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### Acronyms and Abbreviations

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<th>Acronym</th>
<th>Definition</th>
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<tr>
<td>CDM</td>
<td>Conservation and Demand Management</td>
</tr>
<tr>
<td>EUL</td>
<td>Effective useful life</td>
</tr>
<tr>
<td>FTP</td>
<td>File Transfer Protocol</td>
</tr>
<tr>
<td>HP</td>
<td>Horsepower</td>
</tr>
<tr>
<td>IESO</td>
<td>Independent Electricity System Operator</td>
</tr>
<tr>
<td>LDC</td>
<td>Local Distribution Company</td>
</tr>
<tr>
<td>LUEC</td>
<td>Levelized Unit Electricity Costs</td>
</tr>
<tr>
<td>NTGR</td>
<td>Net-to-Gross Ratio</td>
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<td>PAC</td>
<td>Program Administrator Cost Test</td>
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<tr>
<td>PY</td>
<td>Program Year</td>
</tr>
<tr>
<td>TRC</td>
<td>Total Resource Cost Test</td>
</tr>
<tr>
<td>VAI</td>
<td>Vendor Adjustment Influence</td>
</tr>
</tbody>
</table>
Executive Summary

As part of the 2017 residential portfolio evaluation, the Cadmus team (Cadmus and Econoler) evaluated the Swimming Pool Efficiency Program, which was offered by three groups of local distribution companies (LDCs), namely: Toronto Hydro Electric System and Oakville Hydro Electricity Distribution Inc.; Hydro Ottawa Ltd and Renfrew Hydro; and Burlington Hydro Inc., Milton Hydro and Halton Hills Hydro.

For this evaluation, the Cadmus team sought to address several research objectives:

- Determine net and gross verified energy and summer peak demand savings
- Compare evaluated performance against reported participation and energy savings
- Assess delivery channel and marketing methods
- Assess stakeholder and participant experiences including satisfaction and motivation
- Document areas of success, challenge and changes to the program
- Determine cost-effectiveness and greenhouse gas reductions

Program Description

Through the Swimming Pool Efficiency Program, the LDCs aim to replace constant-speed swimming pool pumps with variable-speed pumps. Constant-speed pumps are sized to provide a continuous flow rate regardless of usage, whereas variable-speed pumps adjust flow rates by use (filtering and sanitation, heating and cleaning), resulting in energy savings.

The program design was based on a pilot previously conducted by London Hydro. Because Southern Ontario has many residential pools, the LDCs identified the area as a good target market for the program.

Toronto Hydro developed a program business case, which was used as a model for the business cases developed by Hydro Ottawa and Burlington Hydro. The three lead LDCs held shared training sessions for vendors during Pool and Hot Tub Council of Canada meetings to inform interested vendors about the program and participation process. Lead LDCs were also responsible for marketing and processing program applications for their region.

All single-family residential customers of participating LDCs who own an in-ground pool with a constant-speed pump with or without existing controls are eligible for the program. New pool installations are not eligible for the program. The participating LDCs provided an instant $400 discount at the point of sale toward ENERGY STAR® variable-speed pool pumps. To be eligible, the pool pump must be installed by a participating pool pump vendor or a participating vendor’s contracted installer. The program design uses

---

1 The Pool and Hot Tub Council of Canada is a non-profit association of companies, organizations, and individuals involved in the aquatic leisure industry.
a midstream approach where vendors are responsible for recruiting participants, providing the discounted equipment to customers and claiming incentives from the LDCs.

**Methodology**

To address the research objectives (listed above), the Cadmus team conducted both impact and process evaluation tasks. To produce gross verified energy and demand savings, the team reviewed program data records and conducted an engineering analysis of input assumptions, examining the inputs and algorithms used by the LDC.

To produce net verified energy and demand savings, the team estimated net-to-gross ratios (NTGR) using results from the market actor interviews and participant surveys.

The Cadmus team gathered insights on the program’s effectiveness and assessed the overall program operation and performance through a process evaluation. This evaluation included a comprehensive review of program documents and phone interviews with eight LDC staff from the three lead LDCs, one Independent Electricity System Operator (IESO) staff member, 39 participating vendors and one staff member from the Eastern Ontario branch of the Pool and Hot Tub Council of Canada. Additionally, the Cadmus team conducted an online survey of 285 participants to assess their experience with the program and with the pool pump measure.

**Key Observations and Recommendations**

As shown in Table ES-1, the Swimming Pool Efficiency Program achieved gross verified savings of 5,957 MWh and 1.140 MW and distributed 1,959 pool pumps in PY2017. The program achieved an NTGR of 1.00. The Cadmus team estimated a gross realization rate of 99.7% for energy and 83.4% for demand. A small adjustment was applied to energy savings because of some discrepancies found in the amount of new pump energy consumption reported for 4% of projects. A bigger adjustment was needed for demand savings to consider the IESO summer peak demand summer period.

<table>
<thead>
<tr>
<th>Table ES-1. Swimming Pool Efficiency Program Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td>Incentive Spending</td>
</tr>
<tr>
<td>Participation</td>
</tr>
<tr>
<td>Gross Verified Savings</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Gross Realization Rate</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Net Verified Annual Savings (First Year)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Net Verified Annual Savings (2020)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Net-to-Gross Ratio</td>
</tr>
</tbody>
</table>
The following statements present the team’s evaluation key observations and recommendations:

**Key Observation 1:** The program effectively leveraged vendors and provided a cost-effective and satisfying customer experience.

**Key Observation 2:** While the methodology used by the LDCs to calculate savings on customer submission forms is sound, there were some inconsistencies in the project list.

- **Recommendation 2:** Add an inconsistency test to the submission form as well as a saving calculation tool to alert vendors of an inconsistency (such as unreasonable power draw) so they may correct the item prior to submitting the form.

**Key Observation 3:** Pump programming could be used to maximize summer peak demand savings.

- **Recommendation 3:** Educate and encourage vendors to program pumps for the greatest demand savings and to provide time settings for each pump speed on the submission form to enable the calculation of resulting summer peak demand savings.

**Key Observation 4:** Oversizing of pumps by vendors is a noted concern, and proper sizing of pool pumps could result in additional energy savings.

- **Recommendation 4:** Train vendors on the proper sizing of variable-speed pool pumps to maximize efficiency.

**Key Observation 5:** Vendors are critical to program success, driving program participation through the recommendations they make to their customers.

**Key Observation 6:** Diversifying LDC marketing materials would improve vendor marketing.

- **Recommendation 6:** Provide marketing materials to vendors in digital format so it can be used on vendor websites and in social media and emails.

**Key Observation 7:** While the LDCs are sharing resources, there are further opportunities to enhance collaboration and reduce costs.

- **Recommendation 7:** Continue to share training resources and provide marketing materials and vendor support (such as the hotline) that can be jointly leveraged across LDCs.

**Key Observation 8:** The program effectively leveraged vendors and could be scaled to expand its reach.

- **Recommendation 8:** Consider including above-ground pools, as the program cost-effectiveness is likely robust enough to support measures with slightly lower savings.

**Key Observation 9:** The Swimming Pool Efficiency Program is cost-effective.
Introduction

As part of the PY2017 residential portfolio evaluation for the IESO, the Cadmus team (Cadmus and Econoler) evaluated the Swimming Pool Efficiency Program, which was offered by three groups of LDCs: Toronto Hydro Electric System and Oakville Hydro Electricity Distribution Inc.; Hydro Ottawa Ltd and Renfrew Hydro; and Burlington Hydro Inc., Milton Hydro and Halton Hills Hydro.

The Cadmus team conducted an impact and process evaluation to address several research objectives:

- Determine net and gross verified energy and summer peak demand savings
- Compare evaluated performance against reported participation and energy savings
- Assess delivery channel and marketing methods
- Assess participant and market actor experiences
- Document areas of success, challenge and changes to the program
- Assess market acceptance and interest in efficient pool pumps
- Determine cost-effectiveness and greenhouse gas (GHG) reduction using the IESO’s custom Conservation and Demand Management Energy Efficiency Cost Effectiveness Tool (CDM Cost Effectiveness Tool)

The impact evaluation, process evaluation and cost-effectiveness methods and results are provided in separate chapters after this introduction. The evaluation included these primary tasks:

- Participant surveys
- In-depth interviews with LDC program staff and market actors
- Desk review and engineering analysis of savings

Program Description

Through the Swimming Pool Efficiency Program, the LDCs aims to replace constant-speed swimming pool pumps with variable-speed pumps for existing in-ground pools. Constant-speed pumps are sized to provide a continuous flow rate regardless of usage, whereas variable-speed pumps adjust flow rates by use (filtering and sanitation, heating and cleaning), resulting in energy savings. The program design was based on a pilot previously conducted by London Hydro. Because Southern Ontario has many residential pools, the LDCs identified the area as a good target market for a program.

Toronto Hydro developed a program business case, which was used as a model for the business cases developed by Hydro Ottawa and Burlington Hydro. The three lead LDCs held shared training sessions for vendors during Pool and Hot Tub Council of Canada meetings to inform interested vendors about the program and process. Lead LDCs were also responsible for marketing and for processing program applications for their region. The delivery of the program was very similar across the three LDC groups,
however the application submittal process varied by LDC. Table 1 below details the launch dates for each group of LDCs participating in the program.

<table>
<thead>
<tr>
<th>LDC</th>
<th>Launch Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toronto and Oakville Hydro</td>
<td>February 2017</td>
</tr>
<tr>
<td>Burlington, Halton Hills and Milton Hydro</td>
<td>April 2017</td>
</tr>
<tr>
<td>Hydro Ottawa and Renfrew Hydro</td>
<td>May 2017</td>
</tr>
</tbody>
</table>

Figure 1 shows the territories of the LDCs participating in the program.

The program design uses a midstream approach where pool pump vendors are responsible for several actions:

- Promoting ENERGY STAR variable-speed pool pumps to interested customers
- Providing and installing the discounted equipment to participants
- Collecting the $400 incentive from LDCs

2 The three lead LDCs are Toronto Hydro, Hydro Ottawa and Burlington Hydro.
Program Participation Summary

The program has been in market since PY2017 and will be offered until PY2020. The LDCs reported rebating 1,960 pool pump measures, with total costs of $1,004,990 in PY2017. Table 2 shows the number of pool pump measures installed by LDC territory.

Table 2. Reported and Verified Measure Volume

<table>
<thead>
<tr>
<th>Lead LDC</th>
<th>Reported Measures</th>
<th>Verified Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burlington Hydro</td>
<td>308</td>
<td>308</td>
</tr>
<tr>
<td>Halton Hills Hydro</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>Hydro Ottawa</td>
<td>664</td>
<td>664</td>
</tr>
<tr>
<td>Milton Hydro</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>Oakville Hydro</td>
<td>417</td>
<td>416 (^c)</td>
</tr>
<tr>
<td>Renfrew Hydro</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>438</td>
<td>438</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,960</strong></td>
<td><strong>1,959</strong> (^a)</td>
</tr>
</tbody>
</table>

\(^a\) Source: Swimming Pool Efficiency Program Project List.
\(^b\) Source: Swimming Pool Efficiency Program Project List.
\(^c\) One reported project was a duplicate and removed.
\(^d\) One project was confirmed to have installed two pumps, therefore there are 1,958 projects.
Impact Evaluation

The Cadmus team conducted desk reviews, engineering analysis and literature review to determine the gross and net verified energy and demand savings from the Swimming Pool Efficiency Program.

Methodology

For the impact evaluation, the team reviewed the savings input assumptions and algorithms used by the LDCs and updated those inputs to reflect program data and information from market actor interviews and participant surveys. The following sections present the gross per-unit savings and net savings calculation methodologies.

Gross Savings Methodology

This section presents the LDC-reported savings, followed by the evaluation results.

Reported Energy and Demand Savings

The LDCs calculated the energy consumption of participants’ existing pumps based on Equation 1.

\[
\text{Equation 1. Existing Pump Daily Energy Consumption} \\
\text{Existing Pump Daily Energy Consumption} \left[ \frac{kWh}{day} \right] = \frac{\text{Existing Pump Daily Operating Hours} \left[ \frac{hrs}{day} \right] \times \text{Flowrate} \left[ \text{GPM} \right] \times 60 \frac{\text{min}}{\text{hrs}}}{\text{Energy Factor} \left[ \text{Gal} \times 1,000 \frac{W}{kW} \right]} \]

Vendors reported the nameplate horsepower, pool pipe diameter and reported daily operating hours for each participant’s existing pump in a form they submitted for each new pump installation. Using these inputs, the form automatically calculated the energy factor and flowrate using a table from the “Savings Calculator for ENERGY STAR Certified Inground Pool Pumps.”

For the new variable-speed pump, the vendor input the power draw and operating hours for up to three different speeds into the submission form. The form incorporated a tool that used two calculation approaches to determine the energy consumption of the new pump depending on the data collected.

1. If the power draw was provided, the submission form automatically calculated the daily energy consumption using Equation 2, summed for each speed.

---

Equation 2. New Pump Daily Energy Consumption

\[ \text{New Pump Daily Energy Consumption} \ [kW\cdot h/\text{day}] = \sum \frac{\text{New Pump Daily Operating Hours} \ [\text{hrs/day}] \times \text{Power Draw} \ [W]}{1000 \ [\text{kW}]} \]

2. If the power draw was not available, the form used the equation for existing pumps (Equation 1) to calculate the energy consumption at the various pump speeds, and then summed these results to obtain the total new pump daily energy consumption.

The submission form’s tool then calculates the annual energy consumption of both the existing and new pumps by multiplying the daily energy consumption by the number of days the pool is open (assumed to be 122 days if not provided, for the four summer months). Equation 3 shows the reported annual per-unit energy savings calculation.

Equation 3. Reported Annual Per-Unit Energy Savings

\[ \text{Savings}_{\text{GrosskW}} = (\text{Existing Pump Daily Energy Consumption} - \text{New Pump Daily Energy Consumption}) \times (30.5 \times \text{Number of Months the Pool is Open}) \]

The LDCs used two different approaches to estimate demand savings:

1. Hydro Ottawa assumed that demand savings equated to the maximum power drawn by the new pump. For example, if the reported power draw values were 300 W and 900 W for the low and high speed respectively, the Hydro Ottawa submission form tracked the demand savings to be 0.9 kW.

2. Burlington Hydro calculated gross demand savings as the difference between the existing and new pump average demand.

3. Toronto Hydro used the method applied by Hydro Ottawa at the inception of their program, but subsequently adopted Burlington Hydro’s approach.

Engineering Review

To conduct the engineering review, the Cadmus team (1) reviewed the savings algorithms and inputs used by the participating LDCs, (2) validated the program assumptions and 3) updated savings based on the results of the two first tasks.

The Cadmus team reviewed all projects provided in the submission forms provided by LDCs, as described above, to ensure that the inputs were consistently entered and that the savings algorithms provided the expected outcomes. These submission forms contained information on the pool, existing pump and new pump, which allowed the team to validate how those data were used to obtain energy savings. The lead LDCs (Toronto Hydro, Ottawa Hydro, and Burlington) provided submission for data for
each of the respective groups from the LDC interview process. However, data for Halton Hills Hydro and Milton Hydro was not provided, so the team used the average realization rate of other LDCs (99.7%) to calculate the verified values for these LDCs.

Following the review of submission forms, the team compared the program assumptions to technical reference manuals from other jurisdictions and to studies and reports on pool pump energy consumption, adjusting for climate as required. Several technical reference manuals consulted used deemed values and therefore did not allow a thorough comparison of the assumptions. The team therefore considered data from Massachusetts, Vermont, Illinois and Minnesota, which used input values obtained with the “Savings Calculator for ENERGY STAR Certified Inground Pool Pumps” or a methodology like that of the calculator. The ENERGY STAR Calculator estimates the amount of water that needs to be filtered and the amount of time it will take to filter, which together provide the average flowrate required from the pump. Based on this average flowrate, the team then identified the pump’s energy factor from a table for the existing pump and from a formula for the new pump. The calculator assumes that the new pump runs at high speed during two hours per day for cleaning and runs at low speed for any remaining time required to filter the volume of pool water.

The team’s ENERGY STAR Calculator methodology is slightly different than that used by LDCs in the Swimming Pool Efficiency Program. The LDCs used values reported in the submission form, instead of assumed values, for the power draw of each programmed speed as well as for the operating hours. However, the LDCs also used a table from the ENERGY STAR Calculator, but not the tool itself. The team found one jurisdiction, Pennsylvania, which used a similar approach to that used by the LDCs to calculate energy savings.

While the ENERGY STAR Calculator is used widely, the team determined that the Swimming Pool Efficiency Program approach is more accurate since the old and new operating hours as well as the power drawn by the new pump are tracked on the submission form, thereby reducing the number of assumptions. In addition, when available, the vendors took the new pump power draw values directly from the variable-speed pump display screen, therefore accounting for the effects of the piping system on the energy consumption.

To further test the validity of the LDC methodology, the Cadmus team also compared the energy savings obtained from the ENERGY STAR Calculator against those reported by the LDCs for a sample of projects. Since some inputs required in the ENERGY STAR Calculator were not mandatory on the LDC submission forms, the team selected projects with a pipe size available in the Calculator and only two speeds for the new pump, to ensure methodologies could be compared. The savings reported by the LDCs were similar

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4 Most parameters of the “Savings Calculator for ENERGY STAR Certified Inground Pool Pumps” have a default value that can be manually changed if the real value is known.

5 If the power draw values were unavailable, the vendors estimated them based on manufacturer specification sheets.
to those obtained with the ENERGY STAR Calculator, with a variance of under 10%. Thus, the Cadmus team made no adjustment to the energy savings calculation methodology.

While the team adopted the same methodology as the LDCs, there were some discrepancies between the IESO-reported savings in the program data and the Cadmus team savings obtained when applying the calculation methodology to the LDC-provided submission form data. The source of discrepancies was not identifiable as the majority of submission forms contained hard-coded values without showing the savings calculations. **For the 78 affected projects (4% of total projects), the team adjusted the net verified savings based on what was calculated with the LDC data instead of what was reported to the IESO. On average, these discrepancies resulted in slightly lower savings (-0.3%) than reported (Key Finding 2a).**

In addition, 21 projects did not have operating hours or power draws identified for the new pump: these submission forms calculated no energy consumption for the new pump installed due to missing a necessary variable to complete the calculation. In these cases, the energy savings calculation attributed the total energy consumption of the old pump as energy savings for these projects, which is incorrect. To calculate savings for those projects, the team used the average energy consumption of the new pump from all other projects.6

**Gross Verified Demand**

To determine gross verified summer peak demand savings, the team used Equation 4.

**Equation 4. Gross Verified Kilowatt Savings**

\[
\text{Savings}_{\text{GrosskW}} = \text{Savings}_{\text{GrosskWh}} \times \text{kW factor}
\]

Where:

\[
\text{kW factor} = \text{Summer peak conversion factor from kilowatt-hour to kilowatt (the team used the IESO Prescriptive Measure and Assumptions List)}
\]

Variable-speed pool pumps can be programmed to perform energy intensive activities (such as cleaning cycles) during non-peak hours which may increase the summer peak demand savings of the pump, which may increase the summer peak demand savings of this program. However, vendors did not provide information on the submission form on the daily schedule of programmed speeds. Therefore, the team applied the summer peak demand ratio of 0.000193 for Residential Swimming Pool Pumps load profile from the IESO Prescriptive Measure and Assumptions List to all participants to obtain their gross verified summer peak demand savings (Key Finding 3a). The team did not use the summer peak demand savings established by the LDC methodology since it was based on the average demand savings and not on the power draw during the summer peak period (which could be higher or lower than the average). The team deemed the uncertainty associated with the summer peak demand savings

6 To refine the adjustment made to those projects, the team analysed the average energy consumption based on the motor size (nameplate horsepower), but the results were inconclusive.
ratio as less significant than using the average power draw since it was developed specifically for residential pool pumps.

LDCs used a value of 10 years for the measure effective useful life (EUL), and the Cadmus team determined this value as reasonable: as presented in the Table 3. Cadmus conducted a literature review which revealed that 10 years is the most commonly value used, concluding that a 10 year EUL is appropriate to calculate the program cost-effectiveness.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Effective Useful Life</th>
<th>Reference</th>
</tr>
</thead>
</table>

^ Pool measures, unspecified.

**Net Savings Methodology**

The team derived net verified energy and demand savings (Equation 5 and Equation 6, respectively) by adjusting the gross energy savings by the NTGR (Equation 7).

**Equation 5. Net Verified Energy Savings for Pool Pumps**

\[ kWh_{net} = NTGR \times kWh_{Gross\ Verified} \]

**Equation 6. Net Verified Demand Savings for Pool Pumps**

\[ kW_{net} = NTGR \times kW_{Gross\ Verified} \]

**Equation 7. Net-to-Gross Ratio for Pool Pumps**

\[ NTGR = 1 – Free Ridership + Spillover \]
The Cadmus team used self-reported participant survey data to assess free ridership and spillover for the program. Free ridership refers to participation by those who would have acquired the energy efficiency measure in the absence of the program’s influence. The effect of free riders reduces the net savings attributable to the program. Spillover represents the additional energy savings that occur when customers—as a result of the program’s influence—install other energy efficiency measures without getting a rebate or change their energy use behaviour.

**Free Ridership**
The Cadmus team used participant survey responses to calculate free ridership, based on questions that collected data on each participant’s intention and factors that might have influenced the participant.

The intention score captures what the participant would most likely have done if not receiving program assistance. In addition, the intention score incorporates the influence of vendor recommendations, that is when a respondent would have followed the vendor recommendations. The team established the intention score using a vendor adjustment influence, derived from the level of program influence vendors reported on their recommendations during interviews. The team asked participating vendors to rate how strongly the program affected the types of pool pumps they recommended to customers on a scale from 0 to 10, where 0 means not at all influential and 10 means strongly influential. The team calculated the average vendor rating, then multiplied by 10 to create a vendor adjustment influence factor, expressed as a percentage.

The Cadmus team also assessed the program’s influence on respondents’ decisions to implement energy-efficient measures by asking respondents to identify the extent to which several program elements influenced their decision regarding the energy-efficient measures implemented:

- $400 rebate
- Information or recommendation from vendor or contractor
- Marketing or advertising about the program

Influence and free ridership have an inverse relationship: the greater the program influence, the lower the free ridership.

The team then calculated free ridership at the program level, as no significant differences were observed between LDCs or LDC groups.

**Spillover**
The Cadmus team used Equation 8 to calculate the percentage of spillover, at the measure level, in which the spillover savings reported by respondents is divided by the total gross verified savings achieved by all survey respondents for the pool pump measure.

**Equation 8. Spillover**

\[
\text{Spillover} \% = \left( \frac{\sum (\text{Spillover Measure Energy Savings for All Survey Respondents} \times \text{Influence})}{\sum \text{Program Measure Energy Savings for All Survey Respondents}} \right)
\]
The Cadmus team calculated spillover savings for survey respondents who indicated that they installed additional energy-efficiency measures after participating in the Swimming Pool Efficiency Program, that they did not receive a rebate for those measures, and that the program was influential in their decision to install the additional measures.

The team calculated measure savings values for each individual qualifying spillover measure using the best information available from the PY2016 Consumer Programs Evaluation, the IESO Prescriptive Measure and Assumptions List and results from the PY2017 Coupons Program evaluation.

**Findings**

This section describes the gross verified and net verified savings results.

**Gross Savings**

The Swimming Pool Efficiency Program produced a total gross verified savings of 5,957 MWh and 1.140 MW in PY2017, as shown in Table 4. This resulted in gross realization rates of 99.7% for energy (Key Finding 1a). The near unity realization rate for energy savings is because the team only adjusted a few projects with discrepancies or incorrect new pump energy consumption. The team determined a gross realization rate of 83.4% for summer peak demand savings. The summer peak demand savings realization rate is lower because the team applied a summer peak demand ratio which provides demand savings occurring during the IESO peak period rather than the average demand used by the LDCs.

<table>
<thead>
<tr>
<th>LDC</th>
<th>Annual Gross Energy Savings (MWh)</th>
<th>Annual Gross Peak Demand Savings (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reported</td>
<td>Verified</td>
</tr>
<tr>
<td>Burlington Hydro</td>
<td>1,070</td>
<td>1,064</td>
</tr>
<tr>
<td>Halton Hills Hydro</td>
<td>171</td>
<td>170</td>
</tr>
<tr>
<td>Hydro Ottawa</td>
<td>1,778</td>
<td>1,762</td>
</tr>
<tr>
<td>Milton Hydro</td>
<td>288</td>
<td>288</td>
</tr>
<tr>
<td>Oakville Hydro</td>
<td>1,260</td>
<td>1,272</td>
</tr>
<tr>
<td>Renfrew Hydro</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>1,402</td>
<td>1,399</td>
</tr>
<tr>
<td>Total **</td>
<td>5,973</td>
<td>5,957</td>
</tr>
</tbody>
</table>

* Due to rounding, the realization rates do not equal to the division of the adjusted values by the reported values presented in this table.

* Numbers may not add due to rounding.

The team calculated savings for each pool pump installed and considering the wide variation in pool pump variables (such as size and hours of use). Table 5 shows the average savings per unit by LDC. Variations across LDCs are due to small differences in pool sizes and pump schedules across regions. On average, the installation of a variable-speed pool pump generated 3,041 kWh per year of energy savings and 0.582 kW per year of summer peak demand savings.
Table 5. PY2017 Average Gross Verified Savings per Variable-Speed Pump

<table>
<thead>
<tr>
<th>LDC</th>
<th>Energy Savings (kWh)</th>
<th>Peak Demand Savings (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burlington Hydro</td>
<td>3,456</td>
<td>0.661</td>
</tr>
<tr>
<td>Halton Hills Hydro</td>
<td>3,627</td>
<td>0.694</td>
</tr>
<tr>
<td>Hydro Ottawa</td>
<td>2,653</td>
<td>0.508</td>
</tr>
<tr>
<td>Milton Hydro</td>
<td>3,383</td>
<td>0.647</td>
</tr>
<tr>
<td>Oakville Hydro</td>
<td>3,057</td>
<td>0.585</td>
</tr>
<tr>
<td>Renfrew Hydro</td>
<td>2,355</td>
<td>0.450</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>3,194</td>
<td>0.611</td>
</tr>
<tr>
<td>Total</td>
<td>3,041</td>
<td>0.582</td>
</tr>
</tbody>
</table>

Net Savings

As shown in Table 6, the program resulted in 5,969 MWh and 1.142 MW in net verified first year and 2020 savings. The team used responses from participant surveys and vendor interviews to derive a program-level NTGR of 1.002. The program had a low free ridership rate, indicating an untapped market for variable-speed pool pumps (Key Finding 1b).

Table 6. Net Verified Savings

<table>
<thead>
<tr>
<th>Measure</th>
<th>n</th>
<th>Free Ridership</th>
<th>Spillover</th>
<th>NTGR</th>
<th>Annual Energy Savings (MWh)</th>
<th>Annual Peak Demand Savings (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Net Verified First Year</td>
<td>Net Verified 2020</td>
</tr>
<tr>
<td>Variable-Speed Pool Pump</td>
<td>1,959</td>
<td>0.066</td>
<td>0.068</td>
<td>1.00</td>
<td>5,969</td>
<td>1.142</td>
</tr>
</tbody>
</table>

Free Ridership

The participant survey revealed that 82% of respondents had no intention of installing a variable-speed pool pump if the program had not been offered and that 90% of respondents were highly influenced by the program on their decision to purchase an efficient pool pump. In addition, 7% of respondents relied on the vendor recommendation alone to decide to buy a variable-speed pump. Most interviewed vendors (69%) reported that they were significantly influenced by the program. All these elements contributed to a low free-ridership level of 6.6%, indicating an untapped market for variable-speed pool pumps (Key Finding 1b).

Spillover

The participant surveys revealed that 34% of respondents reported installing at least one other energy efficiency measure that was influenced by their participation in the program. These respondents did not receive an incentive and said that the program was important in their decision to install additional measures. The team calculated savings for spillover measures and divided the total survey sample spillover savings by the gross program savings to obtain a spillover estimate of 6.8%.
Respondents reported installing the following measures or adopting the following behaviours:

- LED bulbs (44 respondents)
- Window film (4)
- Weather-stripping (23)
- Lighting controls (47)
- Smart power bars (8)
- Programmable thermostats (48)
- Insulation blankets (2)
- Low-flow showerheads (19)
- Switched to washing laundry with cold water (40)
- Reduced use of lights (107)
- Turned down thermostat setting in winter (49)
- ENERGY STAR clothes washers (26)
- ENERGY STAR clothes dryers (26)
- High-efficiency heating or cooling systems (24)
- Unplugged devices usually plugged into outlets (31)

The gross and net verified savings for each LDC, as well as the NTGR, is shown in Table 7. The team assumed that the LDC-level NTGR was the same as the program-level NTGR, and these values, when established at the regional level (by LDC group), were not found to vary significantly by LDC.

**Table 7. Swimming Pool Efficiency Program NTGR, Gross Verified and Net Verified Savings by Region**

<table>
<thead>
<tr>
<th>LDC</th>
<th>Gross Verified First Year Savings</th>
<th>Net Verified First Year Savings</th>
<th>Net Verified 2020 Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MWh</td>
<td>Coincident Peak (MW)</td>
<td>MWh</td>
</tr>
<tr>
<td>Burlington Hydro</td>
<td>1,064</td>
<td>0.204</td>
<td>1,067</td>
</tr>
<tr>
<td>Halton Hills Hydro</td>
<td>170</td>
<td>0.033</td>
<td>171</td>
</tr>
<tr>
<td>Hydro Ottawa</td>
<td>1,762</td>
<td>0.337</td>
<td>1,765</td>
</tr>
<tr>
<td>Milton Hydro</td>
<td>288</td>
<td>0.055</td>
<td>288</td>
</tr>
<tr>
<td>Oakville Hydro</td>
<td>1,272</td>
<td>0.243</td>
<td>1,274</td>
</tr>
<tr>
<td>Renfrew Hydro</td>
<td>2</td>
<td>0.000</td>
<td>2</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>1,399</td>
<td>0.268</td>
<td>1,402</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5,957</strong></td>
<td><strong>1.140</strong></td>
<td><strong>5,969</strong></td>
</tr>
</tbody>
</table>

Due to rounding, numbers may not add up.
Process Evaluation

In addition to addressing the research objectives listed in the Introduction, the team used the process evaluation to better understand measure characteristics and pump replacement processes by determining, when pool pumps break, what fraction of customers replace the entire pump versus just the motor.

Methodology

The Cadmus team began with a comprehensive review of program documentation (listed in Appendix B) then conducted phone interviews with eight staff members from the three lead LDCs, one IESO staff member, 39 participating vendors and one staff member from the Eastern Ontario branch of the Pool and Hot Tub Council of Canada. Through these interviews, the team learned about stakeholder and market actor experiences, motivations and satisfaction with the program. For insight into the customer experience, the Cadmus team conducted online participant surveys. The team conducted the interviews and surveys in spring PY2018.

Stakeholder In-Depth Interviews

The Cadmus team conducted telephone interviews with eight staff members from the three lead LDCs and with one IESO staff member. These interviews provided insight into how the program was delivered, marketing methods, participant and market actor experiences and information on successes and challenges.

Market Actor In-Depth Interviews

The Cadmus team also conducted telephone interviews with 39 participating vendors, asking about program delivery, recruiting, training, marketing methods, data collection, satisfaction, scalability and areas of success, challenges and lessons learned. In addition, the team interviewed a representative of the Pool and Hot Tub Council of Canada to further understand the impact of the program on the market and on the Council’s participating members.

Participant Surveys

The team defined a participant as any LDC residential customer who purchased a variable-speed pool pump through this program. The team completed online surveys with participating customers, asking about their motivations, awareness of and experience with the program (including experience with the installation process) and questions to inform the NTGR. In total, 285 participants responded, with 108 from Toronto Hydro, 108 from Hydro Ottawa and 69 from Burlington Hydro (as the lead LDC).

Findings

This section discusses the program design and delivery and the experiences, successes, challenges and lessons learned for future planning from the perspective of LDC staff, pool pump vendors, the Pool and Hot Tub Council of Canada and participants.
Program Design and Delivery

As described in the business cases, the primary program goal was to transform the residential swimming pool market by encouraging customers with existing swimming pools to retrofit single-speed inefficient pumps with energy-efficient variable-speed pumps. The program design was based on a pilot previously conducted by London Hydro. Because Southern Ontario has many residential pools, the LDCs identified it as a good target market for a program.

Referencing a report from the Consortium for Energy Efficiency, the LDCs identified two barriers preventing the adoption of the variable-speed pool pump in the pool design and servicing community that needed to be addressed through the program:

- Vendors have difficulty sizing motors to achieve maximum efficiency
- Vendors often recommend single-speed pumps to avoid complications and follow-up service calls

Through design, program customers receive a $400 rebate on a variable-speed pump at the point of sale. The program required participating vendors to be a member of the Pool and Hot Tub Council of Canada and to conduct the pump installation and confirm the participant’s eligibility for the rebate. The program required participating customers to have a single-speed pool pump for an existing in-ground pool. The LDCs favored this delivery model to limit administrative costs by avoiding a potentially lengthy application and approval process with customers. Furthermore, by requiring vendors to conduct installations, the LDCs could more easily collect information on the existing pump to improve the accuracy of energy savings calculations and to ensure the new pump’s proper installation. Additionally, the LDCs designed the program to encourage pool pump vendors to recruit participants among their existing customer base and to conduct the bulk of the marketing activities.

Toronto Hydro developed a program business case, which was used as a model for the business cases developed by Hydro Ottawa and Burlington Hydro. The three lead LDCs held shared vendor training sessions, reducing the administrative burden and sharing costs across LDCs (Key Finding 7a). The training was held during Pool and Hot Tub Council of Canada meetings to inform interested vendors about the program and process. The sessions also included a presentation from a variable-speed pump manufacturer on the technology, its energy saving benefits and how to properly install and program the pump. While the program design (through the incentive and vendor training) addressed the barrier of vendor’s not recommending variable-speed pumps, there is not any evidence of vendor training on proper pool pump sizing to achieve maximum efficiency (Key Finding 4a).

Vendors provided participants with the $400 incentive as an instant discount. To obtain reimbursement, vendors would submit an application form to the LDC, which included a customer application form, a photo of the old pump and a receipt that showed they provided the incentive. While the delivery of the

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program was very similar across the three LDC groups, the application submittal process varied. Hydro Ottawa and Toronto Hydro used an FTP site for vendor applications, whereas Burlington Hydro developed an online vendor portal. The other LDCs plan to adopt Burlington Hydro’s vendor portal, aligning the vendor submission process across all participating LDCs (Key Finding 7b).

Participant, Local Distribution Company and Market Actor Experience
This section discusses participant, LDC and market actor program experiences.

Participant Experience
The Cadmus team conducted an online survey with 285 participants. The following subsections describe survey findings of participant demographics, awareness, motivation, pool installation and satisfaction.

Demographics
The survey respondents reported higher levels of education and household income compared to the Ontario general population. Approximately 72% of program respondents have a university degree, compared to 21% of the Ontario general population. Program respondents are also more likely to be from middle or higher income households, with 96% reporting income above $50,000, and 58% reporting income above $150,000 (compared to 17% in the Ontario general population; see Appendix A for more demographic details and figures).

Awareness
The LDCs designed the program to encourage pool pump vendors to recruit participants among their existing customer base. As expected, most survey respondents reported hearing about the program from either a pool pump vendor (52%) or their pool maintenance service company (35%) (Key Finding 5a). As illustrated in Figure 2, survey respondents described becoming aware of the program primarily through discussions with a pool pump vendor (68%), a sign located in a store (22%) and via email (8%).
Figure 2. Awareness of the Swimming Pool Efficiency Program


Among participants who reported not learning about the program through a vendor or service company (12%), 30% became aware of the program through word of mouth, 30% from their LDC’s website and 12% from an LDC bill insert.

**Motivation**

The team asked participants about the condition of their existing pool pump to better understand their motivations for purchasing a variable-speed pool pump. Most respondents reported having an existing pool pump that was six to 16 years old, with 43% that were six to 10 years old and 22% that were 11 to 16 years old. In addition, 56% of respondents reported having a pool heater linked to their pumping system and 31% claimed to have a pool cleaner linked to their system. Importantly, **82% of respondents said they had a functioning pump that did not require immediate replacement** (Key Finding 5b). It appears that program marketing about energy and cost savings were the driver for replacement. As shown in Figure 3, respondents cited saving energy (70%), saving money (69%) and following their vendor’s recommendation (38%) as initial motivations to upgrade their constant-speed pool pump to a variable-speed pool pump.
Figure 3. Participant Motivations to Upgrade Pool Pump

Source: Participant Survey Question C6. “What motivated you to upgrade your constant-speed pool pump to a high-efficiency variable-speed pump?” (multiple response)

Furthermore, the team asked participants why they chose their specific model of pool pump after having decided to purchase a variable-speed pool pump. As illustrated in Figure 4, the vendor’s recommendation was the most mentioned driver for purchasing a variable-speed pool pump, following the program incentive and energy savings (Key Finding 5c).

Figure 4. Reasons for Choosing Specific Model of Variable-Speed Pump

Source: Participant Survey Question D5. “Why did you select the specific model and brand of pool pump that you purchased through the Swimming Pool Efficiency Program?” (multiple response)
**Installation**
To be eligible to receive the $400 rebate, the new pool pump had to be installed by the vendor. As shown in Figure 5, 96% of respondents received information about their pool pump at the time of installation, either verbally (45%) or on a handout (51%).

![Figure 5. Information Provided by the Pool Pump Installer](image)

Source: Participant Survey Question C7. “Did your pool pump installer provide you with information about your pool pump?”

In a follow up question, 84% of respondents reported not needing more information from their pool pump installer at the time of installation. Ten percent of respondents would have liked to receive additional information, primarily on how to program the pool pump.

**Satisfaction**
As shown in Figure 6, respondents reported being highly satisfied with their program experience. Specifically, most respondents reported being very satisfied with their interactions with the pool pump vendor (82%), with the performance of their pool pump (84%) and with the program overall (83%) (Key Finding 1c).
A few respondents reported being not at all satisfied or only a little satisfied with their interactions with the pool pump vendor (5%), the performance of their pool pump (3%) and the program overall (4%).

When prompted, respondents gave the following details about being dissatisfied with their interactions with the vendor:

- **Poor installation.** Five respondents (2%) noted that the quality of the installation was poor.
- **Lack of timeliness.** Two respondents (1%) remarked that the installer did not show up at the scheduled date and time.

As for the variable-speed pool pump itself, a few respondents stated the two issues:

- **Poor suction.** Two respondents (1%) mentioned that the pump generated poor suction.
- **Unit incompatibility.** Two respondents (1%) reported compatibility issues with their heater.

When asked for recommendations to improve the program, respondents had several suggestions:

- **Advertising.** Eight respondents (9%) suggested more program advertising.
- **Additional rebates.** Eight respondents (9%) suggested offering incentives for additional energy-efficient products, such as heaters, filters and solar power pool pumps.
- **Education on pump.** Seven respondents (8%) suggested that the vendors provide more information about the variable-speed pump.
- **Self-installation.** Four respondents (4%) suggested allowing participants to install the new pump themselves to save money on installation costs.

**LDC Experience**

The lead LDC staff reported being satisfied with the program, citing the effective delivery model and the productive relationships with the vendors and with the Pool and Hot Tub Council of Canada.
However, all three LDC staff mentioned having difficulties with meeting their participation targets. Two LDCs mentioned during the interviews that awareness and vendor recruitment were more time consuming than they anticipated and that the participation targets in the business cases did not consider enough time for program ramp up. The third LDC explained the lower-than-expected participation by noting the difficulty with capturing the complete market for variable-speed pumps, especially online pool pump sales (which are not eligible for the program). In their analysis, some individuals are retrofitting their pumps with variable-speed pumps purchased online that are therefore not eligible for the program. Furthermore, one LDC reported that they expect participant recruitment to be easier in PY2018 since vendors are already familiar with the program. This was supported by another LDC who reported already having a backlog of customers ready to participate in PY2018.

All three lead LDC staff identified the importance of having a line of communication and support for the participating vendors. They highlighted the need to answer vendor questions as quickly as possible to ensure a smooth application process. To this end, two lead LDCs set up a hotline for vendors to contact any time to ask questions and receive application support. Several interviewed vendors reported using the hotline and appreciating the availability of this support.

Additional areas exist for sharing resources across LDCs to reduce costs, improve consistency and improve vendor support. For example, Ottawa Hydro and Toronto Hydro used a hotline to provide vendor and customer support, which proved useful and represents the type of activity that could be shared across the other LDCs to benefit vendors in other regions (Key Finding 7c).

**Market Actor Experience**

The Cadmus team interviewed 39 pool pump vendors. This section describes their experiences regarding awareness, motivation, barriers, training, outreach, the pool pump market and overall program satisfaction.

Among the vendors interviewed, 80% represented small businesses with fewer than 15 employees. These vendors described their business activities as selling equipment and offering maintenance services (72%). Almost all vendors (95%) reported doing at least some variable-speed pool pump installations themselves, while 5% exclusively subcontract the installations.

**Awareness and Motivation**

The LDCs held training and information sessions at the Pool and Hot Tub Council of Canada meetings to inform pool pump vendors about the program. As shown in Figure 7, interviewed vendors reported becoming aware of the program primarily through the Pool and Hot Tub Council of Canada (67%), with variable-speed pump manufacturers (21%) having the second greatest influence on program awareness.
As illustrated in Figure 8, vendors cited the opportunity to increase their sales (56%) and to offer their customers a rebate (49%) as primary motives for participating in the program. In addition, 15% said they participated to stay competitive.

**Figure 8. Vendor Motivations to Participate**

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity to Increase Sales</td>
<td>56%</td>
</tr>
<tr>
<td>Offer Customers a Rebate</td>
<td>49%</td>
</tr>
<tr>
<td>Be Competitive</td>
<td>15%</td>
</tr>
<tr>
<td>Opportunity to Offer Customers an Upgrade</td>
<td>10%</td>
</tr>
<tr>
<td>Appreciate the Pumps</td>
<td>10%</td>
</tr>
<tr>
<td>Energy Savings for Customers</td>
<td>5%</td>
</tr>
<tr>
<td>Environmentally Friendly</td>
<td>5%</td>
</tr>
<tr>
<td>Other</td>
<td>5%</td>
</tr>
</tbody>
</table>

Source: Vendor Interview Question C2. “What motivated your company to participate in the program?” (multiple response)

**Barriers**

To understand barriers to program participation, the Cadmus team also interviewed three vendors who had completed the training with the LDC but did not register variable-speed pool pumps program sales in PY2017. These vendors said they did not participate in the program due to the lack of their customers’ eligibility, either because they were not a customer of one of the participating LDCs or because they were installing a new pool. One vendor mentioned that even with the rebate, the high price of variable-speed pumps makes them more difficult to sell.
Training
Eight-four percent of vendors participated in a group training session at a Pool and Hot Tub Council of Canada meeting. One-on-one sessions were given to the 11% of vendors who missed the group training sessions (Figure 9). Another 3% of vendors benefited from both the group and one-on-one sessions.

Figure 9. Vendor Training Participation

Source: Vendor Interview Question D2. “Your LDC offered training sessions about the Swimming Pool Efficiency Program. Did you participate in a group training session or in a one-on-one session?”
Note: One vendor, who reported having participated in leading the training given to other vendors, was excluded from results reported in Figure 9.

The interviewed vendors reported that the content of the training was clear and that program information was well communicated. When asked, vendors cited several items as the most important aspect of the training:

- Understanding how the program worked in general (34%)
- Understanding how to fill out all the necessary paperwork to submit a rebate claim (24%)
- Understanding equipment and customer eligibility requirements (10%)

Four vendors suggested specific areas to provide more detailed information during trainings:

- Program processes. Two vendors suggested a more detailed walk-through of the entire program participation process, from filling out the paperwork to outlining what information to collect when on the site with a customer.
- Customer educational information. One vendor suggested providing additional materials to help explain the energy savings benefits to customers.
- Marketing rules. One vendor suggested providing more information on marketing rules, such as guidelines for the vendor use of LDC logos.
Program Outreach

Ninety percent of interviewed vendors reported promoting variable-speed pumps prior to their participation in the Swimming Pool Efficiency Program. The four vendors who did not promote variable-speed pumps prior to the program provided each of the following reasons once:

- High cost of variable-speed pumps
- Relatively new technology
- Their own lack of knowledge about variable-speed pumps
- Customers often opt to only replace their motor versus replacing their pump
- Sales are focused on automation products, which render the variable-speed pump useless

The program model provided a direct link to customers’ purchasing pool pumps through vendors (Key Finding 8b). As shown in Figure 10, the program significantly increased how often vendors recommended variable-speed pumps to their customers by providing a direct link to customers purchasing pool pumps. Before enrolling in the program, 51% of vendors recommended efficient pumps more than 75% of the time. After enrolling in the program, 80% of vendors recommended efficient pumps more than 75% of the time. The vendors reported that the program was an important influence on their recommendations to customers: on a scale of 1 to 10, where 1 is not at all important and 10 is very important, vendors gave a median rating of 9 to the influence of the program on their recommendations to customers.

Figure 10. Frequency of Vendor Recommendations for Swimming Pool Efficiency Program

Source: Vendor Interview Questions E3 and E4. “How often did you recommend variable-speed pumps to your customers before enrolling in the program?” “Since enrolling in the program, how often do you recommend variable-speed pumps to your customers?”

Since vendors were responsible for participant recruitment, they also carried out the bulk of marketing activities. As shown in Figure 11, vendors reported promoting the program through a variety of methods: advertising on their website (67%), on social media (64%) and distributing brochures (56%)
were the most frequently used method. **Three of the four methods most often mentioned by vendors for marketing were digital (website, social media and email)** (Key Finding 6a).

Figure 11. Vendor Marketing Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertised the program on your website</td>
<td>67%</td>
</tr>
<tr>
<td>Advertised the program on social media</td>
<td>64%</td>
</tr>
<tr>
<td>Distributed brochures</td>
<td>56%</td>
</tr>
<tr>
<td>Contacted previous customers by email</td>
<td>38%</td>
</tr>
<tr>
<td>Installed window clings</td>
<td>33%</td>
</tr>
<tr>
<td>Contacted previous customers by phone</td>
<td>21%</td>
</tr>
<tr>
<td>No promotion</td>
<td>5%</td>
</tr>
</tbody>
</table>

Source: Vendor Interview Question E5. “Since enrolling in the program, what methods have you used to promote variable-speed pumps to your customers with existing pools?” (multiple response)

In addition, 77% of vendors reported using materials provided by LDCs such as brochures and window clings (stickers on windows that can be seen from outside). Among those who did not use the LDC materials (23%), two claimed to prefer their own marketing materials and one reported that the medium provided by the LDC (such as door hangers and brochures) was outdated and no longer the most effective way of reaching customers.

When asked how marketing and outreach overall could be improved, four vendors suggested that LDCs create digital content that vendors can add to their website and social media accounts (10%), three said the LDCs should increase advertisements on radio and television (8%) and three said the LDC should provide more posters and other promotional materials they can show or hand out to customers (8%). **The LDCs provided marketing materials for vendors to use (such as door hangers and brochures), the vendors indicated that more focus on digital material would be useful to promote the program (Key Finding 6b).**

**Pool Pump Market**

This section presents the vendors’ perceptions of the pool pump market and existing barriers for variable-speed pumps.

**Current Market**

In total, 80% of the interviewed vendors confirmed that the program increased their sales of variable-speed pool pumps. Figure 12 presents the proportion of variable-speed pool pumps among total pumps
sold in PY2016 prior to the program and in PY2017 during the program. The proportion of vendors reporting that variable-speed pumps made up over 40% of their total pump sales increased from 26% before the program to 62% after the program.

**Figure 12. Percentage of Variable-Speed Pool Pumps among Total Pumps Sold by Year**

![Bar chart showing percentage of variable-speed pool pumps sold by year]

Source: Vendor Interview Question F1. “In 2017, approximately what percentage of all the pumps you sold for existing pools were variable-speed pumps?” and F2. “In 2016, before the Swimming Pool Efficiency Program was offered, approximately what percentage of all the pool pumps you sold for existing pools were variable-speed pumps?”

Vendors reported that the main impacts of the program on their business were an increase in sales (43%) and increased market awareness of energy efficiency products (12%). A few vendors said participation also increased their administrative load (10%) and some saw no impact (12%).

Vendors specifically reported that the $400 incentive made the sale easier (60%) and reduced the economic barrier for customers (23%). As shown in Figure 13, 62% of vendors believe the $400 incentive is less than the price difference between a constant-speed pool pump and a variable-speed pump. As discussed in Cost-Effectiveness and Greenhouse Gas Impacts, the Cadmus team estimated an average incremental cost of $735 to go from constant-speed to variable speed pump.

“The rebate definitely makes the sale easier. The fact that the customers get the rebate directly from us makes it easier for them.”

– Pool Pump Vendor
Figure 13. Incentive Compared to Price Difference of Constant- and Variable-Speed Pumps

Source: Vendor Interview Questions F10. “Considering the price difference between a constant-speed pool pump and a variable-speed pump, is the incentive...”

Market Barriers
The interviewed vendors reported several barriers to customers’ buying variable-speed pumps:

- High cost (68%)
- Customers plan on moving and thus will not benefit from energy savings in the long term (19%)
- Customers are risk-averse or do not trust the technology (10%)

Finally, the Cadmus team asked vendors about customers in need of a motor replacement to understand under what circumstances these individuals would opt to replace their pump entirely. As illustrated in Figure 14, 74% of vendors reported that more than 75% of customers replace their entire pump when they only need a motor replacement.

Figure 14. Customers Who Need Motor Replacement and Will Replace Pump Entirely

Source: Vendor Interview Questions F6. “Approximately what percentage of customers who are only in need of a motor replacement opt to replace their pool pump entirely?”
Vendors reported that it is less expensive to replace the pump entirely (50%) and that customers are motivated to do so because new pumps are more energy efficient (21%). The Cadmus team found that 83% of variable-speed pumps installed through the program were sized larger in terms of HP than the pump it replaced. Further energy savings may be possible through proper sizing of pool pumps installed through the program (Key Finding 4b).

**Satisfaction**

The use of an association to identify vendors for the program was successful with most vendors indicating high satisfaction with the program (Key Finding 8a). As shown in Figure 15, 61% of interviewed vendors were very satisfied with the program overall. In addition, the majority rated themselves as somewhat satisfied or very satisfied with all program aspects: training sessions (92%), LDC support (88%), LDC marketing materials (87%), FTP application process (80%), application form (67%), vendor portal application process (66%) and amount of delay before receiving the incentive payment (62%).

![Figure 15. Vendor Satisfaction with Various Swimming Pool Efficiency Program Aspects](image)

Source: Vendor Interview Questions G1 through G18.

In total, 42 answers were collected for satisfaction with LDC support because this question was asked separately for each LDC and some vendors worked with more than one LDC.

Vendors reported being somewhat less satisfied with the amount of delay before receiving the incentive payment, with 19% being a little satisfied and 19% being not at all satisfied. Six vendors (17%) mentioned that in some cases, the reimbursement process took several months.

As mentioned in the *Program Design and Delivery* section, there were two different application processes, with Burlington Hydro providing an online vendor portal and Hydro Ottawa and Toronto Hydro using an FTP site for application submission. Vendors reported being somewhat more satisfied with the FTP site (80%) than with the vendor portal (66%). Those who were less than satisfied with the FTP process mentioned that it was not user friendly (7%) and that it did not work (7%). Those who were less than satisfied with the vendor portal mentioned that it was time consuming (8%) and that changes in what information was required over the program duration made the process confusing (17%).
Vendors were less satisfied with the application form itself, with 22% being a little satisfied and 11% being not at all satisfied. The primary reason given for lower satisfaction was that the application form required too much information and consequently took too much time to fill out.

Finally, only a handful of vendors were a little satisfied (7%) or not at all satisfied (5%) with the support offered by the LDCs, but it is noteworthy that there was some variation in the results across the three lead LDCs. Less satisfied respondents indicated that their dissatisfaction was related to the availability of the LDC staff to answer their questions.

**Council Experience**

The Cadmus team also interviewed a representative of the Eastern Ontario branch of the Pool and Hot Tub Council of Canada. The Council staff reported that their members were very satisfied with the program, citing the effectiveness of the training and the support offered to vendors by the LDCs during the program. Furthermore, the representative noted that the incentive offered by the LDCs was considered effective since it lowered the price of a variable-speed pump sufficiently to convince customers to purchase one instead of a constant-speed pump.

“Many businesses in this market are older family businesses that have been doing things the same way for years. This program was a good way to get them motivated to sell a new technology.”

– Pool and Hot Tub Council of Canada

According to the Council, vendors want the program eligibility requirements modified to include new pools. They reported that not all customers purchasing a new pool, purchase a variable-speed pool pump because the price differential between a constant-speed pool pump and a variable-speed pump is too high. However, manufacturer interviews completed for the LDC business case reported that a large majority of new pools are built with a variable-speed pool pump.

**Success, Challenges and Future Planning**

This section outlines areas of program successes, challenges and future planning considerations, based on the process evaluation activities.
**Successes**

The lead LDC staff, pool pump vendors and Pool and Hot Tub Council of Canada identified two program successes:

- **Generating high interest among pool pump vendors.** By all accounts, the program was successful in generating interest in selling variable-speed pool pumps among pool pump vendors in Southern Ontario. In total, 81 vendors signed up to participate and, according to the Pool and Hot Tub Council of Canada, all vendors who work with existing pools and in the markets covered by the program participated. As reported by the LDCs, working with the Pool and Hot Tub Council of Canada was an effective approach for identifying potential vendors. Furthermore, the LDCs reported that working directly with vendors by offering the rebate at the point of sale reduced the program administrative costs and facilitated the participation process for customers.

- **Increasing the frequency of variable-speed pump recommendations.** Although most vendors reported promoting variable-speed pumps before enrolling in the program, the program significantly increased how often vendors recommended variable-speed pumps to their customers. Before enrolling in the program, 51% of vendors recommended efficient pumps more than 75% of the time. After enrolling in the program, 80% of vendors recommended efficient pumps more than 75% of the time. The vendors reported that the program was an important influence on their customer recommendations: on a scale of 1 to 10, where 1 is not at all important and 10 is very important, vendors gave a median rating of 9 to the influence of the program on their recommendations to customers.

**Challenges**

The lead LDC staff members, pool pump vendors and Pool and Hot Tub Council of Canada identified two program challenges:

- **Offering support to pool pump vendors.** The LDCs reported that pool pump vendors were not as tech-savvy as expected and had difficulty with the participation process in general. One LDC reported that some vendors were overwhelmed by the quantity of information they needed to submit and were not always comfortable emailing and scanning documents.

- **Reaching participation targets.** The LDCs reported having difficulty reaching the PY2017 participation targets set in their business cases. They attributed this challenge to the fact that recruiting and training vendors took more time than anticipated as well as not capturing the complete market for variable-speed pumps, especially for online pool pump sales that are not eligible for the program. The LDCs reported that this challenge should be partially mitigated in future years, as a large base of vendors will be trained on the program.

**Future Planning**

The successes and challenges outlined above led to two primary lessons learned from the program:

- **Limit the administrative burden on pool pump vendors.** To participate, vendors needed to recruit participants, offer the incentive, confirm technical specifications of the existing equipment and submit required documents to the LDC. As the LDCs expected, some vendors
reported that the application process was tedious and time consuming. The LDCs are considering how to make this process easier for vendors, including adopting the vendor portal developed by Burlington Hydro, which minimizes vendors having to submit the same information across multiple forms.

- **Explore the opportunity to expand eligibility.** Burlington Hydro staff reported that they were currently analyzing whether including new pool installations and above-ground pools would be feasible. This opportunity was also mentioned by a representative of the Pool and Hot Tub Council of Canada, who believes that the cost of variable-speed pumps remains a barrier in these markets. **While above-ground pool systems tend to be smaller than in-ground pool systems and would therefore result in less energy savings, it may be worth considering taking cost-effectiveness into account (Key Finding 8c).**
Cost-Effectiveness and Greenhouse Gas Impacts

This section provides the cost-effectiveness methodology and findings for the Swimming Pool Efficiency Program.

**Methodology**

The Cadmus team reviewed the initial program planning cost-effectiveness inputs prepared by LDCs, and then used the IESO’s *CDM Cost Effectiveness Tool* to calculate the TRC, PAC and LUEC cost-effectiveness tests and obtain greenhouse gas (GHG) reductions. The cost-effectiveness tests assess several critical performance metrics: benefits, costs, net benefits and benefit/cost ratios. Programs are cost-effective when the benefits exceed the costs, meaning the program must have a benefit/cost ratio greater than 1.0.

Table 8 shows the various components included in each test and whether they are treated as a benefit or cost.

<table>
<thead>
<tr>
<th>Table 8. Cost-Effectiveness Test Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>Avoided Energy Costs</td>
</tr>
<tr>
<td>Non-Energy Benefits</td>
</tr>
<tr>
<td>Secondary Fuel Savings (Natural Gas)</td>
</tr>
<tr>
<td>Incremental Participant Costs</td>
</tr>
<tr>
<td>Administration Costs</td>
</tr>
<tr>
<td>Incentive Payments</td>
</tr>
<tr>
<td>Participant Bill Savings</td>
</tr>
<tr>
<td>Discounted Lifetime Energy Savings</td>
</tr>
</tbody>
</table>

The remainder of this section presents the three cost-effectiveness tests in detail, as well as *CDM Cost Effectiveness Tool* inputs.

**Total Resource Cost Test**

The TRC measures the overall impacts of program benefits and costs. The test compares the total resource benefits to total resource costs to society to determine if the benefits received by the populace outweigh the total costs incurred by the customers, the LDCs and the IESO. In addition, the TRC includes an non-energy benefit adder of 15%. The TRC uses the benefit/cost ratio shown in Equation 9.

**Equation 9. Total Resource Cost Test**

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

**Where:**

\[B = \text{Benefits}\]

\[C = \text{Costs}\]
PV = Present value (discount rate (real) + societal discount rate (real) = 4.00%)

Value of Gross Saved Energy = Gross savings multiplied by utility avoided energy and capacity costs

NTGR = Net-to-gross ratio

Incremental Participant Cost = Additional costs incurred by participants to install the energy-efficient technology over baseline or standard equipment typically installed in the absence of efficient technology

**Program Administrator Cost Test**

The PAC examines program benefits and costs solely from the administrators’ perspective using the benefit/cost ratio shown in Equation 10.

**Equation 10. Program Administrator Cost Test**

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

**Levelized Unit Electricity Cost**

The LUEC measures the overall competitiveness of different electricity sources, which allows for comparing demand-side management programs, programs over different timeframes or different supply-side options. The LUEC represents the annualized costs (discounted costs and lifetime savings) per lifetime kilowatt-hours from the PAC test perspective (administrative, delivery and incentive costs) using Equation 11 (costs divided by kilowatt-hours).

**Equation 11. Levelized Unit Electricity Costs**

\[
LUEC = \frac{PV \left[ \text{Administrative Costs} + \text{Incentive Payments} \right]}{PV \left[ \text{Gross Lifetime kWh} \times NTGR \right]}
\]

**Inputs and Assumptions**

The Cadmus team’s cost-effectiveness analysis relied on several PY2017 evaluation impact results:

- Net verified energy savings
- Summer peak demand savings
- Variable-speed pool pump’s incremental product cost
- Variable-speed pool pump’s EUL

To establish the incremental product cost of a variable-speed pool pump, the Cadmus team reviewed the costs used in the business cases. The team looked at incremental cost values for variable-speed pumps used in other jurisdictions (Massachusetts, Vermont, Illinois, Minnesota and Pennsylvania) and the team analyzed the reported costs of variable-speed pool pumps in the project list provided by the IESO.
The business cases assumed an incremental cost of $860 and $760 for a variable-speed pumps replacing a constant-speed pump without and with a timer, respectively, based on a total variable-speed pump cost of $1,400 from the 2013 CEE High Efficiency Residential Swimming Pool Initiative report.

Most reviewed jurisdictions assume an incremental cost of $714 based on the value provided in the ENERGY STAR calculator. The ENERGY STAR calculator value is based on United States Environmental Protection Agency research conducted in 2013.

Using the costs reported in the IESO project list, the team established an average project cost of $1,257. The Cadmus team looked at the website of two Canadian pool pump suppliers and identified an average cost of $522 for a constant-speed pump of 1.0 HP since the average size of the constant-speed pump on the submission forms was 1.05 HP. The team subtracted the average constant-speed price from the average project cost to establish an average incremental product cost of $735. This value generally aligns with the ENERGY STAR calculator value of $714. The team therefore used the value of $735 to calculate the cost-effectiveness of the Swimming Pool Efficiency Program.

The team combined the evaluation data with program financial data provided in the CDM Cost Effectiveness Tool:

- LDC Administrative costs
- Incentive payments

The IESO and LDC variable program costs were not provided and assumed to be zero. The team used the Residential Variable-Speed Pool Pump load profile in the LDC-provided CDM Cost Effectiveness Tool.

Findings

New programs, such as the Swimming Pool Efficiency Program, typically have benefit/cost ratios less than 1.0 because overhead costs frequently outweigh the benefits from a limited number of participants. However, as shown in Table 9 and Table 10 (respectively), the program is cost-effective, with a TRC result of 2.70, a PAC result of 3.88 and a LUEC of $0.02 (Key Finding a).

8 The ENERGY STAR calculator has a value of $549 USD, which was converted to $714 CAD assuming an exchange rate of 1.0 USD to 1.3 CAD.

### Table 9. Swimming Pool Efficiency Program Total Resource Cost Test Ratios and Net Benefits

<table>
<thead>
<tr>
<th>LDC</th>
<th>Ratio</th>
<th>Benefits ($)</th>
<th>Costs ($)</th>
<th>Net Benefits ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burlington Hydro</td>
<td>3.13</td>
<td>770,915</td>
<td>246,310</td>
<td>524,605</td>
</tr>
<tr>
<td>Halton Hills Hydro</td>
<td>3.16</td>
<td>123,475</td>
<td>39,131</td>
<td>84,344</td>
</tr>
<tr>
<td>Hydro Ottawa</td>
<td>2.66</td>
<td>1,275,930</td>
<td>480,122</td>
<td>795,808</td>
</tr>
<tr>
<td>Milton Hydro</td>
<td>2.60</td>
<td>208,274</td>
<td>80,114</td>
<td>128,160</td>
</tr>
<tr>
<td>Oakville Hydro</td>
<td>2.80</td>
<td>921,070</td>
<td>328,559</td>
<td>592,511</td>
</tr>
<tr>
<td>Renfrew Hydro</td>
<td>2.41</td>
<td>1,706</td>
<td>708</td>
<td>998</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>2.39</td>
<td>1,013,320</td>
<td>424,570</td>
<td>588,750</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2.70</td>
<td>4,314,690</td>
<td></td>
<td>$2,715,176</td>
</tr>
</tbody>
</table>

As shown in Table 11, the program has a LEUC of $0.02 per kilowatt-hour.

### Table 10. Swimming Pool Efficiency Program Administrator Cost Test Ratio and Net Benefits

<table>
<thead>
<tr>
<th>LDC</th>
<th>Ratio</th>
<th>Benefits ($)</th>
<th>Costs ($)</th>
<th>Net Benefits ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burlington Hydro</td>
<td>4.57</td>
<td>670,360</td>
<td>146,701</td>
<td>523,659</td>
</tr>
<tr>
<td>Halton Hills Hydro</td>
<td>4.49</td>
<td>107,370</td>
<td>23,931</td>
<td>83,439</td>
</tr>
<tr>
<td>Hydro Ottawa</td>
<td>4.18</td>
<td>1,109,504</td>
<td>265,382</td>
<td>844,123</td>
</tr>
<tr>
<td>Milton Hydro</td>
<td>3.44</td>
<td>181,108</td>
<td>52,625</td>
<td>128,483</td>
</tr>
<tr>
<td>Oakville Hydro</td>
<td>4.13</td>
<td>800,930</td>
<td>194,022</td>
<td>606,908</td>
</tr>
<tr>
<td>Renfrew Hydro</td>
<td>3.86</td>
<td>1,483</td>
<td>384</td>
<td>1,099</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>3.11</td>
<td>881,148</td>
<td>282,919</td>
<td>598,229</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3.88</td>
<td>3,751,904</td>
<td>965,965</td>
<td>2,785,939</td>
</tr>
</tbody>
</table>

Table 12 shows the first year and lifetime GHG reductions from the CE calculator.
<table>
<thead>
<tr>
<th>LDC</th>
<th>First Year (Tonnes CO₂ Equivalent)</th>
<th>Lifetime (Tonnes CO₂ Equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burlington Hydro</td>
<td>217.08</td>
<td>2,981.04</td>
</tr>
<tr>
<td>Halton Hills Hydro</td>
<td>34.77</td>
<td>477.47</td>
</tr>
<tr>
<td>Hydro Ottawa</td>
<td>359.29</td>
<td>4,933.88</td>
</tr>
<tr>
<td>Milton Hydro</td>
<td>58.65</td>
<td>805.37</td>
</tr>
<tr>
<td>Oakville Hydro</td>
<td>259.36</td>
<td>3,561.68</td>
</tr>
<tr>
<td>Renfrew Hydro</td>
<td>0.48</td>
<td>6.60</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>285.34</td>
<td>3,918.39</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,214.97</strong></td>
<td><strong>16,684.43</strong></td>
</tr>
</tbody>
</table>
Key Observations and Recommendations

The following statements present a high-level overview of the Cadmus team’s evaluation key observations and recommendations:

Key Observation 1: The program effectively leveraged vendors and provided a cost-effective and satisfying customer experience. The team determined a gross savings realization rate of 99.7% (Finding 1a). The program had a low free-ridership rate, indicating an untapped market for variable-speed pool pumps (Finding 1b). Participants reported being very satisfied with all elements of the program, including their interactions with the pool pump vendor, the performance of their pool pump and the program overall (Finding 1c).

Key Observation 2: While the methodology used by the LDCs to calculate savings on customer submission forms is sound, there were some inconsistencies in the project list. About 4% of projects had inconsistent energy savings calculated between the project list and the actual details on the submission form. On average, these discrepancies resulted in slightly lower savings (-0.3%) than reported (Finding 2a).

- Recommendation 2: Add an inconsistency test to the submission form as well as a saving calculation tool to alert vendors of an inconsistency (such as unreasonable power draw) so they may correct the item prior to submitting the form.

Key Observation 3: Pump programming could be used to maximize summer peak demand savings. Variable-speed pool pumps can be programmed to perform energy intensive activities (such as cleaning cycles) during non-peak hours, which may increase the summer peak demand savings of this program. However, vendors did not provide information on the daily schedule of programmed speeds; therefore, Cadmus adjusted the summer peak demand savings calculation using the IESO’s load shape for residential swimming pool pumps (Finding 3a).

- Recommendation 3: Educate and encourage vendors to program pumps for the greatest demand savings and to provide time settings for each pump speed on the submission form to enable the calculation of resulting summer peak demand savings.

Key Observation 4: Oversizing of pumps by vendors is a noted concern, and proper sizing of pool pumps could result in additional energy savings. The sponsoring LDCs identified that vendors have difficulty properly sizing pumps to maximize energy savings. However, there is no evidence that the program addressed this barrier (Finding 4a). In fact, 83% of variable-speed pumps installed through the program were sized larger in terms of horsepower (HP) than the pump it replaced. Further energy savings may be possible through proper sizing of pool pumps installed through the program (Finding 4b).

- Recommendation 4: Train vendors on the proper sizing of variable-speed pool pumps to maximize efficiency.

Key Observation 5: Vendors are critical to program success, driving program participation through the recommendations they make to their customers. Participant survey results indicated the importance of
vendors in driving program participation. Most participants reported learning about the program from their vendor (Finding 5a) and that their pump was an early replacement i.e., the existing pump had not stopped functioning prior to program participation (Finding 5b). The vendor’s recommendation was the most mentioned driver for purchasing a variable-speed pool pump, following the program incentive and the energy savings (Finding 5c).

**Key Observation 6: Diversifying LDC marketing materials would improve vendor marketing.** Vendors were responsible for the bulk of program marketing, and three of the four methods most often mentioned by vendors for marketing were digital (website, social media and email) (Finding 6a). The LDCs provided marketing materials for vendors to use (such as door hangers and brochures). The vendors indicated that more focus on digital material would be useful to promote the program (Finding 6b).

- **Recommendation 6:** Provide marketing materials to vendors in digital format so it can be used on vendor websites and in social media and emails.

**Key Observation 7: While the LDCs are sharing resources, there are further opportunities to enhance collaboration and reduce costs.** The LDCs participating in the local program successfully shared vendor training, reducing the administrative burden and sharing costs across LDCs (Finding 7a). To strengthen collaboration, the LDCs plan to adopt Burlington Hydro’s vendor portal, aligning the vendor submission process across all participating LDCs (Finding 7b). Additional areas exist for sharing resources across LDCs to reduce costs, improve consistency and improve vendor support. For example, Ottawa Hydro and Toronto Hydro used a hotline to provide vendor and customer support, which proved useful and represents the type of activity that could be shared across the other LDCs to benefit vendors in other regions (Key Finding 7c).

- **Recommendation 7:** Continue to share training resources and provide marketing materials and vendor support (such as the hotline) that can be jointly leveraged across LDCs.

**Key Observation 8: The program effectively leveraged vendors and could be scaled to expand its reach.** The program is a good model of how vendors can be successfully used for marketing, recruiting, providing the rebate and installing program equipment. The program was successful in generating vendor interest and in using an association to identify potential vendors. Most vendors were very satisfied with the program (Finding 8a). The program model provided a direct link to customers’ purchasing pool pumps (Finding 8b).

Above-ground pools are not currently eligible for the program, however both LDCs and the Pool and Hot Tub Council of Canada vendors identified above-ground pools as a potential area for program growth. While these pool systems tend to be smaller than in-ground pool systems and would therefore result in less energy savings, it may be worth considering given the robust cost-effectiveness of the current program (Finding 8c).

- **Recommendation 8:** Consider including above-ground pools, as the program cost-effectiveness is likely robust enough to support measures with slightly lower savings.
Key Observation 9: The Swimming Pool Efficiency Program is cost-effective. The program had positive cost-effectiveness results, with a TRC result of 2.70, a PAC result of 3.88, and a LUEC of $0.02 (Finding 9a).
Appendix A. Participant Demographics

This appendix outlines details of program participants’ education, household size and income, home type and age and internet access, as reported in participant surveys.

Education Level

As shown in Table 13, approximately 72% of Swimming Pool Efficiency Program respondents have a university degree, compared to 21% of the Ontario general population.

Table 13. Highest Education Level Completed

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Participants (n=259)</th>
<th>Ontario General Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>No degree, certificate or diploma</td>
<td>2%</td>
<td>22%</td>
</tr>
<tr>
<td>High school graduate</td>
<td>3%</td>
<td>27%</td>
</tr>
<tr>
<td>High school graduate, some college or post-secondary, no degree or diploma</td>
<td>11%</td>
<td>0%</td>
</tr>
<tr>
<td>College or trade certificate, below a Bachelor’s degree</td>
<td>12%</td>
<td>31%</td>
</tr>
<tr>
<td>University degree (bachelor level)</td>
<td>46%</td>
<td>13%</td>
</tr>
<tr>
<td>Master’s degree or higher</td>
<td>26%</td>
<td>8%</td>
</tr>
</tbody>
</table>

Sources: Participants: Participant Survey Question G1. “What is the highest level of education that you have completed?”
Ontario General Population: Statistics Canada 2006 Census Profile for Ontario

Household Size

As illustrated in Figure 16, program respondents tend to live in a home with two to four people. This is similar to the Ontario general population, although the proportion of respondents who live alone (5%) is lower than the proportion among the Ontario general population (26%).

Figure 16. Household Size

Sources: Participants: Participant Survey Question G2. “How many people, including yourself, live in the household full time?”
Ontario General Population: Statistics Canada 2016 Census Profile for Ontario
Dwelling Type
As shown in Figure 17, 73% of Ontario residents and all Swimming Pool Efficiency respondents live in a single-family dwelling. Furthermore, 69% of Ontario residents (69%) and all respondents own their home.

**Figure 17. Dwelling Type**

Ontario General Population: Statistics Canada 2016 Census Profile for Ontario

Dwelling Age
As illustrated in Figure 18, 73% of Swimming Pool Efficiency Program respondents live in homes built in 1990 or before, which is consistent with the Ontario general population (67%).

**Figure 18. Household Age**

Sources: Participants: Participant Survey Question G5. “What year was your home built?”
Ontario General Population: Statistics Canada 2016 Census Profile for Ontario
Household Income

Swimming Pool Efficiency Program respondents are most likely to be from middle or higher income households, with 96% reporting income above $50,000 and 58% reporting income above $150,000, compared to only 17% of the Ontario general population. Figure 19 shows a full income distribution.

Figure 19. Household Income

Sources: Participants: Participant Survey Question G8. “Please tell me which of the following categories applies to your total household income for the year 2017.”
Ontario General Population: Statistics Canada 2016 Census Profile for Ontario
Appendix B. Impact and Process Evaluation Documents

The Cadmus team used the documents listed in Table 14 to inform the impact evaluation.

<table>
<thead>
<tr>
<th>Document Type</th>
<th>Information and Document Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project List</td>
<td>Independent Electricity System Operator. “Swimming Pool Efficiency Project List (Clean) 04242018.1.”</td>
</tr>
<tr>
<td>Submission Form</td>
<td>Template submission form with programmed information:</td>
</tr>
<tr>
<td></td>
<td>• Toronto Hydro. “Poolsaver Submission Form.v6.unlocked.”</td>
</tr>
<tr>
<td></td>
<td>Filled submission forms in Excel format with existing and new pool pump information:</td>
</tr>
<tr>
<td></td>
<td>• Toronto Hydro and Oakville Hydro. &quot;TH&amp;OH SwimmingPool Efficiency Project List_02232018.1.”</td>
</tr>
<tr>
<td></td>
<td>• Hydro Ottawa and Renfrew Hydro. “Audit-All Submissions 2017.”</td>
</tr>
<tr>
<td></td>
<td>• Burlington Hydro. “Poolsaver Submission Form - For the IESO.”</td>
</tr>
</tbody>
</table>

The team reviewed the documents shown in Table 15 to inform development of the data collection instruments. The IESO provided these documents on behalf of the LDCs.

<table>
<thead>
<tr>
<th>Document Type</th>
<th>Document Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant Database</td>
<td>Burlington Hydro, Hydro Ottawa and Toronto Hydro. “Swimming Pool Efficiency Program Participant Data.” 2017</td>
</tr>
</tbody>
</table>