Equipoise Consulting, Inc.

Energy Analysis

Project Management

Training

Final Report for

Evaluation of the Agricultural Pumping Efficiency Program (CPUC Project 230-02ABCD)

Submitted by:

Equipoise Consulting Incorporated

In association with

Vanward Consulting
Ridge & Associates, and
California AgQuest Consulting Inc,

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1 Executive Summary

In 2002, the California Irrigation Technology (CIT) Agricultural Pumping Efficiency Program (APEP) was awarded funding from the California Public Utilities Commission (CPUC) to provide an incentive-based energy efficiency program for Program Years (PY) 2002 and PY2003. The APEP is a multi-faceted approach to reaching agricultural customers and assuring implementation of energy efficient technologies. Energy efficiency education is provided both to a broad spectrum of growers and a targeted audience of smaller and medium-sized growers. The information is provided through multiple avenues, including education and pump tests. Once the customers become both aware of and knowledgeable about pumping efficiency, the program provides financial incentives to help growers implement more energy efficient technologies.

Because of timing issues surrounding data collection and deadlines required of the evaluation report, this report does not include the full energy impacts attributable to the program. An errata report is planned that will update the energy impacts to include all pump repairs paid prior to the end of the program. The program implementer has received an extension to March 1, 2005. An errata report will follow prior to the June 1, 2005 deadline from the CPUC.

The evaluation began with an evaluability assessment that focused the research. This assessment systematically created logic models of the program implementation and program theory, discussed the models with the program staff, and set evaluation priorities based on those models. The priorities led to an evaluation approach with primary data collection from program staff and participants in the program to determine how the program was doing and what the impacts were of the program actions. Three hundred pump test customers, 29 pump repair customers, and 10 pump test/pump repair companies were surveyed by telephone, while 9 APEP staff were interviewed in person. Onsite audits were performed to collect information on the mobile energy centers (MEC) and the interaction of the program with the Irrigation Training Facility in Chico. During the MEC onsite audits, 194 participants were surveyed. Part way through the evaluation process, it became clear that a similar pump repair program being fielded may have influenced participation in the APEP. The evaluation team, with the cooperation of the California Energy Commission (who was responsible for the other program), surveyed 57 participants in the other program to determine their awareness of the two pump repair programs.

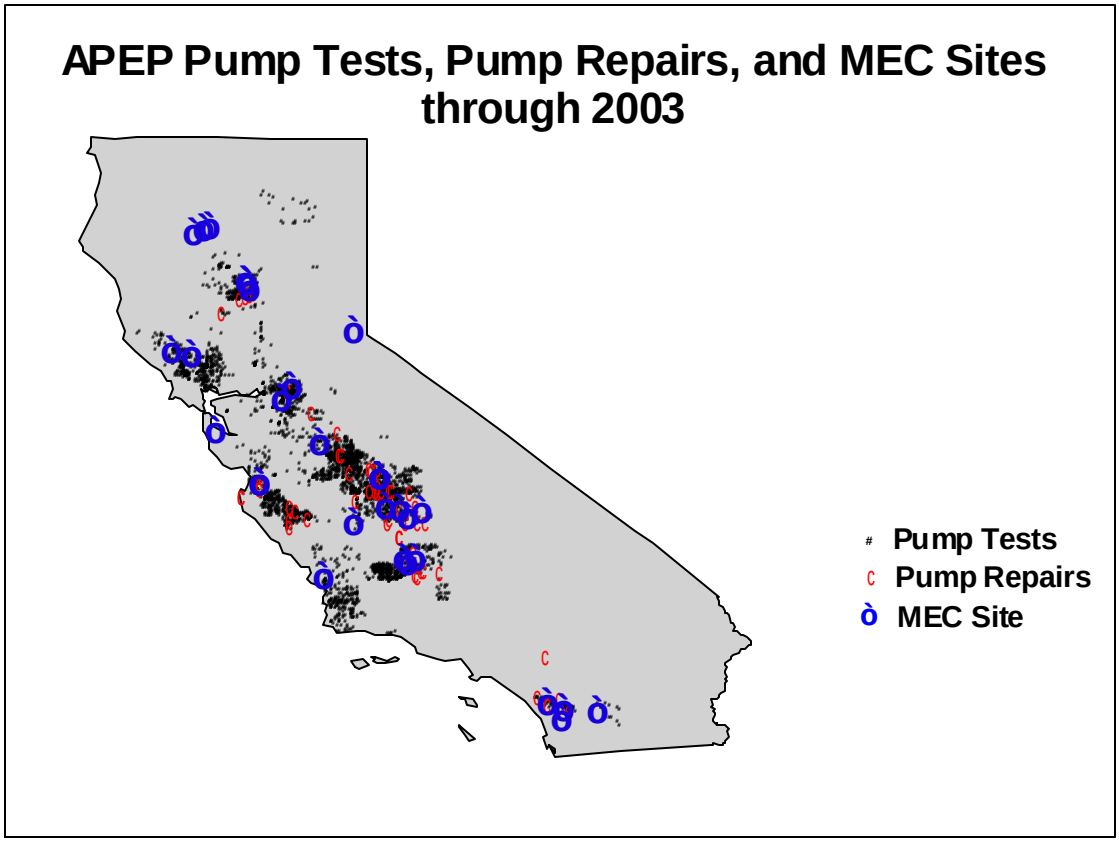
Both quantitative and qualitative approaches were used to analyze the data collected by the evaluation team.

1.1 Verification Results

The program exceeded the goal of 32 educational seminars, with 34 events in 2002 and 2003. There are continuing seminars slated for 2004 before the program funding cycle is completed. The program is assumed to have most likely met the goal of 5,000 pump tests, as 4,132 pump tests had occurred by December 2003 and will continue through the end of the program funding cycle. According to data through the end of December, 2003, the program fell short of the energy goals originally set. The ultimate percentages of energy

attained will not be known until the assessment of those funds encumbered through the end of the program is completed. The errata report will have the final energy impacts from the entire PY2002/2003 APEP. Locations of MEC seminars, pump tests, and pump repairs are shown in Exhibit 1.1.

Exhibit 1.1
Location of Pump Tests, Pump Repairs, and MEC Sites



1.2 Impact Evaluation Results

There were 62 pump repairs paid for under the program through December 31, 2003. The estimated gross energy impacts from these repairs are shown in Exhibit 1.2.

Exhibit 1.2
Gross Energy Impacts

Utility	N	Gross Impacts Through 12/31/03					
		kWh Goals	kWh Attained	% of Goal	Therm Goals	Therm Attained	% of Goal
PG&E	53	10,867,500	3,185,610	29%	56,250	-	0%
SCE	3	2,362,500	34,522	1%	NA	NA	NA
SDG&E	5	504,000	391,603	78%	9,000	-	0%
SoCalGas	1	NA	NA	NA	78,750	-	0%
Total	**62**	**13,734,000**	**3,611,736**	**26%**	**144,000**	**-**	**0%**

After the default net-to-gross ratio (NTGR) of 0.75 was applied to the gross impact values, the net impacts of the program are shown in Exhibit 1.3.

Exhibit 1.3
Net Energy Impacts

Utility	N	Net Impacts Through 12/31/03					
		kWh Goals	kWh Attained	% of Goal	Therm Goals	Therm Attained	% of Goal
PG&E	53	8,150,625	2,389,208	29%	42,188	-	0%
SCE	3	1,771,875	25,892	1%	NA	NA	NA
SDG&E	5	378,000	293,702	78%	6,750	-	0%
SoCalGas	1	NA	NA	NA	59,063	-	0%
Total	**62**	**11,017,125**	**2,708,802**	**25%**	**129,938**	**-**	**0%**

As stated previously, the ultimate energy attained by the program will not be known until the assessment of those funds encumbered through March 1, 2005 is completed.

The program is successful at reaching smaller, family-owned businesses. This is a key point since results indicate that smaller companies are less likely to make repairs. Interviews with pump test companies implied that the larger growers were more able to take advantage of pump repair incentives. The multivariate analysis conducted, which controlled for a number of factors that might influence the repair decision, did point to a positive relationship between company size and making pump repairs. The analysis conducted showed that pump repair participants used a more complex financial analysis when evaluating energy efficiency options. This is a potential reflection of the notion that larger customers and companies, which tend to have more expert staff, are more likely to make a repair. The analysis indicates further opportunities to provide additional information to customers in order to encourage them to make repairs. Many respondents suggested that they did not know about all aspects of the program or did not know that they needed to make a repair and thus were unable to participate fully in the program.

A main implication for the pump repair decision is the importance of providing program information either through an economic analysis of the pump, the APEP seminars, or MEC demonstrations. The analysis shows that all these factors have a positive impact on the likelihood that someone will make a change to their pumping system. Results also show that customers' perceived barriers to obtaining financing are low, but since a significant proportion of customers report at least some instance of not being able to make a repair or improvement because of a lack of financing, there still may be some barriers faced by customers in this regard. By providing financial assistance in the form

of incentives, the program may be able to help mitigate barriers faced by customers relating to obtaining financing

1.3 Process Evaluation Results

Two mobile energy centers were built and used for educational seminars and demonstrations throughout the state. The events were professionally presented by the APEP staff and received high ratings from the MEC participants.

The structure created at the California State University Chico site, in conjunction with the Irrigation Training Facility, was well planned with plans for future use and staffing resources to assure that the site is used as intended. No funding was encumbered toward a planned comparable site in Fresno.

Overall, the interviews and surveys developed a picture of an exceptionally well-run program that appropriately staffed positions, established good communication, developed and clearly communicated the program goals to staff and contractors, tracked progress against those goals and communicated that progress to staff. Participants showed high levels of satisfaction with their program interactions and trade allies felt that the program was doing a good job overall. While recommendations are made for potential program improvements, these are considered to be fine-tuning of the program.

1.4 Recommendations

Using the data from the analysis, the evaluation team makes the following high-level recommendations for the Agricultural Pumping Efficiency Program. The full set of recommended actions is provided in Section 6.

- The program should continue their MEC events and critically assess whether they should redouble their effort to make sure that pump testers explain the economic analysis to the pump test participants and thoroughly review the results of the pump test. Results show that customers who had a pump repair were more likely to agree that the pump testers explained the economic analysis, thoroughly reviewed the results of the pump test, and found the results more useful.
- Based on the responses of the participants in the CEC program and the ways in which APEP repair participants found out about the program, APEP should explore marketing to trade allies to help increase awareness of their program in the customer base.

2 Overview

In 2002, the California Irrigation Technology (CIT) Agricultural Pumping Efficiency Program (APEP) was awarded funding from the California Public Utilities Commission (CPUC) to provide an incentive-based energy efficiency program for Program Years (PY) 2002 and PY2003.

Due to contractual issues beyond the control of the APEP, the program began on October 1, 2002. The original end date was slated for December, 2003. However, as many programs began late in 2002 (due to similar contractual issues), upon request, the CPUC provided an extension for all such programs. The APEP program requested and received an extension. The official end date for PY2002 and PY2003 funding is March 1, 2005 with reporting to be completed by June 1, 2005.[1]

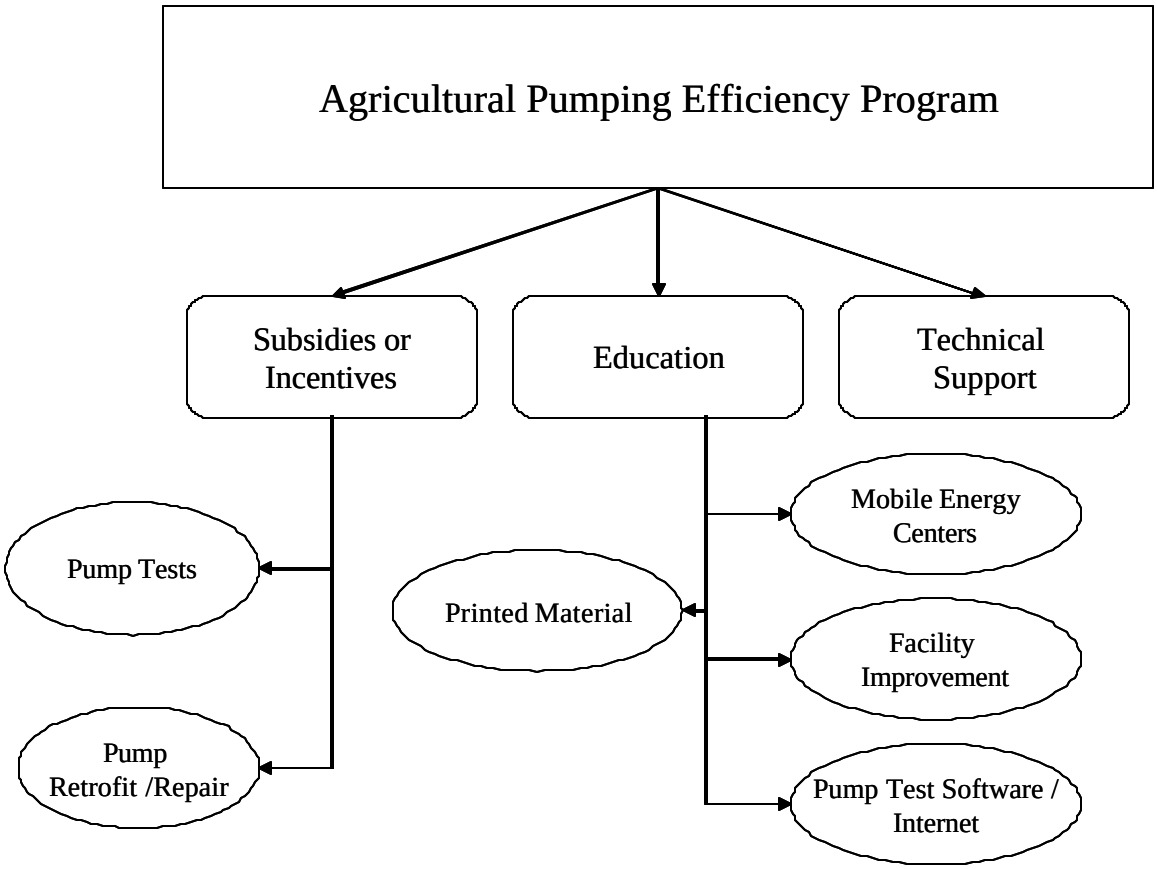
Because of timing issues surrounding data collection and deadlines required of the evaluation report, this report does not include the full energy impacts attributable to the program. An errata report is planned that will update the energy impacts to include all pump repairs paid prior to the end of the program.

2.1 Background on Program

The APEP is a multi-faceted approach to reaching agricultural customers and assuring implementation of energy efficient technologies. Energy efficiency education is provided both to a broad spectrum of growers and a targeted audience of smaller and medium-sized growers. The information is provided through multiple avenues. Once the customers become both aware and knowledgeable, the program provides financial incentives to help growers implement more energy efficient technologies. The basic structure of the program is illustrated in Exhibit 2.1.

[1] ALJ Malcolm ruling. 6/3/04.

Exhibit 2.1
Program Structure



Mobile Energy Centers (MECs) are an integral part of the program. These MECs travel around the state to grower meetings and events and provide energy efficiency information and hands-on demonstration of how a pump's efficiency can affect costs to the grower. The APEP provides information and useful "tools" (i.e., computer programs to help inform decisions) via the Internet (http://www.pumpefficiency.org/education.htm). Many pages on this website are provided in both English and Spanish. In this part of the program, information is disseminated to a broad spectrum of growers.

Technical support occurred through helping customers find pump testers or fill out forms as needed. Staff were prepared to answer questions from both customers and vendors.

Because the implementation of potential solutions requires financial investments, growers may be reluctant to participate. To reduce this cost barrier, the program provided subsidies for pump testing to determine the overall efficiency of the pumping plant, and incentives for pump repair or replacement of inefficient pumping plants.

For PY2002-PY2003, the APEP had four goals:

1. Increase awareness of problems and solutions regarding energy use for irrigation water pumping.

2. Provide technical assistance for individual problem identification and solution planning and implementation to reduce energy use for irrigation water pumping.
3. Provide incentives to aid in solution implementation.
4. Fully service small and medium-sized agricultural customers.

An evaluation of the program needed to address all aspects of the program and provide meaningful feedback to both the program implementer and the CPUC. The next section outlines the evaluation approach.

2.2 Evaluation Approach

Equipoise Consulting Inc., in conjunction with California AgQuest Consulting Inc., Ridge & Associates, and Vanward Consulting (the Team), were chosen through a competitive process to evaluate the APEP. For all evaluations in this time period, the CPUC required that a set of eight overall objectives, as well as specific EM&V components, be addressed. There were items specifically outlined by the CPUC in the Energy Efficiency Policy Manual (EEPM)[2]. These EEPM objectives and components are presented first in order to make it clear at the outset how the evaluation addressed each of them.

2.2.1 CPUC Stipulated Items

The CPUC required that a set of eight overall objectives as well as specific EM&V components be addressed in each evaluation. These eight objectives are listed and a description of the response to each is shown by:

1. referring to the appropriate section of the plan that addresses the objective,
2. pointing out that, while the evaluation will address the objective, it will be addressed at a later date in collaboration with the Program Implementer, or
3. stating that, given the nature of the program or the existence of a study that already addresses the objective, the objective is not relevant to this particular evaluation.

Each of the EM&V components is listed next.

Exhibit 2.2
CPUC Evaluation Objects

CPUC Objective	***How evaluation met this objective***
Measuring level of energy and peak demand savings achieved.	*The Team used IPMVP Option A to measure the energy impact of the program. No peak demand impacts were expected and peak demand savings were not assessed.*
Measuring cost-effectiveness (except	*The evaluation used the quarterly reports to track the pump test repairs and used the macros in the*

[2] California Public Utilities Commission. (2001) "*Energy Efficiency Policy Manual.*" Prepared by the Energy Division of the California Public Utilities Commission.

CPUC Objective	*How evaluation met this objective*
information-only)	*CPUC worksheets to calculate a TRC.*
Providing up-front market assessments and baseline analysis, especially for new programs	*Since market assessments have been completed within the last five years for this sector, a market assessment or baseline analysis was not done as a part of this evaluation. The most recent market assessments are in the References Section (Appendix A).*
Providing ongoing feedback and corrective and constructive guidance regarding the implementation of programs.	*The Team provided communication, both orally and via email, to the program manager as needed. Additionally, written feedback and recommendations are in this report.*
Measuring indicators of the effectiveness of specific programs, including testing of the assumptions that underlie the program theory and approach.	*The program theory was articulated to identify possible indicators of immediate, intermediate, and long-range outcomes. An evaluability assessment was done to determine the desirability and feasibility of obtaining these indicator data in light of the stated program objectives.*
Assessing the overall levels of performance and success of programs.	*The Team assessed the extent to which the program achieved its stated objectives through the various areas of the program evaluation.*
Informing decisions regarding compensation and final payments. (except information-only)	*The Team tracked the total kWh impact in comparison to the planned kWh objectives for the program. This information is provided in this report.*
Helping to assess whether there is a continuing need for the program.	*The Team used all the information gathered during this evaluation to help assess the need for this program in the future.*

EM&V Components for the Pump Repairs

Baseline Information

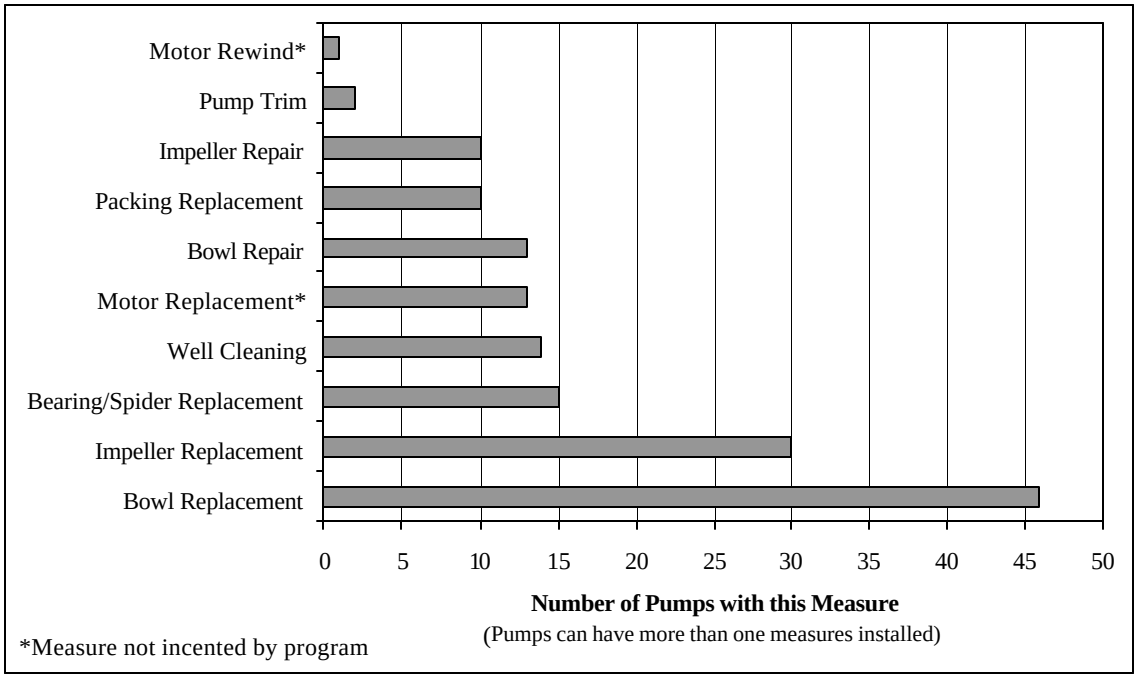
For the energy component of the program, the baseline is defined as the state of the customer's pump before program participation. The pre-repair pump tests provide all necessary data on this state before participation. The baseline information on awareness and knowledge of growers and water agencies are covered in the previous evaluation reports covered in the References Section of this plan.

Energy Efficiency Measure Information

The APEP provided incentives for measures that improved the efficiency of pumping systems. The measures ranged from new bowls for the pump to cleaning the well. Exhibit 2.3 shows the

measures installed through the APEP as of December 31, 2003. This data will be updated in a July, 2004 errata report. As can be noted in this exhibit, a single pump repair could consist of multiple measures at one time (i.e., a pump repair could have both an impeller and bowl replacement).

Exhibit 2.3
Energy Efficiency Measures Installed in the 62 Pumps Repaired



Measurement and Verification Approach

The measurement and verification of the pump repair measures was done through database and paper review of a sample of the repairs paid in each quarter. The number of pump repairs verified by this method was randomly chosen to provide the evaluation team with a 95% confidence level (± 5%) that there were no errors in the database and that the pump repair occurred. No onsite audits were feasible for these measures due to the nature of the measure.

The net-to-gross ratio that was used in the program implementation plan (0.75) was kept and used in the final evaluation of net energy impact. No net-to-gross analysis occurred in this evaluation.

Evaluation Approach

The evaluation approach used primary data collection from program staff and participants in the program to determine how the program was doing and what the impacts were of the program actions. Pump test customers, pump repair customers, and pump repair companies were surveyed by telephone while APEP staff were interviewed in person. Onsite audits were performed to collect information on the mobile energy centers and the interaction of the program with the Irrigation Training Facility in Chico. During the MEC onsite audits, surveys were collected.

2.2.2 Evaluability Assessment

The first step in any comprehensive, systematic evaluation is an evaluability assessment (EA).

> Evaluability assessment is a diagnostic and prescriptive tool for improving programs and making evaluations more useful. It is a systematic process for describing the structure of a program (i.e., the objectives, logic, activities, and indicators of successful performance); and analyzing the plausibility and feasibility for achieving objectives, their suitability for in-depth evaluation, and their acceptability to program managers, policymakers, and program operators (Smith, 1989, p. 1)

Although the evaluation team had some knowledge of the program, the evaluation of the APEP started with an EA in order to facilitate a thorough understanding of the program and focus the evaluation. While intrinsic to the evaluation process, only the highlights of the assessment are provided next. The complete write up of the EA is provided in Appendix B.

The EA produced two logic models for the APEP. One model gives a visual structure to how the program was implemented (Exhibit 2.4). The second model shows the underlying theory behind inputs of the program and the expected outcomes (Exhibit 2.5). During the EA, each of the numbered links were assessed to determine what type of information could be provided from the specific link, from whom the evaluation team would collect the specific information, and what was the priority level of each link. The completed table with priorities and details on the logic models are presented in Appendix B.

Exhibit 2.4
Program Implementation Logic Model

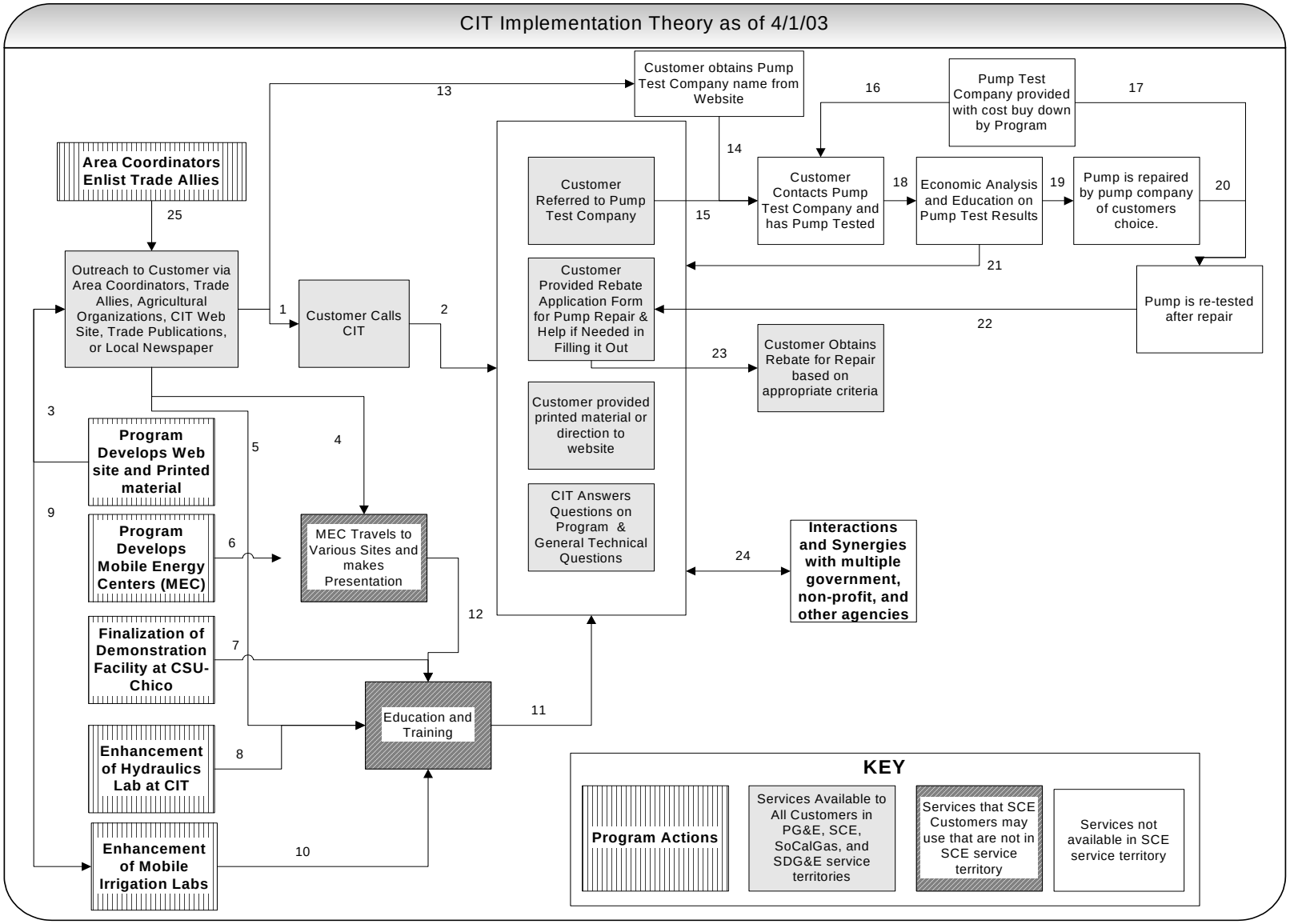
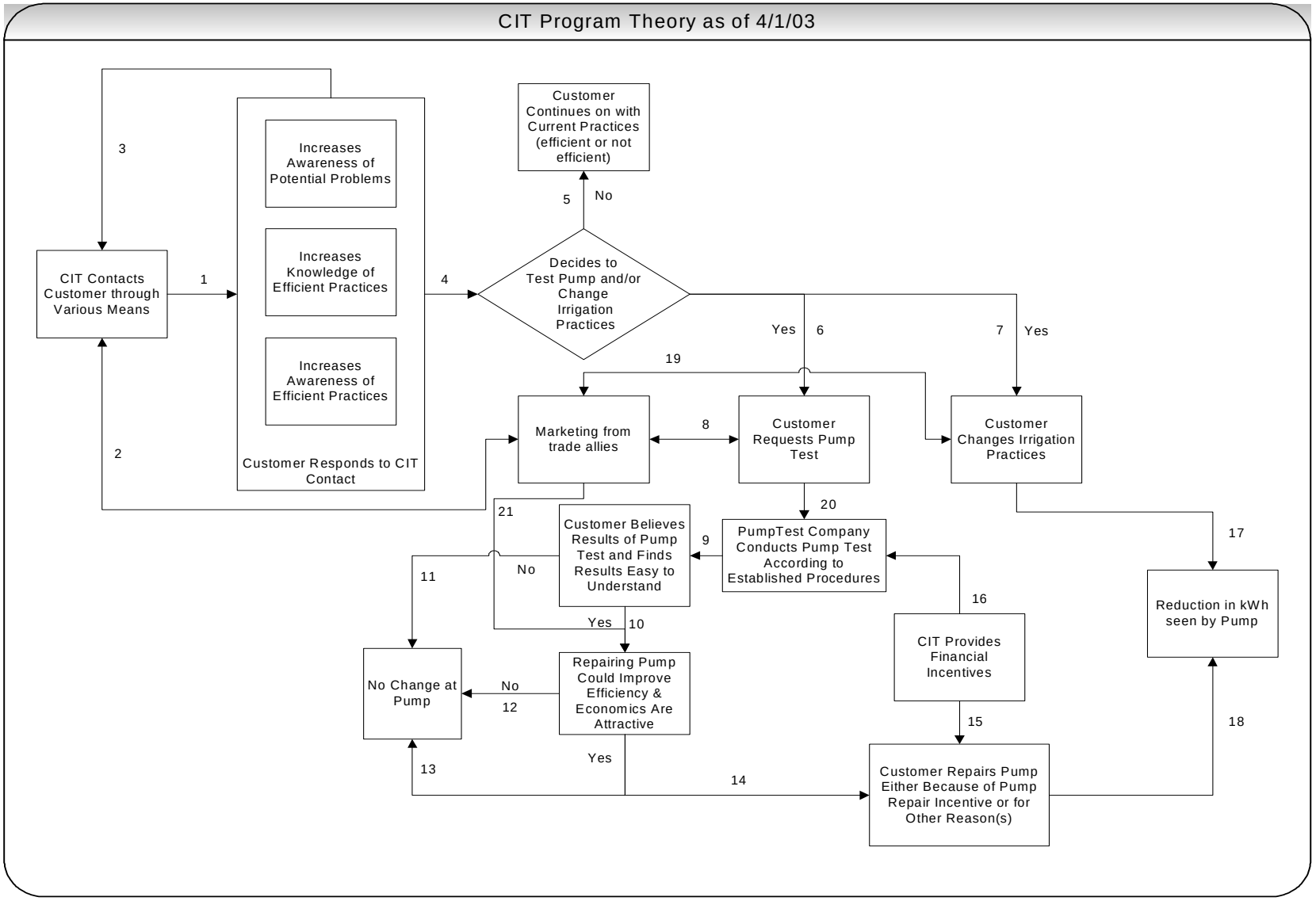


Exhibit 2.5
Program Theory Logic Model



3 Data Collection

The evaluation team gathered information from a wide variety of sources to assess the Agricultural Pumping Efficiency Program. Onsite audits were performed and pictures taken of the products created through APEP funding. Traditional telephone surveys gathered large amounts of information for quantitative assessments and in-depth interviews provided data for qualitative analysis.

The evaluability assessment provided the team with the ability to focus the data collection efforts. The evaluability assessment: 1) outlined the implementation and program theory, 2) obtained feedback from CIT on the theories, 3) agreed with CIT on which linkages will be covered in the evaluation as well as the priority of those linkages, and 4) determined the number of data points. Based on this assessment, nine data collection instruments were created:

1. Computer Aided Telephone Instrument (CATI) survey for pump test customers. (Appendix C)
2. CATI survey instrument for pump test customers who indicated that it would be beneficial to repair their pump, but did not do so. (Appendix C)
3. CATI survey instrument for pump repair customers. (Appendix C)
4. In-depth interview guide for APEP staff. (Appendix H)
5. In-depth interview guide for Pump Test/Pump Repair Companies. (Appendix I)
6. Interview instrument for Mobile Energy Clinic (MEC) participants. (Appendix L)
7. Mobile Irrigation Lab (MIL) Seminar Instrument (Appendix K)
8. Outline of points to cover during interview with Pete Canessa regarding synergies of program. (Appendix J)
9. Outline of points to cover during onsite audits of the Fresno and Chico sites. (Appendix M)

Additionally, it became clear during the evaluation that participation in the APEP may have been affected by another pump repair program (also run by the CIT). This program, funded by the California Energy Commission (CEC), was called the Agricultural Peak Load Reduction Program (APLR). Because of a decision by the CEC, the APLR had been continued from 2001 into the 2002/2003 program years. Since both the APLR and APEP provided incentives for the pump repair measure (although the programs differed in other respects), there were known pump repairs during PY2002 that could have gone toward the APEP program, but were rebated under the APLR program. With cooperation from the CEC, the evaluation team obtained contact information for pump repair participants in the CEC APRL program that had the opportunity to participate in the CPUC APEP program, but did not do so. The evaluation team created a short survey to determine these participants' awareness of the CPUC program and to attempt to determine why they chose to participate in the APLR program. This survey is called the CEC Overlapping Survey in this document with the instrument and frequencies located in Appendix C and Appendix E.

The original timing of the CATI data collection was set to collect the data, perform analysis, and write the report prior to the end of the PY2002/2003 funding cycle (February, 2004). The sample frame for data collection efforts was to be based on

participation in the program through the end of the third quarter of 2003. With the extension of the program to June, 2004, the evaluation team, in conjunction with the APEP program manager, determined that extending the sample frame to include all participants who had been paid prior to the end of 2003 would provide more information and enable the evaluation team to obtain robust data and meet specified deadlines. Although the program could encumber funds through the end of the first quarter of 2004, waiting until April, 2004 to begin data collection would cause difficulties in two areas. The timing for the evaluation team to collect data, perform the analysis, and write the draft and final reports was thought to be too short. Additionally, as the participants are agricultural customers, attempting to contact this group during spring time when crops are being planted had the possibility of biasing the results or having fewer completed surveys. As there was no change in how the program was offered in the first quarter of 2004, the likelihood of a substantive difference between participants prior to 2004 and those in the last quarter of the program (i.e., the first quarter of 2004) was thought to be quite low.

At the time the data were assessed, the evaluation team realized that a census of the population was needed as the participation numbers did not require sampling. A random value was assigned to each participant, the group was sorted by the random value, and called in that order. Participants were called four times before being considered an invalid data point. Dispositions of the surveys are provided in the respective appendices.

The population for the data collection efforts and completed survey numbers are shown in Exhibit 3.1.

Exhibit 3.1
Population and Completed Survey Numbers for Data Collection

Data Collection Effort	Population N	Completed Survey N
Telephone Survey of Pump Test Participants	664	300
Telephone Survey of Pump Repair Participants	43	29
Telephone Survey of Pump Repair Companies	48	10
Telephone Survey of CEC Overlapping Participants	75	57
In-person Interviews of APEP Staff	16	9

In addition to the data collection efforts shown in Exhibit 3.1, the evaluation team attended the one seminar for the Mobile Irrigation Labs offered in early April, 2003 and attended 11 of the 35 Mobile Energy Clinic presentations provided in 2003 (35% of the programs offered in 2003). Of the 690 participants who attended the 35 presentations,

surveys were collected for 194 participants (28% of the population). Details are presented in Exhibit 3.2 and the sites are presented graphically in Exhibit 5.1.

It should be noted that the research plan was not finalized until May, 2003. At that point, MEC presentations were attended by evaluation team members on a somewhat random basis. However, as the MEC presentation schedule was fluid from month to month, the choice of which presentations to attend was not determined through any statistical approach. The data collection effort and results to date for MEC presentations were assessed at the end of 2003. Because the variation in survey responses was minimal and it was known that the presentations were not changing in 2004, the evaluation team attended no further MEC presentations. There were an additional 10 MEC seminars in the first quarter of 2004 with 239 participants attending.

Data collection instrument #8 was created to perform an in-depth interview with the program manager to detail potentially synergistic relationships between the program and other entities. This interview, 2.5 hours in length, took place in November, 2003.

The last primary data collection effort consisted of an onsite audit of the new irrigation training facility at California State University, Chico. An interview of the director of the Chico site took place at the same time. The audit took place in July, 2003.

Exhibit 3.2
MEC Attendance and Data Collection in PY2002 and PY2003

Quarter/ Year	Date	IOU	Location	N Attended	N Surveys Completed
Q1, 2003	3/11/2003	PG&E & SCG	Southern California Edison AgTac facility in Tulare	11	0
Q2, 2003	4/9/2003 and 4/10/2003	PG&E	CSU Fresno (MIL Seminar Survey)	10	10
	4/15/2003	PG&E	Parking lot at Piccadilly Inn – University, Fresno	5	0
	5/2/2003	PG&E	Gary Wilson Ag Service, Shafter	14	0
	5/6/2003	PG&E	UC Cooperative Ext Research Center, Shafter	11	0
	5/13/2003	PG&E	CSU Chico Farm	36	0
	6/4/2003	PG&E	CSU Chico Farm	7	0
	6/6/2003	PG&E	CSU Fresno	15	0
	6/10/2003	PG&E	Ag Commissioner's Office – San Luis Obispo	9	0
	6/12/2003	SDG&E	Castle Creek Country Club – Escondido	23	0
	6/13/2003	SDG&E	San Diego County Farm Bureau – Valley Center	14	0
	6/17/2003	SDG&E	Mission Resource Conservation District – Fallbrook	16	0
	6/18/2003	PG&E	Harris Ranch (I5 and Hwy 198	27	0
	6/24/2003	PG&E	UC Cooperative Extension – Stockton	25	25
	6/28/2003	PG&E	Rural Development Center – Salinas	15	0
Q3, 2003	7/10/2003	PG&E	Half Moon Bay	21	16
	8/13/2003	PG&E	Weimer Irrigation Atwater	33	22
	9/9/2003	PG&E	Ag Tac Facility Tulare	11	10
	9/25/2003	SDG&E	Borrego Springs	51	0
Q4, 2003	10/6/2003	PG&E	Exeter	15	13
	10/9/2003	PG&E	CSU Fresno	25	15
	10/16/2003	PG&E	Armona	15	15
	10/21/2003	PG&E	Redding / Shasta College (Morning, Afternoon, and Evening Seminars)	58	0
	10/22/2003	PG&E	Durham Pump	30	0
	10/23/2003	PG&E	Durham Pump	19	0
	10/30/2003	PG&E	Salinas	19	0
	11/7/2003	PG&E	South Lake Tahoe	13	0
	11/12/2003	SoCalGas	Natural Gas Seminar Shafter	28	23
	11/13/2003	PG&E	CSU Fresno	29	0
	12/8/2003	PG&E	Lodi	15	14
	12/10/2003	PG&E	Healdsburg - AM & PM Seminars	39	31
	12/16/2003	SoCalGas	CSU Fresno	31	0
2002 / 2003	**Total**			**690**	**194**

= MEC attended by evaluation team member

In addition to the primary data collection that occurred, the evaluation team performed verification of the number of pump tests and pump repairs through 2003. Following the procedure outlined in Section 4.1.1, the evaluation team requested and verified the data as indicated in Exhibit 3.3.

Exhibit 3.3
Data Points for Verification

Verification Period	APEP Pump Tests		APEP Pump Repairs	
	N of Population	N of Verification	N of Population	N of Verification
Through 2nd Q 2003	1,381	91	19	16
3rd Q 2003	2,314	93	24	19
4th Q 2003	411	79	18	15
Data Points Missed by Verification*	26	0	1	0
Total through 2003	**4,132**	**263**	**62**	**50**

*Pump tests were not verified due to database issues as discussed in the memo of 8/4/03. One pump repair was inadvertently left out of verification by evaluation team.

The energy impacts in this report were calculated using the 62 data points shown above. As indicated earlier, the evaluation team plans an additional errata report that will cover the pump tests and pump repairs through the time when the program can encumber funds. Those data points will be verified and the energy impacts calculated to provide the complete energy impacts for the PY2002 and PY2003 funding cycle.

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4 Evaluation Method

This section provides the methods used in the evaluation. The results of the evaluability assessment align with the method rationale.

The APEP is a complex program, involving the coordination of numerous staff members, who are each responsible for carrying out various activities. The allocation of evaluation resources had to take into account the allocation of program resources. In reviewing quarterly reports of the program, it was discovered that resources directed specifically toward activities to be evaluated (i.e., not program administration costs) could be broken down into three components, as shown in Exhibit 4.1. Additionally, of the four program-level goals, Exhibit 4.1 indicates a loose alignment of the goals with each program component.

Exhibit 4.1
Program Resources & Goals

Component	Program Activity Resources	Program Goals
Incentives	39%	⇨ Provide incentives to aid in solution implementation.
Education Pump Testing Seminars MEC & Labs	56%	⇨ Fully service small and medium agricultural customers. ⇨ Increase awareness of problems and solutions regarding energy use for irrigation water pumping.
Technical Assistance	5%	⇨ Increase awareness of problems and solutions regarding energy use for irrigation water pumping. ⇨ Provide technical assistance ⇨ Fully service small and medium agricultural customers

Exhibit 2.2 makes it clear that, while much of the program resources were devoted to the subsidies/incentives component, this component addressed only one of the program-level goals. On the other hand, technical assistance had the smallest amount of program resources but addressed the largest number of goals. In terms of the evaluation, it was clear that evaluation resources should not be allocated based purely on program activity resources, but also according to the number of program goals addressed by each component.

An alternate view of the allocation of evaluation resources was that areas where the least information is available and the uncertainty is the greatest should have the greatest

allocation of resources. For the APEP, the pre- and post-repair pump tests and the repair invoices required for program participation supplied the vast majority of the information needed to assess impacts for the Subsidies/Incentives component. However, there was very little information available on the affect of the Education or Technical Assistance components. Thus, it was necessary to allocate more evaluation resources to these components, despite the fact that they represented a relatively small proportion of total program spending.

The evaluation consisted of three distinct activities in order to provide the needed information:

1. Measurement and verification of the Subsidies/Incentives component,
2. Measurement of the impact of the information component of the program, and
3. An integrated assessment of the APEP implementation activities via a process evaluation.

Each of these areas is detailed next.

4.1.1 Incentive Component Verification

This part of the program provided incentives to undertake a capital investment and make a change to pumping equipment. This program component was designed to generate energy savings, and thus, was required to undergo a measurement and verification. A second part of the incentive component included dollars provided directly to pump test companies in order to offset the cost of a customer's pump test. While there were no energy impacts from these tests, a verification of the payment interaction was performed by the evaluation team.

The CPUC had stipulated that measurement and verification of local programs must adhere to guidelines in the International Performance Measurement and Verification Protocol (IPMVP). For the APEP, Option A of the IPMVP was the most appropriate approach to use. This is called the Partially Measured Retrofit Isolation approach in which savings are determined by partial field measurement of the energy use of the system to which an energy conservation measure (ECM) is applied. It is an engineering calculation using post-retrofit measurements and stipulations. In this case, the pre- and post-retrofit pump tests[3] supplied the majority of the parameters of the energy savings with billing data used to obtain estimated annual energy savings. Billing data that were the stipulated parameter within this option.

It must be realized that the IPMVP is a set of protocols that outline requirements for sites, not for entire programs. Under these guidelines, each grower who implements an energy saving measure affecting the pump would be required to have a post-retrofit pump test. Since this occurred as part of the program implementation, no deviation was found from IPMVP Option A.

The measurement of the energy savings is shown in the algorithm used to calculate energy savings from the pump repairs, shown in Exhibit 4.2.

[3] The program will pay for either the pre- or post-repair pump test, but not both.

Exhibit 4.2
Program Energy Impact Algorithm

$$\text{Program Impact} = \sum_{i=1}^{j} kWh_{12\,months,\,i} * \left(1 - \frac{OPE_{pre,\,i}}{OPE_{post,i}}\right)$$

Where:

j = number of pump repair participants

kWh = 12 months of actual billing data from the pump, assumed to be pre-repair in most cases, this data obtained from the grower. This value would be therms in the case of a natural gas engine pump.

OPE = operating pump efficiency, pre and post, from pump tests on that pump

There were five pump repair sites where an OPE could not be determined. For example, one site's well could not be sounded. While the OPE could not be calculated, another value (the kWh/acre foot of water pumped) was provided from the pre-retrofit and post-retrofit tests. For four of the five sites, the algorithm shown in Exhibit 4.3 was used.

Exhibit 4.3
Alternate Energy Impact Algorithm

$$AF_i = kWh_{pre} * \left(\frac{AF}{kWh}\right)_{pre}$$

$$kWh_{post} = \frac{AF_i}{\left(\frac{AF}{kWh}\right)_{post}}$$

$$kWh\ \text{Impact} = kWh_{pre} - kWh_{post}$$

Where:

i = pump repair site

kWh_{pre} = 12 months of actual billing data from the pump, assumed to be pre-repair in most cases, this data obtained from the grower

AF/kWh = pre and post values from pump test

The fifth site without either a pre- or post-repair OPE was a natural gas engine. This case is slightly different because of the fact that there were pump tests performed by two different entities. SoCalGas performed both a pre- and post-repair pump test on this pump with much information on the gas usage. The other pump test company did not provide therm information and no OPE or therm/AF value could be determined for either their pre- or post-retrofit test. However, the timing of the four tests and the known values create difficulties that could not be surmounted. The data are:

- 5/9/02 – Engine tune-up by SoCalGas. Water flow rate (gallons per minute, GPM) of 1,200 before tune-up and 1,500 after tune-up with the RPM at 1750. The flow rate cannot actually change by this much if the RPM remains the same unless the pumping water level is still pulling down for the tuned test. No depth of water listed, so no total head available. No OPE can be calculated. (Pre-Test data).
- 10/3/02 – Pump test by participating pump test company. Water flow rate at 743 GPM. No therm use information. No OPE can be calculated. (Pre-Test data).
- 8/27/03 – Engine test by SoCalGas. Water flow rate at 1,728 GPM. OPE = 0.62. (Post-Test data).
- 10/26/03 – Pump test by participating pump test company. Water flow rate at 1,800 GPM. No therm use information. No OPE can be calculated. (Post-Test data).

The pump was repaired in March, 2003. Therefore, just prior to the pump repair, the pump provided only about half of the water flow rate as after the repair, and one can assume that the OPE would be based less on the empirical data from the first SoCalGas test. However, the data do not support a positive impact for this pump, although there most likely was improvement in the efficiency of the pump. The evaluation team conservatively set the impact to zero for this site.[4]

While the evaluation team relied on the data from the program to calculate energy impacts attributable to the program, a complete verification of the data occurred on a quarterly basis. The quarterly data assessment served two functions. First, it formed a validation of the program's progress toward attaining its program energy goals. Second, it allowed the evaluation team to review the data be sure that the data needed for the project evaluation were being collected and correctly entered into the program database. The latter assessment also indicated areas of the database that required attention.

At the end of each quarter, the evaluation team received the program tracking database from the program manager. From that data, a sample size was calculated based on the population of tests and repairs in that quarter. The sample was pulled using the following assumptions:

- Results of verification would be accurate at the 95th percentile
- Expected percentage of valid occurrences in the population set to 90% (conservative value)
- Finite population correction factor used

The following algorithms were used to calculate the sample size:

$$nsample = \frac{t^2 * p * (1-p)}{d^2} \quad (1)$$

[4] It is noted that, following the policies of the program, the customer received an incentive for the repair work on this pump.

$$nfinite = \frac{nsample}{\left(1 + \frac{nsample}{N}\right)} \quad (2)$$

where:

t	=	1.645 (95% confidence level for a one-tailed test with infinite degrees of freedom)
p	=	expected percentage of valid occurrences in the population (0.9)
d	=	desired level of accuracy (0.05)
N	=	population size
Nsample	=	required sample size without the finite population correction
Nfinite	=	required sample with finite population correction

For the sampled records, the evaluation team assessed the total number of cells within each database table that contained data, provided a subjective indicator of the importance of the data for both program and evaluation purposes, and subjective comments on the data populating the cells for each variable.

Once the electronic verification of the data was completed, ten records from the sampled group were randomly selected for visual verification of hardcopy data. The visual verification for the pump tests used four items: 1) invoice from the pump tester that was associated with this test, 2) a record with a signature of the recipient that indicated they received the test results, 3) a picture of the test site, and 4) the site access agreement. The visual verification for the pump repair used five items: 1) application with the signature included, 2) paid invoice and notice of project completion, 3) pre-repair pump test, 4) post-repair pump test, and 5) payment authorization. (Specific population numbers and points requested for verification are shown in Exhibit 3.3.)

The inclusion of pump tests and pump repairs in this part of the evaluation plan did not mean that this was the only evaluation of these measures. This section refers to the calculation of the energy impact and auditing part of the verification of the energy impact. However, the interactions between growers, pump testers, and the relationship between pump tests and pump repairs were addressed in other parts of the evaluation.

4.1.2 Evaluation Methodology

This sections provides an explanation of the analytical techniques used to carry out:

1. the impact evaluation, which involved testing the hypothesized causal linkages illustrated in the Program Theory.
2. the process evaluation which involved an analysis of the program linkages described in the Implementation Theory, and

The evaluability assessment culminated in a set of hypotheses about the implementation and impact of the program. The research data collection was designed to attempt to determine if the hypotheses were confirmed. Exhibit 4.4 presents the hypotheses and the data source used to test the hypotheses.

Exhibit 4.4
Research Hypotheses

Hypotheses Regarding Program Activities, Outputs and Outcomes	Link*	Source of Data							
		Pump Test / Pump Repair Company	Customers with Pumps Tested	Customers with Pumps Repaired	Pump Test Customer with Good Financial but No Repair	On-site Audit	APEP Staff	MEC Seminar Participants	Database
Activities									
APEP had interactions and synergies with other agencies.	-						X		
Planned mobile energy centers were created and used	-					X			X
Planned facility enhancements occurred	-					X			
Outputs									
The program flows smoothly. There are enough staff to perform the needed duties. Program staff are aware of the objectives of the program.		X					X		
APEP has met the required number of pump tests and pump repairs.	-								X
Customers are interested in receiving pump test results	I18		X		X				
Customers receive and understand an economic analysis of the pump test	I18	X	X		X				
Customers learn something from the economic analysis provided by the pump tester	I18		X		X				
Customers are satisfied with the process in getting a pump test and the results	I13, I14		X		X				

Hypotheses Regarding Program Activities, Outputs and Outcomes	Link*	Source of Data							
		Pump Test / Pump Repair Company	**Customers with Pumps Tested**	**Customers with Pumps Repaired**	**Pump Test Customer with Good Financial but No Repair**	**On-site Audit**	**APEP Staff**	**MEC Seminar Participants**	**Database**
Pump testers provide relevant information regarding the pump test to their customers	I18	X	X		X				
Pump testers feel that the process between them and APEP is working	I13, I14, I15	X							
Pump testers feel the buy-down provided by the program is adequate	I16	X		X					
Outcomes									
Pump repairs save energy	-								X
Customers are more aware of potential problems with their pump.	P1, P3		X	X	X			X	
Customers are more aware of solutions for problems	P1, P3			X				X	
Customers have more knowledge of solutions for problems	P1, P3			X				X	
Customers become aware of pump testing availability thru APEP seminars	P6, P7		X						
Most customers select pump testing versus changes in irrigation practices	P6, P7			X					
Customers use the results of the pump test to help decide to repair their pumping system.	P9, P10,P11			X					
Expected improvements in OPE from pump repair are verified by post-repair pump test results	P18								X

Hypotheses Regarding Program Activities, Outputs and Outcomes	Link*	Source of Data							
		Pump Test / Pump Repair Company	**Customers with Pumps Tested**	**Customers with Pumps Repaired**	**Pump Test Customer with Good Financial but No Repair**	**On-site Audit**	**APEP Staff**	**MEC Seminar Participants**	**Database**
Trade allies bring in more pump repairs than would otherwise have been obtained	P21	X	X						
An appropriate incentive amount would have moved the customer to getting a pump repair	P13				X				
There are many factors that determine when a pump is repaired.	P14, P15		X	X					

*See Implementation Logic Model (Exhibit 2.4) for links starting with "I" and Program Theory Logic Model (Exhibit 2.5) for links starting with "P".

A small part of the evaluation reviewed the Internet website and provided simple information about what is included on the site. As this is a very small portion of the overall program, few resources were allocated to this assessment.

4.1.3 Impact Evaluation

With respect to the impact evaluation, those linkages associated with IDs 7 through 14 in Appendix B were examined through both descriptive and inferential statistics. The team analyzed the extent to which contact with the CIT Program had increased the level of awareness of potential problems, as well as awareness and knowledge of efficiency practices among those who had their pumps tested, those who had their pumps repaired, and those who attended a MEC seminar. These analyses focused on whether there are any differences across a variety of firmographic characteristics including size and type of irrigation system.

One key analysis sought to explain why customers with positive pump test results decide to repair their pump while others who also had positive pump test results decided not to repair their pump. A number of variables were examined including firmographic variables, if the customer believes the pump test results or finds them useful, the quantity and quality of economic data provided by the pump tester, and overall satisfaction with the pump test. For example, customers who have little confidence in the information provided in the pump test and do not find the payback estimates credible may have a lower probability of deciding to repair their pumps. Such a finding would help to validate the Program Theory and reinforce the importance of providing pump test results and simple paybacks that are credible. While the focus of this analysis was on Linkages 13 & 14 in the Program Theory (shown in Exhibit 2.5), it must be added that analysis examined only the relative importance of a number of program and participant firmographic variables and did not seek to determine what the participants would have done in the absence of the program.

These data were analyzed using a binary logit model, which regressed a binary variable (where 1 equals participant repairs pump and 0 equals participant does not repair pump) on the variables described above. Variables that are strongly related to an increased probability of repairing a pump were identified. The logic model below was used to conduct this analysis.

$$P_{r_i} = \frac{e^{\sum_{k=1}^{K} b_k x_k}}{1 + e^{\sum_{k=1}^{K} b_k x_k}} \qquad (1)$$

where

P_{r_i} = *the probability of repairing a pump for the i^{th} customer*

x_i = *the vector of explanatory variables corresponding to the i^{th} customer that affect the choice to repair a pump*

b = *the vector of estimated coefficients that maximizes* P_{ri}.

A second logic model was estimated that sought to identify which program and firmographic variables best explained why customers chose to change their irrigation practices, Linkage 7 in the Program Theory.

In these two models, there were three basic types of variables: 1) binary variables, 2) interval variables, and 3) variables that represent the interaction of a binary variable and an interval variable.

4.1.4 Process Evaluation

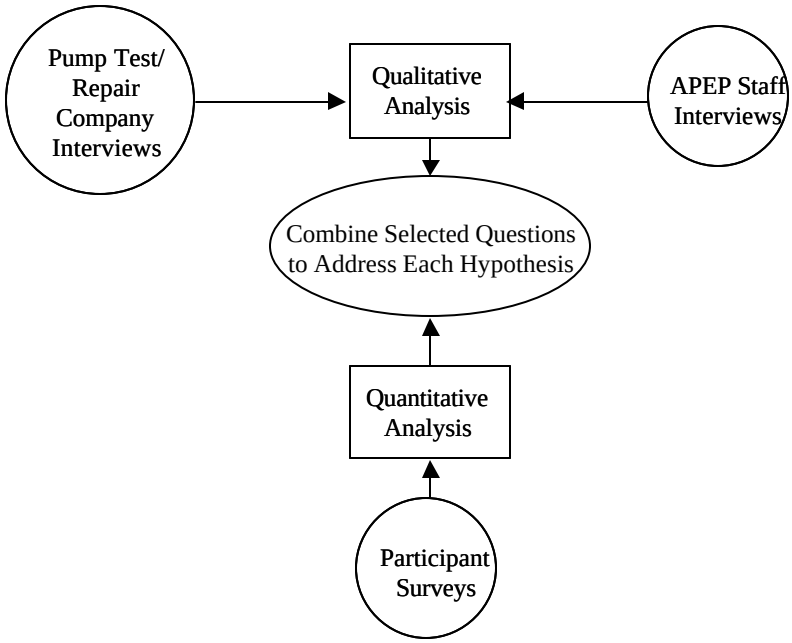
Process evaluations can have more than one purpose. One type of process evaluation helps "provide ongoing feedback and corrective and constructive guidance regarding the implementation of the program." This type of evaluation is directly called for in the CPUC manual. When addressing this objective, the evaluator works very closely with the Program Implementer and determines potential kinks in information flow that can be altered within or across program years. This is commonly accomplished by performing in-depth interviews of a cross-section of program staff, and using that information to form an image of how the program operates in practice. By comparing this information to the program design, bottlenecks or other issues inhibiting optimal operation of the program can be identified. Data collected from other participants in the program process can further enhance this picture and improve the targeting of program resources. Questions concerning the operation of the program from the participants' perspective were included in the surveys performed for the impact component of the evaluations. Other major actors in the fielding of the program were the pump test/pump repair companies. A set of in-depth interviews was conducted with companies who participated in fielding the program, asking them to opine, from their perspective, on the operation of the program.

All of this information was then analyzed using various techniques to allow the evaluation team to draw conclusions. Since the sample sizes were large enough to allow it, the participant telephone survey techniques were analyzed statistically, where applicable. The in-depth interviews with program staff and pump test/pump repair companies were designed to probe for less quantifiable responses and generally resulted in open-end descriptive responses. Thus, these results were analyzed qualitatively.

These three different types of data analyses were then combined to address each of the research hypotheses identified in Exhibit 4.4 under the subheading "Activities/Outputs". These are the research hypotheses that address the operation of the program. The overall analyses on a question-by-question basis that was conducted for the process analysis can be found, by type of data collection, in Appendix O.

Exhibit 4.5 depicts the process evaluation approach, including the type of analysis generally used with each type of data.

Exhibit 4.5
Process Analysis Overview



Any critical issues on program operation identified by the process evaluation were provided by the evaluation team on an informal basis throughout the year. This report formally documents all issues that surfaced in the evaluation. The process evaluation was also used to attempt answer questions about why there are differences in outcomes of the program activities.

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5 Results and Conclusions

This section covers the results of the analysis as well as conclusions and recommendations from the evaluation.

5.1 Verification of Savings

There were no inconsistencies in the database or hard copy information found in the verification process. This was a very thorough database that was kept up-to-date by the program. The hard copy data sent to the evaluation team were clearly labeled and easy to follow. Any questions that arose during the verification process were quickly answered by program staff.

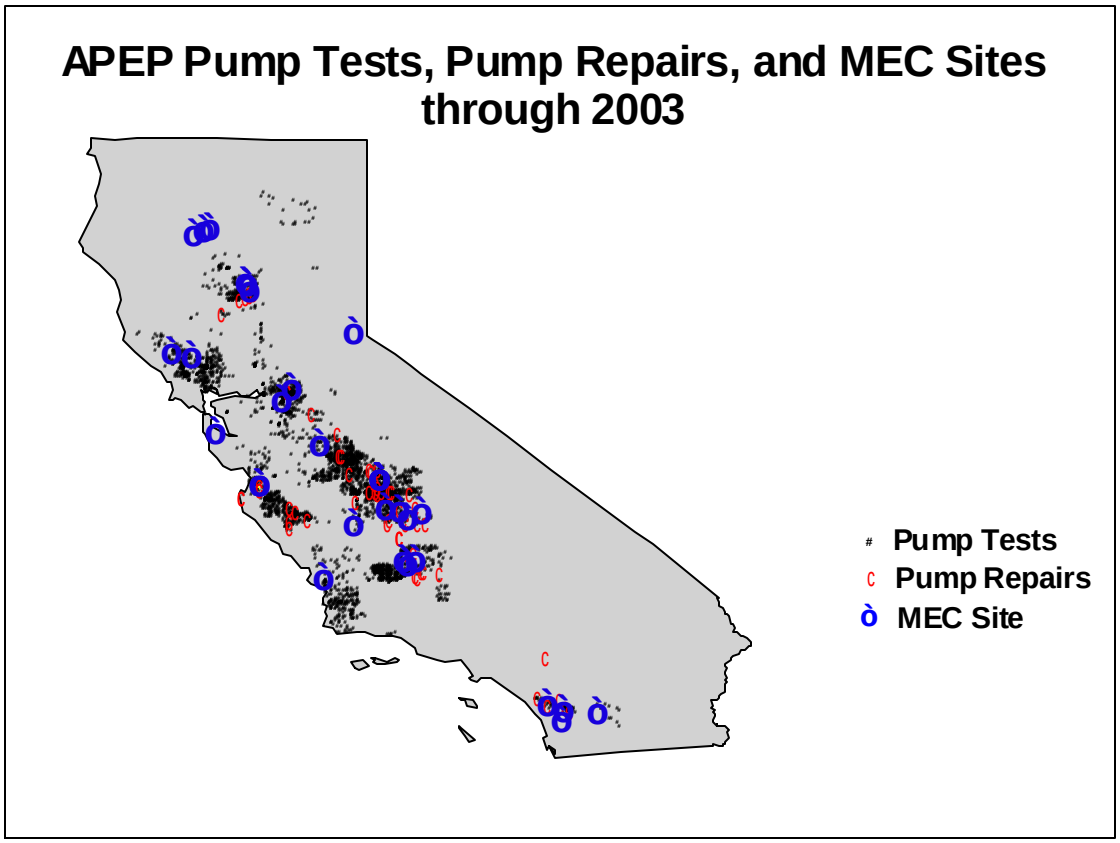
Quarterly verification of energy impacts from pump repairs and pump test numbers was performed. Memos were sent to the program manager as follows:

- August 4, 2003 – Covered all pump tests and pump repairs in the program from the beginning of the program to June 30, 2003.
- October 21, 2003 – Covered pump tests and pump repairs from July 1, 2003 to September 30, 2003.
- January 28, 2004 – Covered pump tests and pump repairs from October 1, 2003 to December 31, 2003.

These three memos are included in Appendix N.

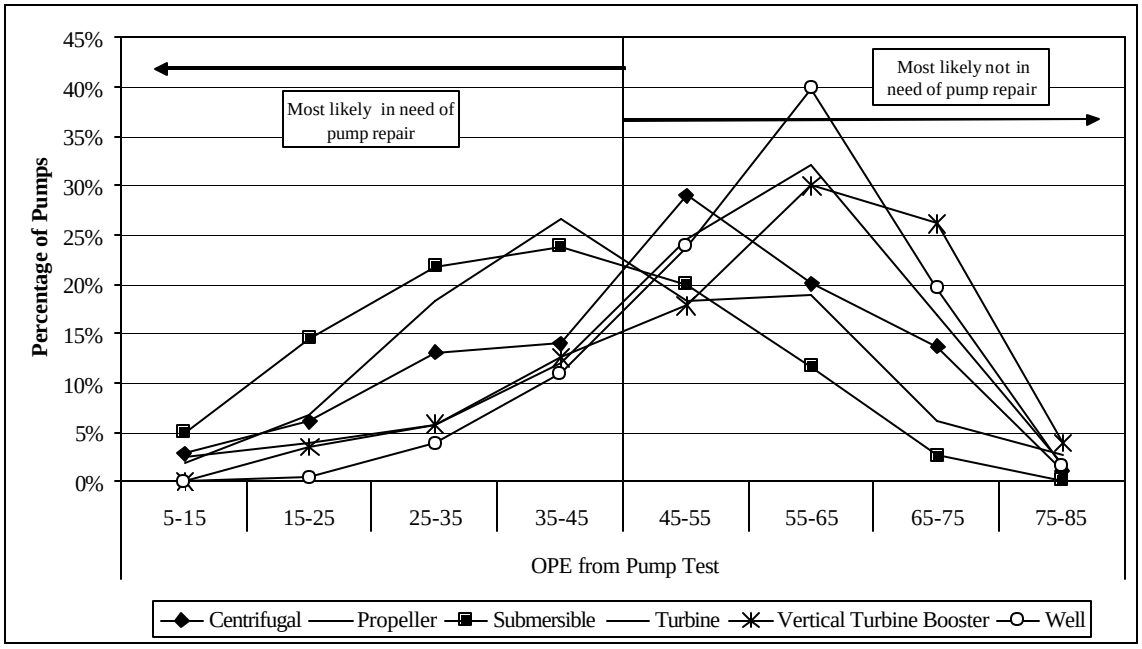
The locations of the pump tests and pump repairs are shown in Exhibit 5.1. Plant efficiency data from pump tests were also analyzed to determine the percentage of pumps tested that appeared to be in need of repair.

Exhibit 5.1
Location of Pump Tests, Pump Repairs, and MEC Sites



As shown in Exhibit 3.3 and graphically indicated above, there were 4,132 pump tests and 62 pump repairs through the APEP from program inception to the end of 2003. Exhibit 5.2 shows the percentage of the tests by OPE bin.

Exhibit 5.2
Pump Test OPE



*Only pump types with more than 15 tests and pumps with an OPE greater than 5 included in chart. N=3,740.

One indication of the need for a pump repair for most types of pumps is an OPE less than 45. (Submersible pumps may need a repair at an OPE of 35.) Based on that criterion, about one third of the pumps tested and shown in Exhibit 5.2 appear to be in need of a repair. However, larger pumps (greater than 200 hp) may be in need of a repair if the OPE is even 5% lower than what is considered the ideal OPE because large pumps generally run longer and a small difference in OPE can make a large cost difference (ideal OPE from APEP database and varied from 42 to 75). Also, if the pump is more than 25% lower than the ideal OPE, a pump repair is probably needed. The data were analyzed further using these criteria (i.e., if greater than 200 hp and OPE not within 5% of the ideal OPE, or if less than 200 hp and OPE not within 25% of the ideal OPE) and are shown in Exhibit 5.3.

Exhibit 5.3
Tested Pumps In Need of Repair

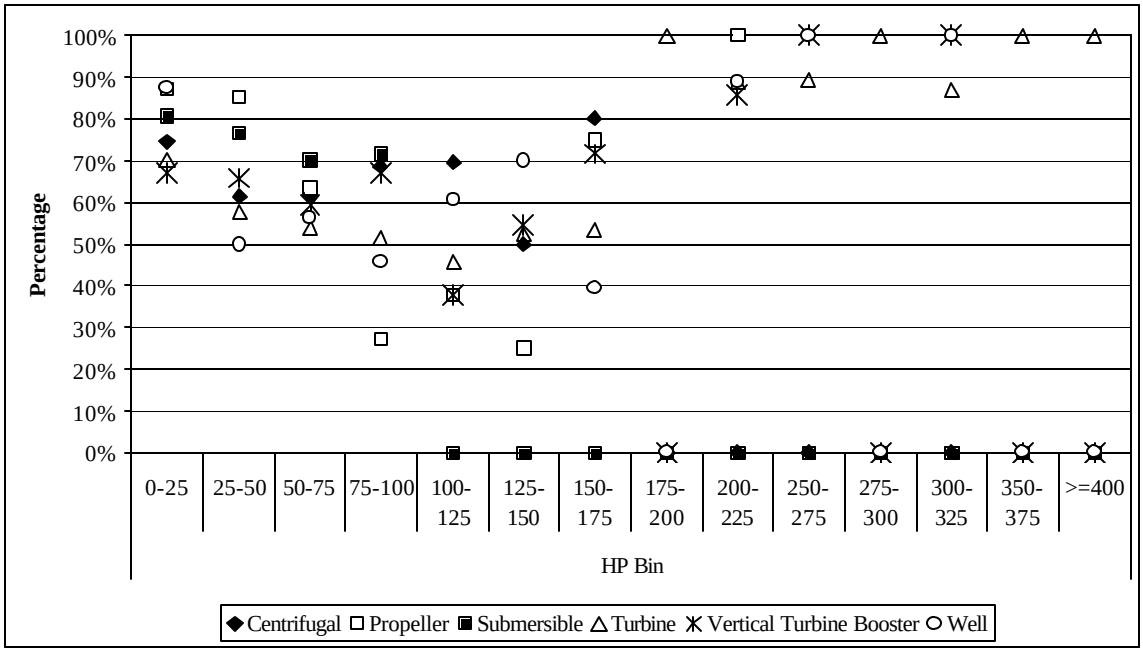


Exhibit 5.3 indicates that almost all of the larger horsepower pumps that were tested needed a repair as well as the majority of smaller pumps. While other portions of the report discuss interactions with customers or impacts on customers, another aspect of determining why pump repairs are not done, even when customers think they are needed, is most likely the capital cost of the work. The APEP database contained the actual project cost for each of the 62 pump repairs with incentive payments. On average, a pump repair done for program participants costs $12,700, with a standard deviation of $7,500. The incentive typically covered 22% of the project cost, or about $2,800, with a standard deviation of 16%. Section 5.2.2.5.2 provides data on why customers chose not to perform a pump repair – cost was part of this picture.

5.2 Impact Results

There are energy impacts from the pump repairs and program impacts on awareness or knowledge. The energy impacts are discussed first.

5.2.1 Energy Impacts

There were 62 pump repairs paid for under the program through December 31, 2003. The gross energy impacts from these repairs are shown in Exhibit 5.4.

Exhibit 5.4
Gross Energy Impacts

Utility	N	Gross Impacts Through 12/31/03					
		kWh Goals	kWh Attained	% of Goal	Therm Goals	Therm Attained	% of Goal
PG&E	53	10,867,500	3,185,610	29%	56,250	-	0%
SCE	3	2,362,500	34,522	1%	NA	NA	NA
SDG&E	5	504,000	391,603	78%	9,000	-	0%
SoCalGas	1	NA	NA	NA	78,750	-	0%
Total	**62**	**13,734,000**	**3,611,736**	**26%**	**144,000**	**-**	**0%**

After the default net-to-gross ratio (NTGR) of 0.75 was applied to the gross impact values, the net impacts of the program are shown in Exhibit 5.5.

Exhibit 5.5
Net Energy Impacts

Utility	N	Net Impacts Through 12/31/03					
		kWh Goals	kWh Attained	% of Goal	Therm Goals	Therm Attained	% of Goal
PG&E	53	8,150,625	2,389,208	29%	42,188	-	0%
SCE	3	1,771,875	25,892	1%	NA	NA	NA
SDG&E	5	378,000	293,702	78%	6,750	-	0%
SoCalGas	1	NA	NA	NA	59,063	-	0%
Total	**62**	**11,017,125**	**2,708,802**	**25%**	**129,938**	**-**	**0%**

For the data through the end of December, 2003, the program fell short of the energy goals originally set. The ultimate percentages of energy impact attained will not be known until the assessment of those funds encumbered through the end of the program. The errata report will have the final energy impacts from the entire APEP for PY2002 and PY2003.

5.2.2 Non-Energy Program Impacts

Non-energy program impact results for the program participants are presented first, followed by the results for the pump test companies and pump dealers. Program participants are classified into three groups: pump test customers who made a pump repair; pump test customers who did not make a repair; and customers who participated in an APEP seminar or MEC demonstration.

Pump Test (PT) customers were asked about their overall program participation and, specifically, about their pump test and pump repair experiences, as applicable, whereas MEC participants were specifically asked about the impact of the APEP seminar or MEC demonstration. Thus, the bulk of the results presented here pertain to the PT customers. Although a few participants in the sample of pump test customers also attended a MEC demonstration or APEP seminar, they are not included within the sample of MEC participants. The group of PT customers is further classified into three subgroups:

1. those who needed a repair and made one,
2. those who needed a repair but did not make one, and
3. those who did not need a repair and did not make one.

The general discussion of non-energy impact results are presented for all PT customers, inclusive of these three groups; but, whenever specific comparisons are made between those who made a repair and those who did not make a repair, the focus, in particular, was on the subset of PT customers who needed a repair, because this comparison provides the most meaningful and relevant information pertaining to program performance and the hypothesized outcomes.

5.2.2.1 Firmographics

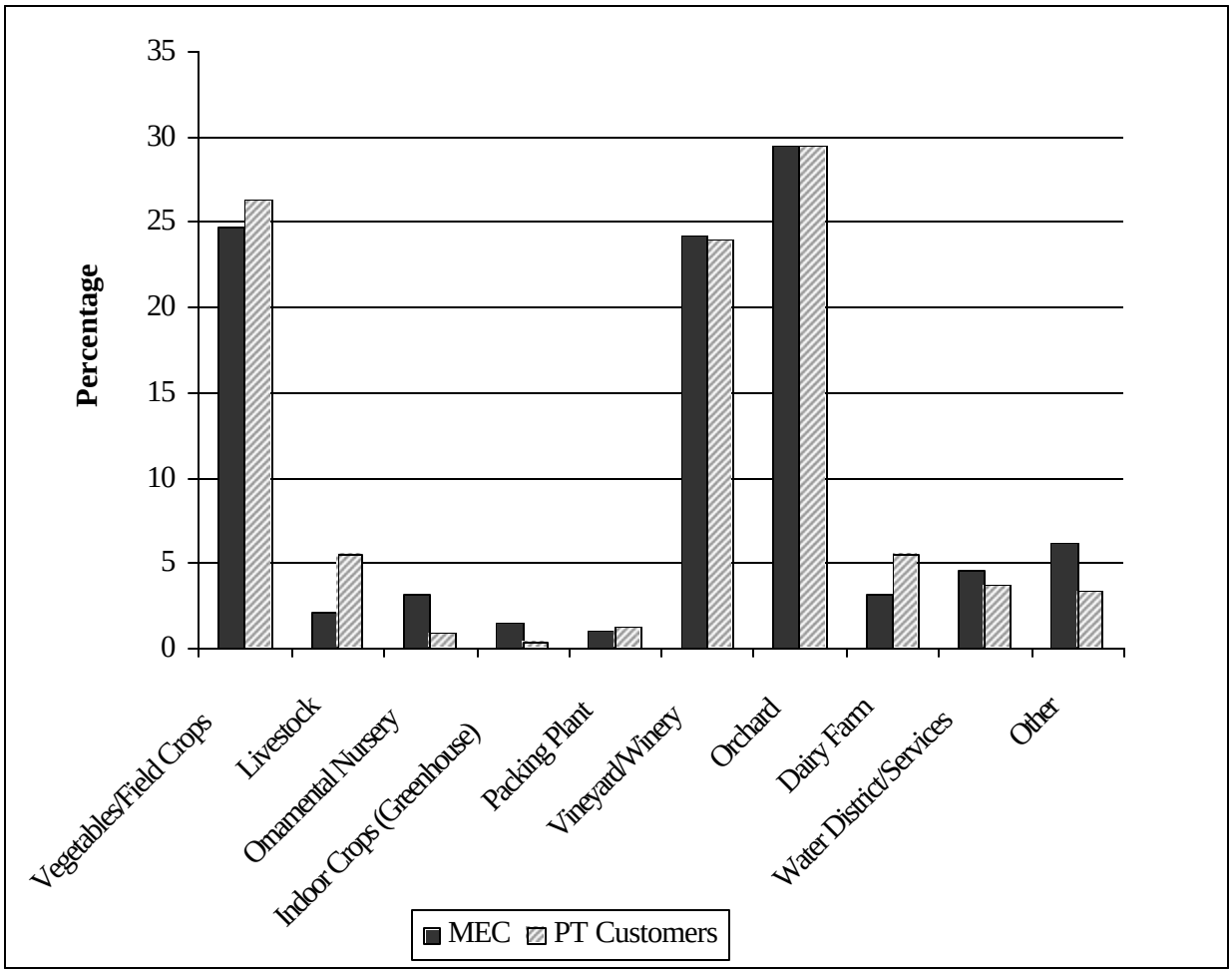
In this section, the self-reported firmographic information regarding participant characteristics is presented, including:

- Largest source of revenue
- Type of organization
- Ownership of property
- Size of organization
- Time at current location
- Number of pumps in use
- Average age of pumps
- Number of months in which pumps are in use
- Type of irrigation system used
- Percentage of total operating costs spent on electricity bills
- Type of financial method used

Exhibit 5.6 through Exhibit 5.16 below summarize these results. Information presented here is intended primarily for descriptive purposes and is reported for all surveyed customers, including MEC participants where noted. Direct comparisons between the various customer groups is presented in later sections of this report.

PT customers and MEC participants were asked about their largest source of revenue. Exhibit 5.6 presents these results.

Exhibit 5.6
Largest Source of Revenue



For PT customers, orchards comprise nearly 30% of all customers while vegetable/field crops and vineyards/wineries represent 26.3% and 23.9%, respectively. Indoor crops (greenhouses), 0.3%, and ornamental nurseries, 0.9%, are the smallest groups. Similar results were observed for MEC participants. The most frequent response was orchards, 29.4% of all responses, followed by vegetables/field crops with 24.7% of responses, and then by vineyards/wineries, 24.2% of all responses.[5] These results are not surprising as the participants are growing crops where the pumps are most used.

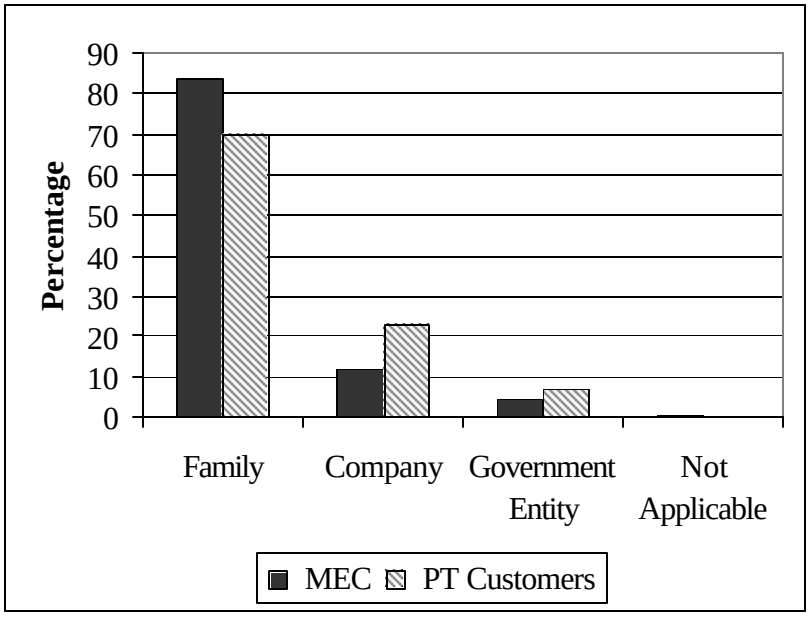
[5] MEC participants were asked to indicate all relevant responses for this question. Because respondents could give multiple responses, the indicated percentages do not add up to 100%.

Exhibit 5.7
Property Ownership

Responses		Frequency	Percentage
PT Customers	**Yes**	283	86.3
	No	45	13.7
	Total	328	100.0
MEC Participants	**Yes**	157	94.6
	No	9	5.4
	Total	166	100.

Exhibit 5.7 shows that over 86% of all PT customers and 95% of all MEC participants own the property their business occupies. Exhibit 5.8 shows that nearly 84% of all PT customers consider their business as owned by a family with the next largest percentage described as being owned by a company. For MEC participants, 70% report they consider their business as owned by a family, with 23%indicating company ownership.

Exhibit 5.8
Type of Organization



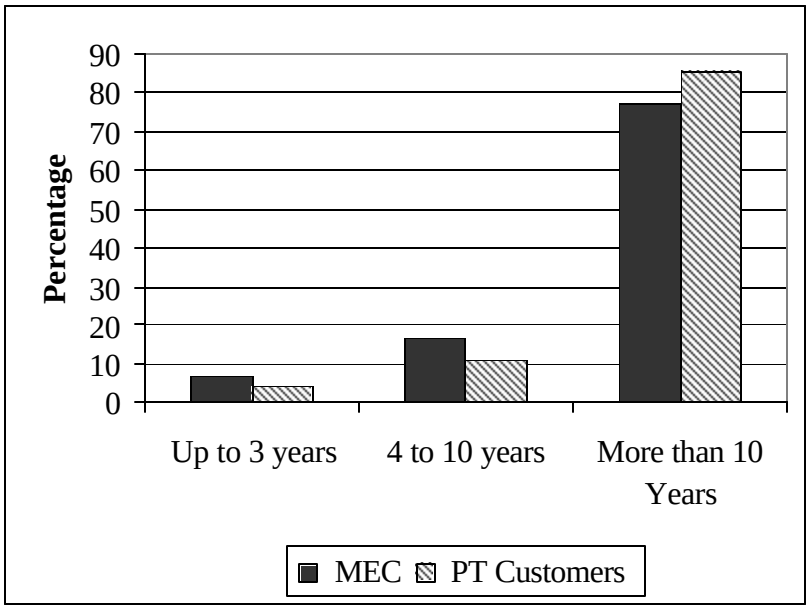
A large portion of PT customers, 83%, and an even larger portion of MEC participants, 89%, indicate they are either small or medium size businesses. Exhibit 5.9 shows these results.

Exhibit 5.9
Business Size

Responses		Frequency	Percentage
PT Customers	**Small**	140	42.8
	Medium	130	39.8
	Large	57	17.4
	Total	327	100.0
MEC Participants	**Small**	87	52.4
	Medium	61	36.7
	Large	18	10.8
	Total	166	100.0

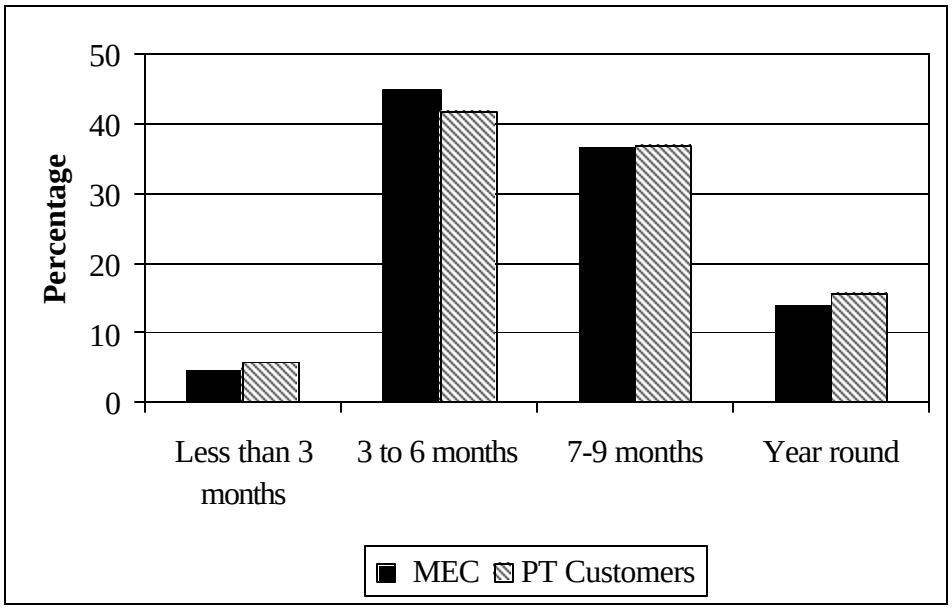
Exhibit 5.10 shows that the greater majority of PT customers have been operating at their current location for more than 10 years, with only 4% being at their current location for 3 years or less. For MEC participants, over 77% have been operating at their current location for more than 10 years, with 7% for 3 years or less.

Exhibit 5.10
Time at Current Location



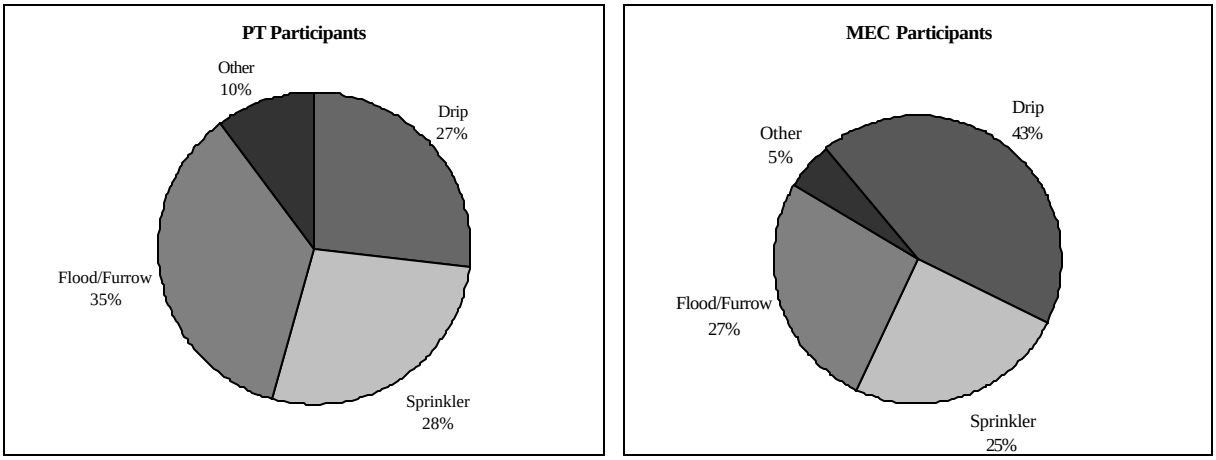
On average most PT customers indicate that their pumps are used between 3-6 months and 7-9 months, with 41.7% indicating the former and 36.8% the latter. For MEC participants, most (44.9%) indicated that their pumps were used for 3-6 months and 36.5% indicate 7-9 months. Exhibit 5.11 shows these results.

Exhibit 5.11
Number of Months Pumps Used



The types of irrigation systems used varies widely across all customers, with 35% of PT customers reporting that they use Flood/Furrow, 27% of PT customers using Drip, and 28% using Sprinklers. For MEC customers, the most frequently indicated system was Drip with 43% of cases, next was Flood/Furrow with 27%, followed by Sprinklers with 25% of cases. Exhibit 5.12 show these results.

Exhibit 5.12
Type of Irrigation System



For pump test customers, the mean number of electric pumps used in their operation is 12.25, the mean number of natural gas pumps is 1.15, and the mean number of diesel pumps is 1.79. For MEC participants, the mean number of electric pumps is 7.67.[6] For pump test customers, the

[6] MEC participants were not asked about the average number of natural gas and diesel pumps used in their operation.

average age of their pumps is approximately 19 years, for MEC participants, the average age is 15 years.[7] Exhibit 5.13 and Exhibit 5.14 show these results.

Exhibit 5.13
Mean Number of Pumps

Participant Group	Type of Pump	Mean Number of Pumps	N	Std. Error
PT Customers	Electric	12.25	327	1.023
	Natural Gas	1.15	325	0.805
	Diesel	1.79	327	0.517
MEC Participants	Electric	7.67	156	1.209

Exhibit 5.14
Average Age of the Pumps

Participant Group	Mean Age	N	Std. Error
PT Customers	18.86	316	0.655
MEC Participants	15.04	145	0.836

The percentage of total operating costs spent in electricity bills also varied widely across customers. For pump test customers, the mean percentage was approximately 14%, for MEC participants, it was approximately 15%.[8] Exhibit 5.15 shows these results.

Exhibit 5.15
Percentage of Total Operating Costs Spent in Electricity Bills

Participant Group	Mean Percentage in Electricity Bills	N	Std. Deviation
PT Customers	13.87	246	0.734
MEC Participants	15.11	84	1.137

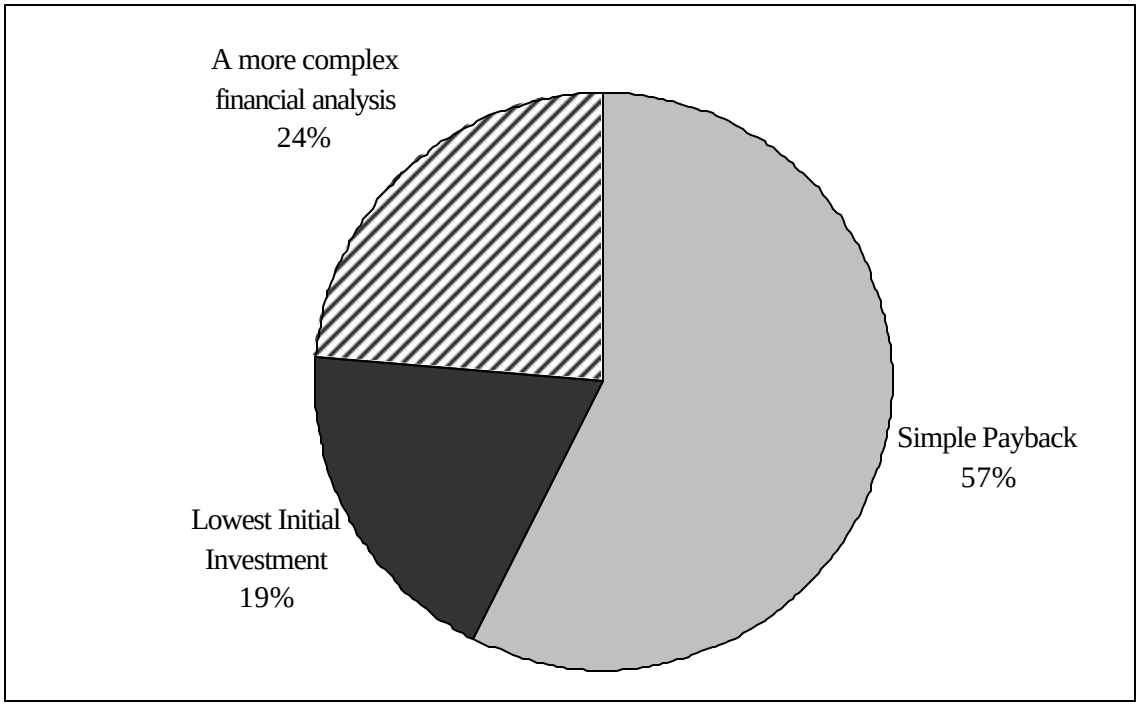
Lastly, for the PT customer, the most common type of financial method used to evaluate EE improvements is simple payback at 57.4%. The remaining customers are split fairly evenly

[7] If the average age of the pumps was given by a range, the midpoint of the range was used as the estimate of the average age.

[8] A few respondents indicated values greater than 50% and upwards of 95-100%. These observations were excluded from the group as invalid responses and the totals were not included when computing the mean percentage.

between the lowest initial investment, 19.1%, and a more complex financial analysis, 23.5%. Exhibit 5.16 shows these results.

Exhibit 5.16
Which of the following financial methods do you typically use to evaluate EE improvements?



Based on this self-reported data, program participants in PY2002-2003 can be generally characterized as:

- Customers with a small number of pumps between 15 and 20 years old
- Having pumps in use between 3 and 9 months of the year
- Family-owned businesses, who own the property the business occupies
- Small and medium-sized organizations
- A relatively even distribution between orchards, vegetables/field crops, and vineyards/wineries
- Customers who have been in their location for more than 10 years

This might suggest that the program, rightly, may not need to be as concerned with issues relating to split incentives, and is successful at reaching smaller, family-owned businesses. This may be a key point in that results, which will be presented in later sections, suggest that smaller companies are less likely to make repairs. Therefore, if the program is successful in reaching these customers, the greatest impacts may be achieved by encouraging customers, who would not otherwise do so in the absence of the program, to make EE pump repairs or improvements.

5.2.2.2 Market Barriers

Participants were asked about the ease of getting information about alternative ways of reducing energy use in pumping systems. They were also asked how willing they are to spend time looking for information on ways to reduce energy use. PT customers were also asked to rate the

ease of getting financing for pumping system equipment changes or energy efficient (EE) improvements and how often, if ever, they have not made changes to their pumping system due to a lack of financing. These questions were intended to identify some of the barriers faced by PT customers, but will be examined in more detail in Section 5.2.4.4 when the factors influencing the pump repair decision are examined.

Results suggest that 72% of customers find it at least 'somewhat easy' to get information about alternative ways of reducing energy use, with 17% of these suggesting that it is 'very easy'; only 6% suggest that it is 'not at all easy'. While most indicate that it was 'easy' to find information on EE alternatives, 41% indicate they are 'very willing' to spend time looking for information, with nearly 94% of all PT customers indicating that they are at least 'somewhat willing' to search for EE information. Only 6% indicate any degree of 'unwillingness' to search for information. Exhibit 5.17 and Exhibit 5.18 show their responses.

Exhibit 5.17
How easy is it to get information about alternative ways of reducing energy use in pumping systems?

Responses	Frequency	Percentage
Not at all Easy	19	5.9
Not too Easy	73	22.7
Somewhat Easy	175	54.5
Very easy	54	16.8
Total	321	100.0

Exhibit 5.18
How willing are you to spend time looking for information on ways to reduce energy use?

Responses	Frequency	Percentage
Not at all Willing	3	.9
Not too Willing	18	5.5
Somewhat Willing	173	52.6
Very willing	135	41.0
Total	329	100.0

In terms of getting financing for pumping system equipment changes or EE improvements, over 70% suggest that it is at least 'somewhat easy' to obtain financing, with 30% of those indicating that it is 'very easy'. However, 62% of all PT customers indicate at least some instances in which they have not made necessary changes to their pumping system due to a lack of financing. Exhibit 5.19 and Exhibit 5.20 show these responses.

Exhibit 5.19
How easy would it be for you to get financing for pumping system equipment changes or EE improvements?

Responses	Frequency	Percentage
Not at all Easy	21	6.8
Not too Easy	70	22.5
Somewhat Easy	127	40.8
Very easy	93	29.9
Total	311	100.0

Exhibit 5.20
How often have you NOT made necessary changes to your pumping system due to lack of financing?

Responses	Frequency	Percentage
Often	40	12.4
Sometimes	73	22.7
Not too often	89	27.6
Never	120	37.3
Total	322	100.0

Results suggest that, even though customers indicate that it is easy to find information, they are still somewhat less willing to search for energy efficiency information. This may suggest that there is room for an information program to positively impact customers by providing information in a manner that limits the customers' need to search for information on EE alternatives relating to pumping systems. This would reduce customers' information search costs. Results also suggest that customers' perceived barriers to obtaining financing are low, but since a significant proportion of customers report at least some instance of not being able to make a repair or improvement because of a lack of financing, there still may be some barriers faced by customers in this regard. By providing financial assistance in the form of rebates, the program may be able to help mitigate barriers faced by customers relating to obtaining financing.

5.2.2.3 Changes in Awareness and Knowledge

All PT customers and MEC participants were asked to self-report changes in their level of awareness and knowledge as a result of participating in the program, as well as changes in their attitudes toward EE. PT customers' attitudes, awareness, and knowledge of EE options relating to pumping systems prior to participating in the program were also queried. The results that point to prior knowledge of EE and pumping efficiency are presented first. Next are results that indicate the amount of customer contact and the direct impacts from this contact and from participating in the program. Lastly, results that quantify self-reported changes in awareness and knowledge of EE or pumping efficiency and changes in participants' attitudes toward energy efficiency as a result of participating in the program are presented.

5.2.2.3.1 Prior Knowledge and Awareness

Exhibit 5.21 through Exhibit 5.23 gives an indication of PT customers' prior awareness and knowledge of EE options and attitudes toward EE. More than 86% of PT customers report that they knew that using efficient technologies relating to their pumping system could affect their electricity bills. Nearly 98% report that it is at least somewhat important to be sure that their pumping system makes efficient use of electricity, with 74% of those indicating that it is very important. PT customers were also asked whether they had a regular schedule for testing their pumps and how long this schedule has been in place. While a large portion of PT customers report having prior knowledge that using efficient technologies could affect their electricity bills, and nearly all PT customers indicate that it is relatively important to make sure their pumping system makes efficient use of electricity, only 34% report having a regular schedule in place for testing their pumping system. For those who reported having a regular schedule for testing their pumps, the mean number of years the schedule has been in place is just over 10 years.

Exhibit 5.21
Did you know using efficient technologies relating to pumping system efficiency could affect electricity bills?

Responses	Frequency	Percentage
Yes	284	86.3
No	45	13.7
Total	329	100.0

Exhibit 5.22
Importance of Making Efficient Use of Electricity

Responses	Frequency	Percentage
Not at all important	1	0.3
Not too important	7	2.2
Somewhat important	75	23.3
Very important	239	74.2
Total	322	100.0

Exhibit 5.23
Pump Testing Schedule in Place?

Responses	Frequency	Percentage
Yes	111	33.7
No	218	66.3
Total	329	100.0

These results suggest that while customers are somewhat familiar with EE as it relates to pumping systems, there is a current need for an information program that seeks to actively encourage customers to act on known information about EE by encouraging them to test their pumps. Given that a significant proportion of these customers have a positive attitude toward EE,

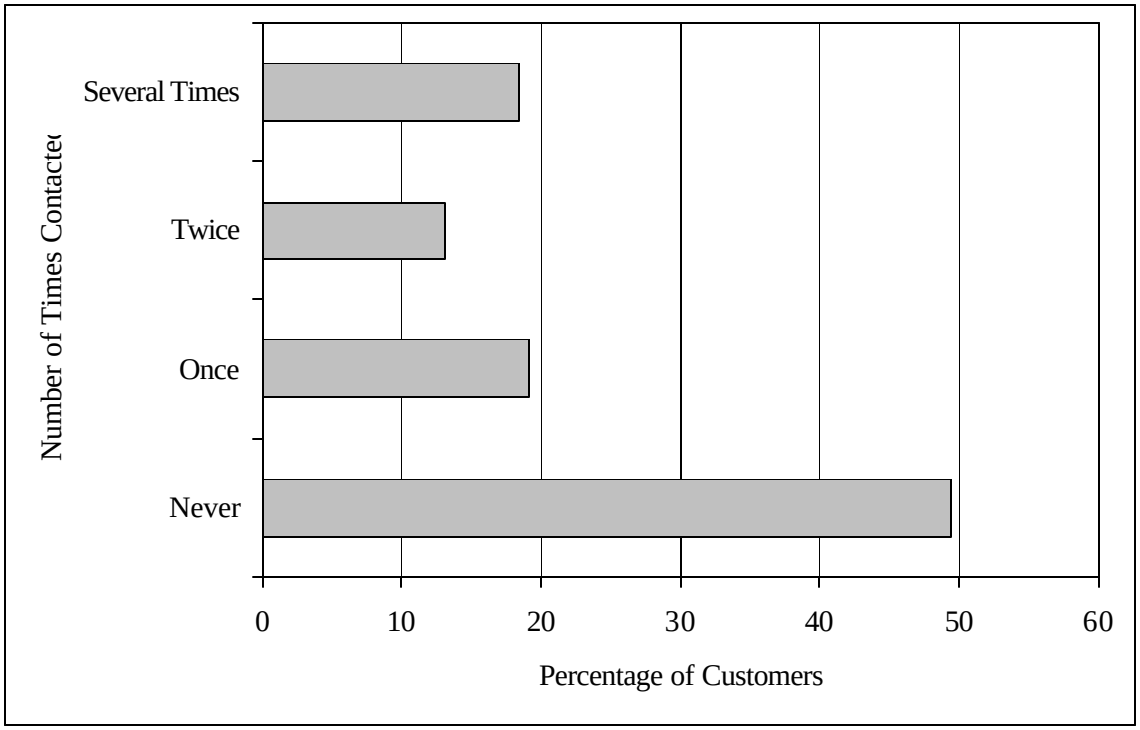
it seems reasonable to expect that they would be receptive to participating in this type of program.

5.2.2.3.2 Program Contact with the Customer

The program can only create impacts in awareness or knowledge if customers receive information. This section covers how customers were contacted and the response to various outreach efforts.

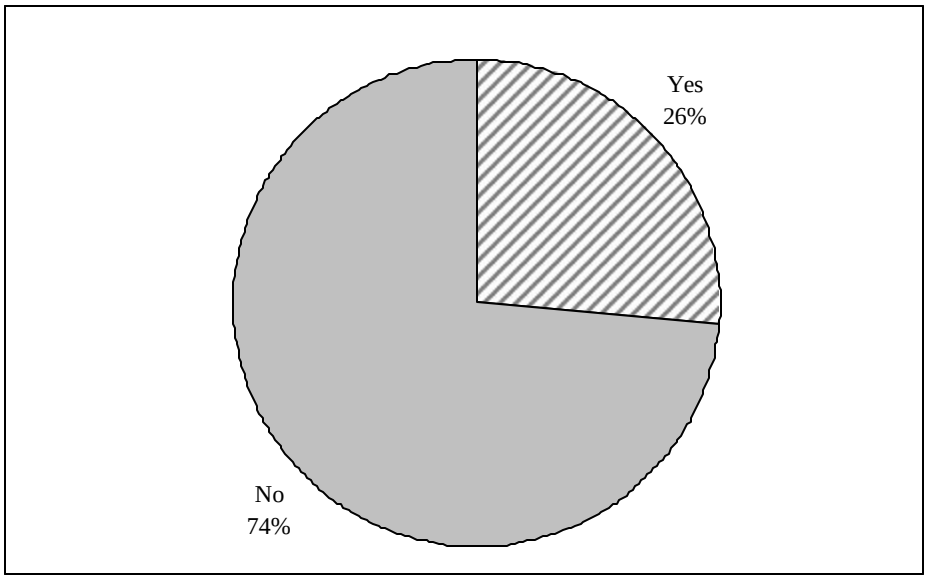
The APEP was designed to reach participants in a number of ways including: printed material, direct contact with program staff, via the program web site, APEP seminars or MEC demonstrations, and through pump tests. Therefore, an impact hypothesis is that customers would report an increase in their knowledge and awareness of EE options and pumping system repairs and improvements as well as changes in their attitudes toward energy efficiency as a result of participating in the program. Exhibit 5.24 through Exhibit 5.26 show data relating to the amount of customer contact.

Exhibit 5.24
Number of Times Contacted by the Program



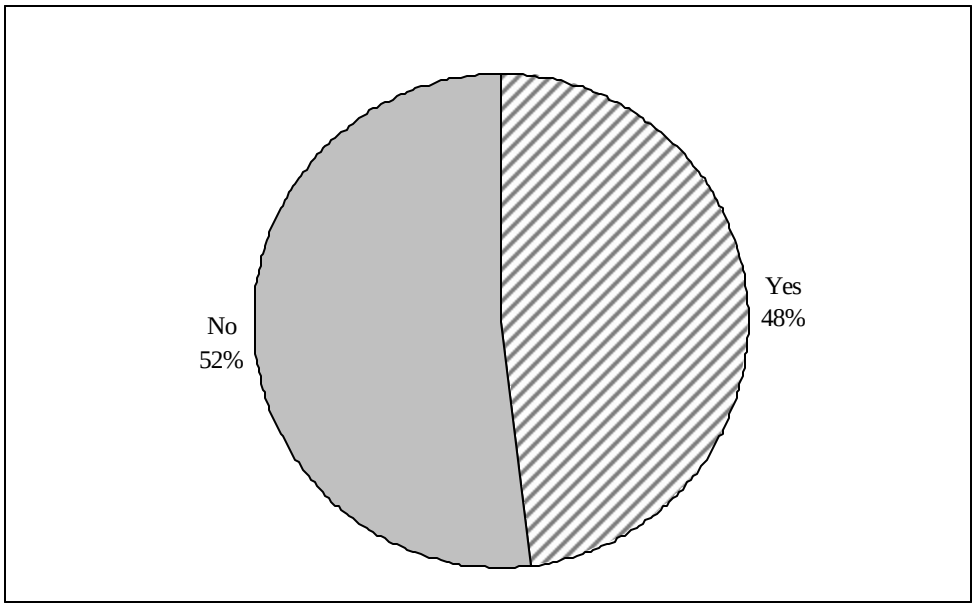
Of those who were contacted or received information, approximately 26% indicate that they changed their irrigation practices as result of this contact. Exhibit 5.25 below shows this result.

Exhibit 5.25
Percentage Who Changed Irrigation Practices



***Contact via Printed Material* -** While a little more than half of all Pump Test customers report being contacted at least once by program staff a similar number, 48%, report receiving printed material from the program other than the pump test results (Exhibit 5.26).

Exhibit 5.26
Percentage who Received Printed Material



When asked to rate, on a 4-point scale with a 1 being 'disagree strongly' and 4 being 'agree strongly', whether they learned a considerable amount about available EE options from reading the printed material, or whether the printed material increased the likelihood that they would investigate EE options, the mean rating for each statement was 3.19 and 3.55, respectively. This seems to indicate that participants felt strongly that the APEP materials and contact had a significant, positive impact on their knowledge about EE options and their attitudes toward EE.

Further, those participants who received printed material also seemed to agree that the information provided in the printed material had a positive affect on their attitude toward energy efficiency, as shown by a mean rating of 3.52 for this statement. Exhibit 5.27 shows these results.

Exhibit 5.27
Mean Impacts of Printed Material

Responses	Mean	N	Std. Error
I learned a considerable amount about available EE options	3.19	137	0.068
The information increased the likelihood I will investigate EE options	3.55	137	0.055
The information in the material positively affected my attitude toward EE	3.52	132	0.050

Contact via Website - Exhibit 5.28 shows that only about 40% of participants were aware of the program website and, of those who were aware, only 28% report using the website to gain information about getting a pump test or repair. However, Exhibit 5.29 shows that those who report using the website, give favorable ratings in terms of the impact of the website information on their attitudes toward EE (mean rating of 3.23), how much they learned about EE from reading the website material (mean rating of 3.21), and whether the information on the website will increase the likelihood that they will investigate EE options (mean rating of 3.34).

Exhibit 5.28
Percentage Who Are Aware of and Use the Program Website

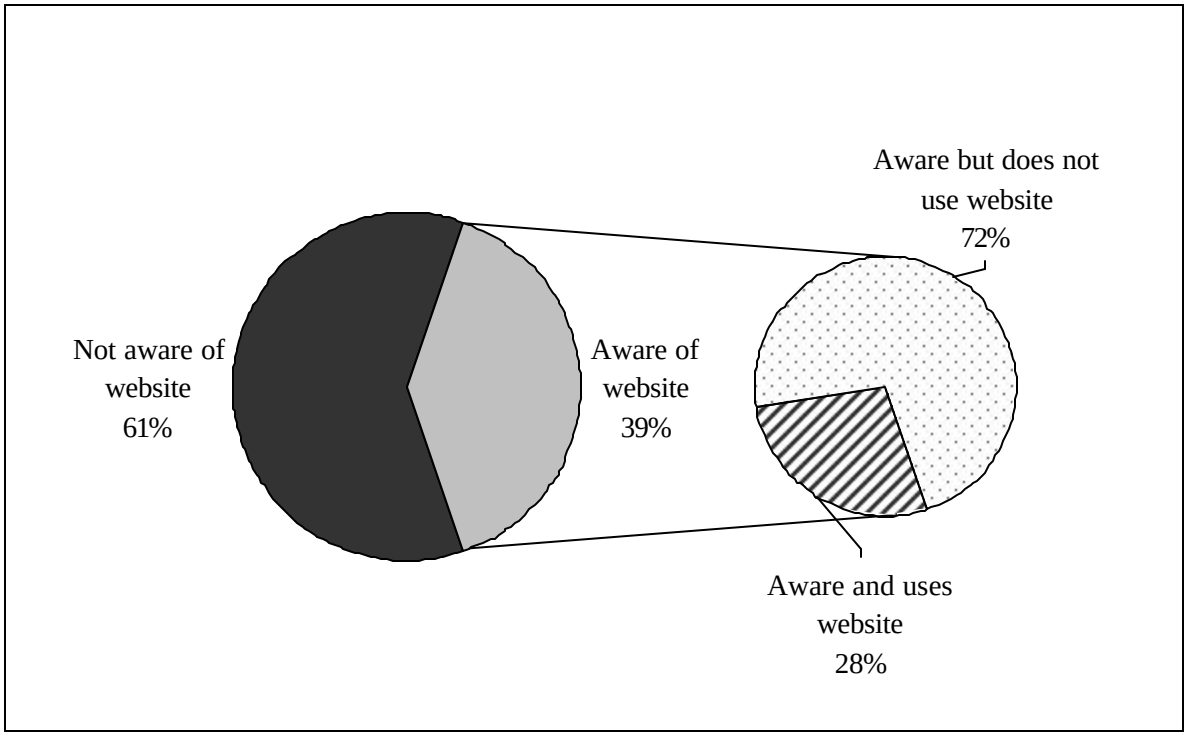


Exhibit 5.29
Mean Impacts of the Program Website

Responses	Mean	N	Std. Error
I learned a considerable amount about available EE options from the information on the website	3.21	34	0.145
The information on the website increased the likelihood I will investigate EE options	3.34	35	0.129
The information on the website positively affected my attitude toward EE	3.23	35	0.130

Contact via Pump Test - The pump test process is another means by which the program impacted participants. Participants had a high rating, a mean of 3.68, of the believability of the financial information in the pump test report, and of their overall satisfaction with the pump test process, with a mean rating of 3.75 (using a 4-point scale, with 1 being 'very dissatisfied' and 4 being 'very satisfied'). This is an important result in that participants seem to believe the pump test results provided under the program and are satisfied with the pump test process. In later sections the degree to which these factors explain why some customers get a pump repair or make irrigation system changes and others do not is examined. Exhibit 5.30 shows these results.

Exhibit 5.30
Mean Impacts of the Pump Test Process

Responses	Mean	N	Std. Error
I believed the financial information in the pump test report.	3.68	249	0.035
What was your overall level of satisfaction with the pump test process?	3.75	318	.027

Conclusion of Program Contacts: These results of looking at the program contacts with customers suggest that pump test customers believed the pump test results they received through the program and were very satisfied with the overall pump test process. However, the APEP could be a bit more aggressive in terms of reaching participants, both by direct customer contact and printed material, and by marketing the program website. It is expected that increased outreach efforts would be successful, as those who either were contacted by the program, received information from the program, or were aware of the website, were positively affected by these forms of contact.

5.2.2.3.3 Changes in Awareness and Knowledge Resulting from Program Participation

The main research hypotheses dealt with potential changes in awareness and knowledge from the program. This section covers the self-reported changes by participants.

While only 8% of pump test participants interviewed report also participating in any of the APEP seminars or MEC demonstrations, those who participated had very high ratings, a mean of 3.81, 3.69, and 3.73, respectively, of whether the seminars or demonstrations increased their awareness of potential problems, increased their awareness of potential solutions to these

problems, and increased their knowledge about possible solutions to these problems as it relates to pumping efficiency. MEC participants who were surveyed and asked about the impact of the seminars and demonstrations on their awareness and knowledge of potential problems and solutions to these problems give similar favorable ratings of the seminars. These results are presented in Exhibit 5.31 and Exhibit 5.32.

Exhibit 5.31
Percentage of Pump Test Participants Who Also Participated in an APEP Presentation or MEC Demo

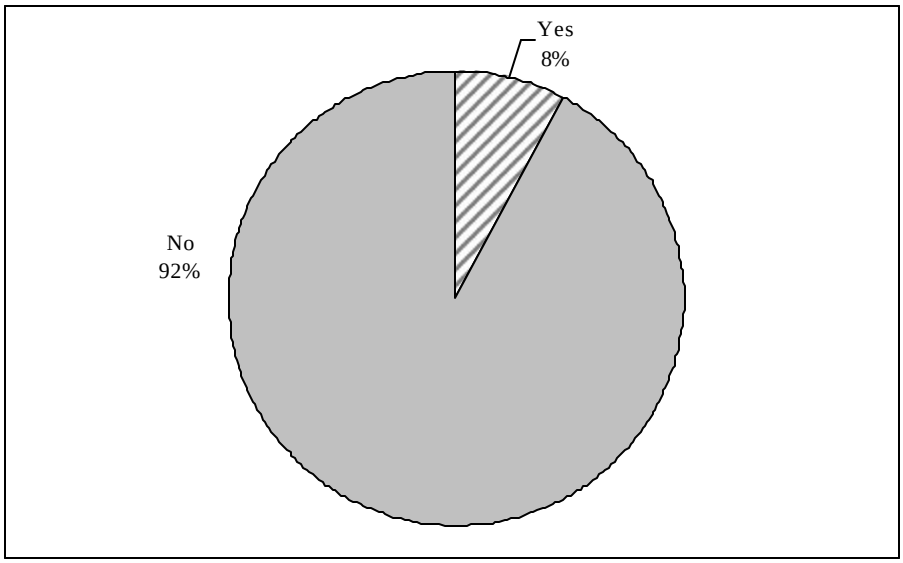


Exhibit 5.32
Mean Ratings of Changes in Awareness and Knowledge from Participating in APEP Seminars and MEC Demonstrations

Participant Group	Responses	Mean	N	Std. Error
PT Customers	The seminar by the APEP increased my AWARENESS of potential problems with respect to pumping efficiency.	3.81	26	0.145
	The seminar by the APEP increased my AWARENESS of potential solutions to these problems.	3.69	26	0.129
	The seminar by the APEP increased my KNOWLEDGE of potential solutions to these problems.	3.73	26	0.130
MEC Participants	The MEC demo increased my AWARENESS of potential problems with respect to pumping efficiency	3.78	182	0.034
	The MEC demo increased my AWARENESS of potential solutions to these problems?.	3.69	182	0.036
	The MEC demo increased my KNOWLEDGE of potential solutions to these problems.	3.68	182	0.036

When asked about the impact of having their pumps tested, participants gave a high rating, a mean of 3.68, suggesting that, after the pump test, they are more knowledgeable about needing

operating efficiency improvements for their pumping operations. These results are shown in Exhibit 5.33 and discussed further in the process results in Section 5.3.2.

Exhibit 5.33
Knowledge About Operating Efficiency Improvements

Responses	Mean	N	Std. Error
As a result of having my pump tested, I am now more knowledgeable about needing operating efficiency improvements for my pumping operations	3.68	49	0.035

Slightly more than 62% indicate that the pump tester reviewed an economic analysis of their pump based on the pump test. Then, when asked whether the information from the pump tester increased their awareness of potential problems with respect to pumping efficiency and of potential solutions to these problems, PT customers gave high ratings, with a mean of 3.59 and 3.42, respectively. Exhibit 5.34 and Exhibit 5.35 shows these results.

Exhibit 5.34
Pump Tester Gave a Review of Economic Analysis Based on Pump Test

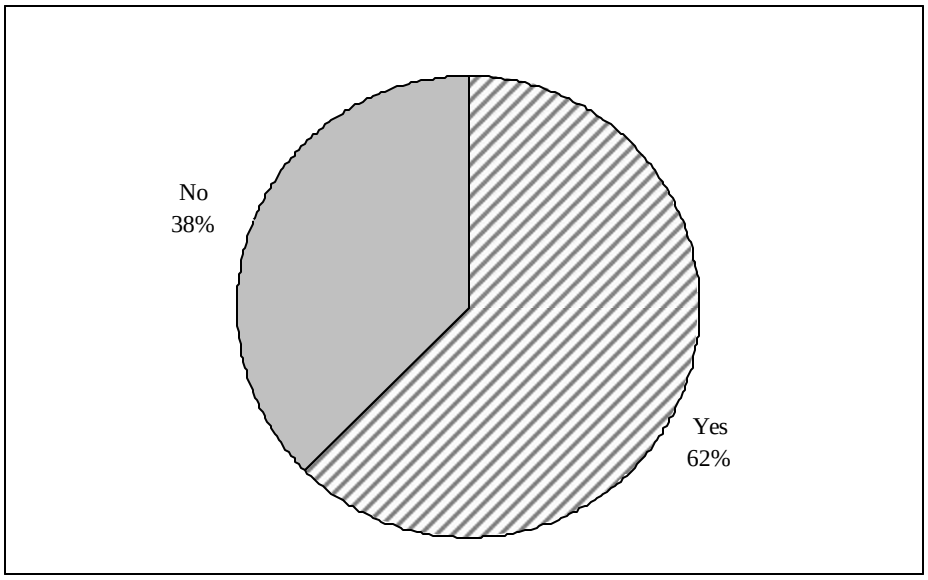


Exhibit 5.35
Increased Awareness Resulting from Information Obtained from the Pump Tester

Responses	Mean	N	Std. Error
The information from the pump tester increased my AWARENESS of potential problems with respect to pumping efficiency	3.59	316	0.037
The information from the pump tester increased my AWARENESS of potential solutions to these problems	3.42	313	0.043

Ensuring that pump testers provide quality pump tests, including a review of the economic analysis based on the pump test, is important since participants indicate that after having their pumps tested, they are more knowledgeable about the need for operating efficiency improvements for their pumping system. These results show, as hypothesized, that participating in APEP seminars and MEC demonstrations, or having the pump tester review the economic analysis of the pump based on the pump test, increases customer awareness and knowledge regarding pumping efficiency.

5.2.2.4 Differences in Awareness and Knowledge Across Participants

The previous section shows that the program increased awareness and knowledge. Next, statistical t tests and Chi Square tests were conducted to investigate whether the observed differences *across participants* were statistically significant. The analysis looked at differences in factors relating to prior knowledge of and attitudes toward EE; program contact; and changes in attitudes, awareness, and knowledge as a result of participating in the program. Specifically, three questions were investigated, and the results of these tests are summarized in the noted sections.

1. Did an APEP seminar or MEC participation increase awareness more than getting the pump test results? (Section 5.2.2.4.1)
2. Did prior knowledge of, attitudes toward EE, or the degree of program contact vary for those who needed and made a pump repair versus those who needed but did not make a pump repair? (Section 5.2.2.4.2)
3. Did changes in awareness or knowledge vary for those who needed and made a pump repair versus those who needed but did not make a pump repair? (Section 5.2.2.4.2)

5.2.2.4.1 MEC Participants and PT Customers

First, whether participating in an APEP seminar or MEC demonstration would result in a greater increase in awareness than getting a pump test was considered. Exhibit 5.36 shows these results.

Exhibit 5.36
Comparing respondents' rating of the impact on their awareness given information received through the pump tester versus through an APEP seminar or MEC

Question	MEC Participant	N	Mean	Std. Error Mean	T-value (Difference of the Means)
The information from the pump tester or MEC demo increased my AWARENESS of potential problems with respect to pumping efficiency.	Yes	182	3.78	0.034	4.178**
	No	291	3.56	0.040	
The information from the pump tester or MEC demo increased my AWARENESS OF potential solutions for these problems.	Yes	182	3.69	0.036	4.867**
	No	288	3.40	0.046	
* Significant at the 0.05 level.					
**Significant at the 0.01 level.					

While the t values here are statistically significant, it is important also to consider the size of the effect measured when drawing conclusions relating to program design decisions. In the first case, the mean difference is 0.22 (a 6% difference) and in the second, the mean difference is 0.29 (an 8.5% difference). Given that both groups of participants rate the increase in their awareness very high, it might not be worth the investment of program funds to attempt to increase the ratings of those exposed only to the pump testers.

5.2.2.4.2 Pump Repair Customers and Customers Not Making a Pump Repair

There are multiple variables that could affect differences in the self-reported changes. Next comparisons were made to assess the significance of differences in:

- prior knowledge of EE options,
- attitudes toward EE, and
- the amount of program contact for those who needed a repair and made one – pump repair (PR) customers – and those who needed a repair (based on the pump test results) but did not make one – no repair (NR) customers.

Results of these tests are summarized below in Exhibit 5.37, Exhibit 5.38, and Exhibit 5.39.

Exhibit 5.37
Summary of Differences Between Pump Repair Customers and No Repair Customers: Prior Knowledge of and Attitudes Toward EE

Factor	Results of Comparison	Statistical Test Results
Importance of using electricity efficiently	Statistically significant difference: PR customers rated the importance that their pumps make an efficient use of electricity higher than NR customers.	t-test=-2.689**
Prior knowledge how efficient technologies affect electricity bills	N/A	Chi-Square=0.015***, p = 0.903
Pump test schedule in place	No statistically significant difference.	Chi-Square=.073, p=0.787
Time pump test schedule in place	No statistically significant difference.	t-test=-0.856

* Significant at the 0.05 level.

**Significant at the 0.01 level.

***Insufficient data make the Chi-Square results reported for this factor unreliable.

These results show that there were few differences in attitudes, knowledge and awareness toward EE prior to customers participating in the program, except that PR customers rate the importance of using electricity efficiently higher than do NR customers. This seems reasonable and may suggest that those who make pump repairs are more conscientious about their energy use. This could reflect either a difference in attitudes toward EE or other factors. For example, interviews with pump companies suggest that those who make pump repairs are likely to have higher costs and it is important to these customers to make an efficient use of electricity more than it is to a customer who has low electricity costs. More details relating to these interviews are presented in Section 5.2.2.6.2

Exhibit 5.38
Summary of Differences Between Pump Repair Customers and No Repair Customers: Program Contact with the Customer

Factor	Results of Comparison	Statistical Test Results
Awareness of website	**Statistically significant difference**: PR customers rated awareness of the APEP website higher than NR customers. The strength of this positive relationship between getting a pump repair and awareness of the website is moderate.	Chi-Square=4.641, p = 0.031*
Use of website	No statistically significant difference. Although not significant, it is not far off. While insufficient data make the Chi-Square results for this factor unreliable, the relationship indicated suggests that participants who made a repair made use of the website more than did those who did not make a repair.	Chi-Square=3.153***, p = 0.076
Number of times contacted by APEP	No statistically significant difference	Chi-Square=2.133***, p = 0.344
Number received printed material	No statistically significant difference	Chi-Square=.615, p = 0.433
I believed the financial information in the pump test report.	No statistically significant difference	t-statistic=-0.666
Overall satisfaction with pump test process	No statistically significant difference	t-statistic=-1.384
Participate in APEP seminar or MEC	N/A	Chi-Square=1.050***, p = 0.305
Pump tester reviewed economic analysis	No statistically significant difference.	Chi-Square=2.989, p = 0.084

* Significant at the 0.05 level.

**Significant at the 0.01 level.

***Insufficient data make the Chi-Square results reported for this factor unreliable.

These results suggest there are no significant differences in the degree to which PR customers were contacted by the program as compared to NR customers, nor in terms of their believability of the pump test results, or their overall satisfaction with the pump test process. Thus, while it may be that the program is similarly impacting both PR and NR customers in terms of contact, it may be beneficial to do more to market the program website, since those who make pump repairs are more aware of the website and may make more use of it than those who did not make a repair.

Exhibit 5.39
Summary of Differences Between Pump Repair Customers and No Repair Customers: Impacts of Contact

Factor	Results of Comparison	Statistical Test Results
Changed irrigation practices	**Statistically significant difference**: More NR customers made changes to their irrigation systems than did PR customers. The strength of this negative relationship between getting a pump repair and changing irrigation practices is moderate.	Chi-Square=5.000, p = 0.025*
Printed material increased likelihood will investigate EE options	**Statistically significant difference**: PR customers rated this statement higher than NR customers.	t-statistic=-2.280*
Printed material affected attitude toward EE	No statistically significant difference.	t-statistic=-0.392
Learned a great deal from printed material	No statistically significant difference.	t-statistic= 0.058
More knowledgeable about need for operating efficiency improvements	No statistically significant difference.	t-statistic= 1.065
Info from pump tester increased awareness of potential problems	No statistically significant difference.	t-statistic= 0.338
Info from pump tester increased awareness of possible solutions for these problems	No statistically significant difference.	t-statistic=-0.709
Website information affected attitude toward EE	No statistically significant difference.	t-statistic=-1.179
Learned a great deal from website information	No statistically significant difference.	t-statistic= 0.187
Website information increased likelihood will investigate EE options	No statistically significant difference.	t-statistic=-0.473

Factor	Results of Comparison	Statistical Test Results
APEP/MEC increased awareness of potential problems	N/A	Not possible to compute t statistic due to insufficient data.
APEP/MEC increased awareness of possible solutions for these problems	N/A	Not possible to compute t statistic due to insufficient data.
APEP/MEC increased likelihood will investigate EE options	N/A	Not possible to compute t statistic due to insufficient data.

* Significant at the 0.05 level.

**Significant at the 0.01 level.

Conclusion for differences in awareness/knowledge: These results suggest that PR customers are not significantly different from NR customers in terms of changes in knowledge and awareness gained from participating in the program. Both customer groups gave high ratings when describing the degree to which participating in the program resulted in increases in awareness and knowledge. However, there were differences noted on a couple of factors. In particular, PR customers had a higher rating regarding the degree to which the printed material increased the likelihood that they will investigate EE options; and, interestingly, NR customers made more changes to their irrigation practices than did PR customers. This latter result may simply indicate that those who did not make a pump repair did make some basic changes in their behavior as a result of information gained by participating in the program. Recall that results indicated PR customers thought it more important to make an efficient use of electricity, which may mean that they were already knowledgeable about and had instituted efficient irrigation practices. In Section 5.2.2.5.6 the analysis considers more closely the reasons why customers make changes to their irrigation practices.

5.2.2.5 The Pump Repair Decision

There are many factors that determine when a pump is repaired. One of the primary objectives of the analysis was to investigate factors affecting the pump repair decision including both why customers make a repair and why others do not make a repair. To fully explore various factors, the evaluation team looked at the following questions:

1. Did customers learn about the program through marketing by trade allies? (Section 5.2.2.5.1)
2. What additional steps could have helped customers choose to repair their pumps if the pump test indicated a need for a repair? (Section 5.2.2.5.2)
3. What were the attributes of the customers who had made a repair? (Section 5.2.2.5.3)

4. What were the attribute differences between customers who had made a pump repair and those who had not? (Section 5.2.2.5.4 presents t-test and Chi-Square results while Section 5.2.2.5.5 provides the results of a logit model)
5. What were the attribute differences between customers who had made irrigation changes and those who had not? (Section 5.2.2.5.6)

5.2.2.5.1 Marketing by Trade Allies

An issue related to the pump repair decision is the consideration of whether marketing of the program by trade allies generated more pump repair customers than the program otherwise would have had. Marketing by trade allies accounted for 19% of all responses (21% of all cases) as it relates to how customers learned about the program, with another 8% of responses (9% of cases) indicating that customers learned about the program through trade publications. While not a definitive test, this may suggest that in the absence of this marketing, some customers would not have learned about the program and thus would not have gotten a pump repair. Exhibit 5.40 shows these results.

Exhibit 5.40
How Learned about the Program?

Category Label	Count	Percentage of Responses	Percentage of Cases
Contacted by the Program	44	12.2	13.4
Trade Publication	31	8.6	9.4
Marketing by Trade Ally (Pump Dealers)	103	28.5	31.3
APEP Seminar or Demonstration	5	1.4	1.5
CIT/APEP Internet Website	4	1.1	1.2
From another grower	44	12.2	13.4
You contacted CIT/APEP by phone	11	3.0	3.3
Through an agricultural organization	59	16.3	17.9
Other: Through utility (PG&E/SCE/SDG&E) flyer/ rep/ contractor/ employee	34	9.4	10.3
Other: Already aware of program	10	2.8	3.0
Other: Through other business dealings	1	0.3	0.3
Other: Consultant / Specialist	7	1.9	2.1
Don't Know	9	2.5	2.7
Total (329 Cases)	362	100	110

5.2.2.5.2 Factors Influencing the Decision Not to Make a Pump Repair

Pump test customers who had not made a repair (NR participants) were asked to provide reasons why they did not make a pump repair and indicate what additional steps APEP could have taken to help them to make a repair. 'Plan to repair pump in off-season' accounted for 14% of responses followed by 'payback incentive too small' with 8% of responses. 'Other' was given by 52% of NR customers with explanations including: costs were prohibitive; a lack of information

about making repairs; no one told them they needed to make a repair when the pump was tested; and they were unable to test the pump at that time. A number of respondents said no one indicated they needed a repair or they believed their pumps tested well and so did not need a repair. NR customers also indicated that the incentive would have needed to cover about 57% of their costs to have caused them to make a repair. Exhibit 5.41 and Exhibit 5.42 show these results.

Exhibit 5.41
Reasons for Not Repairing Pump

Category Label	Count	Percentage of Responses	Percentage of Cases
Incentive too small	17	7.9	8.9
Implied payback too long	3	1.4	1.6
Timing did not coincide with regular maintenance	11	5.1	5.7
Reducing energy use of the pump is not a critical factor	2	0.9	1.0
Could not take the pump offline due to growing issues	20	9.3	10.4
Plan to repair pump in the off-season	31	14.4	16.1
Pump was repaired outside the program	21	9.8	10.9
Did not believe the pump test results	6	2.8	3.1
Other: Cost Prohibitive	26	12.1	13.5
Other: Repair not cost effective	9	4.2	4.7
Other: Sold/no longer lease property	4	1.9	2.1
Other: Problems with landlord/owner	3	1.4	1.6
Other: The paperwork was a hindrance	4	1.9	2.1
Other: Replace rather than repair	2	0.9	1.0
Other: Alternative solution cheaper/implemented	3	1.4	1.6
Other: Didn't remember which to repair	1	0.5	0.5
Other: Got results late	2	0.9	1.0
Other: Repairing now	2	0.9	1.0
Other: Unaware this was part of the program	6	2.8	3.1
Other: Decided not to/didn't think necessary	4	1.9	2.1
Other: No time/Not worth time	2	0.9	1.0
Other: Didn't qualify	1	0.5	0.5
Other: Would negatively affect performance of system	1	0.5	0.5
Other: Repaired last year	1	0.5	0.5
Other: Needed to replace rather than repair	1	0.5	0.5
Other: Encountered difficulties, couldn't complete repair	1	0.5	0.5
Other: Plan to change system	2	0.9	1.0
Other: No repair was indicated as necessary	11	5.1	5.7
Other: We did repair the pump(s)	9	4.2	4.7
Other: Didn't get repair information	1	0.5	0.5
Other: Multiple reasons	2	0.9	1.0

Category Label	Count	Percentage of Responses	Percentage of Cases
Other: No Answer	1	0.5	0.5
Don't Know	5	2.3	2.6
Total (192 Cases)	**215**	**100**	**112**

Exhibit 5.42
Mean Percentage of Cost Need Covered by Incentive to Make Repair

Responses	Mean	N	Std. Error
Approximately, what percentage of your cost would the incentive have needed to cover to cause you to make the improvement?	56.9	130	2.0

However, when asked whether the program could have taken additional steps to help them to make a repair, a response of 'No' accounted for 65% of all responses followed by 'Other' with 18% of all responses. Customers indicated reasons such as: they would like more information on the cost of the repairs that need to be made; they didn't have information on the pump repair aspect of the program or the pump repair rebate; they did not have the money when it came time to take their pumps offline to make the repair; they would like better information about available options; and the paper work is too difficult, especially if they go through the trouble to complete it, but find out in the end that they don't qualify. Exhibit 5.43 shows these results.

Exhibit 5.43
Could the Program Take Additional Steps?

Category Label	Count	Percentage of Responses	Percentage of Cases
None	129	65.2	67.2
Additional Detail	6	3.0	3.1
Better Financial Analysis	10	5.1	5.2
Other: Provide bigger financial incentives	2	1.0	1.0
Other: Provide incentive to stay with electric rather than diesel	1	0.5	0.5
Other: Provide information about the actual repair costs	3	1.5	1.6
Other: Simplify the paperwork	3	1.5	1.6
Other: Provide description of what needed repairing and why	2	1.0	1.0
Other: Have more funding for the program	1	0.5	0.5

Category Label	**Count**	**Percentage of Responses**	**Percentage of Cases**
Other: Provide better/more timely information about the program and available incentives	9	4.5	4.7
Other: Provide better information about available options	2	1.0	1.0
Other: Provide seasonal timing of testing	1	0.5	0.5
Other: Provide in-person/ follow-up	4	2.0	2.1
Other: Clarify who does what and who covers what	1	0.5	0.5
Other: Provide rebate forms	1	0.5	0.5
Other: Provide low interest loans	1	0.5	0.5
Other: Provide help with the repairs	1	0.5	0.5
Other: No Answer	4	2.0	2.1
Refused	1	0.5	0.5
Don't Know	16	8.1	8.3
Total (192 Cases)	198	100	103

While the majority of NR customers indicated that the program could not have done more to cause them to make a repair, these results suggest further opportunities for providing additional information to customers in order to encourage them to make repairs. Also, incentives would need to cover over half of the repair cost for some customers to choose to repair a pump. Many respondents indicated that they did not know about all aspects of the program or that they needed to make a repair and thus were unable to participate fully in the APEP.

5.2.2.5.3 Factors Influencing the Decision to Repair

Customers who had made a pump repair (PR participants) were asked to indicate, where 1=Strongly Disagree and 4=Strongly Agree, the extent to which a variety of factors influenced their decision to make a pump repair. Respondents all agreed strongly (a mean rating of 4.0) that they are now more knowledgeable about needing operating efficiency improvements for their pumping operations, and gave a high rating when asked whether they used the pump test results when making this decision (indicated by a mean rating of 3.45), and similarly when asked to rate whether the payback was sufficient to justify a repair (indicated by a mean rating of 3.8). Exhibit 5.44 shows these results.

Exhibit 5.44
Factors Influencing the Pump Repair Decision

Responses	Mean	N	Std. Error
As a result of having my pump tested, I am now more knowledgeable about needing operating efficiency improvements for my pumping operations	3.55	20	0.037
I used the pump test results to help decide whether to repair my pumping system.	4.00	20	0.000
The payback was sufficient to justify a repair to my pumping system.	3.45	20	0.170

When asked to identify the primary factors that influenced their decision to make a pump repair to their pumping system, 'Results of the pump test' accounted for 20% of all responses followed by 'Importance of reducing energy use', which accounted for 19% of all responses, although all responses were fairly evenly distributed across all options. For this question, the respondents were able to give multiple responses. In fact, of the 29 cases who responded to the question, there was an average of 3.4 reasons given that influenced their decision to repair their pump. Exhibit 5.45 summarizes these results. We caution the reader against any assumptions regarding possible free-ridership based on the responses indicated in Exhibit 5.45 as the evaluation team made no effort to probe into the responses given. As an example, in looking at the statement "the pump was not providing sufficient water" it may appear that the grower may have performed the pump repair regardless of the program. However, the grower may not have known the rate of water flow from his pump, but knew what the crops required. The pump test provided by the APEP may have been the piece of information needed to help the grower realize that the pump was not working correctly.

Exhibit 5.45
Factors Why Repaired Pump – Multiple Responses Provided

Category Label	Count	Percentage of Responses	Percentage of Cases
Availability/Amount of Incentive	13	13.0	44.8
Results of the Pump Test	20	20.0	69.0
Payback Implied by the Pump Test Results	15	15.0	51.7
Repair Coincided with Regular Maintenance	5	5.0	17.2
Importance of Reducing Energy Use	16	16.0	55.2
Pump Was Not Providing Required Water	19	19.0	65.5
Other	12	12.0	41.4
Total (29 Cases)	100	100	

These results suggest that the pump test results are important and that having a positive attitude toward energy efficiency is also a significant factor in the decision to make repairs to a pumping system. These results seem to support the results detailed in Section 5.2.2.4 where the significance of the observed differences between PR and NR customers regarding changes in awareness and knowledge of EE options were discussed.

5.2.2.5.4 Pump Repair Customers and No Repair Customers

This section shows the result of attempting to determine if there were differences in attributes between customers who had simply had a pump test versus those who had a pump repair. Direct comparisons are made between PR customers and NR customers with respect to 14 attributes:

- Willingness to look for EE information
- Type of financial method used
- Ease of obtaining financing
- No changes made due to lack of financing
- Largest source of revenue
- Ownership of the property
- Type of organization
- Size of organization
- Time at current location
- Average number of pumps: electric; natural gas; and diesel
- Average age of pumps
- Number of months in which pumps are used
- Type of irrigation system used
- Percentage of total operating costs spent on electricity bills
- Time pump testing schedule in place

Both chi-square and t-tests were used to examine any differences. Exhibit 5.46 presents a summary of the findings.

Exhibit 5.46
Summary of Differences Between PR and NR Customers:
Factors Influencing the Pump Repair Decision

Attribute	Results of Comparison	Statistical Test Results
Type of financial method used	**Statistically significant difference**: More PR customers indicated that a more complex financial analysis is used than do non program participants. The strength of the relationship between getting a pump repair and type of financial method used is strong.	Chi-Square=11.921, p = 0.0003**
Willingness to look for information	No statistically significant difference	t-test=-1.203
Size of organization	No statistically significant difference	Chi-Square=2.402, p = 0.301
Ease of obtaining financing	No statistically significant difference	t-test=-.009
No changes due to lack of financing	No statistically significant difference	Chi-Square=7.031, p = 0.071
Time pump testing schedule in place	No statistically significant difference	t-test=-0.856
Average number of pumps: Electric; Natural Gas; Diesel	No statistically significant difference	t-statistic=-0.09 t-statistic=-0.958 t-statistic=0.663
Average age of pumps	No statistically significant difference	t-test=-.135
Number of months pumps used during year	No statistically significant difference	Chi-Square=0.298, p = 0.585
Type of irrigation system used	No statistically significant difference	Chi-Square=4.121, p = 0.249
Percentage of total operating costs spent on electricity bills	No statistically significant difference	t-test=0.406
Largest source of revenue	N/A	Chi-Square=8.279***, p = 0.506
Ownership of property	N/A	Chi-Square=0.260***, p = 0.610
Type of organization	N/A	Chi-Square=0.890***, p = 0.828
Time at current location	N/A	Chi-Square=0.398***, p = 0.528

* Significant at the 0.05 level.

**Significant at the 0.01 level.
***Insufficient data make the Chi-Square results reported for this attribute unreliable.

These results suggest that the factors listed here do not explain why some customers get a repair and some do not. The only significant attribute is 'Type of financial method used'. These results indicate that PR customers use a more complex financial analysis when evaluating EE options and repairs. This may reflect the notion that larger customers and companies, which tend to have more expert staff, are more likely to make a repair, a point that was also made by pump company interviewees (See Section 5.2.2.6). In this bivariate analysis, there were insufficient data to adequately test whether company size explains why some companies make pump repairs and others do not.

5.2.2.5.5 Logit Model: Factors Affecting the Decision to Make Pumping System Repairs

While the relationships of individual variables to whether pump repairs were made have been examined in previous sections, it is always useful to examine the relationships of all these variables simultaneously in a multivariate logistic regression analysis where the effects of the other variables can be statistically controlled. In such an environment, previously undetected relationships might emerge while other previously observed relationships might disappear. Therefore, a logistic regression model was formulated to explain why customers with positive pump test results decide to repair their pump.

A number of variables were examined including firmographics and other relevant also programmatic variables that might explain why customers make a pump repair were considered. The analysis focused only on participants and does not seek to determine what the participants would have done in the absence of the program.

These data were analyzed using a binary logit model, which regresses a binary variable (decision status where 1 equals participant repairs pump and 0 equals participant does not repair pump) on the variables described above. Variables that are strongly related to an increased probability of making a pump repair were identified. Exhibit 5.47 shows these results.

The Odds-Ratio in this exhibit shows the odds of a customer repairing a pump as a function of a given independent variable, such as size of organization (small, medium, or large). If the value is greater than one, the odds are increasing; if the value is less than one, the odds are decreasing. A value of 1 leaves the odds unchanged. For example, an odds ratio for 'Size of Organization' of 1.62 suggests that, as the size of the firm goes from 'Small' to 'Medium' or 'Medium' to 'Large', the odds or chances that a customer will make a repair increases by 1.62.

Exhibit 5.47
Logit Regression: Likelihood a Customer Makes Repair to Pumping System

Variable	Statistical Significance*	Odds Ratio
Financial Method Used	0.064	1.597
Largest Source of Revenue	0.407	0.969
Size of Organization	0.109	1.620
Number of Natural Gas Pumps	0.190	1.029
Number of Diesel Pumps	0.143	0.839
Type of Irrigation System Used	0.220	0.956
Importance of Making Efficient Use of Electricity	0.072	2.610
Constant	0.002	0.001
R-square: .105		

*Parameters that are equal to or less than 0.05 are considered to meet the traditional level of statistical significance.

These results show that a number of variables are moderately significant including 'Financial Method Used', 'Importance of Making Efficient Use of Electricity', and 'Size of Organization'. This model explains nearly 10.5% of the variation in whether one repaired their pump. The small r-square value of 0.105 indicates that 90% of the variation in whether one gets a pump repaired is not explained by the model. This suggests that there is not enough information to identify all of the variables that explain why people get a pump repair.

The model does confirm the Chi Square results for the variable 'Financial Method Used' and the t-test for 'Importance of Making Efficient Use of Electricity' reported earlier in Exhibit 5.46. That is, the odds of making a pump repair for a customer who uses a complex financial analysis are nearly 1.6 times those of a customer who only uses a simply payback method. Also, the odds of a customer making a pump repair increase by 2.6 for each one unit increase in the importance that a customer attaches to making efficient use of electricity.

Finally, recall that in the Chi-Square analysis presented in Section 5.2.2.5.4, the Chi-Square statistic was unreliable for 'Size of Organization' due to insufficient data observations. However, here, the variable is marginally significant. The implications are that large customers may be more likely to make a repair than smaller companies. These results might suggest that it is important to focus on smaller customers who are less likely to make a pump repair. Interviews with pump test companies and pump dealers also support this conclusion. Interviewees suggest that larger customers, who have higher energy usage, find it necessary to make an efficient use of electricity to control (high) costs. Then, since they are able to pay for the costs of the repair, they are likely to be more responsive to available incentives and to make needed pump repairs when they arise. The results of the interviews with Pump Testers are discussed in detail in Section 5.2.2.6.

5.2.2.5.6 Logit Model: Factors Affecting the Decision to Make Irrigation System Changes

Another logistic regression model was estimated to explain why customers make changes to their irrigation systems. A number of variables were examined including firmographic and other relevant programmatic variables that might explain why customers make a change to their irrigation system. The analysis is intended to examine the relative importance of these variables

but does not seek to determine what the participants would have done in the absence of the program.

These data were analyzed using a binary logit model, which regresses a binary variable (1 equals participant makes a change in their irrigation practices and 0 equals participant does not make a change in their irrigation practices) on the variables described above. Variables that are strongly related to an increased probability of making a change to their irrigation system were identified. Exhibit 5.48 shows these results.

Exhibit 5.48
Logit Regression: Likelihood a Customer Makes Change to Irrigation Practices

Variable	Statistical Significance	Odds-Ratio
Received Printed Material	0.008**	0.330
Pump Test Person Reviewed Economic Analysis Based on Pump Test	0.008**	0.291
Participated in APEP seminar or MEC demo	0.007**	0.179
Size of Organization	0.032*	1.736
Constant	0.003**	80.883
R-square: .175		

*Significant at the 0.05 level.

**Significant at the 0.01 level.

These results show that all of the variables in the model are significant, most of which are significant at greater than the 0.01 level. This model explains 17.5 percent of the variation in whether one made changes to their irrigation system. In this model, the independent variables are defined as 1 if 'Yes' and 2 if 'No'. Thus, a decreasing odds ratio for 'Received Pump Test Material,' for example, suggests that the odds of making a change in their irrigation practices for a person who did not receive pump test materials are only 0.33 as high as the odds for someone who did receive materials. In other words, if a customer received printed materials, they are much more likely to have make a change in their irrigation practices (approximately 3 times as likely).

As such, the model suggests that customers who receive printed materials have a higher likelihood of making a change to their irrigation practices as compared to those who do not receive printed materials. This is also the case for customers who participate in APEP seminars and whose pump tester reviews the economic analysis based on the pump test. Although significant here, these attributes were not statistically significant in the bivariate models formulated in the Chi-Square and t tests presented earlier in Exhibit 5.46. Similarly, the Chi-Square for 'Size of Organization' was unreliable due to insufficient data; however, here the variable is significant at a p-value greater than .05, suggesting larger companies are more likely to make changes to their irrigation systems than smaller companies.

Conclusion for a pump repair decision: A key implication for the pump repair decision is the importance of providing program information, including an economic analysis of the pump and the APEP seminars or MEC demonstrations. The analysis shows that these factors have a

positive impact on the likelihood that someone will make a change to their pumping system. This is similar to what was indicated in the comparison between MEC participants and PT customers regarding increased awareness due to participating in the APEP seminars or MEC demonstrations. This provides further support for the argument that providing program information in the form of seminars or educational events has a positive impact on increasing pumping efficiency and encouraging customers to make changes to their irrigation practices. Interviews with pump companies also support this conclusion. Specifically, interviewees note that a good economic analysis is the key piece of information needed for a customer to be able to make a pump repair in that it clearly shows the bottom line and the cost efficiency of making repairs and improvements to their pumping systems. In addition, larger companies and companies that use a more complex financial analysis to evaluate pumping efficiency improvements are more likely to make pump repairs or changes to their irrigation practices, which might point to the importance of focusing on reaching smaller companies, who are less likely to make pumping efficiency improvements. These points are considered further in the next section.

5.2.2.6 Pump Testing/Repair Companies

5.2.2.6.1 Marketing by Trade Allies

A hypothesized outcome is that marketing by pump test/repair companies will increase the number of pump repair customers. Pump companies report that they did market APEP, primarily by word of mouth and by providing or sending out program brochures and materials. When they contacted the customers, they would inform them about APEP. However, they reported that some customers already knew about the program before they contacted them.

Pump companies had mixed perceptions about the degree to which their marketing the pump repair rebate affected the customer's decision to make a repair. There seemed to be a general perception that it was important to get out the information about the incentives and about energy savings. The idea is that getting the incentive information out generated interest and might encourage the customer to take action or in some cases would accelerate the customer's decision to take action because of the dollar savings from the rebate. Alternatively, some companies interviewed noted that marketing had no effect, and others further suggested that customers repair their pumps based on whether or not the pump required a repair not based on whether a rebate was available.

About half of those interviewed indicated that they brought in more pump repair customers in 2002 and 2003 than they otherwise would have. The reported increase in customers ranged anywhere from a 'few' to between 10% and 25% more customers. One noted that they may not have gotten additional customers, but they at least brought in additional work, even if it came from the same customers. Some noted that they are still serving their local customers and did not see any change in the number of new pump repair customers.

Most interviewees did not have any suggestions for improvements to reach a wider or different set of customers, although some mentioned that the one option would be to have pump companies market the program more or broadcast on the radio, which they feel is a key source of information for farmers. Another respondent noted that the program could market through farm bureaus by distributing information or attending farm bureau meetings.

Pump companies felt that the economic or cost analysis is the best marketing tool, but that one-on-one conversations with the customers to review the pump test results were key. If customers understand that low OPE will have a strong payback, then this is a good incentive to sell the repairs. The general agreement is that a better understanding of the economics of the pump repair will motivate the customer to make a repair. However, respondents didn't offer any suggestions on how the program could improve their current marketing strategy.

5.2.2.6.2 Pump Test Results

Pump companies were also asked whether pump test results provide adequate information to help customers make decisions about making a pump repair. Respondents were nearly unanimous in their assessment that the results provided sufficient information to aid the customer in this regard. They were also asked what, in their view, is the key factor in a customer's decision to repair or not to repair a pump. Again, the general consensus was efficiency. OPE is the key factor and the rebates provided help to balance the cost against the value of the repair. Alternatively, some relayed a similar argument, but in terms of the basic dollars and cents for pumping water. The idea is that the customer must have sufficient water to maintain his crops and must make the necessary repairs to maintain the right pumping efficiency.

Various ideas were offered as to why customers may not make a repair even if it were cost effective. The main answer offered centered, again, on cost. If customers could not afford to make an efficiency repair then they did not do it. However, when asked about the role of rebates, a significant number of respondents indicated that larger growers were the companies that were able to take advantage of the rebates. The idea being that rebates are small for smaller companies because they have low operating costs and the size of the rebate is tied to the size of their operating costs. In contrast, large companies have higher operating costs and are more likely to respond to the (larger) rebate and get their pumps repaired. Also, large customers may be more likely to deal with the paperwork required to get their pump repaired.

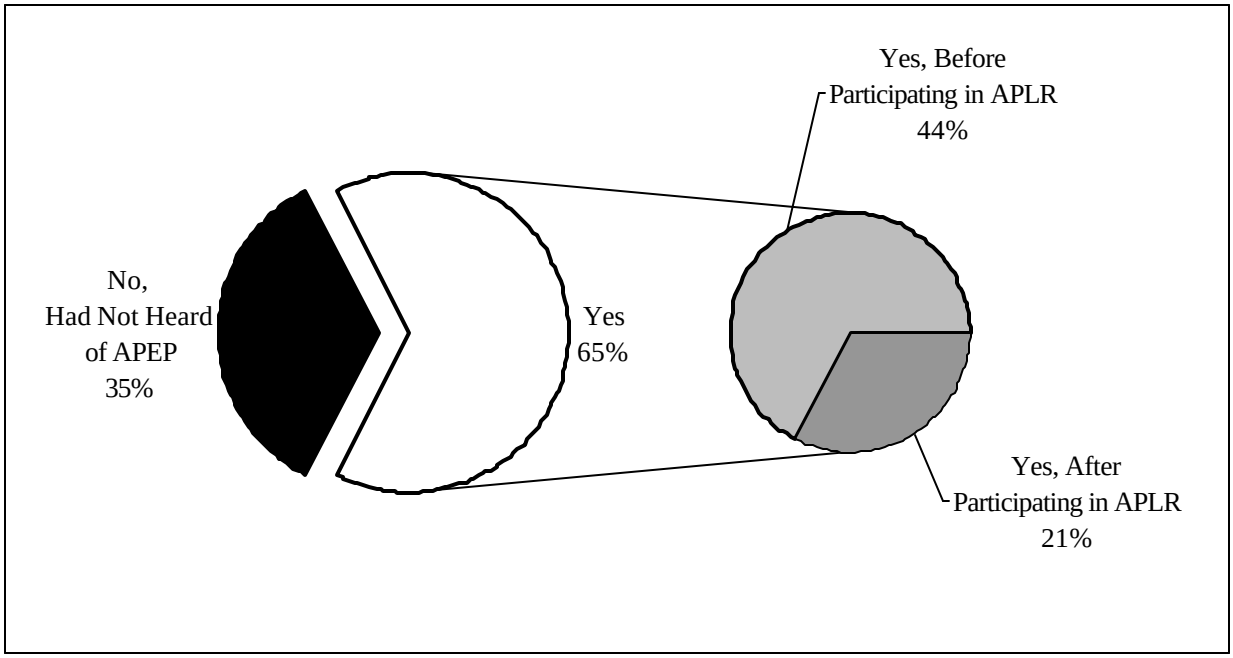
5.2.2.7 CEC Overlapping Program

As discussed in Section 3, there were two pump repair programs in place during the implementation of the APEP. Both were fielded by the CIT. There was speculation on the part of the program manager and the evaluation team that the reason some customers participated in one program over the other was due to basic awareness of the two programs (i.e., they were aware of one, but not the other). The evaluation had the ability to assess this possibility through telephone surveys with both groups.

There was no assessment of the similarities and differences between the two programs by the evaluation team, although the customers were queried about their perceptions of why they participated in one or the other program. According to the APEP program manager, they were similar programs.

As shown in Exhibit 5.49, 21% of the CEC APLR Program customers were not aware of the CPUC Agricultural Pumping Efficiency Program prior to participating in the CEC program. Therefore, they did not truly have a choice in which program to participate.

Exhibit 5.49
CEC APLR Participants' Awareness of CPUC APEP Program



The 44% of customers who did know about the APEP prior to participating in the APLR were queried about why they chose the one program over the other. Exhibit 5.50 shows that about the same number of customers believed they participated in both programs as believed that the CEC program provided better incentives. There were six telephone numbers that overlapped between the telephone surveys. The account numbers for each of these six pump repairs were compared between the two groups. No pump was paid twice – the customers repaired multiple pumps through the two programs.

Exhibit 5.50
Reasons for Not Choosing APEP

Reason	N	Percentage
Better incentives in APLR	6	26
Participated in both programs	5	22
Don't know	4	17
Pump dealer recommended APLR	3	13
Was more familiar with APLR	2	9
Incentive was faster in APLR	1	4
Explained that was ineligible	1	4
Other	1	4
Total	**23**	**100**

The APEP pump repair customers were also asked if they were aware of the CEC APLR program. There were fewer completed surveys in this group to start with, but of the 29 completed surveys, 52% had not heard of the APLR at all (see Exhibit 5.51).

Exhibit 5.51
CPUC APEP Participants Awareness of CEC APLR Program

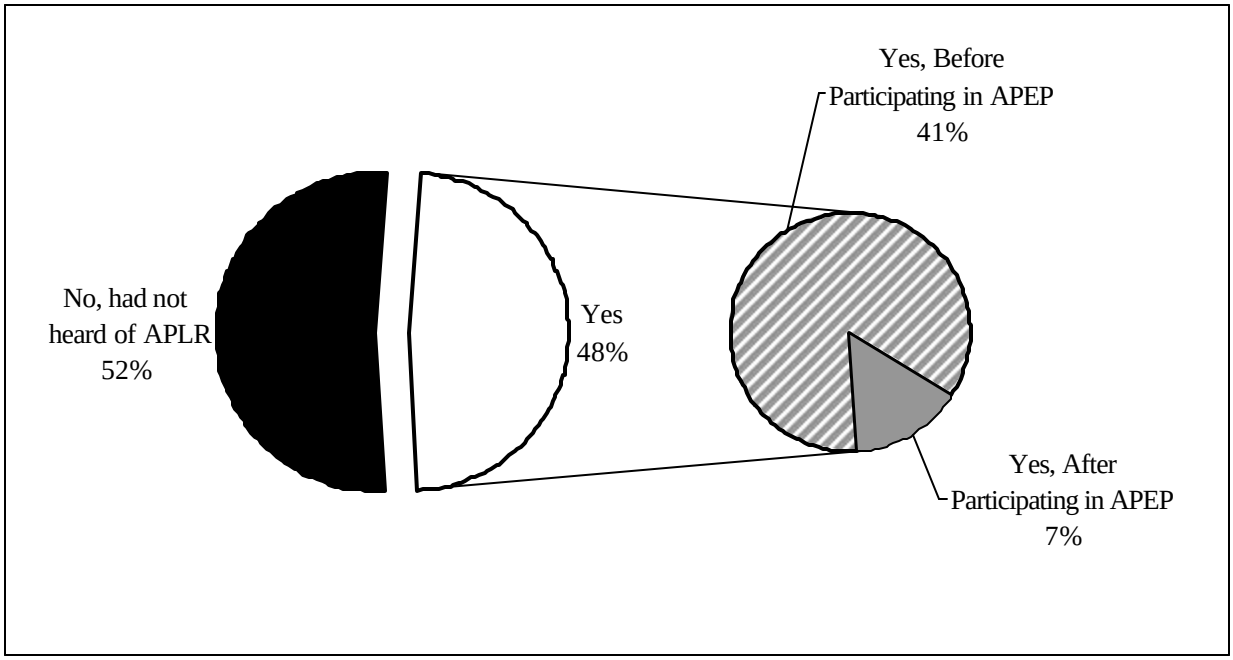


Exhibit 5.51 also shows that 41% of the customers knew of both programs and chose the APEP. For those 41%, most did not know why they chose one program over the other. Some customers appeared to have misperceptions about the criteria needed for APLR participation. They indicated they were unwilling to move their pumping to the off-peak period and thus were considered ineligible for the APLR. However, as this was not a program criteria, it is unclear why the growers thought this was required.

Exhibit 5.52
Reasons for Not Choosing APLR

Reasons for not participating in APLR	N	Percentage
Don't know	4	36
Explained that was ineligible*	3	27
Pump dealer recommended APEP	1	9
Was more familiar with APEP	1	9
Better incentives in APEP	1	9
Other	1	9
Total	**11**	**100**

*Customer chose not to make change to off-peak operating hours and thought they were ineligible for the program.

The same firmographic questions were asked of the customers who participated in the APLR and APEP. However, there were no significant differences between the responses of the two groups.

In summary, analysis indicated that about an equal number of customers were aware of both programs before they participated in either program (somewhat over 40%). Customers chose the CEC Agricultural Peak Load Reduction Program because they felt that the program offered better incentives. However, about an equal number of customers stated they had participated in both programs. Conversely, of those who gave a reason, customers chose the APEP program because they did not want to, or could not, reduce peak period pumping – a requirement of the APLR program.

Close to 60% of the APLR participants who overlapped the same time period as the APEP and *could have* participated in the APEP, were not aware of the APEP. The APRL group was not queried about how they heard of the program. However, the APEP pump repair customers found out about the program (as shown in Exhibit 5.40) mainly from trade allies (such as pump testers, consultants, local pump company). Therefore, to help increase awareness of programs in the customer base, trade allies should be kept informed about new or revised programs in order to market these programs to their customers.

5.3 Process Results

As stated in Section 4.1.4, the process analysis combined quantitative analysis of participant surveys with qualitative analysis of the APEP staff interviews and pump test/repair company interviews to address each of the research hypotheses identified in Exhibit 4.4 under the subheading "Activities/Outputs". These research hypotheses address the operational aspects of the program that evaluability assessment identified as the most important aspects to evaluate. The overall analyses of each of theses data sources on a question-by-question basis, which was conducted for the process analysis, can be found in Appendix O.

5.3.1 Survey/Interview Participant Firmographics

Participant Telephone Surveys - The telephone surveys of the participants generally resulted in responses to the surveys' process-related questions from a maximum of 29 participants who had had their pumps repaired and 300 participants who had a pump test but not a pump repair. The firmographics for those surveys are presented in Section 5.2.2.1 of this report.

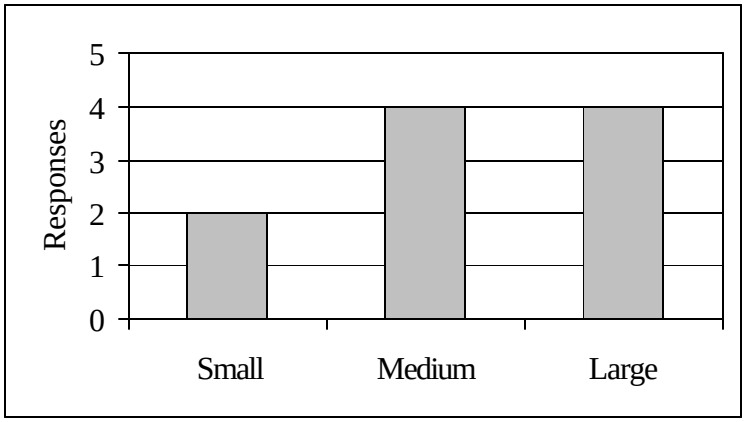
Staff Interviews - The APEP staff interviews covered a wide cross section of the APEP operations staff. These included:

Overall Program Manager (1)
Project HR and Communications Manager (1)
Area Coordinators that Market Program in Regions (3)
Senior Engineer, Advisor on Program and Construction of MECs (1)
Education, Responsible for all Outreach Implementation (1)
Rebate Processing & Pump Tester Coordination (1)
Accounting, Bookkeeper for Program (1)

These staff covered all activities within the APEP program. Because the same set of questions was used for all staff, and not all staff could comment on all aspects of the program assessment, the results of these interviews were much less amenable to grouping and graphic presentation. An overall summary was created, coalescing the findings of the interviews into a cohesive picture of program operation.

Pump Test/Repair Companies - The pump test/repair interviews asked three questions to define the companies being interviewed. Exhibit 5.4 shows that the companies interviewed tended to be of medium and larger size.

Exhibit 5.53
Pump Test/Repair Company, Self-Reported Size



The average period of time the companies have been in business is presented in Exhibit 5.54, demonstrating that they tend to be fairly well established businesses. This almost certainly emanates from APEP efforts to use experienced pump test companies to support the program. While they had no control over which pump repair company participants used, many of the pump repair companies also do testing for their customers.

Exhibit 5.54
Pump Test/Repair Company, Years In Business

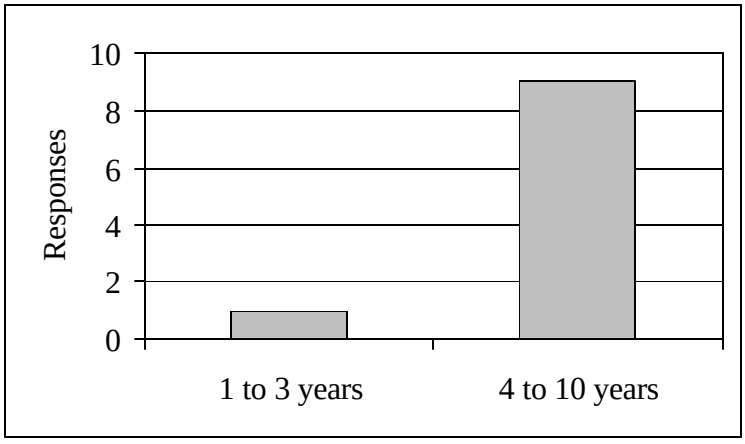
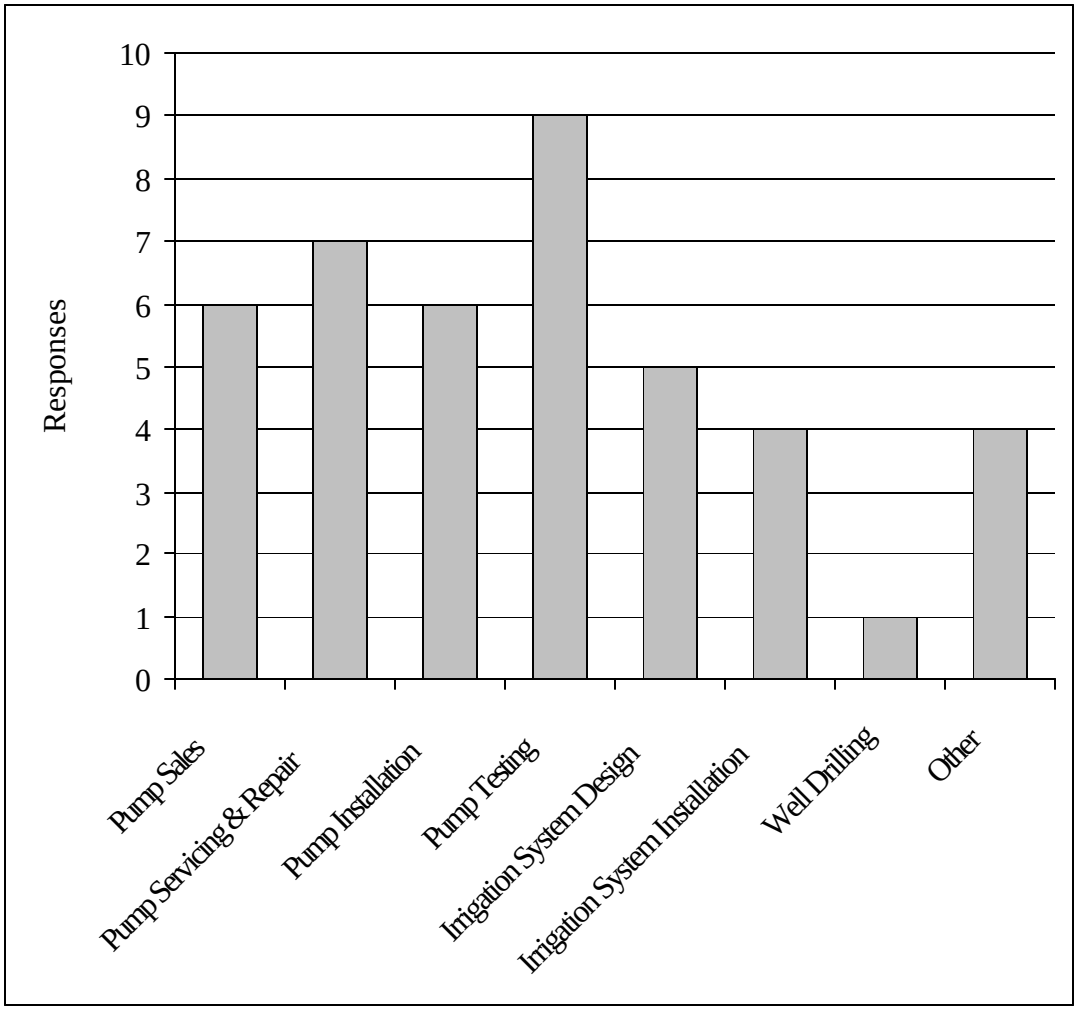


Exhibit 5.55 shows that the most common services provided by the pump test/repair companies were testing and repairing pumps, confirming that the interviews succeeded in contacting the correct population. It also illustrates that these companies tend to offer an array of pumping and irrigation related services to their customers.

Exhibit 5.55
Pump Test/Repair Company, Services Provided



5.3.2 Process Results by Hypothesis

The following presentation of the process analysis first reiterates each hypothesized outcome, presents the data or analysis from each data source that addresses the issue, then forms a conclusion for that hypothesis based on the all of the data. It should be noted that the data sources presented for each hypothesis match the data sources presented in the Activities/Outputs section of Exhibit 4.4.

Process Hypothesis 1 - *The program flows smoothly. There are enough staff to perform the needed duties. Program staff are aware of the objectives of the program.*

APEP Staff Interviews Findings

Program Implementation/Organization

All staff clearly understood their function in the operation of the program. In general, they had a good mental picture of the roles and responsibilities of other staff, and, with two exceptions, felt that the operation was adequately staffed to achieve the goals of the APEP. Program

management appears to have established good communication channels, using bi-weekly status meetings (that include a review of goals and progress toward them), email, and land and cellular phones. Virtually all staff agreed that the ramp up to field the program, while it had its fits and starts, went exceptionally well and succeeded in putting the program in place with all of its capabilities in an incredibly short time.

Program management seems to have done a good job of recruitment and placement of staff. Not only were they able to find people to fill the slots in a short period, but they also appear to have done an excellent job of filling each position with people who have the right skills and experience. As a result, staff morale is extremely high and they exhibit a "can do" attitude.

The two areas where staffing and distribution of responsibilities seem to warrant improvement are interconnected. Several observations supported the contention that the overall program manager was over committed. This over commitment appears to be related to two primary factors, (1) the unanticipated level and complexity of monthly reporting responsibilities to the CPUC, and (2) inadequate staffing to support those reporting needs. The result was a staff-wide consensus that the program manager was working extremely long hours and being less than available to support some mid-level management tasks. This gap was partially filled by bringing in a good day-to-day manager to address operational issues, but still appears to have left the program manager over committed. Hiring a full time controller to handle the accounting and to support/handle the CPUC reporting would probably resolve much of this issue. It should be noted that the program manager made sure he was available to guide the technical portion of the program, as staff generally agreed he was appropriately available to them.

Training

The fielding of this program depended heavily upon staff with long-term experience in pumps and pumping. The program succeeded in hiring staff with such expertise. This experience was then supplemented with in-depth training seminars at the beginning of the program and as needed as the program was fielded. The training generally covered program software, program procedures, and information on program objectives and goals. Operations manuals are posted on the program website for review. While training is generally perceived as good to excellent, the suggestion was made to supply Area Representatives with interpersonal skills training to better effect interaction with customers (the suggestion was made by an area manager).

Program Goals

When asked, all staff were able to state the overall program objective, and most were able to recite the specific numerical goals of the program. The program staff generally understood how the program goals were set, and felt consulted in setting them for the second round of funding. In addition, due to goal review at the bi-weekly meetings, virtually all staff knew where the program stood in achieving the goals, where they were succeeding and where they were falling short. Each area manager, and each person responsible for fielding a program element understood their targets and were very aware of where they were in terms of meeting the goals for their area. In addition, the area managers and other staff generally knew what corrective actions were being taken to achieve goals where the program was falling short.

Program Target Population

All staff queried about the target population identified, in one way or another, irrigated agricultural customers who were served by IOUs as the primary target population of the

program. Most seemed to agree that the program has targeted all sizes of customer, but one indicated that the program was now going after large customers because "that is where the savings potential is." When asked what program changes they might suggest, several mentioned that the program was missing opportunities by not including golf courses, municipalities, and industrial sites. These responses may have resulted from these ideas having been included in the 2004-05 proposal. Staff suggestions for program improvement included:

- Improve the timing of information delivery to partners so that it coordinated with their publication schedules and promotion goals.
- Several staff felt that more effort should be put into forcing the IOUs to supply lists of their customers so that the the program can directly market to these customers. Apparently this had been suggested before, but the political obstacles were believed to be too large.

Program Promotion and Marketing

When asked about the most effective means of promoting the program, program staff named the wide variety of outreach methods used by the program, including the MEC, trade allies, mail, printed material, association meetings, seminars, trade shows, and the website. The general consensus was that the pump test, as a means of demonstrating energy and dollar savings, was the program feature most likely to get customers to participate in the pump repair program. The responses, when staff were asked which features tend to prevent people from participating, were much more varied. They ranged from lack of knowledge (three responses), message too complicated (one response), to economy down/ lack of funds/ incentive not large enough (three response), to distrust of government.

When asked about mass marketing, the interviewees acknowledged that the program used direct mail and billboards. When asked about mass media marketing, 40% of the respondents stated that it doesn't work with this audience, while the other 60% stated that it helped to complete overall picture or that plans were underway to conduct mass media marketing.

The program manager stated that no market research was conducted before the program was fielded and that program design relied on the accumulated knowledge of the people involved. Given the disagreement on the usefulness of mass media marketing, and the seemingly belated plans to use it, it would appear that the program ought to either try it in a limited area and assess its effectiveness or conduct market research to determine whether it is an effective tool in this market.

Program Delivery

A set of questions was asked of the personnel responsible for delivery of the program. In addition, the evaluation staff attended 12 seminars using the MEC. Overall, it was clear that the program had delivered all needed material into the hands of the people responsible for implementing the program. It had identified and hired skilled staff to field the program, and had well-trained those staff in program delivery. It had supported their efforts to field the program with well-designed and implemented central support systems, including website tracking databases. The program management succeeded in motivating program delivery personnel and keeping them enthusiastic about the program. This was partially because they kept the program focused on the goals and kept staff aware of progress toward those goals through sound communication practices. Additionally, the effort has been supported by the creation of program

tracking databases that appear to be well managed, although the databases themselves were not completely assessed (some of the variables in the database were assessed during the quarterly verification effort).

Pump Test/Repair Companies Interview Findings

The pump test/repair companies were asked a series of questions addressing the issue of APEP program operation. Overall, the pump test/repair companies felt that the APEP communicated well and was adequately staffed. Nine out of ten felt that that their communications with APEP on pump test and repair approval was very good and had no recommendations for improvements. Of those that could comment on communication among the APEP staff, all seven thought communication was good. When asked directly whether they felt that the program was adequately staffed, eight of ten thought it was and made no suggestions for improvements. Two thought it took too long to get paper work processed.

When queried about program goals, all ten responded that the goal was to increase the efficiency of pumping plants, and indicated that the goals had not changed since program inception. They stated that goals are communicated through seminars and one-on-one meetings with APEP Staff.

Conclusion: Overall, the interviews developed a portrait of an exceptionally well-run program that appropriately staffed positions, established good communication, developed and clearly communicated the program goals to staff and contractors, tracked progress against those goals and communicated that progress to staff.

Process Hypothesis 2 - The customers are interested in receiving pump test results.

The two parties able to comment on this interaction are the pump test participants themselves and the pump test/repair companies that supplied the services. Neither of these parties was asked this direct question. Since the pump test was requested by each participant, it seems a foregone conclusion that they were interested in receiving the results of the pump test. The answer to this question is supported by responses to the next hypothesis, which addresses whether the customer received and understood the economic analysis of the pump test.

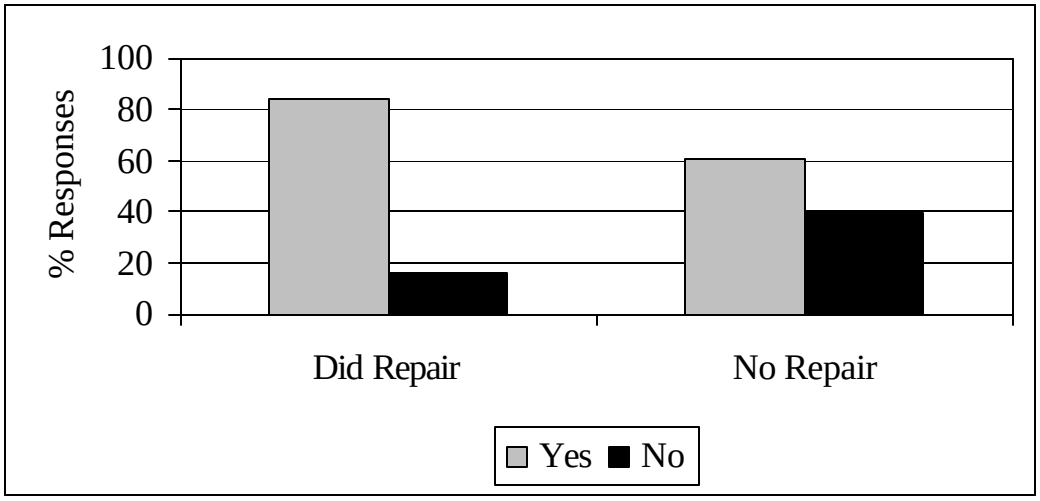
Process Hypothesis 3 - *The customers receive and understand an economic analysis of the pump test.*

The two parties able to comment on this interaction are the pump test participants themselves and the pump test/repair companies that supplied the services.

Pump Test Customer Survey Responses

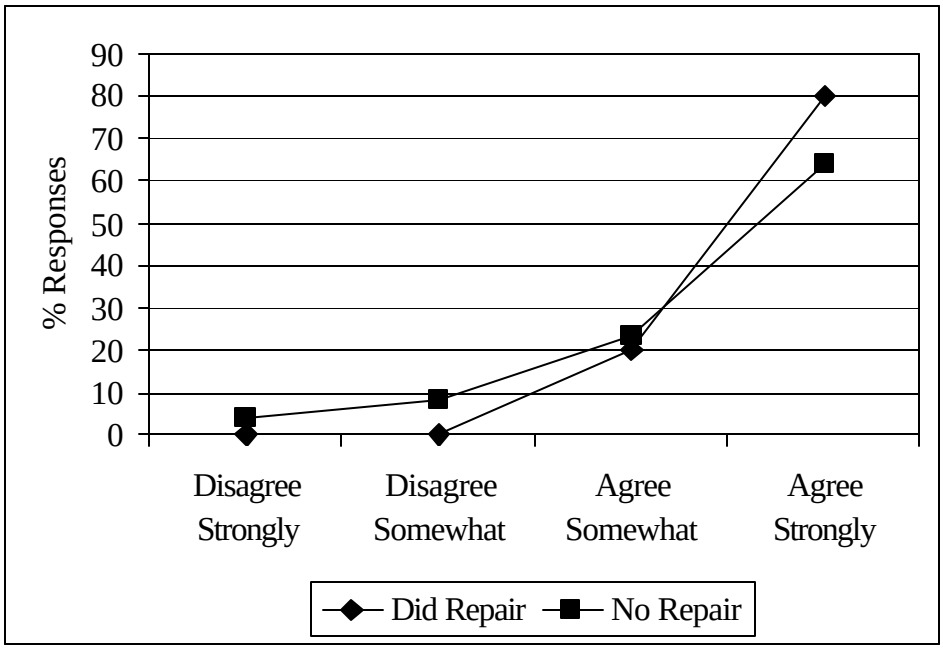
When the pump test participants were asked whether the pump tester reviewed an economic analysis of their pump, based on the pump test, the response varied depending on whether the pump test participant subsequently performed a pump repair. Exhibit 5.56 presents the responses, illustrating that those customers who eventually went on to do a repair were 23% more likely to say that the pump tester reviewed the economic analysis based on the pump test. Although the Chi-Square statistic was not significant at the 95% confidence level, it was not too far off from being so (Chi-square value shown in Exhibit 5.38). The relationship noted in this test suggests that more participants who made a repair indicated that the economic analysis was reviewed with them as compared to those who did not make a repair.

Exhibit 5.56
Was Economic Analysis Reviewed?



When asked to agree or disagree with the statement, "The information from the pump tester was clearly and thoroughly gone over", the participants gave the responses presented in Exhibit 5.57. The results in Exhibit 5.57, which are statistically significant, agree with Exhibit 5.56, saying that, directionally, more pump repair participants had the results reviewed with them than those who did not make a repair. This result was statistically significant at greater than the 95% confidence level.

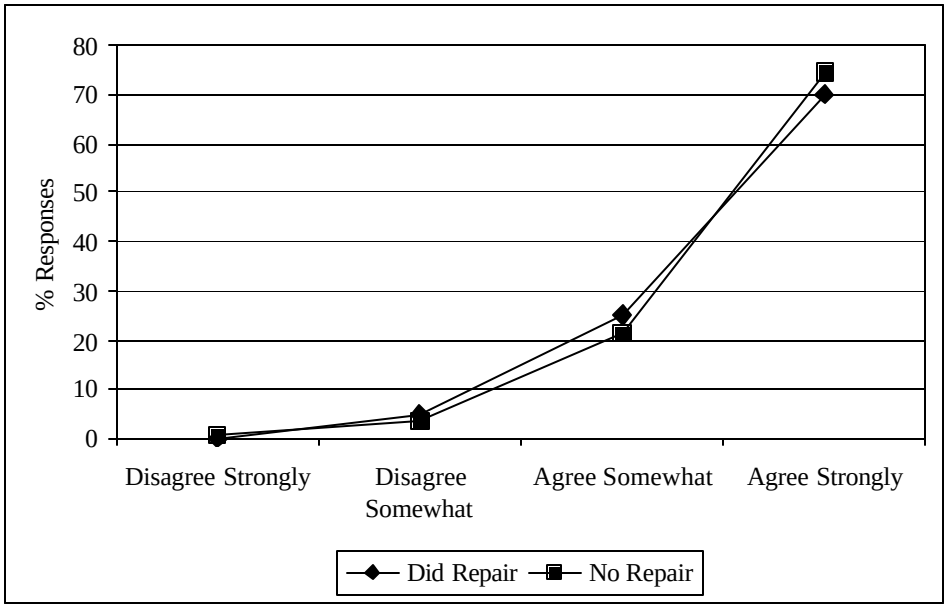
Exhibit 5.57
Pump Test Results Clearly and Thoroughly Presented



In an attempt to assess whether customers understood the pump test results, they were asked to agree or disagree with the statement, "The pump test results were easy to understand." Exhibit

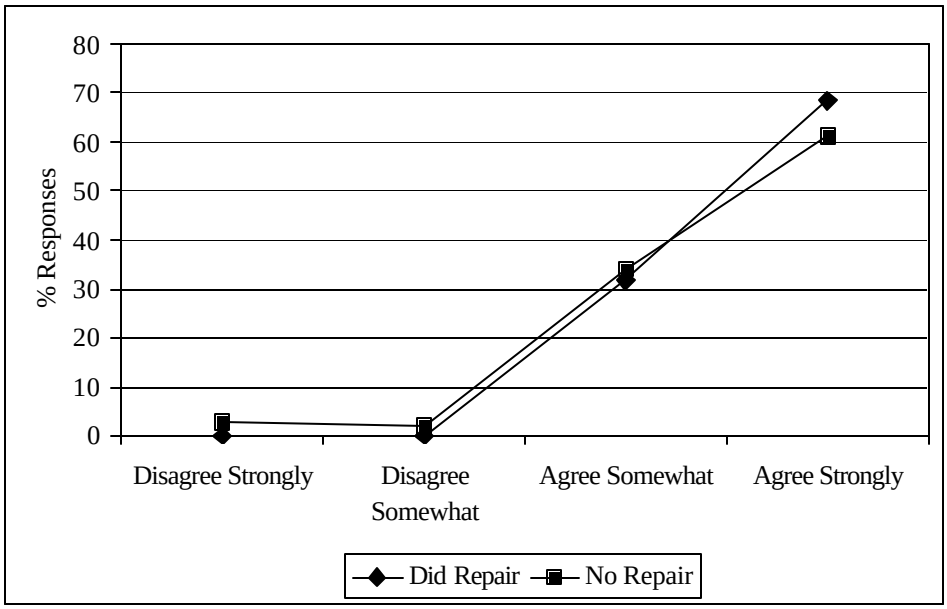
5.58 shows that both groups had similar experiences, with over 70% agreeing strongly and over 95% agreeing somewhat or strongly that the pump test results were easy to understand. Only 5% of either group disagreed with this statement.

Exhibit 5.58
Pump Test Results Understandable to Participants



Beyond understanding, Exhibit 5.59 shows that, when queried, over 95% of both groups agreed somewhat or strongly that the financial information in the pump test report was believable. Only 5% of the no repair group disagreed with this statement.

Exhibit 5.59
Believability of Economic Analysis to Participants



Pump Test/Repair Company Interview Responses

Pump test/repair companies were asked four questions relevant to this hypothesis.

First the pump test/repair companies were asked, "As part of the program, you are supposed to hand deliver an Economic Analysis to the customer and explain the results? Do you do this, and how does the program track whether you do?" Eight of nine that supplied valid responses said that they did hand deliver the economic analysis. Three pointed out that customers had to sign off on the economic analysis. One employee said he didn't discuss it with customers because they didn't care, they just wanted to know how much water it was pumping.

Next the pump test/repair companies were asked how the program assured that customers were receiving quality pump tests. The general response was that the program did this by providing training, selecting experienced testers, checking test results, and supplying pump test reporting standards and pump test software.

Then the pump test/repair companies were asked for their estimate of the percentage of customers who really understand the pump test results. Six of eight responded that between 75% and 95% really understood the pump test results, one said 50%, and one said 10%.

When asked if they could suggest changes in the program that would increase the likelihood that the customers would understand the pump test results, six of seven relevant respondents couldn't suggest any improvements. One respondent suggested decoding the abbreviations (kWh, AF, etc.) for the customer, since most are not familiar with them.

Conclusions: Statistics indicate that the participants who had a pump repair more often reported having received a clear and thorough explanation of the pump test results and the economic analysis than did those who only had a pump test. Eighty-nine percent of the pump testers report supplying those services, but only sixty to 65% of participants report having received them. Overall, 95% of participants agreed that the pump test results were easy to understand with pump testers estimating that about 75% to 80% of the customers really understood the pump test results. Together these results suggest that if results are explained to customers, they understand the implications and may be more likely to repair their pumps. This further suggests that the program ought to redouble efforts to assure that pump test results, especially the economic analysis results, are explained to pump test participants in-person, by the pump testers.

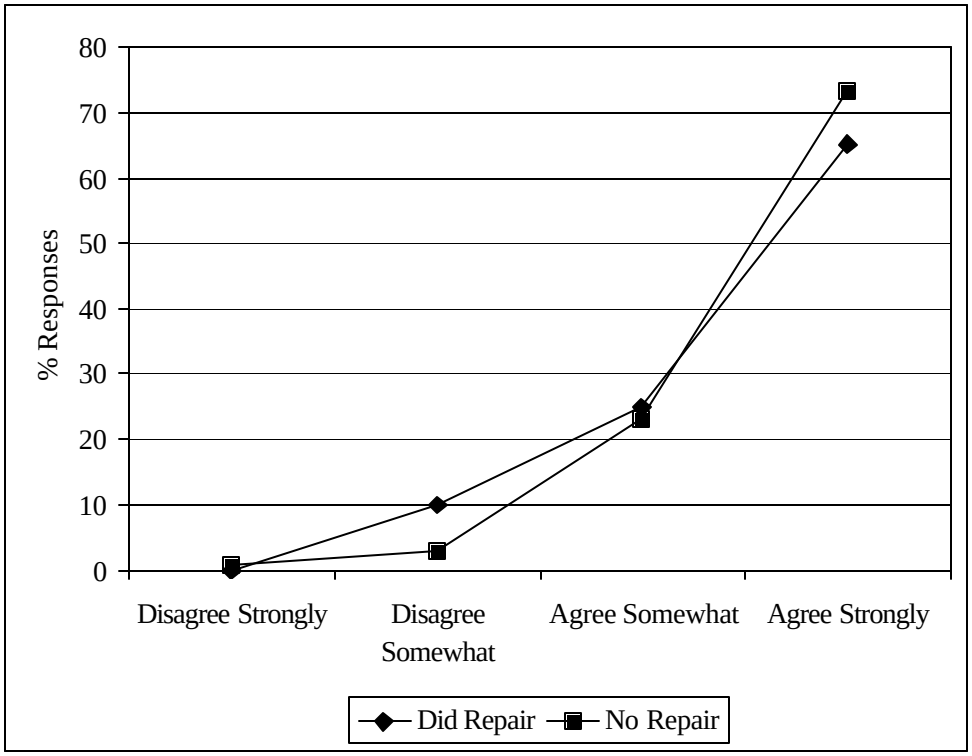
Process Hypothesis 4 - *The Customers learn something from the economic analysis provided by the pump tester.*

The only survey respondents able to comment on whether they learned something from the pump test are the pump test participants themselves.

Pump Test Customer Survey Responses

To assess the validity of this hypothesis, pump test participants were asked to agree or disagree with the statement, "As a result of having my pump tested, I am now more knowledgeable about needed operating efficiency improvements for my pumping operations." The results, presented in Exhibit 5.60, show that both groups agree with this statement, with approximately 25% agreeing somewhat and over 70% agreeing strongly.

Exhibit 5.60
Participants Learned from Pump Test



To further support this statement, all of the 20 valid respondents who performed pump repairs indicated that they used the results of the pump test when deciding whether to repair the pump.

Conclusion: Ninety-five percent of all pump test participants surveyed indicated that they agreed to some degree that they were more knowledgeable about needed operating efficiency improvements for pumping operations after the pump test results were presented. This response, combined with a reported 100% use of the information by people who performed pump repairs and the high believability of the economic analysis (Exhibit 5.59) presented in the previous hypothesis, strongly supports the hypothesis that customers learn something from the economic analysis provided by the pump tester.

Process Hypothesis 5 - *The Customers are satisfied with the process for getting a pump test and the pump test results.*

Once again, the only survey respondents able to comment on whether their satisfaction with the process of getting a pump test and its results are the pump test participants themselves.

Pump Test Customer Survey Responses

To address this hypothesis, customers were asked to agree or disagree with a series of four statements concerning the process for obtaining a pump test. These statements are presented in Exhibit 5.61 through Exhibit 5.64 along with the summarized customer response percentages.

Exhibit 5.61 shows a fairly high degree of agreement that customers found it easy to find a program-approved company to perform the pump test. Ninety-two percent of the No Repair group and 100% of the repair group agreed to some degree. However, participants who did

repairs reported that it was easier to find an approved company to do the pump test than did those who did not do repairs. The difference between the mean responses was significant at the greater than the 95% confidence level. It is unclear whether this says that the ease of finding a company to do the pump test has a significant effect on the likelihood of repair, or whether the growers who did the repairs were inherently more comfortable with the process for some other reason (e.g., larger, more experienced, had energy efficiency staff, etc.)

Exhibit 5.61
Ease of Finding Approved Pump Test Company

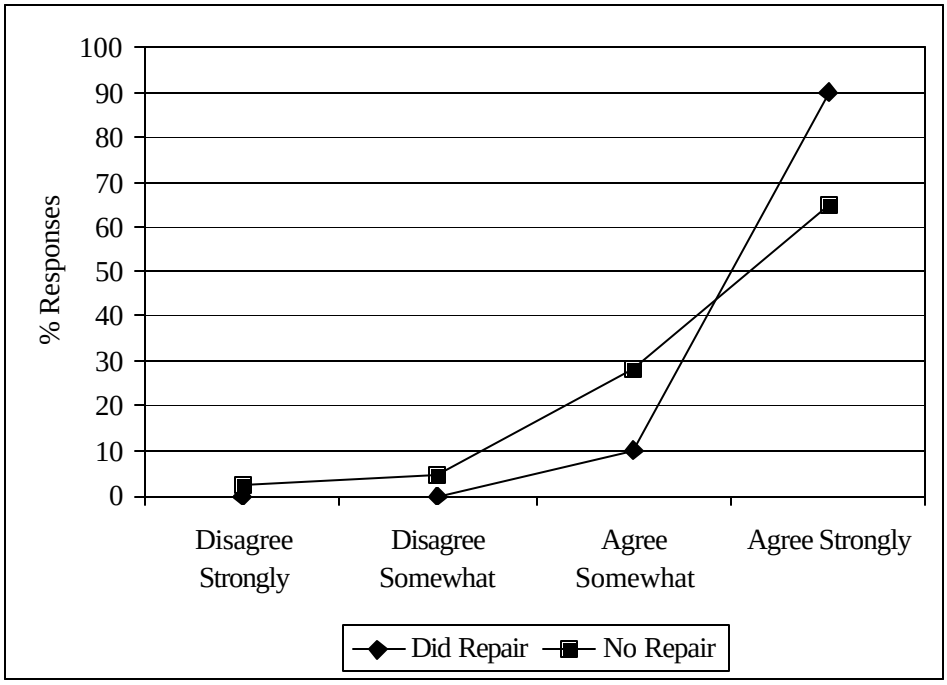


Exhibit 5.62 presents the ease of requesting a pump test from a program-approved company. Once again, as in Exhibit 5.61, the repair group found it easier to request a pump test from a program-approved pump test company than did the no repair group. One hundred percent of the repair group strongly agreed with the statement, while less that 80% of the no repair group strongly agreed and 3% strongly disagreed. The difference between the mean responses was significant at the greater than the 95% confidence level. It should be pointed out, that while the means are significantly different, over 96% of both groups agreed somewhat or agreed strongly that it was easy to find a program-approved pump test company.

Exhibit 5.62
Ease of Requesting a Pump Test

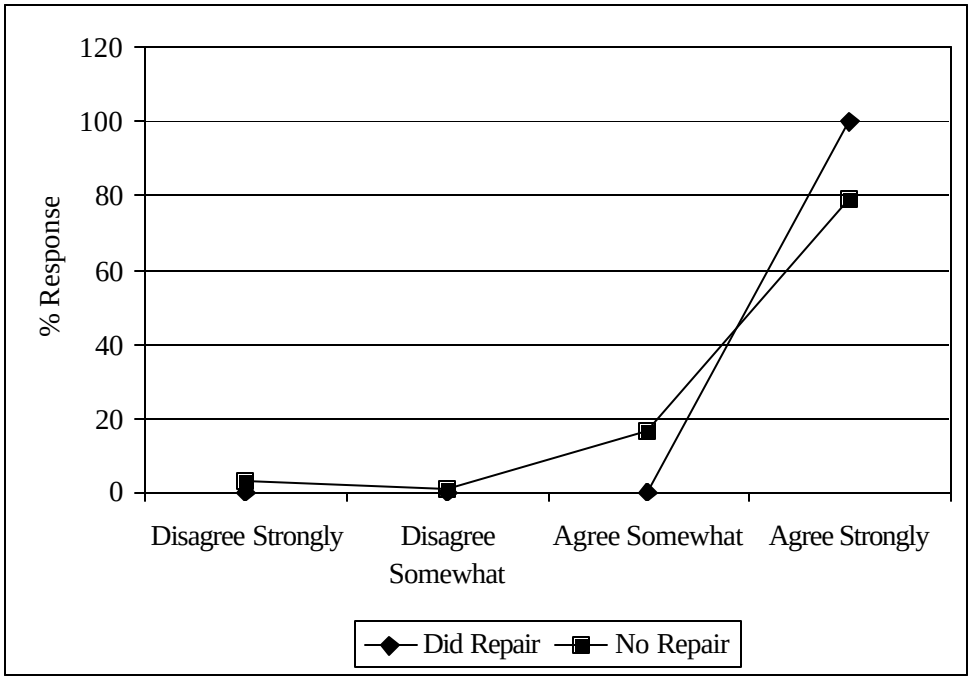


Exhibit 5.63 and Exhibit 5.64 present customer satisfaction with the time required to have the pump test performed once it was requested, and the time required for the results once the test had been conducted. For both questions there was no significant difference between the repair and no repair group, and in both cases over 90% of all respondents agreed somewhat or agreed strongly with the statement that the wait wasn't very long.

Exhibit 5.63
Satisfaction with Wait Time for Pump Test

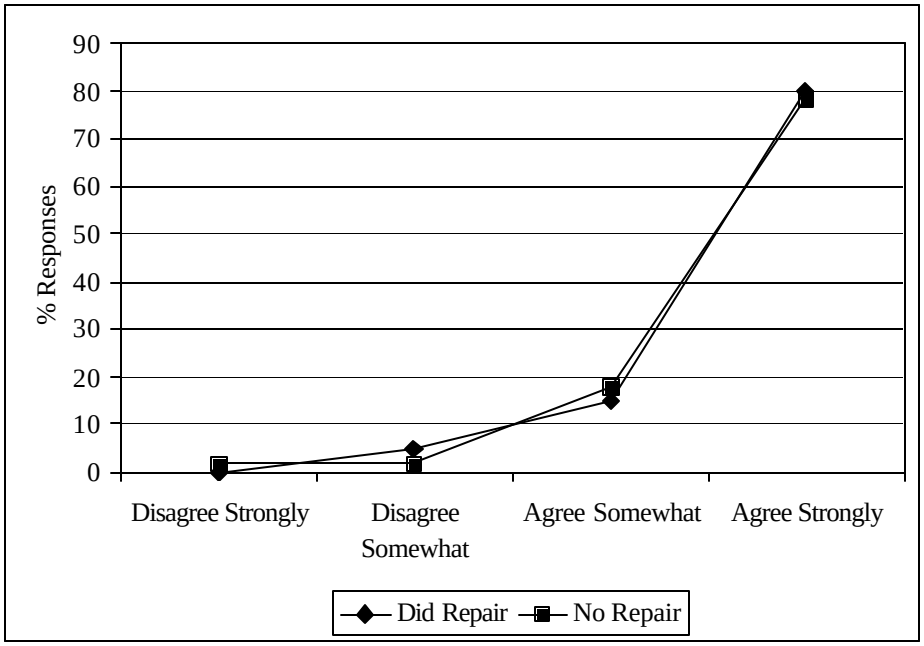
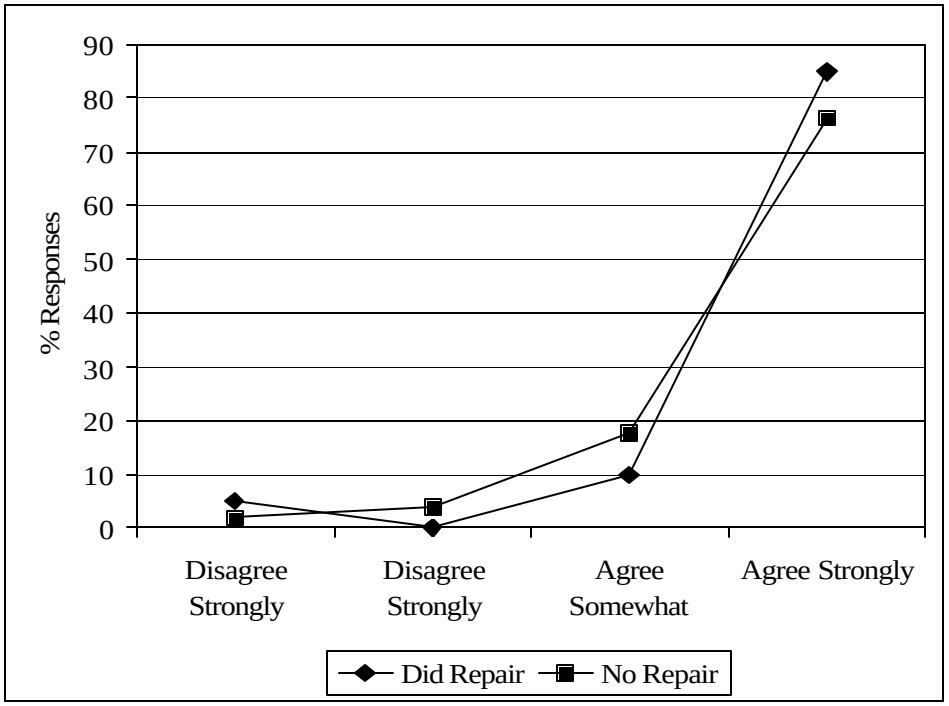


Exhibit 5.64
Satisfaction with Wait Time for Pump Test Results



Conclusion: Overall, satisfaction with the process is very high, with over 90% of respondents agreeing somewhat or agreeing strongly on all questions asked. At the same time, statistically,

the average pump repair participants found it easier to both find a company to do the pump test and to schedule the pump test than those who did no repairs.

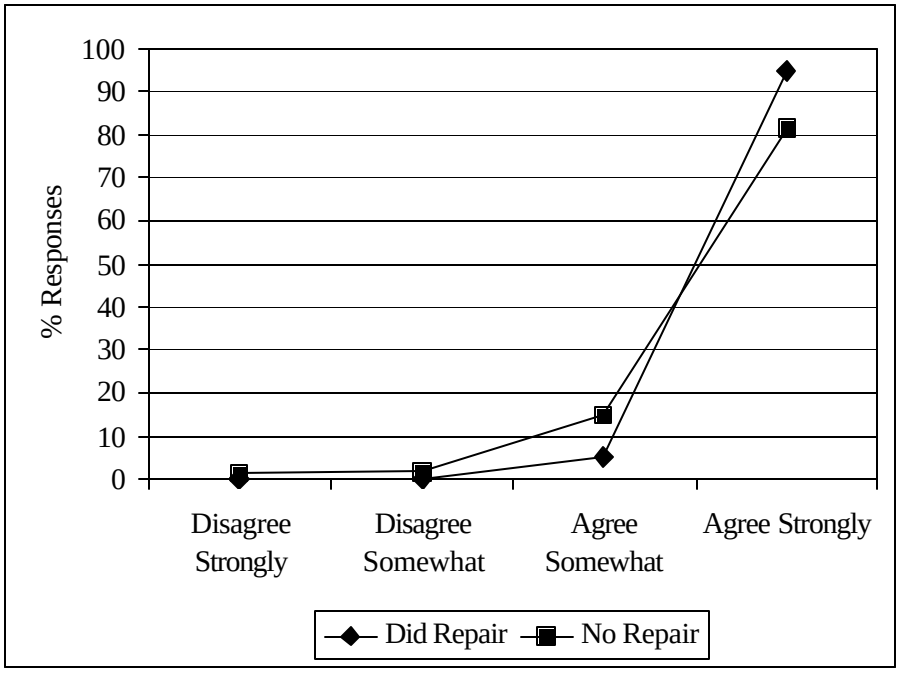
Process Hypothesis 6 - *The pump testers provide their customers with relevant information regarding the pump test.*

The two parties able to comment on this interaction are the pump test participants themselves and the pump test/repair companies that supplied the services.

Pump Test Customer Survey Responses

The pump test participants were asked to agree or disagree that the pump test results were useful. The results of this straightforward question are presented in Exhibit 5.65, and show that both groups had similar experiences, with over 80% agreeing strongly and over 95% agreeing somewhat or strongly that the pump test results were useful. Only 3% of the no repair group disagreed with this statement. Respondents who made a repair agreed more strongly that the pump test results were useful than those who did not make a repair, in that the mean results of the two groups were statistically different at the 95% confidence level.

Exhibit 5.65
Pump Test Results were Useful



As further testament to the usefulness of the pump test results, 100% of the 20 respondents in the repair group agreed strongly with the statement "*I used the pump test results to help decide whether to repair the system*."

Pump Test/Repair Company Interview Responses

When asked, "Do you think the pump test results provide adequate information to help the customer make a decision whether or not to make pump repairs?" 100% of the pump test/repair companies gave an affirmative response.

Conclusions: Overall, both pump test/repair companies and pump test participants agree that pump test results provide their customers with relevant information regarding the pumping system. Participants who repaired their pumps agree more strongly with this statement than customers who did no repairs.

Process Hypothesis 7 – *The pump testers feel that the process between them and APEP is working.*

The pump test/repair companies were the only party to have input on this hypothesis.

As stated earlier during the discussion of Process Hypothesis 1, the pump test/pump repair companies felt that communications with program staff were good and that the APEP was adequately staffed and well organized, generally making the interaction with the program work.

Exhibit 5.66 presents a series of questions asked of pump test/pump repair companies concerning their overall view of the process. In general, most companies feel the program is working well, with individual recommendations for ways to improve the program. One theme that often recurred in different formats is the view of the pump test companies that customers find the paperwork too difficult and cumbersome.

Exhibit 5.66
Pump Test/Repair Company View of Process

Question	Response Summary
What are the advantages and disadvantages of the current program marketing arrangements? What would you change?	Five respondents said the program was doing a good job and not to change it. Three said that the stopping and starting of the program made it unreliable and undependable to the customers. One pump repair shop said the program didn't benefit them, and one said that it should be simplified (there were too many options with no real energy savings differences between them.)
Does this system work well? What changes would you make?	Seven respondents said it works well, no changes needed. Two said the paperwork was too complicated and cumbersome.
Do you feel that the approaches you have used to market the program have influenced customers to repair their pumps? If so, what specific approaches have been successful?	Six of seven said yes, marketing helps their customer decide to make a repair. Four out of seven said that explaining the economic analysis was the primary factor. One said the rebate was key and one said just telling their customers about the program influenced the customer decision in some cases.
What do you think the program might do to make your marketing more successful in influencing customers to make pump repairs?	Four said "Nothing." Suggestions were (1) encourage pump companies to do mailings to customers, (2) one-on-one discussion of economic analysis works best, (3) market rebates more.
General Comments	Four comments: good program, keep it up (all), one said make the paperwork simpler.

Conclusion: In general, the pump test companies found the process between the APEP and themselves satisfactory and requested no major changes other than a request for reduction in paperwork.

Process Hypothesis 8 – *The pump testers feel the buy-down provided by the program is adequate*

Data were collected from the APEP staff and pump test/repair companies to address this hypothesis.

Pump Test/Repair Company Interview Responses

The pump test/repair group was asked three questions concerning the reasons that customers do and do not make repairs. Summaries of the responses are presented in Exhibit 5.67. This exhibit brings to the surface most of the factors that enter into complex decisions that growers make when deciding to repair a pump. It demonstrates that while the rebate can tip the balance to a

decision to repair the pump, issues such as cash flow (often correlated with the size of the grower), alternate sources of water, and whether the land is leased or owned also have major effects on the decision.

In addition, when pump test/repair companies were asked, "What actions do you think would increase the success of the program in reaching its goals?" one response was that the program should "think of a better rebate structure for small pumps; rebate isn't worth it." This comment needed to be combined with the APEP comment noted below.

APEP Staff Interviews Findings

During the interviews with APEP staff, the person responsible for processing rebate forms commented that the program should possibly up the ante for the smaller customers to make it more worth their while. He had had several conversations with smaller pump owners who say the rebate isn't worth the effort.

Small Pumps - When the pump/repair company and APEP staff input are combined, it raises the question of whether the rebate structure for small pumps is adequate to influence the owners of small pumps in need of repair to make those repairs.

Conclusion: There is no one easy answer to the question of whether the "buy down" is adequate. Other factors, such as size of the pump owner and economic conditions, play a major role in the overall decision. However, there were at least two indications that buy down may be inadequate to promote repair of small pumps.

Exhibit 5.67
Test/Repair Company View of Reasons Driving Repair Decision

Question	Response Summary
What do you think is the key factor in a customer's decision to repair or not to repair the pump? Can the program do anything to influence that decision in a positive way?	Five said economic analysis, five said pump test result or whether pump can deliver needs. Improvements included reducing paperwork, and giving a "good" rebate.
Some pump test results show good economic incentive for repairing a pump, yet customers don't repair them. Do you have any insight into typical reasons that they don't repair the pump under these conditions?	Main response (7/10) is "couldn't afford it" or "cash flow." Others were leased property and had other pumps to fill the gap. Suggestions to change the situation were to increase incentive and offer low interest loans.
How much of a role do you believe the amount of the pump repair rebate has on a customer's decision? Does this decision depend on the size of the grower's operation?	About 60% of the responses said the incentive had a large effect on the decision. Other responses said that it depended on the overall size of the rebate, how bad the pump was, and the size of the grower. There seemed to be consensus that the size of the grower was important to whether they decided to do it or not. Larger growers are more likely to do it because their cash flow is better.

5.3.3 Creation of Mobile Energy Center

Two mobile energy centers (MECs) were built with APEP funds. A MEC is pulled by a truck to sites throughout the state (see Exhibit 5.1 for locations serviced through 2003) and set up for an educational event and demonstration. Exhibit 5.68 provides a picture of the set up.

Exhibit 5.68
Picture of a MEC

Exhibit 5.68 shows the truck/trailer type of set up of each of the MECs, along with where participants in the clinic sat. Exhibit 5.69 shows more closely the inside of the MEC, with some of the hardware labeled.

Exhibit 5.69
Interior of MEC

Each of the two MECs was set up to include both a turbine and centrifugal pump. Run by a generator on board the MEC, each of these pumps could be set to move water from the holding tank, through the piping, and back to the tank. The valve shown in Exhibit 5.69 was able to mimic various situations seen by a pump such as: 1) well depth and the ramifications of water table depth on the pump; 2) what occurs when a filtration system is clogged; or 3) what happens when the impellers and bowls become worn and the pump cannot maintain the desired water flow rate. The APEP wrote computer software to indicate what happens in each of these (and other) situations to the energy used by the pump and resulting cost to the grower. The computer was integrated with MEC hardware to gather real time data as the pumps ran and the valve was changed by the presenter (or grower). Growers could see first hand the cost ramifications of different events and discuss questions thoroughly with the APEP staff.

The participant seating arrangement at each site varied from relatively open (Exhibit 5.70) to fully enclosed (Exhibit 5.71).

Exhibit 5.70
Example #1 of MEC Set Up

As this exhibit shows, the MEC traveled directly to the growers – in this case, a local grower had an area close to his fields that he allowed the APEP to use for the educational event.

Exhibit 5.71
Example #2 of MEC Set Up

At each MEC, educational pamphlets were handed out as well as applications for pump repairs. In some cases, the information was available in Spanish. The list below covers handouts available during MEC events.

- Incentive applications
- APEP Brochure (in English and Spanish)
- APEP Education Brochure
- Calculation Brochure
- Reprint from California Farmer highlighting CIT
- CIT Brochure
- Irrigation Planning Brochure
- Pump Efficiency Test Brochure (in English and Spanish)
- Information on Flow Meters
- PowerPoint presentation slides
- International Center for Water Technology Brochure
- Information on Waterright.org
- Pumping Energy Calculator and Brochure on how to use it
- Glossy 6” x 8” Postcard with contact information on program
- An eight-minute video on a pump test procedure was run during some MEC events.

At each event attended by the evaluation team, the presentation by APEP staff was professional and informative. MEC participants appeared engaged and attentive. Questions were asked of the presenter throughout. The evaluation team's suggestions for enhancing presentations were usually attempted and incorporated when they were found to be worthwhile.

In addition to the MEC's mobile educational events, there were also fixed-site seminars. The next section describes APEP involvement with the Irrigation Training Center in Chico, one of the fixed sites.

5.3.4 Creation of Chico Irrigation Training Center

California State University at Chico (CSUC) has had a working university farm since about 1966. The farm produces crops and is used for research and training of university students. Approximately three years ago, an irrigation training facility was needed in the region and CSUC began working with various entities to create such a facility.

Phase one of the training facility included supervisory control and data acquisition (SCADA) on six of the nine deep well turbines on the university farm and variable frequency drives (VFD) on two of the SCADA controlled pumps. The second phase of the facility occurred through a collaboration between the Center for Irrigation Technology (with funding from the Agricultural Pump Efficiency Program), the Bureau of Reclamation, and the Chico Agricultural Teaching and Research Center (ATRC). In this phase a structure (shown in Exhibit 5.72) was built. This structure created the ability to perform pump efficiency and meter test training, open canal water measurement and management training, SCADA control and monitoring demonstration training, and undergraduate education in irrigation technology. The Irrigation Training Facility incorporates both the deep well turbines from phase one and the pump/canal structure into its education and training.

Exhibit 5.72
Part of the Irrigation Training Facility in Chico

The Irrigation Training Facility (ITF) was officially dedicated on May 16, 2003, although the first APEP seminar took place on May 13, 2003. The site was designed to fulfill three purposes:

- Education on pumping efficiency,

- SCADA and water measurement training, and
- Undergraduate training in irrigation issues.

Within 2002 and 2003, the APEP had the goal of providing two seminars at the facility and four seminars within a relatively short distance of the facility using the mobile education center (i.e., within 50 miles). These goals were met, as shown in Exhibit 3.2 (i.e., Chico, Redding, and Durham sites).

Apart from APEP goals, however, the ITF plans other seminars for water measurement training (i.e., with the Bureau of Reclamation). These plans provide an indication of the synergies between the APEP and other entities. They show how collaborative work in one area can continue to educate growers about energy efficiency at the pump. Starting in the fall of 2003, the ITF planned to provide training to their undergraduate population at Chico, both at the site and through a microwave connection of the SCADA controls to a university computer so students do not actually travel to the university farm, but can control the pumps from their classroom and see results of varying parameters at the pump. The ITF also plans to work with local community colleges and bring students to the irrigation training facility for learning. Additionally, the ITF is available to any pump company that wants to demonstrate a technology or pumping efficiency to a customer. (There was no follow up by the evaluation team to determine the outcome of the ITF plans discussed in the summer of 2003.)

While there is no official mission statement for the facility governing long-term goals, the APEP (through the California State University, Fresno Foundation) has a contract with California State University, Chico to allow use of the facility for educational purposes through the end of 2003. Specifically, two fixed site presentations and up to three local area education seminars are agreed to through 2003. The contract can be extended if the parties so desire.

In order to assure that the purposes for which the facility was designed are met, there is a half-time, tenured track faculty person with a water specialty to deliver the academic programs. There is a full-time SCADA technician responsible for outreach to water districts in the region. That person is also available for coordination with the APEP and other universities to set up seminars. Additionally, the secretary at the irrigation training facility is available to provide full support for any planned workshops. Through the Memorandum of Understanding (MOU), the ITF is available to the APEP for seminars and workshops. Faculty at the site are also available to the APEP, as needed, to educate seminar participants.

As mentioned earlier, the facility came about due to a collaboration between different entities. During the interview, it was stressed that three different university sites in the California system have very rarely collaborated on anything, so the fact that Chico, Fresno and CalPoly are working together at this site is unusual. In addition to the university groups, the Bureau of Reclamation and local irrigation companies provided cash or in-kind funding to create the pumping/canal structure pictured earlier. The funding for this phase of the ITF totaled close to $190,500 and is summarized in Exhibit 5.73.

Exhibit 5.73
APEP's Part in Funding of ITF

Part of Facility	Previously Funded	APEP	Bureau of Reclamation	Chico ATRC	Pump Companies	Future Funding
SCADA and VFD on existing turbine pumps	✖	-	-	-		-
Pump/Canal Structure	-	42% of Cash	51% of Cash	7% of Cash	In-Kind Services	-
Sand filters, microwave link to campus, and other possible equipment	-	-	-	-		✖

A set of the interview questions attempted to determine the use of this new facility versus what was available before it was created. According to the project manager at the Chico farm, there was nothing like this available anywhere near the farm. The nearest available educational facilities with this type of hands-on product were in Fresno and San Luis Obispo (CalPoly). Therefore, the information and education being disseminated through the ITF, while not necessarily new to others in the state, is reaching out to those who could be considered hard-to-reach due to geographic location. Previously, if a company or person wanted to learn about pump efficiency, they would have to travel a great distance to attend a workshop (most likely a participation barrier to most people). As the northern counties have about 23% of all irrigated agricultural land in the state (1999 Agricultural Sector Demographic Analysis), it appears that the new irrigation training center is strategically placed and most likely able to meet a previously unmet need. More detailed pictures of the Chico Irrigation Training Facility are provided in Appendix M.

5.3.5 Relationships with Other Agencies

As indicated in Section 3, the evaluation team had a lengthy interview with the program manager to elicit relationships between the APEP and other agencies and attempt to determine areas of synergy. It was outside the scope of this evaluation to discuss the potential relationships with those other agencies, so this is an acknowledged one-sided conversation. However, the results of the interview are presented next.

Overall, the APEP has resulted in the enhancement of existing relationships as well as the formation of new relationships for the Center for Irrigation Technology (CIT). Owing to the APEP, CIT currently has relationships with eight different categories or types of organizations. A few of the relationships are documented with contracts or agreements, but most are informal. The organization and group categories are as follows (also see Exhibit 5.74):

1) Contractor for the APEP (Pacific Gas & Electric, PG&E)
2) Rule Maker for the APEP (California Public Utility Commission, PUC)
3) Pump Testing Companies

4) Pump Repair Companies
5) Ag Community Organizations
   a) Farm Bureaus
   b) Others (Irrigation Equipment Dealers, Resource Conservation Districts & Ag Commodity Organizations)
6) Educational Partners
   a) Universities & Colleges
   b) Mobile Irrigation Laboratories
   c) Others (Pump Testing Companies & Pump Repair Companies)
7) Energy Efficiency Implementers (regional utilities: PG&E; Southern California Edison(SCE); San Diego Gas & Electric(SDG&E) and Southern California Gas (SCG)
8) Ag Agencies (US Bureau of Reclamations & California Department of Water Resources)

5.3.5.1 Types of Companies & Organizations with Relationships

As indicated in the list above, the APEP has relationships with a diverse set of organizations ranging from private companies and local organizations to federal and state agencies.

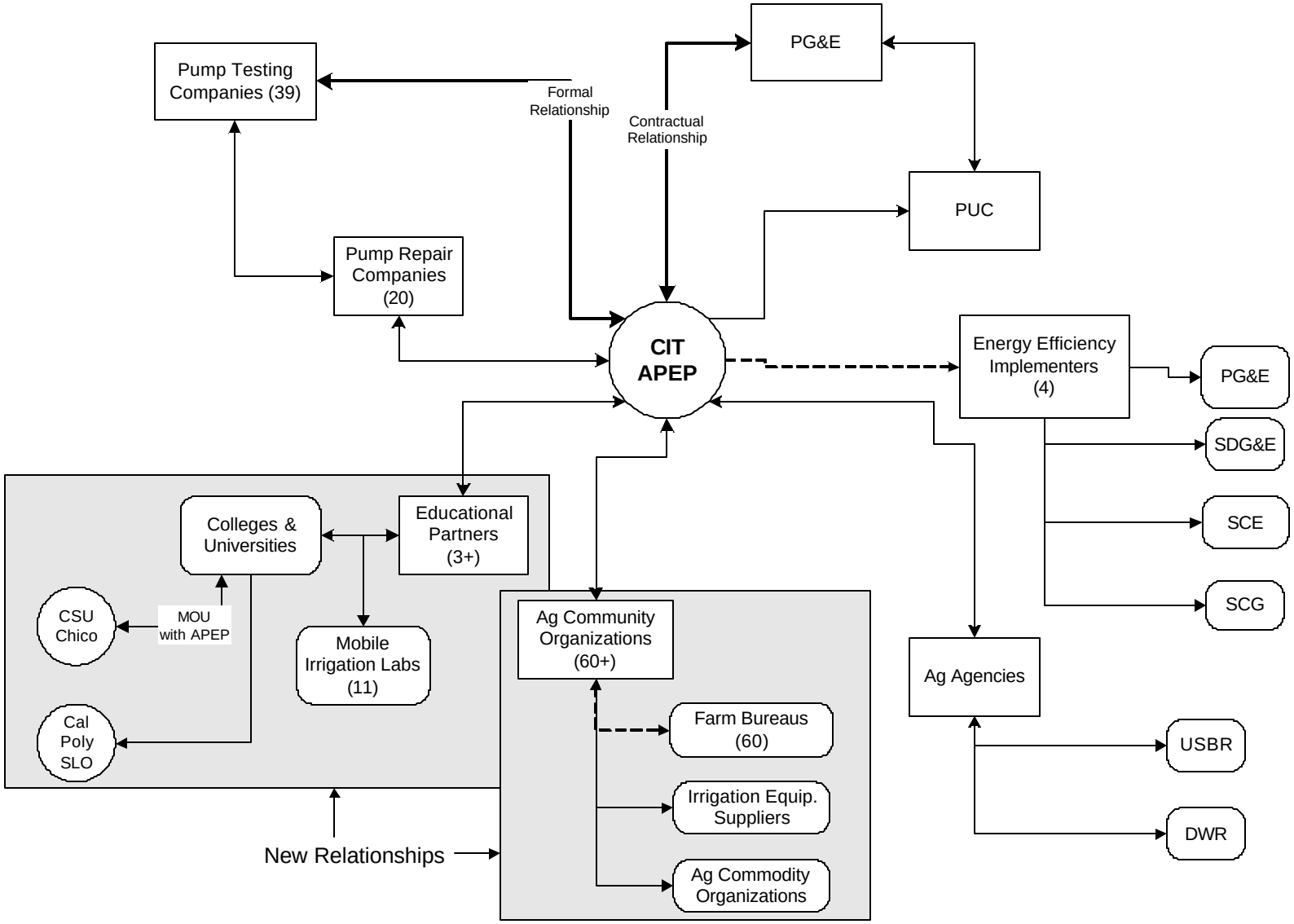
For day-to-day operation of the APEP, CIT has relationships primarily with private companies and local organizations. These include Pump Testing and Pump Repair Companies who are an intrinsic part of the APEP process, as well as Ag Community Organizations and Educational Partners who act as cooperators to sponsor seminars.

The contractual and reporting relationship for the APEP is with a private company (PG&E as the contractor) and a state level agency (the PUC) for reporting. Very few relationships have developed with other state or federal level agencies. CIT has had exploratory discussions with both the U.S. Bureau of Reclamation (USBR) and the California Department of Water Resources (DWR). These discussions have been focused on the potential expansion of the APEP and incorporating the sponsorship of these agencies.

Many of the relationships that exist with the APEP are enhancements of those that previously existed, while others have been formed as a direct result of the APEP.

While CIT has had previous relationships with many organizations in the agricultural, water and energy use arena, the APEP resulted in a strengthening and enhancing of most previously existing relationships. However, with the Ag Community Organizations (Farm Bureaus, et al.), the relationships were, for the most part, newly established.

Exhibit 5.74
Current Relationships between APEP and Other Entities



5.3.5.2 Length of Relationships

CIT has a long history of involvement with energy and water use in the agricultural industry. As a result, CIT has had previous relationships with many of the companies and organizations involved in the APEP. CIT's relationships were enhanced during the period when CIT provided administrative support for the Agriculture Peak Load Reduction Program sponsored by the California Energy Commission (2001 to 2003). With initiation of the APEP in 2002, existing relationships were strengthened and expanded. This strengthening and expansion occurred primarily with the Pump Tester and Pump Repair Companies.

New relationships were formed in 2002 to 2003, primarily with the Ag Community Organizations and Educational Partners categories as CIT developed relationships with entities that could act as sponsors for educational seminars.

5.3.5.3 Degrees of Formality in Relationships

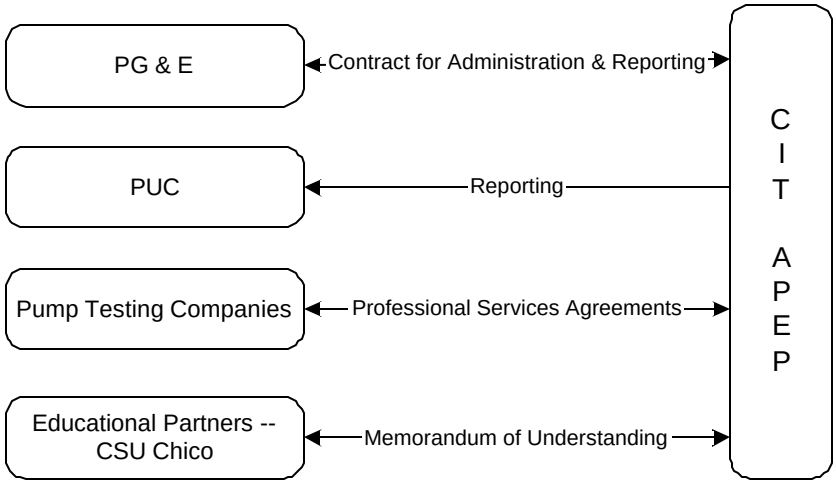
CIT has both formal (contractual) and informal relationships with respect to the APEP.

CIT has formal relationships with three categories of organizations.

1. The contractor for the APEP is PG&E and there is a formal, written contract between the parties. The terms of the contract were defined by the PUC along with required reporting to PG&E and the PUC. CIT's relationship with the PUC is not "formal" in that there is no written agreement, though the contract with PG&E requires reporting to the PUC.
2. CIT established Professional Service Agreements with Pump Testing Companies to define quality standards, reporting requirements, and terms for payment.
3. CIT has a Memorandum of Understanding with CSU Chico, as a fixed site educational facility.

All other relationships that CIT has with regard to the APEP are informal.

Exhibit 5.75
Formal Relationships



5.3.5.4 Frequency & Types of Communications

CIT communicates very regularly (one or two times per week) with PG&E administrators and with the CPUC, through telephone calls and e-mails. Additionally, the contract requires monthly and quarterly status reports to these organizations. Communications are very professional and business-like with both organizations.

Regular communications (typically at least once per month) occur with the Pump Testing Companies and Pump Repair Companies. For the Pump Testing Companies, the communication has involved the processing of field pump testing data and reporting. For the Pump Repair Companies, the communication has typically related to grower applications for pump repairs. These communications are in the form of telephone calls and e-mail, plus the required reporting by the testing companies.

In order to describe the objectives and procedures of the APEP, CIT held educational meetings for Pump Testing Companies, Pump Repair Companies, and for the staff of the Mobile Irrigation Laboratories. This series of three to four meetings occurred near the beginning of the APEP (i.e., in 2002 and early in 2003). The purpose of these meetings was primarily to familiarize these organizations with the parameters of the APEP and to motivate them as Educational Partners.

Communications have occurred on an as needed basis (typically several times per month) to arrange for the presentation of educational seminars. These communications are by telephone and e-mail. Sponsors for the grower seminars include entities from the Ag Community group (i.e., Farm Bureaus, irrigation equipment dealers, Resource Conservation Districts, and Ag Commodity organizations) as well as Pump Repair Companies. As shown in Exhibit 3.2, over 30 educational seminars for growers have been held through December 2003.

Efforts by CIT to establish communications and relationships concerning the APEP with the Energy Efficiency Implementers group (regional utilities) have not been successful. The regional utilities have resisted overtures by CIT to become educational partners or to sponsor grower seminars.

Exhibit 5.76
Frequency & Content of Communications

Weekly	Monthly	As Needed	Infrequent
PG&E *Contract Administration & Reporting*	Pump Testing Companies *Processing pump test results*	Educational Partners *Grower seminars*	Energy Efficiency Implementers *Grower seminars & APEP promotion*
CPUC *Reporting*	Pump Repair Companies *Educational seminars; questions on grower pump repair applications*	Ag Community Organizations *Grower seminars* Ag Agencies *Exploratory, future programs*	

5.3.5.5 Expectations from Relationships

In any relationship, both parties have certain expectations. Below are the expectations the APEP program manager indicated he sees for the various entities.

Formal, Contractual Relationships -- For these relationships (i.e., with PG&E and the PUC), APEP is expected to fulfill the terms of the contract, that is, to provide grower education and improvements in pumping efficiency. APEP expects to receive payments under the contract. APEP also expects (or would like to receive) a more long-term commitment from the PUC so that they can make longer-term commitments to employees and program participants.

Pump Testing Companies -- From these companies, APEP expects quality, accuracy, and accountability in the conduct and reporting of pump tests. APEP also expects education of growers concerning the interpretation of pump test results. In turn, these companies expect clear instructions, resolution of any problems, and timely reimbursement.

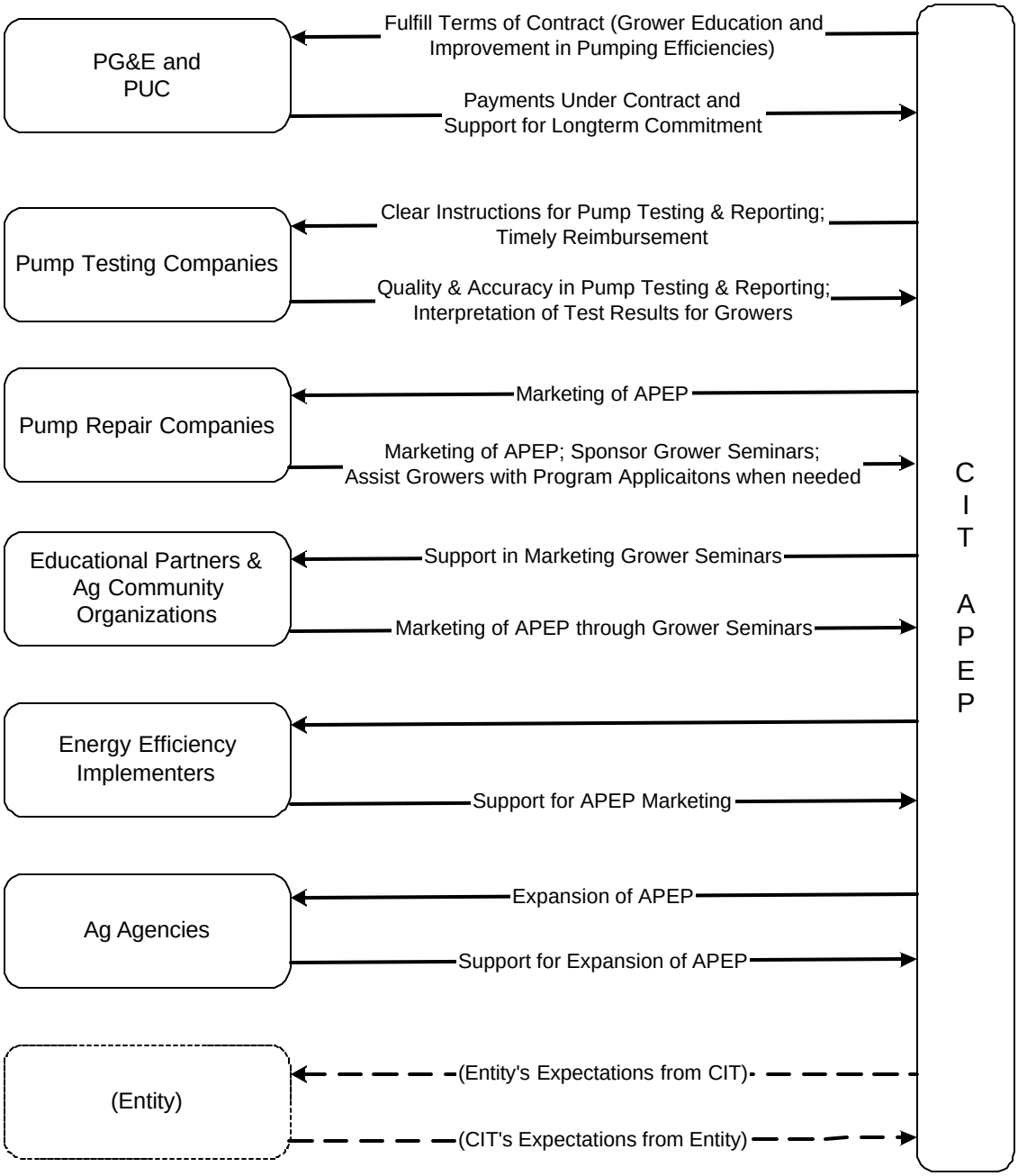
Pump Repair Companies – These companies appear to expect program marketing from the APEP. Unfortunately, APEP also expects program marketing from the repair companies. APEP views the program as an opportunity for the repair companies and feels they should more aggressively market the program and the seminars. APEP feels that these companies have concentrated primarily on grower situations with larger energy savings and have not realized the full potential of the business opportunities. APEP also expects Pump Repair Companies to sponsor grower seminars and, when needed, to assist growers with program applications.

Educational Partners & Ag Community Organizations -- From other organizations and groups, APEP primarily expects marketing of the program through seminars. This expectation has been realized with many of the individual companies and organizations; however, the goals of some entities are not necessarily those of the APEP, and there has sometimes been a lack interest. For example, some of the local Farm Bureaus focus on political objectives as a better service to their grower-members.

Energy Efficiency Implementers – The initial expectation was that APEP would receive support for the program from the regional utilities; however, this support has not materialized. Although there has been support from a few individuals within the utilities with whom APEP had previous relationships, there has been none from the utilities as a whole.

Ag Agencies – CIT has held discussions with the US Bureau of Reclamations and the California Department of Water Resources concerning support for APEP expansion . Expectations for relationships with these agencies remain in the future.

Exhibit 5.77
Expectations from Relationships



5.3.5.6 Assessment of Relationships by APEP

APEP generally views its relationships as being successful. Using a rating scale of 1 to 5 (1-poor, 5=excellent), all relationship categories were rated as 4 or 5 by APEP with the exception of the relationships with Farm Bureaus (in the Ag Community Organizations group) and the Energy Efficiency Implementers (regional utilities).

PG&E [Rating=4] and the PUC [Rating=5] -- The relationships with PG&E (as the contractor) and the PUC received high ratings because the communication channels are professional and business-like and APEP appears to have fulfilled its contractual obligations to the satisfaction of both organizations.

Pump Testing [Rating=4] & Pump Repair Companies [Rating=4] -- High ratings are also given to relationships with Pump Testing and Pump Repair companies. With 39 individual Pump Testing Companies, there was a need to standardize testing procedures, enforce the requirement for liability insurance, and standardize recordkeeping procedures. Given the effort involved, Pump Testing Companies responded quite well.

With Pump Repair Companies, there has been good communication and involvement. However, APEP feels that effective use of the program has been limited by the fact that these companies do not always recognize the program's full potential.

Ag Community Organizations – This group of relationships received mediocre ratings of 3 and 4 owing primarily to problems with compatibility of goals and objectives of certain organizations (i.e., Farm Bureaus) [Rating=3] and those of the APEP. For organizations with compatible goals (i.e., Resource Conservation Districts, irrigation equipment dealers, etc.), the APEP rating of relationships are high [Rating=4].

Educational Partners -- The relationship with the Mobile Irrigation Laboratories [Rating=4] received a high rating because of their interest in the APEP. The limitation with the Mobile Labs relates to the fact that they do not have a centralized administration to assist with the implementation of new programs. Issues concerning the compatibility of goals also extend to the University and College partners in that CSU Chico [Rating=4] receives high marks, while Cal Poly San Luis Obispo received low marks [Rating=2].

Energy Efficiency Implementers [Rating=2] – The four regional utilities were rated quite low because APEP has received no cooperation from any of the organizations within this group. The program had expected to receive at least a minimal level of support for APEP promotion, but despite requests by the program manager, no support has been received. The only relationships that have evolved are those that were previously developed with individuals within these companies.

Federal and State Ag Agencies [Rating=4] – Relationships with the USBR and California DWR have been good; however, contact has been informal and infrequent. These relationships have the opportunity to evolve in the future.

5.3.5.7 Organizations with Potential Relationships

In the Educational Partners group, APEP feels that there are opportunities within the Community Colleges. Program staff have worked with these colleges in the past through various programs but an involvement with them is currently outside the scope of the APEP.

There is also significant potential for enhancing relationships with several of the organizations, particularly in the area of the Farm Bureaus and the Energy Efficiency Implementers. The development of closer relationships with the USBR and DWR may offer an opportunity for additional financial support for the APEP.

5.3.5.8 Goals & Measurements of Success

CIT and the APEP have defined goals through contracts and a Memorandum of Understanding (MOU). Under the APEP contract with PG&E, goals are quantified for numbers of seminars, pump tests, and pump repairs. The original proposal, as submitted by CIT, did not specify goals by utility service area. However, the finalized contract did include goals by utility service area, but CIT had no input for the separation of goals by service area. Success in achieving goals is reported to the PUC and PG&E on a monthly and quarterly basis.

A second set of goals relates to the Pump Testing Companies. Under the Professional Services Agreements, there are written standards for each of the pump testers for quality assurance and recordkeeping. Pump testers are measured by the quality of work performed through regular reviews of pump test reports and records submitted for each pump test.

The written goals with CSU Chico are set forth in an MOU. These goals call for establishing a fixed-site educational center and conducting a specific number of APEP seminars.

5.3.5.9 Expected Duration & Evolution of Relationships

The contract with PG&E (and the PUC) for the APEP is of a relatively short term. While CIT would like the established formal and informal relationships to be of a longer term, the short-term nature of the current contract necessitates short-term relationships. It is hoped that all relationships continue, even if the APEP contract is not renewed; however, without staff and funding, relationships are expected to deteriorate over time.

The types of longer-term future relationships that continue with CIT as the implementer of the APEP will be dependent on the levels of funding available. With adequate funding, CIT could focus on the relationships that enhance marketing of the APEP. The framework for the administration of the APEP by CIT has been developed and is operating effectively. In order to enhance program marketing, CIT feels that it needs to: 1) identify mutually acceptable marketing objectives with its various partners and 2) provide these partners with assurances that the APEP is a long-term program.

The previous programs under which pump testing and pump repair cost sharing were offered to growers by the regional utilities were in place and operating for over 20 years. The current programs have been in place for only three years and have different structures (CEC's Agricultural Peak Load Reduction Program and the CPUC's APEP). Continuity in program structure and assurance of long-term continuation would significantly enhance the ability to market the program.

5.3.5.10 Effects of Relationship on APEP

The development of various relationships has definitely affected the plans, goals and strategies for APEP. Below is a list of how various relationships affected the program.

1. California Public Utility Commission -- The overall program goals proposed by APEP (i.e., number of pump tests, seminars, etc.) were redefined at the utility service area level by the CPUC in the final contract. This redefinition was completed without discussions with the program manager and required a reformulation of strategies. CIT feels that mutually agreed upon goals should be incorporated into future contracts.
2. Regional Utilities – A a reasonable level of cooperation was expected from the regional utilities; however, cooperation has not been forthcoming. The exception has been individuals within the utilities with whom CIT had a previous relationship. Since agricultural growers have a long history of receiving information and support for APEP type activities from the regional utilities, CIT feels that marketing and overall effectiveness of the APEP would be significantly enhanced with support from the utilities. CIT feels that a future contract for the APEP should require at least a minimal level of cooperation from the utilities.
3. Pump Testing Companies -- The lack of uniform testing and reporting procedures among the pump testing companies required the development and implementation of standardized computer programs and reporting protocols by APEP that was unexpected at the outset of the program.
4. Pump Repair Companies – To date, the experience with the pump repair companies has indicated that CIT needs to help these companies focus on how to provide services to all of their customers. The repair companies tend to focus on customers with higher energy savings potential and lose sight of the fact that one of the APEP goals is to work with smaller growers. CIT needs to reexamine its relationship with repair companies to identify how the business goals of these companies can be better matched to those of the APEP.
5. Mobile Irrigation Labs -- The lack of centralized administration for the Mobile Labs has made it difficult for the individual labs to integrate the APEP into their procedures. Encouraging the development of a centralized administration would be in CIT's interest. CIT developed an "energy calculator card" that has been distributed to each lab and is working with individual labs to develop energy management software.
6. As the APEP has evolved, CIT has found that there is a need to emphasize the education of growers when structuring relationships with the various groups that interact with individual growers (i.e., Pump Testing Companies and Pump Repair Companies).

One of the reasons that CIT feels it has been successful as an implementer of the APEP is due to CIT's long term and extensive involvement with energy and water-related issues in the agricultural industry. CIT was established in 1982 as a facility to perform independent research and testing of irrigation equipment (sprinklers, drip emitters, etc.). Over the past 20 years, CIT has expanded its role to include a full range of support services for irrigation system designers, equipment manufacturers, and users of irrigation equipment. Certification testing for irrigation designers, educational seminars for

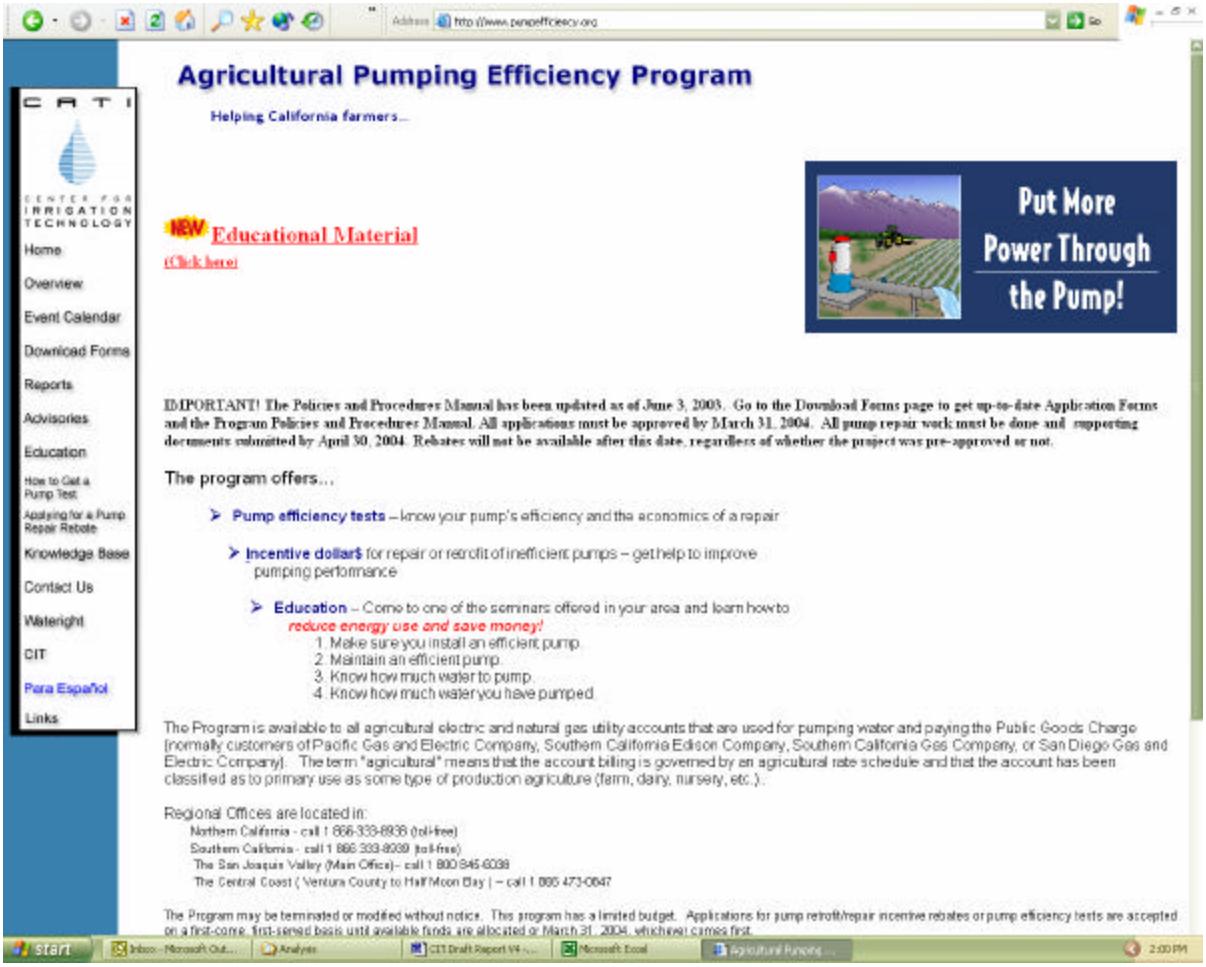
growers, and computer software for irrigation designers and growers are among the services provided by CIT.

With this broad and diverse background, CIT feels it is in a unique position to provide an integration of energy and water efficiency programs for agriculture. CIT would like to foster longer-term relationships with State and Federal level agencies as well as with the regional utilities to assist in the development of integrated programmatic decisions for the APEP and other related programs.

5.4 Web Site Review

The APEP web site was reviewed for content. The home page is shown below. Similar pages can be selected to load in either Spanish or English.

Exhibit 5.78
Website Home Page



According to the counter on the home page, this site has been accessed 5,919 times since January 1, 2003. While somewhat difficult to read in this report, the home page shows the ease in finding educational material. The educational link leads the reader to a page with ten Adobe Acrobat documents that are the program marketing materials (listed in Section 5.3.3).

Another link on the left side is the events calendar. The events calendar comes up a month at a time with the ability to scroll back or forward by month. If an MEC event or fixed-site seminar is planned, it is located by date with a hyper-link that sends the viewer tospecific information on the event. The site has hyper-links throughout that point to the web site's other relevant information.

While not conducting an extensive search, the evaluation team looked at other Internet sites that linked to the APEP web site and found several sites (http://www.irrigation.org/links_universities.htm and http://www.itrc.org/), indicating that some

work had been done by the program to link up with other sites. Additionally, the web site provides over 60 links to other sites with information on energy efficiency, California Water agencies, Water Associations and Irrigation Scheduling.

Lastly, the "Contact Us" page allows customers to give feedback directly to the program through an easy-to-use email format. As indicated in the previous discussion (see Exhibit 5.29), this web site, when used by the customer, appears to provide value.

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6 Conclusions and Recommendations

There was a great deal of data collected by the evaluation team and reported in Section 5. Analysis of the various components of the program led to the generalized conclusions below.

6.1 Conclusions

The program has met its goals for the educational seminars and MEC presentations. It is expected that the number of pump tests performed through the end of the program funding cycle (March, 2005), will exceed the goals. While the number of pump repairs and subsequent energy impacts through 2003 are currently substantially below the goals of the program, this must be revisited in the errata report. The energy impacts in this report do not include the repairs encumbered in the first quarter of 2004.

Based on self-reported data, program participants in PY2002-2003 can be generally characterized as:

- Customers with a small number of pumps between 15 and 20 years old
- Having pumps in use between 3 and 9 months of the year
- Family-owned businesses, who own the property the business occupies
- Small and medium-sized organizations
- A relatively even distribution between orchards, vegetables/field crops, and vineyards/wineries
- Customers who have been in their location for more than 10 years

The program is successful at reaching smaller, family-owned businesses. This is a key point since results indicate that smaller companies are less likely to make repairs. Interviews with pump test companies implied that the larger growers were more able to take advantage of pump repair incentives. And while there were not enough data points to definitively test whether company size explained why a pump repair was performed, the analysis points to a positive relationship between company size and the likelihood of making pump repairs or a change in irrigation practices. The analysis showed that pump repair participants did use a more complex financial analysis when evaluating energy efficiency options. This is a potential reflection of the notion that larger customers and companies, which tend to have more expert staff, are more likely to make a repair.

A main implication for the pump repair decision is the importance of providing program information either through an economic analysis of the pump, the APEP seminars, or MEC demonstrations. The analysis shows that all these factors have a positive impact on the likelihood that someone will make a change to their pumping system. Ensuring that pump testers provide quality pump tests, including a review of the economic analysis based on the pump test, is important since participants indicate that after having their pumps tested, they are more knowledgeable about the need for operating efficiency improvements for their pumping system. These results show, as hypothesized, that participating in APEP seminars and MEC demonstrations, or having the pump tester review the economic analysis of the pump based on the pump test, increases customer awareness and knowledge regarding pumping efficiency.

Results also show that customers' perceived barriers to obtaining financing are low, but since a significant proportion of customers report at least some instance of not being able to make a repair or improvement because of a lack of financing, there still may be some barriers faced by customers in this regard. By providing financial assistance in the form of incentives, the program may be able to help mitigate barriers faced by customers relating to obtaining financing

The analysis indicates further opportunities to provide additional information to customers in order to encourage them to make repairs. Many respondents suggested that they did not know about all aspects of the program or did not know that they needed to make a repair and thus were unable to participate fully in the program.

Two mobile energy centers were built and used for educational seminars and demonstrations throughout the state. The events were professionally presented by APEP staff and received high ratings from MEC participants.

The structure created at the California State University, Chico site, in conjunction with the Irrigation Training Facility was well planned with plans for future use and staffing resources to assure that the site is used as intended. There was no funding encumbered toward a planned, comparable site in Fresno.

Overall, the interviews and surveys developed a portrait of an exceptionally well-run program that appropriately staffed positions, established good communication, developed and clearly communicated program goals to staff and contractors, tracked progress against those goals and communicated that progress to staff. Participants showed high levels of satisfaction with their program interactions and trade allies felt that the program was doing a good job overall. While recommendations are made for potential program improvements, these are considered to be fine-tuning of the program.

The table in Exhibit 6.1 provides a subjective confirmation between the hypothesized activities, outputs, and outcomes synthesized from the evaluability assessment and findings of the analysis.

Exhibit 6.1
Degree of Confirmation of Hypotheses by Evaluation Findings

Hypotheses Regarding Program Activities, Outputs and Outcomes	Degree of Confirmation by Evaluation		
	Weak	Medium	Strong
Activities			
APEP had interactions and synergies with other agencies.			X
Planned mobile energy centers were created and used.			X
Planned facility enhancements occurred.		X	
Outputs			
The program flows smoothly. There are enough staff to perform the needed duties. Program staff are aware of the objectives of the program.			X
APEP has met the required number of pump tests.		X	
APEP has met the required number of pump repairs.	X		
Customers are interested in receiving pump test results.	X		
Customers receive and understand an economic analysis of the pump test.		X	
Customers learn something from the economic analysis provided by the pump tester.			X
Customers are satisfied with the process in getting a pump test and the results.			X
Pump testers provide relevant information regarding the pump test to their customers.			X
Pump testers feel that the process between them and APEP is working.			X
Pump testers feel the buy-down provided by the program is adequate.		X	
Outcomes			
Pump repairs save energy.			X
Customers have more knowledge of specific efficiency practices.			X
Customers are more aware of specific efficiency practices.			X
Trade allies bring in more pump repairs than would otherwise have been obtained.	X		
There are many factors that determine when a pump is repaired.			X

6.2 Recommendations

The following recommendations evolved from the evaluation.

- The program should continue the MEC events and critically assess whether to redouble efforts to make sure pump testers explain the economic analysis to pump test participants and thoroughly go over the results of the pump test. Results show that customers who had a pump repair were more likely to agree that the pump testers explained the economic analysis, thoroughly went over the results of the pump test, and found the results more useful.
- APEP should increase its efforts to reach and provide information to customers. Participants indicated they were not fully aware of the different elements of the program or that they needed a pump repair and, as a result, they could not take full advantage of the program. However, participants who received printed material were more likely to make changes in their irrigation practices than those who did not, and these customers indicated that the information in the printed material made them more likely to investigate EE options.
- Based on the results of the participants in the CEC program and how APEP repair participants found out about the program, APEP should explore marketing to trade allies to help increase awareness of the program in the customer base.
- Program staff disagree on the usefulness of mass media marketing. The program manager should consider either a trial in a limited area or a market research study to determine the effectiveness of mass media marketing in target markets.
- On several occasions during the various interviews associated with the process evaluation, interviewees stated that the program did not give a large enough rebate to encourage owners of small pumps to perform pump repairs. The program should review whether these are missed opportunities and whether the program should modify the rebate structure to further encourage the repair of small pumps.
- Accounting/reporting staff should be increased to relieve the program manager of some of this responsibility and allow his increased availability for overall management of the program.
- Program staff and pump test/repair companies both identified the yearly on/off funding cycle as a major factor affecting program credibility. Consistency is needed to create credible programs in the eyes of the growers. It is acknowledged that APEP can do little to assure funding consistency.

This completes the report on the PY2002-2003 Agricultural Pumping Efficiency Program. Appendices of survey instruments, frequencies, and other information follow.