



Swimming Pool Efficiency Program Evaluation Report

FINAL REPORT

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SUBMITTED TO:

Independent Electricity System Operator

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Acronyms

Acronym	Definition
CDM	Conservation and Demand Management
CE Tool	Cost-Effectiveness Tool
CFF	Conservation First Framework
CI	Confidence Interval
EM&V	Evaluated Measurement and Verification
HOU	Hours of Use
IDI	In-depth Interview
IESO	Independent Electricity System Operator
IF	Interim Framework
ISR	In-Service Rate
LDC	Local Distribution Company
LED	Light-emitting Diode
LUEC	Levelized Unit Energy Cost
MW	Megawatt
MWh	Megawatt-hour
NTG	Net-to-Gross
PAC	Program Administrator Cost Test
PIA	Prescriptive Per Unit Input Assumption
PY	Program Year
RR	Realization Rate
TRC	Total Resource Cost Test
TRM	Technical Reference Manual

Executive Summary

NMR Group, Inc. (NMR), in partnership with subcontractor, Nexant, Inc., (collectively, “the NMR team”) and under contract to the Independent Electricity System Operator (the IESO), performed an evaluation of the Swimming Pool Efficiency Program.

PROGRAM DESCRIPTION

The Swimming Pool Efficiency Program was a locally delivered program offered by Hydro Ottawa and ten other participating LDCs.¹ It provided eligible residential customers with rebates at the time of purchase to install energy-efficient variable-speed pool pumps. The program was promoted and delivered through program-qualified service vendors who replaced constant-speed pumps with variable-speed pumps for existing in-ground pools. It was available to customers between the fall of PY2019 and the end of PY2020.

EVALUATION GOALS AND OBJECTIVES

The Swimming Pool Efficiency Program evaluation sought to address several research goals and objectives, as follows:

- Verify energy and demand savings;
- Estimate realization rates (RRs) and net-to-gross (NTG);
- Conduct cost-effectiveness analyses;
- Estimate the avoided greenhouse gas (GHG) emissions;
- Review 8,760 load shapes (benchmarking only); and
- Perform a limited process evaluation.

¹ Other participating LDCs include Milton Hydro Distribution Inc., Halton Hills Hydro Inc., Energy+ Inc., Kitchener-Wilmot Hydro Inc., Waterloo North Hydro Inc., Burlington Hydro Inc., Niagara Peninsula Energy Inc., Welland Hydro-Electric System Corp., Oakville Hydro Electricity Distribution Inc., and Alectra Utilities.

RESULTS

The impact evaluation results for the Swimming Pool Efficiency Program are displayed in [Table 1](#). The overall gross RR is 99% for energy savings and 100% for demand savings. The overall net RR is 71.1% for energy savings and 72.1% for demand savings.

Table 1: Swimming Pool Efficiency Program Results

Metric	Units	Evaluated
Participation	Homes*	1,402
Reported Energy Savings	MWh	4,814
Reported Demand Savings	MW	1.171
Gross Energy RR		99%
Gross Demand RR		100%
Gross Verified Energy Savings	MWh	4,787
Gross Verified Demand Savings	MW	1.167
Net Energy RR		71.1%
Net Demand RR		72.1%
Net-to-Gross Ratio (NTG) (Energy)		71.5%
Net-to-Gross Ratio (NTG) (Demand)		72.3%
Net Verified Annual Energy Savings (First Year)	MWh	3,422
Net Verified Annual Demand Savings (First Year)	MW	0.844
Net Verified Annual Energy Savings (PY2022)	MWh	3,422
Net Verified Annual Demand Savings (PY2022)	MW	0.844

*One measure installed per home

KEY FINDINGS AND RECOMMENDATIONS

The following section summarizes the Swimming Pool Efficiency Program evaluation’s key findings and recommendations. [Section 8](#) presents these key findings and recommendations in greater detail.

Finding 1: Limited information collected and tracked in the tracking database. A review of the tracking database revealed that limited measure information is currently being captured. The database does not track some of the key submission form input parameters used in the calculations of the savings – such as pre and post operating hours, post-installation pump speeds and power, and pool volume. These additional input parameters are recorded in a separate file by the LDCs but are not provided to IESO during reporting. However, these input parameters were requested during the evaluation and were provided by the LDCs which were then used in the savings verification.

- Recommendation 1.** Standardize the submission form input parameters for the LDCs and require their inclusion in the tracking database during reporting. Embedding the savings algorithm in the tracking database to use these input parameters to verify the reported savings will reduce future evaluation costs and allow for early identification of data-related issues.

Finding 2: The horsepower of installed pumps is marginally greater than the pumps they replaced. For 80% of the sampled sites, the NMR team found that the horsepower of the installed variable-speed pump was marginally greater than the horsepower of the pump it replaced. Installing the same size variable-speed pump as the one it replaced may result in marginally higher savings based on how they are operated.

- **Recommendation 2.** Continue the existing installation approach but implement a QA/QC process to make sure the size difference between the installed variable-speed pump horsepower and the one it replaced is not unreasonable.

Finding 3: Program free-ridership (FR) was moderately high at 28.9%, relative to historical results, which were last estimated in PY2017. The program helped about one-third (30%) of participants with upgrades they otherwise would not have been able to implement or postpone. However, over two-thirds (70%) of participants would have done the “exact same upgrade” anyway (31%), done the upgrade but scaled back on the pool pump efficiency (29%), or were unsure of what they would have done (10%). This suggests that there is still room for FR improvements in future program years.

- **Recommendation 3a.** Maintain focus on minimizing FR if the program continues in future years. Key areas to focus on include the following:
 - Identifying and targeting customers who would be unlikely to make upgrades without program support,
 - Screening customers to ensure they have not already begun implementing measures, and
 - Encouraging all participants to complete the evaluation surveys to ensure that the FR results are as representative of the true population of program participants as possible.
- **Recommendation 3b.** Encourage participants to install additional energy-efficient equipment or services beyond what is covered through the program if it is feasible for them to do so (for example, encouraging customers to have a home energy audit performed to identify other opportunities). Doing so may lead to increases in the program’s spillover (SO), which may in turn help offset FR and lead to improved net-to-gross (NTG).

Finding 4: Satisfaction with the program and its elements was relatively low across the service vendors, which suggests there is some room for improvement. Service vendors reported relatively low satisfaction (average ratings between 2.7 and 3.6 on a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied”). This suggests that there is an opportunity to address aspects that vendors were less satisfied with.

- **Recommendation 4a.** Minimize the time it takes to reimburse program service vendors for customer rebates. To avoid delays in issuing rebate payments, consider allowing vendors to submit invoices earlier in the process to help the rebate review and approval process move along more quickly.
- **Recommendation 4b.** Consider expanding on the types of marketing materials made available to service vendors to promote the program (e.g., brochures or handouts, and

templates for digital content, such as posts for social media, website content, and e-mail footers).

- **Recommendation 4c.** Assess the feasibility of allowing customers to work with the program directly, rather than requiring a program service provider manage the process.

Finding 5: There is a desire for more training amongst the program service vendors. While most service vendors received training on the rebate application process and the program rules (73% and 65%, respectively), few received any other training. This suggests that there is an opportunity to expand training topics covered if the program were to continue.

- **Recommendation 5.** Offer additional training opportunities to program service vendors on topics that will provide them with the knowledge they need to effectively support the program (for example, installation procedure/practices training, and marketing and outreach techniques).

Finding 6: Opportunities exist to improve the application process. Close to two-fifths (39%) of service vendors found the application process challenging because it involved too much paperwork or was too time consuming. This suggests that there is an opportunity to improve the program through simplifying the application process and reducing the amount of work and time it requires, which would remove potential barriers to participation.

- **Recommendation 6.** Simplify the application process for service vendors. Identify specific improvement opportunities by requesting detailed feedback on the application process from a subset of service vendors.

Finding 7: Satisfaction with the program and its elements was high overall across the participants, but there is some room for improvement. Participants reported high satisfaction (average ratings between 4.3 and 4.6 on a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied”) with various aspects the program. The one-fourth (24%) of participants who offered recommendations often mentioned that the program should improve or increase advertising, wait to conduct the follow-up survey until participants have a full season of data, and expand the program to more service vendors and equipment types (i.e., home appliances).

- **Recommendation 7a.** Identify ways to further promote the program to new participants and service vendors (such as more widespread online and print marketing campaigns from the LDCs). Support service vendors in efforts to further promote the program (refer to Recommendation 5).
- **Recommendation 7b.** Consider the timing of future evaluation surveys, if feasible, to ensure that most customers are able to use the new pump for a full season.
- **Recommendation 7c.** Explore the feasibility of offering additional energy-saving equipment at the time of the pump installation.

Finding 8: Opportunities exist to better educate customers about the capabilities of the variable-speed pool pumps.

While over four-fifths (81%) of respondents reported that the installing vendor programmed the pump's time settings, close to one-fifth (17%) programmed their own time settings. Of those who did their own programming, only about one-third (36%) received information from the installer on the best times of the day to program cleaning cycles. Additionally, participants often recommended that the program provide them with additional information or training on the new pumps. This suggests an opportunity to encourage vendors to better communicate the capabilities of variable-speed pool pumps to their customers. Doing so will give customers the confidence needed to use their pumps in the most efficient way possible.

- **Recommendation 8.** Encourage service vendors to communicate the capabilities of variable-speed pool pumps to their customers (e.g., how to use it generally, details about the best times of the day to program cleaning cycles, training on how to optimize their pool pump's schedule).

Finding 9: Efficient pool pump offerings for above-ground pools and/or whirlpools were recommended for inclusion as part of future program offerings.

LDC staff and program delivery vendor staff recommended that future program designs consider offering efficient pool pumps for above-ground pools and/or whirlpools in addition to in-ground pools given the many inquiries they had from customers.

- **Recommendation 9.** Consider the feasibility of offering variable-speed pool pump equipment to customers with above-ground pools and/or whirlpools in future program designs.

Section 1 Introduction

The Independent Electricity System Operator (the IESO) retained NMR Group, Inc. (NMR), in partnership with subcontractor, Nexant, Inc., (collectively, “the NMR team”) to conduct an evaluation of its Low Income, First Nations, and Residential Local programs and pilots offered under the Interim Framework (IF). This report includes results, findings, and recommendations specific to the Swimming Pool Efficiency Program.

1.1 EVALUATION GOALS AND OBJECTIVES

The Swimming Pool Efficiency Program evaluation sought to address several research goals and objectives, including the following:

- Verify energy and demand savings with a 90% level of confidence at 10% precision for the program;
- Estimate realization rates (RRs) and net-to-gross (NTG);
- Conduct cost-effectiveness analyses;
- Estimate the avoided greenhouse gas (GHG) emissions from electricity savings using the *IESO Cost Effectiveness (CE) Tool*;
- Review 8,760 load shapes used in the programs and determine if they are representative of the seasonal energy savings pattern (benchmarking only); and
- Conduct a limited process evaluation by addressing key research questions of interest to the program.

1.2 PROGRAM DESCRIPTION

1.2.1 Design and Delivery

Under the IF, the Swimming Pool Efficiency Program was a locally delivered program offered by Hydro Ottawa and ten other participating LDCs.² Each LDC was responsible for managing participant and program-qualified service vendor activity in their respective service territory and for using LDC staff or program delivery vendor staff at their discretion. Program-qualified vendors needed to hold Class 5 or 12 membership in the Pool and Hot Tub Council of Canada (PHTCC), complete on-line training, and pass a certification examination with the participating LDC. The PHTCC is an association representing the top companies that make up the pool and spa industry in Canada.

² Other participating LDCs included Milton Hydro Distribution Inc., Halton Hills Hydro Inc., Energy+ Inc., Kitchener-Wilmot Hydro Inc., Waterloo North Hydro Inc., Burlington Hydro Inc., Niagara Peninsula Energy Inc., Welland Hydro-Electric System Corp., Oakville Hydro Electricity Distribution Inc., and Alectra Utilities.

The program provided eligible residential customers with \$400 rebates at the time of purchase to replace their constant-speed swimming pool pumps with variable-speed swimming pool pumps for existing in-ground pools. It was promoted and delivered through program-qualified service vendors to help customers reduce their energy consumption and costs. The primary goals and objectives of the program were to help customers reduce their home's electricity consumption and improve its energy efficiency by reducing the cost of replacing constant speed pumps with variable-speed pumps.

1.2.2 Eligibility

The program was open to all residential customers of participating LDCs who owned, rented, or leased a detached, or semi-detached single-family home with an in-ground pool and constant-speed pool pump. The pumps had to be installed by a program-qualified service vendor.

1.2.3 Measures

The Swimming Pool Efficiency Program offered ENERGY STAR® certified variable-speed swimming pool pumps to replace constant-speed swimming pool pumps for existing in-ground pools to eligible customers.

Section 2 Methodology

A summary of the impact and process evaluation methodologies is presented in this section. Detailed descriptions of these methodologies are provided in [Appendix A](#).

2.1 IMPACT EVALUATION METHODOLOGY

To complete the impact evaluation, the NMR team performed various evaluation activities, including a review of the program tracking data and engineering desk reviews. The NMR team used the results from these evaluation activities to calculate the RRs to compare evaluated savings and reported savings.

The following subsections provide context about each activity. A detailed description of the impact methodology is provided in [Appendix A.1](#).

2.1.1 Program Tracking Database Review

The NMR team analyzed the participant database to assess the quality of the data and identify any data gaps. The NMR team then used the data to develop a sampling plan for desk reviews. The NMR team also conducted a comprehensive review of the program tracking database to identify savings discrepancies and other issues that impact the accuracy of reported savings.

2.1.2 Secondary Data Review of TRMs

The NMR team reviewed the previous Swimming Pool Program impact evaluation report that was completed for the 2017 program year. That report covered a detailed review of the algorithms used by the LDCs to calculate the savings. Since a thorough review was conducted during the previous evaluation and was found to be reasonable, the NMR team did not repeat the process.

The vendors used a submission form that had the algorithm embedded in it. The submission form took inputs, such as the nameplate horsepower, pool pipe diameter, and reported daily operating hours, for the existing pump to calculate the energy factor and flowrate.³ These values were used in calculating the existing daily energy use.

Similarly for the new variable-speed pump, the vendor input the power draw and operating hours for up to three different speeds. These values were used to calculate the proposed daily energy use. The difference in the existing and proposed daily energy use multiplied by the number of days the pool was open is the annual energy savings.

³ Energy factor and flowrate are calculated using the inputs in the submission form and references from Savings Calculator for ENERGY STAR Certified Inground Pool Pumps.

2.1.3 In-service Rate (ISR) and Hours of Use (HOU) Analysis

The NMR team surveyed the program participants to determine ISRs to verify the number of measures that were actually installed and used on the premise. The results for the ISR aspect of the participant surveys are discussed in [Section 3.3](#).

2.1.4 Engineering Desk Reviews

The engineering desk reviews consisted of a review of a sample of 77 projects that the NMR team selected as part of the program tracking database review process. The LDCs then provided the NMR team with documentation for the sampled projects. The NMR team conducted a thorough review of the detailed project documents, which consisted of application forms, invoices, existing pump nameplate photos, and the installed pump nameplate photos. For the sampled sites, one LDC also provided a spreadsheet containing input parameter details from the submission forms. However, the actual submission forms were not available for review in the project documentation.

2.2 NET SAVINGS ESTIMATE METHODOLOGY

To calculate the net verified savings, the NMR team calculated the portion of gross verified savings attributable to the Swimming Pool Efficiency Program. The NMR team determined the net verified savings by multiplying the gross verified savings by the NTG ratio, as shown in [Equation 1](#).

Equation 1: Net Verified Savings

$$Savings_{net} = Savings_{verified} \times NTG$$

Where:

$Savings_{net}$ = Net savings impact (kW or kWh)

$Savings_{verified}$ = Verified savings (kW or kWh)

NTG = Net-to-gross

To estimate the direct influence of the program in generating net verified energy savings, the NMR team implemented attribution surveys to collect inputs used to calculate free-ridership (FR) and spillover (SO) rates. Both FR and SO are represented as percentages of the program’s total reported savings and are estimated for each survey respondent. The NMR team then aggregated the results to develop total FR and SO estimates and weighted them by the percent of savings associated with each respondent’s completed energy-efficiency project. Therefore, respondents with comparatively larger projects influence the total estimates more so than smaller projects, allowing for results that are reflective of the responding participants and their associated impact on the program.

FR refers to the program savings attributable to free riders, who are program participants who would have implemented a program measure or practice in the program’s absence. SO refers to additional reductions in energy consumption and demand due to program influences beyond those directly associated with program participation. SO represents installations of energy-

efficient equipment that were influenced by the participant’s experience with the program and that were completed without receiving any program rebates or other financial support.

The NTG ratio is defined by Equation 2, where FR is the participant FR percentage, and SO is the participant SO percentage.

Equation 2: Net-to-gross Ratio

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

The NMR team calculated the FR and SO for a single rebated project for each sampled participant. The NMR team then combined these results to develop overall FR, SO, and NTG values.

Additional details regarding the NTG evaluation methodology can be found in Appendix A.3.

2.3 REALIZATION RATE

The evaluation desk review activities result in adjustment factors, or realization rates (RR), calculated using Equation 3. The realization rate is the ratio of verified savings to reported savings.

Equation 3: Realization Rate

$$RR = \frac{\sum \text{Sample Verified Savings}}{\sum \text{Sample Reported Savings}}$$

2.4 COST-EFFECTIVENESS EVALUATION

The NMR team completed the cost-effectiveness analysis in accordance with the IESO requirements as set forth in the *IESO CDM Energy Efficiency Cost Effectiveness Guide*⁴ and using *IESO’s CDM Energy Efficiency Cost Effectiveness Tool* (referred to as the *IESO CE Tool in this report*). The energy and demand savings results from the impact evaluation were inputs into the IESO CE Tool. Other inputs included the administrative cost and rebate information supplied from IESO. A more detailed description of the cost-effectiveness methodology is provided in Appendix A.2

2.5 MEASURE-LEVEL 8760 LOAD SHAPE REVIEW

The NMR team reviewed the load shape entered in the IESO’s CE Tool submitted as part of the program’s business case, which was the “PSP-Consumer-Residential-Swimming_Pool_Pumps” load shape. The NMR team also reviewed the CE Tool’s full measure library to determine which of the library’s other load shapes were applicable to the program’s measure.

The NMR team analyzed IESO’s swimming pool pump load shape from several different perspectives to determine its reasonableness and appropriateness:

⁴ *Conservation & Demand Management Energy Efficiency Cost Effectiveness Guide*, Independent Electricity System Operator, April 1,2019, <http://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation/EMV/2019/IESO-CDM-Cost-Effectiveness-Test-Guide.pdf?la=en>

- Checked for duplicity among other existing IESO load shapes
- Conducted a visual inspection to examine load shapes across 24-hour, monthly, and seasonal timeframes
- Compared IESO load shapes to other load shapes available from other jurisdictions, including the following:
 - California Database for Energy-Efficiency Resources (DEER)
 - Electric Power Research Institute (EPRI)
 - U.S. Department of Energy’s Office of Energy Efficiency & Renewable Energy (DOE EERE)
 - Illinois Statewide Technical Resource Manual (IL TRM)
- Recommended changes to the IESO load shapes

The load shape review included a two-part visual inspection to ensure that the load shape was reasonable and appropriate for the represented end use. The first inspection examined just the IESO load shape, breaking out 24-hour load profiles for each month of the year. This inspection enabled the NMR team to quickly observe outliers in the load shapes for further investigation.

A second visual approach involved comparing each IESO load shape against equivalent load shapes from other sources. This review served multiple functions: (1) provided context from other available load shape libraries, (2) highlighted outliers in the IESO load shape, and (3) provided a reference source for recommended IESO load shape updates.

2.6 PROCESS EVALUATION METHODOLOGY

2.6.1 Sampling, Interviews, and Surveys

The process evaluation focused on program design and delivery. The NMR team evaluated program processes through in-depth interviews (IDIs) and surveys with relevant program actors, including LDC staff, service vendors, and participants. For each respondent type, the NMR team developed a customized interview guide or survey instrument to ensure responses produced comparable data and to allow the NMR team to draw meaningful conclusions.

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

Table 2: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Completed	Population	90% CI Error Margin
LDC Program Staff	Phone IDI	1	1	0%
Program Delivery Vendor Staff	Phone IDI	1	1	0%
Service Vendors	Web Survey	40	65	8.2%
Participants	Web Survey	416	1,183	3.3%

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

2.6.2 LDC and Program Delivery Vendor Staff Interviews

The NMR team interviewed one LDC staff member and one program delivery vendor staff member to obtain a detailed understanding of the Swimming Pool Efficiency Program. The program delivery vendor interviewed represented four of the participating LDCs. To complete these interviews, the IESO evaluation, measurement, and verification (EM&V) provided the NMR team with e-mail introductions to the appropriate LDC and program delivery vendor staff members. The NMR team then followed up directly to schedule and complete the interviews. Interview topics for the LDC staff and program delivery vendor staff addressed program roles and responsibilities, program design and delivery, program measurement and tracking, market actor engagement, customer participation, market impact, program strengths and weaknesses, and suggestions for improvement.

2.6.3 Service Vendor Survey

The NMR team e-mailed all 65 unique service vendors in the sample to request their participation in the survey. Forty service vendors responded to this request and completed the survey. The NMR team developed the sample list used to complete these service vendors surveys using a list of contacts provided to the team by the LDC staff. Survey topics for the service vendors addressed history with the program, program awareness, motivations for participation, training and education received, marketing and outreach to customers, the application process, FR, SO, satisfaction, program barriers, suggestions for program improvement, and firmographics.

2.6.4 Participant Survey

The NMR team e-mailed all 1,183 unique participants in the sample to request their participation in the survey. A total of 433 participants responded to this request and 416 of them completed the survey. The NMR team developed the survey sample from program records provided by the IESO EM&V staff. Survey topics for participants addressed ISRs, HOU, how participants learned about and applied to the program, motivations for doing the upgrades, education and support provided by the service vendor, satisfaction with various aspects of the program process, suggestions for program improvement, and likelihood to recommend the program.

Section 3 Impact Evaluation

The following subsections outline the impact evaluation results. Details regarding the impact methodology can be found in [Section 2](#) and [Section A.1](#).

3.1 HIGH-LEVEL RESULTS

3.1.1 Net Verified First Year Energy and Demand Savings Key Results

- The overall verified gross program RR is 99% for energy savings in PY2020.
- The overall verified gross program RR is 100% for demand savings in PY2020.
- The ISR for the pool pump measure was 97%.

3.2 NET VERIFIED AND REPORTED SAVINGS ASSESSMENT

3.2.1 Program Level Savings

[Table 3](#) presents reported and net verified first year energy and demand savings for the entire program. Program-level results are representative of 1,402 homes, 19 of which were completed in 2019 and 1,383 of which were completed in 2020. The program net RR is 71.1% for energy savings and 72.1% for demand savings.

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

Metric	Energy (MWh)	Demand (MW)
<i>PY2019 Reported Savings</i>	59	0.018
<i>PY2020 Reported Savings</i>	4,755	1.153
Total Reported Savings	4,814	1.171
<i>PY2019 Net Verified Annual Energy Savings (First Year)</i>	42	0.013
<i>PY2020 Net Verified Annual Energy Savings (First Year)</i>	3,380	0.831
Total Net Verified Annual Energy Savings (First Year)	3,422	0.844
Overall Net RR	71.1%	72.1%

3.3 IN-SERVICE RATES AND HOURS OF USE

Nearly all (97%) surveyed participants confirmed that the variable-speed pool pump that was installed as part of the Swimming Pool Efficiency Program is still installed and functional. The remaining 3% did not know or refused to answer. There were no cases where the pool pump was uninstalled or non-functional.

[Table 4](#) displays the average number of hours per day that variable-pool pumps were used. Participants reported that, on average, their variable-speed pool pump are in use 20 hours per day. Over three-fifths (61%) of surveyed participants reported that their variable-speed pool pump was in use 24 hours per day. Similarly, of the four-fifths (83%) of surveyed service vendors who

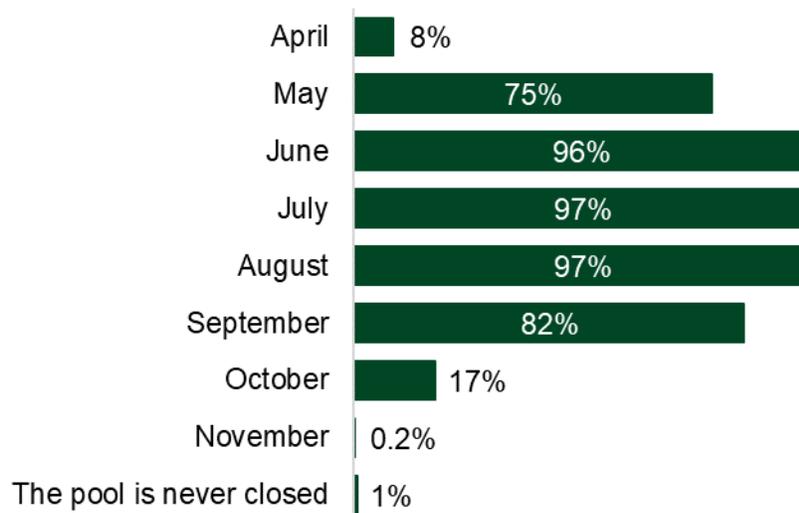
provided an estimate of how many hours per day the variable-speed pool pumps were in use at participating customer sites, over five-sixths (88%) estimated that the pumps were in use 24 hours per day. Please note that the usage estimates presented in Table 4 do not consider how the variable-speed pumps were programmed, such as the speed or frequency at which they were programmed to operate. Although the pumps were determined to operate an average of 20 hours per day, it is likely that they are operating at lower speeds or operating with less frequency, resulting in lower power draws. Future evaluation efforts may benefit from requesting additional information from program service vendors about how they typically program the variable-speed pumps.

Table 4: Average Hours per Day of Variable-Speed Pool Pump Use (n=404)

Hours per Day of Use	
Mean	20
Median	24

Figure 1 displays which months participants’ pools were in use. Participants reported primarily using their pools from May through September.

Figure 1: Months When Pool is in Use (n=404, Multiple Response)*



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

3.4 NET-TO-GROSS

The NTG evaluation results are presented in the following subsections. Appendix B presents additional details.

3.4.1 Net-to-Gross Results

Table 5 presents the results of the PY2020 Swimming Pool Efficiency Program NTG evaluation. The NMR team targeted and achieved confidence and precision levels of 90% and 10% when

calculating the program’s NTG. The following subsections summarize the completed analyses for the interpretation of these values.

Table 5: NTG Results

Unique Participants	NTG Responses	Savings Weighted FR	SO, Energy	SO, Summer Demand	NTG, Energy	NTG, Summer Demand	Energy Precision
1,183	416	28.9%	0.4%	1.2%	71.5%	72.3%	2.1%

3.4.2 Key Findings

- Participant feedback indicates moderately high levels of FR at 28.9%.
 - The program helped about one-third (30%) of participants with upgrades they otherwise would not have been able to implement (24%) or would have had to postpone (6%).
 - Over two-thirds (70%) of participants would have done the “exact same upgrade” anyway (e.g., they would have installed a pump with the same efficiency at the same time) (31%), done the upgrade but scaled back on the pool pump efficiency (29%), or were unsure of what they would have done (10%). This suggests that there is still some room for FR improvements in future program years.
 - The availability of the program rebate and the recommendations from program service vendors had the greatest influence on the respondents’ decision to participate in the program (75% and 70%, respectively).

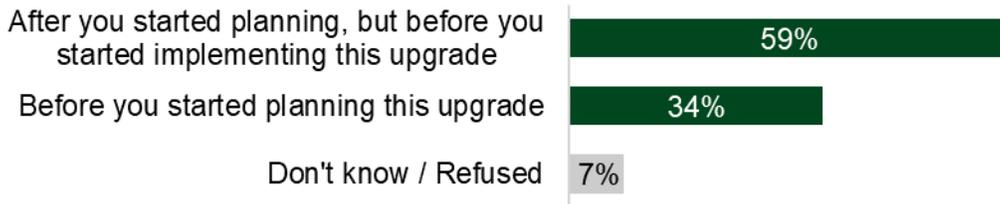
Participation in the program resulted in a relatively low SO at 0.4%, which somewhat helped to offset the FR. Close to one-twentieth (3%) of respondents installed equipment with attributable SO savings.

3.4.3 Free-ridership

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

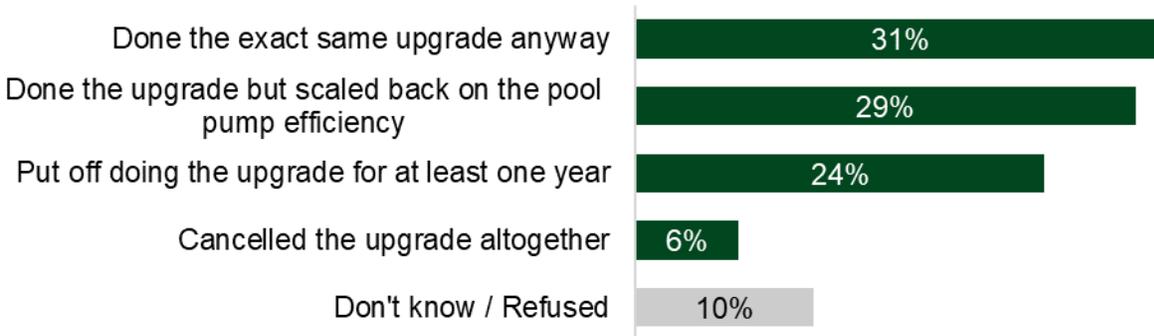
Nearly three-fifths (59%) of respondents stated that they first learned they could receive a rebate through the Swimming Pool Efficiency Program after they first started planning the upgrade, but before they started implementing the upgrade (Figure 2). Over one-third (34%) learned about the rebate before they started planning the upgrade. This may suggest that the program was influential in some but not all of these respondents’ decisions to begin the upgrade. While responses to this question did not directly impact the FR score, they provided additional context for understanding the point during the process when participants became aware of the program.

Figure 2: When Participants First Learned About the Program (n= 416)



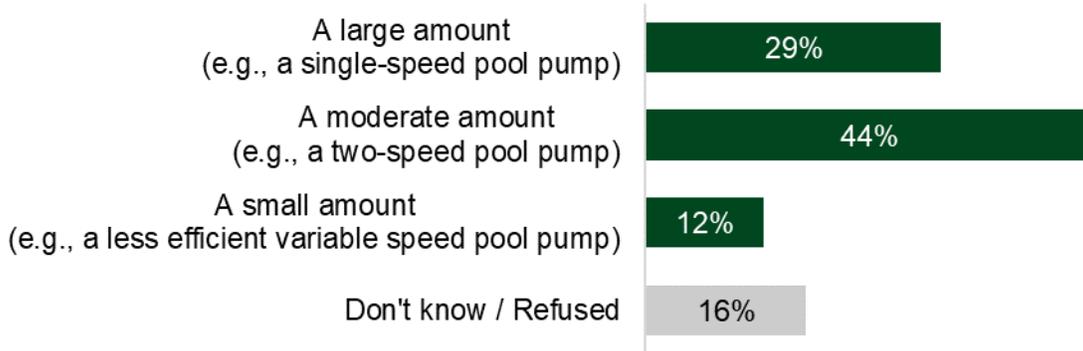
Respondents provided feedback about what they would have done in the program’s absence (Figure 3). Overall, their responses suggest moderate FR as over two-thirds (70%) would have done the “exact same upgrade anyway” (31%), would have done the upgrade but scaled back on the efficiency (29%), or were unsure of what they would have done (10%) all of which is indicative of partial or full FR for these respondents. Less than one-third (30%) of the remaining respondents would have put off (24%) or cancelled (6%) the upgrade without the program’s support. Responses from this participant intent question were factored into the FR analysis.

Figure 3: Actions in Absence of Program (n=416)



Respondents who indicated that they would have installed less energy-efficient pools pumps described the extent to which they would have reduced the pool pump’s efficiency (Figure 4). Close to three-fourths (73%) of these respondents would have scaled it back by a moderate or large amount. These results indicate that the program allowed these participants to increase the efficiency of their pool pump projects beyond what they would have been able to upgrade it to on their own. The NMR team did not use this question to calculate the FR score but did use it to provide additional context around participant intentions.

Figure 4: Extent to Which Pump Efficiency Would Have Been Scaled Back in Absence of Program (n=121)*



*Does not add to 100% due to rounding.

Respondents who stated they would have done the “exact same upgrade” in the program’s absence confirmed whether they would have had the funds to cover the upgrade’s entire cost without the program funding (Figure 5). Over one-half (53%) of respondents said they definitely would have had the funds to cover all of the upgrade’s costs, while about one-third (34%) said they might have had the funds. A small percentage (5%) of respondents said they definitely would not have had the necessary funds. This feedback indicates some degree of FR but also suggests that the program has likely helped a portion of these customers to complete upgrades they might not have been able to otherwise. This NMR team factored the participant intent question into the FR analysis.

Figure 5: Availability of Funds in Absence of Program (n=128)*



■ Definitely would have ■ Might have ■ Definitely would NOT have ■ Don't know / Refused

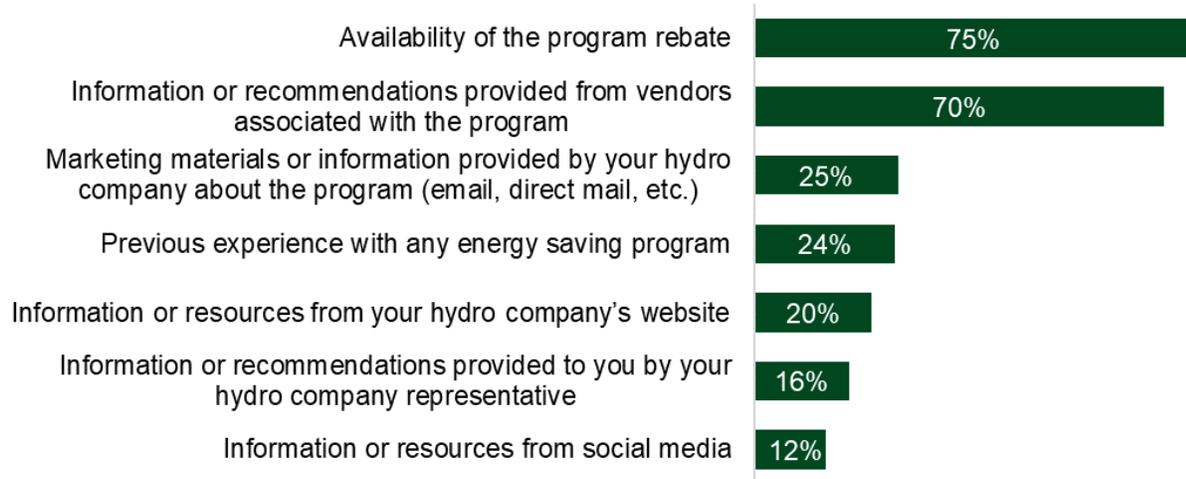
*Does not add to 100% due to rounding.

Respondents rated how influential various program features were on their decision to install an energy-efficient pool pump (Figure 6). They rated each feature’s influence on a scale from 1 to 5, where 1 meant it had “no role at all” and 5 meant it had a “great role.” The highest-rated responses were the availability of the program rebate and the recommendations from program service vendors (75% and 70% with a 4 or 5 rating, respectively). The next most-influential program features, marketing materials and previous program experience (25% and 24% with a 4 or 5 rating, respectively), were rated as influential much less often. The findings from this question emphasize the service vendors’ strength in driving the program’s engagement and highlight the opportunity to expand the program’s marketing and outreach should the program continue in the

future. The NMR team used this question, which focuses on the program’s influence, along with the prior questions about customer intentions, to estimate the FR score.

Figure 6: Influence of Program Features on Participation (n=416)

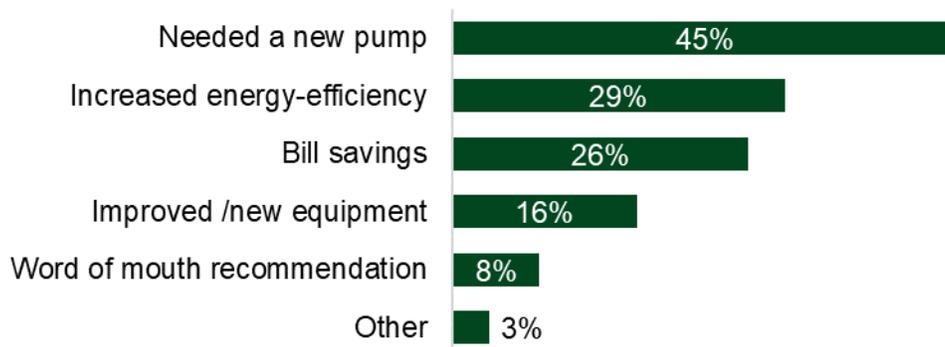
(Rating of 4 or 5 on a scale from 1 to 5)*



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

Over one-fifth (22%) of respondents reported other factors played “a great role” in influencing their household to install the energy-efficient pool pump. Respondents’ answers varied widely (Figure 7). The most common responses included needing a new pump (45%), the possibility of increased energy-efficiency (29%), and bill savings (26%).

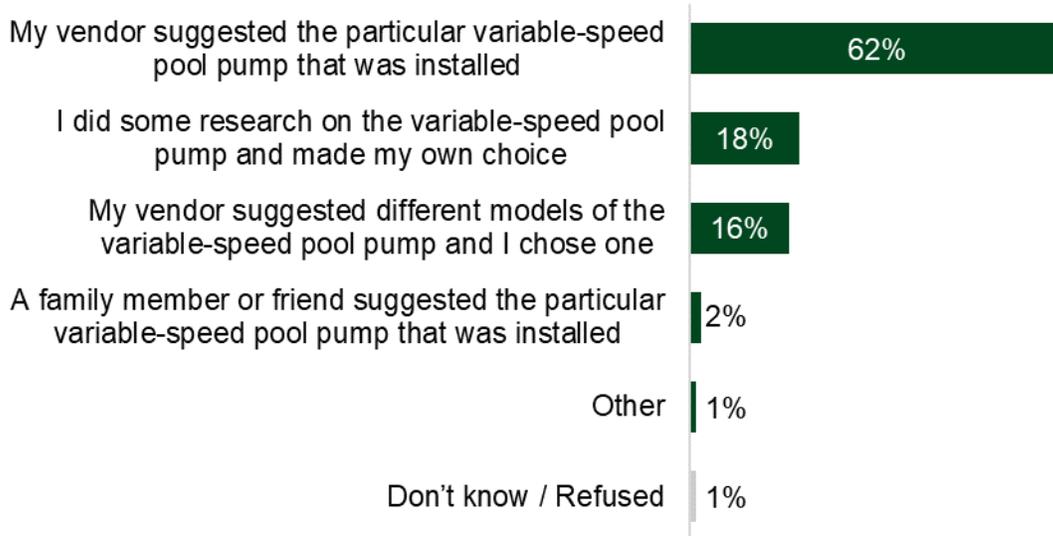
Figure 7: Other Influential Factors on Upgrade Decision (n=92; Multiple Response)*



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

As shown in [Figure 8](#), over three-fifths (62%) of surveyed participants selected the pool pump based on their service vendor’s suggestions – three times (or more) the number of participants who either made the choice based on their own research (18%), chose from a shortlist of equipment models that their service vendor provided (16%), or followed a family member or friend’s suggestions (2%). This reinforces the importance of the service vendors’ role in helping drive customers to efficient equipment decisions.

Figure 8: Equipment Selection Process (n=416)*



In summary, FR results among the Swimming Pool Efficiency Program participants indicate moderately high FR levels at 28.9%. Less than one-third (30%) of respondents would have put off or cancelled the upgrade without the program’s support, which indicates low FR among these respondents. However, over two-thirds (70%) would not have completed an upgrade, would have postponed it, or would have completed a scaled-back version of it in the program’s absence, all of which are indicative of partial or full FR for these respondents. These results suggest there is still some room for FR improvements in future program years.

3.4.4 Spillover

To estimate SO, participants provided feedback about whether they had installed any energy-efficient equipment for which they did not receive an incentive following their participation in the Swimming Pool Efficiency Program. Nearly one-tenth (8%) reported installing new equipment and close to one-twentieth (3%) reported installing equipment with attributable SO savings.

[Table 6](#) displays the types of non-incentivized equipment installed by participants after their Swimming Pool Efficiency Program project was complete. Some survey respondents installed multiple types of equipment.

Respondents rated the level of influence their participation in the Swimming Pool Efficiency Program had on their decision to install additional energy-efficient equipment. Participants rated the program’s influence on a scale from one 1 to 5, where 1 meant the program had “no influence

at all” and 5 meant the program had “great influence.” As indicated in [Table 6](#), the average influence score for most equipment types was below a 3-rating, which suggests the program was not influential on most respondents’ additional equipment installations. However, some respondents indicated that the program had an influence (a rating of 3 or higher) on their decisions to install some of the following equipment types: ENERGY STAR appliances, ENERGY STAR LEDs, lighting controls, heating equipment, cooling equipment, water heating equipment, programmable or smart thermostats, and smart power bars.

Table 6: Program Influence on Efficient Equipment Installed Outside the Program (n=33; Multiple Response)*

Type of Equipment Installed	Count of Respondents	Average Influence Score
ENERGY STAR appliance	8	2.0
ENERGY STAR LED	8	2.6
Lighting controls (lighting timers, occupancy sensors)	9	2.6
High-efficiency heating, cooling, or water heating equipment	16	1.6
Weatherstripping around doors and windows	7	1.1
Window film	1	1.0
Programmable or smart thermostat	9	2.3
Smart power bar	4	1.5
Low-flow showerhead	3	1.0
Faucet aerator	1	1.0
Windows	2	1.0

*Does not add to 33 due to multiple response.

The survey then asked participants who indicated they installed the program-influenced non-incentivized equipment a series of follow-up questions (i.e., capacity, efficiency, and annual hours of operation). These details are displayed in [Appendix B](#) and are used within the NTG algorithm to attribute SO savings to each equipment installation. SO savings were driven mainly by the installation of 67 new ENERGY STAR LEDs completed by four respondents, four new lighting controls upgrades completed by four respondents, and five new ENERGY STAR appliance upgrades completed by three respondents.

Section 4 Cost-effectiveness Evaluation

The cost-effectiveness results are presented in [Table 7](#). The program passed both the Total Resource Cost (TRC) test and the Program Administrator Cost (PAC) test because both tests had benefits greater than their respective costs.

Table 7: Program Level Cost-Effectiveness Key Metrics

Cost-effectiveness Test	Value
TRC	
TRC Costs (\$)	1,099,135
TRC Benefits (\$)	1,957,031
TRC Net Benefits (\$)	857,895
TRC Net Benefit (Ratio)	1.78
PAC	
PAC Costs (\$)	918,137
PAC Benefits (\$)	1,701,766
PAC Net Benefits (\$)	783,629
PAC Net Benefit (Ratio)	1.85
Levelized Unit Energy Cost	
\$/kWh	141.16
\$/kW	0.03

Section 5 Avoided Greenhouse Gas Emissions

The NMR team used the IESO CE Tool to calculate avoided GHG emissions. The NMR team calculated Avoided GHG emissions for the first year and for the lifetime of the measures. [Table 8](#) presents the results of these calculations.

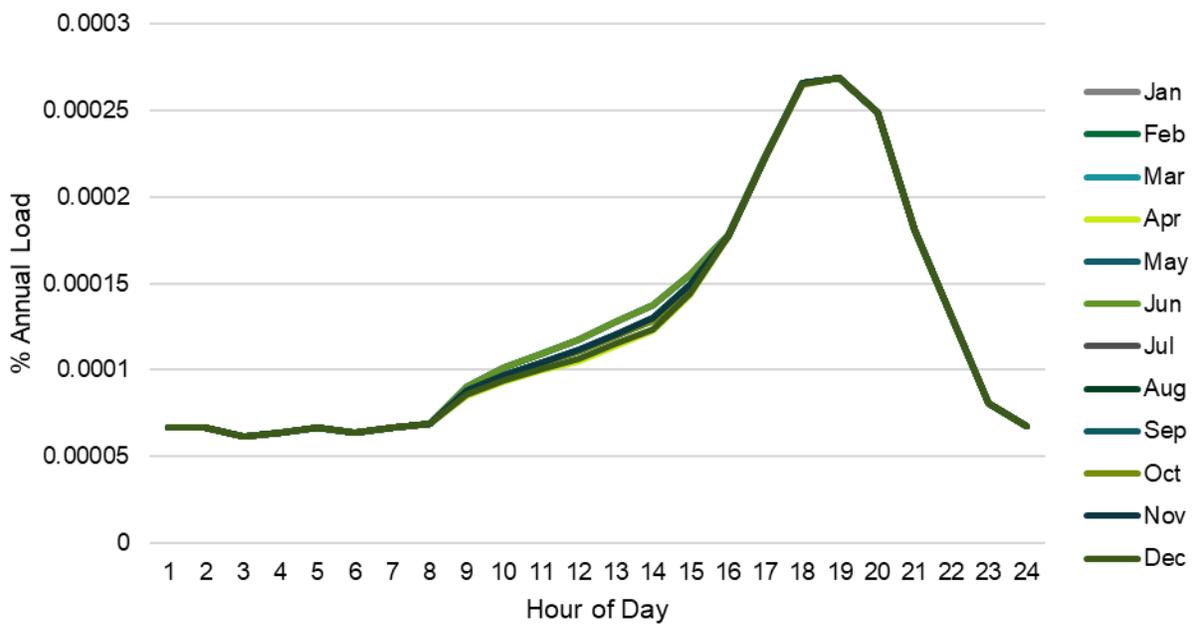
Table 8: Avoided GHG Emissions

First Year GHG Avoided (Tonnes CO ₂ equivalent)	Lifetime GHG Avoided (Tonnes CO ₂ equivalent)
371.44	5,042.66

Section 6 Measure-Level 8760 Load Shape Review

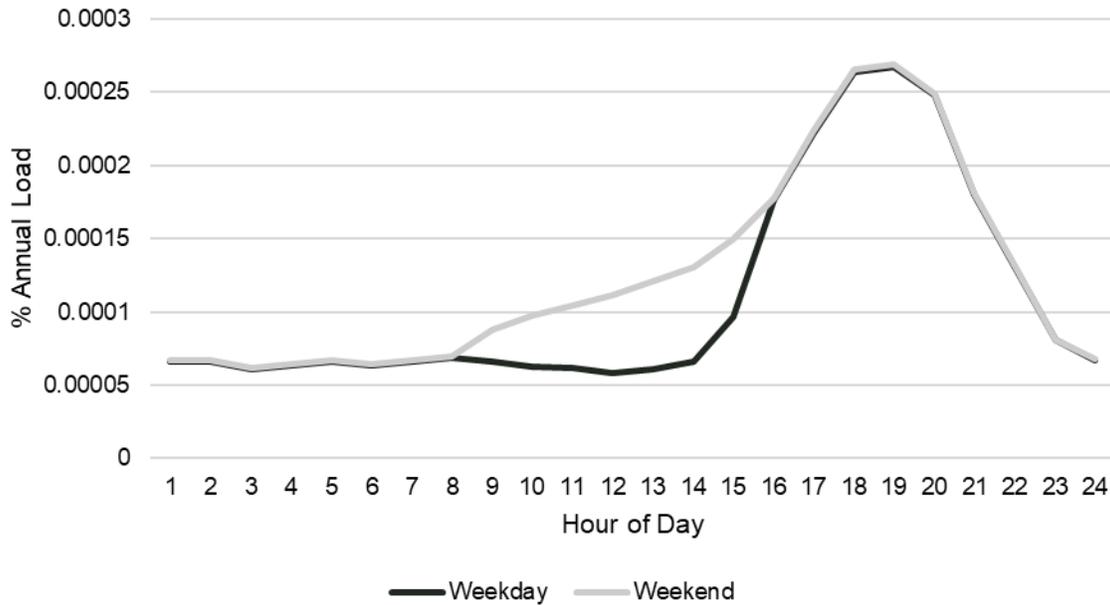
The NMR team’s review of the IESO library’s swimming pool pump load shape showed little variation in the average daily load profiles across months and seasons. [Figure 9](#) graphically displays the average 24-hour load shape for each month of the year. This finding suggests that swimming pool pumps are assumed to have consistent use throughout the entire year, which does not seem plausible. The NMR team addresses this finding and provides recommended changes in the following section of this report.

Figure 9: Average Daily Weekend Load Profiles by Month



The greatest distinction is seen in the comparison of load profiles between weekdays and weekends, where larger usage shares are observed in the late-morning and early-afternoon hours during weekend days. This finding seems reasonable given the greater expected use of residential pools during weekends. [Figure 10](#) presents average daily load profiles for swimming pool pumps on summer weekdays and weekends.

Figure 10: Average Daily Summer Load Profiles – Weekday vs. Weekend



Given the seasonal use of swimming pools, it does not seem reasonable that loads remain constant across all months/seasons of the year. Because swimming pools are primarily used during summer months (and, presumably, not at all during non-summer months), one would expect the largest share, if not all, of the annual load to be applied during summer months.

In the absence of Ontario-specific seasonal pool use data, the NMR team recommends considering a summer-only load profile, where all of the annual load is distributed across the summer season (defined as June 21 through September 22) and none of the annual load is observed during non-summer months.

Section 7 Process Evaluation

This section outlines the process evaluation results. Details regarding the process methodology can be found in [Section 2.6](#) and [Appendix A.3](#).

7.1 LDC STAFF AND PROGRAM DELIVERY VENDOR STAFF PERSPECTIVES

The following subsections highlight the feedback received from the LDC staff and Program Delivery Vendor about the design and delivery of the Swimming Pool Efficiency Program.

7.1.1 High-Level Results

High-level results from the LDC staff IDIs include the following:

- Both the LDC staff and program delivery vendor staff indicated that COVID-19 presented the greatest challenge to the program, though both interviewees indicated that the program worked well overall despite these challenges.
- The program delivery vendor reported that service vendors could not install pumps for at least four to six weeks at the beginning of pool season and LDCs could not participate in in-person events to promote the program due to COVID-19.
- Additionally, given the later than anticipated start in 2019 due to contracting challenges, the program was only effectively in market for one season leading up to the customary opening of residential pools in the spring and summer. Most installations occurred in the in the late spring and summer of 2020 following the lifting of COVID-19 lockdown restrictions.
- If the program were to be relaunched again in the future, the LDC staff recommended that the program be in market by March at the latest to allow time for service vendors to prepare and engage customers prior to the beginning of the pool season later in the spring.
- Additionally, LDC staff and program delivery vendor staff recommended that future program designs consider being inclusive of above-ground pools and/or whirlpools in addition to in-ground pools given the many inquiries they had from customers about their eligibility.

7.1.2 Program Design

The Swimming Pool Efficiency Program, branded as “the Poolsaver Program” to customers, followed a similar program design and delivery approach as the program had under prior frameworks. This program was previously offered by approximately 12 LDCs in Ontario under local or regional programs. The program was administered by the participating LDCs with two LDCs operating this type of program for the first time. One LDC, Hydro Ottawa, served as the lead LDC, coordinating with the IESO, program delivery vendor, other participating LDCs, and other market actors as needed. The program was typically delivered by the LDCs themselves, though some LDCs hired a program delivery vendor to support the delivery, with some LDCs coordinating to use the same program delivery vendor. The program began delivery under the IF in the fall of 2019, with most program activity occurring in the late spring and summer of 2020 as COVID-19 restrictions eased.

LDC program staff and program delivery vendor staff both indicated that the program worked well overall despite the challenges associated with COVID-19. LDC staff reported that the contracting phase involved some challenges as it took some time to come to consensus on contracting language amongst all the participating LDCs. Additionally, as the LDCs were winding down the program activities associated with the prior Conservation First Framework (CFF), employee turnover took place, which meant that some institutional knowledge about the prior iterations of the program were not retained. However, LDC staff stated that as the program started up, there was a lot of collaboration amongst the LDCs, especially amidst the backdrop of COVID-19 .

7.1.3 Service Vendor Engagement

The mid-market program approach relied on program-qualified service vendors to engage with and service customers. The service vendors were responsible for working with the customers to sign the participation agreements, installing the program-qualifying equipment, and submitting all program materials to the LDCs.

Program-qualified service vendors were required to hold a Class 5 or 12 membership with the Pool and Hot Tub Council of Canada (PHTCC), complete an online training, and to pass a certification examination with the participating LDC. The LDC staff said that vetting service vendors in this way set the program up for successful delivery. They also noted that there was a sufficient number of participating service vendors available to support the program.

LDC staff stated that many, but not all, of the service vendors had experience with the program from prior years. Regardless, the program offered all service vendors training and support. The program coordinated with the PHTCC to provide a training webinar at the beginning of the program, which was recorded and could be viewed on-demand. LDC staff encouraged new vendors to engage with the PHTCC for additional installation training support on an as-needed basis. The program delivery vendor noted that some LDCs that were newer to the program provided additional training and support to their service vendors, who were also new to the program, to address questions as they arose.

During COVID-19 lockdown, the program could not complete follow-up site visits to verify installations, which is a common quality assurance practice. Instead, the program required service vendors submit before and after pictures of the removed and newly installed pool pumps.

Additionally, the LDC staff carefully reviewed all program materials submitted by the service vendors or the program delivery vendors before invoices for rebates were issued to the service vendors and before participation data was passed on to the lead LDC.

7.1.4 Customer Engagement

The program's service vendors directly engaged with customers to inform them about the program. The program provided the service vendors with marketing materials, such as brochures for both customers and interested vendors, and door hangers.

The LDCs conducted additional marketing to promote the program. In some instances, the program provided materials from prior iterations of the program that were re-purposed and customized by LDCs who added their own branding. Some LDCs put significant effort into marketing, while others relied on service vendors to perform most of the marketing. Examples of marketing materials and activities developed or undertaken include news releases; a program website; newsletter content; customer e-mails; advertisements in the Pools, Spas & Patios Magazine; window cling graphics; and social media postings.

LDC staff stated that, during COVID-19, they tried to be sensitive to promoting a program that did not necessarily serve customers who were most in-need or affected by COVID-19. They also noted that the lack of face-to-face opportunities to promote the program during the lockdowns made it difficult for LDCs and service vendors to promote the program to customers.

7.1.5 Barriers and Opportunities

Both the LDC staff and program delivery vendor staff indicated that COVID-19 presented the greatest challenge to the program. LDC staff indicated that, during the pandemic, the program was, understandably, not always the highest priority for the LDCs and service vendors. They were more concerned with managing their own operations and paying employees. The program delivery vendor reported that service vendors could not install pumps for four to six weeks at beginning of pool season and LDCs could not participate in in-person events to promote the program due to COVID-19. While the program did not reach participation targets, LDC staff and program delivery vendor staff stated that the participation levels were reasonable and met their expectations given the challenges experienced.

Additionally, given the later than anticipated start in 2019 due to contracting challenges, the program was only effectively in market for one season leading up to the customary opening of residential pools in the spring and summer, with most installations occurring in the late spring and summer of 2020 following the lifting of COVID-19 lockdown restrictions.

LDC staff stated that program delivery was particularly challenging for the two LDCs who were operating the program for the first time. Experienced LDCs and experienced service vendors ultimately saw higher participation than those who were inexperienced. LDC staff stated that if the program misses reaching a customer before their pool is open for the season, they are less likely to participate later in the season. They noted that it took some time for the new service vendors to learn this.

If the program were to be relaunched again in the future, the LDC staff recommended that the program be in market by March at the latest to allow time for service vendors to prepared and

ready to engage customers prior to the launch of the pool season later in the spring. Program delivery vendor staff stated that it is important for the service vendors to be informed of any future program launches the season prior to the new program's launch as they need enough lead time to increase their stock and sell through their other inventory during the prior pool seasons.

Program delivery vendor staff noted that not all service vendors wanted to become a member of the PHTCC – a requirement to become a program-qualified vendor – as it was additional expense to them.

Additionally, LDC staff and program delivery vendor staff recommended that future program designs consider being inclusive of above-ground pools and/or whirlpools in addition to in-ground pools given the many inquiries they had from customers about their eligibility.

Program delivery vendor staff noted that some LDCs achieved program milestones earlier than others but that funds were only provided by the IESO when others reached their own milestones. They recommended changing this process to allow individual LDCs to receive their funds as they hit their individual milestones.

Finally, the LDC staff stated that it can be confusing for customers when not all LDCs participate in a given program. Program delivery vendor staff reported receiving many calls from ineligible customers at the start of the program. To help alleviate this market confusion, they recommended that LDCs who share borders with each other consider offering the program when possible.

7.2 SERVICE VENDOR PERSPECTIVES

The following subsections highlight the feedback received from the Swimming Pool Efficiency Program service vendor survey. Results are presented either as percentages or counts, depending on sample size. [Appendix B](#) presents additional details.

7.2.1 High-Level Results

High-level results from the service vendor survey include the following:

- On average, service vendors completed 56 pool pump projects in 2020, 25 of which went through the Swimming Pool Efficiency Program.
- Pool pump projects that went through the program represented, on average, 6% of service vendors' total sales in 2020.
- Service vendors typically learned about the Swimming Pool Efficiency Program through the PHTCC (73%) and from variable-speed pool pump manufacturers (15%).
- While most service vendors received training on the rebate application process and the program rules (73% and 65%, respectively), few received any other training, suggesting an opportunity to expand training topics covered if the program were to continue.
- Service vendors predominately promote variable-speed pool pumps through digital mediums, including social media posts (40%), e-mails (38%), and websites (33%). Service vendors would like the program to help them promote the program by providing additional marketing materials, including brochures or handouts (20%) and templates for digital content (13%), such as posts for social media, website content, and e-mail footers.

- Service vendors found the application process challenging because it involved too much paperwork or was too time consuming (39%). This suggests that there is an opportunity to improve the program through streamlining the application process and reducing the amount of work and time it requires, which would remove potential barriers to participation.
- Service vendors estimated that approximately three-fifths (62%) of residential customers who are only in need of a motor replacement opt to replace their pool pump entirely. While this is a relatively high percentage, it indicates there is still room in the market for the program to help customers upgrade to variable-speed pool pumps.
- Service vendors reported mid-level or lower levels of satisfaction (average ratings between 2.7 and 3.6 on a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied”), which indicates the program should consider addressing aspects of the program that vendors were less satisfied with, such as LDC training, LDC support, LDC marketing materials, the rebate application process, and the speed of receiving rebate payments, should the program continue in the future.

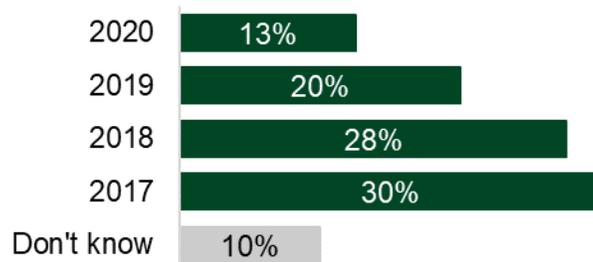
7.2.2 Service Vendor Profile

Responding service vendors indicated having an average of nine full time employees and ten part time employees working at their company. The average number of years respondent companies had been in business was 30.

7.2.3 Program Experience

Figure 11 displays the year respondents began working with the program or an earlier version of it under prior frameworks. Close to three-fifths (58%) began working with the program in 2018 or earlier.

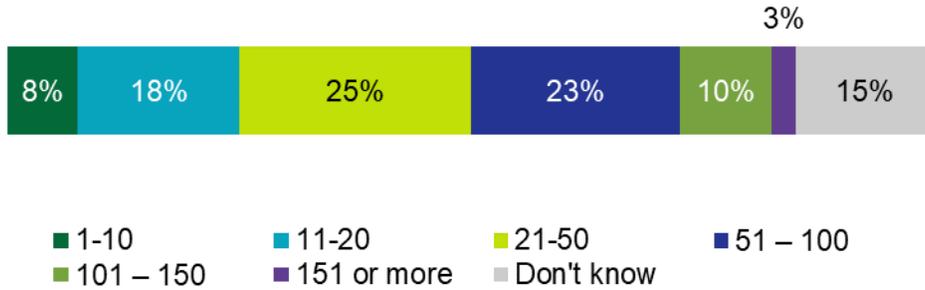
Figure 11: Year Began Working with the Swimming Pool Efficiency Program (n=40)*



*Does not add to 100% due to rounding.

Figure 12 displays the total number of projects respondents reported completing in 2020, regardless of whether they went through the Swimming Pool Efficiency Program. About one-half (51%) of service vendors reported completing 50 or fewer projects in 2020. On average, service vendors completed 56 pool pump projects in 2020.

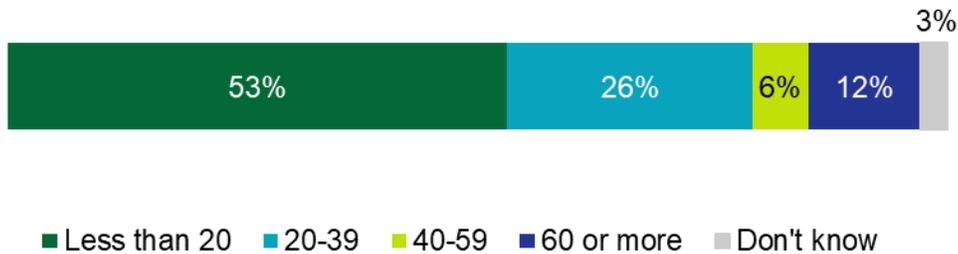
Figure 12: Total Number of Pool Pump Projects Completed in 2020 (n=40)*



*Does not add to 100% due to rounding.

Figure 13 displays the number of projects respondents reported completing in 2020 through the Swimming Pool Efficiency Program. About one-half of service vendors (53%) reported completing 20 pool pump projects or fewer through the program in 2020. On average, service vendors completed 25 pool pump projects through the program in 2020.

Figure 13: Total Number of Pool Pump Projects Completed Through the Swimming Pool Efficiency Program in 2020 (n=34)*

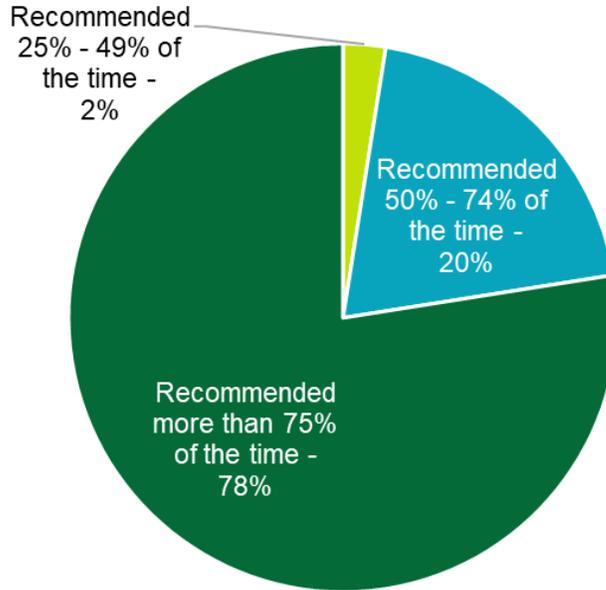


*Six respondents are excluded from this figure due to reporting “don’t know” when responding to the prior question about the total number of projects they completed in 2020.

Close to two-fifths (38%) of respondents were able to estimate the percentage of their company’s total sales in 2020 that were represented by the projects that participated in the Swimming Pool Efficiency Program. These respondents approximated that, on average, 6% of their company’s total sales in 2020 were represented by projects that participated in the Swimming Pool Efficiency Program.

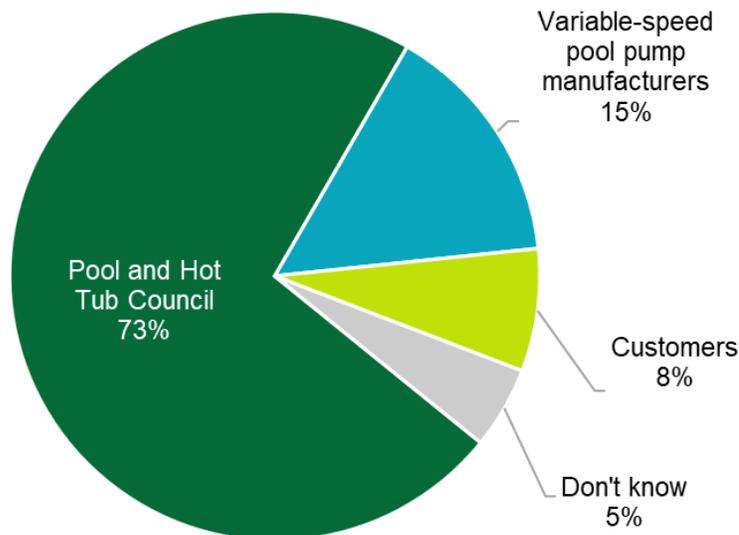
As shown in Figure 14, over three-fourths (78%) of respondents recommended variable-speed pool pumps to their customers over 75% of the time.

Figure 14: How Often Vendors Recommend Variable-Speed Pool Pumps (n=40)



As shown in Figure 15, nearly three-fourths of respondents (73%) first heard about the Swimming Pool Efficiency Program from the Pool and Hot Tub Council of Canada. Service vendors also heard about the program from variable-speed pool pump manufacturers (15%) and customers (8%).

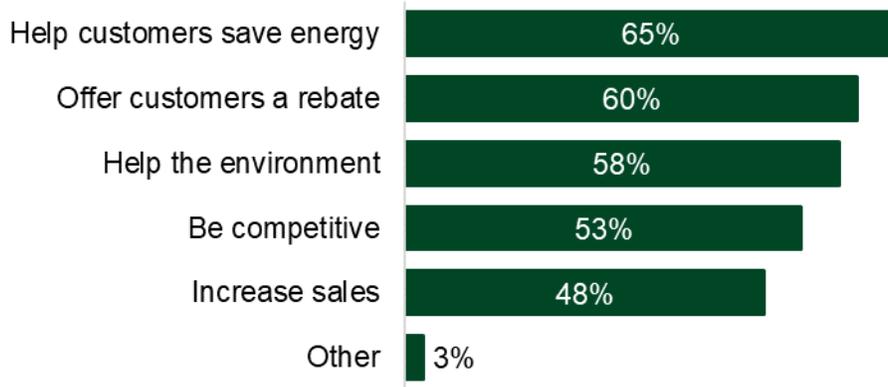
Figure 15: Program Awareness (n=40)*



*Does not add to 100% due to rounding.

As shown in Figure 16, service vendors were primarily motivated to participate in the Swimming Pool Efficiency Program to help customers save energy (65%), offer customers a rebate (60%), and help the environment (58%).

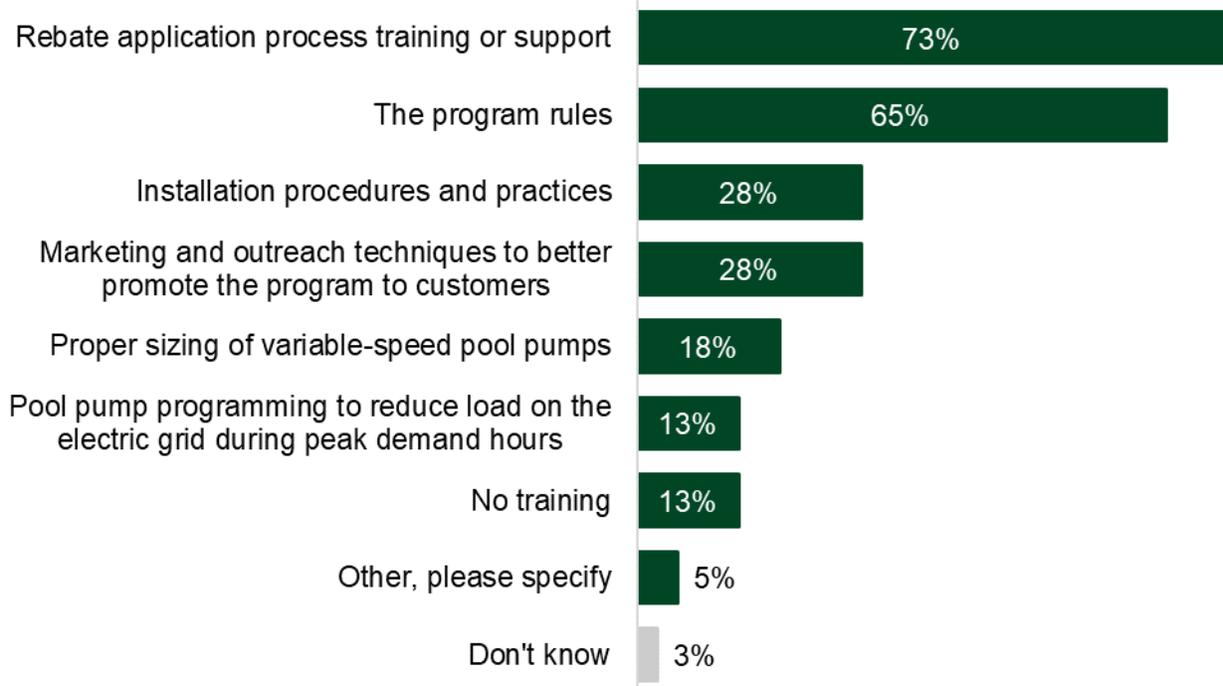
Figure 16: Motivation for Service Vendor Participation (n=40, Multiple Response)



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

Figure 17 displays the types of training respondents received from the LDCs in support of the Swimming Pool Efficiency Program. Most respondents received training on the rebate application process (73%) and the program rules (65%). Fewer respondents mentioned receiving any other training, which suggests there is an opportunity to expand training topics covered if the program were to continue in future years. For example, only about one-fourth of respondents reported receiving trainings on installation procedures and practices (28%) and marketing and outreach techniques (28%). Just over one-tenth (13%) reported receiving no training at all.

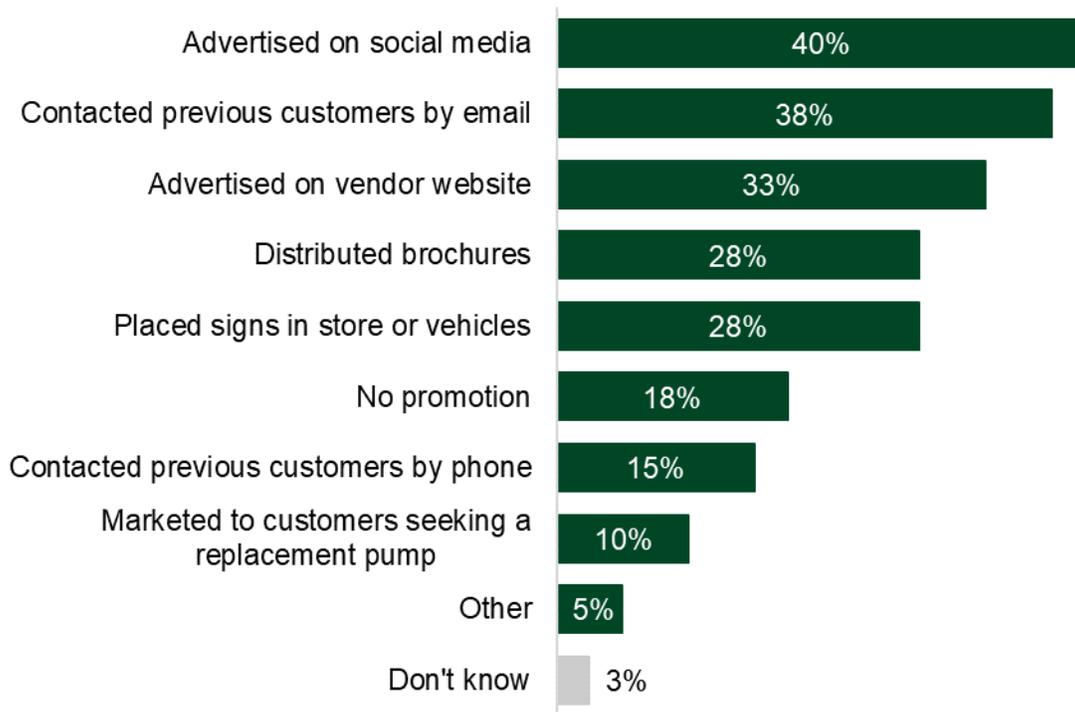
Figure 17: Type of Training Received (n=40, Multiple Response)



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

As shown in Figure 18, the most common methods of promoting variable-speed pool pumps that the service vendors reported using since enrolling in the program included advertising on social media (40%), contacting previous customers by e-mail (38%), and advertising on vendor websites (33%). Less common marketing strategies included distributing brochures (28%), placing signs in stores or vehicles (28%), and contacting previous customers by phone (15%). The emphasis on online activities is likely, at least in part, a response to the restrictions associated with COVID-19 in 2020.

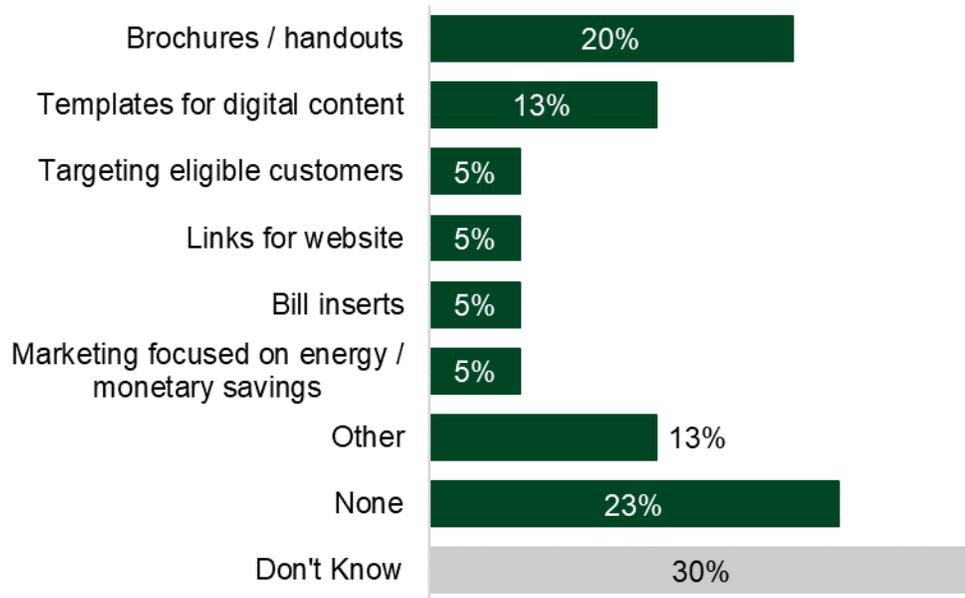
Figure 18: Methods of Promoting Variable-Speed Pool Pumps (n=40, Multiple Response)*



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

When asked if there was any additional marketing materials or support that the program could provide to help them promote variable-speed pool pumps to their customers, nearly one-half of respondents (48%) mentioned at least one way the program could help support them further (Figure 19). Respondents commonly mentioned that the program could provide brochures or handouts (20%) and templates for digital content (13%), such as posts for social media, website content, and e-mail footers.

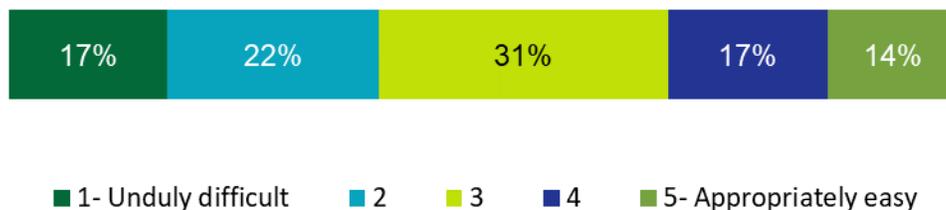
Figure 19: Additional Marketing Materials and Support (n=40, Multiple Response)*



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

Most respondents (90%) were involved in submitting applications to the LDCs for the Swimming Pool Efficiency Program. Using a scale from 1 to 5, where 1 meant “unduly difficult” and 5 meant “appropriately easy,” these respondents indicated how difficult they found the application submission process. As shown in Figure 20, close to two-fifths (39%) found the application process unduly difficult or somewhat difficult. The average rating among respondents was 2.9, indicating an opportunity to improve the application process for service vendors.

Figure 20: Difficulty of the Application Submission Process (n=36)*



*Does not add to 100% due to rounding. Four respondents are excluded from this figure due to reporting “don’t know” or “no” when describing whether they submitted applications on behalf of their customers.

As shown in [Table 9](#), of the two-fifths (39%) of respondents who indicated that the application process was difficult, nearly two-thirds (nine respondents) thought that the process involved too much paperwork for the service vendor and over two-fifths (six respondents) explained that the process was too time consuming.

Table 9: Reasons for Difficult Application Submission Process (n=14, Multiple Response)*

Reasons	Count of Respondents
Too much paperwork for vendor	9
Too time consuming	6
Application collected unimportant / repetitive information	4
Process was overly complicated	4
Slow rebate processing time	3
Lack of support / instructions	3
No contractor incentive	2
Digital interface was difficult or unclear	2

*Does not add to 14 due to multiple response.

The 90% of respondents who participated in the application process provided suggestions on ways the program could improve this process. While over one-fourth (28%) of service vendors did not make any suggestions to improve the application process, 72% of respondents made at least one recommendation. As shown in [Table 10](#), service vendors most commonly suggested the program streamline or clarify the application process (22%) and reduce the work or time required by the application (19%).

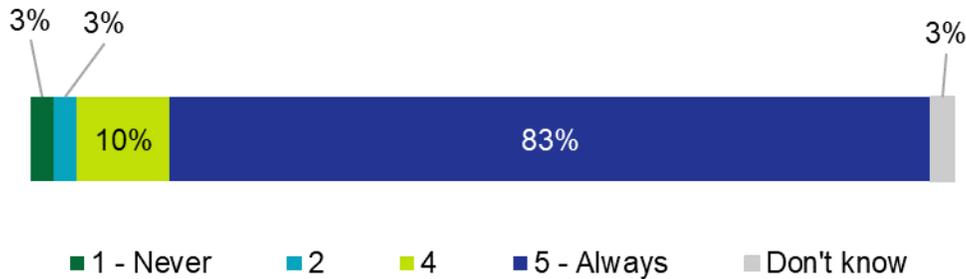
Table 10: Suggestions for Improving the Application Submission Process (n=36, Multiple Response)*

Suggestions	Percent of Respondents
Streamline / clarify the application process	22%
Reduce the work / time required for application	19%
Improve LDC support / shorten response times from LDCs	11%
Add flexibility to application submission timeline	11%
Require utility or client complete part(s) of the application	8%
Work directly with consumer	6%
Expedite rebate processing time	6%
Have different application requirements when replacing very old pumps / previously replaced motors	6%
Other	17%
None	28%

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

Using a scale from 1 to 5, where 1 meant “Never” and 5 meant “Always,” respondents indicated how often they informed their customers about the availability of the program. As shown in [Figure 21](#), over five-sixths of respondents (83%) always informed customers about the program. The two respondents (6%) explained that they never or rarely inform customers about the program because the program is too much work, the program is too time consuming, and there is no incentive for the contractor.

Figure 21: How Often Vendors Informed Customers about The Swimming Pool Efficiency Program (n=40)*



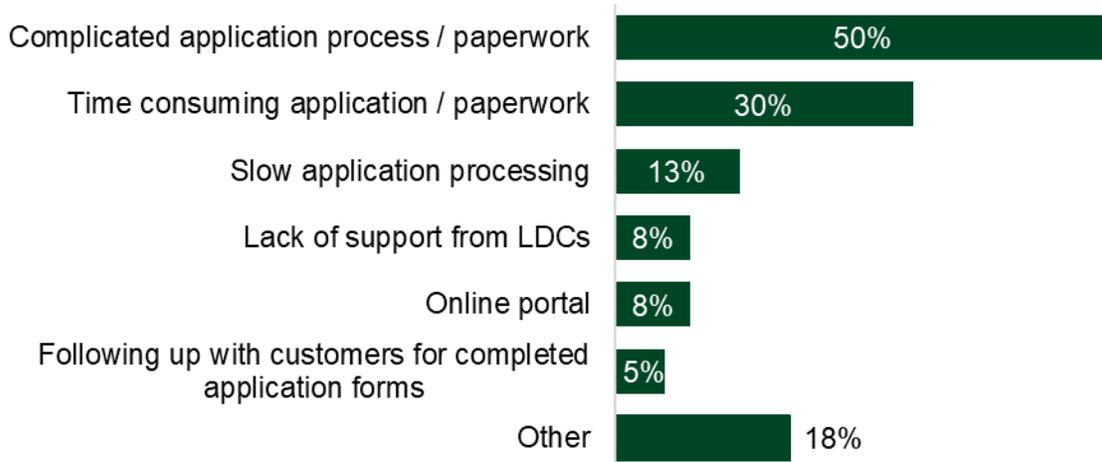
*Does not add to 100% due to rounding.

Service vendors estimated that approximately three-fifths (62%) of residential customers who are only in need of a motor replacement opt to replace their pool pump entirely. While this is a relatively high percentage, it indicates there is still room in the market for the program to help customers upgrade to variable-speed pool pumps.

7.2.4 Program Barriers

Respondents provided feedback about whether there was anything that made the Swimming Pool Efficiency Program difficult or unappealing to the service vendors. As shown in [Figure 22](#), one-half (50%) of respondents thought that complicated application process or paperwork was an issue, while nearly one-third (30%) mentioned that the time required to complete the application or paperwork is burdensome. This indicates that the application process was likely a barrier that prevented service vendors from participating in the program.

Figure 22: Unappealing or Difficult Aspects of the Program (n=40, Multiple Response)*



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

As shown in Table 11, service vendors identified barriers they thought may have prevented more households from participating in the Swimming Pool Efficiency Program. Nearly one-half (48%) of respondents reported that some customers plan on moving and thus will not benefit from the long-term energy savings, two-fifths (40%) noted that the rebate did not cover the full price differential between a constant- speed and variable-speed pool pump, and over one-third (35%) reported that customers do not know about the program.

Table 11: Barriers Preventing More Households from Participation (n=40; Multiple Response)*

Barriers	Percent of Respondents
Customers plan on moving and thus will not benefit from energy savings in the long term	48%
The rebate does not cover the full price difference between a constant-speed and variable-speed pool pump	40%
They do not know about it	35%
They do not think a variable-speed pool pump will save them money	18%
They do not think there are any barriers to participation in the Swimming Pool Efficiency Program	8%
Not being offered through all LDCs	8%
Customers do not trust the technology	5%
Other	10%
Don't know	5%

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

As shown in Table 12, to address these barriers, respondents suggested increasing the rebate amount (20%), marketing the benefits and savings related to the program (17%), and increasing or targeting the advertising (17%). “Other” responses were each mentioned once (3%) and included simplifying the application process or paperwork, banning constant-speed pumps, sending information from electricity suppliers, and allowing customers to install the pump themselves.

Table 12: Suggestions to Address Barriers to Participation (n=35; Multiple Reponse)*

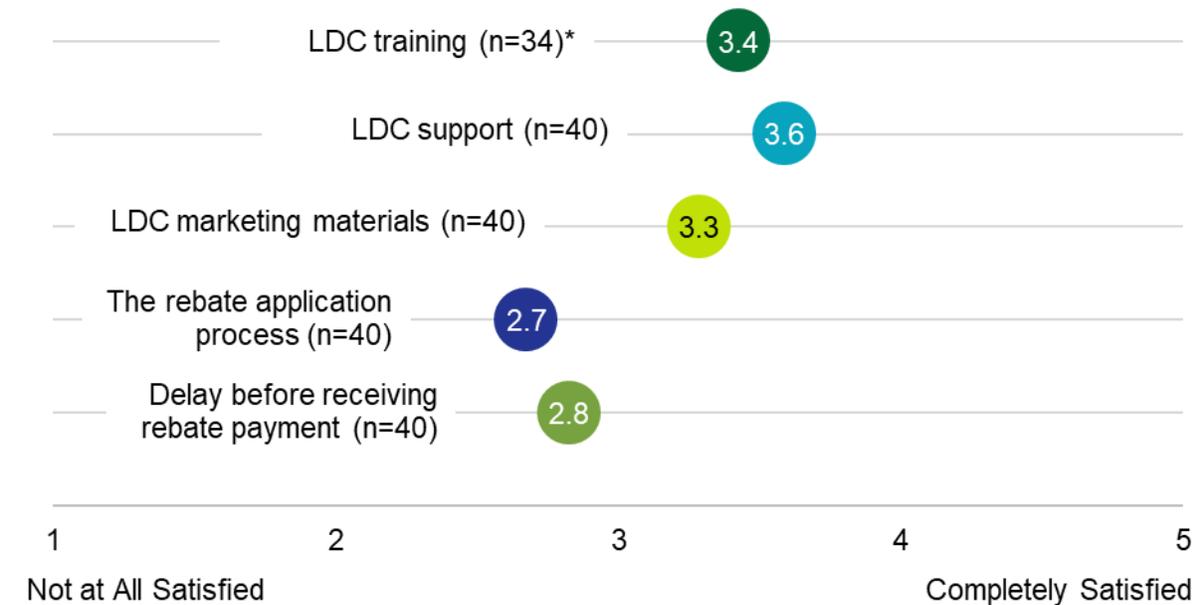
Suggestions	Percent of Respondents
Increase the rebate amount	20%
Market the benefits and savings related to the program	17%
Increase / target advertising	17%
Offer program consistently so vendors can market it	9%
Offer program through all LDCs	9%
Other	11%
Don't know	29%

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

7.2.5 Program Satisfaction

Using a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied,” respondents indicated their satisfaction with various aspects of the program. As shown in [Figure 23](#), service vendors generally reported mid-level or low levels of satisfaction, indicating that the program should consider addressing aspects of the program that vendors were less satisfied with should the program continue in the future. In particular, the program should work to improve the rebate application process and minimize the delay before receiving rebate payment, as these aspects were rated lower (averages of 2.7 and 2.8, respectively). Addressing these areas will allow service vendors to deliver the program more effectively and will help to retain their interest in recommending the program to residential customers.

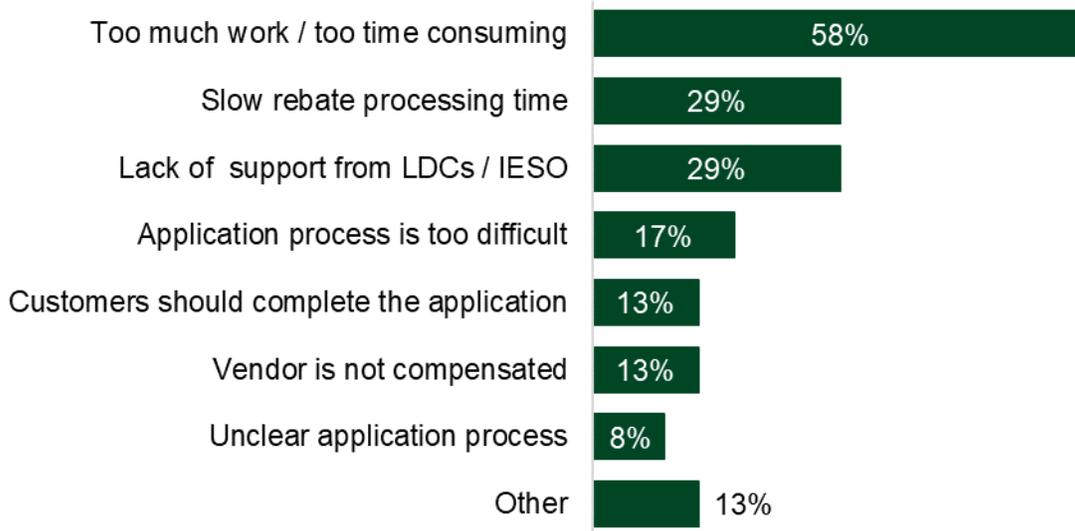
Figure 23: Satisfaction with Program Aspects



*The survey only asked respondents to indicate their satisfaction with “LDC training” if they previously indicated having received training from the LDCs in support of the Swimming Pool Efficiency Program.

Respondents who were not at all satisfied or mostly dissatisfied described their reasons for dissatisfaction. [Figure 24](#) shows that the most common reasons for dissatisfaction was that the process was too much work or too time consuming (58%), the rebate processing time was too slow (29%), or there was a lack of support from LDCs or IESO (29%).

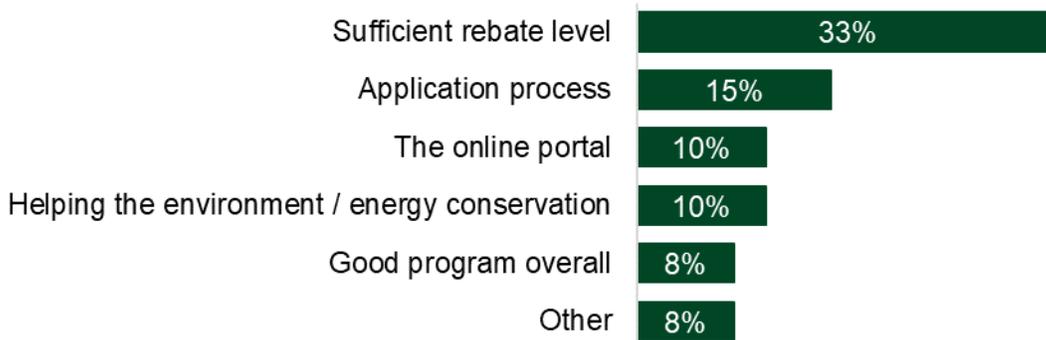
Figure 24: Reasons for Dissatisfaction with Program Aspects (n=26; Multiple Response)*



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

Thirty-one respondents provided feedback on which aspects of the program they thought worked particularly well. As shown in [Figure 25](#), one-third (33%) of respondents think the rebate level is sufficient and over one-tenth (15%) of respondents mentioned the application process.

Figure 25: Aspects of the Program that Worked Particularly Well (n=31, Multiple Response)*

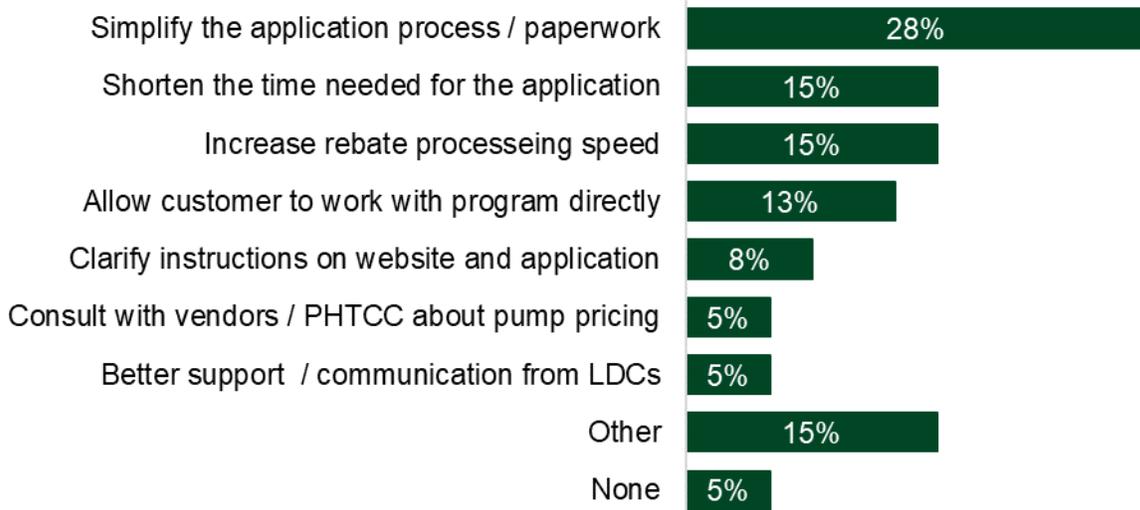


*Does not add to 100% due to multiple response. Nine respondents are excluded from this figure due to not responding meaningfully or otherwise indicating they were not sure.

7.2.6 Recommendations for Program Improvement

As displayed in Figure 26, the most commonly suggested recommendations for program improvements include simplifying the application process or paperwork (28%), shortening the time needed to complete the application (15%), increasing the rebate processing speed (15%), and allowing customers to work with the program directly (13%).

Figure 26: Suggestions to Improve the Program (n=40, Multiple Response)*



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

7.3 PARTICIPANT PERSPECTIVES

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

7.3.1 High-Level Results

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

- Respondents most frequently heard about the Swimming Pool Efficiency Program from a pool professional, including pool pump vendors (60%) and pool pump maintenance companies (20%).
- While over four-fifths (81%) of respondents reported that the installing vendor programmed the pump’s time settings, close to one-fifth (17%) programmed their own time settings, and only about one-third (36%) of them received information from the installer about the best times of the day to program cleaning cycles. This is an opportunity to encourage vendors to better communicate the capabilities of variable-speed pool pumps to the customer and maximize efficiency.

- Using a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied” participants reported high satisfaction (average ratings between 4.3 and 4.6) with various aspects the program, including the ease of participating in the program, the quality of work done by the installing vendor, the professionalism of the installing vendor, the performance and cleaning ability of the new pump, the energy savings achieved from the new pump, and the program overall.
- Participants often recommended that the program provide additional information/training on the new pumps (e.g., how to use it generally, details about the best times of the day to program cleaning cycles, training on how to optimize their pool pump’s schedule), improve or increase advertising, wait to conduct the follow-up survey until participants have a full season of data, and expand the program to more service vendors and equipment types (i.e., home appliances)
- Nearly nine-tenths (89%) of participants were extremely or very likely to recommend the Swimming Pool Efficiency Program to others.

7.3.2 Participant Profile

Figure 27 and Figure 28 display characteristics of respondents’ homes, including the type of dwelling and the year it was built. Respondents’ homes are predominately (96%) single-family houses. Over three-fifths (63%) of respondents’ homes were built prior to 1990 and only 3% were built in 2010 or later. Nearly all (99%) homes are primary residences and nearly all (99%) respondents are homeowners.

Figure 27: Type of Home (n=416)

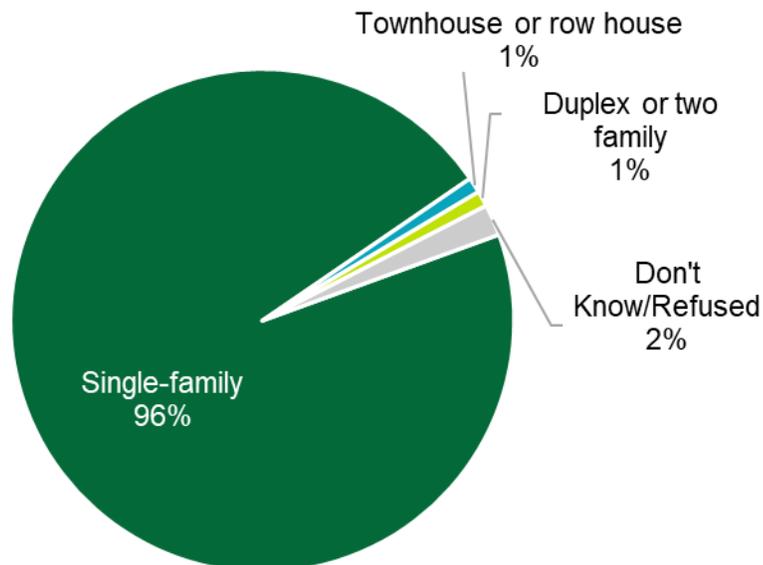


Figure 28: Year Home Built (n=416)

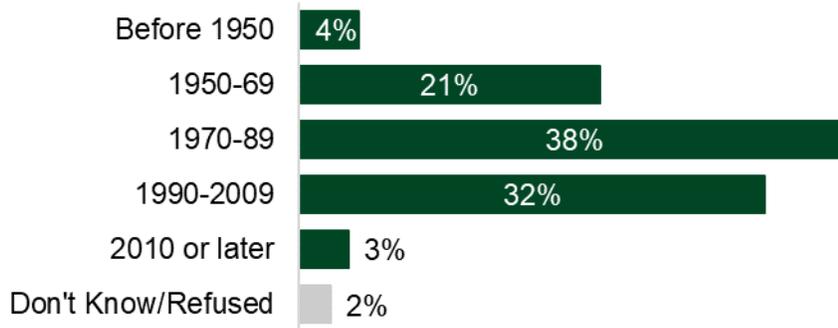
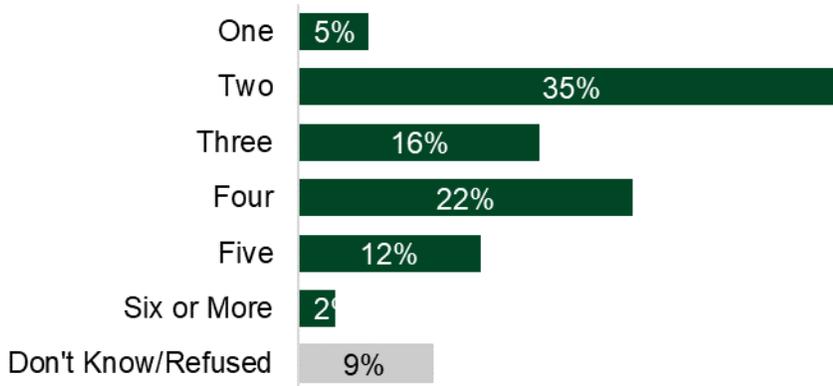


Figure 29 and Figure 30 display the number of occupants in the respondents' households and their total household income in the last year. Around one-third (35%) of respondents live with one other person and over one-half (52%) of respondents live with two or more other people. One-fifth (20%) of respondents have a total household income of at least \$200,000 and only 2% have an income under \$50,000. Figure 31 illustrates that over three-fourths (77%) of respondents had graduated college or pursued additional education beyond college.

Figure 29: Number of Occupants (n=416)*



*Does not add to 100% due to rounding.

Figure 30: Household Income (n=416)

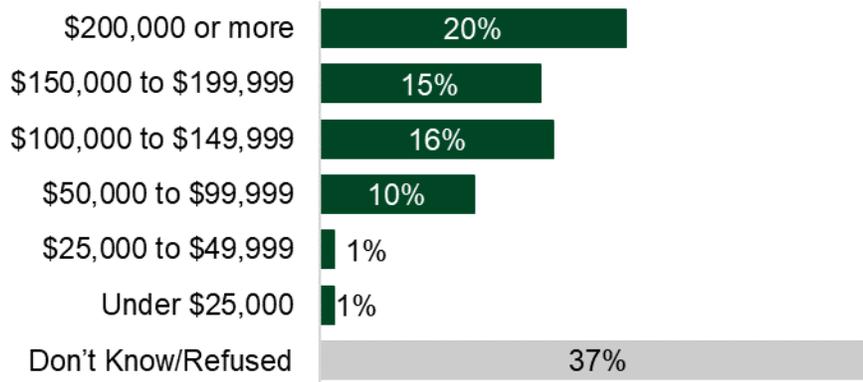
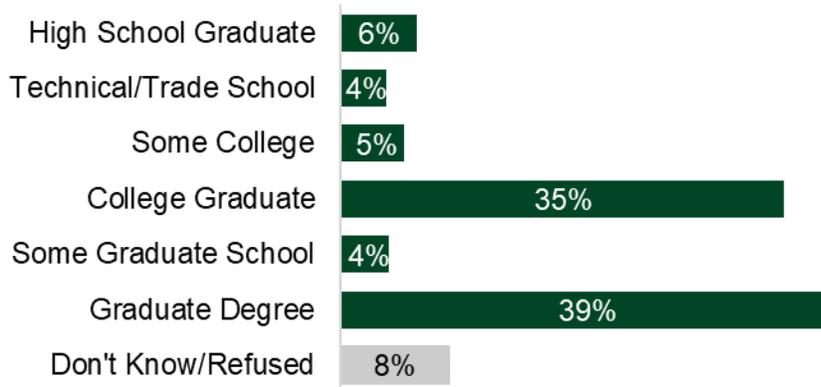


Figure 31: Level of Education (n=416)*

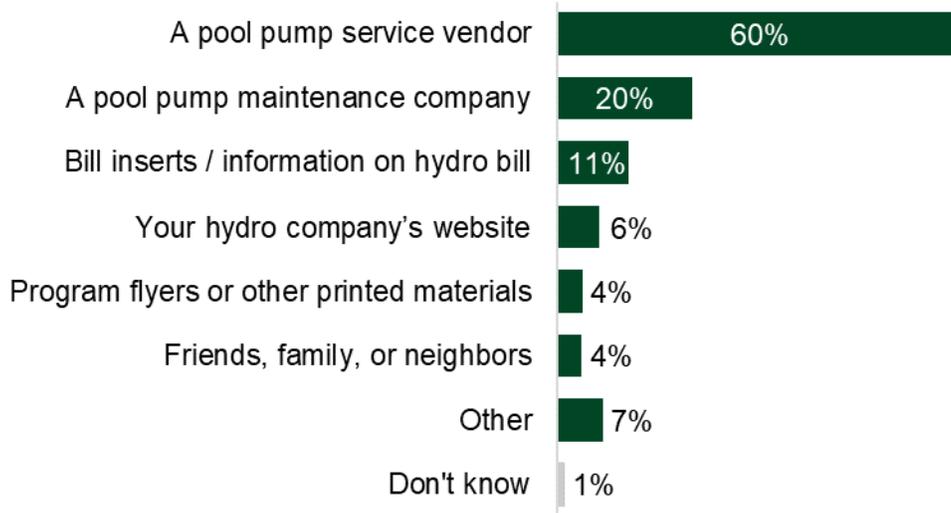


*Does not add to 100% due to rounding.

7.3.3 Program Experience

As shown in Figure 32, three-fifths (60%) of respondents first heard about the Swimming Pool Efficiency Program from a pool pump service vendor. Participants also frequently heard about the program from pool pump maintenance companies (20%) and bill inserts (11%).

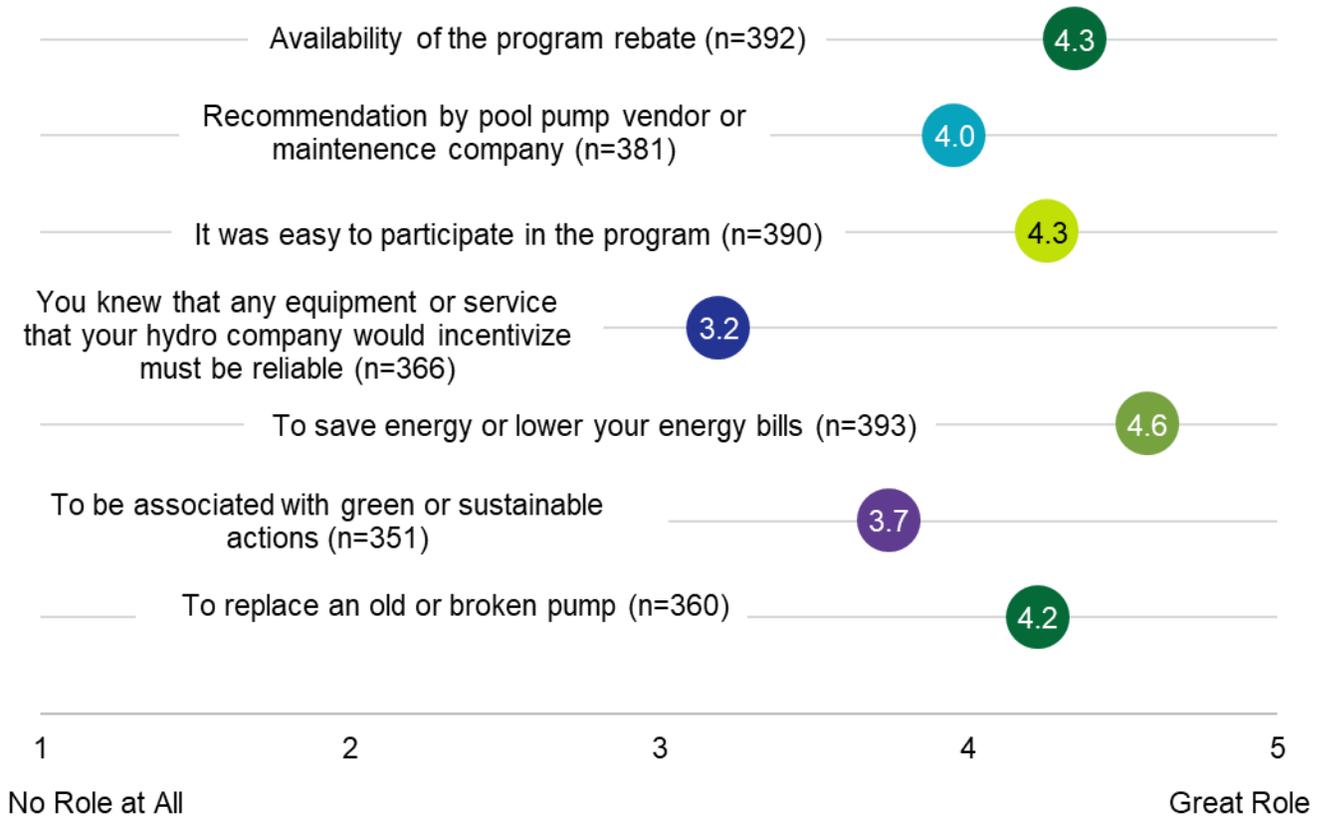
Figure 32: Program Awareness (n=416, Multiple Response)*



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

Figure 33 displays participants’ average ratings for the level of influence various factors had on their decision to participate in the Swimming Pool Efficiency Program. Respondents rated the influence of each factor using a scale from 1 to 5, where 1 meant “no role at all” and 5 meant “great role.” The most influential factor was to save energy or lower energy bills (4.6). Respondents provided the lowest average rating (3.2) for the factor associated with knowing that equipment or services that their hydro company incentivized would be reliable. This suggests that some participants may not have a trusting relationship with their hydro company and presents an opportunity for relationship building.

Figure 33: Factors Influencing Swimming Pool Efficiency Program Participation*



* The NMR team excluded respondents who selected “don’t know” or “not applicable” from this figure.

Four respondents noted that the equipment upgrade (i.e., the programmable variable-speed pool pump) somewhat (rating of 4) influenced their decision to participate in the program. Specifically, these participants appreciated the “high tech,” “improved filtration,” “quieter operation,” and ease “to program / re-program.”

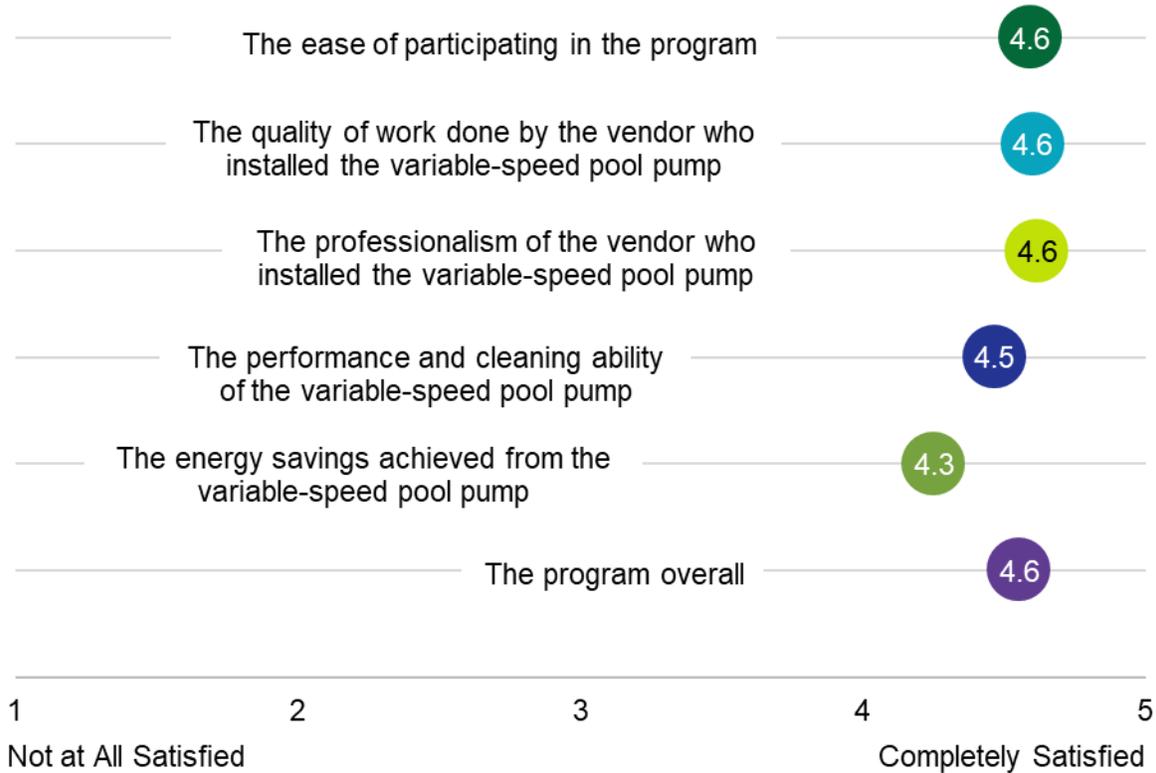
Over four-fifths (81%) of respondents reported that the service vendor who installed the variable-speed pool pump also programmed the time settings. Of the close to one-fifth (17%) of participants who programmed their own time settings, only about one-third (36%) reported that the service vendor provided information on the best times of the day to program cleaning cycles. Almost three-fifths (59%) indicated the service vendor did not provide this information, revealing

an opportunity to encourage service vendors to better communicate the capabilities of variable-speed pool pumps to the customer and increase the pump’s efficiency.

7.3.4 Program Satisfaction

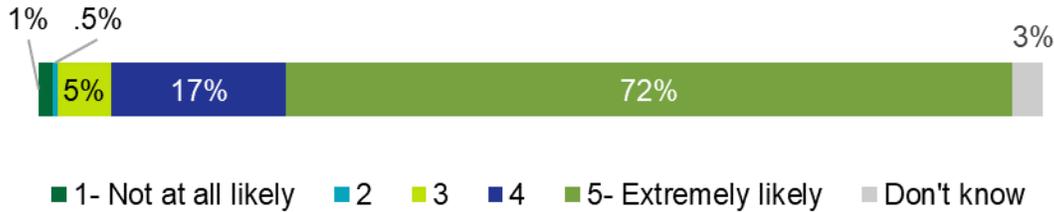
Using a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied,” respondents indicated their satisfaction with various aspects of the program. As shown in [Figure 34](#), participants reported high satisfaction with the program overall (average of 4.6) and with the program aspects. The energy savings achieved from the variable-speed pool pump received a slightly lower average rating of 4.3, though this might be the result of many of the participants not having yet gone through a full pool season with the pump. Respondents who were not at all satisfied or mostly dissatisfied with the program overall provided additional feedback, including that they experienced an issue with their variable-speed pool pump and that the rebate only covered the installation costs (two respondents each).

Figure 34: Satisfaction with Program Aspects (n=416)



As illustrated in Figure 35, nearly nine-tenths (89%) of participants are extremely or very likely to recommend the program to others. Participants who were not at all likely or somewhat unlikely to recommend the program provided additional feedback, including that the pump was expensive (two respondents), they experienced installation issues (one respondent), the rebate only covered installation costs (one respondent), and energy savings are not apparent (one respondent).

Figure 35: Likelihood to Recommend the Program (n=416)*



*Does not add to 100% due to rounding.

7.3.5 Recommendations for Program Improvement

Nearly one-fourth (24%) of respondents provided suggestions to improve the program. As shown in Figure 36, nearly one-fifth (17%) of these participants recommended the program provide additional information or better training on the pumps, improve program advertising (16%), and wait to conduct a follow-up survey until participants have a full season of data (15%).

Figure 36: Suggestions to Improve the Program (n=98, Multiple Response)*

Suggestions	Percent of Respondents
Provide more information / better training on pump	17%
Improve advertising of program	16%
Wait to conduct survey until participants have a full season of data	15%
Expand program to more vendors / equipment types	12%
Make sure program and benefits are clearly explained from the start	9%
Improve quality of equipment offered	8%
Increase rebate amount	7%
Allow homeowner to go through the program without a vendor or to choose installer	7%
Other	13%

*Does not add to 100% due to multiple response. Three hundred and eighteen respondents are excluded from this figure due to reporting that they did not have any suggestions to improve the program.

Section 8 Key Findings and Recommendations

The following section presents detailed key findings and recommendations for the Swimming Pool Efficiency Program evaluation.

Finding 1: Limited information collected and tracked in the tracking database. A review of the tracking database revealed that limited information is currently being captured in there. The database does not track some of the key submission form input parameters used in the calculations of the savings – such as pre and post operating hours, post-installation pump speeds and power, and pool volume. These additional input parameters are recorded in a separate file by the LDCs but are not provided to IESO during reporting. However, these input parameters were requested during the evaluation and were provided by the LDCs which were then used in the savings verification. These site-specific inputs are the basis for the savings calculations in the submission forms. Including the submission form input parameters as part of standard reporting requirements for IESO will facilitate future evaluation activities.

- **Recommendation 1.** Standardize the submission form input parameters for the LDCs and require their inclusion in the tracking database during reporting. Embedding the savings algorithm in the tracking database to use these input parameters to verify the reported savings will reduce future evaluation costs and allow for early identification of data-related issues.

Finding 2: The horsepower of installed pumps is marginally greater than the pumps they replaced. For 80% of the sampled sites, the NMR team found that the horsepower of the installed variable-speed pump was marginally greater than the horsepower of the pump it replaced. Installing the same size variable-speed pump as the one it replaced may result in marginally higher savings based on how they are operated.

- **Recommendation 2.** Continue the existing installation approach, but implement a QA/QC process to make sure the size difference between the installed variable-speed pump horsepower and the one it replaced is not unreasonable.

Finding 3: Program FR was moderately high at 28.9%, relative to historical results, which were last estimated in PY2017 The program's NTG was moderately low at 71.5%, and the FR score was moderately high at 28.9%. SO was low at 0.4%, which only helped offset the FR by a modest amount. The program helped about one-third (30%) of participants with upgrades they otherwise would not have been able to implement (24%) or would have had to postpone (6%). However, over two-thirds (70%) of participants would have done the “exact same upgrade” anyway (31%), done the upgrade but scaled back on the pool pump efficiency (29%), or were unsure of what they would have done (10%). This suggests that there is still room for FR improvements in future program years.

- **Recommendation 3a.** Maintain focus on minimizing FR if the program continues in future years. Key areas to focus on include the following:

- Identifying and targeting customers who would be unlikely to make upgrades without program support,
- Screening customers to ensure they have not already begun implementing measures, and
- Encouraging all participants to complete the evaluation surveys to ensure that the FR results are as representative of the true population of program participants as possible.
- **Recommendation 3b.** Encourage participants to install additional energy-efficient equipment or services beyond what is covered through the program if it is feasible for them to do so (for example, encouraging customers to have a home energy audit performed to identify other opportunities). Doing so may lead to increases in the program’s SO, which may in turn help offset FR and lead to improved NTG.

Finding 4: Satisfaction with the program and its elements was relatively low across the service vendors, which suggests there is some room for improvement. Service vendors reported relatively low satisfaction (average ratings between 2.7 and 3.6 on a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied”). Low satisfaction indicates that the program should consider addressing aspects that vendors were less satisfied with, such as the rebate application process, the speed of receiving rebate payments, LDC marketing materials, LDC training and support (see finding 5), and the length and complexity of the application (see Finding 6), should the program continue in the future.

- **Recommendation 4a.** Minimize the time it takes to reimburse program service vendors for customer rebates. To avoid delays in issuing rebate payments, consider allowing vendors to submit invoices earlier in the process to help the rebate review and approval process move along more quickly.
- **Recommendation 4b.** Consider expanding on the types of marketing materials made available to service vendors to promote the program (e.g., brochures or handouts, and templates for digital content, such as posts for social media, website content, and e-mail footers).
- **Recommendation 4c.** Assess the feasibility of allowing customers to work with the program directly, rather than requiring a program service provider manage the process.

Finding 5: There is a desire for more training amongst the program service vendors. While most service vendors received training on the rebate application process and the program rules (73% and 65%, respectively), few received any other training. This suggests that there is an opportunity to expand training topics covered if the program were to continue. For example, only about one-fourth of respondents reported receiving trainings on installation procedures and practices (28%) and marketing and outreach techniques (28%). Just over one-tenth (13%) reported receiving no training at all.

- **Recommendation 5.** Offer additional training opportunities to program service vendors on topics that will provide them with the knowledge they need to effectively support the program (for example, installation procedure/practices training, and marketing and outreach techniques).

Finding 6: Opportunities exist to improve the application process. Close to two-fifths (39%) of service vendors found the application process challenging because it involved too much paperwork or was too time consuming. This suggests that there is an opportunity to improve the program through simplifying the application process and reducing the amount of work and time it requires, which would remove potential barriers to participation.

- **Recommendation 6.** Simplify the application process for service vendors. Identify specific improvement opportunities by requesting detailed feedback on the application process from a subset of service vendors.

Finding 7: Satisfaction with the program and its elements was high overall across the participants, but there is some room for improvement. Participants reported high satisfaction (average ratings between 4.3 and 4.6 on a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied”) with various aspects the program, including the ease of participating in the program, the quality of work done by the installing vendor, the professionalism of the installing vendor, the performance and cleaning ability of the new pump, the energy savings achieved from the new pump, and the program overall. The one-fourth (24%) of participants who offered recommendations often mentioned that the program should improve or increase advertising, wait to conduct the follow-up survey until participants have a full season of data, and expand the program to more service vendors and equipment types (i.e., home appliances).

- **Recommendation 7a.** Identify ways to further promote the program to new participants and service vendors (such as more widespread online and print marketing campaigns from the LDCs). Support service vendors in efforts to further promote the program and to educate customers about the efficiency and monetary benefits of variable-speed pumps (refer to Recommendation 5).
- **Recommendation 7b.** Consider the timing of future evaluation surveys, if feasible, to ensure that most customers are able to use the new pump for a full season.
- **Recommendation 7c.** Explore the feasibility of offering additional energy-saving equipment at the time of the pump installation.

Finding 8: Opportunities exist to better educate customers about the capabilities of the variable-speed pool pumps.

While over four-fifths (81%) of respondents reported that the installing vendor programmed the pump’s time settings, close to one-fifth (17%) programmed their own time settings. Of those who did their own programming, only about one-third (36%) received information from the installer on the best times of the day to program cleaning cycles. Additionally, participants often recommended that the program provide them with additional information or training on the new pumps. This suggests an opportunity to encourage vendors to better communicate the capabilities of variable-speed pool pumps to their customers. Doing so will give customers the confidence needed to use their pumps in the most efficient way possible.

- **Recommendation 8.** Encourage service vendors to communicate the capabilities of variable-speed pool pumps to their customers (e.g., how to use it generally, details about

the best times of the day to program cleaning cycles, training on how to optimize their pool pump's schedule).

Finding 9: Efficient pool pump offerings for above-ground pools and/or whirlpools were recommended for inclusion as part of future program offerings.

LDC staff and program delivery vendor staff recommended that future program designs consider offering efficient pool pumps for above-ground pools and/or whirlpools in addition to in-ground pools given the many inquiries they had from customers.

Recommendation 9. Consider the feasibility of offering variable-speed pool pump equipment to customers with above-ground pools and/or whirlpools in future program designs

Appendix A Detailed Methodology

This appendix includes additional details about the impact evaluation methodology, cost-effectiveness methodology, NTG methodology, and process evaluation methodology.

A.1 IMPACT METHODOLOGY

This section provides additional details about the impact evaluation methodology. A summary of the methodology was provided in [Section 2](#).

A.1.1 Impact Sampling

The NMR team sampled the program at the project level to generate data for the desk reviews. Only one type of measure was installed through the program. The NMR team used the entire population to sample from for the desk review. The NMR team employed stratified ratio estimation (SRE) to improve precision and minimize sample sizes. The NMR team stratified projects by LDCs. The NMR team selected sample sizes for five LDCs with the highest total savings to meet a target of 10% precision at 90% confidence level. The NMR team assumed the error ratios to be 0.5.

[Table 13](#) presents the sampling plan for the desk reviews.

Table 13: Sampling Plan

LDCs	Applications (N)	Savings (kWh)	% Program Savings	Sample (n) ⁵	Target Precision
LDC1	312	976,703	37%	25	16%
LDC 2	189	566,721	22%	15	20%
LDC 3	137	481,237	18%	12	23%
LDC 4	132	313,990	12%	8	28%
LDC 5	20	68,158	3%	5	32%
Total	790	2,406,809	100%	65	9.9%

⁵ The NMR team oversampled for a total of 77 projects.

A.2 COST-EFFECTIVENESS METHODOLOGY

The cost-effectiveness analysis was completed using the IESO CE Tool and in accordance with the IESO *CDM Energy Efficiency Cost Effectiveness Guide*.⁶ The IESO CE Tool was populated with the following key information from the evaluation:

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

Where directed by IESO, inputs reflected the current IESO default values and not the updated values recommended by this evaluation to replace the default values. Specifically, this analysis used the default pool pump load shape in the CE Tool.

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

- Program administrative costs
- Rebate payments

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

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

⁶ *Conservation & Demand Management Energy Efficiency Cost Effectiveness Guide*, Independent Electricity System Operator, April 1, 2019, <http://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation/EMV/2019/IESO-CDM-Cost-Effectiveness-Test-Guide.pdf?la=en>

A.3 NTG EVALUATION METHODOLOGY

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

The NMR team developed an effective questionnaire to assess FR and SO. The approach has been used successfully in many previous evaluations. The NTG ratio is defined as follows (Equation 4).

Equation 4: NTGR

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

A.3.1 Free-Ridership Methodology

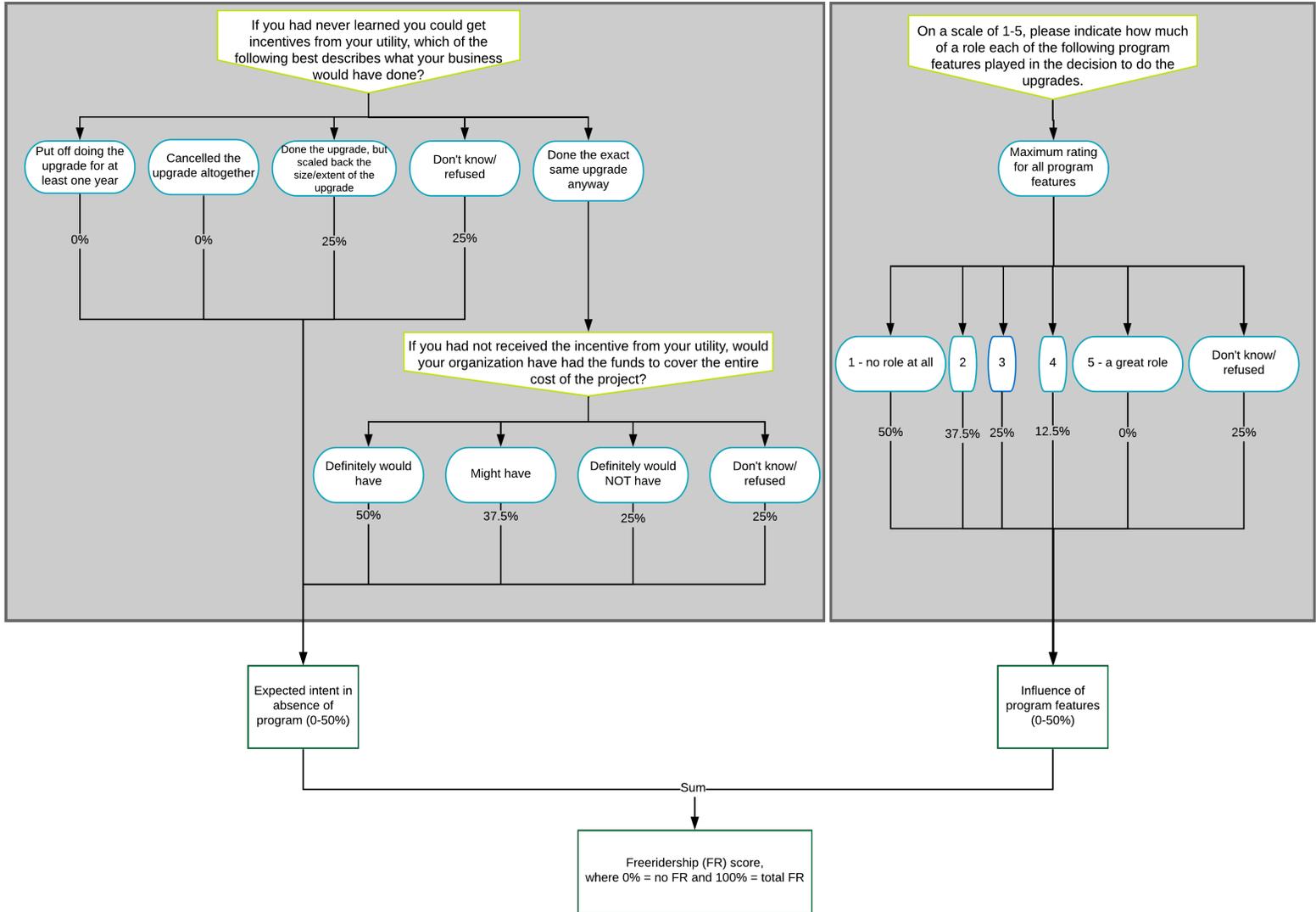
The survey addressed the attribution of savings for each sampled project or type of equipment through two main components:

- Intention of the expected behaviour in the absence of the program; and
- Influence of various program features, such as the rebate, program marketing and outreach, and any technical assistance received.

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

Figure 37 illustrates the FR methodology.

Figure 37: FR Methodology



Intention Component

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

Question 1: If you had never learned you could get rebate through the program, which of the following best describes what you would have done? You would have...

1. Put off doing the upgrade for at least one year
2. Cancelled the upgrade altogether
3. Done the upgrade but scaled back on the pool pump efficiency Done the exact same upgrade anyway Ask Question 2
98. Don't know
99. Refused

[ASK ONLY IF RESPONSE TO QUESTION 1=4: Done the exact same upgrade anyway]

Question 2: If you had not received the rebate/upgrades at no cost from the program, would you say your organization definitely would have, might have, or definitely would not have had the funds to cover the entire cost of a variable-speed pool pump?

1. Definitely would have
2. Might have
3. Definitely would NOT have
98. Don't know
99. Refused

Table 14 indicates the possible intention scores a respondent could have received depending on their responses to these two questions.

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

The second question asks the participants who had said they would have done the exact same project if they definitely would have, might have, or definitely would not have had the funds to cover the cost of a variable-speed pool pump if they had not received the rebate from the program. If the respondent answered 1 (definitely would have had the funds), the respondent would receive a score of 50% (associated with high FR). If the respondent answered 2 (might have had the funds), they would receive a slightly lower FR score of 37.5%. If the respondent answered 3 (definitely would not have had the funds) or did not know or refused the question, the respondent would receive an FR intention score of 25% (associated with moderate FR).

Table 14: Key to FR Intention Score

Question 1 Response	Question 2 Response	Intention Score (%)
1 or 2	Not asked	0 (no FR for intention score)
3, 98 (Don't Know), or 99 (Refused)	Not asked	25
4	3, 98 (Don't Know), or 99 (Refused)	25
4	2	37.5
4	1	50 (high FR for intention score)

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

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

Influence Component

The influence component of the FR score asks each respondent to rate how much of a role various potential program-related influence factors had on their decision to do the upgrade(s) in question. Influence is reported using a scale from one (1) to five (5), where one means “it played no role at all” and five means “it played a great role.” The potential influence includes the following:

- Availability of the program rebate
- Information or recommendations provided to you by your hydro company representative
- Information or recommendations provided from vendors associated with the program
- Marketing materials or information provided by your hydro company about the program (e-mail, direct mail, etc.)
- Information or resources from your hydro company's website
- Information or resources from social media
- Previous experience with any energy saving program
- Others (identified by the respondent)

Table 15 indicates the possible influence scores a respondent could receive depending on how they rated the influence factors above. For each respondent, the program influence is set equal to the maximum influence rating that a respondent reports across the various influence factors. For example, suppose the respondent provided a score of 5 (great role) to at least one of the influence factors. In that case, the program is considered to have had a great role in their decision to do the upgrade, and the influence component of FR is set to 0% (not a free rider).

Table 15: Key to FR Influence Score

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

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

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

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

A.3.2 Spillover Methodology

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

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

For each equipment type that the respondent reports installing without a program rebate, the survey instrument asks about the extent of influence that earlier involvement in the program had on the decision to carry out the upgrades. Influence is reported using a scale from 1 to 5, where 1 means “it played no role at all” and five means “it played a great role.” In the case that the influence score is between 3 and 5 for a particular equipment type, the survey instrument solicits details about the upgrades to estimate the quantity of energy savings that the upgrade produced.

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

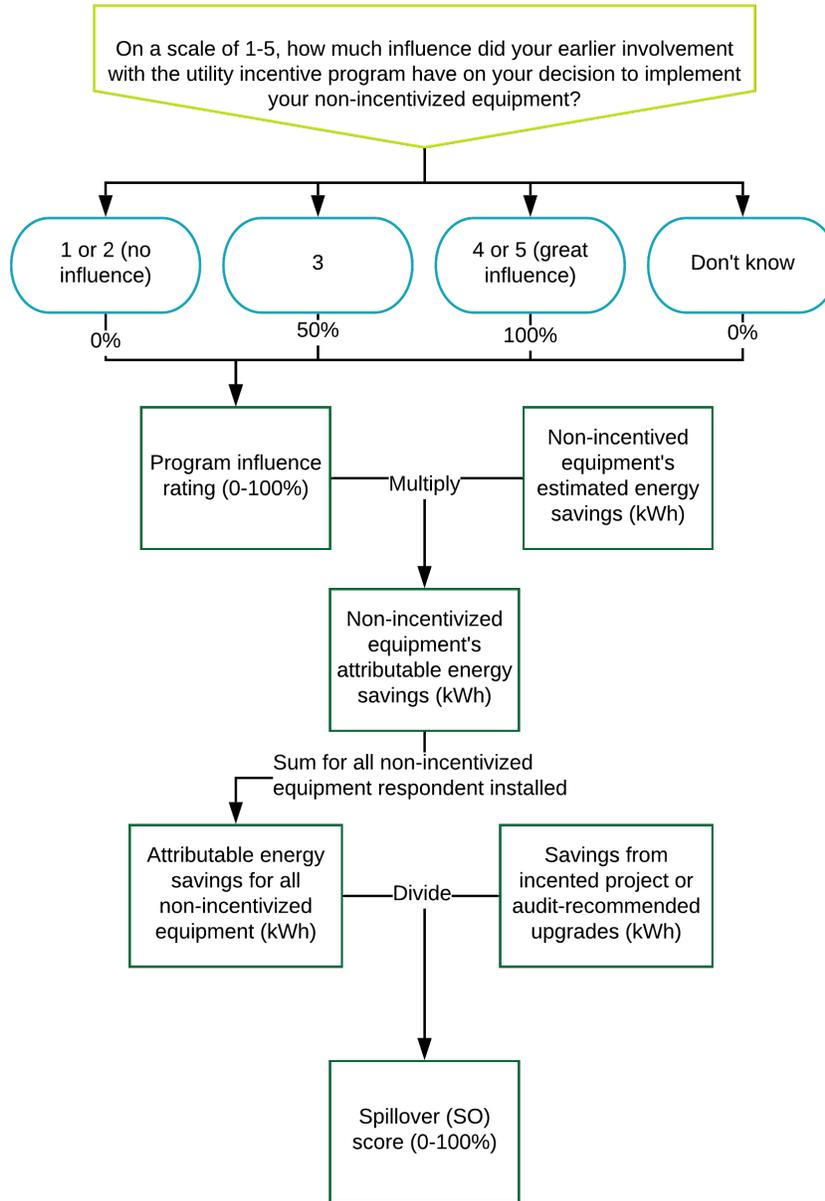
- Maximum rating of 1 or 2 (no influence) = 0%
- Maximum rating of 3 = 50%
- Maximum rating of 4 or 5 (great influence) = 100%
- Respondent does not know how much influence any factor had = 0%

The NMR team used the following procedure to calculate an SO percentage for each respondent:

- Multiplying the estimated energy savings for each upgrade by the influence percentage to calculate the upgrade’s program-attributable energy savings.
- Summing program-attributable energy savings from all identified upgrades for each respondent to calculate the respondent’s total SO savings.
- Dividing each respondent’s total SO savings by the savings from the incented project.

Figure 38 illustrates the SO methodology.

Figure 38: SO Methodology



A.3.3 Other Survey Questions

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

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

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

A.3.4 Net-to-gross Survey Implementation

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

A.4 PROCESS EVALUATION METHODOLOGY

This section provides additional details about the process evaluation methodology. A summary of the methodology was provided in [Section 2.6](#). During the process evaluation, the NMR team collected primary data from key program actors, including the LDC program staff, the program delivery vendor program staff, the service vendors, and participants ([Table 16](#)). The NMR team collected the data using different methods, depending on what was most suitable for a particular respondent group (e.g., web surveys or telephone-based-IDIs). This data, when collected and synthesized, provides a comprehensive understanding of the delivery of the program.

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

The NMR team conducted the IDIs with the LDC program staff and program delivery vendor staff using in-house staff (rather than through a survey lab). The NMR team fielded service vendor and participant surveys as web-based surveys in partnership with the Nexant survey lab based in

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

Table 16: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Fielding Firm	Completed	Population	90% CI Error Margin
LDC Program Staff	Phone IDI	NMR Staff	1	1	0%
Program Delivery Vendor Staff	Phone IDI	NMR Staff	1	1	0%
Service Vendors	Web Survey	Nexant Survey Lab	40	65	8.2%
Participants	Web Survey	Nexant Survey Lab	416	1,183	3.3%

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

A.4.1 LDC and Program Delivery Vendor Staff Interviews

The NMR team interviewed one LDC staff member and one program delivery vendor staff member to gain a detailed understanding of the program (Table 17). The program delivery vendor interviewed represented four of the participating LDCs. The purpose of the interviews was to better understand program design, delivery, and barriers, and solicit suggestions for improvement.

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

The NMR team identified the appropriate staff to interview in consultation with the IESO EM&V staff. Each interview took approximately 45 minutes to complete. The NMR team conducted the IDIs via phone from May 11 to June 3 of 2021.

Table 17: LDC and Program Delivery Vendor Staff Interview Disposition

Disposition Report	LDC Program Staff	Delivery Vendor Staff	Total
Completes	1	1	2
E-mails bounced	--	--	--
Bad Contact Info (No Replacement Found)	--	--	--
Unsubscribed	--	--	--
Partial Complete	--	--	--
Screened Out	--	--	--
No Response	--	--	--
Total Invited to Participate	1	1	2

A.4.2 Service Vendor Survey

The NMR team surveyed 40 service vendors from a sample of 65 service vendors (Table 18). The purpose of the survey was to better understand service vendor perspectives related to program delivery.

The survey topics included their history with the program, program awareness, motivations for participation, training and education received, marketing and outreach to customers, the application process, FR, SO, satisfaction, program barriers, suggestions for program improvement, and firmographics.

The NMR team developed the survey sample with support from the LDC staff. The NMR team employed a census-based approach to reach the largest number of respondents possible given the small number of unique contacts.

The NMR team delivered the survey over the web in partnership with the Nexant survey lab using Qualtrics survey software. The NMR team implemented the survey between April 6 and May 3 of 2021. The survey took an average of 18 minutes to complete after removing outliers.⁷ The NMR team sent weekly e-mail reminders to non-responsive contacts over the course of web survey fielding.

Table 18: Service Vendor Survey Disposition

Disposition Report	Count
Completes	40
E-mails bounced	--
Bad Contact Info (No Replacement Found)	--
Unsubscribed	--
Partial Complete	3
Screened Out	--
No Response	22
Total Invited to Participate	65

A.4.3 Participant Survey

The NMR team surveyed 416 participants from a sample of 1,183 unique contacts (Table 19). The purpose of the survey was to better understand participant perspectives related to program experience.

The survey topics included ISRs, HOU, how participants learned about and applied to the program, motivations for doing the upgrades, education and support provided by the service vendor, satisfaction with various aspects of the program process, suggestions for program improvement, and likelihood to recommend the program.

The NMR team developed the sample from program records provided by the IESO EM&V staff. NMR team employed a census-based approach to reach the largest number of respondents possible given the small number of unique contacts.

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

May 3 of 2021. The survey took an average of 11 minutes to complete after removing outliers.⁷ The NMR team sent weekly e-mail reminders to non-responsive contacts over the course of web survey fielding.

Table 19: Participant Survey Disposition

Disposition Report	Count
Completes	416
E-mails bounced	53
Bad Contact Info (No Replacement Found)	--
Unsubscribed	--
Partial Complete	34
Screened Out	26
No Response	654
Total Invited to Participate	1,183

⁷ Note that the NMR team designed the survey to allow the respondent to come back to the survey at a later time to complete it if they preferred. The average survey time was calculated with this in mind and assumed that any survey that took 40 minutes or more to complete was likely completed by a respondent who took a break before completing the survey.

Appendix B Additional Net-to-gross Evaluation Results

This appendix provides additional detail regarding the NTG results for the Swimming Pool Efficiency Program.

B.1 SERVICE VENDOR SURVEY

The survey with service vendors collected data regarding service vendor perspectives on FR and SO. Due to a low response to these questions, this data was not used to update the program's NTG results. The data collected is included in this section to provide additional context.

The 33 vendors who confirmed completing pool pump projects through the Swimming Pool Efficiency Program in 2020 reported that, on average, almost one-half (48%) of their program projects would have installed the same equipment with the same efficiency levels if there had been no rebate available to customers.

Respondents with at least one pool pump project that did not go through the Swimming Pool Efficiency Program indicated that nearly one-half (48%) of their non-program projects had installed efficient equipment that would have been eligible for the Swimming Pool Program.

Respondents who completed at least one efficient pool pump project that would have been eligible for the program but that did not go through it rated the level of influence the Swimming Pool Efficiency Program had on their decision to install the energy-efficient equipment. Vendors rated the program's influence on a scale from one to 5, where 1 meant the program had "no influence at all" and 5 meant the program had "great influence". The average influence score was a 3-rating, which suggests the program was somewhat but not highly influential on decisions to install efficient pool pump equipment. Of the 18 vendors who were asked this question, one-third (five respondents) gave a 1-rating, two-fifths (six respondents) gave a 5-rating, and one-fourth (four respondents) gave a 2- or 3- rating.

B.2 PARTICIPANT SURVEY

Figure 39 and Table 20 present additional detail regarding the participant FR and SO results collected as part of the participant survey.

Figure 39: Influence of Program Features on Participation (n=416)

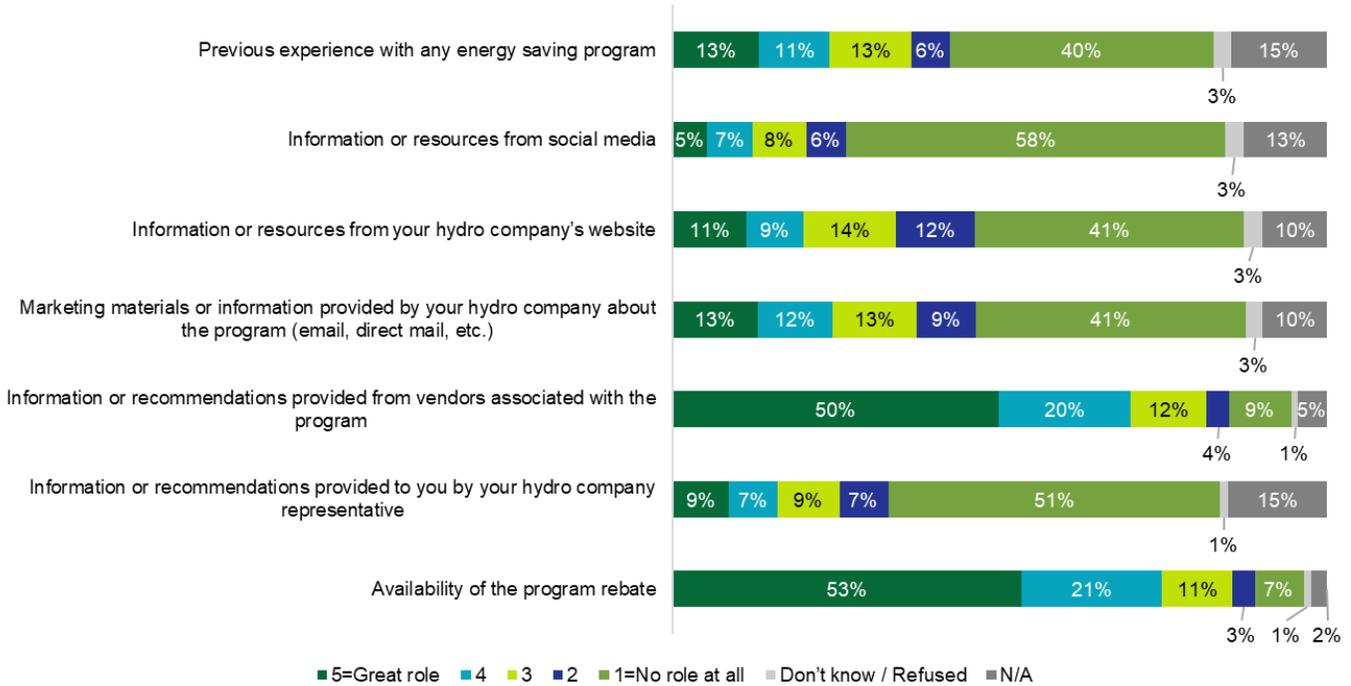


Table 20: Detailed SO Results (n=13)

Type of Equipment Installed	Count of Respondents with Spillover Projects	Number Installed	Size or Type
ENERGY STAR appliance	5	5	n/a
ENERGY STAR LED	67	67	< 10 watts (two respondents); 11-20 watts (two respondents)
Lighting controls (lighting timers, occupancy sensors)	4	4	Timer (two respondents); Occupancy sensor (two respondents)
High efficiency heating, cooling, or water heating equipment	4	5	AC (one respondent); Furnace (three respondents)
Weatherstripping around doors and windows	0	0	n/a
Window film	0	0	n/a
Programmable or smart thermostat	3	3	n/a
Smart power bar	1	1	n/a
Low-flow showerhead	0	0	n/a
Faucet aerator	0	0	n/a
Windows	0	0.0	n/a