EM&V FINAL REPORT

SCE PUMP TEST AND HYDRAULIC SERVICES PROGRAM
PROGRAM YEARS 2003 AND 2004-2005

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EXECUTIVE SUMMARY

This report presents the results of an impact and process evaluation of Southern California Edison's 2003 and 2004-05 Pump Test and Hydraulic Services Program. The Southern California Edison Pump Test and Hydraulic Services Program provides in-field test services for water pumping applications. Test services include an assessment of pumping plant efficiency, including water flow and overall plant efficiency (OPE), and a written report submitted to the customer that describes the results of the test and recommendations for improving the efficiency of the plant. The program is thus an information and education program and is delivered to customers as a free-of-charge energy service.

The objectives of this EM&V study include: a) verify program accomplishments, b) assess energy savings, realization rate, and net-to-gross ratio, c) conduct a process evaluation, d) conduct a market assessment, e) assess customer satisfaction, and f) test the program logic assumptions underlying the program theory.

Methodology

This project combined the evaluations of two program years: program year 2003 and program year 2004-2005. The evaluation of these program years was broken into two phases. The first phase focused on the 2003 and 2004 calendar year participants and the second phase focused on the 2005 calendar year participants.

To meet the objectives of this EM&V project, the project team conducted a review of the program records, analysis of the program tracking database, and surveys with the key market actors, including program participants and non-participants. The program verification activities involved conducting a detailed review of program documentation and the information contained in the program tracking database, and comparing it to the final results filed by the program. The program documentation review helped to gain a full understanding of program design, previous evaluation findings, and current customer outreach and marketing activities.

There were five distinct samples drawn for this study. Sample size calculations were based on the proportional approach, which implicitly assumes that the variable in question is a proportion. The sample design was developed to achieve a 90% confidence level ± 10%. The various types of data collected in this evaluation were as follows:

- **SCE program management and field staff interviews**. The project team interviewed key program management staff and 11 SCE pump test technicians to gather insights into program operations and to identify opportunities for improving various aspects of the program.

- **Participant pump test records**. The project team requested a sample for both program years 2003 and 2004-05 of completed pump tests for the purposes of verifying completed tests for the program year. Sixty-eight records were examined for the participants in the calendar years 2003 and 2004; an additional 68 records were examined for participants in the calendar year 2005.

- **Pre/post measure implementation pump test data for calculation of savings realization rate**. The project team drew a random sample of program participants for the participant survey and queried the respondents on whether or not they had implemented the recommended pump system efficiency improvements subsequent to the pump test. Those who had implemented measures were recruited for a follow-up test. The results of this follow-up test were used in the energy

savings realization rate analysis. The final sample was a stratified random sample with the key stratification variable being pump type. A total of 27, from a target of 68, post-retrofit tests were conducted and analyzed. The field data was supplemented with pump records which showed a marked improvement in OPE in consecutive tests. Table E-1 presents the targeted and actual sample sizes for the pre/post implementation pump test data analysis.

- **Program participant telephone surveys**. Two samples of program participants, 2003 and 2004 calendar year participants and 2005 calendar year participants were drawn for the purposes of a telephone survey to examine program process and satisfaction, net-to-gross ratio elements, program theory elements, and market perception issues. This sample was a random stratified sample with the key stratification variable being market segment (i.e., municipal water service, agricultural irrigation). Table E-2 presents the targeted and actual completed participant surveys.

- **Non-participant telephone surveys**. A sample of non-participants were surveyed to assess program awareness and perceptions, net-to-gross elements, program theory elements, market penetration, and market perception topics. This evaluation follows the standards set forth in previous evaluations and defines non-participants for the PTHS program as customers that have not participated in the program in the past 3 years. This sample was a random stratified sample with the key stratification variable being market segment (i.e., municipal water service, agricultural irrigation). Table E-3 presents the targeted and completed non-participant surveys.

Table E-1: Pre/Post-retrofit test Sample: 2003 and 2004 Participants

Pump Type	2003 Program Pump Count	2003 Program Percentage	Targeted Post-retrofit tests	Actual Post-retrofit tests	Database Pre/Post
Turbine Well	1,686	46%	31	11	97
Turbine Booster	1,154	31%	21	8	71
Submersible Well	401	11%	7	5	44
Centrifugal Booster	356	10%	7	2	18
Submersible Booster	87	2%	2	1	9
Total	3,684	100%	68	27	239

Table E-2: Program Participant Samples

Revenue Class	2003 Program Pump Count	2003 Program Percentage	Targeted Completes by Group	2003 and 2004 Completes	2005 Completes
Agricultural	1,469	42%	29	29	29
Water Supply	2,215	58%	39	39	39
Total	3,684	100%	68	68	68

Table E-3: Non-participant Sample

Revenue Class	Percentage	Targeted Completes	Actual Completes
Agricultural	60%	41	41
Water Supply	40%	27	27
Total	100%	68	68

Findings

The findings for this study can be segmented into 3 sections: 1) Verification, 2) Expected Savings Realization Rate Analysis, and 3) Process and Market Assessment.

Verification Results

The program verification activities involved conducting a detailed review of program documentation and the information contained in the program tracking database, and comparing it to the results filed by the program.

To complete the review, we selected 68 customers' records at random from the program participation records for both the 2003 and 2004 calendar year participants and the 2005 calendar year participants. The address data from the participant database was compiled in an analytic database and the data was examined to confirm that:

- the customer had a valid SCE customer number,
- the customer had a valid SCE Customer Service Account Number (CSSSERV),
- the customer was sent a congratulations letter or economic analysis, and
- the pump test occurred in the calendar year indicated in the program database.

For both program participant datasets the verification review indicated that 100% of the sample satisfied these criteria, and thus the 2,646 pump tests reported by SCE in program year 2003 and the 8,795 pump tests reported by SCE in program year 2004-2005[1] are considered to be verified.

Expected Energy Savings Realization Rate Analysis Results

The savings calculation method employed by the program is referred to in the 2002 EM&V study[2] as "method two" and is described below:

$$\text{Program Gross kWh Impact} = \left(\sum_{i=1}^{n} \text{kWh Expected Impact}_i \right) \text{ x Realization Rate}$$

Realization Rate = % Expected Savings x Implementation Rate

[1] January 1, 2004 through December 8, 2005

[2] Southern California Edison Company's Evaluation, Measurement, and Verification of the 2002 Pump Test and Hydraulic Services Program. Equipoise Consulting Incorporated. November 14, 2003. Page 5-49.

Where:

$\sum$ kWh Expected Impact	= sum of expected kWh savings based on a pre-retrofit pump tests
% Expected Savings	= percent of forecast savings found in the field from post-retrofit tests
Implementation Rate	= rate at which the participant population implements a recommended efficiency improvement
n	= number of unique pump tests in a program year population
i	= counter variable, takes on values 1 to n.

The expected kWh savings for each site is determined from the results of the pump test using the data collected during the test. From these tested variables, the Overall Plant Efficiency, OPE (%), is computed for existing condition using a laptop based software package that completes the performance calculations and prepares the customer report. Based upon the pump readings, an expected OPE is estimated that may be achieved through the installation of energy efficiency pump measures. The expected OPE ratio is dependent on the pump type.

The historical energy use of the pump plant is known from SCE metered data. The customer energy savings (kWh Expected Savings) is calculated by applying the percent improvement from the existing OPE to the expected OPE to the energy use data for the pump plant (Eq. 1). After the energy efficiency measures are installed a second pump test is conducted and the actual improved OPE is measured (Eq. 2). The % Expected Savings is calculated as the ratio between actual savings and the expected saving (Eq. 3).

$$\text{kWh Expected Savings} = \text{Total Annual kWh} \times \left(1 - \frac{OPE_{existing}}{OPE_{expected}}\right) \quad \text{(Eq. 1)}$$

$$\text{kWh Actual Savings} = \text{Total Annual kWh} \times \left(1 - \frac{OPE_{existing}}{OPE_{improved}}\right) \quad \text{(Eq. 2)}$$

$$\%\ \text{Expected Savings} = \frac{kWhActualSavings}{kWhExpectedSavings} = \frac{\left(1 - \frac{OPE_{existing}}{OPE_{improved}}\right)}{\left(1 - \frac{OPE_{existing}}{OPE_{expected}}\right)} \quad \text{(Eq. 3)}$$

Note: improved OPE was obtained through the post-retrofit pump tests performed as part of this study or from post-retrofit pump tests performed through the program.

Where:

$OPE_{existing}$ = the pre-retrofit OPE of the pump as measured by a pump test.

$OPE_{expected}$ = the expected OPE of the pump if energy efficiency measures are installed. This OPE is based upon the data collected during the pre-retrofit pump test.

$OPE_{improved}$ = the actual improvement to the pump OPE as measured during a post-retrofit pump test.

Overall program savings are estimated using the aggregate values for expected savings over all participating pumps adjusted by the Implementation Rate and % Expected Savings. Currently, the program uses values that are also documented in the 2002 EM&V study and are based on a previous 1996 study of the SDG&E agricultural program[3]. The values used are:

- Implementation rate = 33%
- % Expected Savings = 87%
- Realization Rate = 33% x 87% = 28.7%

This evaluation focused on updating the % expected savings for the SCE program. The post-retrofit sites were used to update the percent of the expected energy savings (% Expected Savings) in the savings calculations. This analysis was conducted in two phases. The first phase used the data from the post-retrofit pump tests conducted on the sample who had installed energy efficiency measures identified by the participant surveys combined with the pre-retrofit tests to compute the savings realization rate (% Expected Savings). The results from this first phase were very close to the value that SCE has been using for program tracking. However, the confidence interval was quite large. It was decided to conduct a second phase of the analysis and to supplement the post-retrofit pump tests conducted by this study with additional observations from the pump test tracking database. Customers that have most likely implemented retrofits were identified by searching the database for customers with discernable differences in pump plant performance values such as Overall Plant Efficiency (OPE) indicating that the customer may have implemented improvements.

These additional observations did not introduce an unacceptable level of bias into the realization rate calculation, since the realization rate was confirmed via a random sample in the first phase of the analysis and the supplement observations were used primarily to improve on the confidence of the estimate for expected savings realization rate. The assessment of the % expected savings was calculated following the same procedures as above. Table E-4 summarizes the estimated % expected savings and the accuracy at a 90% confidence interval for these estimates.

[3] Johnson, D. Memorandum regarding kilowatt hour savings reporting procedure. 2/2/1996.

Table E-4: % Expected Savings by Pump Type

Pump Type	Count	% Type	Average % Expected Savings	Standard Deviation	± Confidence Interval[a]	Accuracy @ 90% Confidence Interval[b]
TW	108	41%	101%	46%	7%	7%
TB	79	30%	88%	43%	8%	9%
SW	49	19%	77%	57%	13%	17%
CB	20	7%	84%	108%	41%	49%
SB	10	4%	82%	110%	60%	74%
Overall	**266**	**100%**	**89%**	**69%**	**7%**	**8%**

[a] Limits of the 90% Confidence Interval, i.e., 90% Confidence Interval = Mean ± Limit
[b] Error term for the 90% Confidence Interval, Limit/Mean

Based on these post-retrofit tests, the overall % Expected Savings is 89% with an accuracy of ±8% at a 90% Confidence Interval. This result is very close to the 87% expected savings currently in use by the program.

Although not specifically in our scope of work, based on the results of the participant survey it appears that the current 33% Implementation Rate may be low. Of those participants surveyed, 72% said that they had implemented energy savings measure(s). Participants who responded that they implemented measures were not asked what percentage of the pumps tested received improvements. As a result the 72% represents a customer-level implementation rate and not the pump-level implementation rate. The review of the database shows that on average each participant had 6.88 pumps tested. If those respondents that indicated that they had implemented energy savings measure(s) did 100% of the pumps that they had tested this yields an Implementation Rate of 72%. However if these respondents only implemented an energy savings measure on one pump the overall Implementation Rate may be as low as 10%, 1 out of 6.88 pumps times 72% customer implementation rate. The implementation rate by participant needs to be determined to actually determine the Implementation Rate. Ideally the implementation rate could be determined through on-site audits of a sample of participants. These audits would examine all the pumps that the customer had tested in the program to determine how many of these pumps were actually retrofitted. This activity was beyond the scope of this project. Further research on the Implementation Rate is recommended.

Based on the new estimate for % expected savings, the overall realization rate could then be revised as follows:

Realization Rate = Implementation Rate x % Expected Savings

Realization Rate = 33% x 89% = 29.4%

Net-to-Gross Analysis Results

The estimated NTG Ratio (NTGR) in the 2002 EM&V study (73%) accounted for only the free ridership component. This evaluation adjusted the value to account for spillover effects that can be expected to exist for this type of information program. The NTGR will then be defined as:

NTGR = (Net Factor) x (Market Effects Factor)

Where:

Net Factor = [1 – free ridership]

Market Effects Factor = [1 + inside participant spillover + outside participant spillover + non-participant spillover[4]]

Free Ridership

A series of "direct" and "influencing" free ridership questions were included in the participant surveys to elicit explicit estimates of free ridership. The responses to these questions were used to estimate free ridership. This analysis was conducted using both the 2003-2004 and the 2005 participant surveys.

Free ridership was calculated for each respondent and the free ridership across the participant respondents was averaged to come up with the total free ridership for the program. The average free ridership was calculated to be 22%.

It should not be surprising to identify free ridership among program participants. Although the program, like most energy efficiency programs, has some checks in place to prevent large-scale free ridership, it is essentially impossible to identify up front those facilities that might have installed high-efficiency measures even in the absence of the Pump Test Program and prevent them from participating. This is especially true of an information program such as the Pump Test and Hydraulic Services program that provides the pumping test free of charge.

Spillover

About 4% of all participant respondents, 2003-2004 and 2005 respondents, report some inside spillover: improvements to pumps that were not tested under the program. Adjusting for the influence of the program, the probability that these participants would have made the improvements to the pumps that weren't part of the program if the program didn't exist was about 42% for 2003-2004 participants and 26% for 2005 participants, or an average of 34%. Since only 4% of all the respondents reported this inside participant spillover, the inside participant spillover rate for the entire sample is approximately 1.4%.

Outside participant spillover is defined as the participant making other energy efficiency improvements to equipment not covered under the program. For example, if a participant in the Pump Test program learned about energy efficiency improvements through the program and applied this experience to performing a lighting retrofit, it would be considered outside participant spillover. All participants in the sample were asked if they made any improvements other than those to the pumping system as a result of the program. None of the participants indicated that they had made any other improvements as a result of the program.

Non-participant spillover results from non-participants making the improvements based upon their knowledge of the program. Responses to the non-participant survey indicate that 38% of the non-participants have made improvements to their systems based upon their knowledge of the program. Of those non-participant respondents that made improvements to their pumping systems, on average the improvements impacted about 40% of their pumps. Therefore the non-participant spillover is estimated to be about 15%.

The spillover or market effects factor is then estimated to be:

[4] Non-participant spillover savings have been recently disallowed in the California energy efficiency programs.

Market Effects Factor = [1 + inside participant spillover + outside participant spillover + non-participant spillover]

= [1 + 1.4% + 0% + 14%] = 115%

Overall NTGR

Based on the survey responses, the Net to Gross Ratio (NTGR) is calculated as follows:

NTGR = (Net Factor) x (Market Effects Factor)

Where:

Net Factor = [1 – (free ridership)]

= [1- 22%] = 78%

Market Effects Factor = 115%

NTGR = (78%) x (115%) = 90%

Process and Market Assessment Analysis

The process evaluation was conducted in two phases. The first phase of the process evaluation consisted of surveying a sample of the 2003 and 2004 program participants, a sample of non-participants, and program staff. The second phase of the process evaluation consisted of surveying a sample of the 2005 program participants in early 2006. The key findings of this research are presented here.

44 out of 68 (65%) of the 2003 and 2004 participants surveyed and 54 out of 68 (79%) of the 2005 participants surveyed made improvements to their pumping system as a result of the SCE pump test. Table E-5 and Table E-6 present a breakout of the improvements that were made, how influential the SCE pump test was to making these improvements, and the likelihood that the customer would have made these improvements without the Pump Test program. The Pump Test program strongly influenced participants to replace the pump bowl and impeller and to adjust the bowl and impeller on deep well pumps. These results indicate that the Implementation Rate used in the realization rate computation could be as high as 72%; however, further research will be necessary to determine the percentage of program-tested pumps receiving energy efficiency improvements.

Table E-5: Pump System Improvements as a Result of the PTHS Program – 2003-2004 Participants

Measure	%[a]	Influence of Program[b]	Likelihood of making same changes without Program[b]
Replace pump bowl and impeller	93%	4.4	2.1
Install high-efficiency motor	50%	3.8	2.8
Adjust bowl and impeller on deep well pump	45%	4.5	1.6
Other: Prioritizing pumps based on highest efficiency	41%	3.9	2.6
Change distribution system discharge lines to reduce pressure or friction	34%	3.4	2.8
Install variable-speed drive on pump motor	32%	3.4	3.0
Replace well column with coated or treated pipe to reduce friction losses	23%	3.3	2.1
Trim existing impeller on booster pump	16%	4.6	2.1
Other: Changed rate plan	9%	4.1	2.3

[a] % of those participants that reported that they made improvements.
[b] Scale of 1-5 where 1 is the least likely and 5 is the most likely

Table E-6: Pump System Improvements as a Result of the PTHS Program – 2005 Participants

Measure	%[a]	Influence of Program[b]	Likelihood of making same changes without Program[b]
Replace pump bowl and impeller	83%	4.5	1.7
Install high-efficiency motor	54%	4.2	1.9
Adjust bowl and impeller on deep well pump	44%	4.4	1.8
Other: Prioritizing pumps based on highest efficiency	24%	4.2	1.8
Change distribution system discharge lines to reduce pressure or friction	20%	4.8	1.6
Install variable-speed drive on pump motor	20%	4.2	2.1
Replace well column with coated or treated pipe to reduce friction losses	15%	3.7	1.8
Trim existing impeller on booster pump	15%	5.0	1.3
Other: Changed rate plan	11%	3.8	2.1

[a] % of those participants that reported that they made improvements.
[b] Scale of 1-5 where 1 is the least likely and 5 is the most likely

Participants' overall perceptions are that the program is very easy to participate in and very useful. Table E-7 and Table E-8 present the responses to a series of questions regarding participation in the program. On average, participants strongly agree that it was easy to request a pump test, there wasn't a long wait for results, the results were easy to understand, believable, and useful, and the test provided actionable information for making improvements. As shown, overall satisfaction with the program is very high.

Table E-7: 2003-2004 Participant Perceptions about the Program

Indicator	Participant Respondents that Agree 1= strongly disagree 5 = strongly agree			
	Avg.	% Low (1-2)	% Med. (3)	% High (4-5)
It was easy to request a pump test.	4.9	0%	0%	100%
There wasn't a long wait between my request and when the pump test was performed.	4.6	0%	0%	100%
There wasn't a long wait to receive the results of the pump test.	4.9	0%	0%	100%
The pump test results were useful.	4.9	0%	0%	100%
The pump test results were easy to understand.	4.9	0%	0%	100%
The pump test results were believable.	4.9	0%	0%	100%
I am now much more knowledgeable about needed improvements for my pumping operations.	4.8	0%	0%	100%
The pump test report provided the relevant and actionable information about improvements on my pumping system.	4.9	0%	0%	100%
Overall Satisfaction with the Program	**4.9**	**0%**	**0%**	**100%**

Table E-8: 2005 Participant Perceptions about the Program

Indicator	Participant Respondents that Agree 1= strongly disagree 5 = strongly agree			
	Avg.	% Low (1-2)	% Med. (3)	% High (4-5)
It was easy to request a pump test.	4.8	4%	1%	94%
There wasn't a long wait between my request and when the pump test was performed.	4.4	1%	12%	87%
There wasn't a long wait to receive the results of the pump test.	4.8	0%	6%	94%
The pump test results were useful.	5.0	0%	0%	100%
The pump test results were easy to understand.	4.9	0%	1%	99%
The pump test results were believable.	5.0	0%	1%	99%
I am now much more knowledgeable about needed improvements for my pumping operations.	4.8	1%	0%	99%
The pump test report provided the relevant and actionable information about improvements on my pumping system.	4.9	0%	0%	100%
Overall Satisfaction with the Program	**4.9**	**0%**	**0%**	**100%**

Table E-9 presents the reasons the customers chose to participate in the program. Most of the participant respondents said they participated in the program to reduce the time spent and the hassle involved in collecting pump data.

Table E-9: Areas where Pump Test Program helped Participants

Reason	% of 2003-2004 Participant Respondents	% of 2005 Participant Respondents
Reduce the time or cost of collecting information you would otherwise need to get on your own?	97%	84%
Reduce your doubt and uncertainty about your pumping system efficiency?	94%	84%
Work more effectively with dealers and suppliers?	53%	74%
Reduce the hassle of performing the test yourself?	97%	87%
Increase the availability of products and services of benefit to you?	34%	37%

The participants felt that the SCE cost analysis was very influential in determining when to spend money on pump repairs, an average of 4.1 for the 2003-2004 participants and an average of 4.5 for the 2005 participants on a 5 point scale. The program participants are very confident in the data provided by EDISON, an average of 4.7 for the 2003-2004 participants and an average of 4.9 for the 2005 participants on a 5 point scale.

Based on the survey data, the following insights regarding the Pump Test and Hydraulic Services program were developed.

Participants

- The program is influencing participants to make improvements to their pumping systems.
- Most (93%) of the participants that make improvements replace the pump bowl and impeller.
- Participants make pumping improvements to reduce their energy costs.
- Participants have most of their pumps tested, not just a few.
- Participants are active in spreading the benefits of the program to others.
- The program is working very well for the participants.
- Overall satisfaction with the program is very high.
- Satisfaction with the individual program components is very high.
- Almost half of the participants indicated that they used non-SCE pump testers also.

Non-Participants

- About 1/3 of the non-participants had heard about the program primarily from others or the SCE representative.
- Non-participants typically don't have their pumps tested on a regular basis. Only 18% of the pumps were reported to have been tested regularly.

- These regular pump tests were most likely conducted by vendors either as needed or on an annual basis.

- Non-participants appear not to need the data to make the pumping improvements, as 37% of the respondents made improvements to their systems without a pump test.

- There appear to be no prominent reasons that the non-participants who are regularly testing their pumps were not participating in the Pump Test and Hydraulic Services program. Some of the reasons included being protective of their pumps, being unable to turn the ditch on and off very easily, and believing they were not eligible for the SCE tests.

Conclusions and Recommendations

Based on the research conducted for this study, the project team offers the following overarching observations and conclusions about program operations and customer response. We have also indicated several recommendations for updating the program savings parameters and for improving the program design.

Overall the program is well implemented and effective. Based upon the findings in this report it is recommended that the program adopt the following set of recommendations. The items in this list are not ranked by order of importance.

Recommendation #1: Adjust the % Expected Savings to 89%.

Recommendation #2: Adjust the NTGR to 90%.

Recommendation #3: Investigate the current 33% Implementation Rate.

Recommendation #4: Restrict testing per pump to no more than once every two years to help free up resources to conduct testing on pumps that have never been tested.

Recommendation #5: Modify the Cost Analysis Letter to specify specific measures which may be taken and the estimated savings for each measure.

Recommendation #6: Develop a way to track "new" customers to the program.

Recommendation #7: Develop a consistent classification method that corresponds closely to the specific market segments that the program serves and track these data on a going forward basis.

Recommendation #8: Develop a data entry procedure that uses a lookup function to fill in customer information based upon the CSSCUST entered. This should help correct the multiple spellings of the customer name.

Recommendation #9: Consider the role that the PT&HS program might play as a source of data for water supply entities as participants in the following programs: Agricultural and Pumping Interruptible (AP-I), California Power Authority Demand Reserves Program (CPA DRP), Critical Peak Pricing (CPP), and the Demand Bidding (DBP) programs.

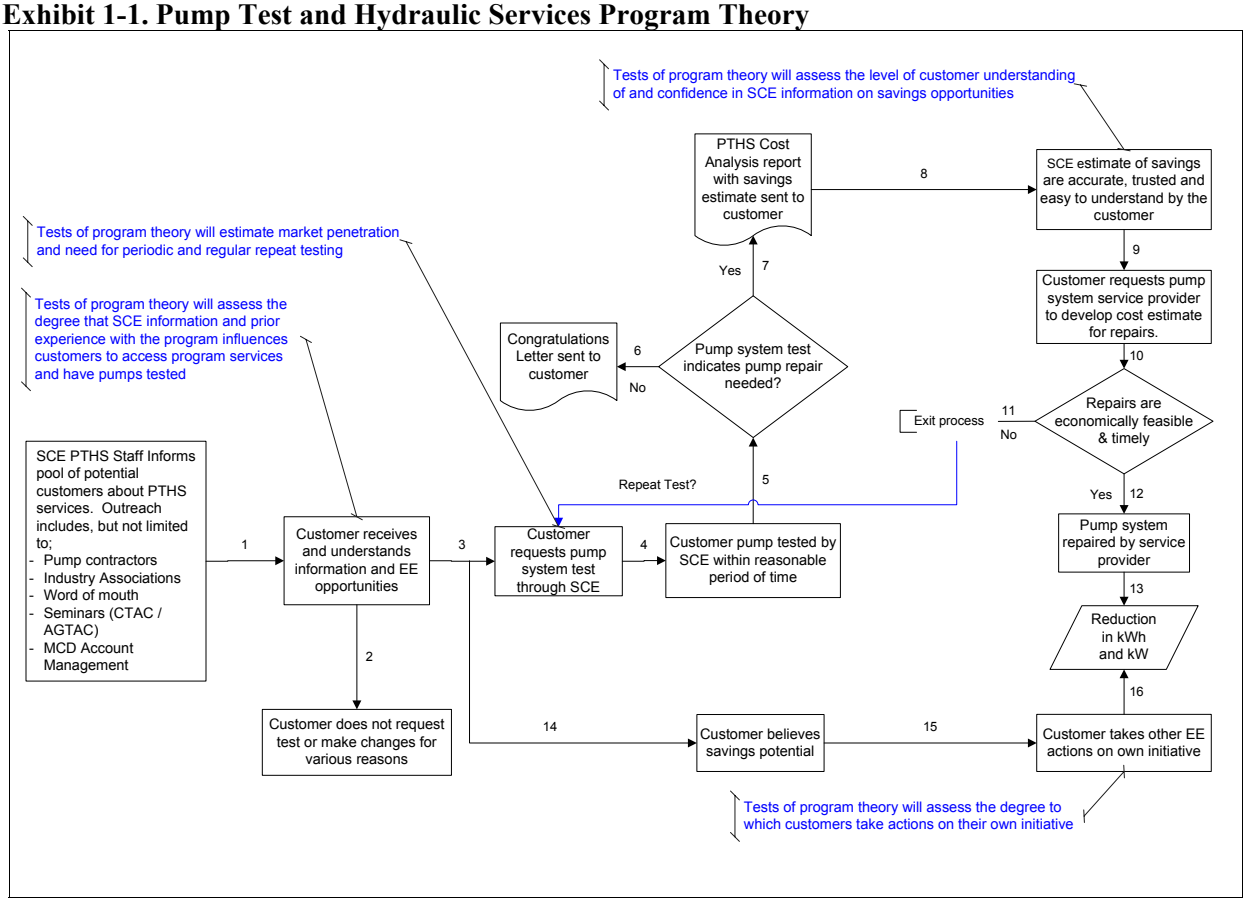
1. INTRODUCTION

This report presents the results of an impact and process evaluation of Southern California Edison's 2003 and 2004-2005 Pump Test and Hydraulic Services Program years. The Southern California Edison Pump Test and Hydraulic Services Program provides in-field test services for water pumping applications. Test services include an assessment of pumping plant efficiency, including water flow and overall plant efficiency (OPE), and a written report submitted to the customer that describes the results of the test and recommendations for improving the efficiency of the plant. The program is thus an information and education program and is delivered to customers as a free-of-charge energy service.

1.1 Program Theory

The program theory is based on the observation that customers lack energy efficiency and cost/savings information on the performance of their water pumping plants and do not have the wherewithal to generate this information on their own. The program assumes that if customers are presented with objective and credible information on plant performance and understand the benefits that can be achieved through improved efficiency (e.g., lower energy costs per acre foot of water pumped), they will have their plants tested on a routine basis. The program further assumes that if the test reveals sufficient savings and an acceptable return on investment, a reasonable percentage of customers will adopt the recommended energy efficiency measures. Exhibit 1-1 presents the program theory, including underlying program assumptions to be tested in the evaluation.

Exhibit 1-1. Pump Test and Hydraulic Services Program Theory



1.2 Summary of EM&V Study Objectives

The objectives of the EM&V study include: a) verify program accomplishments, b) assess energy savings, realization rate, and net-to-gross ratio, c) conduct a process evaluation, d) conduct a market assessment, and e) test the program logic assumptions underlying the program theory. The discussion below reviews each of these research objectives in greater detail.

This project combined the evaluations of two program years: program year 2003 and program year 2004-2005. The evaluation of these program years was broken into two phases. The first phase focused on the 2003 and 2004 calendar year participants and the second phase focused on the 2005 calendar year participants.

A. Verify program accomplishments

1. Conduct verification activities to validate program accomplishments as reported by SCE in their 2003 and 2004-2005 program claims.
2. Evaluate additional program performance compared to goals as stated in the program's implementation plan (PIP):
    - Refine and verify the estimated 29% to 41% of participating customers that this program has influenced in terms of improving the operating efficiency of their pump(s). This verification will help determine if further research on the Implementation Rate is required.
    - Measure the effectiveness of outreach and network building activities involving:
        - Pumping equipment manufacturers, distributors, contractors, and independent pump testing agencies to assist customers with plant improvements.
        - Outreach programs designed to reach a wide range of customers such as city/county agencies, municipal water districts, and agriculture and water related associations within the SCE service territory.
        - Continuation of education and outreach efforts at events such as training classes and plans to enhance the existing brochures utilized to promote the program.

B. Assess savings calculation parameters for potential program energy impacts

1. Gather and analyze data to update specific parameters that can be used to calculate gross program energy savings. These parameters include the savings realization rate (see Impact Calculation Method below for more details).
2. Estimate new parameters that can be used to measure potential energy savings attributable to the pump test recommendations, such as the spillover effect factor in the net-to-gross calculation, including:
    - Non-participant spillover – Does the program influence program non-participants to have tests completed by other independent pump testers?
    - Participant inside spillover – Do program participants make improvements to pumps that were not tested under the program?
    - Participant outside spillover – Are some participants testing additional measures outside of the SCE tests as a result of interaction with the SCE program?

C. Conduct a process evaluation

1. Examine changes in the program processes that have occurred since PY 2002 and provide feedback to the program manager.
2. Determine improvements in the overall program direction in areas such as tracking database management and access to tracking data.
3. Continue to assess performance of the program, building on previous program evaluations.
4. Assess achieved level of pump efficiency and customer awareness by continuing the development of dataset on awareness indicators on participants and non-participants using questions from the survey instruments developed for previous data collection efforts.
5. Identify opportunities for the program that are innovative in addressing customer information issues for energy efficiency pumping system operation.
6. Assess customer perceptions of and satisfaction with the program, their experiences with the pump test process, and the influence of the program on customer actions and decision making relative to efficiency improvements.
7. Review internal reporting, customer service, and complaint management.

D. Conduct a market assessment

1. Assess the effectiveness of outreach activities and identify new outreach opportunities and innovative approaches to enhance the program's effectiveness.
2. Assess the general effectiveness of energy efficiency information dissemination.
3. Assess general population awareness of program services/efficiency potential and behaviors and practices of pumping system operation, and compare to those of program participants.
4. Profile program participation, identify new market opportunities, and identify underserved and/or hard-to-reach market segments.
5. Disaggregate the participant market (municipal customers, agricultural customers, etc.) more accurately to reflect the program results by characteristics of the market.

E. Test assumptions underlying the program theory

1. Assess the level of customer understanding of and confidence in SCE information on savings opportunities. Surveys of participating customers will include metrics on customer baseline knowledge of pump related energy issues, understanding of SCE cost analysis calculations and presentations, and confidence in PTHS calculations.
2. Assess the degree that SCE information and prior experience with the program influences the customers to access program services and have pumps tested. Surveys of participating customers will include metrics on customer acceptance of program information, including on which information and media components are most effective, and also why repeat customers are pursuing continued testing and what their previous experience has been.
3. Assess the degree to which customers take other energy efficiency improvement actions as a result of program influence. Participating customers will be asked both inside and outside spillover questions, while non-participants will be asked about their level of awareness of the program, and if there have been non-participant spillover effects.
4. Assess market penetration and need for periodic and regular repeat testing. The market will be disaggregated into municipal and agricultural participants, and statistics compiled for

gross market penetration and persistence of behavior (including metrics on retesting by both SCE and 3rd party providers).

1.3 Program Participation Summary

The primary markets served by the program are municipal water service and agricultural irrigation. Pumping applications include well water extraction, reservoir and storage tank refill, and pressure boosting. A review of the program database reveals that a variety of other market segments are also served by the program. A review of the 2003 participation data suggests the following highlights:

- According to SIC codes, 55% of participants were water supply customers. The total of all agricultural SICs was approximately 32%. Less than one percent were identified as public golf courses.

- According to SCE customer use category, 37% of participants were fresh water pumping applications, while 24% were irrigation pumping.

- A wide range of pump motor sizes from as small as one horsepower to 800 horsepower have been tested by the program. The breakdown by size category is as follows:
    - 5% of motors tested were less than 10 horsepower
    - 40% of motors were 10 to 50 horsepower
    - 24% of motors were 51 to 100 horsepower
    - 19% of motors were 101 to 200 horsepower
    - 12 % of motors were over 200 horsepower

- By SCE service district, 31% of tests were conducted in the San Joaquin valley district, 9% in the Inland district, 6% in the Antelope Valley, San Jacinto Valley, and Ventura districts, and 5% in the Foothill and Palm Springs districts. The remainder of the tests (31%) were fairly well distributed across the other 20 districts served by the program.

- By far, the largest fraction of pump types tested were turbine boosters (31%) and turbine well pumps (46%).

2. RESEARCH METHODS AND APPROACHES

Key research issues for the program verification, savings parameter update analysis, process, and market assessment components of the evaluation are presented below. These research issues were developed from information provided in the RFP, discussions with CPUC master evaluation team, SCE staff, the program implementation plan, monthly/quarterly/final filings and program documentation, and a review of key recent research documents including the 1998 RLW Pump Test and Hydraulic Services Market Effects Study and the 2002 Equipoise Pump Test and Hydraulic Services EM&V Study.

2.1 Program Verification

The focus of this research task was to verify the program accomplishments that SCE is claiming in its Final Report for PY2003 and PY 2004-2005. The program verification activities involved conducting a detailed review of program documentation and the information contained in the program tracking

database, and comparing it to the final results filed by the program. The program documentation review helped to gain a full understanding of program design, previous evaluation findings, and current customer outreach and marketing activities.

2.2 Savings Parameter Update Analysis

The savings parameter update analysis entailed updating and revising factors related to the gross and net savings calculations. The savings calculation method employed by the program is referred to in the 2002 EM&V study as "method two" and is described below:

$$\text{Program Gross kWh Impact} = \left(\sum_{i=1}^{n} \text{kWh Expected Impact}_i \right) \text{ x Realization Rate}$$

Realization Rate = % of Expected Savings x Implementation Rate

Where:

$\sum$ kWh Expected Impact	= sum of expected kWh savings based on a pre-retrofit pump tests
% Expected Savings	= percent of forecast savings found in the field from post-retrofit tests
Implementation Rate	= rate at which the participant population implements a recommended efficiency improvement
n	= number of unique pump tests in a program year population
i	= counter variable, takes on values 1 to n.

The expected kWh savings for each site is determined from the results of the pump test. Performance variables tested on site include:

- Discharge pressure (psi)
- Discharge head (ft.)
- Suction lift (ft.)
- Capacity flowrate (GPM)
- Motor kW input (kW)

From these tested variables, the plant performance is computed using a laptop based software package that completes the performance calculations and prepares the customer report. Factors computed from test variables include:

- Total head (ft.)
- Motor horsepower (HP)
- Motor load (%)
- kWh energy use per acre-foot
- Overall Plant Efficiency, OPE (%)

The OPE is a key performance parameter for estimating customer energy savings and is computed as follows:

$$\text{OPE (\%)} = \frac{WaterHP}{InputHP} \times 100 = \frac{GPM \times TotalHead}{3960} \text{ x } \frac{1}{kW \times 1.342} \times 100$$

Where,

GPM = capacity flowrate in gallons per minute,

TotalHead = total dynamic head pressure of the system in feet

3960 = conversion factor

kW = motor input power in kW

1.342 = kW per HP

The expected kWh savings for each site is determined from the results of the pump test using the data collected during the test. From these tested variables, the Overall Plant Efficiency, OPE (%), is computed for existing condition using a laptop based software package that completes the performance calculations and prepares the customer report. Based upon the pump readings, an expected OPE is estimated that may be achieved through the installation of energy efficiency pump measures. The expected OPE ratio is dependent on the pump type.

The historical energy use of the pump plant is known from SCE metered data. The customer energy savings (kWh Expected Savings) is calculated by applying the ratio of the improvement from the existing OPE to the expected OPE to the energy use data for the pump plant (Eq. 1). After the energy efficiency measures are installed, a second pump test is conducted and the actual improved OPE is measured (Eq. 2). The % Expected Savings is calculated as the ratio between actual savings and the expected saving (Eq. 3).

$$\text{kWh Expected Savings} = \text{Total Annual kWh x } \left(1 - \frac{OPE_{existing}}{OPE_{expected}}\right) \quad \text{(Eq. 1)}$$

$$\text{kWh Actual Savings} = \text{Total Annual kWh x } \left(1 - \frac{OPE_{existing}}{OPE_{improved}}\right) \quad \text{(Eq. 2)}$$

$$\text{\% Expected Savings} = \frac{kWhActualSavings}{kWhExpectedSavings} = \frac{\left(1 - \frac{OPE_{existing}}{OPE_{improved}}\right)}{\left(1 - \frac{OPE_{existing}}{OPE_{expected}}\right)}$$

Where:

$OPE_{existing}$ = the pre-retrofit OPE of the pump as measured by a pump test.

$OPE_{expected}$ = the expected OPE of the pump if energy efficiency measures are installed. This OPE is based upon the data collected during the pre-retrofit pump test.

$OPE_{improved}$ = the actual improvement to the pump OPE as measured during a post-retrofit pump test.

Note: improved OPE was obtained through the post-retrofit pump tests performed as part of this study or from post-retrofit pump tests performed through the program.

Overall program savings are estimated using the aggregate values for expected savings over all participating pumps adjusted by the Implementation Rate and % Expected Savings. Currently, the program uses values that are also documented in the 2002 EM&V study and are based on a previous 1996 study of the SDG&E agricultural program. [5] The values used are:

- Implementation rate = 33%
- % Expected Savings = 87%
- Realization Rate = Implementation Rate x % Expected Savings = 33% x 87% = 28.7%

For the purposes of this evaluation, the project team examined the % Expected Savings value and updated this value based on the pre-/post-retrofit pump test data. Based on the survey data, it is also recommended to update the Implementation Rate.

Net savings calculations are computed as follows:

Program Net kWh Impact = Program Gross kWh Impact x NTGR

The estimated NTG Ratio (NTGR) in the 2002 EM&V study (73%) accounted for only the free ridership component. This study adjusted the value to account for spillover effects that can be expected to exist for this type of information program. The NTGR is then be defined as:

NTGR = (Net Factor) x (Market Effects Factor)

Where:

Net Factor = [1 – (free ridership)]

Market Effects Factor = [1 + inside participant spillover + outside participant spillover + non-participant spillover]

2.3 Process Evaluation and Market Assessment

The primary objective of the Process Evaluation was to provide ongoing feedback to program staff on the elements of the Pump Test program that can be improved to enhance the program's effectiveness and performance. This objective was achieved by performing in-depth interviews with program managers and staff, and by asking a series of process related questions in telephone surveys of program participating and nonparticipating end use customers in the SCE territory.

[5] Johnson, D. Memorandum regarding kilowatt hour savings reporting procedure. 2/2/1996.

2.4 Data Collection Activities

There were five distinct samples drawn for this study. Sample size calculations were based on the proportional approach, which implicitly assumes that the variable in question is a proportion. The sample design was developed to achieve a 90% confidence level ± 10%. The various types of data collected in this evaluation were as follows:

- **SCE program management and field staff interviews**. The project team interviewed key program management staff and 11 SCE pump test technicians to gather insights into program operations and to identify opportunities for improving various aspects of the program.

- **Participant pump test records**. The project team requested a sample for both program years 2003 and 2004-05 of completed pump tests for the purposes of verifying completed tests for the program year. Sixty-eight records were examined for the participants in calendar years 2003 and 2004; and additional 68 records were examined for participants in calendar year 2005.

- **Pre/post measure implementation pump test data for calculation of savings realization rate**. The project team drew a random sample of program participants for the participant survey and queried the respondents on whether or not they had implemented the recommended pump system efficiency improvements subsequent to the pump test. Those who had implemented measures were offered a follow-up test. The results of this follow-up test were used in the savings realization rate analysis. The final sample was a stratified random sample with the key stratification variable being pump type. A total of 27, from a target of 68, post-retrofit tests were conducted and analyzed. The field data was supplemented with pump records that showed a marked improvement in OPE in consecutive tests and were picked randomly. Table 2-1 presents the targeted and actual sample sizes for the pre/post implementation pump test data analysis.

- **Program participant telephone surveys**. Two samples of program participants, 2003 and 2004 calendar year participants and 2005 calendar year participants, were drawn for the purposes of a telephone survey to examine program process and satisfaction, net-to-gross ratio elements, program theory elements, and market perception issues. This sample was a random stratified sample with the key stratification variable being market segment (i.e., municipal water service, agricultural irrigation). Table 2-2 presents the targeted and actual completed participant surveys.

- **Non-participant telephone surveys**. A sample of non-participants were surveyed to assess program awareness and perceptions, net-to-gross elements, program theory elements, market penetration, and market perception topics. This evaluation follows the standards set forth in previous evaluations and defines non-participants for the PTHS program as customers that have not participated in the program in the past 3 years. This sample was a random stratified sample with the key stratification variable being market segment (i.e., municipal water service, agricultural irrigation). Table 2-3 presents the targeted and completed non-participant surveys.

Table 2-1: Pre/Post-Retrofit Sample: 2003-2004 Participants by Pump Type

Pump Type	2003-2004 Program Pump Count	2003-2004 Program Percentage	Targeted Post-retrofit tests	Actual Post-retrofit tests	Database Pre/Post
Turbine Well	1,686	46%	31	11	97
Turbine Booster	1,154	31%	21	8	71
Submersible Well	401	11%	7	5	44
Centrifugal Booster	356	10%	7	2	18
Submersible Booster	87	2%	2	1	9
Total	3,684	100%	68	27	239

Table 2-2: Program Participant Survey Samples by Market Segment

Market Segment	2003-2004 Program Pump Count	2003-2004 Program Percentage	Targeted Completes by Group	2003-2004 Completes	2005 Completes
Agricultural	1,469	42%	29	29	29
Water Supply	2,215	58%	39	39	39
Total	3,684	100%	68	68	68

Table 2-3: Non-participant Survey Sample by Market Segment

Market Segment	Percentage	Targeted Completes	Actual Completes
Agricultural	60%	41	41
Water Supply	40%	27	27
Total	100%	68	68

3. EXPECTED SAVINGS REALIZATION RATE ANALYSIS

As discussed in the methodology section, one of the primary elements of the gross kWh savings calculation is the % Expected Savings. The analysis for updating the value for this variable relied on a sample of post-retrofit field tests on customers who indicated in the participant survey that they had implemented efficiency improvements following a pump test. The field data were organized in an analytic model that accounted for pre/post pump operating factors and efficiencies and disaggregated by pump type.

This analysis was conducted in two phases. The first phase used the data from the post-retrofit pump tests conduct on the sample who had installed energy efficiency measures identified by the participant surveys combined with the pre-retrofit tests to compute the savings realization rate (% Expected Savings). The results from this first phase were very close to the value that SCE has been using for program tracking. However, the confidence interval was quite large. It was decided to conduct a second phase of the analysis and to supplement the post-retrofit pump tests conducted by this study with additional observations from the pump test tracking database. Customers that have most likely implemented retrofits

were identified by searching the database for customers with discernable differences in pump plant performance values such as Overall Plant Efficiency (OPE) indicating that the customer may have implemented improvements.

These additional observations did not introduce an unacceptable level of bias into the realization rate calculation, since the % expected savings was updated via a random sample in the first phase of the analysis and the supplemental observations were used primarily to improve on the confidence of the estimate of % expected kWh savings.

3.1 Data Collection

As part of the overall evaluation effort of the Pump Test program, surveys were conducted of customers participating in the program during calendar years 2003, 2004, and 2005. During the surveys of 2003 and 2004 calendar year program participants, respondents were asked if they had made any energy improvements to their pumps as a result of participating in the Pump Test program. If the participant had made changes to their pumps they were recruited to receive a post-retrofit pump test verification of their pump savings. Recruited customers were passed to SCE Pump Test staff to schedule the post-retrofit pump test.

This recruitment process was complicated by several issues encountered during the participant surveys. Part way through conducting the participant surveys it was noted that the pump test records, from which the random sample was pulled, did not contain a customer identification number. As a result the pump test records were not grouped by customer but listed by pump reference number. From this data it was not apparent that a customer may have many pumps tested during this time period. When participants were asked if they had made any improvements to their pumps resulting from the pump test, the researcher was referencing the one pump listed on his record for the participant and the participant could have been referring to multiple pumps when responding. As a result of this confusion, the specific pump reference numbers passed to the Pump Test staff may not have been the pump to which the customer made improvements. This problem was quickly remedied in the field. If the referenced pump was not retrofitted, then the Pump Tester was instructed to ask for a pump which was recently tested that had had improvements made. Also, customer identification numbers were provided so that the researcher could sort by customer and, with the customer on the phone, determine exactly the pump to which the customer made improvements.

The second issue that possibly complicated the post-retrofit test recruitment was a result of multiple contacts at the customer site. When conducting the post-retrofit test recruiting, the researcher discussed pump improvements with the contact listed in the program database. On several occasions when pump testers arrived at the site to conduct the post-retrofit tests, they were told that no improvements had been made to the pump referenced. This may have been a result of the researcher talking with one contact at the customer site and the pump-tester talking to a different contact, with each contact having different knowledge of any pumping improvements.

A third issue was that pump tests during the 2003 and 2004 calendar years may have actually been post-installation tests to verify savings from improvements made as a result of earlier pump tests. Where this was the case, the pump tester did not re-test the pump, but provided results of the pump tests prior to and after the pumping improvements were completed.

As a result of these complicating factors, we were only able to test 54 out of the 68 pumps, using the pump reference number, identified for the post-retrofit tests during this first phase of the analysis. As a result of missing data (missing OPE or other data) and the parsing out of the outliers (negative savings) only 27 pumps were used in the first phase of the analysis. The resulting accuracy for the sample is

discussed below. Table 3-1 presents the distribution of pumping improvements made by Pump Test participants recruited for the post-retrofit test study.

Table 3-1: Pumping Improvements

Pumping Improvement	Total
Replace pump bowl and impeller	73%
Rebuild motor	10%
Adjust pump bowl and impeller	6%
Downsize motor	6%
Install high-efficiency motor	4%
Replace shaft and bearings	2%
Total	**100%**

3.2 Realization Rate Analysis

The post-retrofit consisted of standard pump tests to determine how the customer improvements to the pumping system impacted the OPE and were conducted by the SCE pump testers. After the post-retrofit tests were completed the completed post-retrofit test report, the pre-retrofit test report and the Cost Analysis Letter from the pre-retrofit test were forwarded to the evaluation team for analysis. Table 3-2 summarizes the data that was used in this analysis from each of the data sources.

Table 3-2: Summary of Data Sources

Data Collected	Pre-retrofit Test	Cost Analysis Letter	Post-retrofit Test
Company	✓		✓
Test Ref. #	✓		✓
Pump Type	✓		✓
Pump Motor HP	✓		✓
Test Date	✓		✓
Total Head	✓		✓
Capacity(GPM)	✓		✓
kW Input	✓		✓
kWh/Acre Ft	✓		✓
OPE	✓		✓
Expected OPE		✓	

The pump testers test the pumping system while the pump is running under normal operating conditions. The pump testers will usually take one reading for each of the variables listed in Table 3-2. Some of the pump testers will conduct multiple tests on the same pump, but generally most pump testers only perform one pump test.

Since most pre-retrofit tests and post-retrofit pump tests only include one set of readings on the performance of the pump, it was not possible to conduct a rigorous regression analysis of the change in pump performance. In order to conduct a regression analysis to control for factors other than the retrofit that may impact the pump performance, multiple tests would have to have been collected for both the pre- and post-retrofit pumps.

Typically the pre- and post-retrofit test for a given pump system are conducted under different operating conditions. Most improvements to the pumping system, e.g. replacing the bowl and impeller, change where the pump operates on the pumping curve, i.e., the pump performance. Initially we felt that we would need to normalize the data to a common head pressure so that the two tests could be compared. However, after using the pumping Affinity Laws to normalize the post-retrofit test results to the pre-retrofit test head pressure, it was determined that normalizing the head pressure didn't impact the pump system OPE. Normalization to head pressure effectively just moved all the readings on the pump curves, but the OPE ratio remained the same. The following calculations show that for a given pump system the OPE at one point on the pump curve (OPE_1) will be equal to the OPE at another point on the pump curve (OPE_2). Also normalization works best for analyses with variables with multiple relationships. For the pumping systems the variables in question are all related according to the Affinity Laws.

Pump Data Collected

$$\text{Water HP} = \frac{GPM \times TotalHead}{3960}$$

Input HP = kW x 1.341

$$\text{OPE} = \frac{WaterHP}{InputHP} \times 100 = \frac{GPM \times TotalHead}{3960} \text{ x } \frac{1}{kW \times 1.342} \times 100$$

$$\text{or, OPE} = \frac{GPM \times TotalHead}{kW} \times const$$

$$\text{or, OPE} = \frac{Q \times H}{kW} \times const \text{ , where Q = Capacity GPM and H = Total Head}$$

Affinity Laws

$$\frac{kW_1}{kW_2} = \left[\frac{N_1}{N_2}\right]^3 = \left[\frac{Q_1}{Q_2}\right]^3 \text{ , where N = Speed (RPM) and Q = Capacity (GPM)}$$

$$\frac{H_1}{H_2} = \left[\frac{N_1}{N_2}\right]^2 = \left[\frac{Q_1}{Q_2}\right]^2 \text{ , where N = Speed (RPM) and Q = Capacity (GPM)}$$

$$kW_1 = kW_2\left[\frac{Q_1}{Q_2}\right]^3 \text{ and } H_1 = H_2\left[\frac{Q_1}{Q_2}\right]^2$$

$$OPE_1 = \frac{Q_1 H_1}{kW_1} \times const$$

Substituting,

$$OPE_1 = \frac{Q_1 H_2 \left[\frac{Q_1}{Q_2}\right]^2}{kW_2 \left[\frac{Q_1}{Q_2}\right]^3} \times const = \frac{Q_1 H_2}{kW_2 \left[\frac{Q_1}{Q_2}\right]} \times const = \frac{Q_1 H_2 Q_2}{kW_2 Q_1} \times const = \frac{Q_2 H_2}{kW_2} \times const = OPE_2$$

$OPE_1 = OPE_2$

Since normalization did not change the post-retrofit test OPE, the data from the pre-retrofit test, Cost Analysis Letter, and the post-retrofit test were used unadjusted to calculate the percent expected savings. The following equation describes the calculation of the expected savings.

$$\text{\% Expected Savings} = \frac{kWhActualSavings}{kWhExpectedSavings} = \frac{\left(1 - \frac{OPE_{existing}}{OPE_{improved}}\right)}{\left(1 - \frac{OPE_{existing}}{OPE_{expected}}\right)}$$

Note: improved OPE was obtained through the post-retrofit pump tests performed as part of this study or from post-retrofit pump tests performed through the program.

Where,

$OPE_{existing}$ = the pre-retrofit OPE of the pump as measured by a pump test.

$OPE_{expected}$ = the expected improvement to the pump OPE based upon the data collected during the pre-retrofit pump test.

$OPE_{improved}$ = the actual improvement to the pump OPE as measured during a post-retrofit pump test.

Findings

Despite the complications experienced during the recruitment phase of the project, test data on 54 pumps were collected; however, only 35 of these pumps had data available on the $OPE_{existing}$, $OPE_{expected}$, and $OPE_{improved}$.

The % Expected Savings was calculated for each of the 35 records. Of these pumps eight had % Expected Savings that were less than zero and were dropped from the analysis. Due to the confusion in the recruitment process these eight pumps were most likely not retrofitted and so their elimination from the analysis will not bias the expected savings results for retrofitted pumps.

In addition to the post-retrofit pump test data, in the second phase of the analysis, 239 participant records with pump tests occurring in 2004 and 2005 were identified as most likely having implemented some

energy efficiency measures. These participants were identified by comparing the OPE readings for two consecutive tests. If there was a significant improvement in the OPE reading then the record was chosen for this analysis. The % Expected Savings was calculated following the same procedures as for the post-retrofit test sample. Table 3-3 summarizes the results of this analysis and the accuracy at a 90% confidence interval.

Table 3-3: % Expected Savings by Pump Type

Pump Type	Count	% Type	Average % Expected Savings	Standard Deviation	± Confidence Interval[a]	Accuracy @ 90% Confidence Interval[b]
TW	108	41%	101%	46%	7%	7%
TB	79	30%	88%	43%	8%	9%
SW	49	19%	77%	57%	13%	17%
CB	20	7%	84%	108%	41%	49%
SB	10	4%	82%	110%	60%	74%
Overall	266	100%	89%	69%	7%	8%

[a] Limits of the 90% Confidence Interval, i.e. 90% Confidence Interval = Mean ± Limit
[b] Error term for the 90% Confidence Interval, Limit/Mean

Based on these post-installation tests, the overall % Expected Savings is 89% with an accuracy of ±8% at a 90% Confidence Interval. This result is very close to the 87% expected savings currently assumed by the program.

Although not specifically in our scope of work, based on the results of the participant survey it appears that the current 33% Implementation Rate may be low. Of those participants surveyed 72% said that they had implemented energy savings measure(s). Participants who responded that they implemented measures were not asked what percentage of the pumps tested received improvements. As a result the 72% represents a customer-level implementation rate and not the pump-level implementation rate. The review of the database shows that on average each participant had 6.88 pumps tested. If those respondents that indicated that they had implemented energy savings measure(s) did 100% of the pumps that they had tested, this yields an Implementation Rate of 72%. However if these respondents only implemented an energy savings measure on one pump the overall Implementation Rate may be as low as 10%, 1 out of 6.88 pumps times 72% customer implementation rate. The implementation rate by participant needs to be determined to actually determine the Implementation Rate. Ideally the implementation rate could be determined through on-site audits of a sample of participants. These audits would examine all the pumps that the customer had tested in the program to determine how many of these pumps were actually retrofitted. This activity was beyond the scope of this project. Further research on the Implementation Rate is recommended.

Based on these revised findings, the overall realization rate could then be revised as follows:

Realization Rate = Implementation Rate x % Expected Savings = 33% x 89% = 29.4%

3.3 Program Attribution Analysis

The estimated NTG Ratio (NTGR) in the 2002 EM&V study (73%) accounted for only the free ridership component. This evaluation will adjust the value to account for spillover effects that can be expected to exist for this type of information program. The NTGR will then be defined as:

NTGR = (Net Factor) x (Market Effects Factor)

Where:

Net Factor = [1 – free ridership]

Market Effects Factor = [1 + inside spillover + outside participant spillover + non-participant spillover]

Free Ridership

A series of "direct" free ridership questions were included in the participant surveys to elicit explicit estimates of free ridership. The responses are ultimately assessed and adjusted based on the responses to a set of "influencing" questions to produce an adjusted free ridership estimate. This analysis was conducted using the 2003, 2004, and 2005 participant surveys.

The free ridership analysis was performed for each of the survey participant respondents that indicated that they had made improvements to their pumping systems. For each measure that the respondent indicated that they had performed, a free ridership value was calculated using the following method.

For each measure the participant respondents were asked to rate on a scale of 1 to 5 the influence of the PTHS program and the likelihood that they would have installed each of the measures if the program did not exist. A rating of 5 indicates that the PTHS was very influential or that the respondent would very likely have installed the measure without the program. A rating of 1 indicates that the PTHS was not influential or that the respondent would not have installed the measure without the program. Table 3-4 presents how these values were converted into influence and probability factors, respectively. Table 3-5 presents the average free rider factor for each of measures installed. This table is for reference only, since the free rider calculations were done for each respondent. For each respondent the average free ridership across all measures was computed.

Table 3-4: Influence and Probability Factors

Question	1	2	3	4	5
Influence of PTHS Program (I_m)	0%	25%	50%	75%	100%
Probability of installation (P_m)	0%	25%	50%	75%	100%

The free ridership for each measure was then calculated using the following formula:

$Free\ ridership_{r,m} = (1- I_m) * P_m$

where,

$Free\ ridership_{r,m}$ = free ridership (FRF) for measure, *m*, for respondent, *r*

I_m = Influence of the PTHS Program for measure, *m*

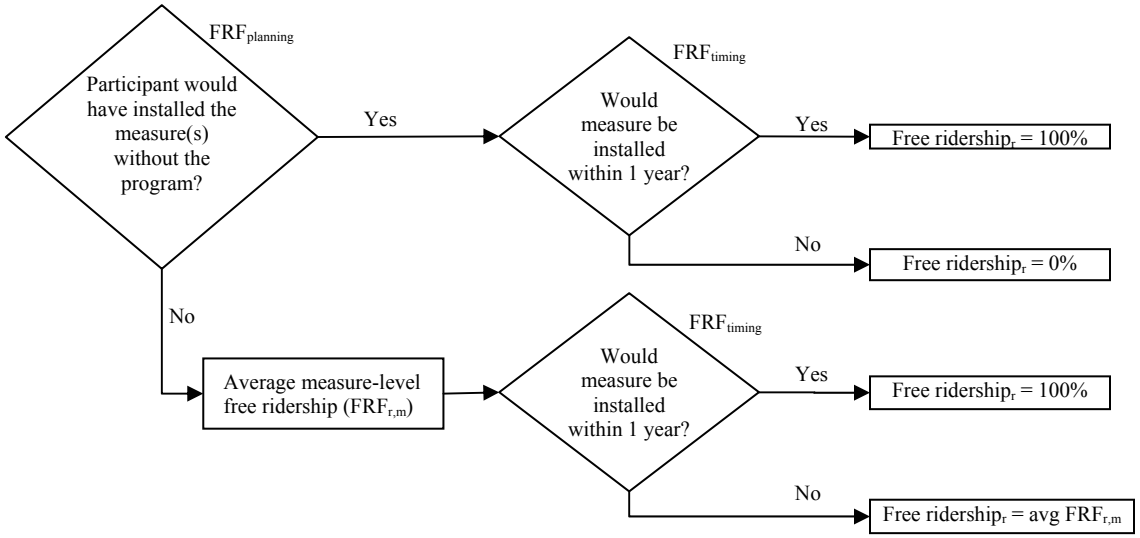
P_m = Probability that the measure, *m,* would have been installed if the PTHS Program didn't exist

The free ridership for all measures installed by the respondent were then totaled to calculate an average free ridership by respondent, FRF_r. As a reference, Table 3-5 presents the average free ridership across measures. The average free ridership by respondent, FRF_r, is not presented in this report.

Table 3-5: Average Free Rider Factors (FRF_m)

Measure	2003-2004 FRF_m	2005 FRF_m
Replace pump bowl and impeller	6%	7%
Adjust bowl and impeller on deep well pump	5%	8%
Trim existing impeller on booster pump	4%	9%
Install high-efficiency motor	24%	13%
Install variable-speed drive on pump motor	32%	12%
Replace well column with coated or treated pipe to reduce friction losses	12%	20%
Change distribution system discharge lines to reduce pressure or friction	28%	12%
Other 1	19%	n/a
Other 2	6%	n/a

Free ridership for each respondent (FRF_r) was adjusted using the answers to two general free ridership questions: "were you already planning to make any operating efficiency improvements in your pumping system?" and "when were you planning to make the improvements?" If the participant responded that they were already planning on doing the improvements ($FRF_{planning}$) a value of 100% was used instead of the FRF_r ; however, if the respondent was unsure if they would have done the measures anyway, FRF_r was used. For those participants that responded that they would have done the project within 1 year, the FRF_r was multiplied by 100%, otherwise it was multiplied by 0% to account for the timing of the free ridership. The following diagram shows how this calculation was performed.



The final free rider factor for each respondent was calculated as using the following formula:

Free ridership$_r$ = (FRF$_{planning}$ or FRF$_r$) * FRF$_{timing}$

where,

Free ridership$_r$ = free ridership for respondent, *r*

FRF$_{planning}$ = Planning free rider factor

FRF$_r$ = Average free rider factor by respondent for all installed measures

FRF$_{timing}$ = Timing free rider factor

After the free ridership was calculated for each respondent, the free ridership across the participant respondents was averaged to come up with the average free ridership for the program. The average free ridership for the 2003, 2004, and 2005 respondents was calculated to be 22%.

It should not be surprising to identify free ridership among program participants. Although the program, like most energy efficiency programs, has some checks in place to prevent large-scale free ridership, it is essentially impossible to identify up front and prevent those facilities that might have installed high-efficiency measures even in the absence of the program from participating in the program. This is especially true of a program such as the Pump Test and Hydraulic Services program that provides the pumping test free of charge.

Spillover

About 4% of all 2003-2004 and 2005 participant respondents report some inside spillover, improvements to pumps that were not tested under the program. On average the 2003-2004 participants estimated that there was a 67% probability that they would have installed the measures without the program and that the program influenced 63% of them to make the energy efficiency improvements. However, on average the 2005 participants estimated that there was a 33% probability that they would have installed the measures without the program and that the program influenced 80% of them to make the energy efficiency improvements. This data indicates that the program had a higher impact on the 2005 program participants to make changes to pumps not tested under the program, i.e., inside spillover. Adjusting for this influence, the probability that these participants would have made the improvements to the pumps that weren't part of the program if the program didn't exist was about 42% for 2003-2004 participants and 26% for 2005 participants, or an average of 34%. Since only 4% of all the respondents reported this inside program spillover, the inside spillover rate for the entire sample is approximately 1.4%.

Outside participant spillover is defined as the participant making other energy efficiency improvements to equipment not covered under the program. For example, if a participant in the Pump Test program learned about energy efficiency improvements through the program and applied this experience to performing a lighting retrofit, it would be considered outside participant spillover. All participants in the sample were asked if they made any improvements other than those to the pumping system as a result of the program. None of the participants indicated that they had made any other improvements as a result of the program.

Non-participant spillover results from non-participants making the improvements based upon their knowledge of the program. Responses to the non-participant survey indicate that 38% of the non-participants have made improvements to their systems bases upon their knowledge of the program. Of those non-participant respondents that made improvements to their pumping systems, on average the

improvements impacted about 40% of their pumps. Therefore the non-participant spillover is estimated to be about 15%.

The spillover or market effects factor is then estimated to be:

Market Effects Factor = [1 + inside spillover + outside participant spillover + non-participant spillover[6]]

= [1 + 1.4% + 0% + 14%] = 115%

Overall NTGR

Based on the survey responses the Net to Gross Ratio (NTGR) is calculated as follows:

NTGR = (Net Factor) x (Market Effects Factor)

Where:

Net Factor = [1 – (free ridership)]

= [1- 22%] = 78%

Market Effects Factor = 115%

NTGR = (78%) x (115%) = 90%

4. PROCESS AND MARKET ASSESSMENT ANALYSIS

The process evaluation was conducted in two phases. The first phase of the process evaluation consisted of surveying a sample of the 2003 and 2004 program participants, a sample of non-participants, and program staff. The second phase of the process evaluation consisted of surveying a sample of the 2005 program participants in early 2006.

4.1 Participant Surveys

The 2003-2004 participant telephone surveys were conducted during March and April 2005 and the 2005 participant telephone surveys were conducted in February 2006. The main objectives for these surveys were to assess program awareness and perceptions, net-to-gross elements, program theory elements, market penetration, and market perception topics. The 2003-2004 participant surveys were also used to identify program participants that had made improvements to their pumping systems as a result of the SCE pump test. Participants that had made improvements were recruited to have a post-improvement pump test performed by SCE. The project team surveyed 2 sets of 68 program participants selected at random, 2003-2004 participants and 2005 participants, stratified by customer type (agricultural or water supply) from data extracted from the program tracking database.

Of the 2003-2004 participants surveyed, 44 out of 68 (65%) participants and 54 out of 68 (79%) of the 2005 participants surveyed made improvements to their pumping system as a result of the SCE pump test. Table 4-1 and Table 4-2 present a breakout of the improvements that were made, how influential the SCE

[6] Non-participant spillover savings have been recently disallowed in the California energy efficiency programs.

pump test was to making these improvements, and the likelihood that the customer would have made these improvements without the Pump Test program. The Pump Test program strongly influenced participants to replace the pump bowl and impeller and to adjust the bowl and impeller on deep well pumps. These results indicate that the Implementation Rate used in the realization rate computation could be as high as 72%; however, further research will be necessary to determine the percentage of pumps receiving energy efficiency improvements.

Table 4-1: Pump System Improvements as a Result of the PTHS Program – 2003-2004 Participants

Measure	%[a]	Influence of Program[b]	Likelihood of making same changes without Program[b]
Replace pump bowl and impeller	93%	4.4	2.1
Install high-efficiency motor	50%	3.8	2.8
Adjust bowl and impeller on deep well pump	45%	4.5	1.6
Other: Prioritizing pumps based on highest efficiency	41%	3.9	2.6
Change distribution system discharge lines to reduce pressure or friction	34%	3.4	2.8
Install variable-speed drive on pump motor	32%	3.4	3.0
Replace well column with coated or treated pipe to reduce friction losses	23%	3.3	2.1
Trim existing impeller on booster pump	16%	4.6	2.1
Other: Changed Rate Plan	9%	4.1	2.3

[a] % of those participants that reported that they made improvements.
[b] Scale of 1-5 where 1 is the least likely and 5 is the most likely

Table 4-2: Pump System Improvements as a Result of the PTHS Program – 2005 Participants

Measure	%[a]	Influence of Program[b]	Likelihood of making same changes without Program[b]
Replace pump bowl and impeller	83%	4.5	1.7
Install high-efficiency motor	54%	4.2	1.9
Adjust bowl and impeller on deep well pump	44%	4.4	1.8
Other: Prioritizing pumps based on highest efficiency	24%	4.2	1.8
Change distribution system discharge lines to reduce pressure or friction	20%	4.8	1.6
Install variable-speed drive on pump motor	20%	4.2	2.1
Replace well column with coated or treated pipe to reduce friction losses	15%	3.7	1.8
Trim existing impeller on booster pump	15%	5.0	1.3
Other: Changed Rate Plan	11%	3.8	2.1

[a] % of those participants that reported that they made improvements.
[b] Scale of 1-5 where 1 is the least likely and 5 is the most likely

Figure 4-1 and Figure 4-2 show that the main reason for making these improvements was to reduce energy costs and as part of a regularly scheduled maintenance.

Figure 4-1: Main Reason for Improvements – 2003-2004

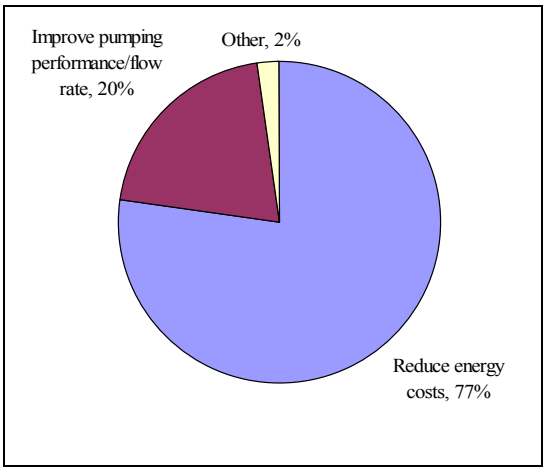
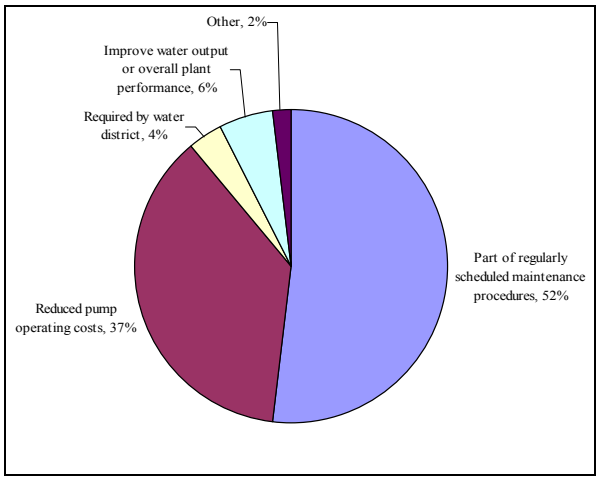


Figure 4-2: Main Reason for Improvements – 2005



Overall, of those participants that made improvements to their pumping systems, 34% of the 2003-2004 participants and 39% of the 2005 participants were planning on making the same changes before they received the pump test. On average they reported that they would have made these changes in the next 2.15 years and 3.10 years, respectively. These participants also felt the pumps should be tested every 1.6 years and 1.5 years, respectively. Participants were not surveyed regarding the timing of the improvements at the measure level.

Returning now to the entire sample of participants, Table 4-3 and Table 4-4 present the breakout of pump types for this sample, the percent of these pumps that are tested on a regular basis, and what percentage of these regular tests are conducted by SCE. The average system HP per participant for the 2003-2004 participants surveyed was 4,751 HP and 1,563 HP for the 2005 participants surveyed.

Table 4-3: Distribution of Pumps – 2003-2004 Participants

Pump Type	Quantity	% Tested regularly	% Tested by SCE
Turbine Booster	1,323	87%	95%
Centrifugal Booster	741	92%	93%
Turbine Well	890	93%	95%
Submersible Well	258	87%	96%
Submersible Booster	86	92%	85%

Table 4-4: Distribution of Pumps – 2005 Participants

Pump Type	Quantity	% Tested regularly	% Tested by SCE
Turbine Well	621	92%	92%
Turbine Booster	533	82%	83%
Centrifugal Booster	350	81%	75%
Submersible Well	243	90%	85%
Submersible Booster	74	94%	97%

Only 4% the participant respondents in both samples indicated that they had made improvements to pumps that had not been tested. Table 4-5 and Table 4-6 present the improvements that were made to pumps that were not tested.

Table 4-5: Improvements Made to Pumps Not Tested – 2003-2004 Participants

Improvement	% of Participant Respondents	% of Overall Pumps	Influence of Program[a]	Would have done without Program[a]
Replace pump bowl and impeller	2.7%	53%	3.5	3.0
Install high-efficiency motor	2.7%	13%	3.5	3.0
Install variable-speed drive on pump motor	2.7%	10%	2.5	4.0
[a] Scale of 1-5 where 1 is the least likely and 5 is the most likely				

Table 4-6: Improvements Made to Pumps Not Tested – 2005 Participants

Improvement	% of Participant Respondents	% of Overall Pumps	Influence of Program[a]	Would have done without Program[a]
Replace pump bowl and impeller	1.3%	-	1.0	5.0
Install high-efficiency motor	1.3%	5%	3.0	2.0
Install variable-speed drive on pump motor	0%	0%	0.0	0.0
[a] Scale of 1-5 where 1 is the least likely and 5 is the most likely				

43% of the 2003-2004 participant respondents recommended the pump test program to others with an estimated 400 people told about the program by participating customers. Of these people that were told about the program, it was estimated that 62% of those customers made improvements to their pumps based on the recommendations of program participants.

51% of the 2005 participant respondents recommended the pump test program to others with an estimated 198 people told about the program by participating customers. Of these people that were told about the program, it was estimated that 47% of those customers made improvements to their pumps based on the recommendations of program participants.

Many of the respondents have been participating in the program for such a long time that it was difficult to determine how they first heard about the program. 96% of 2003-2004 participant respondents and 88% of the 2005 participant respondents were aware of the program prior to 2003. Figure 4-3 shows that most (62%) of the 2003-2004 participant respondents don't remember where they first heard about the program. Figure 4-4 shows that 38% of the 2005 participant respondents heard about the program through word of mouth.

Figure 4-3: How 2003-2004 Participants learned about the Program

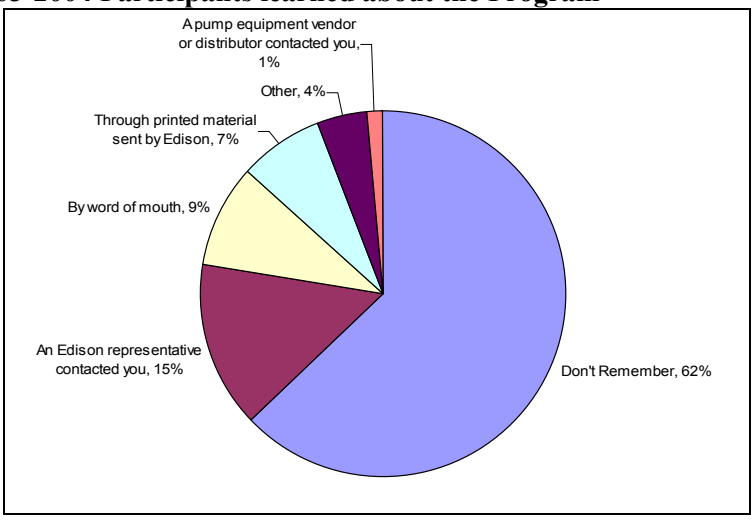
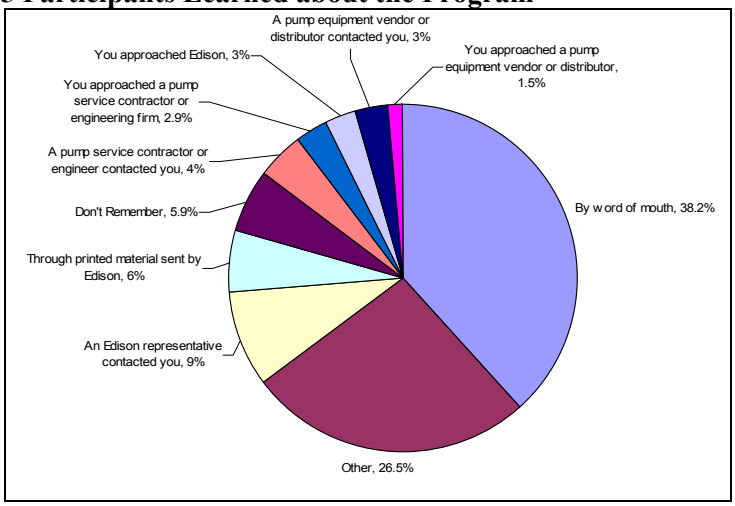


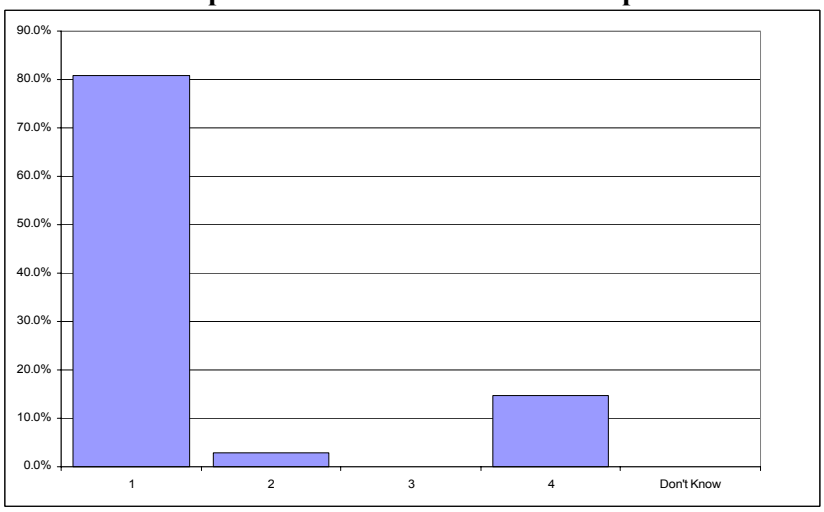
Figure 4-4: How 2005 Participants Learned about the Program



We are unable to tell from the subset of program records used for this evaluation whether these were new participants or past participants. The participant respondents were not asked whether or not they were new participants.

As presented in Figure 4-5, most (80%) participants in these surveys only contacted SCE once before receiving their pump test. This suggests that most requests are responded to after the first call.

Figure 4-5: Number of Times Respondent Contacted SCE for Pump Test



Participants' overall perceptions are that the program is very easy to participate in and very useful. Table 4-7 and Table 4-8 present the responses to a series of questions regarding participation in the program. On average participants strongly agree that it was easy to request a pump test, there wasn't a long wait for results, the results were easy to understand, believable, and useful, and the test provided actionable information for making improvements. As shown, overall satisfaction with the program is very high.

Table 4-7: 2003-2004 Participant Perceptions about the Program

Indicator	Participant Respondents that Agree 1= strongly disagree 5 = strongly agree			
	Avg.	% Low (1-2)	% Med. (3)	% High (4-5)
It was easy to request a pump test.	4.9	0%	0%	100%
There wasn't a long wait between my request and when the pump test was performed.	4.6	0%	0%	100%
There wasn't a long wait to receive the results of the pump test.	4.9	0%	0%	100%
The pump test results were useful.	4.9	0%	0%	100%
The pump test results were easy to understand.	4.9	0%	0%	100%
The pump test results were believable.	4.9	0%	0%	100%
I am now much more knowledgeable about needed improvements for my pumping operations.	4.8	0%	0%	100%
The pump test report provided the relevant and actionable information about improvements on my pumping system.	4.9	0%	0%	100%
Overall Satisfaction with the Program	**4.9**	**0%**	**0%**	**100%**

Table 4-8: 2005 Participant Perceptions about the Program

Indicator	Participant Respondents that Agree 1= strongly disagree 5 = strongly agree			
	Avg.	% Low (1-2)	% Med. (3)	% High (4-5)
It was easy to request a pump test.	4.8	4%	1%	94%
There wasn't a long wait between my request and when the pump test was performed.	4.4	1%	12%	87%
There wasn't a long wait to receive the results of the pump test.	4.8	0%	6%	94%
The pump test results were useful.	5.0	0%	0%	100%
The pump test results were easy to understand.	4.9	0%	1%	99%
The pump test results were believable.	5.0	0%	1%	99%
I am now much more knowledgeable about needed improvements for my pumping operations.	4.8	1%	0%	99%
The pump test report provided the relevant and actionable information about improvements on my pumping system.	4.9	0%	0%	100%
Overall Satisfaction with the Program	**4.9**	**0%**	**0%**	**100%**

Table 4-9 presents the reasons the customers chose to participate in the program. Most of the participant respondents said they participated in the program to reduce the time spent and the effort involved in collecting pump data.

Table 4-9: Areas where Pump Test Program helped Participants

Reason	% of 2003-2004 Participant Respondents	% of 2005 Participant Respondents
Reduce the time or cost of collecting information you would otherwise need to get on your own?	97%	84%
Reduce your doubt and uncertainty about your pumping system efficiency?	94%	84%
Work more effectively with dealers and suppliers?	53%	74%
Reduce the hassle of performing the test yourself?	97%	87%
Increase the availability of products and services of benefit to you?	34%	37%

The participants felt that the SCE cost analysis was very influential in determining when to spend money on pump repairs, an average of 4.1 for the 2003-2004 participants and an average of 4.5 for the 2005 participants on a 5 point scale. The program participants are very confident in the data provided by Edison, an average of 4.7 for the 2003-2004 participants and an average of 4.9 for the 2005 participants on a 5 point scale.

46% of those 2003-2004 participants surveyed and 35% of the 2005 participants surveyed had used non-SCE pump testers. The percentage of their pumps that were tested by non-SCE pump testers was not determined. However, these participants were only semi-confident, an average of 3 and an average of 1.7 on a 5 point scale, respectively, in the data provided by the non-SCE pump testers. This confidence level may be a result of many factors, including: the non-SCE pump testers not promoting their quality control methods, customer's lack of awareness, or past experience with the non-SCE pump testers.

Figure 4-6 and Figure 4-7 and show the distribution of participants by use of pumping.

Figure 4-6: Type of 2003-2004 Participant Respondents

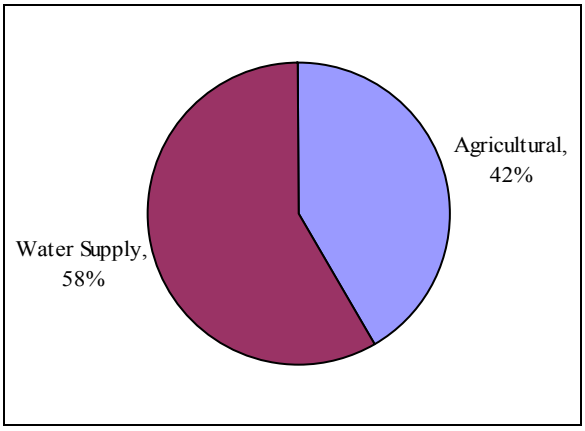
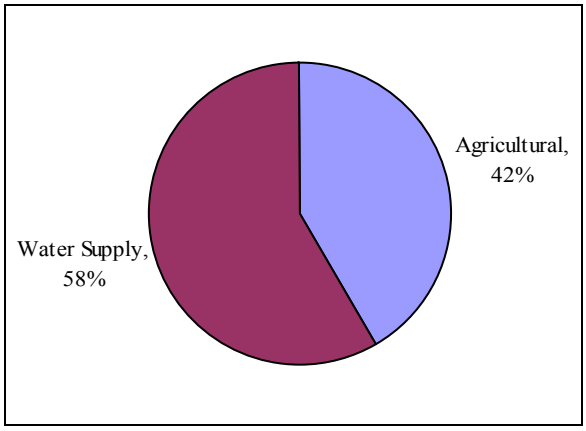


Figure 4-7: Type of 2005 Participant Respondents



4.2 Non-Participant Surveys

This evaluation follows the standards set forth in previous evaluations and defines non-participants for the PTHS program as customers that have not participated in the program in the past 3 years. The sample for these telephone surveys was thus selected from the PTHS participants that had not recently participated in the program.

Overall non-participants were somewhat aware of the PTHS program (an average of 2.7 on a 5 point scale). However, 38% of the non-participants were very or strongly aware of the program. Those that had heard of the program were asked where they heard of the program. Table 4-10 presents how these non-participant respondents had heard of the program.

Table 4-10: How Non-participants Are Aware of Program

Source	%
By word of mouth	28%
An SCE representative contacted you	20%
You approached SCE	12%
Through printed material sent by SCE	12%
Other	8%
A pump service contractor or engineer contacted you	4%
At industry trade shows	4%

Given the criteria for selecting the non-participant sample, it is not surprising that 65% of the non-participants had participated in the program previously. On average it has been about 12 years since the last participation in the program.

Table 4-11: Reason for Previously Participating in Program

Reason	%
Other	43%
Improve water output or overall plant performance	19%
Part of regularly scheduled maintenance procedures	16%
Reduce pump operating costs	14%
Required by water district	3%

The non-participants don't typically have their pumps tested on a regular basis, possibly due to the cost and time involved in regular testing. Overall, they reported that only 18% of their pumping HP is tested on a regular basis.

Table 4-12 is a breakout of regular testing by pump type. Table 4-13 shows that most of these regular tests are conducted by outside vendors (50%) and by in-house staff (20%), and occur either annually or on an as needed basis (Table 4-14). Most (80%) of these pumps were tested as part of ongoing operating and maintenance procedures (Table 4-15). The non-participants are highly confident in these tests (an average of 4.4 on a 5 point scale).

Table 4-12: Pumps Tested Regularly

Pump Type	HP	HP Tested[a]	% Tested
Turbine Well	212	47	22%
Submersible Well	187	29	16%
Centrifugal Booster	98	38	39%
Turbine Booster	171	7	4%
Submersible Booster	23	2	9%
Total	691	123	18%
[a] Tested regularly			

Table 4-13: Agent that Conducts Regular Testing

Agent	%
Outside vendor	50%
In-house staff	20%
Other	20%
Outside mechanic	10%

Table 4-14: Frequency of Pump Testing

Frequency	%
Annually	30%
On an as need basis	30%
Other	30%
Monthly	10%

Table 4-15: Reason for Pump Testing

Reason	%
Part of operating and maintenance procedures	80%
Improve pumping performance/flow rate	30%
To improve pump efficiency and reduce costs	40%
To calculate usage	50%
Other	10%

Only 20% of those that used other testers to conduct the pump test indicated that the SCE wait time was too long. There was not any consistent reason provided for not using SCE to conduct the pump test. The reasons provided for not using SCE included the customer being protective of their pumps, being unable to turn the ditch on and off very easily, and one customer thought that they were not eligible for the SCE tests.

Many (37%) of the non-participants surveyed made improvements to their pumping systems in the past 2 years. Table 4-16 presents the improvements that the non-participants made to their pumping systems over the past 2 years. Replacing the pump bowl and impeller and installing a high-efficiency motor were the most popular improvements, 57% and 48% respectively, of the non-participant respondents who made these improvements. Respondents made these improvements to improve the pumping performance (39% of respondents) and to reduce energy costs (30%).

Table 4-16: Improvements made to Pumping Systems by Non-Participants

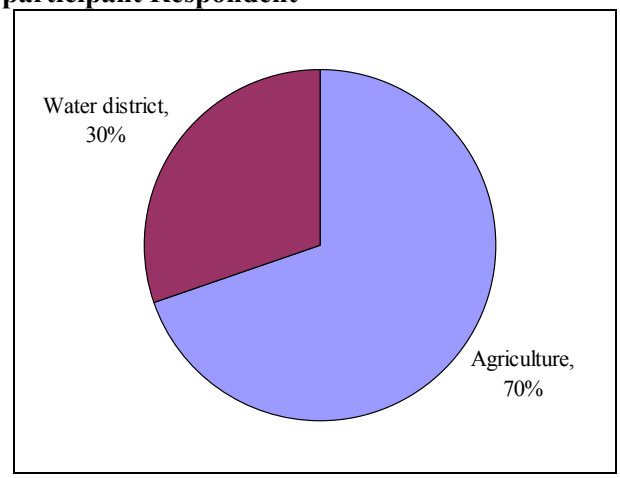
Pump Improvement	%	% of Pumps Impacted
Replace pump bowl and impeller	**57%**	**34%**
Turbine Well	30%	17%
Submersible Well	26%	8%
Centrifugal Booster	0%	50%
Turbine Booster	0%	20%
Submersible Booster	0%	0%
Adjust bowl and impeller on deep well pump	**30%**	**53%**
Turbine Well	22%	17%
Submersible Well	9%	1%
Centrifugal Booster	0%	50%
Turbine Booster	0%	20%
Submersible Booster	0%	0%
Trim existing impeller on booster pump	**9%**	**20%**
Turbine Well	9%	0%
Submersible Well	0%	2%
Centrifugal Booster	0%	0%
Turbine Booster	0%	0%
Submersible Booster	0%	0%
Install high-efficiency motor	**48%**	**50%**
Turbine Well	30%	2%
Submersible Well	13%	14%
Centrifugal Booster	4%	50%
Turbine Booster	0%	100%
Submersible Booster	0%	0%
Install variable-speed drive on pump motor	**22%**	**83%**
Turbine Well	17%	9%
Submersible Well	0%	6%
Centrifugal Booster	4%	50%
Turbine Booster	0%	0%
Submersible Booster	0%	0%

Replace well column with coated or treated pipe to reduce friction losses	**13%**	**51%**
Turbine Well	9%	5%
Submersible Well	4%	0%
Centrifugal Booster	0%	50%
Turbine Booster	0%	0%
Submersible Booster	0%	0%
Change distribution system discharge lines to reduce pressure or friction	**4%**	**10%**
Turbine Well	0%	1%
Submersible Well	4%	0%
Centrifugal Booster	0%	0%
Turbine Booster	0%	0%
Submersible Booster	0%	0%
Other	**22%**	**15%**
Turbine Well	9%	3%
Submersible Well	9%	0%
Centrifugal Booster	0%	0%
Turbine Booster	4%	0%
Submersible Booster	0%	0%

On average the non-participants surveyed believe that pumps should be tested every two years. These were all the non-participant respondents, not just the non-participant respondents that indicated they tested their pumps regularly.

Figure 4-8 shows the distribution of non-participant respondents by use of pumping.

Figure 4-8: Type of Non-participant Respondent



4.3 Staff Surveys

The project team interviewed key program management staff and a sample of the field pump test technicians to gather insights into program operations and opportunities for improving various aspects of the program. These staff surveys are very important to understanding the daily operations of the program and additional insights on the program participants.

Program staff interviewed for this evaluation included:

- Gary Suzuki – Program Manager
- Danny Johnson – Manager of Field Operations
- Kory Meyers – Supervisor of Field Operations
- 10 of the 13 Field Pump Test Technicians

Based on these interviews, the PTHS staff appears to be a well managed and committed group of professionals. The longevity of the staff with the program, an average of 10-13 years, indicates that the program is running smoothly and is providing a certain amount of job satisfaction for the pump testers.

The highlights of the staff surveys included:

- The current staffing level is sufficient to meet the current goals. Any increase in the program goals, expansion to other markets or expanded marketing will require additional staff.

- The staff believes that there are additional energy saving opportunities in non-portable pumping applications, i.e., industrial pumping.

- Most pump test staff believe that the small rural agricultural customers are hard to reach and are currently underserved.

- Some pump tester staff believe that outreach activities could be improved to provide a targeted message to the customers, i.e., targeted marketing to different market segments.

- There are currently no customer service goals and no established service timeline. Response to customer requests are based on the current backlog and the customer needs. The typical response time is 1-2 weeks. Based on the participant survey data, this response time is acceptable for the customers.

- All customer complaints are quickly handled by the program operations manager. As reported by the operations manager, the customer satisfaction is 96%-97%.

- The strong relationships between the pump testers and the participants continue to be one of the strengths of the program. The participants trust the SCE pump testers and their results.

- The pump test staff also felt that based on its longevity the program has earned credibility with participants. The use of the annually calibrated testing equipment provides confidence in the measurements. The pump test staff felt that since they were not trying to sell anything that they are viewed as a good non-biased source of information.

- The pump test staff felt that making customers wait for the pump tests may be a weakness of the program. As was indicated above, this concern was not corroborated through the participant surveys.

- Some of the pump test staff suggested modifying the Cost Analysis Letter to include recommendations for appropriate energy savings measures. Currently the letter states that there is an opportunity to improve the efficiency of the pumping system. If recommendations were provided in this letter, it might improve the Implementation Rate.

- Incentives or rebates were suggested as another method to improve the Implementation Rate.

- Some of the staff felt that the internal tracking of the pump tests could be enhanced to include centralized scheduling. Instead of each pump tester scheduling their visits, have a common calendar with all pump testers' schedules and have a scheduling manager handle the scheduling of the tests.

- It was suggested to enhance the program database to enable reports to be sent electronically. Also it was suggested to make more use of technology, i.e., interface wireless device with DB to facilitate data entry.

- Some pump test staff felt that the program could benefit from having a dedicated program manager to ensure the program receives the resources that it needs. The current program manager runs three separate programs.

- Working more with trade organizations could help improve the program outreach.

Although the program does not appear to have had much success in its outreach activities, most of the participants hear about the program by word of mouth, and this may be acceptable given the current high staff utilization. The program could work more with pumping equipment manufacturers, distributors, contractors, and independent pump testing agencies to assist customers with plant improvements. Outreach efforts to reach a wide range of customers such as city/county agencies, municipal water districts, agriculture and water related associations within the SCE service territory would help expand the program if desired.

4.4 Process and Market Assessment Analysis Findings

Based on the survey data, the following insights regarding the Pump Test and Hydraulic Services program were developed:

Participants

- The program is influencing participants to make improvements to their pumping systems.

- Most (93%) of the participants that make improvements replace the pump bowl and impeller.

- Participants make pumping improvements to reduce their energy costs.

- Participants have most of their pumps tested, not just a few.

- Participants are active in spreading the benefits of the program to others.

- The program is working very well for the participants.

- Almost half of the participants indicated that they used non-SCE pump testers also.

Non-Participants

- About 1/3 of the non-participants had heard about the program primarily from others or the SCE representative.

- Non-participants typically don't have their pumps tested on a regular basis. Only 18% of the pumps were reported to have been tested regularly.

- These regular pump tests were most likely conducted by vendors either as needed or on an annual basis.

- Non-participants appear not to need the data to make the pumping improvements, as 37% of the respondents made improvements to their systems without having a pump test.

- There appear to be no prominent reasons that the non-participants, who are regularly testing their pumps, were not participating in the Pump Test and Hydraulic Services program. Some of the reasons included being protective of their pumps, being unable to turn the ditch on and off very easily, and believing they were not eligible for the SCE tests.

5. PROGRAM PARTICIPANT VERIFICATION

The focus of this research task was to verify the program accomplishments that SCE claimed in its Final Report for program years 2003 and 2004-2005. The program verification activities involved conducting a detailed review of program documentation and the information contained in the program tracking database, and comparing it to results filed in the work books.

To complete the review, we selected 68 customers' records at random from the program participation records for both the 2003 and 2004 calendar year participants and the 2005 calendar year participants. The address data from the participant database was compiled in an analytic database and the data was examined to confirm that:

- the customer had a valid SCE customer number,

- the customer had a valid SCE Customer Service Account Number (CSSSERV),

- the customer was sent a congratulations letter or economic analysis, and

- the pump test occurred in the calendar year indicated in the program database.

For both program participant datasets, the verification review indicated that 100% of the sample satisfied these criteria, and thus the 2,646 pump tests reported by SCE in program year 2003 and the 8,795 pump tests reported by SCE in program year 2004-2005[7] are considered to be verified.

[7] January 1, 2004 through December 8, 2005

Table 4-17: Summary of Verification Sample

Calendar Year	Number of Unique Customers	Number of Unique Customer Service Account Numbers (CSSSERV)	Total Number Of Pumps Tested	Average Number of Pumps Tested Per CSSSERV
2003-2004	53	67	128	1.9
2005	57	68	117	1.7
Totals	110	135	245	1.8

Table 4-18: Number of Pumps Tested by Pump Horsepower

	2003 and 2004		2005	
HP Range	No. of Pumps Tested	% of Pumps Tested	No. of Pumps Tested	% of Pumps Tested
0-10	7	5%	14	12%
15-50	34	27%	31	26%
60-100	21	16%	30	26%
125-200	47	37%	32	27%
200 +	19	15%	10	9%
Total	128	100%	117	100%

Table 4-19: Number of Pumps Tested by Test Result

	2003 and 2004		2005	
Test Result	No. of Pumps Tested	% of Pumps Tested	No. of Pumps Tested	% of Pumps Tested
Congratulations Letter	68	53%	44	38%
Cost Analysis Letter	60	47%	73	62%

6. DATABASE REVIEW

Our assessment is that the database is a comprehensive and well-developed program tracking data system and program management tool. We have discussed the organization, content, and reporting functions of the database with the database manager, and made several data requests over the course of the evaluation for 2003, 2004, and 2005 participation data. In general we have found the dataset to be well organized and populated. It is also clear from our review that the program database is a valuable resource for pre-/post-retrofit test performance information. We were able to search the database for significant changes in GPM, OPE, and kWh/acre-foot in order to identify those customers who have implemented the recommendations.

The data request that we made for the participation data included the following variables:

- **CUSTNAME** – customer name
- **CSSSERV** – customer service number
- **CSSCUST** – customer number

- **TDATE** – test date
- **MOTOR_HP** – pump motor horsepower
- **TEST_KW** – test kW reading
- **OPE** – Overall Plant Efficiency
- **PUMPTYPE** – pump type code
- **PTNAME** – pump type name
- **DIST** – SCE district code
- **DISTNAME** – SCE district name
- **SIC** – Standard Industrial Classification code
- **SICNAME** – Standard Industrial Classification name
- **USECD** – SCE use code
- **USENAME** – SCE use name
- **REVCLASS** – SCE revenue class code
- **REVNAME** – SCE revenue class name

The primary purpose for selecting these fields was to profile program participation, understand the markets and applications served by the program, and develop data to support the sample design process. The data were provided to us in an MS Excel spreadsheet, and data sorts were conducted by selected key variables. The results of the data queries are included in Appendix A. The following are observations on data quality and integrity:

- The major market segments served by the program, i.e., municipal water supply, agricultural irrigation, golf course irrigation, etc. were profiled using SIC code, use category, and revenue class. Comparing the results of these data in Appendix A we see that there are inconsistencies in the reporting along these lines. For example, in 2003 55% of tests by SIC are "water supply" (assumed to be municipal water supply), while 39% of tests are "fresh water supply" according to the use category. Similarly, a summation of agricultural SICs reveals that about 32% of tests were at agricultural facilities while 40% were classified as agricultural by revenue class. This may simply be a result of how these data elements are interpreted in the field, but it does argue for greater consistency of data definition and data interpretation. There may be some discrepancies resulting from classifying the pump application and not the actual customer type. We believe that the database is an important tool for market characterization and program tracking, and that consistent reporting on the markets served by the program can help program management understand its influence on the market and direct the program in the most fruitful directions. Thus, we recommend that SCE develop a consistent classification method that corresponds closely to the specific market segments that the program serves and track these data on a going forward basis. This may argue for eliminating the SIC code as it is often prone to misinterpretation, and instead relying on revenue class or use category codes that accurately describe the market segments served.

- In addition there were multiple variations on customer names for any given CSSCUST number. There should be consistency in the customer name and classification for each CCSCUST number.

- Examining the data extract that we requested, the database appears to be well populated and does not contain substantial data gaps. For example, for the 2003 data only 0.9% of records had a "blank" in the use category and SIC code data fields and 2.4% of records had a "blank" in the district field.

- With regard to understanding the markets and applications served by the program, the use category would appear to be one of the most useful. However, 30% of records were classified as "C/I unknown" rendering this data element less useful in profiling participation.

- The only obvious data anomaly in this data set was the record showing a 25,000 HP motor for one test. This HP is clearly out of range.

- Over this three year period a total of 12,478 pump tests were conducted on 7,621 unique pumps. Of these pumps 3,337, or 44%, received multiple tests. On average the pumps that were tested multiple times received 2.5 tests over this three year period.

This data review is based on our requests for participant data. Again, based on our review, the database appears to be a well-organized, highly specialized, and very useful program management tool.

7. CONCLUSIONS AND RECOMMENDATIONS

One of the goals of this study was to identify ways in which the program can be improved. The following discussion presents a set of conclusions and recommendations based upon the primary and secondary research conducted during this evaluation.

Overall the program is operating effectively and there is high customer satisfaction. The program participants have a high degree of confidence in the results of the pump tests. Program staff appears to be working effectively and the reports to the participants are influencing their decisions to make improvements to their pump systems. The non-participants in the program report that they do not test their pumps on a regular basis.

Our analysis has shown that the current savings adjustment factors, i.e., % Expected Savings and Net to Gross Ratio, are reasonable, but should be updated. The current estimate of the % Expected Savings achieved by the program is 87%. Our analysis shows that the % Expected Savings should be adjusted down slightly to 86%. The current estimate of the Net to Gross Ratio (NTGR) is 73%, but this only accounted for free ridership. When you adjust for spillover and the revised free ridership, the NTGR should be adjusted to 90%.

Although not specifically in our scope of work, the results of the participant survey indicate that the current 33% Implementation Rate may be low. Our surveys show that a large fraction of customers take action on the results of the test. When filtered to the individual pump level, the survey results indicate that the implementation rate may be as high as 72%. It is recommended that SCE perform more research to determine whether the Implementation Rate needs to be adjusted. This research should include determining if there is a relationship between implementation rate and customer size.

Our analysis of the database revealed that over this three year period a total of 12,478 pump tests were conducted on 7621 unique pumps. Of these pumps 3337, or 44%, received multiple tests. On average the pumps that were tested multiple times received 2.5 tests over this three year period. The program appears to be spending a significant portion of its resources retesting the same pumps every year; it may be possible to free up resources to do testing on more pumps by limiting the testing of each pump to once every two years. The program should also develop a way to track "new" customers to the program.

Some of the pump test staff suggested modifying the Cost Analysis Letter to include recommendations for specific appropriate energy savings measures. The evaluation team concurs with this recommendation. Currently the letter states that there is an opportunity to improve the overall efficiency of the pumping system, but stops short of listing specific actions or measures that could be taken. For example, the savings estimates could be broken down by specific measure such as: replace bowl and impeller, install high efficiency motor, and so on. SCE has the data to do this type of breakdown and incorporate it into the report. Pump test staff further believe that if recommendations were provided in the Cost Analysis Letter it might improve the Implementation Rate. This would also enable tracking of program savings accomplishments by measure for resource acquisition purposes, and may enable the program to provide other types of information and incentives tied to specific actions if so desired in the future.

During our analysis of the database, inconsistencies in customer classification in the program database were noted. In particular there were inconsistencies between the SIC codes and the use categories. There needs to be more consistency in the customer classification, revenue code, and use code, which may help to further identify underserved market segments. There may be some discrepancies resulting from classifying the pump application and not the actual customer type. We believe that the database is an important tool for market characterization and program tracking, and that consistent reporting on the markets served by the program can help program management understand its influence on the market and direct the program in the most fruitful directions. Thus, we recommend that SCE develop a consistent classification method that corresponds closely to the specific market segments that the program serves and track these data on a going forward basis. This may argue for eliminating the SIC code as it is often prone to misinterpretation, and instead relying on revenue class or use category codes that accurately describe the market segments served.

In addition there were multiple variations on customer names for any given CSSCUST number. There should be consistency in the customer name and classification for each CCSCUST number.

To help identify underserved segments of the population, the market should be further disaggregated. For example, municipal and agricultural markets could be disaggregated as follows:

1) Water Supply
    i) Municipal agencies
    ii) Mutual water companies
    iii) Privately-owned water companies
    iv) Limited territory utilities
2) Agricultural
    i) Large operators (>5 pumps)
    ii) Small operators (< 5 pumps)

There is a high rate of customer satisfaction with the program. Any customer complaints are handled quickly and effectively by the program operations manager.

SCE may also want to consider the role that the PT&HS program might play as a source of data for water supply entities as participants in the following programs: Agricultural and Pumping Interruptible (AP-I),

California Power Authority Demand Reserves Program (CPA DRP), Critical Peak Pricing (CPP), and the Demand Bidding (DBP) programs. The program database offers a wealth of data that can be mined to identify potential participants in these programs, operational data about their equipment, kW participation potential, and contacts for outreach and educational initiatives.

Overall the program is well implemented and effective. Based upon the findings in this report, it is recommended that the program adopt the following set of recommendations. The items in this list are not ranked by order of importance.

Recommendation #1: Adjust the % Expected Savings to 89%.

Recommendation #2: Adjust the NTGR to 90%.

Recommendation #3: Investigate the current 33% Implementation Rate.

Recommendation #4: Restrict testing per pump to no more than once every two years to help free up resources to conduct testing on pumps that have never been tested.

Recommendation #5: Modify the Cost Analysis Letter to specify specific measures which may be taken and the estimated savings for each measure.

Recommendation #6: Develop a way to track "new" customers to the program.

Recommendation #7: Develop a consistent classification method that corresponds closely to the specific market segments that the program serves and track these data on a going forward basis.

Recommendation #8: Develop a data entry procedure that uses a lookup function to fill in customer information based upon the CSSCUST entered. This should help correct the multiple spellings of the customer name.

Recommendation #9: Consider the role that the PT&HS program might play as a source of data for water supply entities as participants in the following programs: Agricultural and Pumping Interruptible (AP-I), California Power Authority Demand Reserves Program (CPA DRP), Critical Peak Pricing (CPP), and the Demand Bidding (DBP) programs.

APPENDIX A: PARTICIPATION SUMMARY

Exhibit A-1

	2003	2004	2005
Unique Participants	615	646	551
Total Pump Tests	3,684	4,408	4,386
Avg. Tests/Participant	6.0	6.8	8.0

Exhibit A-2

Use Name	2003	2004	2005
C/I Unknown	29.4%	28.2%	27.6%
Fresh Water Pumping, OPA	26.7%	28.8%	30.4%
Irrigation Pumping	24.2%	23.5%	21.5%
Fresh Water Pumping (Private)	12.4%	12.1%	13.6%
Agricultural (Non-Pumping)	3.3%	3.0%	2.9%
C/I Miscellaneous	1.2%	1.7%	1.5%
(blank)	1.0%	0.7%	0.8%
Sewage and Storm Drain	0.8%	0.9%	0.8%
Wind/Fresh Water Pumping	0.2%	0.5%	0.6%
Hospitals	0.4%	0.0%	0.0%
Temporary	0.1%	0.2%	0.0%
Domestic, Non-Dwelling	0.1%	0.1%	0.1%
Petroleum Pumping	0.1%	0.1%	0.0%
Office, Professional	0.1%	0.0%	0.1%
Other Schools, Colleges	0.1%	0.0%	0.0%
General Retail	0.0%	0.0%	0.0%
Elementary Schools	0.0%	0.0%	0.0%
Service Establishments	0.0%	0.0%	0.2%
Manufacturing	0.0%	0.0%	0.1%
C/I Speculative	0.0%	0.0%	0.0%
Wind Machine	0.0%	0.0%	0.0%
Restaurants, Bars	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

Exhibit A-3

Pump Type	2003	2004	2005
TURBINE WELL	45.8%	44.3%	40.1%
TURBINE BOOSTER	31.3%	30.8%	35.7%
SUBMERSIBLE WELL	10.9%	10.5%	9.8%
CENTRIFUGAL BOOSTER	9.7%	11.5%	10.7%
SUBMERSIBLE BOOSTER	2.4%	2.9%	3.7%
Total	100.0%	100.0%	100.0%

Exhibit A-4

Revenue Class	2003	2004	2005
Agricultural	39.8%	38.1%	32.7%
Public Authorities Special Contracts	30.0%	33.5%	35.4%
Commercial	26.4%	25.1%	28.2%
Industrial, Non-Temporary	2.6%	2.4%	2.8%
Other	1.0%	0.7%	0.8%
Residential	0.1%	0.1%	0.1%
KWh Used by Company	0.0%	0.1%	0.0%
Total	100.0%	100.0%	100.0%

Exhibit A-5

SIC Name	2003	2004	2005
WATER SUPPLY	55.0%	60.3%	64.3%
CITRUS FRUITS	9.9%	10.3%	6.5%
GENERAL FARMS, PRIMARILY CROP	3.8%	4.9%	5.3%
TREE NUTS	2.7%	3.0%	1.8%
DAIRY FARMS	4.4%	1.4%	2.3%
IRRIGATION SYSTEMS	3.1%	2.4%	4.2%
GRAPES	2.3%	2.3%	0.8%
VEGETABLES AND MELONS	1.4%	1.9%	1.0%
SEWERAGE SYSTEMS	1.3%	1.6%	1.3%
FIELD CROPS, EXCEPT CASH GRAINS, NEC	1.6%	1.2%	1.3%
DECIDUOUS TREE FRUITS	2.1%	0.7%	1.1%
PUBLIC ORDER AND SAFETY, NEC	0.9%	1.2%	1.5%
FRUITS AND TREE NUTS, NEC	1.1%	1.0%	0.5%
COTTON	1.4%	0.7%	0.7%
Undefined SIC Code	1.0%	0.7%	0.8%
MEMBERSHIP SPORTS & RECREATION CLUBS	0.5%	0.6%	0.4%
PUBLIC GOLF COURSES	0.4%	0.5%	0.8%
ORNAMENTAL NURSERY PRODUCTS	0.2%	0.6%	0.5%
NONCLASSIFIED ESTABLISHMENTS	0.2%	0.5%	0.2%
BEEF CATTLE, EXCEPT FEEDLOTS	0.4%	0.4%	0.1%
PRIVATE HOUSEHOLDS	0.4%	0.2%	0.5%
AMUSEMENT AND RECREATION, NEC	0.2%	0.3%	0.2%
DWELLING OPERATORS, EXC. APARTMENTS	0.5%	0.1%	0.5%
CORN	0.4%	0.1%	0.0%
NONRESIDENTIAL BUILDING OPERATORS	0.2%	0.2%	0.2%
ANIMAL AQUACULTURE	0.4%	0.0%	0.0%
GENERAL MEDICAL & SURGICAL HOSPITALS	0.4%	0.0%	0.0%
CORRECTIONAL INSTITUTIONS	0.2%	0.2%	0.3%
CEMETERY SUBDIVIDERS AND DEVELOPERS	0.2%	0.2%	0.0%
LAND, MINERAL, WILDLIFE CONSERVATION	0.1%	0.2%	0.1%
OPERATIVE BUILDERS	0.1%	0.1%	0.2%
WHEAT	0.2%	0.0%	0.1%

SIC Name	2003	2004	2005
AIRPORTS, FLYILNG FIELDS, & SERVICES	0.1%	0.1%	0.1%
BERRY CROPS	0.1%	0.1%	0.1%
FARM MANAGEMENT SERVICES	0.2%	0.0%	0.0%
NON-STANDARD CODES	0.1%	0.1%	0.1%
CROP PREPARATION SERVICES FOR MARKET	0.0%	0.2%	0.0%
NEW ACCOUNTS - NOT CLASSIFIED	0.2%	0.0%	0.1%
TRAILER PARKS AND CAMPSITES	0.0%	0.2%	0.0%
MUSEUMS AND ART GALLERIES	0.1%	0.1%	0.1%
AIR, WATER & SOLID WASTE MANAGEMENT	0.1%	0.0%	0.1%
LAWN AND GARDEN SERVICES	0.1%	0.0%	0.0%
HOTELS AND MOTELS	0.1%	0.1%	0.0%
EXECUTIVE OFFICES	0.0%	0.1%	0.0%
SCE COMPANY USE	0.0%	0.1%	0.0%
ROOMING AND BOARDING HOUSES	0.1%	0.1%	0.0%
REGULATION, ADMIN. OF UTILITIES	0.0%	0.1%	0.0%
POTASH, SODA, AND BORATE MINERALS	0.1%	0.0%	0.0%
GAS AND OTHER SERVICES COMBINED	0.1%	0.0%	0.0%
GAS TRANSMISSION AND DISTRIBUTION	0.1%	0.0%	0.0%
CONSTRUCTION SAND AND GRAVEL	0.1%	0.0%	0.1%
COLLEGES AND UNIVERSITIES – PUBLIC	0.0%	0.1%	0.0%
NATIONAL SECURITY	0.1%	0.0%	0.3%
GENERAL GOVERNMENT, NEC	0.0%	0.1%	0.1%
HORSES AND OTHER EQUINES	0.1%	0.0%	0.1%
FIRE PROTECTION	0.1%	0.0%	0.0%
SECONDARY SCHOOLS – PUBLIC	0.0%	0.0%	0.0%
COLLEGES AND UNIVERSITIES - PRIVATE	0.1%	0.0%	0.0%
ELEMENTARY SCHOOLS – PUBLIC	0.1%	0.0%	0.0%
MOTION PICTURE AND VIDEO PRODUCTION	0.1%	0.0%	0.0%
MOBILE HOME SITE OPERATORS	0.1%	0.0%	0.0%
CASH GRAINS, NEC	0.0%	0.0%	0.1%
TIRES AND TUBES	0.1%	0.0%	0.0%
EATING PLACES	0.1%	0.0%	0.0%
TIMBER TRACTS	0.1%	0.0%	0.0%
SINGLE-FAMILY HOUSING CONSTRUCTION	0.1%	0.0%	0.0%

SIC Name	2003	2004	2005
HUNTING, TRAPPING, GAME PROPAGATION	0.0%	0.0%	0.1%
POULTRY AND EGGS, NEC	0.0%	0.0%	0.0%
Other Categories	0.3%	0.4%	0.5%
Total	100.0%	100.0%	100.0%

Exhibit A-6

HP	2003	2004	2005
1	0.0%	0.0%	0.0%
1.5	0.1%	0.0%	0.0%
2	0.0%	0.0%	0.1%
3	0.5%	0.2%	0.1%
3.5	0.0%	0.0%	0.4%
5	1.6%	1.0%	0.0%
7.5	2.4%	1.4%	1.0%
10	3.5%	3.4%	2.1%
15	7.1%	5.6%	2.8%
20	4.8%	4.8%	4.9%
25	4.2%	4.6%	4.0%
30	5.7%	6.3%	3.9%
35	0.0%	0.0%	6.0%
40	6.7%	7.2%	0.1%
50	7.9%	8.0%	7.3%
53	0.0%	0.0%	8.6%
60	4.5%	5.5%	5.2%
75	9.2%	10.7%	10.8%
80	0.0%	0.0%	0.0%
100	10.7%	10.7%	12.3%
120	0.0%	0.0%	0.0%
125	5.1%	5.6%	5.8%
150	7.4%	7.6%	6.9%
175	0.1%	0.1%	0.1%
180	0.0%	0.0%	0.0%
185	0.0%	0.0%	7.1%
200	6.6%	6.3%	3.3%
235	0.0%	0.0%	2.0%
250	4.1%	3.1%	1.5%
275	0.0%	0.1%	0.0%
300	2.9%	2.9%	1.7%
325	0.0%	0.0%	0.5%
350	1.5%	1.8%	0.9%
375	0.0%	0.0%	0.0%

HP	2003	2004	2005
400	1.7%	1.7%	0.0%
450	0.2%	0.2%	0.3%
500	0.9%	0.7%	0.0%
600	0.2%	0.2%	0.0%
Total	100.0%	100.0%	100.0%

APPENDIX B: SURVEY INSTRUMENTS

Participant Telephone Survey Questionnaire

Non-Participant Telephone Survey Questionnaire

On-site Survey Questionnaire

SCE Program Staff Interview Guide - Pump Testers

2003 PT&HS Program Evaluation

Participant Telephone Survey Questionnaire

Respondent Name: _____ **Phone:** _____

Respondent Company:_____

Interviewer: _____ **Date:** _____

A. Introduction

Hello, my name is _____ and I'm calling on behalf of the Southern California Edison Company Pump Test program. May I please speak with _____ _____?

SCHEDULE CALL-BACK, IF NECESSARY.

Hello, my name is _____and I'm calling on behalf of the Southern California Edison Company. We are seeking your cooperation in a study, which will help EDISON to better understand the needs of its water pumping customers. Your responses are completely confidential. **(ADD,**

IF NECESSARY: If there are any questions at any point about the purposes of this study, we would ask you to contact Danny Johnson at 800-634-9175 at the Southern California Edison Company Pump Test program or Shahana Samiullah at the Southern California Edison Company at 626-302-8293). **(ADD, IF NECESSARY:** This survey will take approximately 15 minutes.)

Our records indicate that your company participated in SCE's Pump Test Program. Are you the person in your company most knowledgeable about your company's pumping plant and SCE's Pump Test Program?

IF NO: Who in your company would be the most knowledgeable about your company's pumping plant and participation in the EDISON Pump Test Program? _____

May I please speak with _____?

B. Pump Test and Post-Implementation Recruitment Questions

SCE records indicate that, in 2003, your company received a pump test for one or more pumps and received a report on the potential savings from efficiency improvements to your pumping system:

B1. Do you remember receiving a pump test through SCE's Pump Test Program in 2003?
Y / N / DK / RF

B2. Do you remember receiving a report and cost analysis letter regarding the results of the test and potential savings from making efficiency improvements to your pumping system?
Y / N / DK / RF

[Thank and terminate if Q-B1 and Q-B2 = No or Q-B1= DK or RF and Q-B2=DK or RF]

B3. Did you make any changes to improve the energy efficiency of your pump or pump system based on the information that you received from the pump test report?
Y / N / DK / RF [If No, DK, or RF, go to Section D]

Question b4 is for the post-implementation test sample and should be addressed to those customers who responded affirmatively to Q B3. Once the sample has been filled, skip this question and go on to question C1.

B4. We'd like to know how close our estimate of savings was to what you actually realized through your improvements. SCE is offering a complimentary follow-up pump test to a small group of customers who have made modifications to their pumping site to improve pump efficiency. Would you be willing to have this complimentary test completed at your site?
Yes ……1
No ……..…..…..2

IF YES: Thank you for your help, an SCE pump tester will contact you to schedule a time for the test. [Continue with the interview].

Is now a good time to ask you additional questions (it will take about 20 minutes) or could I schedule a time to call you back and finish the survey? Date _____ Time _____

C. Freeridership Questions [Ask only if implemented something in Q-B3, otherwise skip to Section D]

C1. I am going to read you a list of pump and pumping system changes. Please indicate which of these measures that you implemented. Did you … [Read 'Measure' in table below and indicate answer in column C1. For each measure that is 'Yes', immediately ask C2 and C3, for that measure, then return to C1 and finish asking about all remaining measures]

C2. How much influence did the pump test results have on your decision to make the changes to your pumping system? Please rate the influence on a scale from 1 to 5, with 1 being no influence at all and 5 being a lot of influence. [Rate in column C2 in table below]

C3. Looking at it another way, if the pump test results received through SCE's Pump Test Program had not been available, how likely is it you would have made the efficiency improvements exactly the same way anyway? Please rate on a scale from 1 to 5, with 1 being not at all likely and 5 being very likely. [Rate in column C3 in table below]

Measure	C1	C2	C3
Replace pump bowl and impeller	Y / N / DK		
Adjust bowl and impeller on deep well pump	Y / N / DK		
Trim existing impeller on booster pump	Y / N / DK		
Install high-efficiency motor	Y / N / DK		
Install variable-speed drive on pump motor	Y / N / DK		
Replace well column with coated or treated pipe to reduce friction losses	Y / N / DK		
Change distribution system discharge lines to reduce pressure or friction	Y / N / DK		
Other (describe) _____	Y / N / DK		
Other (describe) _____	Y / N / DK		
Don't Know	Y / N / DK		
Refused.	Y / N / DK		

C4. What was your main reason for making the improvements?

Reduce energy costs 1
Improve pumping performance/flow rate 2
Reduce maintenance costs 3
Other (describe)_____ 4
Other (describe)_____ 5
Don't Know ..... DK (88)
Refused ..... REF (99)

C5. Before you obtained the pump test results, were you already planning to make any operating efficiency improvements in your pumping system?

Y / N / DK / RF [If No, DK, or RF, go to Q-C7]

C6. When do you think you would have made the improvements without the pump test results provided by SCE's Pump Test Program? [Don't read response categories]

within 6 months of when the improvements were actually made 1
6 months to one year later 2
one to two years later 3
two to three years later 4
three to four years later 5
four or more years later 6
wait till the pump failed 7
Don't Know 88
Refused to Answer 99

C7. How often do you believe that your pumps should be tested in order to maintain their efficiency and performance?

Every _____ years
Don't know (DO NOT READ) ..... DK (88)
Refused (DO NOT READ) ..... REF (99)

D. Inside Spillover Questions

D1a. Other than improvements to the efficiency of your water pumping system, have you taken any steps to improve the energy efficiency of any other aspect of your operation as a result of the information provided by the test?

Y / N / DK / RF

D1b. [IF D1a YES] What changes did you make?
(Describe) _____

_____

_____

E. Outside Spillover Questions

E1a. How many of the following pump types do you operate in your entire pumping network or operation? [Read 'Pump type' in column E1a table below and for each pump type present, immediately ask E1b and E1c, then return to E1a and finish asking about all remaining pump types]

E1b. Of the total number of pumps that you operate, what percentage do you have tested on a regular basis? [Enter number or percent in column D1b - Enter DK for don't know or RF for refusals. We will estimate average horsepower from program records]

E1c. [If E1b > 0] How many, or what percentage, of these tests were conducted by an SCE tester? [Enter number or percent in column E1c, BE SURE to circle % or # so we know which unit is being referenced.]

Pump Type	# (E1a)	% (E1b)	# or % SCE tested (E1c)
Turbine Well		%	# or %
Submersible Well		%	# or %
Centrifugal Booster		%	# or %
Turbine Booster		%	# or %
Submersible Booster		%	# or %

E2. What do you estimate is the total horsepower of all the pumps in your system?
_____ Total HP in system

E3a. Have you taken any steps to improve the energy efficiency of other pumps not tested?
Y / N / DK / RF [If Y go to D3b, else go to Section F]

E3b. What changes did you make? Did you…[Read 'Measure' in table below and rate in column E3b. For each measure that is 'Yes', immediately ask E3c, E3d, and E3e for that measure, then return to list and finish asking about all remaining measures]

E3c. Overall, what percentage of your pumps have you made this change to? [Read 'Measure' in table below and rate in column E3c.

E3d. How much influence did the SCE pump test have on your decision to make the changes to these other pumps? Please use a scale from 1 to 5, with 1 being no influence at all and 5 being a lot of influence. [Rate 1 to 5 in column E3d in table below]

E3e. If the pump test services and report received through SCE's Pump Test Program had not been available, how likely is it you would have made the efficiency improvements exactly the same way anyway? Please use a scale from 1 to 5, with 1 being not at all likely and 5 being very likely. [Rate 1 to 5 in column E3e in table below]

Measure	E3b	E3c	E3d	E3e
Replace pump bowl and impeller	Y / N / DK	%		
Replace well piping with larger diameter pipe	Y / N / DK	%		
Install high-efficiency motor	Y / N / DK	%		
Install variable-speed drive on pump motor	Y / N / DK	%		
Other (describe)	Y / N / DK	%		
Other (describe)	Y / N / DK	%		
Don't Know	Y / N / DK	%		
Refused.	Y / N / DK	%		

F. Non-participant Spillover

F1. Have you told any other plant operators about the benefits of pump testing as a result of your participation in the SCE program?
Y / N / DK / RF **[If E1 <> yes skip to Section G]**

F2. Approximately how many other plant operators have you told?
____ Number **88** Don't Know **99** Refused

F3. Of these other plant operators that you told about the benefits of pump testing, how many would you estimate have implemented measures based on what you told them? _____ %

G. Process and Customer Satisfaction Questions

G1. Prior to 2003, were you aware of SCE's Pump Test and Hydraulic Services program?
Y / N / DK / RF

G1b. Over the past 10 years, how many times has SCE come and tested the water pumps in your system?
_____

G2. How did you learn about the Pump Test Program? [Ask as open ended question and select appropriate response below. If response is poor, read the list below and select best response]

You approached a pump equipment vendor or distributor 1
You approached a pump service contractor or engineering firm..... 2
You approached SCE..... 3
Through printed material sent by SCE 4
An SCE representative contacted you 5
A pump service contractor or engineer contacted you..... 6
A pump equipment vendor or distributor contacted you 7
By word of mouth..... 8
At industry trade shows 9
Other (SPECIFY) _____ 10
Don't know (DO NOT READ) .....DK (88)
Refused (DO NOT READ) .....RF (99)

G3. What was your main reason for participating in SCE's Pump Test and Hydraulic Services program?

Part of regularly scheduled maintenance procedures..... 1
Reduced pump operating costs 2
Required by water district..... 3
Improve water output or overall plant performance..... 4
Other (SPECIFY)..... 5
Don't know (DO NOT READ) .....DK (88)
Refused (DO NOT READ) .....RF (99)

G4. I'm now going to read a series of statements regarding the pump test and the pump test report. On a scale of 1 to 5 please tell me if you strongly disagree or strongly agree with 1 being strongly disagree and 5 being strongly agree.

Statement	Rating (1-5) 1= Strong Disagree 5= Strong Agree
G4a. It was easy to request a pump test	
G4b. There wasn't a long wait between my request and when the pump test was performed	
G4c. There wasn't a long wait to receive the results of the pump test.	
G4d. The pump test results were useful.	
G4e. The pump test results were easy to understand.	
G4f. The pump test results were believable.	
G4g. I am now much more knowledgeable about needed improvements for my pumping operations.	
G4h. The pump test report provided the relevant and actionable information about improvements on my pumping system.	

G5. How many days passed between the pump test being conducted and the delivery of the pump test results report?

___Response **(number) 88** Don't Know **99** Refused to Answer

G6. Has SCE's pump testing program helped you to (Read each response in table below and select answer....):

G6a. Reduce the time or cost of collecting information you would otherwise need to get on your own?	Y / N / DK / Refused
G6b. Reduce your doubt and uncertainty about your pumping system efficiency?	Y / N / DK / Refused
G6c. Work more effectively with dealers and suppliers.	Y / N / DK / Refused
G6d. Reduce the hassle of performing the test yourself	Y / N / DK / Refused
G6e Increase the availability of products and services of benefit to you?	Y / N / DK / Refused

G7. How influential is the SCE cost analysis in determining when to spend money on pump repairs? Please rate on a scale of 1 to 5 where 1 means it is not influential at all and 5 means the cost analysis is the primary financial justification for spending money on upgrading a well that is still operating.

_____ [Enter number 1 – 5]

G8. Overall, how confident are you in the information received from the SCE pump test results? Please use a scale from 1 to 5, with 1 being not at all confident and 5 being very confident.

__ Response **(1-5)** **88** Don't Know **99** Refused to Answer

G8a. [If the response to G8 was 3 or less] What could SCE do to improve your confidence in the test results? _____

G9. Now I'd like to read you several performance categories and I'd like you to tell me how your Pump Test Technician performed in each category in the past year? Please rate your Pump Test Technician in the following categories on a 5-point scale where 1 equals extremely poorly and 5 equals extremely well.

Pump Test Technician performance	Rating (1-5)
a. Being easy to contact when you have a question or need help	
b. Taking the initiative to communicate with you on important issues	
c. Helping you solve your energy related problems	
d. Responding in a timely manner to your requests or problems	
e. Offering the technical expertise or resources to meet your needs	
f. Providing useful information on energy efficiency	

G10. Overall, how satisfied are you with the services and information you received from the SCE Pump Test Program? Please use a scale of 1 to 5 with 1 being very unsatisfied and 5 being very satisfied

__ Response (**1-5**) **88** Don't Know **99** Refused to Answer

G11. Have you ever used a pump tester other than an SCE tester?

Y / N / DK / RF [If Yes goto F11a, else goto Question G13]

G11a. [If G11 = yes] Why did you choose to use another pump test service provider?

1. Facility outside SCE territory
2. Wait for SCE test was too long
3. SCE declined to test (Pump HP too low)

4. Unsatisfied with SCE test
5. Other reason [Specify] _____

G12. [If G11 = yes] How did these other tests differ from the tests provided by SCE Staff?
1. Not as comprehensive as the SCE test. > Why _____
2. More comprehensive than the SCE test. > Why _____
3. Not as trustworthy as the SCE test. > Why _____
4. More trustworthy than the SCE test. > Why _____

G13. How confident would you be in efficiency improvement information from pump test results if it was provided by a company other than SCE? Please use a scale from 1 to 5, with 1 being not at all confident and 5 being very confident.
__ Response (**1-5**) **88** Don't Know **99** Refused to Answer

H. Firmographic and Market Characterization Questions

READ: Next, I would like to ask you some general questions about your business or organization.

H1. Which of the following categories are most applicable for you:
a. Domestic potable water supplier
[If Domestic, ask] Which category?
1. City
2. County
3. Other (specify)_____
b. Agriculture What primary crop(s)? [Open ended] _____
c. Water district
[If Water district, ask] What type?
1. Water Supply
2. Municipal agency
3. Mutual water company
4. Privately-owned water company
5. Limited territory utility
6. Other (specify)_____

Other? (SPECIFY) _____ 0
Don't know (DO NOT READ).....DK (88)
Refused (DO NOT READ) ..... REF (99)

H2. Do you have any question or comments about the SCE Pump Test and Hydraulic Services program?_

_____

_____

Those are all my questions. On behalf of Southern California Edison, I thank you very much for your time.

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Non-Participant Telephone Survey Questionnaire

Respondent Name: _____ **Phone:** _____

Respondent Company:_____

Interviewer: _____ **Date:** _____

A. Introduction

Hello, my name is _____and I'm calling on behalf of the Southern California Edison Company. We are seeking your cooperation in a study, which will help EDISON to better understand the needs of its water pumping customers. Your responses are completely confidential. **(ADD, IF NECESSARY:** If there are any questions at any point about the purposes of this study, we would ask you to contact Danny Johnson at 800-634-9175 at the Southern California Edison Company Pump Test program or Shahana Samiullah at the Southern California Edison Company at 626-302-8293). **(ADD, IF NECESSARY:** This survey will take approximately 15 minutes.)

B. Customer Testing Questions

B1. How familiar are you with the Southern California Edison Pump Test program? Please use a scale from 1 to 5, with 1 being not at all familiar and 5 being very familiar.

1 (not familiar) **2** **3** **4** **5** (very familiar)

B1a. (If B1 > 3) How did you learn about the Pump Test Program? [Ask as open ended question and select appropriate response below. If response is poor, read the list below and select best response]

- You approached a pump equipment vendor or distributor 1
- You approached a pump service contractor or engineering firm 2
- You approached SCE 3
- Through printed material sent by SCE 4
- An SCE representative contacted you 5
- A pump service contractor or engineer contacted you 6
- A pump equipment vendor or distributor contacted you 7
- By word of mouth 8
- At industry trade shows 9
- Other (SPECIFY) _____ 10
- Don't know (DO NOT READ) ..... DK (88)
- Refused (DO NOT READ) ..... RF (99)

B2. The Southern California Edison Pump Test program has been in operation for many years. Have you ever participated in this program?

Y / N / DK / RF

B2a. (If B2="Yes") Approximately what year(s) did you participate in the program? _____

B2b. (If B2="Yes") What was your main reason for participating in SCE's Pump Test and Hydraulic Services program?

Part of regularly scheduled maintenance procedures 1
Reduced pump operating costs 2
Required by water district 3
Improve water output or overall plant performance 4
Other (SPECIFY) 5
Don't know (DO NOT READ) ..... DK (88)
Refused (DO NOT READ) ..... RF (99)

B2b. (If B1="Yes") Why did you stop participating in the program? _____
_____

B3. What do you estimate is the total horsepower of all the pumps in your system?
_____ Total HP in system

B4a. How many of the following pump types do you operate in your entire pumping network or operation? [Read 'Pump type' in column E1a table below and for each pump type present, immediately ask E1b and E1c, then return to E1a and finish asking about all remaining pump types]

B4b. Of the total number of pumps that you operate, what percentage do you have tested on a regular basis? [Enter number or percent in column D1b - Enter DK for don't know or RF for refusals. We will estimate average horsepower from program records]

Pump Type	# (**B4a**)	% (**B4b**)
Turbine Well		%
Submersible Well		%
Centrifugal Booster		%
Turbine Booster		%
Submersible Booster		%

NOTE: If B4b = 0% skip to C1

B4c. (If B4b >0%) Who conducts these periodic testing?

In-house staff 1
Outside vendor 2
Outside mechanic 3
Other (SPECIFY) _____ 4
Don't know (DO NOT READ) ..... DK (88)
Refused (DO NOT READ) ..... RF (99)

B4d. (If B4b >0%) How frequently to you conduct these pump tests?

Weekly 1
Bi-weekly 2
Monthly 3
Quarterly 4

Annually 5
On an as need basis 6
Other (SPECIFY) _____ 7
Don't know (DO NOT READ) ..... DK (88)
Refused (DO NOT READ) ..... RF (99)

B4e. (If B4b >0%) What are the reasons for conducting these tests? (Check all that apply)

Reason for Tests	**Check if applicable**
Part of operating and maintenance procedures	
Improve pumping performance/flow rate	
To improve pump efficiency and reduce costs	
To calculate usage	
Other (SPECIFY) _____	
Don't know (DO NOT READ)	
Refused (DO NOT READ)	

B4f. (If B4b >0%) How confident are you be in efficiency improvement information from these pump tests? Please use a scale from 1 to 5, with 1 being not at all confident and 5 being very confident.

__ Response (**1-5**) **88** Don't Know **99** Refused to Answer

B4g. (If B4b >0%) Why don't you use SCE to conduct these tests?
Facility outside SCE territory 1
Wait for SCE test was too long 2
SCE declined to test (Pump HP too low) 3
Unsatisfied with SCE test 4
Other reason [Specify] _____ 5
Don't know (DO NOT READ) ..... DK (88)
Refused (DO NOT READ) ..... RF (99)

C. Efficiency Measure Questions

C1. In the past 2 years have you made any improvements to your pumping systems?
Y / N / DK / RF **(If "N", "DK", "RF" skip to C2.)**

C1a. (If C1 = "Yes") I am going to read you a list of pump and pumping system changes. Please indicate which of these measures that you implemented. Did you … [Read 'Measure' in table below and indicate answer in column C1. For each measure that is 'Yes', immediately ask C1b. for that measure, then return to C1a. and finish asking about all remaining measures]

C1b. (If C1 = "Yes") Of the total number of pumps that you operate, what percentage of these pumps have you applied these measures to? [Rate in column C1b. in table below]

Measure	**C1a.**	**C1b**. (%)
Replace pump bowl and impeller	Y / N / DK	
Adjust bowl and impeller on deep well pump	Y / N / DK	
Trim existing impeller on booster pump	Y / N / DK	
Install high-efficiency motor	Y / N / DK	
Install variable-speed drive on pump motor	Y / N / DK	
Replace well column with coated or treated pipe to reduce friction losses	Y / N / DK	
Change distribution system discharge lines to reduce pressure or friction	Y / N / DK	
Other (describe) _____	Y / N / DK	
Other (describe) _____	Y / N / DK	
Don't Know	Y / N / DK	
Refused.	Y / N / DK	

C1c. (If C1 = "Yes") What was your main reason for making the improvements?

Reduce energy costs 1
Improve pumping performance/flow rate 2
Reduce maintenance costs 3
Other (describe)_____ 4
Other (describe)_____ 5
Don't Know ..... DK (88)
Refused ..... REF (99)

C2. How often do you believe that your pumps should be tested in order to maintain their efficiency and performance?

Every _____ years
Don't know (DO NOT READ) ..... DK (88)
Refused (DO NOT READ) ..... REF (99)

D. Firmographic and Market Characterization Questions

D1. Which of the following categories are most applicable for you:

d. Domestic potable water supplier
[If Domestic, ask] Which category?
1. City
2. County
3. Other (specify)_____

e. Agriculture What primary crop(s)? [Open ended] _____

f. Water district
[If Water district, ask] What type?
7. Water Supply
8. Municipal agency
9. Mutual water company
10. Privately-owned water company
11. Limited territory utility
12. Other (specify)_____

Other? (SPECIFY) _____ 0
Don't know (DO NOT READ) ..... DK (88)
Refused (DO NOT READ) ..... REF (99)

D2. What could SCE do to improve the program?_____

_____

_____

_____

D3. Would you be interested in having your pumps tested by SCE? Y N

Those are all my questions. On behalf of Southern California Edison, I thank you very much for your time.

2003 PT&HS Program Evaluation

On-site Survey Questionnaire

Customer Business Name: _____

Customer Address: _____

Customer Contact : _____ **Business Phone Number:** _____

Cell Phone Number: _____ **Email Address:** _____

Pump Location: _____

Date of Last Test: _____ **Test Ref. #:** _____ **Today's Date:** _____

1. Pump test verification: [Complete the table below]

#	Pump Type*	No. of Pumps	Pump Motor HP	Number of Pumps Tested in Last Test	Pump Manufacturer	Pump Serial Number
*	SW	4	10	2	FLOTEC/SIMER	XXX-XXXXX-XXX
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

*Pump Types: SW-Submersible Well, TB-Turbine Booster, CB-Centrifugal Booster, SB-Submersible Booster, TW-Turbine Well

2. What equipment efficiency improvements did you make as a result of the SCE pump test? Did you…..[Check the appropriate measure below]
   - _____ 2a. Replace pump bowl and impeller?
   - _____ 2b. Adjust the pump bowl and impeller?
   - _____ 2c. Trim the impeller?
   - _____ 2d. Replace column piping with a coated or treated pipe to reduce friction loss?
   - _____ 2e. Increase size of discharge lines to reduce system pressure or friction loss?
   - _____ 2f. Install high-efficiency motor?
   - _____ 2g. Install variable-speed drive on pump motor?
   - _____ 2h. Other [Describe] _____
   - _____ 2i. Other [Describe] _____

Which pumps did you make the improvements to since the last SCE test? [Fill in the number of pumps receiving the measure indicated in Question 3 in the table below]

#	3a. Replace Bowl/Imp.	3b. Adjust Bowl/Imp.	3c. Trim Impeller	3d. Replace Column Pipe	3e. Increase Discharge Lines	3f. Install Hi-E Motor	3f. Var. Speed Drive	3g. Other	3i. Other
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Since the work was completed, have you made any other changes to the pumps that would effect electricity consumption? Y N

[If yes to Q5] What changes did you make? [Describe]

2003 PT&HS Program Evaluation

SCE Program Staff Interview Guide - Pump Testers

SCE Staff Person: _____ **Phone:** _____

Respondent Company: _____

Interviewer: _____ **Date:** _____

The purpose of the interview is to explore your views on some of the market aspects of the Pump Test Program. When answering the questions, feel free to note when there are areas that you do not have experience or an opinion. We are interested in honest and candid answers, and your individual answers will be kept confidential. SCE has agreed to confidentiality on these surveys.

A. General Information

A1. What is your role in the program? _____

A2. How long have you been involved in the program? _____

A3. What do think are the areas of strengths of the program? _____

A4. What do you think are the areas of weaknesses of the program? _____

B. PROGRAM STAFFING AND TRAINING

B1. Do you believe that current staffing is adequate to: a) meet program goals; b) meet customer needs and demand? _____

B2. What changes would you recommend to the way the program is currently staffed and managed? _____

B3. What qualifications are required of pump testers? _____

B4. What training to test personnel receive? _____

B5. What kinds of training or education do you believe would help improve the performance of test staff?

C. PROGRAM OUTREACH AND MARKETING

Note: Probe for differences between agricultural customers and municipal water district market in the following set of questions.

C1. According to the program tracking database, 55% of the program participants were municipal water districts and 32% were agricultural customers. Do you agree that these are the primary target markets for this program? If not what other markets should be considered?

C2. Are any specific markets underserved?

C3. How would you characterize the hard-to-reach components of the program market?

C4. What do you believe is the primary way that customers learn about the program?

C5. In your opinion, are the marketing and outreach activities sufficient and successful?

C6. What changes do you think need to be made, if any, to program outreach and marketing in order to better reach target or underserved markets?

C7. Are there any practices/methods/equipment used by independent testers that SCE should adopt?

D. PROGRAM DESIGN AND DELIVERY

D1. What changes would you make, if any, to the test report to make it more informative and/or useful to the customer?

D2. What quality control procedures do you follow in the pump test process? With the pump test instruments?

D3. What other changes, if any, do you think need to be made to the program to make it more successful?_

D4. What features of the program do you think are most attractive to customers?_____

D5. What features of the program do you think are least attractive to customers?_____

E. FREERIDERSHIP AND INSIDE SPILLOVER QUESTIONS

E1. What percentage of your customers do you think make the following changes to their pumping systems? [Read 'Measure' in table below and indicate answer in column E1. For each measure that is 'Yes', immediately ask E2 and E3, for that measure, then return to E1 and finish asking about all remaining measures]

E2. How much influence do you think the pump test results have on your customers' decisions to make the changes to their pumping system? Please rate the influence on a scale from 0 to 10, with 0 being no influence at all and 10 being a lot of influence. [Rate in column E2 in table below]

E3. Looking at it another way, if the pump test results received through SCE's Pump Test Program had not been available, how likely do you think it is that your customers would have made the efficiency improvements exactly the same way anyway? Please rate on a scale from 0 to 10, with 0 being not at all likely and 10 being very likely. [Rate in column E3 in table below]

Measure	E1 (%)	E2 (1-10)	E3 (1-10)
Replace pump bowl and impeller			
Adjust bowl and impeller on deep well pump			
Trim existing impeller on booster pump			
Install high-efficiency motor			
Install variable-speed drive on pump motor			
Replace well column with coated or treated pipe to reduce friction losses			
Change distribution system discharge lines to reduce pressure or friction			
Other (describe) _____			
Other (describe) _____			
Don't Know			
Refused.			

E4. Other than improvements to the efficiency of their water pumping system, do you think the program has influenced your customers to take other steps to improve the energy efficiency of any other aspect of their operation as a result of the information provided by the test?

Y / N / DK / RF

[IF E4 is YES] What changes do you think they make? (Describe) _____

F. OTHER COMMENTS AND SUGGESTIONS