program to customers.

Delivery Agents
Determine customer eligibility, conduct audits.

Delivery Agents
Assess customer needs, install appropriate measures, provide customer education.

Delivery Agents
Gather data, report to LDC via HOT2000 and FAST tool.

Installation Contractors
Some delivery agents use contractors to install weatherization measures or deliver and install appliances.

LDCs
Report participation and savings data to IESO.

IESO
Evaluates program, makes changes to rules as needed.

Figure 4. PY2016 Home Assistance Program Process Map
Targets

While the LDCs have overall savings targets for their portfolios, individual programs do not have associated savings targets. Rather, LDCs must demonstrate to the IESO that they deliver to all customer sectors, including low-income and Aboriginal customers. Those with a large or sometimes almost exclusively low-income customer base will only meet their overall targets by addressing the needs specific to the low-income customer. Therefore, each LDC negotiates savings and participation targets for HAP with delivery agents. A few LDCs do not offer HAP at all, but asserted that they will sufficiently serve their low-income base with the Coupons Program.

Program Changes

Some of the key changes that took place in PY2016 are:

- **Reimbursement for audits**: Reduced from $200 to $125. The intention behind this change was to cover only the basic cost of visiting a site and encourage delivery agents to capture margin by installing measures.

- **Measure mix**: Updated lighting measures to allow only LEDs. Measures now have cost caps rather than fixed fees per measure, and LDCs can negotiate these caps with the IESO. The IESO implemented these changes primarily to increase energy savings and cost-effectiveness.

- **Health and safety funding**: Increased from $500 to $750 per home. LDCs have flexibility with respect to the measures installed. Measures are expected to be associated with energy efficiency, although some funding may be used to remediate mould or other air quality or safety issues that could affect the installer. For example, a portion of insulation funding may be used to replace mouldy drywall. The delivery agents identify the appropriate health and safety measures to install and have discretion over what to offer customers.

- **Reimbursement for weatherization measures**: Customized the approach used to determine the incentive for weatherization measures, in which payment is based on kilowatt-hour savings. Delivery agents may now choose from two options: model savings with HOT2000 or use deemed savings values. This change was an attempt to move beyond the prescriptive-only model, where, for example, reimbursement is based on the square footage of insulation installed.

- **Standardized education component**: The IESO developed a flyer to assist the LDCs with educating customers about energy savings. The flyer is based on a list of turnkey tips for savings energy, which the IESO provided to the LDCs along with a new “best practices” guide for marketing and sales. Some LDCs further customized the educational flyer. Although the IESO developed this flyer with the expectation that it be left with all participants, the only province-wide requirement for HAP education is that delivery agents provide applicable instructions for the measures they install.

- **Eligibility for weatherization measures**: Expanded eligibility for weatherization measures. Now, all customers who pay their own electricity bill are eligible, rather than exclusively home
owners, provided the LDC obtains consent from the property owner. This change was implemented as an attempt to increase the number of renters who participate in the program.

- **Co-op eligibility**: Removed minimum required percentage of qualified co-op tenants for a building to be eligible. This change was also implemented with the aim to increase the number of eligible program participants.

### Data Collection and Documentation

There are two main project and measure data collection tools used by delivery agents: FAST and for weatherization projects the HOT2000 prescriptive modeling tool. The FAST is used to track measures installed for each project and can feed directly into the report that delivery agents submit to the IESO. Some delivery agents have their own versions of these tools. One of the primary delivery agents is in the process of developing a mobile tool for capturing data, but currently captures information on paper and has staff conduct data entry into an internal tracking system, and ultimately, the FAST.

One LDC explained that they developed their own tablet-based data collection tool and software that allows them to audit, assess, report and generate reimbursement reports without using paper. The FAST is integrated into this custom system. They asserted that, without this system, the administrative burden of the program would far outweigh the value to their customers and that they would not offer the program.

Delivery agents mentioned that for weatherization measures, the FAST and HOT2000 inputs should be updated, with an emphasis on costs in HOT2000. Cadmus found that fuel costs were outdated in HOT2000. A full explanation of HOT2000 input findings can be found in the HOT2000 Review section of this report.

#### 3.2.2 Program Awareness, Motivation and Understanding

**Participant Profile**

Most participant survey respondents, 72% (n=306), were owner occupants; the rest were primarily tenants (26%), with a small number of occupants not listed on the lease or deed (who may be relatives of the owner). None of the respondents were landlords or property managers.

Similarly, participants most commonly live in a single-family home (63%; n=309), followed by a single-family attached home (i.e., townhouses or row houses).

Based on the consensus among interviewed delivery agents that most of the social housing occupants in the province were served in prior program years, as well as the current exclusion of multifamily buildings above three stories, the participant survey respondents’ ownership and home types appears representative of the population currently being offered the program. The distribution of participants by home and housing type is shown in Figure 5.
The overwhelming majority of respondents (97%; n=310) said they are responsible for paying the utility bills for the home; only 3% said the bills were either paid or shared in part by the landlord or property manager.

Most respondents heat their home with natural gas (60%; n=304); only one-fifth heat their home with electricity. The distribution of heating fuels is shown in Figure 6.
Figure 6. Participants’ Heating Fuel Types

Source: Participant Survey Question H11. "What type of fuel do you use primarily to heat your home?" (n=304)

The distribution of water heating fuels is more evenly split between electricity and natural gas, as shown in Figure 7.

Figure 7. Participants’ Water Heating Fuel Types

Source: Participant Survey Question H12. "What type of fuel do you use to heat water in your home?" (n=287)
Awareness of Program
Participants most frequently learned about the program via printed materials, such as program flyers. The second most common way was through a friend or family member. The frequency distribution of how participants became aware of the program is shown in Figure 8.

**Figure 8. How Participants Heard About the Program**

- A program flyer or any other printed material: 45%
- A friend or family member: 22%
- LDC’s website: 13%
- Other: 10%
- A government agency: 8%
- My landlord, building superintendent, or building manager: 7%
- Radio or TV commercial: 6%
- Internet: 6%
- A telephone call from program staff: 6%
- Someone coming to your door: 4%
- A non-profit group: 4%
- A government agency, like LEAP or the Ontario Energy Savings Program: 3%

Source: Participant Survey Question C1. “In which of the following ways did you hear about the Save on Energy Home Assistance Program?” (n=299; multiple response)

Most participants applied for the program either via an online or paper application; some said they applied via phone or during an in-person visit by program staff, were signed up by their landlord or building manager or had assistance from a community organization or during an event. These responses are shown in Figure 9.
Figure 9. Ways Participants Applied for the Program

![Bar Chart]

Source: Participant Survey Question C2. “Which of the following ways describes how you signed up for the program?” (n=295)

Decision Making and Challenges

By far the most common motivation participants cited for participating in the program was to save money on their electric bill; some were concerned about their homes’ high energy use and some wanted new appliance or other free benefits. The distribution of participants’ motivations are shown in Figure 10.
Cadmus asked respondents whether five common barriers to saving energy applied to them. The barriers most frequently affirmed by participants were a lack of money for upgrades and the age of their home. Fewer said that lack of information, control over use by others or health issues requiring higher energy use were barriers (Figure 11).
Cadmus also asked delivery agents about barriers to participation that they had observed. One agent said that a common barrier to the installation of weatherization measures is the lack of program funding for standard cosmetic finishing and that some participants refused the installation of insulation because they would be left with unpainted walls or other aesthetic issues. Another agent said that it is sometimes cumbersome for renters to get approval for some measures from the property owner.

One LDC stated that some customers require significant follow-up efforts, either related to no show appointments or before customers feel comfortable allowing delivery agents into their homes. This LDC also said that conditions in some homes that present installer safety or fire safety issues can inhibit or delay delivery.

**Program Education and Behavioural Changes**

Delivery agents suggested that education is most effective when provided in-person during the home audit, noting that people tend to care more about what the auditor says and respond better to demonstrations than to a left-behind checklist or brochure. For example, when auditors replace electrical outlet plates, they spend time talking to customers about what they are doing and why it is important. One LDC specifically said that customers, especially those with children, recognize the value of the health and safety upgrades and assessments provided by the auditors.

Only about half of participant survey respondents said the delivery agent left them printed educational materials, such as a brochure or flyer: this is surprising given the standardized checklist provided by the IESO for this purpose; it may indicate that if materials were left, they weren’t reviewed. Eleven percent of respondents said they received neither verbal nor printed education.

**Figure 12. Education Provided by Delivery Agent**

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A brochure or flyer</td>
<td>52%</td>
</tr>
<tr>
<td>User manuals or instructions for equipment</td>
<td>43%</td>
</tr>
<tr>
<td>No materials provided but discussed</td>
<td>19%</td>
</tr>
<tr>
<td>No, didn’t provide any tips or materials</td>
<td>11%</td>
</tr>
<tr>
<td>Both materials and tips</td>
<td>1%</td>
</tr>
</tbody>
</table>

Source: Participant Survey Question F1. “While at the home, did the program representative give you information on how to save energy by providing you with . . .” (n=308)
Participants were roughly split on whether the information provided was very helpful or somewhat helpful (44% and 45%, respectively; n=245); 11% said it was not at all helpful. When asked if there was something they wished the delivery agent had provided information about, most (65%; n=253) said no, but 14% said they wished they had been given more information regarding the requirements for appliance replacements or weatherization upgrades. Nine percent did not cite anything specific but expressed a general disappointment with the amount of information received from or actions taken by the delivery agent.

Almost half of the respondents who had received either printed or verbal education (47%; n=274) said they used one or more tips in their home. The most common tips that respondents use are changing time of use, turning off lamps and weather sealing. The percentage of respondents using each tip is shown in Figure 13.

![Figure 13. Tips that Respondents Have Used in Their Homes](image)

Source: Participant Survey Questions F4A, F4B and F4C. “Of all the tips you remember, can you tell me which ones you have used in your home?” (n=128; multiple response)

The most common new energy saving behaviours taken by respondents are turning off lights when not in use, waiting until off-peak hours to do laundry or run the dishwasher and using cold water to do laundry. The percentage of respondents using each new energy saving behaviour is shown in Figure 14.
Most respondents did not make any additional energy efficiency upgrades. Of the respondents who did make upgrades, the most common were new energy-efficient appliances, insulation and energy-efficient lighting products. The percentage of respondents who installed each additional energy-efficient upgrade is shown in Figure 15.

Source: Participant Survey Question F7. “What energy saving actions did you take?” (n=97; multiple response)
Figure 15. Additional Energy Efficiency Upgrades Made by Respondents

- None: 73%
- Other: 13%
- New energy-efficient appliances: 5%
- Insulation: 4%
- Energy efficient-lighting products: 4%
- New water heater: 2%
- Weather stripping, caulking, etc.: 2%
- Additional heating or cooling equipment: 2%

Source: Participant Survey Question F8. “Have you made any additional energy efficiency upgrades to your home or installed any additional energy-efficient equipment on your own without program assistance, after participating in HAP?” (n=297; multiple response)

Of the respondents who affirmed that they made additional energy efficiency upgrades or installed additional equipment after participating in the program, about half considered the program to be very influential on their decision. Another 29% considered the program to be somewhat influential. The program’s influence on respondents’ decision to take additional energy saving actions is shown in Figure 16.

Figure 16. Level of Influence on Respondents’ Decision to Take Additional Energy Saving Actions

- Very influential: 48.8%
- Somewhat influential: 28.8%
- A little influential: 11.3%
- Not at all influential: 11.3%

Source: Participant Survey Question F9. “Rate the influence of the program on your decision to take additional energy saving actions.” (n=80)
Most respondents’ reason for taking additional energy saving actions was to save money, increase efficiency or because it was suggested by their contractor. The frequency of respondents’ reasons for taking additional energy saving actions is shown in Figure 17.

Figure 17. Respondents’ Reason for Taking Additional Energy Saving Actions

![Figure 17](image)

Source: Participant Survey Question F10. “How has your experience with the Home Assistance Program influenced your decision to install [these/this] product(s)?” (n=60; multiple response)

About half of respondents reported that their knowledge of energy efficiency stayed the same following the home visit, while slightly less than half reported that their knowledge increased. The impact of the home visit on respondents’ knowledge of energy efficiency is shown in Figure 18.

Figure 18. Impact of Home Visit on Knowledge of Energy Efficiency

![Figure 18](image)

Source: Participant Survey Question F11. “Since the program representative visited the home, has your knowledge and understanding on energy efficiency changed?” (n=306)

Only 7% of respondents (22; n=303) reported having participated in a natural gas distribution company program since participating in HAP. The most common measures these respondents reported installing
through participation in a natural gas program were insulation, weather sealing and hot water heaters. One-third of these respondents reported that they had not installed any additional measures because of the natural gas program. The percentage of respondents who installed each additional measure is shown in Figure 19.

**Figure 19. Measures Installed Through a Natural Gas Program**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>33%</td>
</tr>
<tr>
<td>Insulation</td>
<td>33%</td>
</tr>
<tr>
<td>Weather sealing</td>
<td>10%</td>
</tr>
<tr>
<td>Hot water heater</td>
<td>10%</td>
</tr>
<tr>
<td>Programmable thermostat</td>
<td>5%</td>
</tr>
<tr>
<td>Showerhead</td>
<td>5%</td>
</tr>
<tr>
<td>Fuel switch hot water heater</td>
<td>5%</td>
</tr>
<tr>
<td>Furnace</td>
<td>5%</td>
</tr>
<tr>
<td>Carbon monoxide detector</td>
<td>5%</td>
</tr>
</tbody>
</table>

Source: Participant Survey Question F12L. “What energy efficiency measures were installed as a result of the natural gas distribution company program?” (n=21; multiple response)

Over half of the 22 respondents who subsequently participated in a natural gas program reported that their participation in HAP was *very influential* on their decision to participate in the natural gas program (Figure 20).
Figure 20. Influence of HAP in Decision to Participate in Natural Gas Program

Source: Participant Survey Question F13. "How influential was your participation in the Home Assistance Program in your decision to participate in the natural gas program?" (n=22)

3.2.3 Customer and Market Actor Experience

Satisfaction

When asked about their satisfaction with the program overall, most respondents said they were very satisfied (66%; n=309). One-quarter said they were somewhat satisfied, and only 5% and 4%, respectively, said they were not very satisfied or not at all satisfied with the program. The verbatim responses revealed that some participants were disappointed because they did not receive the new appliances or assistance with weatherization they expected, based on conversations with program representatives, other participants or their LDC’s website. Specifically, some respondents suggested the requirements for such measures were not clear to them.

With regard to specific aspects of the program, most respondents were happy with the convenience, service and equipment received, but less satisfied with the information provided on ways to save and with the actual electricity bill savings. Figure 21 shows the distribution of responses to these satisfaction questions.
Sixty-one percent of respondents (n=287) said their home is more energy efficient after the improvements were installed, while 34% said it was about the same level of efficiency and 5% said it was less efficient (see Figure 22).
Figure 22. Impact of Program Participation on Overall Energy Efficiency of Home

Source: Participant Survey Question E1. “Comparing the home now to before you had the energy efficiency improvements installed, would you say the home is . . . ?” (n=287)

Non-Energy Impacts
Cadmus included questions in the participant survey to capture some of the non-energy impacts of the program, including improvements to safety, comfort, health and economic security. While most participants did not notice any non-energy impacts, 28% (n=291) said they noticed other positive impacts resulting from the energy efficiency improvements made to their home. Of these 28%, the most common benefit was improved comfort, followed by improved lighting levels. The distribution of specific non-energy benefits cited by participants who said they noticed non-energy benefits is shown in Figure 23.
Figure 23. Non-Energy Benefits Cited by Participants

- Improved comfort: 51%
- Improved light levels: 25%
- Better appliance performance: 14%
- Improved health: 14%
- Lower ambient, outside noise: 8%
- Improved electric reliability: 5%
- Improved safety: 5%
- Other: 3%

Source: Participant Survey Question E2. “What positive impacts resulted from the energy efficiency improvements you made to your home?” (n=80)

Cadmus also investigated whether HAP has any effect on the transiency of participants. This included asking participants how likely they would have been to move out of their home if they had not participated in the HAP. While most participants said they were not at all likely (83%; n=303) to move from their current home, regardless of program participation, 9% (n=302) said the program encouraged them to stay in their home. The general reasons they cited are shown in Figure 24.

Figure 24. How HAP Reduced the Likelihood of Participants Moving

- Reduced energy cost: 81%
- New appliances: 26%
- Improved comfort: 19%
- Improved lighting: 15%
- Allowed upgrades I couldn't afford before: 11%

Source: Participant Survey Question E8. “What did the Home Assistance Program provide that changed the household likelihood of moving?” (n=27)
The responses to this open-ended question reveal that some respondents feel strongly that the program made a definitive difference for them. The following are some examples of strong responses related to:

- **Reduced energy cost**
  - “The cost of heating, it was the cost of heating [that made a difference]—we were going to decide whether we stayed or went, and the insulation was what we needed and made the difference.”
  - “It [the program] just helped with my bills, it’s not a complete solving of my financial problems but it helped, and it helped enough that I’m able to stay here.”
  - “[The program] took 40% off the chance of us moving away from [due to] the energy savings we have obtained.”
  - “The energy costs [are what reduced the likelihood of moving]: hydro bills [were] just not possible to pay. I would have to look for a smaller place, which would have made life more difficult for the people that live here.”
  - “[The program] changed [the likelihood of moving] for the better, the audit and the assistance and the knowledge changed it for the better. The dollars that you have for your budget for the month now can go further.”

- **New appliances**
  - “[The delivery agent] replaced the fridge, and the light bulbs, [the] timer for block heater for my vehicle and provided a power bar. That all combined to drop energy consumption to acceptable.”
  - “[It is] quite costly to move so I am now only somewhat likely but much more comfortable where I am now and don’t really want to move.” [Interviewer Note: “[this respondent] was amazed at all the new appliances she was given; she had not expected any appliances, especially the freezer. [She said] she freezes a lot more food now than she could before, because she did not trust her old freezer.”]

- **Allowed for needed upgrades**
  - “The insulation was a key factor [in reducing the likelihood of moving]. I couldn’t afford to [install insulation] being on a fixed income.”

- **Improved comfort**
  - “[The program gave us] more warmth in the house and made it more comfortable for my mom. It also made it more affordable for her to handle the bills.”

**Marketing and Outreach**

IESO provides base marketing messages. LDCs and their delivery agents have a good deal of latitude in terms of developing marketing activities and materials in addition to those provided by the IESO and develop their own marketing budgets for HAP. One of the primary delivery agents mentioned that reimbursements from LDCs for marketing vary: some pay based on savings achieved (i.e., an indirect incentive to invest in marketing), while others pay a fixed fee but expect a minimum participation level.
One LDC does not have a specific marketing budget but focuses on building and maintaining relationships with community organizations to find customers who are seeking assistance, beyond those in social housing.

Delivery agents mentioned the importance of wider broadcasts, such as bill inserts or radio commercials, in encouraging eligible customers to apply. One agent specifically mentioned that HAP could benefit from the province-wide marketing they have seen for other programs under the Save on Energy brand. This agent also suggested that a unifying marketing message would be more effective at promoting the program and its legitimacy. Another delivery agent said that a combination of promotional activities is very effective, such as broadcasting with mailers or commercials to generate awareness and following up with on-the-ground events, where delivery agents make direct contact with customers or employees of social service agencies. Multiple delivery agents mentioned that establishing legitimacy and reputation is very important, as some potential participants are suspicious of offers that sound “too good to be true.”

Anecdotally, Cadmus observed that several survey respondents noted that they were motivated to apply for the program because they either “heard it was legit” or wanted to find out if they would really get free upgrades (indicating an element of curiosity or disbelief). The tendency for potential participants to be suspicious and distrustful of offers of free assistance was also cited by one of the delivery agents as the reason some of the LDCs do not want agents to go door-to-door to recruit participants. This was also mentioned as a barrier to getting approval for upgrades from landlords, who sometimes “don’t believe they won’t have to pay anything.”

One LDC mentioned one challenge in outreach was that, as a utility, they are not always a “welcome visitor” with low-income customers, who are often behind on bills and assume phone calls are related to collection activities. To circumvent this, they work with the Salvation Army, which handles relief program applications; a utility employee makes phone calls directly from the Salvation Army’s office to let THAW (The heat and warmth program) and LEAP (Low-income energy assistance program) applicants know they are pre-approved for free upgrades.

One delivery agent suggested that there are customers who are struggling, even in affluent areas, but because they pay their bills and are “quiet about it,” they are overlooked by program outreach. This agent also suggested that some senior citizens may qualify and could use help but do not think of themselves as low-income.

3.2.1 Success, Challenges and Future Planning

Outlook for Customer Outreach

The IESO and some of the delivery agents mentioned that the recent decline in program participation is primarily the result of having largely saturated the base of customers in single-family social housing. These customers are easy to identify and recruit in bulk. To combat the challenge related to having tapped this channel, some LDCs or delivery agents are increasing their emphasis on developing
partnerships with low-income community service organizations or other community resources such as libraries or churches, to both identify and recruit eligible participants. Some delivery agents use a combination of census data and geo-clustering tools to identify areas with a larger concentration of both low-income households and older homes that may not have been updated.

One agent specifically mentioned that program budgets will need to reflect the additional effort for recruiting more participants individually and the increased documentation, versus enrolling large groups through one social housing representative. In addition, targeting specific demographic groups (one delivery agent mentioned elderly, single mothers and immigrants) via marketing requires additional attention.

One delivery agent mentioned that serving remote customers also presents some challenges, due to both the geographic distances between eligible participants (some effort is made to bundle delivery to combat this inefficiency) and the fact that it is often impossible to service remote locations during winter months.

Multiple delivery agents recommended removing restrictions on building height. One suggested that many higher-rise buildings could benefit from at least lighting and appliances, if not weatherization; one LDC suggested raising the limit to six stories, which would increase the number of potential participants, especially in smaller municipalities. Recruitment via property managers is limited because most of the large companies are mostly focused on high-rise buildings, and therefore do not benefit from the program.

Potential Improvements in Communication and Program Delivery
One delivery agent suggested that many of the web-based program bulletins are not assimilated by LDCs because of the frequency of the updates (i.e., there is too much “noise”) and because it is up to the LDCs to check for updates. This interviewee suggested that some of the LDCs are more “on top of things” than others. Conversely, another delivery agent said that they had not heard much in the way of major changes to the program measures or administrative requirements recently, compared to the previous version of the program, where changes occurred approximately bi-monthly. While this could have simply been a comparative statement, it could also be an indication of a failure in the mechanism for communicating program updates.

IESO would like to move toward collaborating with natural gas LDCs to deliver the program, to capture cost efficiencies (for example, by having one audit for both programs) as well as to provide a more streamlined customer experience. This collaboration is in the pilot stage; one of the primary delivery agents also has a contract with a major natural gas utility, and has already begun to conduct both audits at once. On the other hand, one LDC said they attempted to work with their natural gas counterpart, but the relationship did not work because the LDC was concerned about maintaining both their autonomy and branding when it comes to program delivery. This LDC does collaborate with their local fire and water departments to include fire safety and water conservation offerings through the program.
In addition to collaborating with natural gas companies, IESO sees potential for improvement in recruitment efforts by engaging Ontario Energy Savings Program (OESP) applicants to participate in HAP. One delivery agent also said being able to use OESP customer lists could help, specifically suggesting that the program be mentioned to all customers applying for LEAP, because both programs are designed to “enable people to get out of energy poverty.”

**Barriers to Optimal Measure Installations**

According to multiple delivery agents, appliance reimbursements tend to be on low end. One delivery agent said that the cap for programmable thermostats is insufficient because the installation must be done by an electrician, which adds $125 to the cost. This is particularly relevant in homes with zonal heat, which require multiple thermostats. Another agent reiterated that appliance cost caps are tight, and that it can be hard to find an appropriate unit within this cap, in part because of the higher market costs for ENERGY STAR appliances, and in part because the caps are often only adjusted every four years. This interviewee mentioned that one particular size of air conditioner is “under water” (i.e., it costs more to purchase and install than the reimbursement covers), and suggested that more research into current market costs is warranted.

One delivery agent suggested that block heater timers, installations of which tend to be specific to certain LDC regions, could benefit from increased marketing.

One agent said the program could benefit from adjusting the weatherization cap when mould remediation is necessary, as the additional cost would often be above the current cap. This agent said that, in these cases, they do not proceed with installing measures, but might refer the customer to a social agency for help because, “mostly when things are bad they are so bad you can’t do anything about them [within the budget].”

Overall, the $750 cost cap for health and safety measures covers the measures advised by program protocol, but is marginal and could easily be exceeded by many projects. One LDC asserted that low-income programs should focus on benefits beyond energy savings, since many of the program participants are already on social assistance. Not all delivery agents install carbon monoxide or smoke detectors or conduct toilet leak tests, because these measures do not produce any energy savings and their installation is not a program requirement.

**Cost-Effectiveness**

Multiple delivery agents suggested that HAP should not be subject to the same cost-effectiveness requirements as programs with higher savings potential. They lamented that the overall basis for assessing the impact of the program is kilowatt-hour savings, which make HAP look less valuable than retrofit programs (for example). One delivery agent suggested that some, but not all, LDCs see a higher purpose for the program, and suggested having it “sit on its own like OESP and LEAP.” One LDC suggested HAP be funded provincially, to remove the concern LDCs have about its impact on energy program budgets and cost-effectiveness. Another agent suggested shifting the program from rewarding savings to rewarding participation targets.
4. Cost-Effectiveness

This section presents cost-effectiveness results for the PY2016 HAP. To assess cost-effectiveness, Cadmus used impact evaluation data and program cost data at the LDC level. Cadmus then assessed performance through the TRC test, the PAC test and the LUEC. The performance indicators of interest generated by the tests included benefits, costs, net benefits and benefit/cost ratio. For programs to be considered cost-effective, the benefits must exceed the costs, meaning the program must have a benefit-cost ratio greater than one.

The IESO provided the cost information for each conservation measure across programs. Cadmus used inflation and discount rates provided by the IESO (2% and 4%, respectively) to determine the rates’ present values. Cadmus also selected an industry and project-specific load profile for each project implemented, using various formulas from the Conservation and Demand Management Energy Efficiency Cost Effectiveness Guide.

4.1 Calculation Methodology and Tests

The TRC test estimates program cost and benefits from a societal perspective, while the PAC uses the program administrator’s perspective of cost and benefits; the LUEC measures the overall competitiveness of different electricity sources. Table 14 shows the components considered in each test.

<table>
<thead>
<tr>
<th>Component</th>
<th>TRC</th>
<th>PAC</th>
<th>LUEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoided Energy Costs</td>
<td>Benefit</td>
<td>Benefit</td>
<td>-</td>
</tr>
<tr>
<td>Non-Energy Benefits</td>
<td>Benefit</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Secondary Fuel Savings (Gas)</td>
<td>Benefit</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Incremental Participant Costs</td>
<td>Cost</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Administration Costs</td>
<td>Cost</td>
<td>Cost</td>
<td>Cost</td>
</tr>
<tr>
<td>Incentive Payments</td>
<td>-</td>
<td>Cost</td>
<td>Cost</td>
</tr>
<tr>
<td>Participant Bill Savings</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Discounted Lifetime Energy Savings</td>
<td>-</td>
<td>-</td>
<td>Benefit</td>
</tr>
</tbody>
</table>

Cadmus used the IESO’s CDM Energy Efficiency Cost Effectiveness Tool to calculate results at the program and LDC levels. The body of this report includes the program-level results, and the cost-effectiveness tools detail LDC-specific benefit-cost ratios.
4.1.1 Total Resource Cost Test
The TRC test measures the overall impacts of program benefits and costs. The test compares all program benefits and costs to the province to determine if the benefits received by the populace outweigh the total costs incurred by the residents, the LDCs and the IESO. The TRC uses the following benefit-cost ratio equation:

\[
\frac{B}{C} = \frac{PV \left[ (\text{Value of Gross Saved Energy} + \text{Value of Gross Non Energy Benefits}) \times NTG \right]}{PV \left[ \text{Program Administrative Costs} + (\text{Incremental Participant Cost} \times NTG) \right]}
\]

Where:
- \( B \) = Benefits
- \( C \) = Costs
- \( PV \) = Present value
- \( NTG \) = Net to gross

The value of gross saved energy is: gross savings multiplied by utility-avoided energy and capacity costs. Incremental participant costs are additional costs incurred by the participant to install the energy efficient technology over the baseline or standard technology (i.e., equipment typically installed in the absence of the efficient technology).

4.1.2 Program Administrator Cost Test
This test examines program benefits and costs solely from the program administrators’ (i.e., the IESO and LDC) perspective. The PAC test uses the following benefit-cost ratio equation:

\[
\frac{B}{C} = \frac{PV \left[ \text{Value of Gross Saved Energy} \times NTG \right]}{PV \left[ \text{Administrative Costs} + \text{Incentive Payments} \right]}
\]

Where:
- \( B \) = Benefits
- \( C \) = Costs
- \( PV \) = Present value
- \( NTG \) = Net to gross
4.1.3 Levelized Unit Electricity Costs
LUEC measures the overall competitiveness of different electricity sources, allowing comparisons of demand-side management programs, programs over different timeframes or supply-side options. It represents annualized costs (discounted costs and lifetime savings) per lifetime MWh from the PAC test perspective (program administrative, delivery and incentive costs). The PAC test uses the following equation (costs divided by MWh) to determine LUEC:

\[
LUEC = \frac{PV [\text{Administrative Costs} + \text{Incentive Payments}]}{PV [\text{Gross Lifetime MWh} \times NTG]}
\]

4.1.4 Inputs and Assumptions
The cost-effectiveness analysis relied upon the following PY2016 evaluation impact results:

- Net energy savings
- Peak demand savings
- Measure’s EUL
- Measure’s incremental lifecycle costs
- Program incentive payments
- Secondary fuel savings

Cadmus combined the evaluation data with the following program financial data (provided by the IESO) to calculate cost-effectiveness:

- IESO administrative costs
- LDC administrative costs

4.2 Results

4.2.1 Total Resource Cost Test
Table 15 shows the TRC results for the PY2016 HAP, with a benefit cost ratio of 0.94 resulting from benefits of $5,602,891 and costs of $5,983,121. The PY2015 ratio was 1.01.

<table>
<thead>
<tr>
<th>PY2016 Ratio</th>
<th>Benefits ($)</th>
<th>Costs ($)</th>
<th>Net Benefits ($)</th>
<th>PY2015 Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.94</td>
<td>5,602,891</td>
<td>5,983,121</td>
<td>-380,230</td>
<td>1.01</td>
</tr>
</tbody>
</table>

4.2.2 Program Administrator Cost Test
Table 16 shows PAC results for the HAP, with a benefit cost ratio of 0.80 resulting from benefits of $4,872,079 and costs of $5,983,121. The PY2016 (0.81) and PY2015 (0.88) ratios were similar.
Table 16. PAC Ratio and Net Benefits

<table>
<thead>
<tr>
<th>PY2016 Ratio</th>
<th>Benefits ($)</th>
<th>Costs ($)</th>
<th>Net Benefits ($)</th>
<th>PY2015 Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.81</td>
<td>4,872,079</td>
<td>5,983,121</td>
<td>-1,111,042</td>
<td>0.88</td>
</tr>
</tbody>
</table>

4.2.3 Levelized Unit Electricity Cost

Table 17 shows LUEC results for the HAP program with a dollars/kWh ratio of $0.0775/kWh resulting from costs of $5,983,121 and levelized savings of 77,161,479 kWh.

Table 17. LUEC Ratio Results for Energy Savings

<table>
<thead>
<tr>
<th>Ratio ($/kWh)</th>
<th>Costs ($)</th>
<th>Benefits (Present Value kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0775</td>
<td>5,983,121</td>
<td>77,161,479</td>
</tr>
</tbody>
</table>

4.3 Conclusions

From the perspective of the IESO and participating customers, a TRC ratio less than 1.0 indicated the program was not cost-effective in PY2016. From a program administrator’s perspective, the program also was not cost-effective in PY2016. When compared to PY2015 results, the ratio of PAC cost to levelized lifetime kWh increased 2%, indicating overall program associated costs per kWh increased from the previous year.

The PY2016 analysis included approximately $312,000 in LDC administrative expenses for LDCs without associated CFF program savings. Additionally, 15 different measure descriptions claimed zero savings, resulting in approximately $304,000 in associated incentive/measure costs. Excluding both costs from the TRC would have resulted in a TRC ratio greater than 1.

In addition to LDC costs and measures without savings, refrigerator and freezer measures resulted in TRC net costs of $1.3 million, which vastly exceeded the overall net TRC benefit of $480,000 for the entire program. Thus, these measures reduced the program’s overall cost-effectiveness.
5. Jurisdictional Scan

5.1 Methodology
Cadmus compared HAP to other similar low-income efficiency initiatives in North America. This included investigating successful programs and reviewing their pay-for-performance metrics, performance targets, financing agreements and different delivery strategies. Cadmus also looked at customer engagement strategies and compared program structures, target markets, delivery models, use of incentives and cost-effectiveness assumptions. Finally, Cadmus compared programs with health and safety options.

5.2 Findings
Cadmus reviewed the six programs shown in Table 18 and compared their offerings to HAP. Further details for each program follow the table.
<table>
<thead>
<tr>
<th>Program Name</th>
<th>Jurisdiction</th>
<th>Program Size</th>
<th>Measure Tracks</th>
<th>Health and Safety Measures</th>
<th>Delivery Model</th>
<th>Cost to Participant</th>
<th>Use of Incentives</th>
<th>Cost-Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Save on Energy Home Assistance Program</td>
<td>Participating LDCs in Ontario</td>
<td>$6m in PY2016; 5,066 participants in PY2016</td>
<td>Direct install, weatherization and energy education</td>
<td>Yes, $750 cost cap</td>
<td>Implementer to consumer</td>
<td>Free services to income-qualified customers</td>
<td>Free services to income-qualified customers</td>
<td>0.94 in PY2016 TRC Test</td>
</tr>
<tr>
<td>Massachusetts Low Income Program</td>
<td>Massachusetts</td>
<td>$206m from 2010–2012; 55,021 participants from 2010–2012</td>
<td>Insulation and weatherization, base load and heating system repair and/or replacement</td>
<td>Yes, included in the insulation and weatherization component</td>
<td>Implementer to consumer, Implementer is community agency</td>
<td>Based on household income and whether residence is single family or multifamily</td>
<td>Free to most participants; incentive or loan to other participants</td>
<td>Minimum benefit/cost ratio of 1.0 per TRC test</td>
</tr>
<tr>
<td>Income Qualified Energy Efficiency Assistance Program</td>
<td>Michigan, Consumers Energy service territory</td>
<td>$6.3m in 2014; participation not available</td>
<td>Direct install, weatherization and energy education</td>
<td>Carbon monoxide detection</td>
<td>Implementer to consumer</td>
<td>Free services to income-qualified customers</td>
<td>Free services to income-qualified customers</td>
<td>Evaluated TRC test ratio of 1.65</td>
</tr>
<tr>
<td>People Working Cooperatively</td>
<td>Cincinnati, Ohio</td>
<td>$10.9m in 2009; 6,001 low-income households in 2009</td>
<td>Direct install, weatherization and energy education</td>
<td>Carbon monoxide and smoke detection and electrical wiring repair</td>
<td>Implementer to consumer</td>
<td>Free services to income-qualified customers</td>
<td>Free services to income-qualified customers</td>
<td>Minimum savings-to-investment ratio of 1.0</td>
</tr>
<tr>
<td>Texas Hard-to-Reach Standard Offer Program</td>
<td>Texas</td>
<td>$25m in 2015; 15,270 participants in 2015</td>
<td>Direct install and weatherization</td>
<td>No health and safety measures</td>
<td>Implementer to consumer</td>
<td>Free services to income-qualified customers</td>
<td>Free services to income-qualified customers</td>
<td>Evaluated savings-to-investment ratio of 1.33</td>
</tr>
<tr>
<td>Program Name</td>
<td>Jurisdiction</td>
<td>Program Size</td>
<td>Measure Tracks</td>
<td>Health and Safety Measures</td>
<td>Delivery Model</td>
<td>Cost to Participant</td>
<td>Use of Incentives</td>
<td>Cost-Effectiveness</td>
</tr>
<tr>
<td>--------------</td>
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<td>-----------------------------</td>
<td>-------------------------------------</td>
<td>---------------------</td>
<td>--------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>BC Hydro: Power Smart Energy Saving Kit Program</td>
<td>British Columbia</td>
<td>Cost not available; 20,887 participants in 2009 and 2010</td>
<td>Mail and direct install</td>
<td>No health and safety measures</td>
<td>Direct mail or contractor to consumer</td>
<td>Free energy savings kit to income-qualified customers</td>
<td>Free energy savings kit to income-qualified customers</td>
<td>Not assessed</td>
</tr>
<tr>
<td>Home Energy Solutions Income Eligible program</td>
<td>Connecticut</td>
<td>Cost not available; ~16,000 participants in 2011</td>
<td>Direct install and weatherization</td>
<td>Inspect for natural gas and carbon monoxide leaks, radon, asbestos, mould and knob and tube wiring</td>
<td>Implementer to consumer</td>
<td>Free services to income-qualified customers</td>
<td>Free services to income-qualified customers</td>
<td>Not assessed</td>
</tr>
</tbody>
</table>
5.2.1 Massachusetts Low Income Program

The Massachusetts Utilities offer the Massachusetts Low Income Program jointly with the U.S. Department of Energy’s Weatherization Assistance Program, with both ratepayer and federal monies funding the program. A state law requires utilities to invest at least 10% of total electric efficiency spending and 20% of natural gas energy efficiency spending in comprehensive, low-income residential, demand-side management and educational programs.

The Massachusetts Low Income Program includes free home energy audits and, for income-qualified residential customers of participating program administrators, free or discounted energy efficiency measures. The program is targeted to single-family and two-to-four unit multifamily residential customers with household incomes less than or equal to 60% of the state household median. For multifamily housing above five units, the program most often includes grants to property owners to cover energy efficiency upgrade costs.

The program is jointly administered by the utilities and a Low-Income Energy Affordability Network (LEAN). LEAN was created to ensure statewide coordination and consistency in implementation. A network of 25 community action agencies, public and private housing owners, government organizations and public utilities, LEAN partners work together to provide affordable energy solutions for low-income families throughout Massachusetts. The community action agencies administer and implement the program, managing program funding, determining participant eligibility, arranging for audits, conducting measure installations and issuing progress reports on energy efficiency projects.

For the three-year energy efficiency planning period (2010–2012), the Massachusetts Utilities allotted over $134 million (in U.S. dollars) and $72 million for low-income electric and natural gas funding, respectively. The associated products included health and safety measures, insulation and weatherization measures, heating system repair and/or replacement and base load measures (such as refrigerator/freezer replacement, lighting and domestic hot water measures).

The Massachusetts program is larger in scale and has different delivery strategies than the HAP. The Massachusetts program offers grants to multifamily housing with over five units, while the HAP has no grant offerings for larger multifamily units and excludes buildings above three stories from participation. The Massachusetts program is funded by natural gas and electric utilities and offers natural gas and electric measures. Like the HAP, the Massachusetts program includes similar basic and extended track measure offerings as well as health and safety measures. However, because of the inclusion of natural gas, the Massachusetts program installs a lot more weatherization measures and includes heating system measures. HAP delivery agents acknowledged that establishing legitimacy and trust with utility-sponsored programs is especially important, as customers are often skeptical of offerings or tend to avoid direct contact with utilities when they are having difficulty with utility bills. A network of community action agencies market and implement the Massachusetts program: these groups are most often the first point of contact with a customer, and are sometime the only contact with the customer, which should reduce the hesitation to engage in a utility program.
5.2.2 Income Qualified Energy Efficiency Assistance Program

The Consumers Energy Income Qualified Energy Efficiency Assistance Program is very similar to the HAP in process and measures offered. Consumers Energy’s Income Qualified Energy Efficiency Assistance Program consists of various residential initiatives targeting Michigan households at or below 200% of federal poverty level guidelines. Through delivery of energy efficiency measures, home audits and education to encourage energy savings at no cost to participants, Consumers Energy uses these initiatives to reduce barriers to efficiency improvements faced by this hard-to-reach residential segment. Like the HAP, the program implementation contractor serves as the primary delivery agent for the initiatives, with support from delivery contractors, local community action agencies and non-profit organizations for specific initiatives.

For the single-family segment and multifamily segment, the program includes free services for income-qualified customers, including in-home energy assessments, installations of low-cost measures, energy saving education and recommendations for additional low-cost, energy-saving home improvements and repairs. Like HAP, Consumers Energy uses a network of contractors, managed by an implementation contractor, for delivery.

Consumers Energy offers a portfolio of initiatives under this program and consistently tests new initiatives with partner organizations in order to better serve the market. Recently, Consumers Energy teamed with the existing Michigan Weatherization Assistance Program (WAP) delivery to support weatherization providers with more funding for deeper retrofits than those provided by WAP alone. The addition of electric measures combined with the weatherization fixes continues to extend the program’s reach across the Consumers Energy territory. Ontario does not have a province-wide weatherization program; however, the two largest natural gas providers do. The Enbridge and Union Gas weatherization program currently installs thermostat and domestic hot water measures like those offered through the HAP. Like the WAP without Consumers Energy, both Enbridge and Union Gas do not offer electric measures like LEDs, power strips, dehumidifiers, refrigerators, freezers and window air conditioners.

5.2.3 People Working Cooperatively

People Working Cooperatively (PWC) is a non-profit organization with utility support that provides a comprehensive set of services in Ohio. Its whole-house approach encompasses all services normally provided by weatherization agencies in addition to some extensive home repairs, some ongoing maintenance and some modifications to improve the mobility of senior and/or disabled residents. This whole-house approach is unique among low-income weatherization services for the following reasons:

- The extent of maintenance services available
- The modifications made to enhance residents’ mobility
- The organization’s ability to serve customers on an ongoing basis

The mobility modifications address accessibility issues in the homes of low-income, senior and disabled people. They provide for installations of ramps, grab bars and other modifications that provide residents
with greater safety, independence and access inside their homes. The home repair services include critical repairs for issues with plumbing, wiring, furnaces and roofs as well as for emergency repairs of broken water pipes, lack of heat, safety problems, electrical hazards and lack of water heating. The weatherization services include energy-related health and safety issues (e.g., repairing or replacing heating systems and water heaters, ensuring adequate ventilation, installing carbon monoxide and fire detectors) in addition to typical weatherization measures.

Internal staff, outside contractors and volunteers provide PWC services. PWC staff who work in client homes include licenced professionals (e.g., plumbers, electricians, carpenters, roofers, HVAC specialists, energy auditors, conservation specialists). When PWC does not have an in-house expert available, it enlists other contractors to meet production demands or to provide a specific service. In addition to these staff and contractor resources, PWC uses skilled and nonprofessional volunteer labour to assist with a variety of services. In 2009, PWC’s 5,057 volunteers provided over 23,000 hours of labour, which increased the breadth and depth of services to clients. One barrier mentioned by HAP delivery agents that can hinder the installation of energy-efficient measures in a low-income home is need for aesthetic finishing. Especially when installing weatherization measures, finishing work is not completed (e.g., drywall patch and painting). The PWC Program has home repair services on staff, as well as dedicated volunteers to remedy these issues, allowing for installing energy efficiency measures that a customer may have previously been reluctant to allow.

5.2.4 Texas Hard-to-Reach Standard Offer Program
The Texas Hard-to-Reach Standard Offer Program requires utility participation by statute. Utilities decide how to best implement the program. Program implementers include traditional energy efficiency services companies, the utilities, local contractors, national or local companies that provide energy-related products (e.g., insulation, HVAC) and product retailers that install the particular energy-efficient products sold as part of this program.

The Texas electric utilities’ programs improve the energy efficiency of residential and commercial customers through Standard Offer Programs (SOP) and Market Transformation Programs. SOPs support an infrastructure of contractors (energy efficiency service providers), who deliver equipment and services directly to customers. Over 200 unique energy efficiency service providers participate across the residential SOPs. Some utilities also offer target low-income programs that coordinate with the existing federal weatherization program. The low-income programs encourage energy efficiency improvements in households with annual incomes at or below 200% of the federal poverty guideline. The most common installed measures include ceiling insulation, envelope sealing, duct sealing and lighting.

Different than HAP, the Texas program allows for a variety of delivery options. While all Texas utilities are required to participate, the way a utility delivers the program can vary. Utilities can refund contractors who market and deliver the program through the SOP on their own, coordinate with WAP (like the Consumers Energy program), self-deliver the program and/or deliver it through implementers similar to the HAP.
5.2.5 BC Hydro: Power Smart Energy Saving Kit Program

BC Hydro determined that social marginalization resulting from literacy issues, a disproportionate number of elderly customers and access to information presented major barriers to standard efficiency program participation. The BC Hydro: Power Smart Energy Saving Kit Program offers a solution to standard low-income program offerings, which have difficulty in implementing simple energy efficiency behaviours.

Through this program, BC Hydro provides eligible residential customers with a free package of low-cost, easy-to-install energy-efficient devices and retrofits. The kit includes CFLs, faucet aerators, low-flow showerheads, pipe wrap, caulking, draft proofing materials, outlet gaskets, window film and information on how to save energy in the home. It also is available in bulk for distribution by qualified subsidized housing providers. Additionally, qualified housing providers become eligible to receive funding for vendors to perform direct installation of the kit. The program is administered through a phone-in registration system, where a customer responds to program brochures, community advertisements, bill inserts or initiatives by non-profit organizations and social housing providers.

A completely different offering than HAP, BC Hydro is deploying measures directly to consumers. Via this program, BC Hydro assesses that they have been able to reach many more low-income customers than through traditional audit and installation programs. Like the HAP, these measures come with energy efficiency educational materials; however, for BC Hydro, the materials are included in all kits. As such, a contractor cannot forget to leave the materials behind, and they are received by all participants.

5.2.6 Home Energy Solutions Income Eligible Program

Home Energy Solutions (HES) is the flagship program funded by the Connecticut Energy Efficiency Fund. Program vendors perform energy assessments of single-family and multifamily residences, providing core services measures (e.g., efficient light bulbs, faucet aerators, showerheads, air sealing, duct sealing) for a nominal fee ($99). Vendors recommend add-on measures (i.e., not core services) that participants can adopt to achieve deeper energy savings. Usually, these measures are eligible for rebates, zero- or low-interest program financing or both.

Home Energy Solutions–Income Eligible (HES–IE) shares many characteristics with HES, but services are limited to low-income households. Participating households receive the same core services as those provided by HES, but owner-occupants need not have a co-pay for add-on measures (although landlords may be subject to co-pays).

Different from HAP, because of the HES–IE and HES shared characteristics, in multifamily buildings the program can serve as a “one stop shop” for improvements outside of a single residential unit. For example, if a vendor is working on a single apartment for HES–IE and determines that the whole building could benefit from a new building water heater, they can offer the measure to the landlord, who is eligible for rebates, zero- or low-interest program financing or both. Allowing for shared offerings can turn a small HES–IE project into a much larger energy saving project.
6. Conclusions and Recommendations

Based on the impact and process evaluation, as well as jurisdictional scan, Cadmus offers the suggestions outlined below.

**Conclusion: Participant data included repeat accounts, was missing reported savings and/or reported quantity and was delivered in inconsistent formats.** It is not clear whether data are not being entered properly, not being transmitted properly or not being relayed properly to the final program tracking database. Consistent data would reduce the risk of introducing data error during the cleaning process.

- **Recommendation:** Provide a program data template with pull down menus to provide a consistent format for measure identification numbers, measure names and end-uses for project records and measure data.

- **Recommendation:** Include the reported quantity and savings estimates in the program data for all projects, particularly weatherization projects where square footage need be reported. A program data template could be designed to show an error message if fields are left blank.

- **Recommendation:** Leverage the work of London Hydro, who has created their own FAST integrated tablet-based data collection tool and software that allows them to audit, assess, report and generate bills and data records without using paper. Share London Hydro’s online tool across all the participating delivery agents.

**Conclusion: The HOT2000 tool does not allow for verification of savings and adds administrative costs.** Because HOT2000 pre-files do not need to be kept, Cadmus could not accurately verify savings for some weatherization projects. To properly evaluate savings, both a baseline and upgraded model need to be developed. The HAP currently uses reasonable deemed values per square foot to record savings in the prescriptive path. Using the prescriptive path for all weatherization measures would ensure consistency. Further, HOT2000 project data entry is done by, and often exceeds, a minimum of three people. The possibility of introduced error compounds with each person who handles the data. Finally, not using HOT2000 will reduce program costs, as delivery agents will be able to determine and record savings without modeling homes.

- **Recommendation:** Record weatherization measures only through the prescriptive path. As used currently, HOT2000 does not allow for savings verification.

- **Recommendation:** Retire the HOT2000 tool as it is currently used.

**Conclusion: The PIA, FAST and project data deemed savings and effective useful life values did not match in all cases.** In several cases, the project data reported connected demand reduction instead of peak demand reduction.

- **Recommendation:** Update the deemed values in FAST to be consistent with the latest evaluated values. Use peak demand values consistently instead of connected demand reduction.
Conclusion: The eligible social housing segment of potential participants has been largely exhausted by the HAP. Additional outreach strategies, both province-wide and more targeted, are necessary to boost participation and ensure that the program is served to a sufficiently broad base of customers. Establishing legitimacy and trust is especially important, as customers are often skeptical of “too good to be true” offerings, or tend to avoid direct contact with utilities when they are having difficulty paying bills on time. More targeted recruiting and one-off administration, compared with delivering the program to social housing customers, will have an impact on the budgets required to boost participation.

- **Recommendation:** Have delivery agents continue to pursue and use relationships with community organizations to help reach customers in need of assistance.

- **Recommendation:** Expand the social housing eligibility criteria to include buildings over three stories.

- **Recommendation:** Consider implementing province-wide broadcasting and creating a unified marketing message. Data-based tools, such as geo-clustering in conjunction with census data, may be useful as well. Cadmus will conduct a participation gap analysis and report our findings to IESO in August 2017; this may illuminate additional areas for outreach.

- **Recommendation:** Work with the LDCs to find ways to mitigate the impact of reduced economies of scale on both budgets and participation levels. This may involve more assistance from the IESO, or the development of more collaborative and streamlined delivery strategies.

Conclusion: The HAP participants are typically satisfied with the services and equipment provided by the program, but want more information regarding ways to save energy and lower their bills. Some respondents were confused (and presumably disappointed) when they did not receive the measures they were expecting. Only about half of participation survey respondents said the delivery agent left them printed educational materials, such as a brochure or flyer, and 11% said they received neither verbal nor printed education.

- **Recommendation:** Work with delivery agents to ensure that they make all program requirements for specific measures clear to participants.

- **Recommendation:** Collaborate with natural gas LDCs to deliver the program to allow for more participants to receive weatherization measures.

- **Recommendation:** Ensure that the delivery agents provide each participant with conservation key messaging, information on the measures installed and time of use rates and that they engage participants in promoting energy conservation behaviour. The IESO could require that delivery agents always leave the materials behind that were designed and provided by the IESO, or affirm that they provided verbal or equivalent written materials covering such information.

Conclusion: Extended and Weatherization Track reimbursement levels may not be sufficient for some measures, and may not reflect current market pricing. The programmable thermostat reimbursement does not reflect the regular need for delivery agents to hire electricians for installation. Weatherization
cost caps generally do not allow for sufficient aesthetic finishing (e.g., dry wall patch and painting), which creates a cost to the participant and limits installation potential. In addition, weatherization and health and safety caps are insufficient in cases where mould remediation is required. The health and safety cap covers the limited measures that can be installed according to the program rules, but the requirement that these measures must directly relate to the installation of energy efficiency measures limits the type of measures eligible for reimbursement. In addition, some delivery agents interpret the mitigation of safety issues to be related to the safety of the installer, not the residents. These are some of the reasons why the types of health and safety measures were not installed consistently across LDCs.

- **Recommendation**: Assess the market and installation costs of eligible appliances more frequently to ensure they are sufficient and do not hinder potential installations. Consult with delivery agents on the current cost to install programmable thermostats.

- **Recommendation**: Make the rules for reimbursement of health and safety measures more explicit and consider providing examples of reimbursable measures and appropriate scenarios. For example, the IESO could host a webinar for delivery agents covering common conditions in which specific health and safety measures are appropriate and reimbursable.

- **Recommendation**: To allow for analysis of the lost opportunity related to cases where weatherization measures are not installed due to installation or health and safety mitigation costs that would exceed the cap, consider modifying the data collection requirements to include in FAST delivery agents’ recommended measures that are not installed. These data should include delivery agents’ estimates of associated costs for installing these measures, health and safety mitigation and aesthetic finishing.
Appendix A. Participant Survey Demographics

This appendix compares the demographics of respondents with those of the general population in Ontario as reported by Statistics Canada. In instances where demographic data from survey respondents did not have equivalent data available from Statistics Canada, only the survey data is shown.

Most respondents speak English as their primary language. There is a similar language distribution for all of Ontario. The distribution of primary languages is shown in Figure 25.

![Primary Language Distribution](image)

Source for program participants: Participant Survey Question H1. “What is the primary language used in your household?” (n=306)


The distribution of the education level of respondents and all of Ontario is shown in Figure 26 and Figure 27.
Most respondents live in a household with one or two occupants. There is a similar distribution of number of household occupants for all of Ontario. The distribution of household size is shown in Figure 28.
Figure 28. Number of Household Occupants

Source for program participants: Participant Survey Question H3. “How many people, including yourself, live in the household full time?” (n=310)


The distribution of number of bedrooms per home is shown in Figure 29.

Figure 29. Number of Bedrooms Per Home

Source for program participants: Participant Survey Question H4. “How many bedrooms are in your home?” (n=311)

The distribution of number of bathrooms per home is shown in Figure 30.

**Figure 30. Number of Bathrooms Per Home**

![Bar chart showing the distribution of number of bathrooms per home.](image)

Source for program participants: Participant Survey Question H5. “How many bathrooms are in your home?” (n=311)


The distribution of number of stories in each home is shown in Figure 31.

**Figure 31. Number of Stories in Household**

![Pie chart showing the distribution of number of stories.](image)

Source: Participant Survey Question H6. “How many stories is your home, not including the basement?” (n=311)

The distribution of home age for respondents is shown in Figure 32.
Most respondents have a wireless internet connection in their homes. There is a similar distribution of household wireless connectivity for all of Ontario. The distribution of wireless internet in the home is shown in Figure 33.

Source for program participants: Participant Survey Question H9. “Do you have wireless internet in your home?” (n=311)

Over half of respondents live in a home between 1,000 and 1,999 square feet in size. The distribution of home size is shown in Figure 34.

**Figure 34. Respondent Home Square Footage**

Source: Participant Survey Question H8. “How many square feet is your home?” (n=311)

The distribution of household incomes for respondents and for all of Ontario is shown in Figure 35 and Figure 36.

**Figure 35. Total Household Income for Respondents**

Source: Participant Survey Question H10. “Which of the following categories applies to your total household income for the year 2016?” (n=311)
Figure 36. Total Household Income for All Ontario

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>$75,000 and over</td>
<td>17%</td>
</tr>
<tr>
<td>$50,000 and over</td>
<td>32%</td>
</tr>
<tr>
<td>$35,000 and over</td>
<td>47%</td>
</tr>
<tr>
<td>$25,000 and over</td>
<td>59%</td>
</tr>
<tr>
<td>$20,000 and over</td>
<td>67%</td>
</tr>
<tr>
<td>$15,000 and over</td>
<td>76%</td>
</tr>
<tr>
<td>$10,000 and over</td>
<td>85%</td>
</tr>
<tr>
<td>$5,000 and over</td>
<td>92%</td>
</tr>
<tr>
<td>Under $5,000</td>
<td>8%</td>
</tr>
</tbody>
</table>

Source: Statistics Canada. “Dwelling characteristics and household equipment, by province.”
[http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/famil133g-eng.htm](http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/famil133g-eng.htm)

Most respondents do not have an air conditioning system in their home. The distribution of air conditioning systems is shown in Figure 37.

Figure 37. Central Air Conditioning in Respondent Homes

Source: Participant Survey Question H13. “Do you have a central air conditioning system?” (n=309)
## Appendix B. Measures and Measure End Uses

Table 19 displays HAP PY2016 measures and measure tracks.

<table>
<thead>
<tr>
<th>Measure Number</th>
<th>Measure End Use</th>
<th>Program Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Track Measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Efficient Showerhead/Faucet Aerator</td>
<td>Efficient Showerheads (standard) &lt; 4.8 litres per minute (Lpm)</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Efficient Showerheads (handheld) &lt; 4.8 Lpm</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Efficient Aerators (kitchen) &lt; 5.7 Lpm</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Efficient Aerators (bathroom) &lt; 3.8 Lpm</td>
</tr>
<tr>
<td>5</td>
<td>LED Lighting</td>
<td>≤ 11-Watt ENERGY STAR LED A-Shape</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>≤ 14-Watt ENERGY STAR LED A-Shape</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>≤ 23-Watt ENERGY STAR LED A-Shape</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>≤ 23-Watt ENERGY STAR-Qualified LED (PAR)</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Qualified LED MR16 / PAR16 - GU 10 (Base)</td>
</tr>
<tr>
<td>10</td>
<td>Power Bar</td>
<td>Power Bar with Integrated Timer</td>
</tr>
<tr>
<td>11</td>
<td>Hot Water Tank Wrap/ Pipe Insulation</td>
<td>Hot Water Tank Insulation - Fiberglass R10 (fits up to a 60-gallon tank)</td>
</tr>
<tr>
<td>12</td>
<td>LED Lighting</td>
<td>≤ 16-Watt ENERGY STAR LED PAR20, PAR 30 and PAR38</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>≤ 6-Watt ENERGY STAR LED MR16</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>LED Downlight with Light Output &gt; 600 and &lt; 800 Lumens</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>LED Downlight with Light Output &gt; 800 Lumens</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>ENERGY STAR LED Wet Location ≤ 23 Watt</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>≤ 11-Watt ENERGY STAR-Qualified LED MR16</td>
</tr>
<tr>
<td>18</td>
<td>Block Heater Timer</td>
<td>Block Heater Timer</td>
</tr>
<tr>
<td>19</td>
<td>Clothes Drying Rack</td>
<td>Indoor Clothes Drying Rack</td>
</tr>
<tr>
<td>20</td>
<td>Hot Water Tank Wrap/ Pipe Insulation</td>
<td>Hot Water Tank Pipe Insulation – 1/2-inch inside diameter</td>
</tr>
<tr>
<td>21</td>
<td></td>
<td>Hot Water Tank Pipe Insulation – 3/4-inch inside diameter</td>
</tr>
<tr>
<td>Extended Track Measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Window Air Conditioner</td>
<td>Window Air Conditioner Replacement (ENERGY STAR 6,000–7,999 Btu/hour)</td>
</tr>
<tr>
<td>23</td>
<td></td>
<td>Window Air Conditioner Replacement (ENERGY STAR 8,000–9,999 Btu/hour)</td>
</tr>
<tr>
<td>24</td>
<td></td>
<td>Window Air Conditioner Replacement (ENERGY STAR 10,000–12,000 Btu/hour)</td>
</tr>
<tr>
<td>25</td>
<td>Dehumidifier</td>
<td>Dehumidifier Replacement (ENERGY STAR 14.2–21.2 L/day)</td>
</tr>
<tr>
<td>26</td>
<td></td>
<td>Dehumidifier Replacement (ENERGY STAR 21.3–25.4 L/day)</td>
</tr>
<tr>
<td>27</td>
<td></td>
<td>Dehumidifier Replacement (ENERGY STAR 25.5–35.5 L/day)</td>
</tr>
<tr>
<td>28</td>
<td>Freezer</td>
<td>Freezer Replacement (ENERGY STAR 12–14.4 cu. ft.)</td>
</tr>
<tr>
<td>29</td>
<td></td>
<td>Freezer Replacement (ENERGY STAR 14.5–16.0 cu. ft.)</td>
</tr>
<tr>
<td>30</td>
<td>Refrigerator</td>
<td>Refrigerator Replacement (ENERGY STAR 15.5–16.9 cu. ft.)</td>
</tr>
<tr>
<td>Measure Number</td>
<td>Measure End Use</td>
<td>Program Measure</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>31</td>
<td>Refrigerator Replacement (ENERGY STAR 17.0–18.4 cu. ft.)</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Refrigerator Replacement (ENERGY STAR 10.0–15.5 cu. ft.)</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Programmable Thermostat</td>
<td>Programmable Thermostat</td>
</tr>
<tr>
<td>34</td>
<td>CFLs</td>
<td>13-Watt CFL Twister</td>
</tr>
<tr>
<td>35</td>
<td>CFLs</td>
<td>20-Watt CFL Twister</td>
</tr>
<tr>
<td>36</td>
<td>CFLs</td>
<td>25-Watt CFL Twister</td>
</tr>
<tr>
<td>37</td>
<td>CFLs</td>
<td>3-Way CFL</td>
</tr>
<tr>
<td>38</td>
<td>CFLs</td>
<td>23-Watt CFL PAR 30</td>
</tr>
<tr>
<td>39</td>
<td>CFLs</td>
<td>26-Watt CFL PAR 38, Indoor</td>
</tr>
<tr>
<td>40</td>
<td>CFLs</td>
<td>26-Watt CFL PAR 38, Outdoor</td>
</tr>
<tr>
<td>41</td>
<td>CFLs</td>
<td>Covered A19 CFL</td>
</tr>
</tbody>
</table>

**Weatherization Track Measures**

<table>
<thead>
<tr>
<th>Measure Number</th>
<th>Measure End Use</th>
<th>Program Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>Draft Proofing</td>
<td>Comprehensive Draft Proofing</td>
</tr>
<tr>
<td>43</td>
<td>Insulation</td>
<td>Attic Insulation</td>
</tr>
<tr>
<td>44</td>
<td>Insulation</td>
<td>Wall Insulation</td>
</tr>
<tr>
<td>45</td>
<td>Insulation</td>
<td>Basement Insulation</td>
</tr>
</tbody>
</table>

**Health and Safety Measures**

<table>
<thead>
<tr>
<th>Measure Number</th>
<th>Measure End Use</th>
<th>Program Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>Health and Safety</td>
<td>Health and Safety Measures*</td>
</tr>
</tbody>
</table>

* An LDC may make repairs to the residence in order to install additional eligible measures, and they may make health and safety upgrades to the residence where such upgrades promote energy efficiency and are reasonably required to mitigate an immediate health and safety concern in the residence: The value of such repairs and upgrades is limited to $750 total.
### Appendix C. Verified Savings by Measure

Table 20 provides the complete list of kilowatt and kilowatt-hour verified savings by measure, and the total quantity of each measure installed in PY2016.

**Table 20. Verified Savings by Measure**

<table>
<thead>
<tr>
<th>Program Measure</th>
<th>Measures Installed</th>
<th>kW</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic Track Measures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10W – 14W ENERGY STAR® Qualified LED A Shape</td>
<td>2,256</td>
<td>13</td>
<td>187,841</td>
</tr>
<tr>
<td>13 W CFL Twister</td>
<td>13,037</td>
<td>8</td>
<td>186,297</td>
</tr>
<tr>
<td>14W – 18W ENERGY STAR® Qualified LED PAR 38</td>
<td>680</td>
<td>3</td>
<td>46,003</td>
</tr>
<tr>
<td>17W – 23W ENERGY STAR® Qualified LED A Shape</td>
<td>5,594</td>
<td>40</td>
<td>582,007</td>
</tr>
<tr>
<td>17W – 23W ENERGY STAR® Qualified LED Wet Location Rated PAR</td>
<td>77</td>
<td>1</td>
<td>14,272</td>
</tr>
<tr>
<td>20 W CFL Twister</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>23 W CFL PAR 30</td>
<td>269</td>
<td>-</td>
<td>8,214</td>
</tr>
<tr>
<td>25 W CFL Twister</td>
<td>3,535</td>
<td>3</td>
<td>64,892</td>
</tr>
<tr>
<td>26W CFL PAR 38, Indoor</td>
<td>62</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>26W CFL PAR 38, Outdoor</td>
<td>239</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3' Pipe Wrap (1/2&quot; Pipe)</td>
<td>1,959</td>
<td>7</td>
<td>68,299</td>
</tr>
<tr>
<td>3' Pipe Wrap (3/4&quot; Pipe)</td>
<td>214</td>
<td>1</td>
<td>7,469</td>
</tr>
<tr>
<td>3-Way CFL</td>
<td>571</td>
<td>1</td>
<td>19,978</td>
</tr>
<tr>
<td>7W – 10W ENERGY STAR® Qualified LED MR 16 / PAR 16</td>
<td>396</td>
<td>1</td>
<td>7,728</td>
</tr>
<tr>
<td>7W – 11W ENERGY STAR® Qualified LED A Shape</td>
<td>60,514</td>
<td>274</td>
<td>4,013,782</td>
</tr>
<tr>
<td>7W – 12W ENERGY STAR® Qualified LED MR 16</td>
<td>195</td>
<td>0</td>
<td>6,596</td>
</tr>
<tr>
<td>8W – 12W ENERGY STAR® Qualified LED PAR 20</td>
<td>12</td>
<td>0</td>
<td>593</td>
</tr>
<tr>
<td>8W – 12W ENERGY STAR® Qualified LED PAR 30</td>
<td>460</td>
<td>1</td>
<td>20,347</td>
</tr>
<tr>
<td>Aerator Bathroom Flow Rate &lt; 3.8 L/min*</td>
<td>513</td>
<td>2</td>
<td>27,089</td>
</tr>
<tr>
<td>Aerator Kitchen Flow Rate &lt; 5.7 L/min*</td>
<td>509</td>
<td>4</td>
<td>47,128</td>
</tr>
<tr>
<td>Car Block Heater Timer</td>
<td>348</td>
<td>-</td>
<td>227,070</td>
</tr>
<tr>
<td>Covered A19 CFLs</td>
<td>3,119</td>
<td>2</td>
<td>46,952</td>
</tr>
<tr>
<td>Indoor Clothes Drying Rack</td>
<td>1,239</td>
<td>171</td>
<td>249,986</td>
</tr>
<tr>
<td>LED Downlight with Light Output &gt; 350 and ≤600 lumens</td>
<td>63</td>
<td>0</td>
<td>5,000</td>
</tr>
<tr>
<td>LED Downlight with Light Output &gt;600 and ≤800 lumens</td>
<td>38</td>
<td>0</td>
<td>3,955</td>
</tr>
<tr>
<td>Showerhead (Standard) Flow Rate &lt; 4.8 L/min*</td>
<td>1,273</td>
<td>17</td>
<td>187,046</td>
</tr>
<tr>
<td>Smart Power Bar</td>
<td>978</td>
<td>2</td>
<td>45,689</td>
</tr>
<tr>
<td><strong>Extended Track Measures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dehumidifier Replacement (ENERGY STAR Qualified 14.2 - 21.2 l/day)</td>
<td>306</td>
<td>18</td>
<td>55,594</td>
</tr>
<tr>
<td>Dehumidifier Replacement (ENERGY STAR Qualified 21.3 - 25.4 l/day)</td>
<td>40</td>
<td>2</td>
<td>6,197</td>
</tr>
<tr>
<td>Dehumidifier Replacement (ENERGY STAR Qualified 25.5 - 35.5 l/day)</td>
<td>13</td>
<td>1</td>
<td>2,844</td>
</tr>
<tr>
<td>Freezer Replacement (ENERGY STAR Qualified 12-14.4 cu ft)</td>
<td>637</td>
<td>4</td>
<td>31,851</td>
</tr>
<tr>
<td>Freezer Replacement (ENERGY STAR Qualified 14.5 - 16.0 cu ft)</td>
<td>172</td>
<td>1</td>
<td>8,600</td>
</tr>
<tr>
<td>Programmable Thermostat – Line Voltage</td>
<td>7</td>
<td>-</td>
<td>271</td>
</tr>
</tbody>
</table>
## Program Measure

<table>
<thead>
<tr>
<th>Measure</th>
<th>Measures Installed</th>
<th>kW</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programmable Thermostat – Low Voltage</td>
<td>4</td>
<td>-</td>
<td>5,286</td>
</tr>
<tr>
<td>Refrigerator Replacement (10.0 - 12.5 cu ft)</td>
<td>199</td>
<td>17</td>
<td>132,240</td>
</tr>
<tr>
<td>Refrigerator Replacement (ENERGY STAR Qualified 15.5 - 16.9 cu ft)</td>
<td>580</td>
<td>50</td>
<td>385,425</td>
</tr>
<tr>
<td>Refrigerator Replacement (ENERGY STAR Qualified 17.0 - 18.4 cu ft)</td>
<td>998</td>
<td>86</td>
<td>662,531</td>
</tr>
<tr>
<td>Room Air Conditioner Replacement (ENERGY STAR Qualified 10,000 – 12,000 BTU/hr)</td>
<td>38</td>
<td>4</td>
<td>7,026</td>
</tr>
<tr>
<td>Room Air Conditioner Replacement (ENERGY STAR Qualified 6,000 – 7,999 BTU/hr)</td>
<td>158</td>
<td>10</td>
<td>18,277</td>
</tr>
<tr>
<td>Room Air Conditioner Replacement (ENERGY STAR Qualified 8,000 – 9,999 BTU/hr)</td>
<td>114</td>
<td>9</td>
<td>16,646</td>
</tr>
</tbody>
</table>

### Weatherization Track Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>kW</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attic Insulation</td>
<td>121,964</td>
<td>48</td>
</tr>
<tr>
<td>Basement Insulation</td>
<td>23,989</td>
<td>9</td>
</tr>
<tr>
<td>Comprehensive Draft-Proofing</td>
<td>29,855</td>
<td>12</td>
</tr>
<tr>
<td>Wall Insulation</td>
<td>9,963</td>
<td>4</td>
</tr>
</tbody>
</table>

### Health and Safety Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>kW</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and Safety Measures</td>
<td>894</td>
<td>-</td>
</tr>
</tbody>
</table>

*For the aerator and showerhead savings there was confusion around which prescriptive input assumptions should be used. Cadmus incorrectly applied PIA from the PIA list and we should have used PIA from the FAST. The final numbers had been submitted before the PIA could be corrected. As such the total savings for aerator and showerhead measures should be 33.10 kW and 278,166.71 kWh, they currently are 23.85 kW and 261,262.45 kWh. The increase in savings of 9.25kW and 16,904.26 kWh would be 1.1% of the programs total verified kW and 0.2% kWh.

Table 21 presents the aerator and showerhead PIA. The FAST PIA should have been used where the PIA list was used in PY2016 analysis.

### Table 21. Aerator and Showerhead PIA

<table>
<thead>
<tr>
<th>Measure</th>
<th>In PY2016 Data kW</th>
<th>In PY2016 Data kWh</th>
<th>From PIA List kW</th>
<th>From PIA List kWh</th>
<th>FAST kW</th>
<th>FAST kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient Showerheads (standard) &lt; 4.8 Lpm</td>
<td>0.030</td>
<td>330.44</td>
<td>0.030</td>
<td>330.44</td>
<td>0.046</td>
<td>377</td>
</tr>
<tr>
<td>Efficient Showerhead (handheld) &lt; 4.8 Lpm</td>
<td>0.030</td>
<td>330.44</td>
<td>0.030</td>
<td>330.44</td>
<td>0.046</td>
<td>377</td>
</tr>
<tr>
<td>Efficient Aerators (kitchen) &lt; 5.7 Lpm</td>
<td>0.006</td>
<td>122.62</td>
<td>0.006</td>
<td>122.62</td>
<td>0.017</td>
<td>140</td>
</tr>
<tr>
<td>Efficient Aerators (bathroom) &lt; 3.8 Lpm</td>
<td>0.011</td>
<td>70.07</td>
<td>0.011</td>
<td>70.07</td>
<td>0.010</td>
<td>80</td>
</tr>
</tbody>
</table>
Appendix D. Legacy and True-Up Savings

For the PY2016 evaluation of HAP, Cadmus removed legacy and true-up data from CFF PY2016 data. Legacy projects took place before CFF, while true-up projects were submitted after March 2017. The savings for these projects are not included in the main body of this report, but are shown in Table 22.

<table>
<thead>
<tr>
<th>Year and Framework</th>
<th>Participation</th>
<th>Net Energy Savings (GWh)</th>
<th>Net Summer Peak Demand Reduction (MW)</th>
<th>Persistence of PY2016 Savings in PY2020 (MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PY2016 CFF</td>
<td>5,066</td>
<td>7</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>PY2015 True-Up Legacy</td>
<td>749</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>PY2015 True-Up CFF</td>
<td>225</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total True-Up</strong></td>
<td><strong>974</strong></td>
<td><strong>1</strong></td>
<td><strong>0</strong></td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>
Appendix E. Program Stakeholder Interview Guide

Evaluation Purpose

This interview guide was used to support the process evaluation of HAP. Cadmus completed in-depth telephone interviews with a stakeholder manager administering the program, covering the following topics:

<table>
<thead>
<tr>
<th>Researchable Questions</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction and background</td>
<td>Section A</td>
</tr>
<tr>
<td>Gather insights into program design and delivery and determine if program is being implemented as planned</td>
<td>Section B, C</td>
</tr>
<tr>
<td>Identify areas working well</td>
<td>Section B, C</td>
</tr>
<tr>
<td>Identify areas that could be improved</td>
<td>Section B, C</td>
</tr>
<tr>
<td>Identify and assess program goals</td>
<td>Section B, H</td>
</tr>
<tr>
<td>Assess customer and delivery agent satisfaction</td>
<td>Section C, D, E, G, H</td>
</tr>
<tr>
<td>Identify topics of greatest interest</td>
<td>Section F</td>
</tr>
<tr>
<td>Review marketing</td>
<td>Section D</td>
</tr>
<tr>
<td>Review communication protocol</td>
<td>Section E</td>
</tr>
</tbody>
</table>

Audience: IESO program lead.

Purpose: Review PY2016 objectives, goals and program processes, and assess what is working well and assess areas where challenges exist.

This in-depth interview was conducted by Cadmus. The interview was scheduled in advance of the call via email. The interview took between 30 and 45 minutes. This information was included in the email invitation.

Target: 1 interview

General Instructions

- Interviewer instructions are in green [LIKE THIS].
- Skip pattern instructions are in red [LIKE THIS].

A. Introduction

Thank you for making the time to speak with me about the PY2016 Home Assistance Program. Cadmus is gathering feedback from key program staff and other stakeholders to make sure we have a thorough understanding of the program operations. We’ll also get your perspective on things that are working well or any areas where you have experienced challenges so far. We will use the information you provide to inform our understanding of the program so that we can provide well-rounded and balanced observations and recommendations. The interview will take about 45 minutes to an hour.
A1. To start, please tell me about your role and main responsibilities working on the Home Assistance Program.

B. **Program Goals**

I’d like to talk about the goals and objectives of the program. What are the primary or overall goals for the program in PY2016?

B1. Are HAP savings goals (and/or achieved savings) contributing to overall CEE targets and mission? Do these goals, other than savings targets, vary by LDC?

B2. It looks like the program participation continues to decline. Are you considering any program design changes that could help increase participation?

B3. We understand that IESO may take full ownership of HAP from LDCs next year. What are the expected effects on the program offering?

B4. Are there any questions/topics that are particularly important to explore in this evaluation given that the IESO will likely take full ownership of HAP?

B5. Under the Conservation First Framework, LDCs are required to service all sectors, including low income. The new directive will allow LDCs to choose which conservation programs they offer. The IESO will fill in the program offering gaps to ensure that all Ontarians have access to the same conservation programs. Do you know why the participating LDCs chose to offer the Home Assistance Program and why others offer a coupon or other programs?

C. **Program Design and Implementation**

Now, I’d like to talk with you about design and implementation of the Home Assistance Program.

C1. I think it would be a good idea for you to briefly walk me through a high-level overview of how the Home Assistance Program is administered and delivered, beginning with how participants are identified all the way to documenting the participant results. [PROBE FOR STEPS IN THE PROCESS AND ROLES AND RESPONSIBILITIES OF THE IESO VS. LDCS VS. DELIVERY AGENTS (WHO DOES WHAT)]

C1a. How is the program marketed? (If at all, by whom, what mediums)

C1b. How do delivery agents determine whether weatherization measures should be installed?

C1c. I understand that contractors use a system called FAST Tool to track and report savings for the measures they install, and that if a home is part of the weatherization track, they use
the simulation tool HOT2000 to model the residence and estimate savings from the weatherization measures. Are weatherization measure details also recorded in FAST Tool?

C1d. How are health and safety measures identified? How is need deemed appropriate?

C1e. If a delivery agent deems the need for a health and safety measure install, what is the process from install to reporting install in FAST?

C1f. Have you received feedback on the $750 cost cap?

C2. Are there any variations in the program design and delivery by LDC? If yes, how do they vary?

C3. Who would you say are the primary drivers of program participation: the LDCs or the delivery agents?

C4. One of recommendations from the 2015 program evaluation was that LDCs build and leverage partnerships with low-income community service organizations. Has this recommendation been implemented? [IF NO] Do you know why not?

C5. We understand that some LDCs no longer offer HAP and offer the coupon program instead. How do these LDCs target low-income customers with the coupon program?

C6. From a preliminary data review, it appears that Toronto Hydro-Electric System, Hydro One Networks and London Hydro contribute over 93% of the program savings. Does this sound accurate?

C6a. Do you know why these LDCs are the primary conduits for participation in the Home Assistance Program?

C6b. Are you aware of specific reasons the other LDCs have not reported significant program participation?

C6c. It also appears that London Hydro does not offer the weatherization track. Is this in fact the case? [IF YES] Do you know why that is?

C7. We understand there are around 12 contractors that participate in the program. Do you know if all are currently active delivery agents?

C7a. Do the LDCs have preferred delivery agents?

C8. What specific tools, protocols or processes do IESO and LDC staff use to closely monitor program performance on an ongoing basis?

C9. Are there any challenges with this?

C9a. [IF YES] What are the challenges?
C10. Are there specific data collection and reporting requirements for this program, for contractors as well as LDCs?
   C10a. [IF YES] Who defines and enforces these requirements?

C11. Are there any site verification or quality assurance protocols? [IF NO, WHY NOT? IF YES, PLEASE DESCRIBE. PROBE FOR SOME OR ALL HOMES AND HOW IT IS PERFORMED AND BY WHOM.]

D. Marketing and Education

Now, I’d like to talk with you about marketing activities for the program in PY2016.

D1. [IF NOT ALREADY ANSWERED] My understanding is that the LDCs handle most of the marketing for this program; is this still the case?

D2. Is IESO involved with marketing the program?
   D2a. [IF YES, ASK] Please describe marketing activities IESO has undertaken.

D3. What about participating delivery agents? Are they involved with marketing the program?
   D3a. [IF YES, ASK] Please describe marketing activities contractors have undertaken.

D4. What are the main marketing activities for the program?

D5. Are delivery agents incorporating education into their services?
   1. [IF YES] Can you describe how they deliver the education component?
   2. [IF NO] Can you describe how the education component is delivered?

D6. Are there standard education rules or guidelines for LDCs?
   D6a. [IF YES] Who defines and enforces these guidelines?

D7. One of recommendations from the 2015 program evaluation was that program materials include clear instructions for measures that are either not installed at the time of delivery, or that are programmable. Do you know whether this recommendation has been implemented? [IF NO] Do you know why not?

E. Communication Processes

The following questions are about your typical communication processes, as they relate to the program.

E1. What types of communication regarding the program do you have with individual LDCs?

E2. Do you have any suggestions on how communications between the IESO and LDCs could be improved?
E3. Do you ever communicate directly with the contractors/delivery agents?
   E3a. [IF YES] How frequently, and regarding what types of matters?
   E3b. Do you have any suggestions on how communications between the IESO and delivery agents could be improved?

F. Program Stakeholders

Now I’d like to talk about other possible program stakeholders.

F1. Are there any low-income advocacy groups that have direct or indirect involvement with the Home Assistance Program? [IF NEEDDED] Involvement could be direct, such as assistance with distribution of program marketing or educational materials, or indirect, such as commenting on public reports or making requests of program administrators.
   F1a. [IF YES] Please describe their type and level of involvement with the program.
   F1b. Should Cadmus reach out to any contacts from this/these advocacy groups to solicit feedback or suggestions regarding the program?

F2. Are there any other key stakeholders involved in the program, such as government programs or weatherization-service agencies, other than the program delivery agents?
   F2a. [IF YES] Please describe their type and level of involvement with the program.
   F2b. Should Cadmus reach out to any contacts from this/these other entities?

F3. Are there any other staff of the IESO we should talk to about the Home Assistance Program?

G. Customer and Contractor Satisfaction

Now, I’d like to talk about any experience you have with participant and delivery agent program satisfaction.

G1. Have you heard any feedback from end-use participants regarding the program?

G2. What about the delivery agents? Have you heard, first or second hand, any feedback from any of them? Please describe.

G3. What do you think are the main challenges with the program for participants? For delivery agents?

H. Successes and Challenges

Please think about the program overall for the next set of questions.

H1. What would you say worked particularly in PY2016?
   H1a. Why do you think that is?
H2. Conversely, what did not work as well as anticipated?  
   H2a. Why do you think that is?

H3. Other than [ANSWERS to Section B] we talked about earlier, are you considering any changes to improve the program?

I. Closing

We are almost finished. I have a few final questions.

I1. Thinking about the PY2016 evaluation, what are you interested in learning from this evaluation? [PROBE FOR ANY FEEDBACK WE SHOULD GET FROM EITHER PARTICIPANTS OR DELIVERY AGENTS]

I2. Is there anything else you would like to cover that we did not discuss?

   Thank you for your input. We appreciate your time. Have a nice day.
Appendix F. Delivery Agent Interview Guide

Evaluation Purpose
This interview guide was used to support the process evaluation of HAP. Cadmus completed in-depth telephone interviews with delivery agent managers implementing the program, covering the following topics:

<table>
<thead>
<tr>
<th>Researchable Questions</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery agent relationship with LDCs and level of support provided by LDCs</td>
<td>Section B</td>
</tr>
<tr>
<td>Delivery agent involvement in recruitment</td>
<td>C1-C4</td>
</tr>
<tr>
<td>Barriers to recruitment and participation</td>
<td>C5-C7</td>
</tr>
<tr>
<td>Program tracking data and quality assurance procedures</td>
<td>Section D</td>
</tr>
<tr>
<td>Effects of changes in reimbursement levels for PY2016</td>
<td>G1-G6</td>
</tr>
<tr>
<td>Proclivity to install health and safety measures</td>
<td>E1-E5</td>
</tr>
<tr>
<td>Adequacy of cost cap for health and safety measures</td>
<td>E6</td>
</tr>
<tr>
<td>Perceived benefits of health and safety measures</td>
<td>E7, E8</td>
</tr>
<tr>
<td>Economic impacts of the program</td>
<td>A5, A6</td>
</tr>
<tr>
<td>Implementation of program education and training components</td>
<td>Section F</td>
</tr>
<tr>
<td>Program tracking data and quality assurance procedures</td>
<td>Section D</td>
</tr>
<tr>
<td>Potential alternative program offerings and implementation strategies</td>
<td>A11, C6, D5, D15, G6, G9</td>
</tr>
<tr>
<td>Satisfaction of delivery agents and participants</td>
<td>Section G</td>
</tr>
</tbody>
</table>

A. Introduction
Cadmus was hired by the IESO to evaluate the Home Assistance Program. We’d like your feedback on how the program was delivered, as well as your experience and satisfaction with the program. None of the comments you share today will be attributed to you as an individual or to your organization. This interview should take an hour to complete. Is now a good time to speak?

A1. Our records show that you are currently the contact at [DELIVERY AGENT] for the Home Assistance Program. Is this correct?

A2. Can you begin by telling us your title and role in at [DELIVERY AGENT]?

A3. What does your company specialize in? Do you know what your company’s NAICS code is? [PROBE IF NEEDED: WEATHERIZATION; RENOVATIONS, ELECTRICAL/LIGHTING; ENERGY ASSESSMENTS, DIAGNOSTICS OR RATINGS; OR HVAC EQUIPMENT, COMMISSIONING SERVICES, CONTROLS AND REFRIGERATION]

A4. How long have you been involved with the Home Assistance Program?
A5. Roughly what percentage of your revenue is generated by participation in the Home Assistance Program?

A6. How many staff are involved with the Home Assistance Program? Are these full-time staff? What proportion of their work is related to the Home Assistance Program?

A7. What LDCs do you work with? [IF DELIVERY AGENT WORKS WITH MULTIPLE LDCS]

A8. Do you have different contracts with each LDC? [PROBE, WHAT ARE THE DIFFERENCES?]

A9. Other than the LDCs and the IESO, do you work with any other organizations as part of the Home Assistance Program? What are their roles? [PROBE FOR OUTREACH ORGANIZATIONS, FIRE DEPARTMENTS, NON-PROFITS, ETC.]

A10. Have you worked with the gas utilities [SUCH AS ENBRIDGE] to deliver the low-income energy efficiency programs?

A11. Are there any organizations not currently involved in this program’s delivery that you think should be involved or that you would like to coordinate with?

B. LDC Interaction

B1. Please tell me how you work with the LDCs.
   1. What are your respective roles in implementing the programs?
   2. What works? What doesn’t work?
   3. Anything with relationship that has changed in last year?

B2. Do you get information about the program from the LDCs or the IESO?
   1. Are you satisfied with program information provided?

B3. What types of program information, program materials, guidance and/or tools have the LDCs (or the IESO) provided to help you implement the program?
   1. Has the LDC/IESO provided you with marketing materials?
   2. [IF THE LDC/IESO PROVIDED MARKETING MATERIALS] Is the LDC/IESO marketing material adequate for educating participants about energy efficiency?
   3. Do you have your own marketing materials? [IF SO, WHY?]
   4. Has the LDC/IESO provided you with educational materials?
   5. [IF THE LDC/IESO PROVIDED EDUCATIONAL MATERIALS] Have there been in any changes in the educational materials you received this year?
   6. [IF THE LDC PROVIDED EDUCATIONAL MATERIALS] Is the LDC educational material adequate for educating participants about energy efficiency?
   7. Do you include your own educational materials? [IF SO, WHY?]

B4. Do you have any suggestions or comments to improve coordination and communication?
B5. Does the LDC set any goals for your company? [IF SO, WHAT ARE THEY?]

B6. How did you get hired to be a service provider to the LDC? (for example, was there a competitive procurement process?)

C. Program Recruitment and Participation

C1. How active are you in participant recruitment?

C2. How do you find eligible customers? [PROBE FOR MARKETING PROCESS, OUTSIDE ORGANIZATION ASSISTANCE]

C3. [IF DELIVERY AGENT WORKS WITH MULTIPLE LDCS] Do you have different marketing plans or processes for different LDCs?

C4. Do you have a marketing budget? [PROBE FOR HOW MUCH, WHAT CHANNELS ARE USED]

C5. How do you determine whether the customer is qualified for the program (income level, etc.)?

C6. Once a customer has been identified as eligible to participate, are there any additional barriers to participation that you have observed?

C7. What percentage of the participants you serve live in social housing?

C8. Is there difficulty identifying eligible participants outside of social housing?

D. Program Data

D1. What is the process for data entry from the home to be transferred to the LDC? Does this differ for audit results versus installed measure data?

D2. Can you describe your use of the Field Audit Support Tool (FAST)?

D3. Is there a process in place to ensure that auditors are using the latest version of FAST?

D4. How well do you think FAST identifies cost-effective measures and estimates savings? [PROBE FOR WHY]

D5. Are there any changes you would make to the FAST tool?

D6. Do you offer weatherization measures to qualifying participants? [PROBE FOR WHY, WHY NOT]

D7. [IF DELIVERY AGENT OFFERS WEATHERIZATION MEASURES] How is the Field Audit Support Tool used for weatherization measures?

D8. [IF DELIVERY AGENT OFFERS WEATHERIZATION MEASURES] What data collection tools are used? How are staff trained on these conducting these audits and using the tools?
D9. **[IF DELIVERY AGENT OFFERS WEATHERIZATION MEASURES]** Do you estimate weatherization savings using the HOT2000 model? **[PROBE FOR WHY, WHY NOT HOT2000 IS USED]**

D10. **[IF DELIVERY AGENT OFFERS WEATHERIZATION MEASURES]** Who does this modeling?

D11. **[IF DELIVERY AGENT DOESN’T USE HOT2000]** How do you feel the FAST handles weatherization measures?

D12. **[IF DELIVERY AGENT USES HOT2000]** How do you feel the HOT2000 model does in terms of estimating weatherization savings?

D13. **[IF DELIVERY AGENT USES HOT2000]** What is the process for QA/QC on the model results?

D14. **[IF DELIVERY AGENT USES HOT2000]** What is the process how information from the HOT2000 model is entered into the FAST?

D15. Do you use any other data collection instruments during the audits? If so, what information is collected and how is it used and where is it maintained?

D16. Is there a verification process in place? **[PROBE FOR ON-SITE AND DATA QA/QC; WHY, WHY NOT; HOW VERIFICATION PROCESS WORKS]**

### E. Health and Safety Measures

E1. Do you identify and install health and safety measures?

E2. Is there any reason you don’t or wouldn’t install health and safety measures?

E3. **[IF DELIVERY AGENT INSTALS HEALTH AND SAFETY MEASURES]** What health and safety measures do you typically identify?

E4. **[IF DELIVERY AGENT INSTALS HEALTH AND SAFETY MEASURES]** How do you decide what health and safety measures to install?

E5. **[IF DELIVERY AGENT INSTALS HEALTH AND SAFETY MEASURES]** What percentage of projects would you say require installation of health and safety measures?

E6. **[IF DELIVERY AGENT INSTALS HEALTH AND SAFETY MEASURES]** Is the $750 cost cap for health and safety measures adequate?

E7. **[IF DELIVERY AGENT INSTALS HEALTH AND SAFETY MEASURES]** Do your customers recognize the benefit of health and safety installs?

E8. Do you think there are energy saving benefits from health and safety installs? If so, how?
Appendix F. Delivery Agent Interview Guide

F. Participant Training and Education

F1. Does the program require that you provide training and education regarding things customers can do to save energy?

F2. Does your staff receive training on how to provide such education to customers? [IF YES] Who provides this training?

F3. Do you have guidelines regarding what educational and training information each delivery agent is to provide on the site?

F4. Are education and training customizable by site and situations on the site?

F5. Does staff leave behind any educational materials and/or instructions? [IF SO, PLEASE ASK FOR A COPY]

F6. In what percentage of projects would you say staff deliver training and education?

G. Program Satisfaction

G1. Do you assess customer satisfaction? [PROBE FOR HOW, WHY, WHY NOT]

G2. Have participants requested additional measures? What types?

G3. Do customers express satisfaction or dissatisfaction with the program?

G4. How satisfied are you with the program reimbursement process?

G5. Are you satisfied with the reimbursement levels for audits and installed measures? [PROBE FOR MEASURE MARGIN]
   1. Have the changes in reimbursement levels and costs caps changed what measures and services you offer or your program delivery strategy?
   2. How much does each audit cost your company?

G6. Are there certain measure or measure groups with higher reimbursement margins than others?

G7. Are you satisfied with the administrative requirements and process to participate in the Home Assistance Program? [PROBE FOR WHY OR WHY NOT]

G8. Overall, how satisfied are you with the program?

G9. Finally, do you have any other comments or recommendations concerning the program?
Appendix G. Participant Surveys

Evaluation Purpose
This survey guide was used to support the process evaluation of HAP. Cadmus completed telephone surveys with PY2016 HAP participants, covering the following topics:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Researchable Questions</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness</td>
<td>Determine how participants learned of the program, best medium for outreach</td>
<td>C1, C2</td>
</tr>
<tr>
<td>Participant type</td>
<td>Identify homeowners, renters and landlords; determine home type (single family/multifamily)</td>
<td>B4, B5, B6, B7</td>
</tr>
<tr>
<td>Participant decision-making</td>
<td>Assess reasons and motivation for participation</td>
<td>C3, C3.1</td>
</tr>
<tr>
<td>Program satisfaction</td>
<td>Assess satisfaction with program, measure performance, LDC and delivery agent</td>
<td>Section G</td>
</tr>
<tr>
<td>Program challenges</td>
<td>Identify challenges with program processes, suggested improvements</td>
<td>C3.1, F3, F5, G1</td>
</tr>
<tr>
<td>Measure verification/in-service rate</td>
<td>Verify installation, retention or removal (in-service rate)</td>
<td>Section D</td>
</tr>
<tr>
<td>Demographics, Home specifications</td>
<td>Occupancy, home size and age</td>
<td>Section H</td>
</tr>
<tr>
<td>Behavioural changes</td>
<td>Measure impact of energy education, household changes, take-back behaviour</td>
<td>Section E, D7, D8, D9, D10</td>
</tr>
<tr>
<td>Non-Energy and Ancillary Benefits</td>
<td>Identify improvements to comfort, health, safety and reductions in hardship</td>
<td>Section E</td>
</tr>
<tr>
<td>Participant profiles</td>
<td>Demographics, energy behaviours</td>
<td>Section F, H</td>
</tr>
</tbody>
</table>

General Instructions
- Interviewer instructions are in green [LIKE THIS]
- CATI programming instructions are in red [LIKE THIS]
- Items that should not be read by the interviewer are in parentheses.

Sample Fields
[NAME]: Customer name
[LDC]: Local distribution company
[MEAS]: The measure the customer received, per the program tracking data QTY_A-L: Quantity listed in the program tracking data specific to each measure
[ADDRESS]: Address where the equipment was installed
[LED_QTY]: LED bulbs
[CFL_QTY]: CFL bulbs
[CD_QTY]: Clothes drying rack
[SH_QTY]: Showerhead
[HS_QTY]: Health and safety
[FA_QTY]: Faucet aerators
[DH_QTY]: Dehumidifier(s)
[PT_QTY]: Programmable thermostat(s)
[PB_QTY]: Power bar(s)
[BHT_QTY]: Block heater timer(s)
[WAC_QTY]: Window air conditioner(s)
[REF_QTY]: Refrigerator and/or freezer
[HW_QTY]: Hot water tank or pipe wrap (unit)
[PW_QTY]: Pipe wrap (square feet of insulation or air sealing)
[INS_QTY]: Square feet of insulation or air sealing
[ANNUAL_SAVINGS]: Annual savings from sample

A. Telephone Introduction

A1. Hello, May I speak with [FIRSTNAME] [LASTNAME]?
OR [IF NO NAME] May I speak with the person most familiar with the energy audit and free upgrades made to your home through the [LDC]’s Home Assistance Program?

Hello, my name is __________, and I’m calling from Nielsen Opinion Search, a research company, on behalf of the Independent Electricity System Operator. We are speaking with [LDC] customers who have participated in the Home Assistance Program to learn about their experience and satisfaction with the program. Our records show this household participated in 2016, with energy efficient equipment installed at [ADDRESS]. Are you the person most knowledgeable about the program, which included installation of [MEASURES]?

[IF NEEDED, READ: I only need about 15 minutes. Nielsen adheres to the code of practice of the Marketing Research & Intelligence Association, and any opinions or comments you share with us will be reported only after all personally identifying information has been removed. Please be assured that no sales or promotional solicitation will occur during the interview or afterwards as a result of your participation. If you have questions or concerns about this study, you may call IESO’s call centre directly with this phone number: 1-877-797-9473]
[DO NOT READ; SELECT FIRST RESPONSE]
1. Yes
2. No, person is able to come to phone [ASK FOR PERSON WHO IS AND START AGAIN]
3. No, person is not able to come to phone OR Not a good time [GET NAME AND PHONE NUMBER, SCHEDULE CALL BACK]
4. Did not participate in Home Assistance Program [THANK AND TERMINATE]
98. (Don’t know) [ASK TO SPEAK WITH SOMEONE WHO KNOWS AND BEGIN AGAIN]
99. (Prefer not to answer) [THANK AND TERMINATE]

[ASK IF A1= 1]

A2. I’d like to ask you some questions about your experience with the Home Assistance Program. Your feedback is very important to the IESO and will help inform future program offerings to help Ontario residents save energy and reduce energy bills. Are you in a safe location to be able to complete the survey now?
1. Yes
2. No, not a good time [GET NAME AND PHONE NUMBER, SCHEDULE CALL BACK]
3. No, do not want to complete survey [THANK AND TERMINATE]
99. (Prefer not to answer) [THANK AND TERMINATE]

B. Screening Questions

B1. Thank you. According to program records, this household received a free energy efficiency audit through the Home Assistance Program, where one or two program representatives assessed your home’s energy use, talked to you about ways to save energy and gave you certain energy saving products to help you save energy in your home. Is that correct?
1. Yes
2. No
98. (Don’t know)
99. (Refused)

[ASK IF B1=2, 98 OR 99]

B2. Is it possible that someone else in the home was present when the Home Assistance Program representatives installed the energy saving products?
1. Yes
2. No [THANK AND TERMINATE]
98. (Don’t know) [THANK AND TERMINATE]
99. (Refused) [THANK AND TERMINATE]
Appendix G. Participant Surveys

B3. Is that person available at this time to speak about the energy efficiency upgrades that were installed?
   1. Yes [CONTINUE SURVEY IF AVAILABLE OR IF NOT CURRENTLY AVAILABLE SCHEDULE A TIME TO SPEAK AND CONTACT LATER]
   2. No [THANK AND TERMINATE]
   98. (Don’t know) [THANK AND TERMINATE]
   99. (Refused) [THANK AND TERMINATE]

B4. What is your relationship to the home at [ADDRESS LINE 1], are you the ...
   1. Owner and occupant
   2. Landlord, property manager or building manager
   3. Tenant/renter
   4. Occupant (not on lease or deed)
   5. Something else [SPECIFY]
   98. (Don’t know)
   99. (Prefer not to answer)

B5. As you do not occupy the home, are you familiar enough with the home to answer questions on the energy-efficient program measures installed through the Home Assistance Program?
   1. Yes
   2. No, person is able to come to phone [ASK FOR PERSON WHO IS AND START AGAIN]
   3. No, person is not able to come to phone OR Not a good time [GET NAME AND PHONE NUMBER, SCHEDULE CALL BACK]
   98. (Don’t know) [ASK TO SPEAK WITH SOMEONE WHO KNOWS AND BEGIN AGAIN]
   99. (Prefer not to answer) [THANK AND TERMINATE]

B6. What type of home is this?
   1. Single family
   2. Duplex or two family
   3. Apartment/condo in a two to four unit building
   4. Apartment/condo in building with more than four units
   5. Townhouse or row house (adjacent walls to another house)
   6. Mobile home, house trailer
   7. Other [SPECIFY]
   98. (Don’t know)
   99. (Refused)
B7. Who pays the utility bill for this home?
   1. Me (or members of my household)
   2. The tenant
   3. Assistance agency or group
   4. Landlord or property manager
   5. Shared utility bill between tenant and landlord
   6. Other [SPECIFY]
   98. (Don’t know)
   99. (Refused)

C. Awareness and Motivation

First, I would like to ask you about your participation in the program.

C1. In which of the following ways did you hear about the Home Assistance Program? [MULTIPLE RESPONSE; READ EACH]
   1. LDC’s website
   2. A telephone call from program staff
   3. A community event or seminar
   4. My landlord, building superintendent or building manager
   5. Someone coming to my door
   6. A program flyer or any other printed material
   7. A friend or family member
   8. A government agency, like the Low-Income Energy Assistance Program (LEAP) or the Ontario Energy Savings Program (OESP)
   9. Church
   10. Fire department
   11. Participation in a natural gas distribution company program
   12. A non-profit group, like the Salvation Army [SPECIFY]
   13. Other [SPECIFY]
   98. (Don’t know)
   99. (Refused)

C2. Which of the following best describes how you signed up for the program? [READ EACH]
   1. You filled out a paper application
   2. You signed up at an event or presentation
   3. You signed up online
   4. A program staff member visited your home
   5. Your landlord, building manager or building superintendent signed you up
   6. Other [SPECIFY]
   98. (Don’t know)
   99. (Refused)
C3. What motivated you to sign up for these services? **[SELECT ALL THAT APPLY]**
   1. (The program was free)
   2. (New appliances)
   3. (This home uses too much energy)
   4. (Save money on bill)
   5. (Neighbour, friend, family member suggested I sign up)
   6. (Some other reason) **[SPECIFY]**
   98. (Don’t know)
   99. (Refused)

C4. I’m going to read a list of challenges that people might face when trying to conserve energy. Please tell me if any apply to you. **[RANDOMIZE STATEMENTS] [1=yes, 2=no, 98=don’t know, 99=refused]**
   
   C4a. This is an older home that is hard to heat or cool.
   C4b. I can’t control energy use by other household members or tenants.
   C4c. I don’t have enough information or know what to do to save energy.
   C4d. I (or my household) don’t have money to invest in energy-efficient improvements.
   C4e. My household or tenants have health or other issues that require higher energy use.

D. **Measure Verification**

   **[CFL DESCRIPTION: COMPACT FLUORESCENT LIGHT BULBS, OR CFLS, USUALLY DO NOT LOOK LIKE REGULAR INCANDESCENT LIGHT BULBS. THE MOST COMMON TYPE OF CFL IS MADE WITH A GLASS TUBE BENT INTO A SPIRAL, RESEMBLING SOFT-SERVE ICE CREAM, AND FITS IN A REGULAR LIGHT BULB SOCKET.]**

   **[LED BULB: LIGHT EMITTING DIODE BULBS (LED) OFTEN LOOK LIKE REGULAR INCANDESCENT BULBS. THESE LIGHT BULBS FIT INTO A REGULAR, SCREW-IN LIGHT SOCKET. LEDS ARE DIFFERENT FROM COMPACT FLUORESCENT BULBS, WHICH ARE COMMONLY CALLED CFLS. LEDS ACTUALLY LOOK MORE LIKE REGULAR LIGHT BULBS, RATHER THAN A SPIRAL SHAPE LIKE CFLS. LEDS USE LESS ENERGY THAN CFLS, HALOGENS OR INCANDESCENT BULBS]**

   **[FAUCET AERATOR/SHEROWERHEAD DESCRIPTION: FAUCET AERATORS ARE SMALL DEVICES THAT FIT ON THE END OF A SINK FAUCET. EFFICIENT SHOWERHEADS REPLACE LESS EFFICIENT SHOWERHEADS. BOTH DEVICES CHANGE THE FLOW RATE OF WATER TO HELP REDUCE THE AMOUNT OF WATER AND ENERGY USED IN YOUR HOME.]**

   **[DEHUMIDIFIER DESCRIPTION: A DEHUMIDIFIER IS A PIECE OF EQUIPMENT THAT PLUGS INTO THE WALL AND REMOVES MOISTURE FROM THE AIR. IT TYPICALLY HAS A TANK THAT GETS FILLED WITH WATER AND WILL NEED TO BE EMPTIED PERIODICALLY.]**

   **[PROGRAMMABLE THERMOSTAT DESCRIPTION: THE HOME ASSISTANCE PROGRAM SOMETIMES PROVIDES DIGITAL THERMOSTATS THAT CAN BE PROGRAMMED TO ADJUST THE TEMPERATURE IN**
YOUR HOME AUTOMATICALLY THROUGHOUT THE DAY. THESE DEVICES ARE USUALLY SMALL, WILL HAVE A DIGITAL DISPLAY AND WILL REPLACE AN OLDER TRADITIONAL DIAL THERMOSTAT.]

[POWER BAR DESCRIPTION: THE HOME ASSISTANCE PROGRAM MAY OFFER A TIMER-CONTROLLED POWER BAR THAT HAS FOUR TIMER-CONTROLLED OUTLETS AND FOUR SWITCH CONTROLLED OUTLETS. WHATEVER IS PLUGGED INTO AN OUTLET CONTROLLED BY THE TIMER WILL BE TURNED OFF WHEN THE TIMER IS SET TO GO OFF.]

[BLOCK HEATER TIMER DESCRIPTION: THE HOME ASSISTANCE PROGRAM MAY OFFER A TIMER-CONTROLLED BLOCK HEATER FOR WARMING YOUR CAR ENGINE IN EXTREMELY COLD WEATHER.]

[WINDOW AC DESCRIPTION: A WINDOW AIR CONDITIONING UNIT USUALLY SITS IN AN OPEN WINDOW IN THE SUMMER MONTHS AND TYPICALLY CAN COOL A SINGLE ROOM OR A SMALL SPACE.]

[REFRIGERATOR/FREEZER DESCRIPTION: THE HOME ASSISTANCE PROGRAM MAY OFFER AN EFFICIENT REFRIGERATOR AND/OR FREEZER IN PLACE OF AN EXISTING LESS EFFICIENT MODEL.]

[HOT WATER TANK OR PIPE WRAP DESCRIPTION: THE HOME ASSISTANCE PROGRAM OFFERS INSULATION FOR YOUR HOT WATER TANK AND THE PIPES THAT MOVE HOT WATER TO THE REST OF YOUR HOME.]

[CLOTHES DRYER RACK: THIS IS A METAL AND/OR PLASTIC RACK WITH DRYING BARS THAT ALLOW FOR AIR CIRCULATION FOR DRYING.]

[HEALTH AND SAFETY: PROGRAM STAFF MAY MAKE REPAIRS TO THE RESIDENCE THAT PERMIT ADDITIONAL ENERGY-EFFICIENT MEASURES TO BE INSTALLED AND/OR IMPROVE THE HEALTH AND SAFETY OF RESIDENTS. HEALTH AND SAFETY FEATURES INCLUDE FIXING LEAKING TOILETS, REPLACING FURNACE FILTERS, ADDING COVER PLATES AND ADDING SMOKE AND/OR CARBON MONOXIDE DETECTORS]

[INSULATION OR AIR SEALING DESCRIPTION: THE HOME ASSISTANCE PROGRAM SOMETIMES PROVIDES ADDITIONAL INSULATION, WHICH IS TYPICALLY INSTALLED IN EITHER THE BASEMENT OR ATTIC. ALSO, THE PROGRAM SOMETIMES HELPS LIMIT THE DRAFTINESS OF A HOME BY SEALING HOLES AND CRACKS—YOU MAY RECALL A MACHINE ON THE PROPERTY TO BLOW INSULATION AND/OR SPRAY FOAM SEALING.]

Now I would like to ask you some questions about the free energy efficiency upgrades you were given or the program representative installed in your home. To start, I’d like to confirm some information in the [LDC'S] database.
Appendix G. Participant Surveys

D1. Our records show that you received [ASK FOR EACH MEAS]. Does that sound about right?
   a) [ASK IF LED_QTY > 0] [LED_QTY] LED bulbs
   b) [ASK IF CFL_QTY > 0] [CFL_QTY] CFL bulbs
   c) [ASK IF CD_QTY > 0] [CD_QTY] Clothes drying rack
   d) [ASK IF SH_QTY > 0] [SH_QTY] Showerhead
   e) [ASK IF HS_QTY > 0] [HS_QTY] Health and safety measure(s)
   f) [ASK IF FA_QTY > 0] [FA_QTY] Faucet aerator(s)
   g) [ASK IF DH_QTY > 0] [DH_QTY] Dehumidifier(s)
   h) [ASK IF PT_QTY > 0] [PT_QTY] Programmable thermostat(s)
   i) [ASK IF PB_QTY > 0] [PB_QTY] Power bar(s)
   j) [ASK IF BHT_QTY > 0] [BHT_QTY] Block heater timer(s)
   k) [ASK IF WAC_QTY > 0] [WAC_QTY] Window air conditioner(s)
   l) [ASK IF REF_QTY > 0] [REF_QTY] Refrigerator and/or freezer
   m) [ASK IF HW_QTY > 0] [HW_QTY] Hot water tank or pipe wrap
   n) [ASK IF INS_QTY > 0] [INS_QTY] Insulation or air sealing

1. (Yes) [RECORD V_[MEAS]_QTY = MEAS_QTY]
2. (No, different number) [PROMPT FOR AND RECORD NUMBER AS V_[MEAS]_QTY]
3. (No, none)
98. (Don’t know)
99. (Refused)

If D1=1 (yes), then V_[MEAS]_QTY = [MEAS]_QTY
If D1=2 (no, different number), then V_[MEAS]_QTY = D1(2)
If D1=3, 98 or 99 (none, don't know or refused), then V_[MEAS]_QTY = 0

[IF MEAS=HS_QTY≥1]

D2. Did the program representative install or make repairs to the residence including repairing toilet leaks, replacing furnace filters, adding outlet covers and/or adding smoke or carbon monoxide detectors?
   1. Yes [ASK D2a]
      D2a. What are they? [RECORD VERBATIM]
   2. No
98. (Don’t know)
99. (Refused)

[ASK FOR EACH V_[MEAS]_QTY > 0 EXCEPT MEAS= HS]

D3. Did the program representative install the [MEAS] or did you install it/them?
   1. (The program representative installed it/them)
   2. (I installed it/them)
   3. (It has/they have not been installed) [RECORD AS V_[MEAS]_INS = 0]
98. (Don’t know)
99. (Refused)
Appendix G
Participant Surveys

[ASK FOR EACH V_[MEAS]_QTY > 0 AND D3=3]

D4. Why have/has the [MEAS] not been installed?
   1. (I have not had time to install it/them)
   2. (I am not sure whether I need or can use it/them)
   3. (I am waiting for my existing equipment to fail before installing it/them)
   4. (I am not sure how to use or install it/them)
   5. (Some other reason) [SPECIFY]
98. (Don’t know)
99. (Refused)

[ASK FOR EACH V_[MEAS]_QTY > 0 IF D3=1 OR 2 EXCEPT MEAS= HS]

   1. (Yes) [RECORD AS V_[MEAS]_INS = V_[MEAS]_QTY]
   2. (No)
98. (Don’t know)
99. (Refused)

[ASK IF D5=2]

D6. How many of the V_[MEAS]_QTY of the [MEAS] are currently installed?
   1. (Numeric, open end) [RECORD AS V_[MEAS]_INS]
98. (Don’t know)
99. (Refused)

If D5=1 (yes), then V_[MEAS]_INS = V_[MEAS]_QTY
If D5=2 (no) and D6≠98 or 99, then V_[MEAS]_INS =D6(1)
If D5=98 or 99 or D6=98 or 99, then V_[MEAS]_INS =0

[ASK IF V_[MEAS]_QTY <> V_[MEAS]_INS]

D7. Why are some of the [MEAS] no longer installed?
   1. [OPEN ENDED, WRITE RESPONSE]
98. (Don’t know)
99. (Refused)
D8. What did you do with the [MEAS=CFL, MEAS=LED, MEAS=PW, MEAS=FA, MEAS=SH] that are not currently installed? Did you... [READ LIST] [SELECT ALL THAT APPLY]
   1. Store them for future use
   2. Throw them away or recycle them
   3. Give them to someone else
   4. Do something else with them [specify]
98. (Don’t know)
99. (Refused)

D9. If you removed the light bulb(s) did you replace them with another energy-saving light bulb or with a regular light bulb? [DO NOT READ LIST] [IF RESPONSE TO D8=1, THEN PROBE TO CONFIRM THAT THE ENERGY-SAVING LIGHT BULB IS A CFL, WHICH MAY LOOK CURLY, LIKE A TWISTED ICE CREAM CONE]
   1. Did not remove any bulbs
   2. CFL energy-saving light bulb [CONFIRM CFL INSTALLATION]
   3. LED energy-saving light bulb
   4. Regular light bulb (incandescent)
   5. Other [SPECIFY]
   6. Did not replace
98. (Don’t know)
99. (Refused)

D10. If you removed the [MEAS=FA, MEAS=SH] did you replace it with another energy-saving [MEAS=FA, MEAS=SH] or with a regular equipment? [DO NOT READ LIST]
   1. Did not remove any aerator and/or showerheads
   2. Replaced with another energy saving aerator and/or showerhead
   3. Replaced with old (as in previously installed) aerator and/or showerhead
   4. Other [SPECIFY]
   5. Did not replace
98. (Don’t know)
99. (Refused)
E. **Non-Energy and Ancillary Benefits**

Our next questions are about the impacts of the energy efficiency improvements.

E1. Comparing the home now to before you had the energy efficiency improvements installed, would you say the home is … [READ LIST]?
   1. More energy efficient
   2. Less energy efficient or
   3. About the same level of energy efficiency
   98. (Don’t know)
   99. (Refused)

E2. Homes such as this one that have had energy efficiency improvements typically, as a result, use less energy for heating, cooling and water heating and have lower energy bills. Energy efficiency improvements can also have other impacts related to health, safety, noise or comfort. In addition to your energy savings, have you noticed any other positive impacts resulting from the energy efficiency improvements made to your home?
   1. Yes [ASK E2a]
      E2a. What are they? [DO NOT READ LIST; SELECT ALL THAT APPLY]
      2. (Improved comfort)
      3. (Improved safety)
      4. (Improved health)
      5. (Improved electric reliability)
      6. (Sustainability or “to be green”)
      7. (Energy or bill savings)
      8. (Less maintenance)
      9. (Improved light levels)
      10. (Less drafty home)
      11. (Lower ambient outside noise)
      12. Any others [SPECIFY]
      13. No
      98. (Don’t know)
      99. (Refused)
Appendix G.

Participant Survey

G-90

E3. Please think about the total of all positive and negative effects caused by the energy-efficient improvements made to the home [READ IF B4=1 (OWN), “EXCEPT FOR ANY CHANGES IN PROPERTY VALUE”]. To summarize, you reported that [INSERT RESPONSES FROM E2a] were positive effects. Assuming you’re saving [ANNUAL_SAVINGS] per year on energy, what is the value of the combination of all these other effects each year, either in dollars or as a percentage of energy savings?

1. $______/ year
2. ______% of annual energy savings
3. No savings
98. (Don’t know)
99. (Refused)

E4. In terms of energy bill savings, what would you say the value of all the effects combined is worth...

[READ LIST, RECORD ONE RESPONSE]

1. Nothing
2. About one-fourth of typical annual energy bill savings
3. About one-half of typical annual energy bill savings
4. About three-fourths of typical annual energy bill savings
5. About equal to the typical annual energy bill savings
6. More than energy bill savings
7. Other [SPECIFY]
98. (Don’t know)
99. (Refused)

E5. How much in total? [IF E4=6 OR 7, $/YR MUST BE HIGHER THAN [ANNUAL_SAVINGS] OR % MUST BE GREATER THAN 100]

1. $______/ year
2. ______% of annual savings
98. (Don’t know)
99. (Refused)
E6. If you had not participated in this program, what is the likelihood that the household would have moved from the current home within the next year? Would you say relocating was: [READ LIST. CHECK ONLY ONE ANSWER]

1. Very likely
   E6a. Why did you say “very likely”? [RECORD VERBATIM]
2. Somewhat likely
   E6b. Why did you say “somewhat likely”? [RECORD VERBATIM]
3. Not at all likely
98. (Don’t know)
99. (Refused)

E7. Now that you have participated in this program, how likely is the household to move from the current home in the next year? Would you say relocating is: [READ LIST. CHECK ONLY ONE ANSWER.]

1. Very likely
2. Somewhat likely
3. Not at all likely
   E7a. Why did you say “not at all likely”? [RECORD VERBATIM]
98. (Don’t know)
99. (Refused)

[ASK IF E6.1 <> E7]

E8. What did the Home Assistance Program provide that changed the household likelihood of moving?

1. [RECORD VERBATIM]
98. (Don’t know)
99. (Refused)

F. Behaviour and Education

F1. While at the home, did the program representative give you information on how to save energy by providing you with [READ LIST. RECORD ALL RESPONSES]

1. A brochure or flyer
2. User manuals or instructions for equipment
3. No materials provided but discussed home energy efficiency operations and/or opportunities to conserve energy
4. (No, didn’t provide any tips or materials)
5. Other [SPECIFY]
98. (Don’t know/don’t remember)
99. (Refused)
F2. Did the program representative show you or someone in your household how to program your new thermostat, leave programming instructions or both?
   1. (Showed me/us how to program thermostat)
   2. (Left instructions for programming thermostat)
   3. (Both showed me/us and left instructions)
   4. (No, did not show me how or leave instructions)
   98. (Don’t know)
   99. (Refused)

F3. Did you feel the education information provided to you was: [READ LIST. CHECK ONLY ONE ANSWER]
   1. Very helpful
   2. Somewhat helpful
   3. Not at all helpful
   98. (Don’t know)
   99. (Refused)

F4. Of all the tips you remember, can you tell me which ones you have used in your home?
   1. RECORD VERBATIM [UP TO THREE RESPONSES]: ______________________
   98. (Don’t know)
   99. (Refused)

F5. Thinking about what you learned from the in-home audit, is there something you wish the program representative had provided more information about?
   1. [RECORD RESPONSE]
   98. (Don’t know)
   99. (Refused)

F6. Have you taken any energy-saving actions as a result of the recommendations or educational materials provided by the program representative?
   1. Yes
   2. No
   98. (Don’t know)
   99. (Refused)
[ASK IF F6=1]

F7. What energy-saving actions did you take? [SELECT ALL THAT APPLY] [READ LIST AND RECORD ALL “YES” RESPONSES]

1. Unplug phone chargers, laptops and DVD players when not in use
2. Set thermostat to 20°C when home during the winter and 25°C when home during the summer
3. Wait until off-peak hours to do laundry or run dishwasher
4. Use cold water to do laundry
5. Hang dry clothes after washing them
6. Reduce the temperature on water heater
7. Turn lights off when not using them
8. Turn off the ‘heated dry’ setting on dishwasher and let the dishes air dry
9. Activate energy-saving settings on other appliances
10. Other actions [SPECIFY]
11. (None)
98. (Don’t know)
99. (Refused)

F8. Have you made any additional energy efficiency upgrades to your home or installed any additional energy-efficient equipment on your own without program assistance, after participating in the Home Assistance Program? If so, what? [DO NOT READ LIST; SELECT ALL THAT APPLY]

1. (None)
2. (Additional heating or cooling equipment)
3. (New windows)
4. (New energy-efficient appliances)
5. (Weather stripping, caulking, etc.)
6. (Energy-efficient lighting products such as LEDs, CFLs, dimmers, timers/motion sensors, light fixtures or lighting control products)
7. (Insulation)
8. (New water heater)
9. (Clothesline)
10. (Outdoor timer)
11. (Programmable thermostat)
12. (Ceiling fan)
13. (Other [SPECIFY])
98. (Don’t know)
99. (Refused)
On a scale from 1 to 4, where 1 is not at all influential and 4 is very influential, how would you rate the influence of the program on your decision to take additional energy saving actions? [READ LIST]

1. Very influential
2. Somewhat influential
3. A little influential
4. Not at all influential
98. (Don’t know)
99. (Refused)

Can you tell me how your experience with the Home Assistance Program influenced your decision to install [IF MORE THAN ONE RESPONSE TO F8, INSERT: “THESE PRODUCTS”, ELSE: “THIS PRODUCT”]?

1. RECORD VERBATIM: __________________
98. (Don’t know)
99. (Refused)

Since the program representative visited the home, has your knowledge and understanding of energy efficiency increased, decreased or stayed the same?

1. Increased
2. Decreased
3. Stayed the same
98. (Don’t know)
99. (Refused)

Have you participated in any natural gas distribution company programs since participating in this Home Assistance Program?

1. Yes
   F12a. What natural gas distribution program? [RECORD VERBATIM]
   F12b. What energy efficiency measures were installed as a result of the natural gas distribution company program? [RECORD VERBATIM]
2. No
98. (Don’t know)
99. (Refused)
F13. How influential was your participation in this Home Assistance Program in your decision to participate in the natural gas program?
   1. Very influential
   2. Somewhat influential
   3. A little influential
   4. Not at all influential
   98. (Don’t know)
   99. (Refused)

G. Satisfaction

Next, I’m going to ask you about your satisfaction with the program.

G1. I’ll read a few statements. Please rate your satisfaction with each statement using a 4-point scale where 1 means not at all satisfied, 2 means a little satisfied, 3 means somewhat satisfied and 4 means very satisfied. [RANDOMIZE]
   a. The ability to schedule when the program representative came to the home
   b. The services provided by the program representative
   c. The equipment received through the program
   d. Reductions to electric bill
   e. The ease of participating in the program
   f. The information provided on ways you can reduce energy use and lower monthly bills
   g. [ANCHOR LAST STATEMENT] And finally, how would you rate your overall satisfaction with the program?

H. Demographics

H1. What is the primary language used in your household?
   1. (English)
   2. (French)
   3. (Chinese)
   4. (Spanish)
   5. (German)
   6. (Italian)
   7. (Arabic)
   8. Other [SPECIFY]
   99. (Refused)
H2. What is the last level of education that you have completed? (SELECT ONE)
   1. (Grade school or less)
   2. (Some high school)
   3. (High school graduate)
   4. (Vocational/technical school)
   5. (College)
   6. (Some university)
   7. (University graduate)
   8. (Postgraduate degree)
   99. (Refused)

H3. How many people, including yourself, live in the household full time? (SELECT ONE)
   1. (One)
   2. (Two)
   3. (Three)
   4. (Four)
   5. (Five)
   6. (Six)
   7. (Seven or more)
   99. (Refused)

H4. How many bedrooms are in your home?
   1. (1 bedroom)
   2. (2 bedrooms)
   3. (3 bedrooms)
   4. (4 or more bedrooms)
   99. (Refused)

H5. How many bathrooms are in your home?
   1. (1 bathroom)
   2. (1.5 bathrooms)
   3. (2 or more bathrooms)
   99. (Refused)

H6. How many stories is your home?
   1. (One)
   2. (Two)
   3. (Three or more)
   99. (Refused)
H7. How old is your home? An estimate is fine.
   1. (Less than two years old, built in 2015 or after)
   2. (2 to less than seven years old, built between 2010 and 2015)
   3. (7 to less than 12 years old, built between 2005 and 2009)
   4. (12 to less than 17 years old, built between 2000 and 2004)
   5. (17 to less than 22 years old, built between 1995 and 1999)
   6. (22 to less than 27 years old, built between 1990 and 1994)
   7. (27 to less than 32 years old, built between 1985 and 1989)
   8. (32 to less than 42 years old, built between 1975 and 1984)
   9. (42 to less than 52 years old, built between 1965-1974)
  10. (52 to less than 67 years old, built between 1950-1964)
  11. (67 to less than 92 years old, built between 1925-1949)
  12. (92 years or more, built in 1924 or earlier)
  99. (Refused)

H8. How many square feet is your home?
   1. (<1,000 square feet)
   2. (1,000 to 1,999 square feet)
   3. (2,000 to 2,999 square feet)
   4. (3,000 to 4,999 square feet)
   5. (>5,000 square feet)
  99. (Refused)

H9. Do you have wireless internet in your home?
   1. (Yes)
   2. (No)
  98. (Don’t know)
  99. (Refused)

H10. Which of the following categories applies to your total household income in 2016?
    1. (Under $15,000)
    2. ($15,000 to under $20,000)
    3. ($20,000 to under $30,000)
    4. ($30,000 to under $40,000)
    5. ($40,000 to under $50,000)
    6. ($50,000 to under $60,000)
    7. ($60,000 to under $80,000)
    8. ($80,000 to under $100,000)
    9. ($100,000 to under $120,000)
   10. ($120,000 or more)
  98. (Don’t know)
  99. (Refused)
H11. What type of fuel do you use primarily to heat your home? [IF NEEDED, READ LIST]
1. (Natural gas)
2. (Bottled, tank or LP gas)
3. (Hydro/electricity)
4. (Oil, kerosene)
5. (Coal, coke)
6. (Wood)
7. (Solar)
8. (Other [SPECIFY])
9. (No fuel)
98. (Don’t know)
99. (Refused)

H12. What type of fuel do you use to heat water in your home? [IF NEEDED, READ LIST]
1. (Natural gas)
2. (Bottled, tank or LP gas)
3. (Hydro/electricity)
4. (Oil, kerosene)
5. (Solar)
98. (Don’t know)
99. (Refused)

H13. Do you have a central air conditioning system?
1. (Yes)
2. (No)
98. (Don’t know)
99. (Refused)

Thank you for your time.

[THANK AND TERMINATE: THOSE ARE ALL THE QUESTIONS WE HAD FOR YOU TODAY. THANK YOU FOR YOUR TIME AND HAVE A GOOD (EVENING/DAY)]
Appendix H. Prescriptive Input Assumption Recommendations

This appendix describes measure-specific findings from Cadmus’ review of the PY2016 HAP PIAs. The FAST we reviewed contains deemed values for unit energy savings and demand reduction, in addition to effective useful life (EUL) values. Cadmus reviewed all PIAs for PY2016 HAP measures and compared them to the latest pertinent literature and research, outlined by program measure below, including needed revisions and rationales for updating the measure(s). The literature and research included TRMs, federal appliance standards and other sources as described below for each measure.

Cadmus agrees with the assumptions for most measures; however, we recommend making updates to the following measures and adjusting the associated PY2016 verified saving results:

- Hot Water Tank Insulation - Fiberglass R10
- Freezer Replacement (ENERGY STAR-Qualified 12–14.4 cu. ft.)
- Freezer Replacement (ENERGY STAR-Qualified 14.5–16.0 cu. ft.)
- Dehumidifier Replacement (ENERGY STAR-Qualified 14.2–21.2 l/day)
- Dehumidifier Replacement (ENERGY STAR-Qualified 21.3–25.4 l/day)
- Dehumidifier Replacement (ENERGY STAR-Qualified 25.5–35.5 l/day)
- Hot Water Pipe Wrap (pipe insulation)
- LED Measures

**Hot Water Tank Insulation—Fiberglass R10**

Cadmus’ research suggests that the unit measure savings for the hot water tank insulation measure is too high. The current savings values of 0.33 kW and 270 kWh per year exceed all savings values for similar measures found in the literature and in Cadmus’ research. It appears that the current values may be based on a baseline water heater with no or very low insulation values. Most electric water heaters sold in the past 10 to 15 years have included insulation levels that exceed the current baseline. As such, Cadmus recommends revising the unit measure savings to 0.0096 kW and 99 kWh per year. These values are based on the Minnesota 2017 TRM.\(^\text{12}\) We suggest R-12 as the baseline insulation and R-18 as the efficient case. R-6 water heater blankets are the most common commercially available blankets.

Cadmus used the following algorithm to determine measure savings, assuming a water heater of 50 gallons with 90% efficiency, which is the most common commercially available water heater:

\[
\text{Unit kWh Savings per Year} = \left( \left( U_{\text{base}} \cdot A_{\text{base}} - U_{\text{insul}} \cdot A_{\text{insul}} \right) \cdot \left( T_{\text{hot}} - T_{\text{ambient}} \right) \cdot \text{Hours} \right) / \text{Eff} / \text{ConversionFactor}
\]

---

Unit Average kW Savings = 0.0096 kW; per IESO Cost Effectiveness tool using domestic hot water load profile

Where:
\[
\begin{align*}
U_{\text{base}} &= R-12; \text{ heat transfer coefficient of water heater without insulation jacket} \\
&= 1/12 \\
A_{\text{base}} &= \text{Surface area of uninsulated water heater} \ (= 50 \text{ gallons}; 24.99 \text{ square feet})^{13} \\
U_{\text{insul}} &= R-18; \text{ heat transfer coefficient of water heater with insulation jacket} \\
&= 1/18 \\
A_{\text{insul}} &= \text{Surface area of insulated water heater} \ (= 50 \text{ gallons}; 27.09 \text{ square feet})^{13} \\
T_{\text{hot}} &= \text{Hot water temperature} \ (= 120^\circ F)^{14} \\
T_{\text{ambient}} &= \text{Ambient temperature} \ (= 60^\circ F)^{15} \\
\text{Hours} &= \text{ (= 8,760 hours)} \\
\text{Eff} &= \text{Efficiency} \ (= 0.90)^{13} \\
\text{ConversionFactor} &= \text{(= 3,412 Btu/kWh)}
\end{align*}
\]

Freezer Replacement
The current freezer sizes offered in through HAP—12 to 14.4 cubic feet and 14.5 to 16.0 cubic feet—are very large for residential use as well as compared to other jurisdiction’s energy efficiency offerings. The ENERGY STAR Program offers freezers in two sizes: compact (≤ 7.75 cubic feet) and all others (≥ 7.76 cubic feet). The current savings calculations are also not dependent on size. Additionally, the EUL of 21 years seems extensive when compared to other jurisdictions.

Cadmus suggests revising the size of the freezers to better match what is commercially available (such as “Compact Freezer < 7.75 cubic feet” and “Non-Compact Freezer ≥ 7.75 cubic feet”), making savings dependent on size and revising the EUL to 12 years to conform with industry standards. In addition, consider all compact freezer configuration (upright/chest; manual/automatic defrost) in baseline and ENERGY STAR usage estimates.

The revised savings for the suggested freezer sizes should be changed from 0.086 kW and 633 kWh for both sizes to 0.0056 kW and 41.47 kWh for compact freezers (< 7.75 cubic feet) and to 0.0069 kW and...

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15 The ambient temperature is based on the water heaters being located in the basement.
50.66 kWh for non-compact freezers (≥ 7.75 cubic feet), per the equations below. The values are based on Canada’s ENERGY STAR Calculator V11.3: \(^{16}\)

Unit kWh Savings per Year = equal average of all ENERGY STAR-listed compact freezers (accessed May 24, 2017)

Compact Freezer < 7.75 cubic feet = Average federal standard kWh/year - average listed annual kWh/year
= 272.36 kWh/year - 230.89 kWh/year = 41.47 kWh/year

Non-Compact Freezer ≥ 7.75 cubic feet = Average federal standard kWh/year - average listed annual kWh/year
= 479.16 kWh/year - 428.5 kWh/year = 50.66 kWh/year

Unit Average kW Savings = per IESO Cost-Effectiveness tool for residential freezer

Compact Freezer < 7.75 cubic feet = 0.0056 kW
Non-Compact Freezer ≥ 7.75 cubic feet = 0.0069 kW

**Dehumidifier Replacement**

Cadmus’ research suggests that the unit measure savings for the dehumidifier measures is too high when compared to savings values for similar measures found in the literature and recent research. Cadmus suggests revising the savings based on Canada’s ENERGY STAR Calculator V11.3. Sixty-eight days per year is assumed as operation per the ENERGY STAR Calculator. We determined the following peak kilowatt savings using the IESO Cost Effectiveness tool dehumidifier load profile and suggested EUL of 12 years.

Dehumidifier Replacement (14.2–21.2 L/Day) (30–44 pints/day):
energy savings = 232.75 kWh; peak demand reduction = 0.0745 kW

Dehumidifier Replacement (21.3–25.4 L/Day) (45–53 pints/day):
energy savings = 197.18 kWh; peak demand reduction = 0.0631 kW

Dehumidifier Replacement (25.5–35.5 L/Day) (54–75 pints/day):
energy savings = 278.40 kWh; peak demand reduction = 0.0892 kW

**Hot Water Pipe Wrap**

Two CFF programs are presented in the PIA list with different savings for pipe insulation: the current savings values for the Coupons Program are 0.0004 kW and 4.7 kWh per year, compared to 0.005 kW and 38 kWh per year for HAP. Both programs use an EUL of 15 years.

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Cadmus used the following algorithms to calculate the savings for pipe insulation and compare it to the PIA values:

Heat Loss through Insulation (HL<sub>Insul</sub> [W/m] = \(2\pi k \Delta T / \ln (r_2/r_1)\))

\[
= 2 * 3.1416 * 0.036 * (55 - 21.1) / [ \ln (12 * 2 + 15.875)/15.875] \\
= 8.33 \text{ W/m}
\]

Unit kWh savings per year = (HL<sub>BP</sub> - HL<sub>Insul</sub>) * L * HOU

\[
= [(34.17 - 8.33) \text{ W/m} / 1,000 \text{ W/kW}] * 0.9144 \text{ m} * 1,475 \text{ hours/year} \\
= 34.9 \text{ kWh/year}
\]

Unit Average kW Savings = 0.0034 kW with domestic hot water load profile (per IESO Cost Effectiveness tool for peak demand reduction)

Where:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature of water in the pipe (T2) [°C]</td>
<td>55</td>
<td>OPA 2011</td>
</tr>
<tr>
<td>Ambient temperature (T1) [°C]</td>
<td>21.1</td>
<td>OPA 2011</td>
</tr>
<tr>
<td>Insulation thickness [mm]</td>
<td>12</td>
<td>OPA 2011</td>
</tr>
<tr>
<td>Pipe diameter [mm]</td>
<td>15.875 (Average of 19.05 and 12.7)</td>
<td>Previous PIA (for HAP)</td>
</tr>
<tr>
<td>Heat Loss through bare pipe (HL&lt;sub&gt;BP&lt;/sub&gt;) [W/m]</td>
<td>34.17 (Average of 39.16 W for 19.05 mm and 29.18 W for 12.7 mm)</td>
<td><a href="http://www.engineeringtoolbox.com/copper-pipe-heat-loss-d_19.html">http://www.engineeringtoolbox.com/copper-pipe-heat-loss-d_19.html</a></td>
</tr>
<tr>
<td>Length of pipe (L)</td>
<td>3 feet = 0.9144 m</td>
<td>Previous PIA</td>
</tr>
<tr>
<td>Hours of use annually (HOU)</td>
<td>1,475 hours</td>
<td>OPA 2011</td>
</tr>
<tr>
<td>Unitary Savings [kWh/year]</td>
<td>34.9</td>
<td>Calculation</td>
</tr>
</tbody>
</table>

Based on this calculation, Cadmus recommend changing the unitary savings for pipe insulation to 34.9 kWh and the peak demand reduction to 0.0034 kW, which are closer to the values found in the literature. Cadmus recommend keeping the EUL of 15 years, which is commonly used in other jurisdictions.

**LED Measures**

In PY2016, IESO replaced all HAP CFLs with LEDs, offering the LED measures shown in the following table.
<table>
<thead>
<tr>
<th>PY2016 HAP LED Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 11-Watt ENERGY STAR LED A-Shape</td>
</tr>
<tr>
<td>≤ 14-Watt ENERGY STAR LED A-Shape</td>
</tr>
<tr>
<td>≤ 23-Watt ENERGY STAR LED A-Shape</td>
</tr>
<tr>
<td>≤ 23-Watt ENERGY STAR-Qualified LED PAR</td>
</tr>
<tr>
<td>Qualified LED MR16 / PAR16 - GU 10 Base</td>
</tr>
<tr>
<td>≤ 11-Watt ENERGY STAR-Qualified LED MR16</td>
</tr>
</tbody>
</table>

All LED measures in HAP have a deemed EUL of nine years. Across the CFF, all other program LEDs have a deemed EUL of 20 years. To maintain consistency across CFF, Cadmus recommends revising all HAP LED EULs to 20 years. Further, 20 years is consistent with residential and multifamily in-unit EULs in other jurisdictions, as used in the Wisconsin TRM and as found in a Cadmus field study.¹⁷
