Impact Evaluation Report

Pool Pumps - Residential Program Year 2018

FINAL

April 1, 2020

SUBMITTED TO:
California Public Utilities Commission
CALMAC ID: CPU0207.01

SUBMITTED BY:
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Acronym Glossary

Acronym	Full Name
CPUC	California Public Utilities Commission
DEER	Database of Energy Efficient Resources
EUL	Effective Useful Life
FR	Free-Ridership
GSIA	Gross Savings and Installation Adjustment
ME	Market Effects adder
NTG	Net-To-Gross
NTGR	Net-To-Gross Ratio
PA	Program Administrator
PG&E	Pacific Gas & Electric
POE	Preponderance of Evidence
RUL	Remaining Useful Life
SCE	Southern California Edison
UES	Unit Energy Savings
VSD	Variable Speed Drive (pool pump)

Executive Summary

This report provides calculated gross and net energy and demand savings estimates for of Pacific Gas and Electric Company (PG&E) and Southern California Edison (SCE) pool pump programs for 2018.

Background and Objectives

In 2018, PG&E and SCE provided incentives of $100 to $200 to encourage single-family residences to replace the less efficient pumps for their in-ground swimming pool with variable-speed pumps that use a fraction of the energy. PG&E ended their program in 2018 and SCE ended theirs in 2019.

Figure 1: Variable Speed Pool Pump

The primary objective of this evaluation was to provide independent verification of energy and demand savings attributable to PG&E and SCE's pool pump rebate programs. Specific research topics included the following:

- Determine the number of rebated pool pumps that were installed.
- Gather information from pool pump contractors to inform assumptions related to existing pool pump efficiency and working condition, typical pump size/capacity, the influence of program rebates on stocking practices and promotion of variable speed pool pumps.
- Gather information from program participants to inform assumptions related to existing pool pump efficiency and condition, pool operating schedules including seasonal variability, influence of program rebates on customer choice to install an efficient pump, and customer reasons for installations/upgrades.
- Assess the possible impact of the drought, among other factors, on customer pool usage patterns.
- Estimate program influence on customer participation and savings.
- Assess why program administrators (PA) ended their pool pump programs.

APPROACH

Methods

Our methods to achieve the evaluation objectives included:

- Review and analysis of participant data and PA reported savings
- Interviews with PG&E and SCE program staff
- A web survey of 313 program participants
- A web survey of 93 pool pump installation contractors

This research did not include updates to some values that are part of saving calculations for pool pumps, such as pool volume, flow rates, detailed pump operating schedules, and pump motor efficiency values that would have required more extensive on-site data collection and metering. NMR did review the documentation of SCE's development of these values, which were reviewed in 2017 by the CPUC and adopted as the standard method to be used for all PA pool pump programs. The methods used in this analysis are explained in more detail in Section 2.

Gross Savings

The energy savings that result from replacing an existing pool pump with a variable speed pool pump through a PA program are termed gross savings. NMR calculated evaluated gross savings through analysis of PA claimed savings and re-allocation of reported measures to the correct measure categories. This analysis was informed by a review of participant rebate forms and participant and contractor survey data that included rebated pump installation rates and existing pool pump characteristics.

Net Savings

Some participants in the pool pump program would have replaced their existing pump with a variable speed pump without the program rebate. Some participants completed additional energy-saving upgrades or changed their behavior as a result of participating in the program. A net-to-gross (NTG) ratio accounts for both facts, and net savings are the result of multiplying gross savings by the NTG ratio. NMR included a series of NTG questions in the customer and contractor surveys to derive an NTG ratio. NMR applied the NTG ratio to the gross savings estimates to calculate net savings for the single-family pool pump programs. More detail on NTG methods is included in Section 2.3.

KEY FINDINGS AND CONCLUSIONS

Gross Savings

NMR's evaluations found that a very high percentage of the gross energy savings the PAs reported from installing pool pumps took place (118% for PG&E, 94% for SCE). NMR found that a much smaller percentage (0% for PG&E, 30% for SCE) of gross demand savings from installing pool pumps took place. This is due to the requirement that the existing pool pump must be proved to be a working, single speed pump in order for the PA to claim demand savings. Most rebates did not meet this requirement because the existing pump was not working, was not a single speed pump, or both.

Table 1. Single-Family Pool Pump Program Gross Savings in PY2018

PA	Reported Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Reported Demand Savings (kW)	Evaluated Demand Savings (kW)
PG&E	2,494,758	2,952,192	524	0
SCE	8,132,855	7,621,333	1,134	335

Net Savings

NMR calculated an NTG ratio of 0.55 for the pool pump measures, which is an exact match for the existing assumption used by the PAs for their claimed savings.[1]

Table 2. Single-Family Pool Pump Program Net Savings in PY2018

PA	Reported Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Reported Demand Savings (kW)	Evaluated Demand Savings (kW)
PG&E	1,496,855	1,771,315	314	0
SCE	4,936,668	4,572,800	687	201

Savings Assumptions

- The evaluation supports the assumption that 100% of rebated pool pumps were installed by participants.
- Participant and contractor survey responses support the values used to estimate savings from pool pumps, though NMR did find that further research could improve these estimates if PAs were to restart these programs. For instance, a large share of participants and contractors indicated that they or their customers had reduced their pool use or added a pool cover in the past several years. These changes in usage patterns could warrant an update to the daily use values used in savings calculations.

[1] A 5% Market Effects adder was added to the NTG ratio to calculate evaluated savings.

General Findings

- **Increased Requirements to Claim a Single-Speed Pump Baseline Led PAs to End Programs.** The CPUC issued a decision on savings assumptions in 2017 that updated the assumed existing pump to a two-speed pump to match long-standing Title 20 standards for pool pumps. Subsequently, PAs were required to collect additional evidence to claim a single-speed pump existing pump. PAs found that the reduced savings under the new default two-speed existing pump assumption, along with the administrative requirements to claim a single-speed existing pump, reduced the cost-effectiveness of their programs and chose to end them.
- **Future Savings Opportunities are Limited.** New federal standards for pool pumps are scheduled to go into effect July 19, 2021 that effectively require the installation of VSD pumps (the current program measure). This will further reduce savings opportunities for programs that the PAs have already chosen to end due to low cost-effectiveness, as the code minimum product will become the current efficient measure.

Section 1 Introduction

Pool pumps circulate water in swimming pools for the purposes of filtration and cleaning. Pool pumps contributed 5% to net lifecycle electric savings claimed by energy efficiency programs in the residential sector in program year 2018 (PY2018). Residential pool pump programs in California changed significantly in PY2018. A CPUC decision in March of 2017 updated the assumed efficiency of a participant's existing pump to better reflect long-standing California regulations for minimum pool pump specifications. This reduced the opportunity for cost-effective savings significantly. Due to the reduced savings, all PAs except SCE and PG&E effectively ended their programs prior to PY2018. PG&E discontinued their downstream rebate program early in PY2018 but continued with a with a midstream offering through the end of the year. SCE continued through 2019 with their midstream program. This evaluation focuses only on the PG&E and SCE single-family residential pool pump measures, which accounted for 89% of reported (ex-ante) savings for pool pump programs in PY2018.

1.1 Evaluation Objectives

The objectives of this evaluation are as follows:

- Determine the installation rates of rebated pool pumps
- Gather information from pool pump installation contractors to inform savings assumptions related to baseline technology and related measure life, typical size/capacity, influence of program rebates on stocking practices and promoting the measure
- Gather information from program participants to inform savings assumptions related to baseline technology, pool operating schedules including seasonal variability, influence of program rebates on installation of pool pumps, and reasons for installations/upgrades
- Assess whether customer usage patterns have changed due to the drought or other factors
- Determine the gross and net savings attributable to the program

Pool pumps were included in the CPUC's list of measures to be studied due to uncertainty around installation rates, unit energy savings, the net-to-gross ratio, and estimated useful life. SDG&E recommended that pool pumps be included in PY2018 evaluation to better understand barriers to installing pool measures.

1.2 Program Background

Title 20 energy efficiency standards in California have mandated two-speed pool pumps as the minimum efficiency technology since 2009. Program Administrators (PAs) have provided incentives in the amount of $100 to $200 as rebates for installation of qualifying pool pumps. The incentive aims to encourage the replacement of less energy efficient single- and two-speed pool pumps with variable-speed pumps that use a fraction of the energy.

1.2.1 Pool Pump Basics

Pool pumps circulate water in swimming pools for the purposes of filtration, cleaning, and operation of accessories such as heaters and salt-cell chlorine generators. The different functions require different minimum operating speeds. A single-speed pump must be sized for the mode of operation that requires the highest speed, which means energy is wasted when the pump is run for functions that don't require maximum power. Two-, multi-, and variable-speed pumps allow the pump to operate at a lower speed and, if programmed correctly, save energy compared to a single-speed pump. All types of pool pumps are typically operated on a programmed schedule. Variable-speed drive (VSD) pumps offer the most flexibility to program the pump to operate at speeds and times that meet the needs of the customer and use a minimum amount of electricity or avoid operation during periods of peak electricity demand. VSD pumps were the only type of pump included in PA programs in 2018.

1.2.2 PG&E Program

Description

Prior to 2018, PG&E ran downstream and point-of-sale (POS) programs with a $100 customer rebate for VSD pool pumps. The POS program was an exclusive offering of major pool supply retailer Leslie's Pool Supplies. PG&E decided to sunset the downstream program at the end of 2017, after adopting the SCE workpaper and the mandates of the CPUC's decision on savings assumptions (see Section 1.2.6). PG&E continued rebates through 2018 for pumps sold and installed by Leslie's Pool Supplies (corresponding to Measure A in Table 27). They declined to collect the preponderance of evidence necessary to claim early retirement savings for replacing single-speed pumps. More information on the timeline of events is shown in Table 26 in Appendix H.

Program Goals

Prior to the program changes in 2018, PG&E staff reported success in meeting program savings goals, with a high rebate volume. PG&E did not have savings goals for pool pumps in PY2018.

Program Marketing

PG&E program staff reported that they conducted program outreach using retail, mass marketing and direct customer approaches. In the retail channel, PG&E utilized a field team, Point of Purchase (PoP) signage and rebate forms to promote the program within pool supply and service stores. Mass awareness efforts included Search Engine Marketing (SEM) and digital display marketing in warmer parts of the PG&E service area where residential properties are more likely to have a pool. For direct customer efforts like direct mail and email, PG&E targeted customers that had a high likelihood of a pool present as part of their residential property as indicated by acquired customer data. PG&E also included mention of the rebate program within summer seasonal campaigns, and other communications such as a monthly multi-topic e-newsletter and the PG&E website. PG&E's program marketing did not link pool pump energy use to global warming.

1.2.3 SCE Program

Description

SCE offered rebates for single-family residential VSD pool pump replacements throughout PY2018. SCE also offered a much smaller number of multifamily and commercial pool pump measures, which NMR did not cover in this study, though the reported savings are included below in Section 3.2: Gross Savings. According to SCE program staff, during the first nine months of 2018, SCE offered only a $200 rebate for replacing single-speed pumps. Customers would participate by filling out a rebate form via mail, fax, email, or on SCE's rebate website. SCE did not collect the "preponderance of evidence" (POE) information required to claim early retirement savings for replacing single-speed pumps during this period. During this time, installation contractors could also claim a $100 reward if they had participated in a Foundation for Pool & Spa Industry Education training program sponsored by SCE on proper installation and programming. For the last quarter of 2018, SCE introduced a new additional form that could only be filled out on paper that included a POE questionnaire to collect the evidence required to claim early retirement savings. For this period, SCE also introduced a $100 rebate for replacing a two-speed pump.

Though SCE introduced the new POE form to collect the additional information required to claim early retirement savings, the program did not enter this data into their tracking system due to the administrative burden of changing their existing system to accommodate the new data. Customers applying via web form would agree to the terms and conditions certifying they met the POE requirements and separately submit the paper form. SCE retained the POE forms in case of audit but did not otherwise store the data. Inspectors would visit a random sample of 5% of customers to verify installation of the rebated pump and that the pump was programmed to operate outside the peak period. SCE provided us with a random sample of 376 of the POE forms, which NMR addresses in Section 3.[2]

Given the administrative challenges presented by the POE requirements, SCE abandoned the POE form for 2019 and switched to a purely midstream program with rebates provided through distributors. Even with the reduced administrative costs, SCE determined that the program was no longer cost effective and ended all residential pool pump rebates at the end of 2019. More information on the timeline of events is shown in Table 26 in Appendix H.

Program Goals

During PY2018, SCE had a net energy savings goal of 5.8 million kWh. Their reported savings are 5.5 million kWh, 95% of this goal. They also report achieved demand savings of 1,200 kW, 90% of their PY2018 goal. For 2019, they expect to achieve only 50% of their kWh goals and will claim no demand savings due to the switch to a midstream-only program.

Program Marketing

To promote their pool pump programs, SCE maintains relationships with pump manufacturers and regional sales directors, including annual meetings for program planning. They connect to installation contractors via the manufacturers and direct emails. When SCE offered downstream

[2] SCE rebated 1,771 pumps after September 1, 2018, the period when they introduced the POE form, so the 376 provided represent roughly 20% of the possible total count of forms.

rebates, they found social media marketing was a successful channel to generate participation. For the midstream program, they provide in-store marketing materials and email content. Since the end of the downstream/self-install option, materials direct customers to "inquire with a pool professional" about available rebates. SCE's marketing materials have not linked pool pump energy use to global warming.

1.2.4 Federal Standards

Federal standards for pool pumps were adopted May 18, 2017 but will not go into effect until July 19, 2021.[3] The federal standards do not require variable-speed pumps, but instead set a minimum efficiency value, a calculated WEF (weighted energy factor) score. The minimum scores in the DOE regulations will effectively set the baseline to variable-speed pumps, since no single- or two-speed pumps currently on the market meet the requirements.[4]

1.2.5 California Pool Pump Standards

Title 20, §1605.3(g)(5)(B) of the California Code of Regulations covers residential pool pump motors and controls.[5] This section requires that "residential pool pump motors with a pool pump motor capacity of 1 HP or greater which are manufactured on or after January 1, 2010, shall have the capability of operating at two or more speeds." The regulations require that pool pump motor controls "manufactured on or after January 1, 2008 that are sold for use with a two- or more speed pump shall have the capability of operating the pool pump at least at two speeds. The control's default circulation speed setting shall be no more than one-half of the motor's maximum rotation rate. Any high-speed override capability shall be for a temporary period not to exceed one 24-hour cycle without resetting to default settings."

Title 24 Part 6 of the California Code of Regulations covers building energy efficiency standards. Section 110.4(b)3ii deals with pool pumps and requires a control mechanism such as a timer switch that allows scheduling the pool pump operation during off peak hours, except in the case where public health standards supersede this requirement for multifamily and commercial pools.[6] Additionally, Section 150.0(p), defines requirements for pump sizing and flow rates.[7]

1.2.6 CPUC Decision on Savings Assumptions

On March 1, 2017, the CPUC issued a decision on residential variable speed pool pumps to address issues with the various PA programs and bring their savings calculations into alignment.[8]

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[3] 2017-01-18 Energy Conservation Program: Energy Conservation Standards for Dedicated-Purpose Pool Pumps; Direct final rule. https://www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0109

[4] "Federal Pump Rule Established," Pool and Spa News, May 24, 2017. https://www.poolspanews.com/business/legal-regulatory/federal-pump-rule-established_o

[5] California Code of Regulations, State Standards for Non-Federally-Regulated Appliances. https://govt.westlaw.com/calregs/Document/IEEDE2D64EF7B4F168C0E85379828A8C2

[6] 2019 California Energy Code, Title 24, Part 6, Subchapter 2. https://codes.iccsafe.org/content/CAEC2019/subchapter-2-all-occupancies-mandatory-requirements-for-the-manufacture-construction-and-installation-of-systems-equipment-and-building-components

[7] 2019 California Energy Code, Title 24, Part 6, Subchapter 7. https://codes.iccsafe.org/content/CAEC2019/subchapter-7-low-rise-residential-buildings-mandatory-features-and-devices

[8] SCE17WP001.1 A6. This workpaper attachment can be downloaded from http://www.deeresources.net/workpapers.

- The Commission noted that, though Title 20 regulations had at that time required two-speed pumps for 9 years for a product with a deemed useful life of 10 years, the rebate programs still assumed that single-speed pumps comprised the vast majority of installed pumps. The CPUC mandated a two-speed pump base case, except in the case of direct install programs where PAs could provide a "preponderance of evidence" that a customer's existing pump was single-speed.
- The Commission found that, though program measures were identical for the different PA programs, energy savings approaches and assumptions varied. The CPUC mandated that all PAs use the approach defined by SCE.

Under this decision, the single-family pool pump measures allowed are those defined under SCE's program.[9] . For the single-family market, three measures are defined: a commissioned (professionally installed and programmed to operate outside of the peak demand period of 2pm-5pm) VSD pump replacing a two-speed pump, a self-installed VSD pump replacing a two-speed pump, and a commissioned VSD pump replacing a single-speed pump (see Table 27 in Appendix H). The first two measures (A and B) are replace-on-burnout (ROB) measures, while the third (C) allows early retirement (RET) savings if the PAs collect a preponderance of evidence proving that the existing single-speed pump would have continued to operate during the deemed remaining useful life of 3.3 years. Evidence required includes the make, model, and rated horsepower of the existing pump, that the pump is a main filter pump and not a booster or secondary pump, documentation that it would be expected to continue in operation for a minimum of 3.3 years, and a confirmation that the existing pump would be destroyed rather than refurbished and sold. Measure C also allows PAs to claim demand savings during the first baseline/RUL period under the assumption that the existing pump was installed before current regulations that require off-peak operation.

[9] See SCE17WP001.1. This workpaper can be downloaded from http://www.deeresources.net/workpapers.

Section 2 Methodology

To inform this evaluation, NMR first requested program participation data for PY2018 from PG&E and SCE. NMR then conducted interviews with the program staff to clarify the details of their respective programs in PY2018. Finally, NMR conducted web surveys of participants and contractors from both programs to inform our calculations of gross and net savings.

2.1 Data Sources

2.1.1 Program Staff In-Depth Interviews

To inform findings about program updates, customer participation trends over the life of the program and changes in outreach, messaging, and incentive levels, NMR conducted one in-depth interview with program staff from each PA. The two interview guides vary somewhat due to differences in the PA programs and based on the prior information available to the research team. The interview guides are provided in Appendix F and Appendix G.

2.1.2 Program Data

The team requested all relevant participant data and contractor contact information from SCE and PG&E. NMR also requested a random sample of POE forms from SCE. The PAs provided all requested data. The participant and contractor data formed the sample for our participant and contractor surveys. NMR also include findings below, for purposes of comparison, from our analysis of the POE surveys provided by SCE.

2.1.3 Participant Survey

NMR surveyed SCE and PG&E pool pump program participants to inform evaluated gross and net savings calculations, including the installation rates of rebated pool pumps, existing pump technology, pool operating schedule (including seasonal variability), the influence of program rebates on pool pump installation, reasons for installation/upgrade, and the role played by the installation contractor in participant decision-making. NMR also asked about any events, such as the drought of 2017, that might have led to changes in pool pump usage. The survey instrument is included as Appendix A.

NMR surveyed SCE and PG&E participants via a web survey programmed into Qualtrics. The participant data included email addresses for 63% of PG&E and 75% of SCE participants. NMR had planned to send an initial email invitation for the survey, to be followed by a mailed invitation. NMR had also planned to call customers to conduct the survey over the phone if there was difficulty reaching the response targets. NMR received such a high number of responses in a short period after the first email invitation that NMR abandoned plans for the mailed invitation and did not conduct any surveys by phone. Given that the survey was web only, there is the possibility of response bias for customers without internet access, though NMR expects the population of single-family homeowners with pools and without internet access to be relatively small. NMR sent 2 subsequent email reminders to PG&E customers to achieve our sample targets. The survey

was open from December 31, 2019 through January 15, 2020. Respondents received a $10 gift card incentive, delivered via an email link that allowed them to choose from a selection of retail store, restaurant, and charity gift cards. NMR set a total target of 300 completes, with individual PA targets set proportionally to the number of claimed single-family pool pump measures in the program tracking data. Table 3 summarizes the results.

Table 3: Participant Survey

PA	Participants	Participants Emailed	Response Target	Responses[10]
SCE	6,935	5,209	214	227
PG&E	2,326	1,467	86	86
Total	**9,261**	**6,676**	**300**	**313**

2.1.4 Contractor Survey

NMR surveyed pool pump installation contractors operating in SCE and PG&E service territories to further inform evaluated gross and net savings calculations, assess assumptions related to existing pump technology and related measure life, typical pump size/capacity, the influence of program rebates on sales and stocking practices, and identify barriers to program participation. NMR asked contractors about the equipment they offer to customers when pool pumps are replaced on burnout to establish the proportion of installations that may be below code (i.e. single-speed versus two- or variable speed). NMR also asked their opinions on changes in customer usage patterns due to the drought or other factors.

NMR deployed the contractor survey in a similar fashion to the participant survey. As for the participant data, the contractor sample provided by SCE and PG&E contained a high share of email addresses. NMR did a limited amount of internet research to acquire some of the missing email addresses. Contractors that completed the survey received a $20 gift card via the same service NMR used for the participant survey. As for the participants, the survey was active from December 31, 2019 through January 15, 2020. Again, due to the high response rate overall, NMR did not need to send the planned mailed invitations or conduct any surveys by phone. NMR set a total contractor sample target of 70, with the PA targets proportional to their share of participants. As shown in Table 4, NMR exceeded the total target with 93 responses. Due to the smaller SCE contractor sample, however, NMR only achieved 31 of the 50 targeted responses. NMR well exceeded, however, the PG&E target.

[10] Indicates number of complete responses. Partial responses are included in Section 3 where available.

Table 4: Contractor Survey

PA	Contractors in Sample	Contractors Emailed	Response Target	Responses[11]
SCE	275	161	50	31
PG&E	998	982	20	62
Total	**1,273**	**1,143**	**70**	**93**

2.2 Gross Savings

NMR adjusted the claimed savings values by review of participant data to determine whether PAs had correctly applied the workpaper values for each measure, and that they had correctly categorized each participant's pump as the proper measure. As described in Section 3.1: Savings Assumptions below, the methods of this study are not adequate to fully verify or adjust most of the factors that determine the unit energy savings for the three pool pump measures (such as pool volume, flow rates, and pump efficiency). NMR did provide results from the participant and contractor surveys on factors such as installation rates; base case equipment type, age, and condition; and customer usage patterns and use of pool accessories that influence pool pump energy use.

2.3 Net Savings

A net-to-gross factor indicates how much of the gross savings occurred due to the program and would not otherwise have occurred. A program's free-ridership rate is the percentage of program savings attributed to free-riders. A free-rider refers to a program participant who received an incentive or other assistance through an energy efficiency program who would have adopted the same high-efficiency measure on their own at that same time if the program had not been offered.[12]

The NTGR presently assigned for single-family pool pump measures is 0.60, the value from DEER for measures with no evaluated NTGR. NMR asked participants and contractors a battery of questions in the surveys to develop a specific NTGR for pool pump measures.

The formula NMR employed to calculate NTGR is:

$$NTGR = (1 - FR)$$

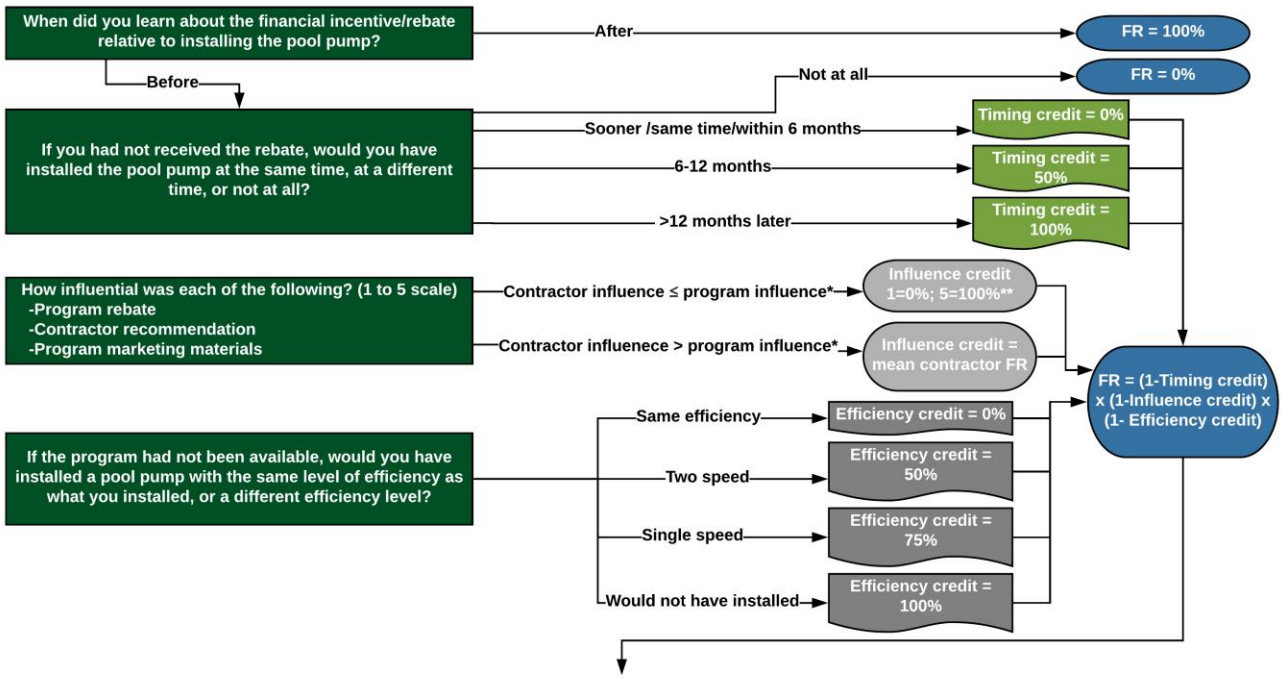
Where:

FR = estimate of free-ridership among participating customers (participants), potentially adjusted by estimates of participating contractors.

[11] Indicates number of complete responses. Partial responses are included in Section 3 where available.
[12] This definition is adapted from" Net-to-Gross Methodology Research—TXC08", March 24, 2017. http://ma-eeac.org/wordpress/wp-content/uploads/Net-to-Gross-Methodology-Research.pdf

Our method for calculating the value of FR is detailed in Figure 2. The score is calculated by blending three credit scores for timing, program influence, and efficiency. The timing credit is assigned based on when the customer learned about the rebate program and how their knowledge of the rebate influenced their decision on when to upgrade their pool pump. The influence credit measures the relative importance of the customer's own knowledge of program rebates and materials versus the influence of their contractor on their decision to upgrade. The efficiency credit measures the influence of the program on the customer's choice to install a variable speed pump instead of a lower-efficiency option.

Figure 2: Net-to-Gross Methodology



*Contractor influence is the rating given to the contractor recommendation. Program influence is the maximum of the ratings given to the program rebate and program marketing materials.
**The values associated with ratings of 2, 3, and 4 will increase incrementally: 25%, 50%, and 75%, respectively. Maximum influence rating used.

Section 3 Findings

3.1 Savings Assumptions

SCE developed the unit energy savings values (UES) assumed for the pool pump measures, with the most recent values appearing in workpaper SCE17WP001.1. The CPUC decision on savings assumption discussed in Section 1.2.6 above mandated that all PAs adopt these UES values to standardize savings claims across PA programs. The calculated UES savings depend on the following factors:[13]

- Pool volume
- Pump operation mode share, which estimates the number of existing pumps operated in either filter only mode, or filter and sweep mode. Sweep mode is a higher power mode used for pools with pump-powered pool sweeping equipment.
- Turnover per day, a measure many times the entire volume of water in the pool is processed through the filter system
- Flow rate of water through the filter system, a function of pipe size and pump power and operating speed
- Pump energy factor, a measure of pump efficiency

SCE's data sources for these factors were:

- An analysis of over 750 single-family pool installations from 2008 from SCE program data
- Data on pool pumps from 2008 and 2018 in the California Energy Commission appliance database

The methods employed in the current study, *i.e.* self-reported data from participants and contractors, are not an adequate replacement for the type of analysis used to develop these UES factors, and NMR did not attempt to adjust any of the assumed savings values for the three single-family pool pump measures. NMR did gather data via the web surveys on the following factors that influence energy use of pool pumps but are not part of the UES calculations.

3.1.1 Installation Rates

The assumed installation rate for the single-family pool pump measures is 1, the default Gross Savings and Installation Adjustment (GSIA) value from the DEER READI tool v2.4.7. **Respondents indicated an installation rate of 100%,** matching the GSIA value.

[13] See SCE17WP001.1 A4 – Savings Calculations v13

3.1.2 Baseline Equipment Type

The CPUC's decision on savings assumptions in 2017 required PAs to assume a two-speed pump base case given that this had been the minimum standard for pumps sold in California since 2008. PAs were required to gather information from participants to justify use of a single-speed pump base case for the assumed remaining useful life of 3.3 years. **Participant survey responses suggest that the majority (82%) of existing pumps were single-speed pumps and 7% were two-speed pumps** (Table 5). Information from the SCE POE forms supported this general pattern. Contractor responses also supported the customer answers, with contractors reporting that 78% of the pumps they replaced in 2018 were single-speed and 5% were two-speed.[14]

Table 5. Existing Pool Pump Efficiency

Response	PG&E (n=87)	SCE (n=212)	Overall (n=299)	SCE POE Forms (n=334)	Contractors (n=96)
Single-speed pump	80%	83%	82%	85%	78%
Two-speed pump	11%	5%	7%	3%	5%
Variable speed pump	7%	8%	8%	--	17%
Did not have an existing pump	1%	4%	3%	12%	--

3.1.3 Effective and Remaining Useful Life

The values for EUL and RUL for the single-family pool pump measures, as included in the DEER READI tool v2.4.7 are 10 years and 3.3 years, respectively (1/3 of the EUL). The RUL value applies only to the first baseline period in savings calculations for Measure C. Two-thirds of customers (67%) reported that their existing pump was still running, with the remaining third (33%) saying the pump was broken (Table 6). Information from the SCE POE forms generally followed this pattern, with a slightly higher percentage (39%) reporting broken existing pumps. On average, contractors said that 54% of pumps were still operational.

Table 6. Existing Pool Pump Condition

Response	PG&E (n=88)	SCE (n=219)	Overall (n=307)	SCE POE Forms (n=207)	Contractors (n=96)
Good, still running	34%	37%	36%	25%	21%
Fair, had issues	33%	32%	32%	37%	33%
Poor, broken	33%	31%	32%	39%	46%

Two-thirds of customers (67%) reported that their existing pump was older than 10 years, with another 23% said the existing pump was between 7 and 10 years old (Table 7). Similarly,

[14] Contractors were about existing pool pump efficiency. Separately, they indicated that 90% of installations replaced an existing pump and 10% were for new pools.

contractors said that 51% of the pumps they replaced in 2018 were older than 10 years and 33% were 7-10 years old.

Table 7. Existing Pump Age

Response	PG&E (n=82)	SCE (n=202)	Overall (n=284)	Contractors (n=96)
Less than 1 year old-3 years old	1%	4%	3%	3%
4-6 years old	9%	12%	11%	13%
7-10 years old	23%	28%	26%	33%
Older than 10 years	67%	56%	60%	51%

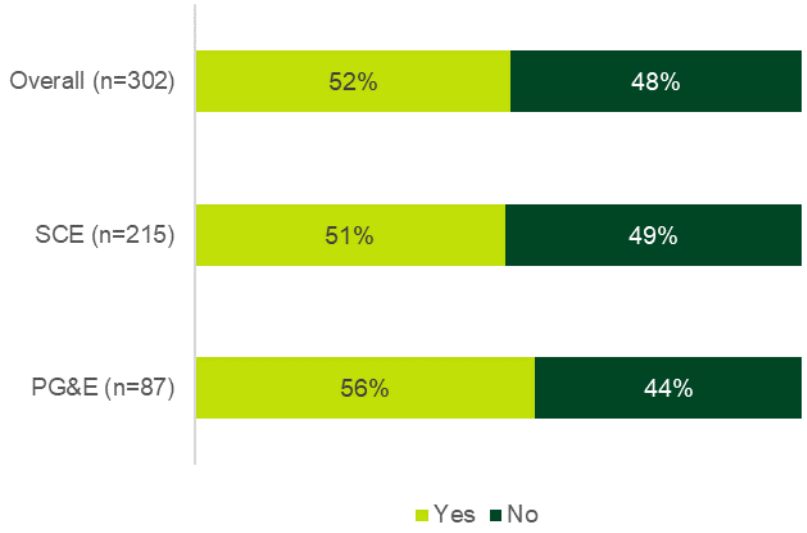
Given the high share of customers with existing single-speed pumps older than 10 years still in operating condition, **the DEER EUL/RUL values may be low**. Even so, with more than 1/3 of replaced pumps 10 years old or less, it is unlikely that many single-speed pumps installed in 2008 or before will operate much longer, so **a change in the two-speed base case assumption is not warranted**.

3.1.4 Months of Operation, Use Patterns

UES values are based on an analysis of daily pump use hours and assume that pumps are operated year-round. Some customers close their pools during part of the year due to weather, absence from the home, or other reasons, which would reduce their pool pump use, but **survey findings indicate that year-round use is a reasonable assumption**. The vast majority (95%) of customers said that they kept their pools open year-round. Similarly, contractors reported that 98% of their customers kept their pools open year-round. The remaining 5% of customers reported that they closed their pool for an average of 4.6 months a year. Further research would be necessary to verify those claims, but 5% of customers stopping their pool pumps for 4.6 months would reduce total pool operating hours (and hence assumed pool pump savings) by about 2%.

Customers were asked if they had changed their pool pump schedule or months of operation in the last several years (Figure 3). About half (52%) of customers said that they had made changes. The most common reasons given for changing the pool pump schedule were to save electricity (71%), to save money (51%), and using the pool less (34%) (Table 8). Less than one in ten (7%) of customers reported changing their schedules as a result of drought.

Figure 3. Customers Reporting Changing Their Pool Pump Schedule in Last Several Years



Contractors were asked what percentage of their customers changed their pool operating schedules during the drought that ended in 2017. Contractors reported that about a quarter (23%) of customers had changed their pool operating schedule, most often by reducing the pool's daily operating hours (73% of this group, or 17% of total customers) and/or adding a pool cover (50% of this group, or 12% of total customers). It should be noted that contractors were asked specifically about the drought, while customers were asked if they had changed their pool pump's schedule and then for the reasons.

Regardless of the reason, **that large a share of customers and contractors reporting reduced usage could warrant an update in daily use values assumed for UES calculations**, if the PAs were to continue or restart pool pump programs.

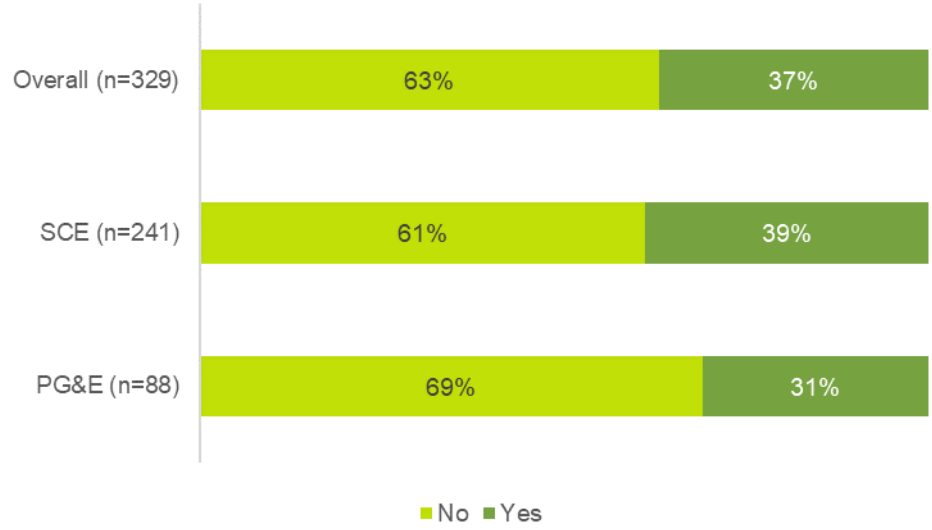
Table 8. Reason for Changing the Pool Pump Schedule

Multiple Responses Allowed

Response	PG&E (n=49)	SCE (n=108)	Overall (n=157)
To save electricity	76%	69%	71%
To save money	53%	50%	51%
Using the pool less	31%	35%	34%
Using the pool more	2%	20%	15%
Drought	8%	6%	7%
To clean the pool better	4%	0%	1%
Pool professional wanted to change the schedule	0%	1%	1%
To keep the pipes from freezing	2%	0%	1%
To align the pump schedule with the solar heater schedule	2%	0%	1%

Customers were asked if their pool pump was typically set to operate between the hours of 2 and 5 PM (Figure 4), the period of summer peak electricity demand. Overall, about two-thirds of customers (63%) said that their pumps were not set to run during peak hours. About half (48%) of contractors said that customer's existing pumps were 'always' (11%) or 'often' (37%) set to operate outside of peak hours. Over three-quarters (76%) of contractors said that they 'always' (47%) or 'often' (29%) set a customer's new pool pump to operate outside of peak hours. Contractors that did not always set their customers pool pumps gave the following reasons: that pools may grow algae if water is not circulated enough, there should be seasonal differences in pool pump schedules, that it depends on whether a solar heater is being used, and that the choice is ultimately up to the customer. **This result indicates some opportunity for demand savings through education of customers and contractors if they can be persuaded that the schedule change will not impact pool water quality.**

Figure 4. Customers Reporting Running Their Pool Pump during Peak Hours



3.1.5 Additional Equipment

Pool accessories can affect pool pump energy use and time of operation. Accessories such as heaters, sweepers, and salt-cell chlorine generators require a minimum flow rate to operate. A pool cover that retains heat can reduce the time a heater, and hence the pump, operates. A solar pool heater operates while the sun is shining, which could impact efforts to keep pumps from running during the peak demand period of 2pm to 5pm. The UES values do not explicitly account for the presence of all these accessories as factors, though the daily pump use hours from SCE's database analysis do incorporate separate filter and sweep hours of use. User behavior can vary

for these accessories as well, so it would be difficult to develop reliable isolated energy use estimates for these pool accessories, though they do affect energy use.

Customers were asked which other pool equipment was installed at their home (Table 9). The most common equipment type was a gas or propane heater (61%), followed by a salt cell chlorine generator (19%) and a solar heater (10%).

Table 9. Additional Pool Equipment
Multiple Responses Allowed

Response	PG&E (n=89)	SCE (n=228)	Overall (n=317)
Gas or propane heater	31%	73%	61%
Salt cell chlorine generator	13%	21%	19%
Solar heater	15%	8%	10%
Heat pump (electric) heater	2%	8%	6%
None of these	51%	19%	28%

3.1.6 Existing Pump Disposal

The CPUC decision on savings assumptions requires PAs to certify that existing pumps will be disposed of when replaced to claim retirement savings. Results from the contractor survey indicate that this is what occurs in the great majority of cases, with 94% being sent to the landfill or recycled for parts or materials (Table 10).

Table 10. Contractor Disposal of Existing Pool Pump

Response	PG&E (n=64)	SCE (n=32)	Overall (n=96)
Disposed of pump in trash/landfill	35%	37%	36%
Recycled for parts or materials	62%	55%	59%
Refurbished for reuse/resale	1%	5%	2%
Donated	1%	0%	1%
Left on site per LADWP rebate spec.	0%	3%	1%

3.2 GROSS SAVINGS

3.2.1 All Reported Savings from Pool Pump Measures

Table 11 shows all reported pool pump measures and energy savings for PY2018 for all PAs. Total reported savings are 11,939,295 kWh. Due to the outsize contribution of single-family residential pool pump measures from SCE and PG&E to total reported savings and measure counts (89% of savings, 85% of measures), only those PAs and measures are considered in this evaluation.

Table 11: PY2018 Reported Savings for Pool Pump Measures

Measure Code	Program(s)	Measure Description	Measure Quantity	First Year Gross kWh	Evaluated in this Report
MCE					
CMF – VAR. SP. POOL PUMP	Multi-family	Variable Speed Pool Pump	1	6,187 (0%)	No
PG&E					
CWA10	School Energy Efficiency, Commercial Calculated Incentives	Pools Retrofit/New-Pumps-Variable Flow	3	248,765 (2%)	No
P106	Residential Energy Efficiency	Efficient Variable Speed Pool Pump and Motor - Retailer	1,659	0 (0%)	No
P107	Residential Energy Efficiency	Variable Speed Pool Pump	1,148	1,343,181 (11%)	Yes
PL001	Residential Energy Efficiency	Commissioned Variable Speed Drive on Pool Pump Controls	1,693	1,152,254 (10%)	Yes
SCE					
PM-19753	Multifamily Energy Efficiency Rebate Program	Programmable Variable Speed Drive on Spa Pool Pump Control Replacing Single-speed Pool Pump	19	91,431 (1%)	No
PM-21834	Commercial Calculated Program	Nonresidential Pool Pump - VFD - Add-On Equipment	4	256,295 (2%)	No
PM-69234	Plug Load And Appliances Program	Commissioned Variable Speed Drive on Pool Pump Controls Replacing Single-speed Pool Pump	4,592	5,750,092 (48%)	Yes
PM-78394	Plug Load And Appliances Program	Commissioned Variable Speed Drive on Pool Pump Controls Replacing Two-speed Pool Pump	1,017	1,111,515 (9%)	Yes
PM-79353	Multifamily Energy Efficiency Rebate Program	Programmable Variable Speed Drive on Pool Pump Control Replacing Single-speed Pool Pump	61	542,642 (5%)	No
PM-98422	Plug Load And Appliances Program	Self-Installed Variable Speed Drive on Pool Pump Control Replacing Two-speed Pool Pump	1,331	1,277,509 (11%)	Yes
SDG&E					
463202	Sw-Com-Calculated Incentives-Calculated	Add VFD Control To 8 Pool/Spa Pumps	1	32,288 (0%)	No
463003	Sw-Cals-Plug Load and Appliances-POS Rebates, Sw-Cals-Plug Load and Appliances-HEER	Commissioned Residential VFD Swimming Pool Pump	14	127,135 (1%)	No

3.2.2 PG&E

NMR used PG&E's program records along with work paper SCE17WP001 Rev. 1 (discussed in Section 1.2.6) to update PG&E's gross energy savings (Table 12) and gross demand savings (Table 13). Reported unit energy savings and unit demand savings were updated to match the

values shown in the SCE17WP001 Rev. 1 work paper. Unit demand savings are 0 kW for both measures because state energy code requires newly installed pool pumps to be programmed to run during off-peak hours.[15]

Realization rate is the comparison between the energy or demand savings reported by the PAs and the energy or demand savings calculated by NMR. The changes discussed above resulted in a gross savings realization rate of 118.3% for both first year and lifetime savings, and a gross demand savings realization rate of 0% for both first year and lifetime savings.

Table 12. PG&E Reported and Evaluated Gross Energy Savings

Measure	Reported Unit Energy Savings (kWh)	Evaluated Unit Energy Savings (kWh)	Measure Quantity	Reported First Year Energy Savings (kWh)	Evaluated First Year Energy Savings (kWh)	Reported Lifetime Gross (kWh)	Evaluated Lifetime Gross (kWh)
Self-install VSD replacing two-speed pump (P107)	1,170	959.81	1,148	1,343,181	1,101,862	13,431,810	11,018,619
Commissioned VSD replacing two-speed pump (PL001)	681	1,092.93	1,693	1,151,577	1,850,330	11,515,770	18,503,305
Total				**2,494,758**	**2,952,192**	**24,947,580**	**29,521,924**
Gross energy savings realization rate				**118.3%**		**118.3%**	

Table 13. PG&E Reported and Evaluated Gross Demand Savings

Measure	Reported Unit Demand Savings (kW)	Evaluated Unit Demand Savings (kW)	Measure Quantity	Reported First Year Demand Savings (kW)	Evaluated First Year Demand Savings (kW)	Reported Lifetime Gross (kW)	Evaluated Lifetime Gross (kW)
Self-install VSD replacing two-speed pump (P107)	0.17	0.0	1,148	191	0	1,907	0.0
Commissioned VSD replacing two-speed pump (PL001)	0.20	0.0	1,693	333	0	3,334	0.0
Total				**524**	**0**	**5,241**	**0**
Gross demand savings realization rate				**0.0%**		**0.0%**	

3.2.3 SCE

NMR used SCE's program records along with work paper SCE17WP001 Rev. 1 (discussed in Section 1.2.6) to update SCE's gross energy savings (Table 14) and gross demand savings (Table 15). The numbers of self-install VSD replacing two-speed pump rebates (PM-98422) and commissioned VSD replacing two-speed pump rebates (PM-78394) were adjusted from the reported savings numbers to match the program records. The number of commissioned VSD replacing single-speed pump rebates (PM-69234) were first adjusted to match program records. NMR then used the sample of preponderance of evidence (POE) records provided by SCE to calculate the percentage of records that were early replacement of a single-speed pump, as required by Measure C in the SCE17WP001 Rev. 1 work paper. NMR found that 59.1% of the submitted POE forms met these requirements. As a result, all of the commissioned VSD replacing

[15] 2019 California Energy Code, Title 24, Part 6, Subchapter 2. https://codes.iccsafe.org/content/CAEC2019/subchapter-2-all-occupancies-mandatory-requirements-for-the-manufacture-construction-and-installation-of-systems-equipment-and-building-components

single-speed pump rebates (PM-69234) submitted before POE forms were in use and 40.9% of the records submitted after that time were reallocated to the commissioned VSD replacing two-speed pump rebates (PM-78394) measure.

These changes resulted in a gross savings realization rate of 93.7% for first year savings and 97.8% for lifetime savings. These changes results in a gross demand savings realization rate of 29.6% for first year savings and lifetime savings.

Table 14. SCE Reported and Evaluated Gross Energy Savings

Measure	Reported Unit Energy Savings (kWh)	Evaluated Unit Energy Savings (kWh)	Measure Quantity	Reported First Year Energy Savings (kWh)	Evaluated First Year Energy Savings (kWh)	Reported Lifetime Gross (kWh)	Evaluated Lifetime Gross (kWh)
Self-install VSD replacing two-speed pump (PM-98422)	959.81	959.81	1,331	1,277,509	1,277,507	12,775,092	12,775,071
Commissioned VSD replacing two-speed pump (PM-78394)	1,092.93	1,092.93	4,268*	1,111,515	4,664,625	11,115,147	46,646,252
Commissioned VSD replacing single-speed pump (PM-69234) – **first baseline**	1,252.20	1,252.20	1,341*	5,743,831	1,679,200	52,543,700	15,361,009
Commissioned VSD replacing single-speed pump (PM-69234) – **second baseline**	1,092.93	1,092.93					
Total				**8,132,855**	**7,621,333**	**76,433,939**	**74,782,332**
Gross savings realization rate				**93.7%**		**97.8%**	

*Measure quantities were adjusted from reported values based on program records.

Table 15. SCE Reported and Evaluated Gross Demand Savings

Measure	Reported Unit Demand Savings (kW)	Evaluated Unit Demand Savings (kW)	Measure Quantity	Reported First Year Demand Savings (kW)	Evaluated First Year Demand Savings (kW)	Reported Lifetime Gross (kW)	Evaluated Lifetime Gross (kW)
Self-install VSD replacing two-speed pump (PM-98422)	0.00	0.00	1,331	0	0	0	0
Commissioned VSD replacing two-speed pump (PM-78394)	0.00	0.00	4,268*	0	0	0	0
Commissioned VSD replacing single-speed pump (PM-69234) – **first baseline**	0.25	0.25	1,341*	1,134	335	3,744	1,106
Commissioned VSD replacing single-speed pump (PM-69234) – **second baseline**	0.00	0.00					
Total				**1,134**	**335**	**3,744**	**1,106**
Gross demand realization rate				**29.6%**		**29.6%**	

*Measure quantities were adjusted from reported values based on program records.

3.3 NET SAVINGS

3.3.1 Free-Ridership

NMR calculated the net-to-gross ratio according to the algorithm diagrammed in Figure 2. Free-ridership was calculated by subtracting an efficiency credit, a timing credit, and an influence credit from 1 and then multiplying those values together. The responses that fed into the timing credit, influence credit, and efficiency credit are shown in the following two tables and figure.

Table 16 shows the customers' responses related to the timing credit with the free-ridership battery. About two-thirds (64%) of customers learned about the pool pump rebate before speaking with a contractor or before choosing the type of pump to install. About one-third (32%) learned of the rebate after deciding to install a VSD pump or after the pool pump was installed.

Table 16. When Customer Learned of Pool Pump Rebate

Response	PG&E (n=82)	SCE (n=225)	Overall (n=307)
Before speaking with a contractor	15%	24%	22%
After speaking with a contractor, but before choosing the type of pool pump to install	35%	45%	42%
After choosing the type of pump to install	40%	18%	23%
After installing the pool pump	7%	10%	9%
Response unclear	3%	3%	3%

Table 17 shows the customer responses related to the efficiency credit within the free-ridership battery. Almost three-quarters (72%) of customers indicated that they would have installed the VSD pump without a rebate, but 14% of customers would have installed a less-efficient pump and 12% would not have installed a pump at all.

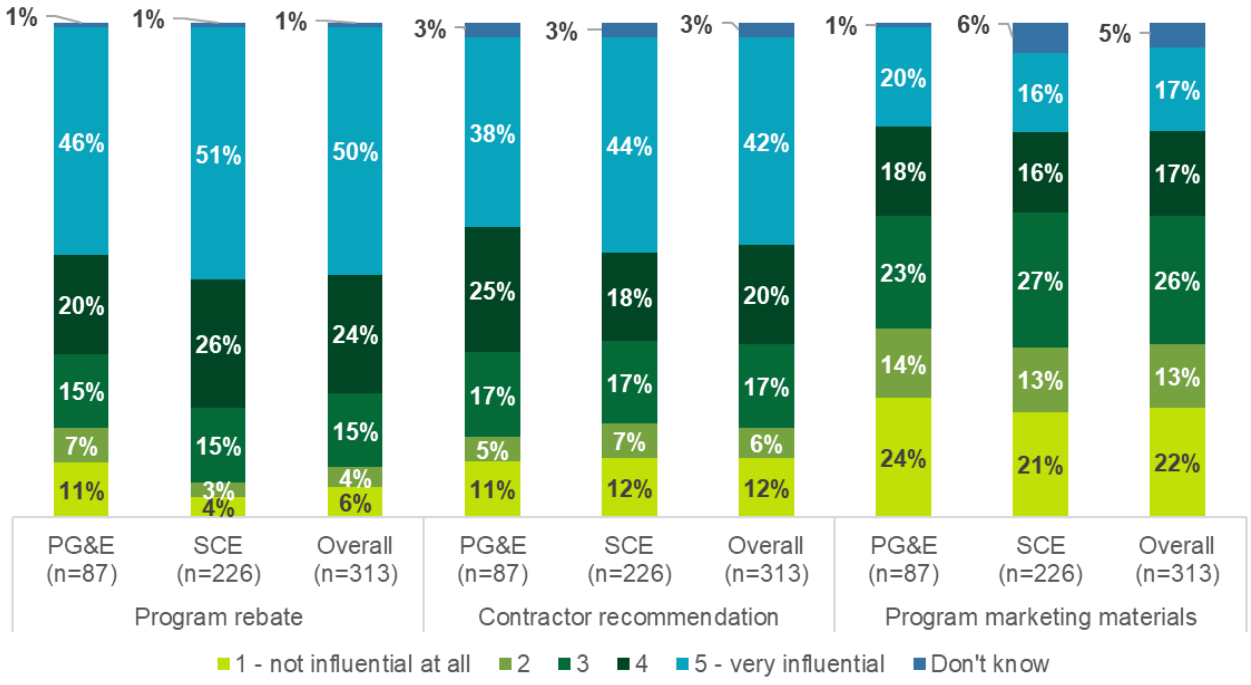
Table 17. Efficiency Level that Customer Would Have Installed without Rebate

Response	PG&E (n=84)	SCE (n=206)	Overall (n=290)
Single-speed pump	1%	7%	6%
Two-speed pump	6%	9%	8%
Same level - Variable speed pump	76%	70%	72%
Would not have purchased a new pump	13%	13%	12%
Response unclear	4%	1%	2%

Figure 5 provides the results of the net-to-gross question battery related to the program influence credit in the participant survey. Program rebates had the most influence on participant choices, with half calling the rebate "very influential," closely followed by contractor recommendations (42%).

Combining the results of the timing, efficiency, and program influence credits using the methodology detailed in Section 2.3, **NMR calculated a free-ridership score of 0.45**.

Figure 5. Influence of Program and Contractor on Installation of VSD Pump



3.3.2 Additional NTG-Related Results from SCE POE Surveys

SCE included a battery questions related to program influence and net savings on their POE forms. NMR provides the results of those questions here, though they were not used in calculation of the evaluated NTGR. Figure 6 shows results from two questions about rebate influence on customer decisions. Results are distributed fairly evenly for both, though slanted towards granting influence of the rebate in their decision to upgrade their pool pump.

Figure 6. Customer Plans for Replacing Existing Pool Pump

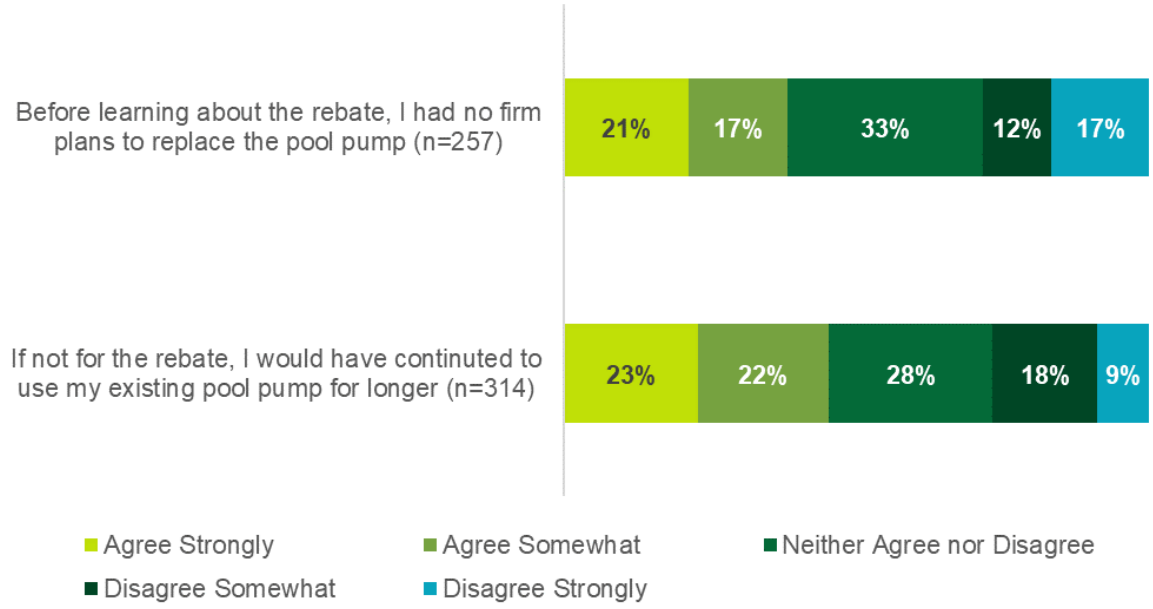


Table 18 shows the results of a question about purchase timing.

Table 18. When Customers Would Have Replaced Existing Pump Without the Rebate

Response	SCE POE Forms (n=256)
When my existing pump stopped working	37%
At the same time	21%
Less than one year	15%
More than one year	21%
Not sure	6%

3.3.3 Evaluated Net Savings

NMR calculated a NTGR of 0.55, using the formula $NTGR = 1 - FR$. NMR calculated net savings using the formula $Evaluated\ net\ savings = Gross\ savings * (NTGR + ME)$, where ME is the market effects adder of 0.05[16]. The evaluated net energy and demand savings results for each PA are presented in Table 19 and Table 20.

[16] From CPUC's Cost-Effectiveness Tool documentation titled "E3_Calculator_TechMemo_6d.docx" available via the California Energy Data and Reporting System (CEDARS) website.

Table 19. PG&E Reported and Evaluated Net Energy and Demand Savings

Measure	NTGR (1-FR)	Market Effects Adder	Reported First Year Net Energy Savings (kWh)	Evaluated First Year Net Energy Savings (kWh)	Reported Lifetime Net Energy Savings (kWh)	Evaluated Lifetime Net Energy Savings (kWh)
Self-install VSD replacing two-speed pump (P107)	0.55	0.05	805,909	661,117	8,059,086	6,611,171
Commissioned VSD replacing two-speed pump (PL001)			690,946	1,110,198	6,909,462	11,101,983
Total			**1,496,855**	**1,771,315**	**14,968,548**	**17,713,154**
Net energy savings realization rate			**118.3%**		**118.3%**	

Measure	NTGR (1-FR)	Market Effects Adder	Reported First Year Net Demand Savings (kW)	Evaluated First Year Net Demand Savings (kW)	Reported Lifetime Net Demand Savings (kW)	Evaluated Lifetime Net Demand Savings (kW)
Self-install VSD replacing two-speed pump (P107)	0.55	0.05	114	0	1,140	0
Commissioned VSD replacing two-speed pump (PL001)			200	0	2,000	0
Total			**314**	**0**	**3,140**	**0**
Net demand savings realization rate			**0%**		**0%**	

Table 20. SCE Reported and Evaluated Net Energy and Demand Savings

Measure	NTGR	Market Effects Adder	Reported First Year Net Energy Savings (kWh)	Evaluated First Year Net Energy Savings (kWh)	Reported Lifetime Net Energy Savings (kWh)	Evaluated Lifetime Net Energy Savings (kWh)
Self-install VSD replacing two-speed pump (PM-98422)	0.55	0.05	780,327	766,504	7,803,268	7,665,043
Commissioned VSD replacing two-speed pump (PM-78394)			675,106	2,798,775	6,751,059	27,987,751
Commissioned VSD replacing single-speed pump (PM-69234)			3,481,235	1,007,520	31,845,812	9,216,605
Total			**4,936,668**	**4,572,800**	**46,400,139**	**44,869,399**
Net energy savings realization rate			**92.6%**		**96.7%**	

Measure	NTGR	Market Effects Adder	Reported First Year Net Demand Savings (kW)	Evaluated First Year Net Demand Savings (kW)	Reported Lifetime Net Demand Savings (kW)	Evaluated Lifetime Net Demand Savings (kW)
Self-install VSD replacing two-speed pump (PM-98422)	0.55	0.05	0	0	0	0
Commissioned VSD replacing two-speed pump (PM-78394)			0	0	0	0
Commissioned VSD replacing single-speed pump (PM-69234)			687	201	2,267	664
Total			**687**	**201**	**2,267**	**664**
Net demand savings realization rate			**29.3%**		**29.3%**	

3.4 Program Awareness and Contractor Practices

There are apparent differences in how customers learned about pool pump rebates by PA, with most PG&E customers (53%) learning from a pool products retailer and the largest share of SCE customers learning from a pool pump contractor (45%). However, given that most PG&E pumps were installed by in-house contractors from a single retailer, it is fair to conclude that the contractor/retailer distinction is not as important among the PG&E participants.

Table 21. How Customers First Heard about the Rebate

Response	PG&E (n=89)	SCE (n=226)	Overall (n=315)
Pool contractor recommendation	14%	45%	37%
Pool products retailer recommendation	53%	13%	24%
My own research	17%	14%	15%
Utility website	7%	15%	13%
Word of mouth	2%	5%	4%
Utility advertising	1%	4%	3%
Utility email	1%	3%	3%
Utility mailing—bill insert, newsletter	2%	3%	3%

Contractor survey respondents responding to the survey reported that their company installed an average of 35 pool pumps per year, with SCE contractors reporting 41 installations and PG&E contractors reporting 32 installations. More than four-fifths of SCE contractors (81%) said that they or someone at their company had attended a Foundation for Pool and Spa Industry Education (FPSIE) training or certification program.

All contractor survey respondents that answered the survey said that they promoted the benefits of variable speed drive pumps to their customers. Popular benefits cited by contractors include saving energy/electricity/money, reduced noise, longer warranties, and higher quality (Table 22). An in-person sales pitch was by far the most common method contractors marketed VSD pumps to their customers (Table 23).

Table 22. Benefits of VSD Pumps that Contractors Promoted
Multiple Responses Allowed

Response	PG&E (n=64)	SCE (n=32)	Overall (n=96)
Save energy/electricity	98%	100%	99%
Saves money	89%	91%	90%
Less noise vs. a single-speed pump	75%	84%	78%
Longer warranty you can provide	52%	69%	57%
Less maintenance/higher quality	34%	41%	36%
Functionality	3%	3%	3%
That a rebate was available	3%	3%	3%

Table 23. Methods that Contractors Used to Promote VSD Pumps

Response	PG&E (n=63)	SCE (n=32)	Overall (n=95)
In-person sales pitch	95%	97%	96%
Phone	19%	38%	26%
Social media	15%	38%	22%
Online ads	15%	12%	14%
Print ads	10%	12%	11%
Direct mail	8%	12%	10%
Door-to-door marketing	5%	0%	3%
Advertising on monthly bills	2%	0%	1%
Truck sign	0%	3%	1%

Section 4 Conclusions

High Realization Rates for Energy Savings but Not for Demand Savings

- High installation rates (100%) led to high energy savings realization rates, though misunderstandings of requirements (PG&E) or lack of provided evidence for all reported measures (SCE) meant low or no evaluated demand savings.

Survey Results Largely Support Savings Assumptions

- Our survey results support the assumed installation rate of 100%.
- Our findings suggested that over four-fifths (82%) of existing pumps were single-speed pumps and 7% were two-speed pumps, meaning that many more single-speed pumps are in use than expected given the regulations in effect since 2008. Even so, it is unlikely that many single-speed pumps installed in 2008 or before will operate much longer, so a change in the two-speed base case assumption is not warranted.
- Though not directly related to claimed program savings, NMR found that 94% of replaced pumps are disposed of or recycled and do not enter the secondary market.
- A large share of customers (52%) and contractors (23%) reported reduced pool pump usage in the last several years for various reasons. Five percent of customers reported closing their pools for several months a year. This could warrant further research to assess assumed daily hours of use values used in UES calculations.
- Many customers have pool accessories that affect pool pump energy use and time of use. This is not factored into UES calculations.

Increased Requirements to Claim a Single-Speed Pump Baseline Led PAs to End Programs

- CPUC issued a decision on savings assumptions in 2017 that updated the assumed base case to a two-speed pump to match long-standing Title 20 standards for pool pumps. Subsequently, PAs were required to collect additional evidence to claim a single-speed base case. PAs found that this reduced the cost-effectiveness of their programs and chose to end them.

Future Savings Opportunities are Limited

- New federal standards for pool pumps are scheduled to go into effect July 19, 2021 that effectively set VSD pumps (the current program measure) as the base case technology. This will further reduce savings opportunities for programs that the PAs have already chosen to end due to low cost-effectiveness, as the code minimum product will become the current efficient measure.

Appendix A Gross and net lifecycle savings

Impact Evaluation Report
Pool Pumps - Residential Program Year 2018

Gross Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Passthru - Pool Pump	7	7	1.00	100.0%	
PGE	Pool Pump - Commissioned VSD repl 2-spd	11,516	18,591	1.61	0.0%	1.61
PGE	Pool Pump - Self-install VSD repl 2-spd	13,432	11,028	0.82	0.0%	0.82
PGE	**Total**	**24,954**	**29,626**	**1.19**	**0.0%**	**1.19**
SCE	Passthru - Pool Pump	3,606	3,606	1.00	100.0%	
SCE	Pool Pump - Commissioned VSD repl 1-spd	15,350	15,350	1.00	0.0%	1.00
SCE	Pool Pump - Commissioned VSD repl 2-spd	48,309	46,603	0.96	0.0%	0.96
SCE	Pool Pump - Self-install VSD repl 2-spd	12,775	12,775	1.00	0.0%	1.00
SCE	**Total**	**80,040**	**78,333**	**0.98**	**4.5%**	**0.98**
MCE	Passthru - Pool Pump	62	62	1.00	100.0%	
MCE	**Total**	**62**	**62**	**1.00**	**100.0%**	
	Statewide	***105,056***	***108,021***	***1.03***	***3.5%***	***1.03***

Impact Evaluation Report
Pool Pumps - Residential Program Year 2018

Net Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	Passthru - Pool Pump	4	4	1.00	100.0%	0.60	0.60		
PGE	Pool Pump - Commissioned VSD repl 2-spd	6,909	11,154	1.61	0.0%	0.60	0.60	0.60	0.60
PGE	Pool Pump - Self-install VSD repl 2-spd	8,059	6,617	0.82	0.0%	0.60	0.60	0.60	0.60
PGE	**Total**	**14,973**	**17,775**	**1.19**	**0.0%**	**0.60**	**0.60**	**0.60**	**0.60**
SCE	Passthru - Pool Pump	2,176	2,176	1.00	100.0%	0.60	0.60		
SCE	Pool Pump - Commissioned VSD repl 1-spd	9,323	9,210	0.99	0.0%	0.61	0.60	0.61	0.60
SCE	Pool Pump - Commissioned VSD repl 2-spd	29,239	27,962	0.96	0.0%	0.61	0.60	0.61	0.60
SCE	Pool Pump - Self-install VSD repl 2-spd	7,803	7,665	0.98	0.0%	0.61	0.60	0.61	0.60
SCE	**Total**	**48,542**	**47,013**	**0.97**	**4.5%**	**0.61**	**0.60**	**0.61**	**0.60**
MCE	Passthru - Pool Pump	37	37	1.00	100.0%	0.60	0.60		
MCE	**Total**	**37**	**37**	**1.00**	**100.0%**	**0.60**	**0.60**		
	Statewide	***63,552***	***64,825***	***1.02***	***3.5%***	***0.60***	***0.60***	***0.60***	***0.60***

Gross Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Passthru - Pool Pump	0.0	0.0	1.00	100.0%	
PGE	Pool Pump - Commissioned VSD repl 2-spd	3.3	0.0	0.00	0.0%	0.00
PGE	Pool Pump - Self-install VSD repl 2-spd	1.9	0.0	0.00	0.0%	0.00
PGE	**Total**	**5.2**	**0.0**	**0.00**	**0.0%**	**0.00**
SCE	Passthru - Pool Pump	0.4	0.4	1.00	100.0%	
SCE	Pool Pump - Commissioned VSD repl 1-spd	1.1	1.1	1.00	0.0%	1.00
SCE	Pool Pump - Commissioned VSD repl 2-spd	2.7	0.0	0.00	0.0%	0.00
SCE	Pool Pump - Self-install VSD repl 2-spd	0.0	0.0			
SCE	**Total**	**4.1**	**1.5**	**0.35**	**8.7%**	**0.29**
MCE	Passthru - Pool Pump	0.0	0.0			
MCE	**Total**	**0.0**	**0.0**			
	Statewide	***9.3***	***1.5***	***0.16***	***3.8%***	***0.12***

Net Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	Passthru - Pool Pump	0.0	0.0	1.00	100.0%	0.60	0.60		
PGE	Pool Pump - Commissioned VSD repl 2-spd	2.0	0.0	0.00	0.0%	0.60		0.60	
PGE	Pool Pump - Self-install VSD repl 2-spd	1.1	0.0	0.00	0.0%	0.60		0.60	
PGE	**Total**	**3.1**	**0.0**	**0.00**	**0.0%**	**0.60**	**0.60**	**0.60**	
SCE	Passthru - Pool Pump	0.2	0.2	1.00	100.0%	0.60	0.60		
SCE	Pool Pump - Commissioned VSD repl 1-spd	0.7	0.7	0.99	0.0%	0.61	0.60	0.61	0.60
SCE	Pool Pump - Commissioned VSD repl 2-spd	1.6	0.0	0.00	0.0%	0.60		0.60	
SCE	Pool Pump - Self-install VSD repl 2-spd	0.0	0.0						
SCE	**Total**	**2.5**	**0.9**	**0.35**	**8.7%**	**0.61**	**0.60**	**0.61**	**0.60**
MCE	Passthru - Pool Pump	0.0	0.0						
MCE	**Total**	**0.0**	**0.0**						
	Statewide	***5.6***	***0.9***	***0.16***	***3.8%***	***0.60***	***0.60***	***0.60***	***0.60***

Gross Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Passthru - Pool Pump	0	0			
PGE	Pool Pump - Commissioned VSD repl 2-spd	0	0			
PGE	Pool Pump - Self-install VSD repl 2-spd	0	0			
PGE	**Total**	**0**	**0**			
SCE	Passthru - Pool Pump	0	0			
SCE	Pool Pump - Commissioned VSD repl 1-spd	0	0			
SCE	Pool Pump - Commissioned VSD repl 2-spd	0	0			
SCE	Pool Pump - Self-install VSD repl 2-spd	0	0			
SCE	**Total**	**0**	**0**			
MCE	Passthru - Pool Pump	0	0			
MCE	**Total**	**0**	**0**			
	Statewide	***0***	***0***			

Net Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	Passthru - Pool Pump	0	0						
PGE	Pool Pump - Commissioned VSD repl 2-spd	0	0						
PGE	Pool Pump - Self-install VSD repl 2-spd	0	0						
PGE	**Total**	**0**	**0**						
SCE	Passthru - Pool Pump	0	0						
SCE	Pool Pump - Commissioned VSD repl 1-spd	0	0						
SCE	Pool Pump - Commissioned VSD repl 2-spd	0	0						
SCE	Pool Pump - Self-install VSD repl 2-spd	0	0						
SCE	**Total**	**0**	**0**						
MCE	Passthru - Pool Pump	0	0						
MCE	**Total**	**0**	**0**						
	Statewide	***0***	***0***						

Net First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	Passthru - Pool Pump	0	0	1.00	100.0%	0.60	0.60		
PGE	Pool Pump - Commissioned VSD repl 2-spd	691	1,115	1.61	0.0%	0.60	0.60	0.60	0.60
PGE	Pool Pump - Self-install VSD repl 2-spd	806	662	0.82	0.0%	0.60	0.60	0.60	0.60
PGE	**Total**	**1,497**	**1,778**	**1.19**	**0.0%**	**0.60**	**0.60**	**0.60**	**0.60**
SCE	Passthru - Pool Pump	387	387	1.00	100.0%	0.60	0.60		
SCE	Pool Pump - Commissioned VSD repl 1-spd	1,019	1,019	1.00	0.0%	0.61	0.61	0.61	0.61
SCE	Pool Pump - Commissioned VSD repl 2-spd	3,133	2,821	0.90	0.0%	0.61	0.61	0.61	0.61
SCE	Pool Pump - Self-install VSD repl 2-spd	780	780	1.00	0.0%	0.61	0.61	0.61	0.61
SCE	**Total**	**5,320**	**5,007**	**0.94**	**7.3%**	**0.61**	**0.61**	**0.61**	**0.61**
MCE	Passthru - Pool Pump	4	4	1.00	100.0%	0.60	0.60		
MCE	**Total**	**4**	**4**	**1.00**	**100.0%**	**0.60**	**0.60**		
	Statewide	***6,821***	***6,788***	***1.00***	***5.7%***	***0.60***	***0.60***	***0.61***	***0.60***

Gross First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Passthru - Pool Pump	0.0	0.0	1.00	100.0%	
PGE	Pool Pump - Commissioned VSD repl 2-spd	0.3	0.0	0.00	0.0%	0.00
PGE	Pool Pump - Self-install VSD repl 2-spd	0.2	0.0	0.00	0.0%	0.00
PGE	**Total**	**0.5**	**0.0**	**0.00**	**0.0%**	**0.00**
SCE	Passthru - Pool Pump	0.1	0.1	1.00	100.0%	
SCE	Pool Pump - Commissioned VSD repl 1-spd	0.3	0.3	1.00	0.0%	1.00
SCE	Pool Pump - Commissioned VSD repl 2-spd	0.8	0.0	0.00	0.0%	0.00
SCE	Pool Pump - Self-install VSD repl 2-spd	0.0	0.0			
SCE	**Total**	**1.2**	**0.4**	**0.33**	**4.8%**	**0.29**
MCE	Passthru - Pool Pump	0.0	0.0			
MCE	**Total**	**0.0**	**0.0**			
	Statewide	***1.7***	***0.4***	***0.23***	***3.3%***	***0.20***

Net First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	Passthru - Pool Pump	0.0	0.0	1.00	100.0%	0.60	0.60		
PGE	Pool Pump - Commissioned VSD repl 2-spd	0.2	0.0	0.00	0.0%	0.60		0.60	
PGE	Pool Pump - Self-install VSD repl 2-spd	0.1	0.0	0.00	0.0%	0.60		0.60	
PGE	**Total**	**0.3**	**0.0**	**0.00**	**0.0%**	**0.60**	**0.60**	**0.60**	
SCE	Passthru - Pool Pump	0.0	0.0	1.00	100.0%	0.60	0.60		
SCE	Pool Pump - Commissioned VSD repl 1-spd	0.2	0.2	1.00	0.0%	0.61	0.61	0.61	0.61
SCE	Pool Pump - Commissioned VSD repl 2-spd	0.5	0.0	0.00	0.0%	0.60		0.60	
SCE	Pool Pump - Self-install VSD repl 2-spd	0.0	0.0						
SCE	**Total**	**0.7**	**0.2**	**0.33**	**4.7%**	**0.61**	**0.61**	**0.61**	**0.61**
MCE	Passthru - Pool Pump	0.0	0.0						
MCE	**Total**	**0.0**	**0.0**						
	Statewide	***1.0***	***0.2***	***0.23***	***3.3%***	***0.60***	***0.61***	***0.60***	***0.61***

Gross First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Passthru - Pool Pump	0	0			
PGE	Pool Pump - Commissioned VSD repl 2-spd	0	0			
PGE	Pool Pump - Self-install VSD repl 2-spd	0	0			
PGE	**Total**	**0**	**0**			
SCE	Passthru - Pool Pump	0	0			
SCE	Pool Pump - Commissioned VSD repl 1-spd	0	0			
SCE	Pool Pump - Commissioned VSD repl 2-spd	0	0			
SCE	Pool Pump - Self-install VSD repl 2-spd	0	0			
SCE	**Total**	**0**	**0**			
MCE	Passthru - Pool Pump	0	0			
MCE	**Total**	**0**	**0**			
	Statewide	***0***	***0***			

Net First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	Passthru - Pool Pump	0	0						
PGE	Pool Pump - Commissioned VSD repl 2-spd	0	0						
PGE	Pool Pump - Self-install VSD repl 2-spd	0	0						
PGE	**Total**	**0**	**0**						
SCE	Passthru - Pool Pump	0	0						
SCE	Pool Pump - Commissioned VSD repl 1-spd	0	0						
SCE	Pool Pump - Commissioned VSD repl 2-spd	0	0						
SCE	Pool Pump - Self-install VSD repl 2-spd	0	0						
SCE	**Total**	**0**	**0**						
MCE	Passthru - Pool Pump	0	0						
MCE	**Total**	**0**	**0**						
	Statewide	***0***	***0***						

Appendix B Per unit (quantity) gross and net energy savings

Impact Evaluation Report
Pool Pumps - Residential Program Year 2018

Per Unit (Quantity) Gross Energy Savings (kWh)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
PGE	Pool Pump - Commissioned VSD repl 2-spd	0	0.0%	0.0%	10.0	10,929.3	1,092.9	1,092.9
PGE	Pool Pump - Self-install VSD repl 2-spd	0	0.0%	0.0%	10.0	9,598.1	959.8	959.8
PGE	Passthru - Pool Pump	1	0.0%		10.0	6,770.0	677.0	677.0
SCE	Pool Pump - Commissioned VSD repl 1-spd	0	100.0%	100.0%	10.0	11,454.9	1,252.2	1,145.5
SCE	Pool Pump - Commissioned VSD repl 2-spd	0	76.1%	0.0%	10.0	10,929.3	1,092.9	1,092.9
SCE	Pool Pump - Self-install VSD repl 2-spd	0	0.0%	0.0%	10.0	9,598.1	959.8	959.8
SCE	Passthru - Pool Pump	1	100.0%		10.0	39,624.0	7,036.6	3,962.4
MCE	Passthru - Pool Pump	1	0.0%		10.0	61,871.4	6,187.1	6,187.1

Appendix C IESR–Recommendations resulting from the evaluation research

Table 24. Study Details

Study ID	Study Type	Study Title	CPUC Study Manager
Group A Residential Sector	Impact Evaluation	Impact Evaluation Report: Pool Pumps - Residential Program Year 2018	Peter Franzese

Table 25. IESR–Recommendations Resulting from the Evaluation Research

Rec #	Program or Database	Summary of Findings	Additional Supporting Information	Consideration/ Recommendation	Recipient	Affected Workpaper or DEER
1	Multiple programs delivering VSD pool pumps	A large share of customers (52%) and contractors (23%) reported reduced pool pump usage in the last several years for various reasons. Five percent of customers reported closing their pools for several months a year.	Section 3.1.4	**Consideration:** if any PA chooses to reinstitute its VSD pool pump program, this finding could warrant further research to assess assumed daily hours of use values used in UES calculations.	All PAs	Statewide WP – SCE17WP001 Rev. 1
2	Multiple programs delivering VSD pool pumps	Many customers have pool accessories that affect pool pump energy use and time of use. This is not factored into UES calculations.	Section 3.1.5	**Consideration:** if any PA chooses to reinstitute its VSD pool pump program, this finding could warrant further research to factor pool accessories into UES calculations.	All PAs	Statewide WP – SCE17WP001 Rev. 1

Appendix D Participant Survey Instrument

Display This Question:

If PA = SCE

SCE Intro

As a participant in Southern California Edison's 2018 Pool Pump Rebate Program, your opinions are important. Southern California Edison and the California Public Utilities Commission (CPUC) would like your input and perspectives to understand how to best structure future energy efficiency programs.

We're requesting your participation in a 5-minute survey. As a thank you for completing the survey, eligible respondents will receive a **$10 gift card** that you can choose from a selection of popular retail stores, charities, or a Visa cash card. The information gathered will be used solely for research purposes and your individual responses will be kept completely confidential. NMR is the research provider retained by the CPUC to help administer this survey. If you'd like to validate the legitimacy of this survey, visit the CPUC website for a listing of this and other CPUC approved research efforts underway: https://www.cpuc.ca.gov/validsurvey/

Display This Question:

If PA = PG&E

PGE Intro

As a participant in PG&E's 2018 Pool Pump Rebate Program, your opinions are important. PG&E and the California Public Utilities Commission (CPUC) would like your input and perspectives to understand how to best structure future energy efficiency programs. We're requesting your participation in a 5-minute survey. As a thank you for completing the survey, eligible respondents will receive a **$10 gift card** that you can choose from a selection of popular retail stores, charities, or a Visa cash card. The information gathered will be used solely for research purposes and your individual responses will be kept completely confidential. NMR is the research provider retained by the CPUC to help administer this survey. If you'd like to validate the legitimacy of this survey, visit the CPUC website for a listing of this and other CPUC approved research efforts underway: https://www.cpuc.ca.gov/validsurvey/

End of Block: Intro

Start of Block: Screening

S1 Are you familiar with this household's decisions about pool equipment purchases?

- Yes (1)
- No (2)

Skip To: End of Block If Are you familiar with this household's decisions about pool equipment purchases? = No

Display This Question:

If Are you familiar with this household's decisions about pool equipment purchases? = Yes

S2 According to our records, your household at ${e://Field/Address} was issued a rebate for a variable speed pool pump installed on ${e://Field/InstallationDate}. Is that correct? (The ${e://Field/PA} program provides a $${e://Field/Incentive} rebate for installing a variable speed drive (VSD) pool pump.)

- Yes (1)
- No (2)
- Don't know (3)

Skip To: End of Block If According to our records, your household at ${e://Field/Address} was issued a rebate for a variab...! = Yes

Display This Question:

If According to our records, your household at ${e://Field/Address} was issued a rebate for a variab... = Yes

S3 Was the pool pump installed?

- Yes (1)
- No (2)
- Don't know (3)

Skip To: End of Block If Was the pool pump installed?! = Yes

S4 Who installed the pool pump?

- A professional installer (1)
- Someone else (2)
- Don't know (3)

End of Block: Screening

Start of Block: Thank and Terminate

Display This Question:

If Are you familiar with this household's decisions about pool equipment purchases?! = Yes

TT1 We're sorry, but you are not eligible to participate in this survey. If someone else in your is familiar with your household's pool pump equipment decisions, please ask them to complete the survey.

Display This Question:

If According to our records, your household at ${e://Field/Address} was issued a rebate for a variab... = Yes

TT2 Thanks for completing our survey! Please provide an email address to receive your $10 incentive. Once we review your survey response and approve your reward, you will receive an email notification with a link to choose your reward. This may take up to two business days. If you have any questions, please email poolsurvey@nmrgroupinc.com.

- Name (1) _____
- Email (2) _____

Display This Question:

If Was the pool pump installed? = No

Or Was the pool pump installed? = Don't know

Or According to our records, your household at ${e://Field/Address} was issued a rebate for a variab... = No

Or According to our records, your household at ${e://Field/Address} was issued a rebate for a variab... = Don't know

TT3 We're sorry, but you are not eligible to participate in this survey.

End of Block: Thank and Terminate

Start of Block: Previous Equipment

PE1
Before you installed the variable speed drive (VSD) pool pump, what kind of pool pump, if any, did you use? There are three basic kinds of pool pumps:

- Single-speed pumps that only pump at one speed
- Two-speed pumps that pump at two pre-set speeds
- Variable speed drive (VSD) pumps that can pump at a range of speeds

- Did not have an existing pool pump (1)
- Single-speed pump (2)
- Two-speed pump (3)
- Variable speed pump (4)
- Don't know (5)

Skip To: End of Block If Before you installed the variable speed drive (VSD) pool pump, what kind of pool pump, if any, di... = Did not have an existing pool pump

PE2 How old was your previous pool pump when you replaced it?

- Older than 10 years (1)
- 7-10 years old (2)
- 4-6 years old (3)
- Less than 1 year old-3 years old (4)
- Don't know (5)

PE3 What condition was the previous pump in when it was replaced?

- Good, still running (1)
- Fair, had issues (2)
- Poor, broken (3)
- Don't know (4)

End of Block: Previous Equipment

Start of Block: Usage Patterns

UP1 Please select which of the following features are present in your pool. Select all that apply.

- ☐ Gas or propane heater (1)
- ☐ Heat pump (electric) heater (2)
- ☐ Solar heater (7)
- ☐ Salt cell chlorine generator (8)
- ☐ None of these (9)

UP2 Do you close your pool for any part of the year? For the purposes of this survey, closing the pool would involve turning off the pool pump, along with any other equipment used for the pool such as a water heater.

- Yes (1)
- No (2)
- Don't know (3)

Display This Question:

If Do you close your pool for any part of the year? For the purposes of this survey, closing the poo... = Yes

UP2a How many months of the year is your pool closed?

▼ 1 (1) ... 12 (14)

UP3 Is your pool pump typically set to operate during the hours of 2pm to 5pm?

- Yes (3)
- No (4)
- Don't know (5)

UP4 Who sets the schedule for your pool pump?

- I or someone in my household sets the schedule (1)
- A pool professional sets the schedule (2)
- Don't know (3)

UP5 Have you or a contractor changed your pool pump schedule or months of operation at all during the last several years?

- Yes (1)
- No (2)
- Don't know (3)

Display This Question:

If Have you or a contractor changed your pool pump schedule or months of operation at all during the... = Yes

UP6 What was/were the reason(s) for the change? Select all that apply.

- ☐ Drought (1)
- ☐ Using the pool less (2)
- ☐ Using the pool more (3)
- ☐ To save electricity (4)
- ☐ To save money (5)
- ☐ Other (6) _____
- ☐ Don't know (7)

End of Block: Usage Patterns

Start of Block: Rebated VSD Pump

RIntro Now we have a few questions about the pool pump you installed as part of the ${e://Field/PA} Pool Pump program.

R1 When you were first thinking about purchasing the pool pump, where did you get information about what to buy? [select all that apply]

- ☐ Retailers/salesperson at pool supply store (1)
- ☐ Installation contractor (2)
- ☐ Friend, neighbor, relative, or co-worker (3)
- ☐ From ${e://Field/PA} (4)
- ☐ Internet (5)
- ☐ Consumer Reports or other product-oriented magazines (6)
- ☐ Did not look for any information about what to buy (7)
- ☐ Other (8) _____
- ☐ Don't know (9)

R2 How did you first hear about the variable speed pool pump rebate?

- My own research (1)
- Pool contractor recommendation (2)
- Pool products retailer recommendation (3)
- ${e://Field/PA} advertising (4)
- ${e://Field/PA} mailing—bill insert, newsletter (5)
- ${e://Field/PA} website (6)
- ${e://Field/PA} email (7)
- Recommendation from home audit/assessment (8)
- Word of mouth (9)
- Other (10) _____
- Don't know (11)

Display This Question:

If Before you installed the variable speed drive (VSD) pool pump, what kind of pool pump, if any, di...! = Did not have an existing pool pump

R3 What was your main reason for upgrading your pool pump?

- Old pump broken/not working properly (1)
- Wanted to save money/electricity (2)
- Contractor recommended it (3)
- Other (4) _____
- Don't know (5)
- Old pump was too loud (7)

R4 What was your main reason for buying a variable speed drive (VSD) pool pump instead of another kind of pump?

- The rebate for a VSD pump (1)
- Wanted to save money/electricity (2)
- Contractor recommended it (3)
- Other (4) _____
- Don't know (5)
- Influenced by ads received from ${e://Field/PA} (7)

Display This Question:

If What was your main reason for upgrading your pool pump? = Contractor recommended it

Or What was your main reason for buying a variable speed drive (VSD) pool pump instead of another ki... = Contractor recommended it

R5 On a scale of 1-5 where 1 is 'very unimportant' and 5 is 'very important', how important was your contractor's recommendation in choosing what pump to install?

- 1 - very unimportant (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 - very important (5)
- Don't know (6)
- I'd rather not say (7)

R6 Is the variable speed pool pump that received a rebate still installed?

- Yes (1)
- No (2)
- Don't know (3)

Display This Question:

If Is the variable speed pool pump that received a rebate still installed? = No

R6a Why was the rebated pool pump removed?

_____

End of Block: Rebated VSD Pump

Start of Block: Program Impact

NTG1 When did you learn about the pool pump rebate?

- Before speaking with a contractor (1)
- After speaking with a contractor, but before choosing the type of pool pump to install (2)
- After installing the pool pump (3)
- After choosing the type of pump to install (4)
- Other (7) _____
- Don't know (8)

NTG2
There are three basic kinds of pool pumps:

- Single-speed pumps that only pump at one speed. These are the least efficient.
- Two-speed pumps that pump at two pre-set speeds. These are moderately efficient.
- Variable speed pumps that can pump at a range of speeds. These are the most efficient.

Without the Pool Pump rebate program, would you have installed a pool pump with the same level of efficiency as what you installed, or a different efficiency level?

- Same level - Variable speed pump (1)
- Single-speed pump (2)
- Two-speed pump (3)
- Would not have purchased a new pump (4)
- Other (5) _____
- I don't know (6)

NTG3 Without the pool pump rebate, when would you have replaced your pool pump?

- Sooner than you did (1)
- At the same time as you did (2)
- 1-5 months later (3)
- 6-12 months later (4)
- More than 12 months later (5)
- Whenever my current pump failed (6)
- Don't know (7)

NTG5 How influential was each of the following, on a scale of 1-5, where 1 is ‘not influential at all and 5 is ‘very influential’?

	1 - not influential at all (1)	2 (2)	3 (3)	4 (4)	5 - very influential (5)	Don't know (6)
Program rebate (1)	-	-	-	-	-	-
Contractor recommendation (2)	-	-	-	-	-	-
Program marketing materials (3)	-	-	-	-	-	-

End of Block: Program Impact

Appendix E Contractor Survey Instrument

Display This Question:

If PA = SCE

SCE Intro

We are conducting a survey on behalf of the California Public Utility Commission about programs in 2018 that promoted energy-efficient pool pumps. This survey should take approximately 10 minutes to complete. After completing the survey, you will receive a $20 incentive that you can choose from a menu of retail store gift cards, charity, or a Visa gift card.

The information gathered will be used solely for research purposes and your individual responses will be kept completely confidential.

NMR is the research provider retained by the CPUC to help administer this survey. If you'd like to validate the legitimacy of this survey, visit the CPUC website for a listing of this and other CPUC approved research efforts underway: https://www.cpuc.ca.gov/validsurvey/.

If you encounter technical difficulties or need assistance completing the survey, please email poolsurvey@nmrgroupinc.com.

Display This Question:

If PA = PG&E

PGE Intro

We are conducting a survey on behalf of the California Public Utility Commission about programs to promote energy-efficient pool pumps. This survey should take approximately 10 minutes to

complete. After completing the survey, you will receive a $20 incentive that you can choose from a menu of retail store gift cards, charity, or a Visa gift card.

The information gathered will be used solely for research purposes and your individual responses will be kept completely confidential.

NMR is the research provider retained by the CPUC to help administer this survey. If you'd like to validate the legitimacy of this survey, visit the CPUC website for a listing of this and other CPUC approved research efforts underway: https://www.cpuc.ca.gov/validsurvey/.

If you encounter technical difficulties or need assistance completing the survey, please email poolsurvey@nmrgroupinc.com.

End of Block: Intro

Start of Block: Informational

I2 What are your responsibilities at ${e://Field/CompanyName}? Select all that apply.

- ☐ Management (1)
- ☐ Sales (2)
- ☐ Installation (3)
- ☐ Customer Support (4)
- ☐ Other (5) _____

I3 Approximately how many pool pumps did ${e://Field/CompanyName} install in California in 2018?

_____ Enter number (1)

End of Block: Informational

Start of Block: Customer Types

CP1 Please estimate the share of pool pump installations your company did by customer type in 2018. The total should add to 100%

Residential homes: _____ (1)

Multifamily properties: _____ (2)

Commercial properties (gyms, hotels, spas): _____ (3)

Total: _____

End of Block: Customer Types

Start of Block: Not eligible

Display This Question:

If Please estimate the share of pool pump installations your company did by customer type in 2018. T... [Residential homes] = 0

Q36 Sorry, if you do not install pool pumps at residential homes you are not eligible to participate in the survey.

End of Block: Not eligible

Start of Block: Residential Homes

CP2 Please estimate the capacity of pool pumps that your company typically installed **in residential homes** in 2018. The total should add to 100%.

Less than 1 hp: _____ (1)

1 hp - 2 hp: _____ (2)

Greater than 2 hp - 3 hp: _____ (3)

Greater than 3 hp: _____ (4)

Total: _____

CP3 What share of the pool pumps that you install **in residential homes** are for new pools with no existing pump versus replacements of existing pumps? The total should add to 100%.

New installation, no existing pump: _____ (1)

Replacing existing pump: _____ (2)

Total: _____

CP4a When replacing existing pumps **in residential homes** in 2018, what type of pump was the **new** pump? The total should add to 100%

Single speed: _____ (1)

Two-speed: _____ (2)

Variable speed (VSD): _____ (3)

Total: _____

CP4b When replacing existing pumps **in residential homes** in 2018, what type of pump was the **existing** pump? The total should add to 100%.

Single speed: _____ (1)

Two-speed: _____ (2)

Variable speed (VSD): _____ (3)

Total: _____

CP4c Please estimate the ages of the pool pumps your company replaced **in residential homes** in 2018 in the following ranges. The total should add to 100%.

Older than 10 years: _____ (1)

7-10 years old: _____ (2)

4-6 years old: _____ (3)

New to 3 years old: _____ (4)

Total: _____

CP4d Please estimate the condition of the pool pumps your company replaced **in residential homes** in 2018. The total should add to 100%.

Fully operational: _____ (1)

Running but needed repairs: _____ (2)

Not operational: _____ (3)

Total: _____

CP4e What happened to the pool pumps that you replaced in 2018? The total should add to 100%.

Disposed of (trash/landfill): _____ (1)

Refurbished for reuse/resale: _____ (2)

Recycled for parts or materials: _____ (3)

Other: _____ (4)

Total: _____

CP5 In a **new installation with no existing pool pump**, how often did you install each of the following in residential homes in 2018? The total should add to 100%.

Single speed: _____ (1)

Two-speed: _____ (2)

Variable speed (VSD): _____ (3)

Total: _____

End of Block: Residential Homes

Start of Block: VSD Promotion

CP6 Did you promote or recommend variable speed (VSD) pumps to your customers in 2018?

- Yes (1)
- No (2)
- Don't know (3)

Display This Question:

If Did you promote or recommend variable speed (VSD) pumps to your customers in 2018? = Yes

CP6a What benefits of variable speed (VSD) pumps did you promote or recommend to customers in 2018? Select all that apply.

- ☐ Save energy/electricity (1)
- ☐ Saves money (2)
- ☐ Less maintenance/higher quality (3)
- ☐ Other (4) _____
- ☐ Longer warranty you can provide (5)
- ☐ Less noise vs. a single-speed pump (6)

Display This Question:

If Did you promote or recommend variable speed (VSD) pumps to your customers in 2018? = Yes

CP6b What methods did you use to promote variable speed (VSD) pumps in 2018? Select all that apply.

- ☐ Direct mail (1)
- ☐ In-person sales pitch (2)
- ☐ Phone (3)
- ☐ Online ads (4)
- ☐ Print ads (5)
- ☐ Door-to-door marketing (6)
- ☐ Other (7) _____
- ☐ Social media (8)

Display This Question:

If Did you promote or recommend variable speed (VSD) pumps to your customers in 2018? = No

CP6c Why not?

_____

End of Block: VSD Promotion

Start of Block: SCE Program Participation

Display This Question:

If PA = SCE

P1
As you may know, SCE offered two types of pool pump rebates in 2017 and 2018. The first were in-store, instant rebates at Leslie's Pools for variable speed (VSD) pool pumps. The second were

mail-in or online rebates available to both the customer ($100 for replacing a two-speed pump or $200 for replacing a single-speed pump) and the contractor ($100).

What percentage of the pool pumps you installed received a rebate from SCE in 2018? Please make your best estimate.

_____ received a rebate (1)

End of Block: SCE Program Participation

Start of Block: PG&E Program Participation

Display This Question:

If PA = PG&E

P2a
As you may know, there were two types of pool pump rebates available through the program in 2017 and 2018. The first was a direct install rebates, where the installer received a rebate if the pump was set to run in off-peak hours. The second was a mail-in or online rebate available to both the customer ($100) and the contractor ($200).

What percentage of the pool pumps you installed received a direct install rebate from PG&E in 2018? (Note, the pump may have been purchased and installed in 2017 with the rebate issued in 2018).

_____ received a direct install rebate (1)

Display This Question:

If PA = PG&E

P2b
In 2018, roughly what percentage of pool pumps you installed received a mail in or online rebate, where the customer got $100 and the contractor got $200? (Note, the pump may have been purchased and installed in 2017 with the rebate issued in 2018).

_____ received a mail-in or online rebate (1)

End of Block: PG&E Program Participation

Start of Block: Program Participation follow up

Display This Question:

If PA = PG&E

P2c
That means that about [insert %] % of the pool pumps you installed received no customer rebate? Is that correct? If not, you can go back and change your answer.

End of Block: Program Participation follow up

Start of Block: Program awareness/training

P3 How did you first learn about the ${e://Field/PA} rebate program for variable speed (VSD) pool pumps?

- From ${e://Field/PA} (1)
- From a customer (2)
- From another pool pump installer (3)
- Other (4) _____
- Pool Industry Association or meeting (5)
- Pool pump manufacturer (6)

Display This Question:

If PA = SCE

P4 Did you or other employees of ${e://Field/CompanyName} participate in the Foundation for Pool & Spa Industry Education (FPSIE) training/certification program?

- Yes (1)
- No (2)
- Don't know (3)

End of Block: Program awareness/training

Start of Block: Program Influence

PI1 What percent of your customers who got the program rebate do you believe would have installed a VSD pool pump without the rebate?

_____ would have installed VSD pump without rebate (1)

End of Block: Program Influence

Start of Block: Customer Behavior

CB1 How often is a customer's existing pool pump scheduled to operate outside of peak hours of electricity demand (2pm to 5pm) before you replace the pump?

- Always (1)
- Often (2)
- Sometimes (3)
- Rarely (4)
- Never (5)
- Don't know (6)

CB2 How often do you program a customer's new pool pump to operate outside of peak hours of electricity demand (2pm to 5pm)?

- Always (1)
- Often (2)
- Sometimes (3)
- Rarely (4)
- Never (5)
- Don't know (6)

CB2a Please enter any comments on differences between what schedules residential customers choose and what you select.

_____

End of Block: Customer Behavior

Start of Block: Operation, Drought

CB3 How many months a year do customers typically operate their pool pumps? The total should add to 100%.

Year round, 12 months: _____ (1)

6-9 months: _____ (2)

Less than 6 months: _____ (3)

Don't know: _____ (4)

Total: _____

CB4 Do you believe customers changed their pool operating schedules during the drought that ended in 2017?

- Yes (1)
- No (2)
- Don't know (3)

Display This Question:

If Do you believe customers changed their pool operating schedules during the drought that ended in... = Yes

CB4a How would they have changed their operating schedule? Select all that apply.

- ☐ Reduced daily operating hours (1)
- ☐ Reduced days of operation during the week (2)
- ☐ Closed their pool (3)
- ☐ Other (4) _____
- ☐ Added a pool cover (5)

Display This Question:

If Do you believe customers changed their pool operating schedules during the drought that ended in... = Yes

CB4b How did you learn that customers had changed their pool operating schedule during the drought?

_____

CB5 For residential customers that chose not to install a VSD pump, what were their reason(s)? Select all that apply.

- ☐ Installation or operation of VSD was too difficult (1)
- ☐ Cost was to go from customers' existing setup to a variable speed was too high (2)
- ☐ Rebate was too small (3)
- ☐ Tried to apply for rebate but encountered issues and gave up (4)
- ☐ Person was a renter, or was not the account owner of the bill, therefore not eligible for a rebate (5)
- ☐ Didn't want to wait to receive rebate (6)
- ☐ Other (7) _____
- ☐ Don't know (8)

CB6 For residential customers who installed a VSD pump but did not apply for a rebate, what were their reason(s)? Select all that apply.

- ☐ Application process was too difficult (1)
- ☐ Didn't want to wait to receive rebate (2)
- ☐ Rebate was too small (3)
- ☐ Tried to apply for rebate but encountered issues and gave up (4)
- ☐ Person was a renter, or was not the account owner of the bill, therefore not eligible for a rebate (5)
- ☐ Other (7) _____
- ☐ Don't know (8)

End of Block: Operation, Drought

Start of Block: Closing

C1 Do you have any comments you would like to add?

_____

End of Block: Closing

Start of Block: Survey complete terminate

TT Thanks for completing our survey! Please provide an email address to receive your $20 incentive. Once we review your survey response and approve your reward, you will receive an email notification with a link to choose your reward (in up to 2 business days). If you have any questions, please email poolsurvey@nmrgroupinc.com

- Name (4) _____
- Email (5) _____

Appendix F PG&E Program Staff Interview Guide

INTRODUCTION

My firm, NMR Group, Inc., is conducting an evaluation of the Pool Pump program. The purpose of the interview today is to better understand (a) how the program was marketed and implemented, (b) why PG&E chose to end the program. Your responses will also help us refine our contractor survey and participant survey questions.

INFORMATIONAL/ROLE

How long have you been involved with the pool pump program?

What is your role in the pool pump program?

Did you receive any training specific to the pool pump program? If so, please describe.

What kind of training, if any, would help you do this work better?

CURRENT PROGRAMS

Is there currently a midstream or direct install pool pump program?

PROGRAM RESULTS IN 2018

Please refer to the spreadsheet we sent with the 2018 program tracking data.

Do the values presented here match your own records for the program?

Can you explain the difference between the "VARIABLE SPEED POOL PUMP" and "COMMISSIONED VARIABLE SPEED DRIVE ON POOL PUMP CONTROLS" measures?

Was the Installer rebate available in 2018? [seem to be no $200/unit incentives there]

Did the program meet its 2018 program savings goal?

How well did the program meet expectations for 2018 in terms of?

a. kWh savings?
b. Appliance contractor/retailer participation?
c. Pool contractor/retailer participation?
d. Customer participation?
a. Marketing

What marketing methods did you use for this program? Which worked well/poorly?

Did your marketing messages link pool pump energy use and global warming?

ENDING OF PROGRAM

We understand that PG&E chose to sunset the downstream pool pump program based on two factors:

- A change in the baseline to a two-speed pump, which reduced kWh savings.
- A PG&E switch to eRebates, which would create administrative issues for this program since the forms require a customer signature.

Is this an accurate assessment of the main reasons PG&E chose to end the program?

Are there any other reasons that went into the decision to end the program?

Were any other programs sunsetted by PG&E for similar reasons in 2018?

Are there any planned changes to the eRebates program that would make it easier to administer a program of this type?

b. Incentives

How did you select the dollar amount for the participant and contractor incentives?

RETAILER/MANUFACTURER/CONTRACTOR ENGAGEMENT

What was included in the Certified Aquatic Equipment Installer (CAEI) course? [assuming this element was active in 2018]

Did you solicit feedback from installers on the training program? What did they have to say?

How did you encourage manufacturers, retailers, and contractors to work with the program?

How did the program benefit them?

What did they do to encourage customer participation?

What are the barriers to securing POS agreements?

How did you seek to address free ridership with retailers and contractors?

MARKETING

What marketing methods did you use for this program? Which worked well/poorly?

Did your marketing messages link pool pump energy use and global warming?

PROCESSING REBATES AND INCENTIVES

I would like to make sure I understand the way the program operated. Can you go through the application and rebate process step-by-step?

Application

Verification

Selection for inspection

Were inspectors just verifying installation or also reviewing quality of installation?

Who are the inspectors? How are they trained? By whom?

Rebate processing

- How long does it take?

Rejections

- How many applications were rejected? Why?

Appendix G SCE Program Staff Interview Guide

INTRODUCTION

My firm, NMR Group, Inc., is conducting an evaluation of the Pool Pump program. The purpose of the interview today is to better understand (a) how the program is currently marketed and implemented, (b) how well it is meeting its participation and savings goals, (c) areas for improvement, and (d) any near- term changes you plan to make. Your responses will also help us refine our contractor survey and participant survey questions.

INFORMATIONAL/ROLE

How long have you been involved with the pool pump program?

What is your role in the pool pump program?

Did you receive any training specific to the pool pump program? If so, please describe.

What kind of training, if any, would help you do this work better?

MULTIFAMILY PROGRAM

When did SCE introduce the pool/spa pump rebates to the Multifamily rebate program (SCE-13-SW-001C)?

How does the MF program differ from the residential program?

LED POOL AND SPA LIGHTS PROGRAM

Can you provide details about the LED Pool and Spa Lights rebates program?

When was it introduced?

Who is eligible?

How is this program marketed in relation to the pool pump rebates program?

How often do customers participate in both the pool and spa lights and pool pump programs?

PROGRAM RESULTS AND PLANS

Please refer to the spreadsheet we sent with the 2018 program tracking data.

Do the values presented here match your own records for the program?

Did the program meet its 2018 program savings goal?

How well is/did the program meeting your expectations in terms of:

e. kWh savings?

f. Appliance contractor/retailer participation?

g. [staff only] Pool contractor/retailer participation?

h. Customer participation?

Will the program meet its 2019 goals?

a. Do you foresee any circumstances or issues that could slow things down? [if mentions problem area] How do you anticipate responding?

b. [If will not meet goals] Are there opportunities to improve the chances of meeting goals?

What changes have been made in the program in 2019, if any? Do you have any changes planned?

Will savings be possible under this program after new DOE standards for pool pumps go into effect in 2021?

INCENTIVES

How did you select the dollar amount for the participant and contractor incentives?

RETAILER/MANUFACTURER/CONTRACTOR ENGAGEMENT

How do you encourage manufacturers, retailers, and contractors to work with the program?

How does the program benefit them?

What do you need them to do in order to increase customer participation?

How do you seek to address free ridership with retailers and contractors?

MARKETING

What marketing methods have you used for this program? Which have worked well/poorly?

Do your marketing messages link pool pump energy use and global warming?

How often do you update the website? Who updates the website materials?

PROCESSING REBATES AND INCENTIVES

I read through the pool pump program documentation. I would like to make sure I understand the way the program operates. Can you go through the application and rebate process step-by-step?

Application

Verification

Selection for inspection

Are inspectors just verifying installation or also reviewing quality of installation?

Who are the inspectors? How are they trained? By whom?

Rebate processing

How long does it take?

Rejections

How many applications were rejected? Why?

Appendix H Additional Background Information

Table 26 summarizes the relevant events for residential pool pumps for PY2018 and beyond.

Table 26: Pool Pump Program Timeline

Date	Event
3/1/2017	CPUC issues decision on savings assumptions that makes two-speed pumps the base case for single-family residential customers.
5/26/2017	DOE issues new pool pump standards to take effect in 2021.[17]
8/2017	PG&E proposes to sunset downstream but keep midstream program with Leslie's Pools, and to launch direct install delivery channel.[18]
12/31/2017	PG&E ends downstream channel, though rebate payments continue into early 2018.[19] Rebates for contractor-installed pumps continue through 2018.
7/13/2018	SCE submits final version of workpaper that updates the single-family base case to two-speed pumps, based on the CPUC decision on savings assumptions of 3/1/2017.[20]
11/30/2018	PG&E ends all single-family residential pool pump rebates.
1/28/2019	PG&E workpaper adopts SCE workpaper values for PY2018.[21]
12/31/2019	SCE ends all single-family residential pool pump rebates.
7/19/2021	New DOE standard scheduled to go into effect making variable speed pumps the base case.

[17] https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=67
[18] Internal PG&E presentation, "Pool Pumps and Motors: SPARC Gate 3 Sunset," Oriana Tell, Product Management, August 2017.
[19] Ibid.
[20] SCE Workpaper SCE17WP001.1.
[21] PG&E Workpaper PGECOPUM102 R8.

Table 27: Single-Family Pool Pump Measures and Savings

Measure Code	Type	Description	First Year Savings (kWh)	Peak Demand Savings (kW)
Measure A SCE: PM-78394 PG&E: PL001	ROB	Commissioned Variable Speed Drive on Pool Pump Controls replacing Two-speed Pool Pump. Variable speed swimming pool pumps that are programmed to operate outside peak hours (2:00 pm to 5:00 pm) as part of a contractor driven offer.	1,092.93	0.00
Measure B SCE: PM-98422 PG&E: P107[22]	ROB	Self-Installed Variable Speed Drive on Pool Pump Controls replacing Two-speed Pool Pump. Variable speed swimming pool pumps that are not installed as part of a contractor driven offer, thus cannot be assumed to be explicitly programmed.	959.81	0.00
Measure C SCE: PM-69234	RET	Commissioned Variable Speed Drive on Pool Pump Controls replacing Single-speed Pool Pump. Variable speed swimming pool pumps that are programmed to operate outside peak hours (2:00 pm to 5:00 pm) as part of a contractor driven offer. Early retirement savings (RET) can be claimed with a preponderance of evidence that the existing pump would have provided adequate service for the RUL period being claimed (a minimum of 3.3 years).	1st Baseline: 1,252.20 2nd Baseline: 1,092.93	1st Baseline: 0.25 2nd Baseline: 0.00

[22] PG&E measure P107 predates the CPUC decision on savings assumptions. PG&E ended measure P107 when adopting Measure A (PL001) as their only pool pump measure for 2018. The details of P107 correspond to Measure B, however, and NMR assigned Measure B savings assumptions to this measure for evaluated gross savings.

Appendix I Response to Reviewer Comments

Table 28. Response to Reviewer Comments

Comment #	Commenter	Comment	Response
1	PG&E	First, do you believe that the market effects adder to the net-to-gross formula shown in section 2.3 is correct? We believe that it should be applied within the CEDARS database rather than within the individual evaluations. If you concur, would you please make the adjustment?	The NTGR (1-FR) of 0.55 and the market effects adder of 0.05 have been separated in Table 19 and Table 20 to make our calculations clearer within those tables. The parameters in the ATR database match the values presented in these tables. The resulting estimated net savings incorporate the market effects adders as in CEDARS.
2	PG&E	Second, in Figure 1, you provide your logic for determining program attribution. The second question as shown in the figure is "If you had not received the rebate, would you have installed the pool pump at the same time, at a different time, or not at all?" but you do not show the score assigned for a respondent who might have said "not at all." What score would have been assigned to such a participant, and why? If such respondents were not assigned 100% credit for this response, how would a change of this "credit score" to 100% affect the resulting NTGR for the program?	In Figure 2, the "not at all" arrow leads to a free-ridership score of 0 (top right corner of figure), which is a 100% credit as you suggest. In other words, respondents who would not have installed the new pool pump without a rebate are considered to have a free-ridership score of 0.

Comment #	Commenter	Comment	Response
3	PG&E	Third, the final question in the series is "If the program had not been available, would you have installed a pool pump with the same level of efficiency as what you installed, or a different efficiency level?" To our minds, since you are speaking to a program participant after having participated, and the question asks the participant to surmise what they might have done in the absence of the program, such a respondent is under substantial social pressure to respond in an "environmentally responsible" manner. A typical response of an environmentally responsible person might be "I would have bought the more efficient pool pump anyway." In other words, we suspect that this final question may result in a biased construction of program attribution, and that an assignment of a "0%" score for these participants is not a fair representation of program influence. Do you agree or disagree, and why? If you were to recalculate the "same efficiency" responses as 100%, or 50% credit to correct for suspected social response bias, how what that change the resulting NTGR for PG&E and SCE?	NMR agrees that there is the opportunity for bias or incorrect recall when asking survey respondents what they would have done in the absence of a rebate. However, the only types of pool pumps on the market in CA in 2018 were two-speed and variable speed pumps. Adding in the fact that many customers were working with contractors who had attended a FPSIE training and were likely to recommend VSD pumps, it seems reasonable that 72% of respondents would have installed the same efficiency pump without a rebate. If the "same level" response was given an efficiency credit of 100% instead of 0%, the resulting NTGR would be 0.62 instead of 0.55. If the "same level" response was given an efficiency credit of 50% instead of 0%, the resulting NTGR would be 0.58 instead of 0.55.
4	PG&E	In Table 5, Section 3.1.3, you present evidence that the majority of PG&E respondents surveyed (67%) report that their existing pumps are older than ten years, and that 90% are seven or more years old. You also observe that the majority of pumps replaced are ten years or older. In spite of this evidence, and that you state in Section 3.1.4 that contractors state that 98% of their customers kept their pools open year-round, you conclude that "it is unlikely that many of the single-speed pumps installed in 2008 or before will operate much longer, so a change in the two-speed base case assumption is not warranted." Given that the preponderance of the survey research that you present suggests that the DEER EUL/RUL values may be low, on what evidence do you draw this conclusion?	While it's true that our survey data suggest that a significant percentage (82%, Table 5) of single-speed pump remain in use, NMR also found that a significant portion (64%, Table 6) of the pumps being replaced we not in good working condition. To keep savings estimates conservative in future program years as single-speed pumps continue to age and become less serviceable, NMR thought that keeping the two-speed base case was prudent.