PACIFIC GAS AND ELECTRIC COMPANY'S AGRICULTURAL SECTOR MARKET NEEDS STUDY

PG&E Study ID number: 405d

March 30, 2000

Measurement and Evaluation
Customer Energy Efficiency Policy & Evaluation Section
Pacific Gas and Electric Company
San Francisco, California

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As part of its Customer Energy Efficiency Programs, Pacific Gas and Electric Company (PG&E) has engaged consultants to conduct a series of studies designed to increase the certainty of and confidence in the energy savings delivered by the programs. This report describes one of those studies. It represents the findings and views of the consultant employed to conduct the study and not of PG&E itself.

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All inquiries should be directed to:

Janice Frazier-Hampton
Revenue Requirements
Pacific Gas and Electric Company
P. O. Box 770000, Mail Code B9A
San Francisco, CA 94177

Pacific Gas and Electric Company's
Agricultural Sector Market Needs Study Report
(Study ID No. 405d)

Purpose of Study

The purpose of the study was to establish the market needs of Pacific Gas and Electric Company's (PG&E's) Agricultural sector customers to better guide future agricultural energy efficiency program design. The study was required as part of a waiver approved by California DSM Measurement Advisory Committee (CADMAC) on May 20th, 1999. That waiver allowed PG&E to conduct a market needs analysis instead of conducting a net-to-gross analysis for the three end use studies for the Carryover for Pre-1998 Agricultural Energy Efficiency Incentives program. These end use studies were conducted in compliance with the requirements specified in "Protocols and Procedures for the Verification of Costs, Benefits, and Shareholders Earnings from Demand-Side Management Programs", as adopted by California Public Utilities Commission Decision 93-05-063, revised June, 1999, pursuant to Decisions 94-05-063, 94-10-059, 94-12-021, 95-12-054, 96-12-079, 98-03-063, and 99-06-052.

Methodology

This study focused on customers who used pumps in the PG&E service territory, which covers 90% of all PG&E agricultural customers. The customers were questioned about three areas – energy use of their irrigation system, maintenance of their irrigation equipment, and water management. These customers were queried about their awareness of each area, their satisfaction with information available to them in these areas, and how willing they were to learn about each area. Preferences for different channels of information dissemination, the likeliness to make a change, and willingness to pay for useful information were explored during the survey.

Survey responses, along with customer attributes from the billing data, were analyzed using cluster analysis and conjoint analysis to determine trends by customer size and location. These trends can be generalized to the larger population since the precision with which the sample is drawn is high.

Study Results

The overall findings from this study can be summarized as follows:

- Of all agricultural customers, only 35% feel they need some type of assistance. The majority of these customers need additional motivation to take action. Unless assistance is designed to motivate customers, informational programs can only address 15% of the total customer segment.
- Though customers' preferences differ by size, they generally do not differ by area of interest (i.e., irrigation systems, maintenance, and water management). This allows market interveners to (1) apply the same choices for the emerging areas that are not covered in this study, and (2) target market by customer size.

- The most effective communication channel was customer size dependent:
  - Mail for small customers.
  - On-sites for medium-sized customers.
  - Presentations/demonstrations/workshops for large customer segment.
- Though small customers are more willing to respond to information via mail, they are not more willing to pay for the assistance. It is the medium-sized customers who are more willing to pay for assistance via mail.
- Only about 7.5% to 12.5% of all of the customers were interested in paying for the information, independent of the assistance channel.

Of the 35% who need assistance:

- A majority of these customers would benefit from assistance in irrigation systems.
- Mail, on-sites, and demonstrations showed the highest levels of preference and willingness to respond.

Overall, the above conclusions paint a picture consistent with the two previous PG&E agricultural sector studies. They depict a market that has, for the most part, been transformed through long interaction with PG&E marketing and energy efficiency programs. While there are market segments that have still not been adequately served by energy efficiency programs, these segments represent the minority of the market. They are also the portion of the market least likely, or least able, to invest in energy efficiency improvements.

Regulatory Waivers and Filing Variances

The retroactive waiver request concerning the AEEI evaluation and this study was approved by CADMAC on May 20, 1999. This waiver is included in Appendix A of the appended report. The waiver stipulates “Instead of a net-to-gross study, allow the use of a default net-to-gross ratio of 0.75 for the agricultural sector, subject to the condition that PG&E conduct a “market needs” study that would help future program design to yield the best returns**”**. This study fulfills the condition of that stipulation.

There were no E-Table variances.

Equipoise Consulting, Inc.

Energy Analysis

Project Management

Training

Final Report for

Pacific Gas and Electric Company's Agricultural Sector Market Needs Study

Submitted by:

Equipoise Consulting Incorporated

in association with
Dr. Kirtida Parikh

PG&E Project Manager
Mary G. Dimit

March 30, 2000

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1. EXECUTIVE SUMMARY

This report presents findings of Pacific Gas and Electric Company's (PG&E's) agricultural customers market needs study. The California DSM Measurement Advisory Committee (CADMAC) approved a retroactive waiver for PG&E's Carryover for Pre-1998 Agricultural Energy Efficiency Incentives (AEEI) program that allowed PG&E to conduct a market needs analysis instead of conducting a net-to-gross analysis for the Carryover for Pre-1998 AEEI program.[1]

The study was proposed on the belief that if potential future programs are to be effective, it was important to determine the customers' needs and then use this information to inform future program design.

1.1 Study Objectives

The focus of this study was to determine the market needs of agricultural customers to help them with energy efficiency. This study objectives were: (1) identify the areas in which customers needed assistance, (2) identify the type of assistance that customers preferred, (3) determine whether customers would be willing to make a change towards energy efficiency, if they got the preferred type of assistance in the area they needed, and (4) determine whether or not customers would be willing to pay for their chosen assistance.

1.2 Scope of the Study

This study focused on customers who used pumps in the PG&E service territory. These customers represent about 90% of all PG&E agricultural customers. The customers were questioned about three areas – energy use of their irrigation system, maintenance of their irrigation equipment, and water management. They were queried about their awareness of each area, their satisfaction with information available to them in these areas, and how willing they were to learn about each area. Customer preferences for different channels of information dissemination, their likeliness to make a change, and their willingness to pay for useful information were explored during the survey.

The approach used was relatively straightforward. Survey responses, along with customer attributes from the billing data, were analyzed to determine trends by customer size and location. These trends can be generalized to the larger population since the precision with which the sample is drawn is high. Once the specific program purpose and objectives are known, further simulations can be done using the results in this study. Such simulations would help the new programs decide the targets of those programs or design an optimum implementation strategy of those programs.

1.3 Primary Study Findings

The overall findings from this study can be summarized as follows:

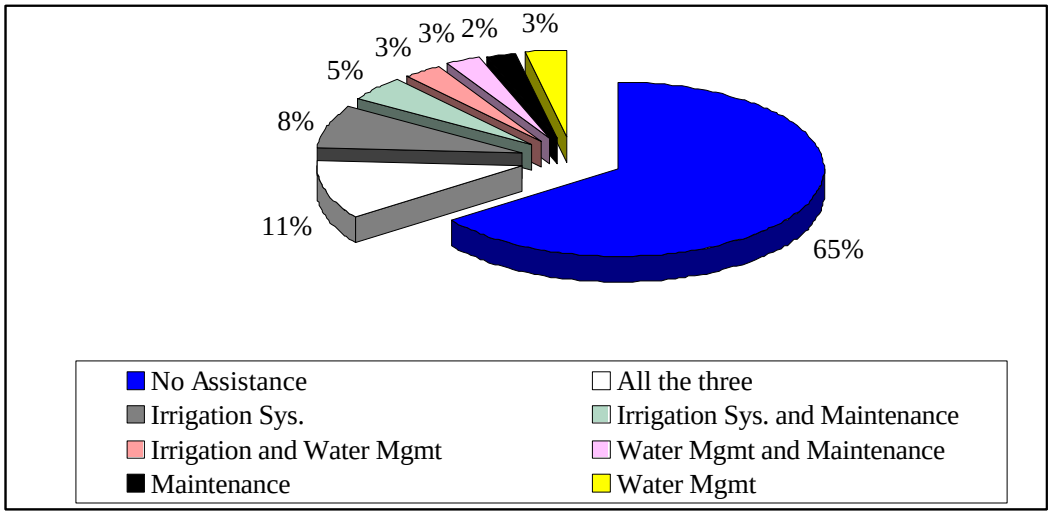
- As shown in Exhibit 1.1, 35% of the agricultural customers feel they need some type of assistance. The majority of these customers need additional motivation to take action.

[1] Approved May 20, 1999. Complete waiver attached in Appendix A.

Unless assistance is designed to motivate customers, informational programs can only address 15% of customers.

- Though customers' preferences differ by size, they generally do not differ by area of interest (i.e., irrigation systems, maintenance, water management). This allows market interveners to apply the same choices for the emerging areas that are not covered in this study and to target market by customer size.
- Mail was the most effective channel type for small customers. On-sites were the most effective channel type for medium-sized customers, and presentations/ demonstrations/ workshops were the most effective channel types for the large customer segment.
- Simulation results indicate that program costs could be minimized and maximum impacts could be targeted if the customers are offered assistance via their preferred channel types.
- Overall, the willingness to pay was lower than the willingness to change current practices.
- Though small customers are more willing to respond to information via mail, they are not more willing to pay for the assistance. It is the medium-sized customers who are more willing to pay for assistance via mail.
- Only about 7.5% to 12.5% of all of the customers were interested in paying for the information, independent of the assistance channel.

Exhibit 1.1
Customer's Needing Assistance Across All Areas



Of the 35% who need assistance:

- A majority of these customers would benefit from assistance in irrigation systems.
- For assistance delivery channels, mail, on-sites, and demonstrations showed the highest levels of preference and willingness to respond.

Overall, the above conclusions paint a picture consistent with the two previous PG&E agricultural sector studies. They depict a market that has, for the most part, been transformed through long interaction with PG&E marketing and energy efficiency programs. While there are segments that have still not been adequately addressed, these market sectors represent the minority of the market. They are also the portion of the market least likely to invest in energy efficiency improvements.

2. INTRODUCTION

This report presents findings from a market needs analysis of Pacific Gas and Electric Company's (PG&E's) agricultural customers. The California DSM Measurement Advisory Committee (CADMAC) approved a retroactive waiver for PG&E's Carryover for Pre-1998 Agricultural Energy Efficiency Incentives (AEEI) program that allowed PG&E to conduct a market needs analysis instead of conducting a net-to-gross analysis.[2]

2.1 Motivation for Market (Customer) Needs Study

PG&E has been encouraging agricultural customers towards energy efficient technology and practices for over 75 years. Most recently, these efforts have been through the Energy Management Services (EMS) and Energy Efficiency Incentive (EEI) programs. One element of the EMS program has been to increase awareness about the benefits of knowing the pump efficiency of a customer's water pump. This has been done by supplying pump tests at no cost to the customer, and then encouraging pump repairs when the test shows them to be cost effective. The complimentary EEI program provided both information about energy-efficient technologies to agricultural customers and offered incentives for implemented measures. Various evaluations of both programs during the past five years have indicated that customers were aware of efficient technologies and used the programs to take action. The free-ridership rate for the 1994 through 1996 program years for the agricultural sector was relatively steady at around 64%. The market effects studies of the 1996 EMS program and 1997 AEEI program indicated that programs that had been offered for such a long time encouraged energy efficient actions, not only by the participants of the program but also by nonparticipating customers. In other words, these programs had significant market effects. Market effects studies of the 1996 AEMS[3] program and 1997 AEEI[4] program both indicated that though market effects of these programs were significant, not all segments of agricultural customers were affected to the same extent. To better focus future programs, it was important to determine the customers' needs. Therefore, instead of conducting a net-to-gross study for the Carryover for the Pre-1998 AEEI program, it was decided that PG&E would put this effort into finding out which groups of customers needed what services.

The importance of understanding the market needs (or more specifically, the customer needs) is realized from the experiences of the 1996 and 1997 program evaluations and market effects studies. A market needs study is useful for two reasons:

- If utilities are required to <u>continue</u> to implement similar programs, (i.e., informational programs and/or incentive programs), focusing program implementation on those customers who are likely to benefit most from the programs is an effective way to transform the market towards higher efficiency.

[2] Approved May 20, 1999. Complete waiver attached in Appendix A.
[3] PG&E 1996 Agricultural Sector EMS Program Market Effects Study, April 28, 1998
[4] PG&E 97PY Agricultural Energy Efficiency Incentives: Pumping and Related Market Effects Study, Study ID #335A, March 30, 1999.

- If utilities are required to change the program design or design new programs, then understanding customers' needs creates a solid platform on which to base the design of new programs.

In this study, the choices of customers in different segments were used to determine what is required in the market and which would be the most effective way of delivering information.

2.2 Study Objectives

The focus of this study was to determine what agricultural customers needed to help them with energy efficiency.

This study had four objectives:

1. Identify the areas in which customers needed assistance.

2. Identify the type of assistance customers preferred.

3. Determine whether customers would be willing to make a change towards energy efficiency if they got the preferred type of assistance in the area they needed.

4. Determine whether or not customers would be willing to pay for their chosen assistance.

2.3 Scope of the Study

Though it is desirable to determine all of the needs of any agricultural customer, limited time and resources restricted the scope of this study.

The study was based on stated preferences of a sample of agricultural customers as determined through structured telephone interviews. Agricultural sector evaluations from the last five years have shown that the length of a telephone interview should be no more than 14 minutes. Within 14 minutes, it was not possible to ask customers about their needs and communication channel preferences on an equipment-specific basis. Therefore, choices were made to limit the scope of the study without adversely affecting the ability to generalize it.

The first step was to define the geographical boundaries of the market, the type of market, and the types of assistance to be studied. The following choices were made in conjunction with the PG&E project manager:

(1) The study would be limited to PG&E's service territory.

It was felt that limiting the study to PG&E's service territory would not limit the ability to generalize the study to California since the majority of California's agriculture occurs within PG&E service territory boundaries.

(2) The study would focus on the pumping and related end use and, specifically, on the major issues within this end use.

The analysis of billing data for the years 1995, 1996, 1997 and 1998 indicated that, on average, 90% of the agricultural customers were in the pumping end use. Thus, the study was limited to pumping end users and the technologies they may consider in the near future.

The survey questionnaire focused on the major problems/issues faced by pump users. The evaluation team, using their field experience in combination with input from PG&E staff

experienced in the agricultural market, identified three main issues that a pump end user currently faces and will continue to face in the near future: (1) water management, (2) irrigation systems, and (3) maintenance of irrigation equipment.

(3) The study would focus on identifying communication channel preference.

The evaluation team put together groupings of assistance channels intended to cover the spectrum of choices of interest to customers. The choices for assistance channels were: information via mail, Internet, training workshops during the off season, advice on the telephone, presentation at a trade association meeting, a demonstration project, or an on-site review. In addition to these, the survey questionnaire included open-ended questions to find out if there were any other type of assistance channels the customers liked.

In summary, the study focused on customers who used water pumps in the PG&E service territory. The customers were questioned about three areas – energy use of their irrigation system, maintenance of their irrigation equipment, and water management. These customers were queried about their awareness of each area, their satisfaction with information available to them in these areas, and how willing they were to learn about each area. Preferences for different channels of information dissemination, the likeliness to make a change, and willingness to pay for useful information were explored during the survey.

A more complete discussion of the rationale for selection of the specific focuses of the study is presented in Appendix D.

2.4 Report Organization

This report is divided into six sections and three supporting appendices. These are:

Section 1. Executive Summary –supplies a synopsis of the report findings.

Section 2. Introduction – summarizes the motivation for the study, presents the objective, and lists the limitations of the study scope.

Section 3. Data Sources and Sample Design – documents sources of data, sample design, and sample sizes for additional data collection.

Section 4. Hypothesis Formulation and Approach – explains analysis framework, the formulated hypotheses, and alternative methods used in the study to test each of the hypotheses.

Section 5 Results – discusses the results of hypothesis tests.

Section 6. Conclusions – summarizes the results and presents overall conclusions that can be drawn from the results.

Appendix A. CADMAC Waiver – presents the CADMAC waiver that initiated this study

Appendix B. Final Telephone Instrument – supplies the final telephone data collection instruments for completeness.

Appendix C. Final Response Frequencies – documents final response frequencies in the context of each interview question.

Appendix D. Rationale for Study – details the processes gone through to arrive at the final scope of the study.

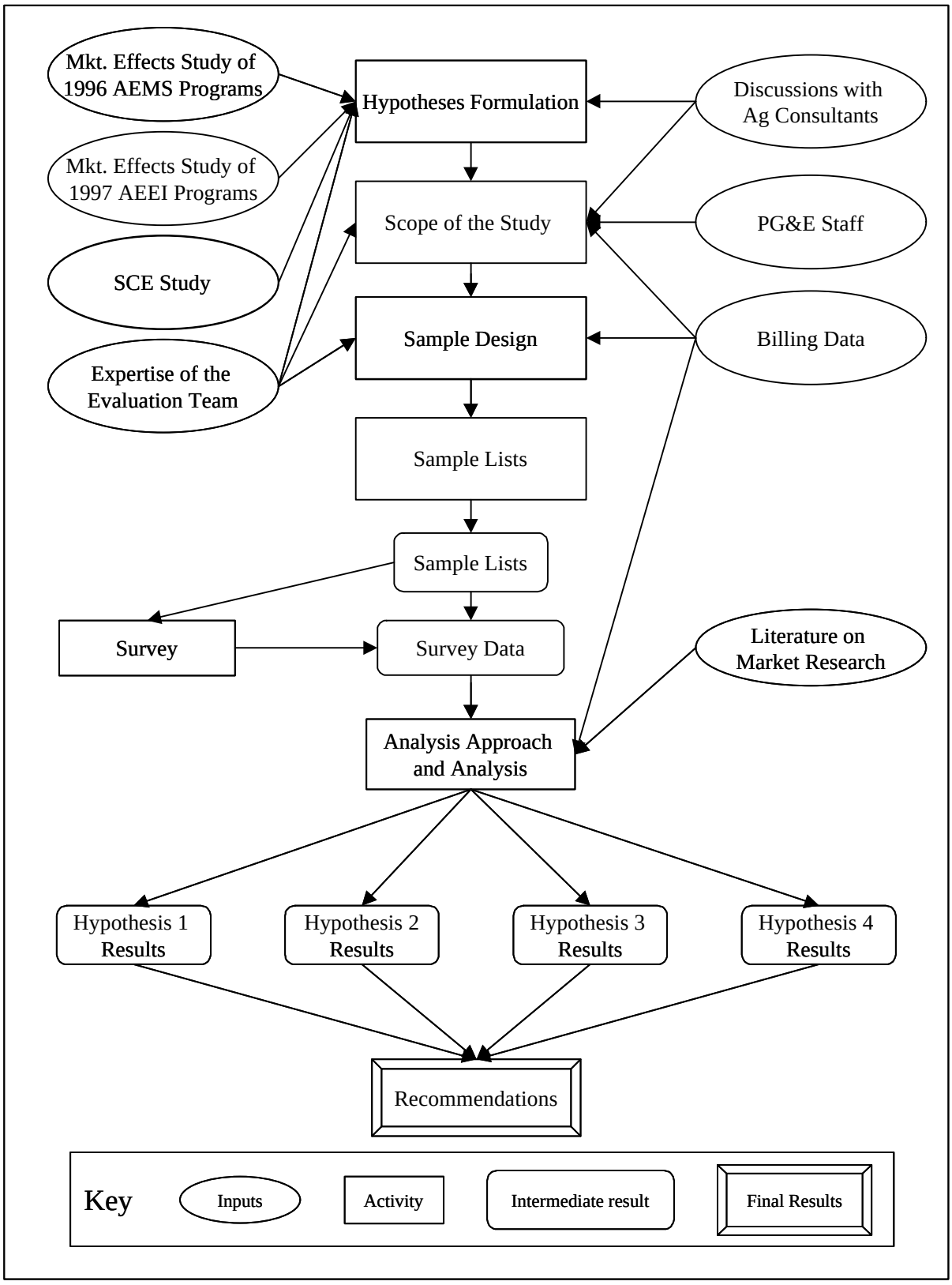
3. DATA SOURCES AND SAMPLE DESIGN

This section presents an overview of information used in the study, the data sources, and the sample design for additional data collection.

3.1 Study Overview

Exhibit 3.1 illustrates how different sources of information were used in the study. The evaluation team gathered a wide range of information in order to broaden its understanding of the market. This information was distilled in formulating the hypotheses to be studied, defining the scope of the study, and designing the survey instrument that is presented in Appendix B. Additional data were required from customers in the market. Therefore, a sample of agricultural sector customers was designed and sample lists were produced for a telephone survey. Information from the survey was combined with appropriate billing data to create an analysis dataset. Each hypothesis was then tested using the information from the analysis dataset. Exhibit 3.1 presents an overview of the data used in the project analysis.

Exhibit 3.1
Overview of the Study



3.2 Data Sources

The key element to obtaining high accuracy in any evaluation is maximum use of all available data sources. The evaluation team assessed all applicable data available from PG&E and industry sources.

3.2.1 Existing Data

The primary existing data sources were:

- The participant data maintained in the PG&E Marketing Decision Support System (MDSS) database for 1994, 1995, 1996, 1997, 1998 – This database contains information on the programs for all sectors. The agricultural sector information was used for this study.
- The PG&E Pump Test Database for 1994, 1995, 1996 1997, 1998 – This database contains information on pump tests conducted as part of the AEMS pump test program.
- PG&E billing data for 1995, 1996, 1997 and 1998 – PG&E nonresidential billing data contains monthly energy consumption information for all agricultural customers in PG&E's service territory.
- PG&E's 1996 Agricultural Sector EMS Program Market Effects Study.
- PG&E's 1997 Agricultural Sector EEI Program Market Effects Study.
- Southern California Edison Hydraulic Services Program Market Effects Study, Study ID #3507, February 1998.·

Since the motivation for this study was based on the observations from the previous years' market effects studies, one of the important sources of data was the information collected in the last two years' market effects studies.

Billing data were also crucial. They were the only source for identifying unique businesses during the creation of a sample frame for the telephone survey. The annual kWh usage was used to segment the customers into small, medium and large customers. The addresses of agricultural customers from the billing data helped identify the weather zones in which the customers were located in[5] and, therefore, the types of weather conditions they may experience.

3.2.2 Collected Data

Since the information collected in previous studies did not include the kind of information required to test the hypotheses formulated in this study, hypothesis testing depended upon responses from a telephone survey specifically designed to support this study.

[5] Weather zones were set based upon "Low Pressure Sprinkler Nozzles", Pete Canessa, P.E., November, 1994 and used in "Impact Evaluation of PG&E's 1994 Agricultural Programs", February 27, 1996.

The additional data collection consisted of telephone interviews of 510 agricultural customers, irrespective of their participation status. Since the purpose was to determine what was needed in the market, it was not appropriate to exclude the participants from the analysis.

3.3 Sample Design

The sampling plan for this study, based on experiences from past evaluations, is presented in this section.

3.3.1 Population, Sample Frame, and Data Screening Criteria

The population included all of the agricultural customers in PG&E's service territory. The samples of agricultural customers for the survey were not drawn from the population of agricultural customers; rather, they were drawn from sample frame. A unique premise (site) was considered an appropriate sample unit for developing the sample frame. The criteria for developing the sample frame are discussed below. It is important to note that the exclusion criteria were applied sequentially. If accounts were already excluded for one reason, those accounts did not qualify to be tested for another criteria.

The population of PG&E agricultural customers based on 1998 billing data includes 89,104 unique control numbers representing 63,731 premises and 35,411 corporate names. Of a total of 89,104 unique control numbers, 12,075 were included in the sample frame. The reasons for excluding the remaining 70,434 control numbers were:

- Since the study was focused on the pumping and related end use, it was important to include those customers that use pumping and related services. The rate code and the address fields from the billing data were checked to see whether or not a control number was likely to be a pumping account. This assessment was based on the first character of the address field. Most pumping account addresses are text descriptions of the location of the pump. Thus, if the first character was a number, the account was assumed to be an address or a non-pumping "regular" account. If the first character was a letter, the address was assumed to have a pump. Rate code and address field tests indicated that 8,458 control numbers were not using pumping and related end use and hence were not included in the sample frame.
- Customers with less than 50kWh annual consumption were excluded because the accounts were considered to be inactive. These customers would not have encountered the issues being probed by the survey questions. There were 8,283 control numbers excluded because the annual kWh consumption was less than 50 kWh.
- In order to avoid over contacting corporations with more than one account, it was decided to limit each corporation to one contact number. In order to verify this, corporate IDs were required. There were 3,024 control numbers with missing information on corporate IDs. Therefore, they were excluded from the sample frame.
- An additional 12,900 control numbers were excluded because the SIC codes were missing or did not indicate control numbers associated with an agricultural account (i.e., SIC less than 100).

- In order to draw a sample for telephone interviews, telephone numbers are very important for contacting customers. Customers with missing phone numbers were excluded. Thus, 11,929 control numbers were excluded for this reason.
- A further 141 control numbers were excluded because they represented control numbers or telephone numbers of customers included in the pretest.
- After excluding control numbers for reasons mentioned above, there were 44,369 control numbers that should have been included in the sample frame. Duplicate corporate IDs were eliminated, leaving 36,750 control numbers/corporate IDs. Of these, there were 18,081 duplicate telephone numbers. That left 18,669 unique control numbers.

The remaining 18,669 accounts representing unique sites were included in the sample frame.

3.3.2 Sample Allocation, Sample Sizes and Sample Selection

Sample allocations designate the number of elements to select. Allocation was influenced by the project objectives, sampling error, and expected response rate.

In a stratified sampling, strata are mutually exclusive and collectively exhaustive cells from which the sample is drawn, allowing different sampling rates for different cells. The objective of stratification is to improve the overall reliability of the estimates by reducing sampling error, controlling non-response bias, and providing larger sample sizes for the sub-populations of most interest to the study. Stratification allows the sample to emphasize certain portions of the population over others. For this study, six strata were defined using annual kWh consumption by all customers included in the sample frame. A sample was selected randomly from each stratum. The annual kWh usage categories were defined by classic stratification techniques.

Exhibit 3.2 indicates the stratification used for the sample, the sample design, and the total number of data points collected in each strata.

Exhibit 3.2
Sample Design and Collected Data

Strata	Customers in Sample			Size Grouping for Analysis
	kWh Boundaries	Sample Design	Completed Data Points	
1	200<1998 annual kWh <=12,800	100	100	Small
2	12,800<1998 annual kWh <=29,700	60	60	Small
3	29,700< 1998 annual kWh <=69,800	110	110	Medium
4	69,800< 1998 annual kWh <=145,500	100	100	Medium
5	145,000< 1998 annual kWh <=292,000	110	110	Medium
6	292,000< 1998 annual kWh	20	30	Large
Total		**500**	**510**	**510**

3.3.3 Relative Precision of Sample

The relative precision of a given sample design based on total annual energy use reflects the extent of uncertainty as to whether the allocated sample sizes are large enough to control for the population annual energy usage variance.

A sample of 510 control numbers was surveyed, representing 18,669 accounts in the sample frame. The relative precision was calculated using the equation shown in Exhibit 3.3.

Exhibit 3.3
Relative Precision Algorithm

$$\begin{pmatrix} \text{RP} \\ (\text{Relative Precision}) \end{pmatrix} = \left[\frac{1.64 * \sqrt{\text{Variance}(sample)}}{\text{Mean kWh}(population)} \right]$$

It is important to note that relative precision defined in this manner is in fact an index of imprecision. Since the variance is proportionately related to relative precision, it measures how imprecisely the sample reflects the population. This means that a lower value of relative precision reflects greater precision.

For a stratified sample, this definition can be further explained as in Exhibit 3.4.

Exhibit 3.4
Stratified Sample Relative Precision Algorithm

$$\begin{pmatrix} \text{RP} \\ (\text{Relative Precision}) \end{pmatrix} = \left\{ \frac{1.64 * \sqrt{\sum_{i=1}^{6} [W_i^2 * (\text{Std Err}_i^2(sample) / n_i) * (1 - s_i/n_i)]}}{\text{Mean kWh}(population)} \right\}$$

Where:

W_i = a ratio of number of accounts in strata$_i$/total population N that is weight n_i/N,

Std Err$_i$ = the standard deviation of mean usage in strata$_i$,

$(1-s_i/n_i)$ = the correction factor for finite sample.

For the sample for this study;

- The denominator = Mean kWh $_{(\text{population})}$ = 43,538.6
- The numerator is (1.64*788) = 1292.32
- This gives us the relative precision of 2.96%.

Thus, the final achieved telephone survey sample for agricultural customers yielded relative precision of less than 10% at the 90 % confidence level, in terms of annual energy usage. This means that the results from this sample can confidently be generalized to the larger population.

4. HYPOTHESES FORMULATION AND APPROACH

The four hypotheses for this study were formulated based on the findings of the previous market effects studies for PG&E's service territory. In particular, PG&E's 1997 Agricultural Energy Efficiency Programs Pumping and Related Market Effects Study and PG&E's 1996 Agricultural Sector EMS Program Market Effects Study. The findings from these two studies and how they helped to determine the hypotheses are detailed next.

4.1 Hypotheses Formulation

The factors contributing to the development of the research hypotheses, and those limiting the study scope, evolved from review of the existing literature and development of the research plan. These factors are discussed here to present the complete context in which the research hypotheses were developed.

Weather Zone Dependency. One of the main issues confounding most studies of California's agricultural energy sector is that energy use depends on customer location. The location defines weather, surface water availability, and well depth. These factors, along with crop type, control the amount of pumping energy used by growers. Thus, the formulation of most hypotheses must include a weather zone dependency.

In order to incorporate weather zone data, the evaluation team needed a variable that was readily available for all customers. An agricultural engineer, as a consultant to PG&E, divided the PG&E service territory into six regions of similar rainfall. These six regions do not follow the California Energy Commissions (CEC) weather zones, but were created by county. The regions were used in the 1996 and 1997 agricultural impact studies and again in this study to test for weather zone dependency.

Need Based Market. Based on the earlier market effects studies, approximately 95% of the agricultural customers take actions to improve the efficiency of their pump or irrigation system; either because the pump/irrigation system is broken, or performance of the pump/irrigation system is poor. Thus, the demand for actions towards energy efficiency among agricultural sector customers is need based. In order to promote the need for energy efficient technologies and practices, the upper limit of this need is determined by the number of customers that use pump or irrigation systems. However, not all customers who need to deal with a broken or less efficient pump/irrigation system are aware of energy efficient technologies and practices. In order for any market intervener to decide whether or not assistance should be provided to customers to increase this awareness, it is important to know the size of the market that needs such awareness. Therefore, one of the main objectives of this study was to determine what proportion of the total market are not already aware of and could benefit from such programs.

Another observation in the two prior PG&E agricultural sector market effects studies, was that customers are not always willing to learn about efficient technologies and practices. Agricultural customers generally spend a very low proportion of their total expenditures on electric bills and, thus, are not willing to put in the effort to learn about efficient technologies and practices. Even if the customers are not aware, unless they are willing, an awareness assistance program would not benefit them. In addition, customers who are not willing to

make an effort to learn about efficient technologies and practices may or may not need motivational programs. If their electric bills continue to be very low in proportion to total operating costs, there is a high potential that they cannot be motivated to change, no matter what intervention is attempted. Therefore, it was also important to find out the proportion of market not willing to learn about energy efficient technologies and practices. Additionally, the evaluation needed to attempt to find out whether the likely reason for their lack of motivation is the low cost of electricity as a proportion of total operating costs.

Hypotheses. Since the need for assistance depends upon multiple influences, including the customers' overall size (kWh), relative size, activities in which they are involved, experience, and weather zone, the following hypothesis was formed:

- Hypothesis 1: Areas in which customers need assistance differ by customer size and weather zone.

Previous studies indicated that the extent to which a market barrier is felt differs by customer segment. It was observed that small, and some medium-sized, customers face certain barriers to a greater extent than the large customers. Similarly, the willingness to change the current practice appeared to depend upon the availability of financing. It was observed that the availability of financing was a big problem for small customers and relatively difficult for medium-sized customers. Therefore, following two hypotheses were formulated:

- Hypothesis 2: Preference for the type of assistance would differ by customer size and weather zone.
- Hypothesis 3: Likely benefits from different types of assistance would differ by customer size and weather zone.

In a new environment, if a market intervener wanted to provide assistance to customers by charging a fee, it was important to find out which type of customers would be most willing to pay for which type of assistance. Therefore, the fourth hypothesis was:

- Hypothesis 4: Willingness to pay for the preferred type of assistance would differ by customer size and weather zone.

Any moves toward energy conservation by pumping end users are likely to be closely linked to the ever present and increasingly important issue of water conservation. Thus, it was also important to ask customers what actions they would take if they were required to curtail water use.

Data Collection Limits Focus Effort. In order to keep the survey length less than 14 minutes, it was important to focus on the major issues PG&E's agricultural customers now face and will continue to face in the future, and possible solutions for these issues. Alternate approaches that attempted to address all relevant equipment types continually produced overly lengthy surveys. By focusing only on the pump users, 90% of all agricultural customers were covered. Therefore, the evaluation team chose to focus on the major problems/issues faced by the pump users. The evaluation team, in conjunction with PG&E staff experience in the field, decided that there were three main issues that a water pumping end user currently faces and will continue to face in the near future: (1) water management, (2) irrigation systems, and (3) maintenance of irrigation equipment.

Only if the focus of the assistance is the area in which customers need the most help, can a high response from the customers be expected. In order to find out which area is considered the most important by the customers, all four hypotheses stated above were tested for all three areas (i.e., water management, irrigation systems, and maintenance of irrigation equipment).

4.2 Analysis Approach

The approach to study the market needs, or more precisely the customers' needs, is substantially different from the approach traditionally used for typical program impacts evaluations. This is because the nature of the research question itself is very different. Program evaluation involves establishing a causal relationship between an event that has already taken place and the program that could have influenced the occurrence of that event. Traditional program evaluations have used regression analysis or choice models to establish causality between the event of technology adoption and the program that could have influenced the event occurrence. However, the customer needs study is expected to look into factors that can help the event to occur. The study was aimed at determining what customers need in order to use electricity more efficiently. Another related and more important question was: "If they get what they want, how likely are they to make a change?" In the customer needs study, since the event has not occurred, customer behavior cannot be observed and, hence, cannot be modeled in the manner typically done in traditional program evaluation.

In order to test the hypotheses, two approaches were considered. One was cluster analysis and the other was conjoint analysis. Each approach served a specific purpose and required a specific type of information. Both the approaches are discussed below.

4.2.1 Cluster Analysis

Cluster analysis is an exploratory data analysis tool for solving classification problems. The object is to sort cases (people, things, events, etc.) into groups, or clusters, so that the degree of association is strong between members of the same cluster and weak between members of different clusters. Each cluster thus describes, in terms of the data collected, the class to which its members belong. This description may be abstracted through use from the particular to the general class or type. Cluster analysis may reveal associations and structure in data, which, though not previously evident, nevertheless are sensible and useful, once found.

In short, cluster analysis is the statistical method of partitioning a sample into homogeneous classes to produce an operational classification. Such a classification is appropriate for market analysis. It requires treating the choices as discrete rather than continuous. Even if the question is asked regarding how likely the customers are to change current technology, and even if the answer is possible on a four-point scale, the scale cannot be treated as continuous. On the other hand, it is extremely useful in finding out the absolute sizes. For example, it can give a clear idea about what proportion of the market requires assistance. Cluster analysis was used for testing all four hypotheses.

4.2.2 Continuous Index

Cluster analysis usually classifies into definite groups. If the response to the question can be on a continuous spectrum, cluster analysis may give importance to the extreme ends of the spectrum in order to group the responses into two groups. This may or may not be

appropriate, depending upon the application. For example, if customers are asked to respond whether or not they like a particular assistance channel, then the answer can be yes or no. However, if they are asked to order their liking in terms of very, somewhat, not too and not all, then cluster analysis with two groups may combine customers with "very" or "somewhat" responses. In this case, the choices are biased towards the higher extreme. For the group with "not too" and "not at all" responses, the choices would be biased downwards. In order to avoid such upward or downward bias, it is possible to treat the four responses as a continuous series from "not too" to "very." The average would represent what customers in a specific group think of a channel type. If the answer is 1, then all of the customers in a group do not like the assistance channel and if it is 4, then all the customers like the channel in question. Any number between 1 to 4 would tell us what customers think. Since it treats the responses as a continuous series, this approach is called continuous index. The average responses of one group can be compared to that of any other group.

4.2.3 Conjoint Analysis

Conjoint analysis is also based on the continuous index, but it takes care of more than one aspect; therefore, it is called conjoint analysis. The term conjoint is a contraction of "consider jointly." Conjoint analysis is a market research tool used to evaluate and improve product or service features. It is a decompositional method that seeks to identify which product or service traits are most desirable by estimating the structure of a consumer's preferences given their overall evaluations of a set of alternatives that are pre-specified in terms of levels of different attributes. Though it is generally applied in order to find out the relative importance of attributes of a single product or service, for this study, it was applied to study different factors affecting the need for assistance. It helped in identifying the relative importance of the factor that affects the benefits of assistance programs. It was used to find out the relative importance of customer segments and prioritize (order) the segments to observe: (1) which group of customers needed the most help, (2) which group was most likely to respond by changing current practices, and (3) which group was most willing to pay for information.

4.2.4 Scoring Approach

In this study, the conjoint analysis was not applied in a traditional way. That is, it was not applied to determine the price of an assistance program, or to rank order the features that were considered important by the customers. Nor was it used to determine what should be emphasized in a campaign promoting the assistance. In this analysis, aspects were combined to observe which group of customers needed assistance and then used to determine how each group should be ordered to obtain the greatest response. This was labeled as a "scoring approach." It was based on the evaluation team's insight that not all segments require the same kind of assistance in order to adopt efficient technologies. As stated earlier, it was hypothesized that customer needs would be different for small, medium and large customers (based on kWh). The answers to questions that asked customers the level of awareness, the willingness to put in the necessary effort, and the level of satisfaction with available information of a specific group were combined. From this combination, an index value of the need of the specific group was created and compared with the overall average.

The index value of each segment indicated the score. Respondent categories were scored based on the relative value of the responses to the questions asked in the telephone survey. For example, responses to the question that evaluated the need for comprehensive review for the whole sample provided an overall index. A score was calculated for one group that reflected their need for the same assistance using responses to the same question by all customers in that particular segment. The score for the segment was compared to the index value of the whole sample. This comparison of scores helped to rank the segments in terms of relative need for a type of assistance. The technique allowed a ranking of the segment that required a particular type of assistance the most (or the least). The overall score indicated the relative effectiveness of investing resources to help customers fulfill their requirements or needs. Such segment-specific relative effectiveness scores can help to better target customers that are likely to benefit the most from the market intervener's efforts.

Likewise, a score can be calculated for each of the factors that discourage the customers. An important aspect of this customer needs study was to find out whether customers were likely to make a change if they got their most preferred type of assistance. Comparing the relative need for that type of assistance and relative response scores allowed conclusions to be drawn about whether or not it may be worth investing in that type of assistance.

The approach used by the evaluation team took aspects of both cluster and conjoint analyses to provide useful information on agricultural customers' needs. To focus the analysis, three areas were outlined (water management, irrigation systems, and maintenance of irrigation equipment) and four hypotheses were created. An appropriate method, or a combination of methods, was used to test each one of the four hypotheses in each of the three areas. The next section provides the results of the analysis.

5. RESULTS

This section presents the analysis of the survey responses using the methods discussed in Section 4. Results are presented in sequence, by hypothesis.

5.1 Hypothesis 1 – Assistance Areas Different by Size and Weather Zone

In hypothesis number one, it was thought that small customers might need different kinds of assistance than large customers. Also, the hypothesis states that the types of assistance that customers needed were weather zone dependent.

It was important to establish the overall size of potential demand (i.e., need) for assistance, as well as the relative importance of assistance in each group of customers. Therefore, cluster and conjoint analysis were both relevant techniques for evaluating this hypothesis.

5.1.1 Conjoint Analysis

With help of the cluster analysis, it was possible to compare the size of potential demand for assistance. However, in the cluster analysis, the distinction between "very likely" and "somewhat likely" was lost when calculating the extent to which customers needed assistance. In order to consider the extent of the customers' need, conjoint analysis was important. In conjoint analysis, the answers to more than one question were combined, but the distinction between different levels of responses was not. For example, responses with "somewhat likely" were not combined with "very likely." This approach helped in identifying the relative importance of each segment as compared to the entire sample.

In order to compare the need for assistance by customers of different size and in different weather zones, first it was necessary to determine the criteria that could be used to identify which customers needed assistance. In the telephone survey, a question (Q8)[6] was included to establish the level of awareness regarding (1) ways to reduce irrigation energy use, (2) ways to maintain irrigation equipment, and (3) current water management techniques. Similarly, questions (Q9 and Q10) were included to measure the level of satisfaction with the available information and willingness to learn about these areas. Using the responses to these questions, the need index for each area of interest was constructed as shown in Exhibit 5.1.

Exhibit 5.1
Need Index Algorithm

$$\left(\text{Need Index}\right)_p = \left(\frac{\sum_{i=1}^{I} \left[\text{Awareness}_i + \text{Willingness}_i + \text{Satisfaction}_i\right]}{N_i} \right)$$

[6] The nomenclature of question (Q) followed by the question number of the survey question (e.g., 8) is used for the remainder of the report.

The Need Index$_p$ was the need index for area of interest *p* and was an average of all the customers who responded to the three questions (Q8, Q9, Q10) for area *p*.

In this way, all three responses (awareness, willingness, and satisfaction) were given the same level of importance. Note that, in the questionnaire, the scale of answers was 1 to 4, with 1 representing the highest level of awareness, willingness, or satisfaction and 4 representing the lowest level. For intuitive interpretation of the analysis, this order was reversed so that the higher number represented a greater level of awareness, willingness, and satisfaction. Since the need index is an additive index of three components, 12 was the maximum value for the index. If the average value was 12, it would mean that all customers were aware of the energy efficient technologies and practices, willing to learn about them, and satisfied with the information available to them. In this case, there would be no need for any assistance. On the other extreme, if the average value of the index was very low, it would mean that many customers needed assistance. Then the question would be what type of assistance would help them. If customers were not aware, then they may need assistance that could educate them and expose them to energy efficient technology. If customers were not satisfied, then they may need detailed information so that they would be comfortable making a decision about changing current practices. If customers were not willing, then they would need to be motivated to become aware so that they could consider the efficient technologies and practices as options. Thus, customers may require education, information, or motivation in order to move towards energy efficient technologies and practices. Exhibit 5.2 summarizes the average need of the surveyed sample for each of the three areas of interest.

Exhibit 5.2
Average Need by Interest Area

Areas of Interest	Average Need Index for the Sample
Irrigation Systems	9.996
Irrigation Equipment Maintenance	10.327
Water Management	10.287

The average need index for the sample for all areas was above 9. Since 12 was the highest level, this high number indicates that most customers are aware of the efficient technologies and practices, are satisfied with the available information, and are willing to learn about efficient technologies and practices. The three areas of interest can be prioritized by comparing the average need index for the sample.

Customer Size Dependency. From Exhibit 5.2 it can be observed that irrigation systems was the area that requires the most assistance, followed by water management, and then irrigation equipment maintenance.

In order to determine which customer segment needed the most assistance, a relative need index was required. The relative need index is a ratio of the average need index for a group of customers and the average need index of the sample as a whole. Using the responses to these questions, a relative need index for each group was constructed as shown in Exhibit 5.3.

Exhibit 5.3
Relative Need Index Algorithm

$$[\text{Relative Need Index}]_g = \frac{\sum_{i=1}^{g}[\text{Awareness}_i + \text{Willingnes}\,s_i + \text{Satisfaction}_i] \Big/ N_g \; *100}{\sum_{i=1}^{I}[\text{Awareness}_i + \text{Willingnes}\,s_i + \text{Satisfaction}_i] \Big/ N_i \; *100}$$

The numerator reflects the average need for a specific group (*g*), and the denominator reflects the average need for all 510 customers who were interviewed. In this way, all three aspects were given the same level of importance. Again, in the questionnaire, the scale of answers is 1 to 4, with 1 representing the highest level of satisfaction, awareness or willingness and 4 representing the lowest level. For intuitive interpretation of the analysis, the order was reversed so that the higher number represented greater level of satisfaction, awareness or willingness. If customers are less aware, or less willing, or less satisfied, then assistance would be required to increase awareness, or increase satisfaction by providing information, or further motivate them to learn about efficiency measures. Exhibit 5.4 summarizes the components of the Relative Need Index and illustrates that the difference between the Relative Need Index was not significant across customer groups.

One of the values in Exhibit 5.4 is the "Factor with Maximum Gap." It was the sum of three factors that went into the relative need index. Within this summation, one of the three factors was lower than the other two. Called the "maximum gap" in this exhibit, it can be looked at as the factor that was most different from the other two. For example, if willingness is shown in this cell, it would mean that the customer segments' lack of willingness to learn was more important than their lack of awareness or satisfaction.

Exhibit 5.4
Relative Need Index by Size for the Sample

	Size		
	Small	**Medium**	**Large**
Area:1 Irrigation Systems			
Numerator	100.26	99.49	103.45
Denominator	99.96	99.96	99.96
Relative Need Index	1.003	0.995	1.035
Factor with Maximum Gap	Willingness	Awareness	Satisfaction
Area:2 Maintenance of Irrigation Systems			
Numerator	103.44	102.87	106.79
Denominator	103.27	103.27	103.27
Relative Need Index	1.001	0.990	1.034
Factor with Maximum Gap	Willingness	Satisfaction	Awareness
Area:3 Water Management			
Numerator	102.89	102.65	105.00
Denominator	102.87	102.87	102.87
Relative Need Index	1.000	0.998	1.021
Factor with Maximum Gap	Willingness	Satisfaction	Awareness

The Relative Need Index was very close to 1.0 for all customer sizes, indicating that none of the groups is particularly different from the whole sample. The average need of the sample (i.e., the denominator) and the average need for all of the groups combined (i.e., the numerator); were above three. Since four was the highest level, this high number indicated that most customers were aware of the efficient technologies and practices, were satisfied with the available information and were willing to learn about efficient technologies and practices.

Weather Zone Dependency. As discussed earlier, part of hypothesis 1 was that the customer responses would depend upon the weather zone in which they were located. For this analysis, weather zones have been created based on California counties. The weather zones used in the analysis are defined in Exhibit 5.5.

Exhibit 5.5
Analysis Weather Zone Mapping

Weather Zone	Name	California Counties
1	Southern San Joaquin Valley	Kern, Kings, Tualre, Fresno, Madera
2	Northern San Joaquin Valley	Merced, San Joaquin, Stanislaus, Solano, Sacramento
3	Sacremento Valley	Tehama, Glenn, Butte, Colusa, Amador, Sutter, Yolo, Yuba
4	North Coast	Humboldt, Del Norte, Trinity, Mendocino
5	Marin	Marin, Sonoma, Napa, Lake
6	South Coast	Contra Costa, Alameda, San Mateo, Santa Clara, Santa Cruz, Sen Benito, Monterey, San Luis Obispo, Santa Barbara

The results of this analysis by different weather zones are presented in Exhibit 5.6. Weather zones four and five are not presented throughout the results section because the number of responses in this zone, while representative, were too small to be relevant (i.e., Zone 4 had 4 responses and Zone 5 had 9 responses).

Exhibit 5.6
Relative Need Index by Weather Zone for the Sample

	Weather Zones			
	W1 Southern San Joaquin Valley	**W2 Northern San Joaquin Valley**	**W3 Sacramento Valley**	**W6 South Coast**
Area:1 Irrigation Systems				
Numerator	100.72	100.82	98.97	98.82
Denominator	99.96	99.96	99.96	99.96
Relative Need Index	1.008	1.009	0.999	0.989
Factor with Maximum Gap	Satisfaction	Awareness	Willingness	Satisfaction
Area:2 Maintenance of Irrigation Systems				
Numerator	104.39	102.95	103.25	101.18
Denominator	103.27	103.27	103.27	103.27
Relative Need Index	1.01	0.997	0.999	0.979
Factor with Maximum Gap	Satisfaction	Awareness	Willingness	Satisfaction
Area:3 Water Management				
Numerator	102.96	103.33	103.87	101.37
Denominator	102.81	102.81	102.81	102.81
Relative Need Index	1.001	1.004	1.009	0.985
Factor with Maximum Gap	Satisfaction	Satisfaction	Willingness	Satisfaction

In the case of irrigation systems, the relative need for assistance was not significantly different for weather zones 1 and 2. At the same time, it was not significantly different for weather zones 3 and 6. However, weather zones 3 and 6 could benefit from the assistance in the irrigation systems area more than weather zones 1 and 2.

With respect to irrigation equipment maintenance and water management areas, weather zones 1, 2 and 3 were not significantly different from each other. Weather zone 6 could benefit more from assistance in these two areas compared to the rest.

Conjoint Analysis Summary. Though the relative need for assistance differed by weather zone, it was not different by customer size. The drawback of this analysis is that it could not find out *why* it was not different. It could not answer other related questions such as: "What is the extent to which customers do not need programs? What is the proportion of customers who are likely to benefit from any programs at all in the coming years? Is there a predominant group of customers who can be the target of these programs? Which aspect of the program is most required?" Some of these questions were answered by using the cluster analysis.

5.1.2 Cluster Analysis

The telephone survey addressed three predetermined areas of interest: irrigation systems, irrigation equipment maintenance, and water management. Survey question 8 inquired about the level of awareness about ways of reducing energy use for irrigation, ways to maintain irrigation equipment, and current water management techniques. All those customers who responded that they were "very aware" or "somewhat aware," did not seem to require any educational programs to increase customer awareness about energy efficiency technologies and practices. Those customers who answered that they were "not aware" or "not at all aware" were the ones who needed exposure to efficient technologies and practices via educational programs. Using this as a criterion, customers were classified into two groups: those who need and those who do not need assistance. Survey question 9 inquired about the level of satisfaction with the information customers currently have in each area, and question 10 inquired about how willing customers were to learn about each one of these areas.

Lack of Awareness. Of a total of 506 respondents to the question for the irrigation systems area (Q8), only 35 were not aware about ways to reduce energy use for irrigation. This suggests that only 6.9% of the customers require any educational assistance. This was confirmed from the responses to question 12, which showed that only 7% had never done a review to see if they could use less energy for irrigation.

Similarly, of a total of 503 respondents to the awareness question about current water management techniques, only 36 (7.2%) customers responded that they were "not aware" of current water management techniques. This was confirmed in other responses. For example, customers were asked what would they do if they were forced to grow crops with 20% less water. Only 7% of the customers did not know what they would do. The rest had some idea about what actions they would take.

Of a total of 500 respondents to the awareness question about maintaining the irrigation equipment, only 25 (5%) were not aware of ways to maintain their irrigation equipment.

Overall, it appears that lack of awareness prevails in less than 8% of agricultural customers. If assistance is provided to increase awareness in any one of the three areas, only 8% of the customers would benefit. Comparing each area, it was observed that water management was the area where the lack of awareness was marginally greater than the other areas.

Lack of Motivation. If customers were "not willing" or "less willing" to learn about efficient technologies and practices, it was assumed that they lack motivation. The survey responses to question 9 indicated that fewer customers responded to this question than to the awareness question. Of a total of 502 customers that responded, 70 customers were not willing to learn about the most profitable choice of irrigation system for their crops. Likewise, 62 customers

out of 501 respondents showed a lack of motivation in learning about efficient ways to maintain irrigation equipment, and 49 out of a total of 499 respondents were not willing to learn about water management techniques. Though lack of motivation prevailed among a greater number of customers, it was not more than 14% of the total respondents. This suggests that if special assistance was designed to motivate customers, it would benefit 14% of the customers or less.

Lack of Satisfaction. From the responses to question 10, it appeared that a large number of customers were fairly satisfied with the information they have for choosing irrigation systems, ways to maintain irrigation equipment, or water management techniques. Even if such assistance was offered, only 12% of customers would benefit from such assistance.

Overall Need for Assistance. The flow chart presented in Exhibit 5.7 was used to find the total number of customers that needed help in each of the three areas. Using this approach, the size of potential demand (or need) for assistance was calculated for each area.

Exhibit 5.7
Flow Chart for Types of Assistance Programs

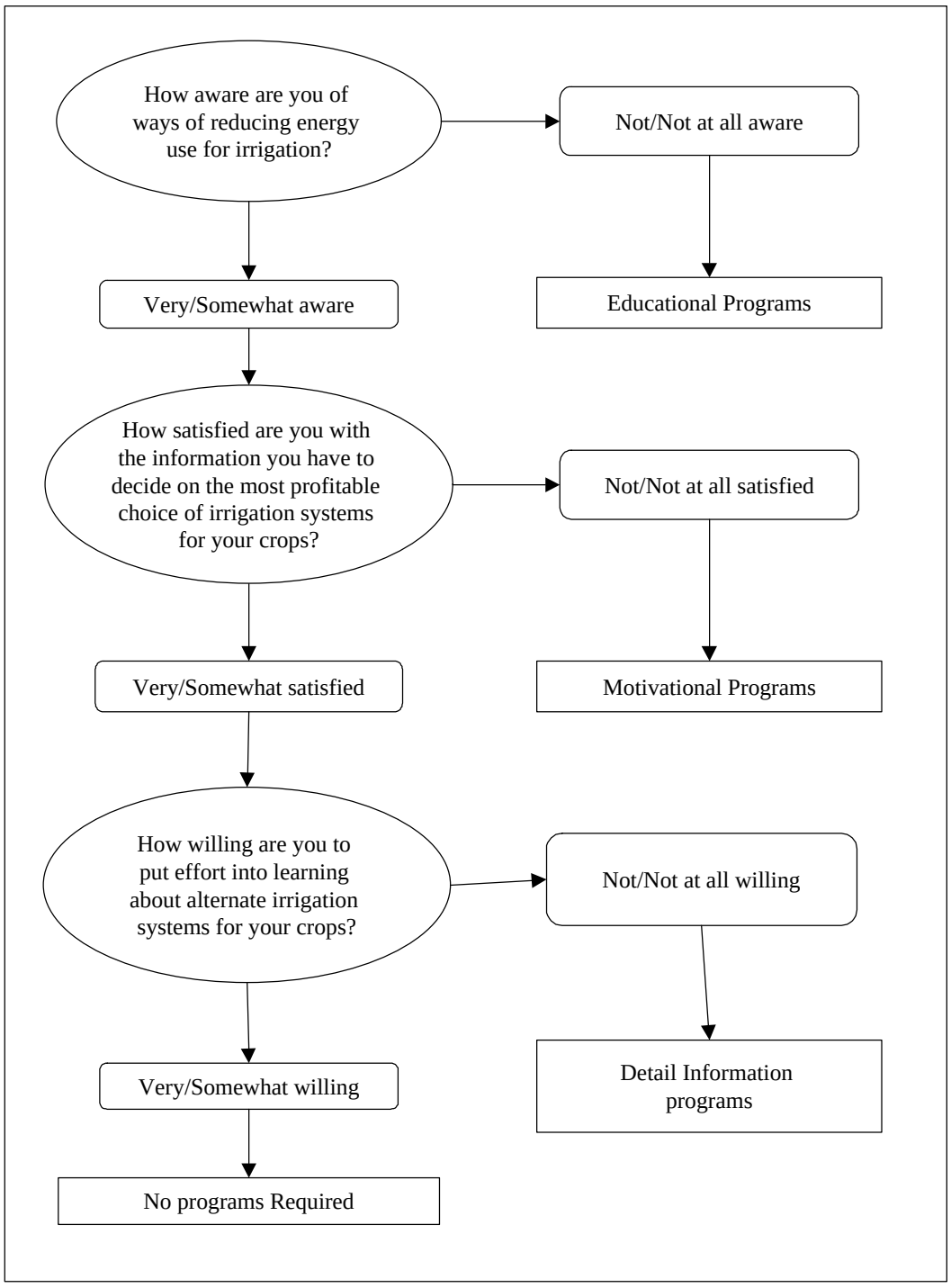


Exhibit 5.8 summarizes the responses. Comparing the percentages it appears that irrigation systems was the area where the most customers needed assistance. It is possible that the customers who were not aware were the same ones who were not willing to learn, or those who were not satisfied with the information they have were the same ones who were not aware. The last column of Exhibit 5.8 accounts for overlap and indicates the proportion of

customers who would require any one or more types of assistance. Customers who needed assistance were identified based on their responses to survey questions 8, 9, and 10.

Need for Irrigation System Assistance. Of the 498 customers who answered the questions regarding the irrigation systems area, 142 customers required at least some type of assistance, and 356 customers did not require any assistance at all. Thus, 71% of customers would not particularly benefit from assistance regarding irrigation systems.

Need for Irrigation Equipment Maintenance Assistance. Of a total of 510 customers who were surveyed, 492 customers responded to the questions regarding maintenance of irrigation equipment. Of 492 respondents, 110 customers needed assistance in terms of education, motivation, or information regarding efficient ways of maintaining irrigation equipment. Again, 78% of the respondents do not need assistance.

Need for Water Management Assistance. With respect to water management techniques, 491 customers responded to all three questions that cover their awareness, satisfaction and willingness to learn. Of 491 customers, only 22% could potentially benefit from any assistance program. Thus, 78% of the respondents were not likely to benefit from such programs.

Exhibit 5.8
Need for Program in Three Areas of Interest

Area	Awareness		Willingness		Satisfaction		Overall*	
	(Need/ Total)	(%)	(Need / Total)	(%)	(Need / Total)	(%)	(Need / Total)	(%)
Irrigation Systems	35/ 506	6.9	70/ 502	13.9	60/ 508	11.8	142/ 498	29
Maintenance of Irrigation Equipment	25/ 500	5.0	62/ 501	12.4	43/ 501	8.6	110/ 492	22
Water Management	36/ 503	7.2	49/ 499	9.8	44/ 503	8.7	107/ 491	22

*If assistance of any type is required.

Overall, the percentage of customers who needed assistance in the three individual areas was less than 30%. Since the sample was representative of the population of agricultural customers, this observation implies that less than 30% of agricultural customers could benefit from any assistance in these three areas.

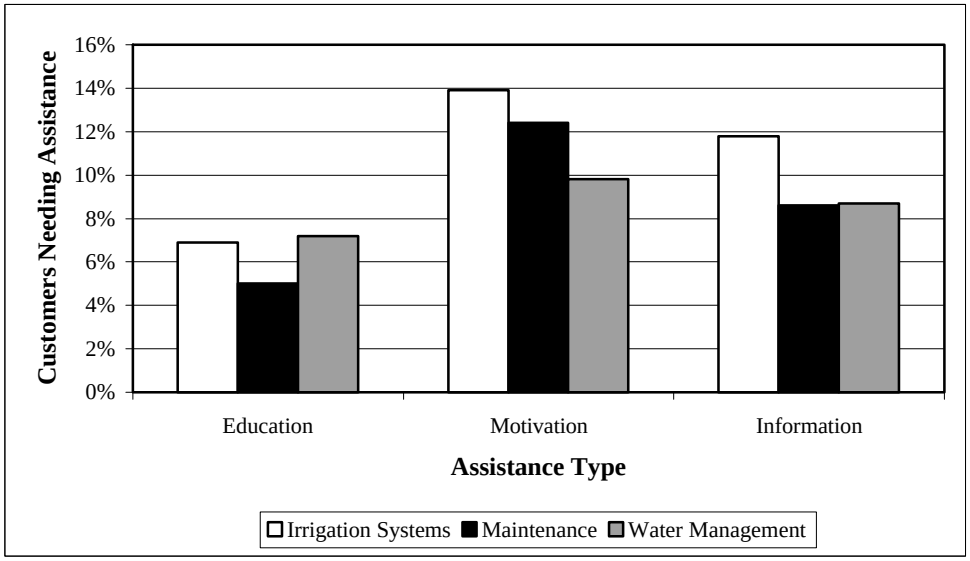
The area in which customers require most assistance was irrigation systems, where 29% of the customers are interested in learning about ways to reduce energy use for irrigation. The other two areas (i.e., water management and maintenance of irrigation equipment) were similar with respect to the customers' interest.

The common feature within each area was that of those customers who needed any type of assistance, most customers required motivational programs, while the type of programs

customers required least were exposure or educational. This implied a high level of awareness among customers.

As can be observed from Exhibit 5.9, maintenance of irrigation equipment was one area where customers least needed the exposure/education.

Exhibit 5.9
Need for Specific Assistance Types by Area

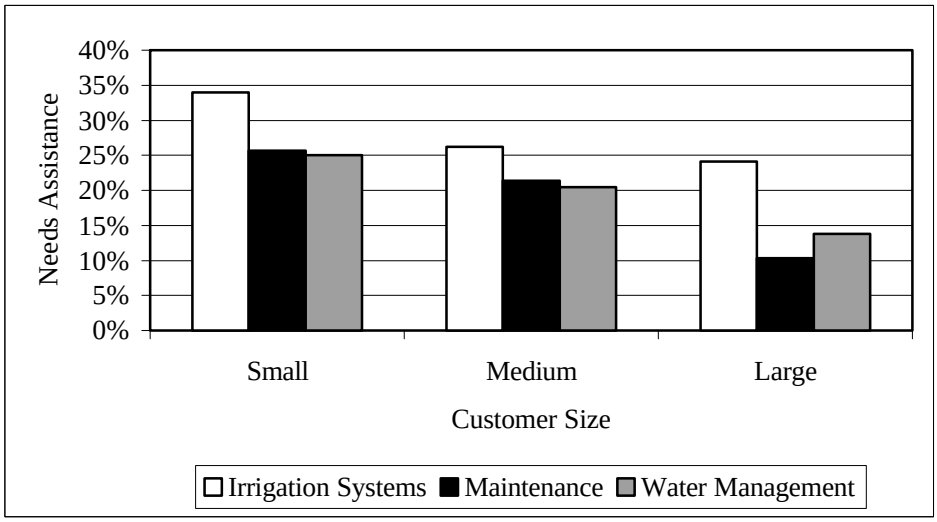


Need by Customer Size (within Cluster Analysis) Having identified the cluster that needed any type of assistance, the next step was to determine which customer attributes would help to identify the customers who may benefit from assistance. The distribution of customers who needed assistance across sizes is summarized in table form in Exhibit 5.10 and graphically in Exhibit 5.11.

Exhibit 5.10
Need by Customer Size - Table

Area	Small		Medium		Large	
	(Need / Total)	(%)	(Need / Total)	(%)	(Need / Total)	(%)
Irrigation Systems	53/156	34	82/313	26	7/29	24
Maintenance of Irrigation Equipment	40/156	26	67/313	21	3/29	10
Water Management	39/156	25	64/313	20	4/29	14

Exhibit 5.11
Need by Customer Size - Chart



One of the common features across different areas was that the proportion of small customers who needed assistance was the highest in all three areas. In other words, small customers could benefit most from the assistance. This could be due to the fact that, proportionally, more large customers probably participated in the AEEI and AEMS programs, sometimes more than once, and may have benefited from those programs already.

This finding implied that the net benefits of future programs, if not geared toward small and medium customers, would be small. However, if programs were geared toward small and medium-sized customers, the kWh savings would be small. Therefore, if future programs were geared toward market transformation in terms of number of customers, the focus should be on small and medium-sized customers. Consequently, relatively low kWh savings would have to be expected.

Overall, the areas in which customers needed assistance did not vary much by customer size. The need for assistance by customers of all sizes was the highest in irrigation systems area.

The second most important area was maintenance of irrigation equipment for small and medium- sized customers, whereas water management was the second most important area for large customers. Three trends evolved from the data that could shed light on why large customers have different responses:

- First, a greater percentage of large customers responded that they run their businesses like a company, rather than as a family business. For example, of all the customers who could benefit from assistance, 95% of small customers' businesses state that they are run as a family business. Conversely, only 65% of the large customers' businesses state that they are run as a family business.
- Second, a greater percentage of large customers have participated in past PG&E efficiency programs than medium or small-sized customers. It appears that 30% of large customers have participated at least once in PG&E's programs in the past four years. However, only

10% of the small customers have participated at least once in PG&E's efficiency programs in the past four years.

- Third, large customers are more likely to use professional services for selecting the most appropriate irrigation systems, irrigation equipment maintenance approach, or water management solution. The survey responses indicate that 10% of the small customers use outside professional services, compared to 20% of large customers.

While there are no causal linkages between these differences and the customer stated needs by size, all three suggest that larger customers are taking a more strategic view, rather than focusing on routine maintenance issues.

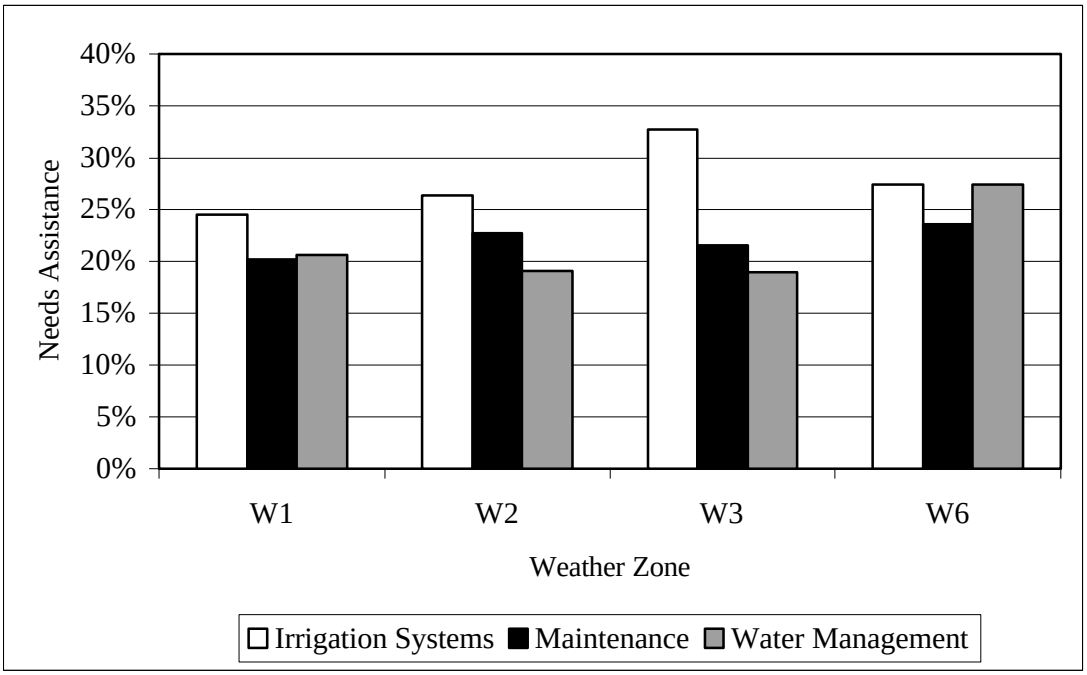
Need by Weather Zone (within Cluster Analysis). Location is another customer attribute that may be important in identifying customers in need of assistance. The distribution of customers that needed assistance across weather zones is summarized below in Exhibit 5.12 and again graphically in Exhibit 5.13.

Exhibit 5.12
Need by Weather Zone - Table

Weather Zones	Irrigation Systems		Maintenance of Irrigation Equipment		Water Management	
	(Need / Total)	(%)	(Need / Total)	(%)	(Need / Total)	(%)
W1: Southern San Joaquin Valley	51/208	24.5	42/208	20.2	43/208	20.7
W2: Northern San Joaquin Valley	29/110	26.4	25/110	22.7	21/110	19.0
W3: Sacramento Valley	38/116	32.8	25/116	21.6	22/116	18.9
W6: South Coast	14/51	27.0	12/51	23.5	14/51	27.5

Again, weather zones 4 and 5 (i.e., North Coast and Marin) were not included in this comparison, primarily because the sample sizes are very small. Interest in the most appropriate irrigation system was the highest across all weather zones. For the Southern Coast (W6), water management issues were equally important.

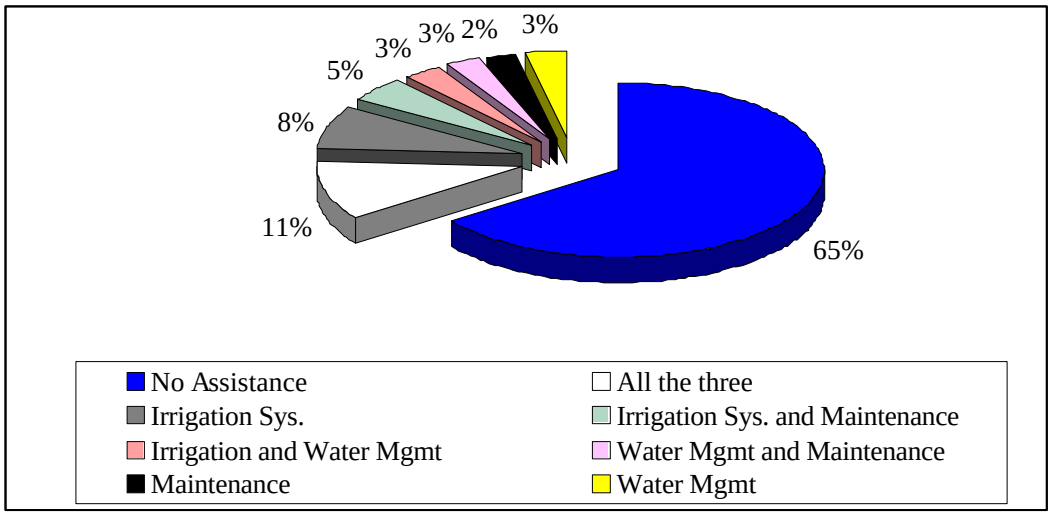
Exhibit 5.13
Need by Weather Zone - Chart



This suggests that if an irrigation systems assistance is fielded, it should target customers based on need by weather zone. Water management should not be given as much importance as irrigation systems in any weather zone except in the South Coast (W6).

Overall Need. Of a total of 510 customers surveyed, 478 customers responded to all the questions used for analysis in this section. Exhibit 5.14 shows the proportion of customers who may benefit from one or more types of assistance in different areas.

Exhibit 5.14
Customer Benefits Across All Assistance Areas



As shown in Exhibit 5.14, 65% of the customers do not need any assistance at all. They are aware of the available information, willing to put in effort to learn, and satisfied with the available information. Only the remaining 35% of the customers would potentially benefit from any type of the assistance. Of these 35% of customers, 11% of the respondents can benefit from the assistance in all three areas. (The findings showed that this cluster included customers from only the small and medium strata.) Conversely, adding the three single areas shown in Exhibit 5.14, 13% of the respondents need assistance in only one of the three areas.

The area of interest did not vary significantly across customer size but did vary by weather zone. The most important area where customers needed assistance was irrigation systems. Water management and maintenance of irrigation equipment were of secondary, though equal, importance, except that water management was slightly more important for large customers.

On the basis of prior studies, the evaluation team believed that motivating customers to take interest in efficient technology and practices would be more difficult than providing them introductory education or detailed information. This was because the customers' willingness to learn depended upon the cost of electricity as a percentage of the total cost of operating the business. The survey indicated that of 35% (167 of 478) of the customers who needed assistance, 56% (93 out of 167) of these customers were not willing to learn about efficient technologies and practices. While determining why they were unwilling was outside the scope of the study, current and past years' surveys indicated that the majority of customers who were not willing to learn about efficient technologies and practices had electricity costs that were less than 8% of their total operating costs. The current survey indicated that 60% of the customers who needed assistance (56 out of 93) had electricity or water bills that were less than 8% of the operating cost. This indicated that only 35% (i.e., 167 out of 478) of the customers needed assistance and 12% (i.e., 56 out of 478) of the customers did not care since electricity cost OR that water cost was less than 8% of the operating costs. Therefore, only 23% of the customers (i.e., (167-56) out of 478) could benefit from assistance. The potential beneficiaries could be increased from 23% to 32% if assistance can somehow convince the customers that energy efficient technologies and practices could affect water as well as electricity usage. This is because the electricity and water bills together are less than 8% of the operating costs for only 3% of the customers who are not willing to learn. In other words, of the 56 customers whose electricity or water bill is less than 8% of operating costs, only 18 customers have water and electricity bills less than 8% of the operating costs.

It is important to note that the surveyed sample was a very good representation of the population of agricultural customers. The potential demand for assistance was 35% for the sample, and there are good reasons to believe that the potential demand for assistance could be as low as that for the market as a whole.

Similarly, if the customers continued to believe that either the electricity or water bill could be affected by efficient technologies and practices, then only 23% of the customers could benefit from the assistance.

Conclusion for Hypothesis 1. Using both the analyses it was observed that

- Only 35% of the customers needed any type of assistance.
- Among the 35% of customers, most customers needed assistance with irrigation systems.

- Of 35% of customers who needed assistance, most customers needed to be motivated to learn about efficient technologies and practices.
- Approximately 15% of all customers would benefit from assistance that brings awareness or provides detailed information.
- Conjoint analysis for all customers surveyed indicated that the relative need for assistance did not differ for customers in different sized segments but did differ across weather zones.
- Cluster analysis of the customers who needed assistance indicated that small customers and medium-sized customers needed assistance more than large customers. Irrigation systems and irrigation equipment maintenance were the two important areas for small and medium-sized customers, whereas irrigation systems and water management were two important areas for large customers.

5.2 Hypothesis 2 – Preference for Assistance Different by Size and Weather Zone

In the second hypothesis, it was theorized that preference for the type of communication channel would be different by customer size and probably by weather zone. The analysis was carried out for two groups of customers. First, for all respondents, and second for a subset of customers who were identified in section 5.1 as those who could benefit from assistance.

Customers were asked to state whether or not they would like to get information regarding three different areas (irrigation systems, irrigation equipment maintenance, and water management) via several specific channels. For practical reasons, respondents were not asked to rank their preferences among the channel choices offered. As such, conjoint analysis was not carried out. However, the popularity of the channel in terms of how many respondents would like to get information via that channel could be compared. Responses to questions 13, 16, and 20 were used for analysis in this section.

Preference Among All Customers. From Exhibit 5.15, it can be observed that, overall, most respondents like to get information via mail inserts. It appeared that mail inserts could be an effective tool to disseminate information among agricultural customers.

The second most popular alternative was the on-site review. On-site reviews tend to provide site-specific information, advice on, and opinions about all the issues related to energy and water use. It is not surprising that customers liked the channel that could provide them site-specific information because choices of appropriate irrigation system, water management issues and problems with maintaining irrigation equipment are specific to each site.

Exhibit 5.15
Preference for Assistance Channel

Channel	Irrigation Systems		Maintenance		Water Management	
	#	%	#	%	#	%
Mail	452	89	399	78	407	80
On-site Review	401	79	391	77	392	77
Demonstration	340	67	344	68	339	67
Advice on Telephone	303	59	282	55	283	56
Training Workshops	258	51	274	54	278	55
Presentation at a Meeting	235	46	259	51	280	55
Internet	133	26	133	26	126	25

The preferences remained the same for the first three choices in all the three areas. After the first three choices, there were subtle differences in the preferences. For example, workshops and presentations were as popular as assistance on the telephone with respect to information regarding maintenance of irrigation equipment and water management. The Internet is the least popular channel at this time. However, this could change with greater availability of useful material on the Internet and increasing popularity of Internet use.

Preference By Size. In order to test the hypothesis, it was important to observe whether or not this pattern remained the same for subsets of customers in different size groups and within each area.

With respect to information about *irrigation systems*, small and medium-sized customers had the same preference as observed earlier of all respondents. However, large customers preferred workshops and presentations more than assistance on the telephone. This could be because the large customers manage their businesses like a company and could afford the time to attend trade association meetings and training workshops.

With respect to information about *maintenance of irrigation equipment*, medium-sized customers preferred on-site reviews more than mail inserts potentially because of the uniqueness of the site requirements and use of the equipment. For large customers, on-site reviews were as popular as mail inserts, and presentations and workshops were more popular than assistance on the telephone.

In all group sizes, presentations and workshops on *water management* were relatively more important than they were for the other two areas. This could be due to the increasing importance of water management issues. It was interesting to observe that for medium-sized customers on-sites were more popular even in the water management areas, whereas

presentations were more important than on-sites for large customers. In the market effects study of the 1997 AEEI program, it was observed that the large customers faced the market barrier of Asymmetric Information. Since presentations and workshops deliver information to a group of customers at the same time, with possible reduction in individual bias, it appeared that the large customers understood the market barrier and preferred a strategy that helped reduce that barrier.

Exhibit 5.16 summarizes the differences in the channel popularity across sizes and area. The first choice for small and large customers across all the three areas of interest is mail. The first choice for medium-sized customers is mail for irrigation systems and on-site for the other two areas. On-sites remained the second choice for small customers for all areas. For medium-sized customers, the second choice was mail for maintenance and water management areas. Large customers prefer presentations for getting information regarding water management techniques.

Exhibit 5.16
Channel Preference by Size

Choice of Channel	Irrigation Systems			Irrigation Equipment Maintenance			Water Management		
	Small	**Med.**	**Large**	**Small**	**Med.**	**Large**	**Small**	**Med.**	**Large**
Mail	1st	1st	1st	1st	2nd	1st	1st	2nd	1st
On-Site	2nd	2nd	2nd	2nd	1st	2nd	2nd	1st	3rd
Demonstration	3rd	3rd	3rd	3rd	3rd	3rd	3rd	3rd	4th
Telephone	4th	4th	6th	4th	4th	6th	4th	4th	5th
Workshops	5th	5th	5th	5th	5th	4th	6th	5th	6th
Presentation	6th	6th	4th	6th	6th	5th	5th	6th	2nd
Internet	7th	7th	7th	7th	7th	7th	7th	7th	7th

Generally, the per-person cost of presentations and workshops should be less than the cost of on-site reviews. If the guidelines presented above were used in designing and implementing the programs, program costs could be minimized.

While testing the first hypothesis, it was observed that only 35% of the respondents could benefit from any assistance. Thus, it was important to test whether or not their preference for the channel remained the same as shown in Exhibit 5.16 when only those 35% were considered. For small customers, there was one major change. The assistance on the telephone appeared to be more popular than a demonstration. However, medium-sized customers showed the same pattern as the medium-sized customers among all respondents. For large customers, presentations were the most popular for water management area, and workshops were as popular as mail inserts in the other two areas.

Preference by Weather Zone. Moving back to the entire population, the preferences by weather zone were analyzed. Again, weather zones 4 and 5 were not included in the analysis due to the limited number of respondents. Comparing the popularity of assistance channels for *irrigation systems*, mail inserts remained the most popular assistance channel and on-site reviews remained the second most popular assistance channel. The order of the preferences remained the same across weather zones until the fourth choice.

For information regarding *irrigation equipment maintenance*, the first choice remained the same for weather zones 1, 2, and 6. Customers in weather zone 3 preferred on-sites as much as mail. The choices remained very similar until the fourth order.

For information regarding *water management techniques*, mail inserts remained the most popular assistance channel for all weather zones except weather zone 2. Customers in weather zone 2 preferred on-sites more than mail.

Exhibit 5.17
Channel Preference by Weather Zone

Choice of Channel	Irrigation Systems				Irrigation Equipment Maintenance				Water Management			
	W1	W2	W3	W6	W1	W2	W3	W6	W1	W2	W3	W6
Mail	1st	1st	1st	1st	1st	1st	1st	1st	1st	2nd	1st	1st
On-Site	2nd	2nd	2nd	2nd	2nd	2nd	1st	2nd	2nd	1st	2nd	2nd
Demonstration	3rd	3rd	3rd	3rd	3rd	3rd	2nd	3rd	3rd	3rd	3rd	3rd
Telephone	4th	4th	4th	4th	4th	5th	3rd	5th	4th	6th	5th	5th
Workshops	5th	6th	5th	5th	5th	5th	4th	5th	4th	5th	4th	5th
Presentation	6th	5th	6th	6th	6th	4th	5th	4th	5th	4th	6th	4th
Internet	7th	7th	7th	7th	7th	7th	6th	6th	6th	7th	7th	6th

Again, the pattern was tested on the group of 35% of customers that could benefit from assistance. For information regarding irrigation systems, mail inserts continued to be the most popular assistance channel for customers from all weather zones. On-site review remained the second most popular assistance channels. The third and fourth most popular channels differed by weather zones. For weather zones 1, 2, and 6, demonstration remained the third choice, whereas for weather zone 3, telephone was the third choice for getting information regarding irrigation systems and water management.

Conclusion for Hypothesis 2.

- For any area, mail inserts were preferred over all other channel types. Unless the choice was compared across customers in different sized segments, or weather zone segments, the channel preference remained the same for all three areas.

- When channel preference was compared across customers in different sized segments, medium-sized customers preferred on-site for two out of three areas of interest.
- The differences in choices across size segments were clearer than those across weather zones.

Though ordering the choices would be helpful in identifying preferences, it would not be sufficient for developing an optimal assistance program. This is because the preferences did not mean customers were likely to act. In fact, customers may have preferred mail because they had the choice of ignoring it if they did not wish to put in more effort.

5.3 Hypothesis 3 - Benefits from Assistance Different by Size and Weather Zone

The third hypothesis looked at the effectiveness of the assistance channel in terms of encouraging customers to change current technologies and practices and adopt appropriate energy efficient technologies and practices. It was thought that the likely effectiveness might differ by size and by weather zone. This hypothesis was tested using cluster analysis and continuous index analysis. Additionally, information from hypotheses one, two, and three were combined for simulation using conjoint analysis.

In the market effects study of the 1996 AEMS programs and 1997 AEEI programs, it was observed that customers' willingness to change current practices to energy efficient ones depended upon the source of information. If customers preferred a particular channel, then the important question was whether the preferred channel was effective enough to cause changes in the current practices. Using this as the base for the study's questionnaire, the telephone survey included questions to examine customers' likelihood to change if they received information from three groups of channels.

In order to determine the effectiveness of the assistance channel, it was important to find out the likelihood of changing the current practices if the information was delivered via each of the seven channels discussed in the second hypothesis. However, the time limit on the telephone survey forced the grouping of these channels. After careful comparison of the cost and ease with which the channel could be used, three groups were created. The first group included mail inserts and the Internet as indirect communication channels. Both were considered relatively low cost and easy to use. The second group included demonstrations, presentations, and workshops - all of which were geared toward group education. The third group included telephone assistance and on-site reviews. Though telephone assistance was less expensive than on-site reviews, these two channels were grouped together because they both required skilled staff and personal or voice contact.

Within each area, the effectiveness of the grouped channel was evaluated using the responses to the survey questions 14, 17, and 21. To allow a more intuitive interpretation, the scale was reversed so that the greater number represented greater willingness to change. Therefore, if everyone was willing to change, the average willingness would be 4.0. If very few customers were willing to change current practices, then the average willingness would be 1.0. The willingness to change was analyzed for the whole sample, by customer size and weather zone. The results are presented in the following sections.

5.3.1 Willingness to Change for Whole Sample

Willingness to change was compared using the continuous index as well as cluster analysis.

Continuous Index. Since the responses to the questions used for analysis in this section were on a scale of 1 to 4, it was possible to compare the effectiveness of three areas. This was done by creating an effectiveness index for customers in different sized groups or weather zones, relative to the whole sample.

While comparing the three areas (irrigation systems, maintenance of irrigation equipment, and water management), it was observed that the average willingness to change to energy efficiency in any of the three areas, via information from any of the three channel groups, ranged between 2.934 to 3.167, as shown in Exhibit 5.18. The range was small but the average was high, indicating that, on average, most people were willing to make the change and their willingness was not significantly different from one channel to another across the three areas.

Within that small range, the willingness to change was lowest for the *water management* area. There could be two reasons for this. One, either the water management issues faced were not as severe as those involving energy use and/or most of the customers were in business for a very long time; or two, they may think that they were very much aware of the amount of water the crop required and that they were managing it very well. As such, they were cautious about changing their current practices.

The willingness to change current practices was the highest in the *irrigation systems* area. Again, if the benefits of efficient technology were well proven, and if it was a very important issue for the agricultural customers, they may have been more inclined to make such changes.

Exhibit 5.18
Willingness to Change– Whole Sample, Continuous Index Analysis

	Mail/Internet	Demonstration/ Presentation/ Workshops	On-site Reviews/ Telephone Assistance
Irrigation Systems	3.167	3.142	3.160
Maintenance of Irrigation Equipment	3.044	2.983	3.033
Water Management	2.992	2.934	2.991

Comparing the communication channels within any specific area, the difference in willingness to change was not significantly different from each other at the 99% significance level. In other words, all the channel types appeared to be equally effective within an area.

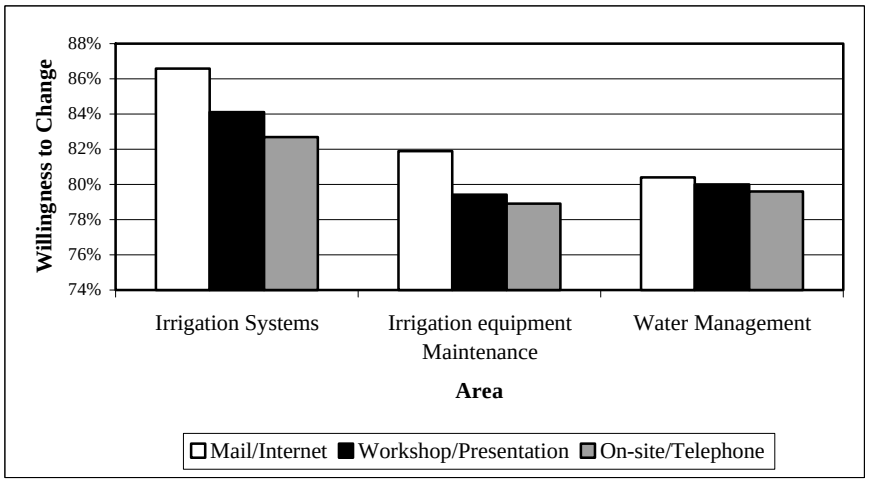
Cluster Analysis. As mentioned earlier, using cluster analysis, customers were grouped into two categories, one group that was "very likely" or "somewhat likely" and another group that was "not likely" or "not at all likely." Responses to questions 14, 17 and 21 were used to classify customers into two categories for irrigation systems, irrigation equipment

maintenance, and water management, respectively. This information is summarized in Exhibit 5.19 and Exhibit 5.20.

Exhibit 5.19
Willingness to Change – Whole Sample, Cluster Analysis

	Mail/ Internet	Demonstration/ Presentation/ Workshops	On-site Reviews/ Telephone Assistance
Irrigation Systems	86.6%	84.1%	82.7%
Irrigation equipment Maintenance	81.9%	79.4%	78.9%
Water Management	80.4%	80.0%	79.6%

Exhibit 5.20
Willingness to Change – Whole Sample, Cluster Analysis Chart



As can be observed from the table and graph, the highest proportion of customers are likely to change their current technologies and practices if information was provided via mail or the Internet. This finding is in agreement with the continuous index analysis and is also similar to the finding in the second hypothesis. The difference in the effect of the channel type was the least for water management techniques and the highest in irrigation systems.

The continuous index approach found on-site/telephone as the second most effective channel type. However, cluster analysis found demonstration/ presentation/ workshop to be the second most effective channel type. This difference is because more customers responded that they were "somewhat likely" to change the current practices via demonstration/presentation/ workshop channel type than for on-sites. The cluster analysis considered "somewhat likely" and "very likely" to be the same, whereas in the continuous index analysis they were not equal, hence this discrepancy.

5.3.2 Willingness to Change by Customer Size

The sample was grouped by customer size and again analyzed using continuous index and cluster analyses.

Continuous Index. The relative effectiveness was calculated as the average willingness of customers in a specific customer size group for a given channel and area, divided by the average willingness of all customers for a given channel and area. The Relative Effectiveness algorithm can be mathematically described as shown in Exhibit 5.21.

Exhibit 5.21
Relative Effectiveness Algorithm for Willingness to Change

$$[\text{Relative Effectiveness}]_{pg} = \frac{\sum_{i=1}^{pg}[\text{Willingness to change}_{pi}] \Big/ N_{pg}}{\sum_{i=1}^{pI}[\text{Willingness to change}_{pi}] \Big/ N_{pi}}$$

Where Relative Effectiveness$_{pg}$ is the effectiveness of channel *p* for group *g*.

Using this index, customers in three groups were ranked to indicate the relative effectiveness of that group compared to the sample of customers interviewed. For example, if the relative effectiveness of small customers with respect to the mail/Internet channel for getting information about irrigation systems was the highest, then the rank was 1 for that group. The results of this analysis are shown in Exhibit 5.22. This exhibit presents much information and requires further explanation. The numbers without parentheses indicate the order of effectiveness of a specific channel type and an area *across customer segments*. The numbers in parentheses represent the order of effectiveness of channel types *for a specific group* (i.e., small, medium, or large) within that specific area. For small customers, the mail/Internet was the most effective channel type for getting information on all the three areas and on-sites/telephone was the least effective channel. For medium-sized customers, the preference was just the reverse. The most effective channel type for them was on-site/telephone for the three areas and the least effective channel type was the mail/Internet. For the large customers, the most effective channel type was presentation/demonstration/workshop. The second most effective channel was mail/Internet. On-site/telephone was as effective as mail for information regarding irrigation equipment maintenance and less effective than mail for the other two areas.

Exhibit 5.22
Order of Customers' Willingness to Change by Size – Continuous Index Analysis

	Mail/Internet	Demonstration/ Presentation/ Workshops	On-site Reviews/ Telephone Assistance
Irrigation Systems			
Small	1—(1)	3—(2)	2—(3)
Medium	2—(3)	1—(2)	1—(1)
Large	3—(2)	2—(1)	3—(3)
Irrigation Equipment Maintenance			
Small	1—(1)	3—(2)	2—(3)
Medium	2—(3)	1—(2)	1—(1)
Large	3—(2)	2—(1)	3—(2)
Water Management			
Small	1—(1)	3—(2)	2—(3)
Medium	2—(3)	2—(2)	1—(1)
Large	3—(2)	1—(1)	3—(3)

*Note: The numbers without ( ) represent the order of effectiveness across groups within a channel and within an area. The numbers in ( ) is the order of preference for a given group across channels within that area.

These finding are consistent with the findings of the previous hypothesis. There, it was observed that small customers preferred mail over other channel types, medium-sized customers preferred on-site over other channel types, and large customers preferred presentations over other channel types for the majority of information. However, when groups were compared for a given channel type, it was found that the effectiveness of demonstration/presentation/ workshops was the highest for medium-sized customers for two of the three areas. This indicated that, overall, the medium-sized customers were willing to change when offered more information than what is currently available to them. Information on water management techniques via presentation/workshop/demonstration was likely to affect the large customers the most. The large customers were reluctant to make changes, even if the information was provided via the channel that they most preferred.

The ordering in the table was based on the comparison of the relative effectiveness of each group. It is very important to note that the relative effectiveness of each group was close to one, indicating that the subgroups were not very different from the overall average.

There may be reasons why a particular segment was less willing to change current practices. For example, if information about any one of the three areas was delivered via either mail or on-site reviews, large customers were least likely to make the changes. Based on their experience, they may feel that information from mail/Internet was insufficient to convince them to change their current technology and practices to the efficient technologies and practices. With respect to on-site reviews, they may have experienced biased information due

to the large size of their businesses. Of all the channels, they were most willing to change current technology and practices if the information source was demonstration/workshop/ presentation, where information is given to a group of customers at the same time. As far as the small customers are concerned, they were most likely to change their current practices if the information about irrigation systems, or maintenance of irrigation equipment or water management was delivered via mail/Internet. The simplicity of this information channel and receiving something in print was important for the small customers. The proportion of small customers that experienced on-site reviews via PG&E's AEEI programs was small; hence, they may not have realized the benefits. For the medium-sized customers, the most effective assistance channel for any one of the three areas was the on-site review or advice on telephone. Thus, preferences for assistance channels differed for small, medium and large customers but did not differ across the three areas.

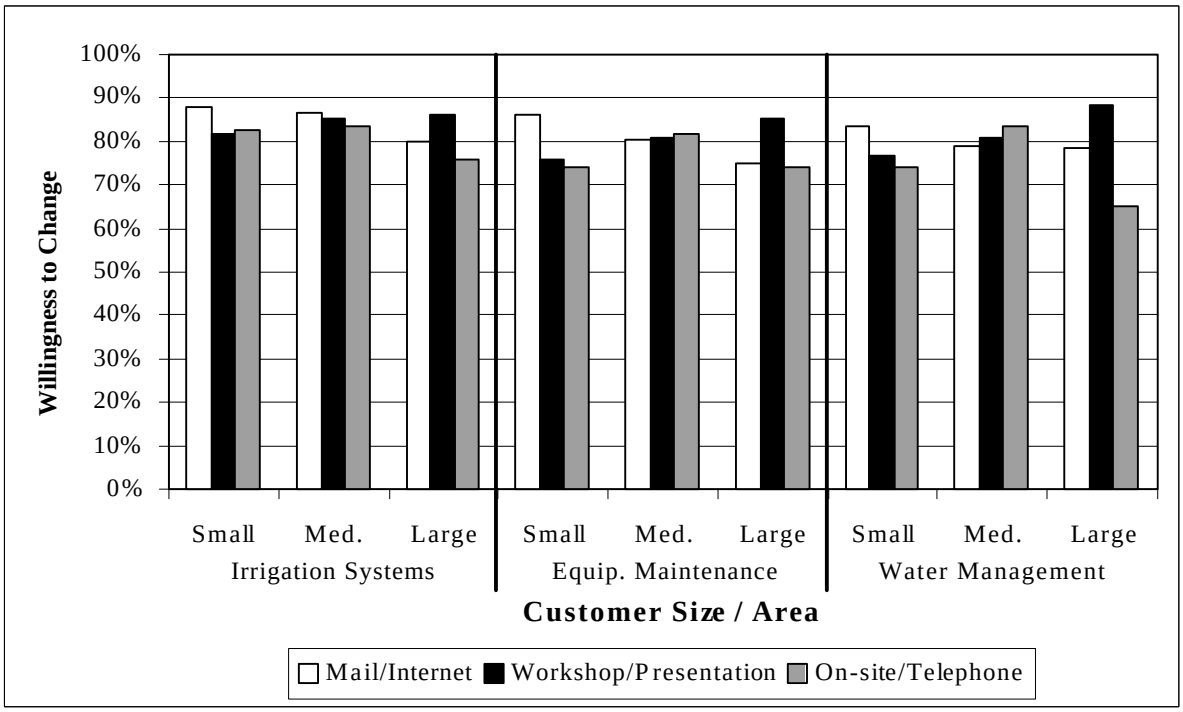
Cluster Analysis. Since the overall analysis did not help in understanding the effective channel types for each customer segment, clusters were formed within size segments.

Exhibit 5.23 and Exhibit 5.24 both illustrate that mail/Internet was the most effective delivery channel for small customers. On-sites were the most effective channel type for medium-sized customers and presentations/demonstrations/workshops were the most effective channel type for the large customer segment. An important inference is that the choice of channel type does not change for small and large customers for different areas of interest in which they need information. This was the one exception where the cluster analysis findings were different from the continuous index approach findings.

Exhibit 5.23
Willingness to Change by Size – Cluster Analysis

	Mail/Internet	Demonstration/ Presentation/ Workshops	On-site Reviews/ Telephone Assistance
	Irrigation Systems		
Small	88.0%	81.6%	82.7%
Medium	86.6%	85.2%	83.3%
Large	80.1%	86.1%	75.8%
	Maintenance		
Small	86.0%	76.0%	74.0%
Medium	80.3%	80.6%	81.7%
Large	75.0%	85.2%	74.0%
	Water Management		
Small	83.6%	77.0%	74.0%
Medium	79.0%	80.9%	83.7%
Large	78.6%	88.5%	65.4%

Exhibit 5.24
Willingness to Change by Size – Cluster Analysis Graph



5.3.3 Willingness to Change by Weather Zone

As with the analysis by customer size, the sample was grouped by weather zone and again analyzed using continuous index and cluster analyses.

Continuous Index. An index of effectiveness was calculated for each of the weather zones relative to the whole sample. Though the index did not vary significantly across different areas and across weather zones, the most effective channel type by area and weather zone are summarized in Exhibit 5.25.

Exhibit 5.25
Willingness to Change by Weather Zone – Continuous Index Analysis

	W1	W2	W3	W6
Irrigation Systems	Mail/Internet	Mail/Internet	On-site Reviews/ Telephone	Demonstration/ Presentation/ Workshops
Irrigation Equipment Maintenance	Demonstration/ Presentation/ Workshops	On-site Reviews/ Telephone	On-site Reviews/ Telephone	Mail/Internet
Water Management	Demonstration/ Presentation/ Workshops	Mail/Internet	On-site Reviews/ Telephone	Mail/Internet

Except for weather zone 3, the most effective channel type varied by area and by weather zones.

A combination of observations regarding effective channel types by size and weather zones could be effectively used to better target and obtain better results from the programs. This would be good background for a cost-effective program development.

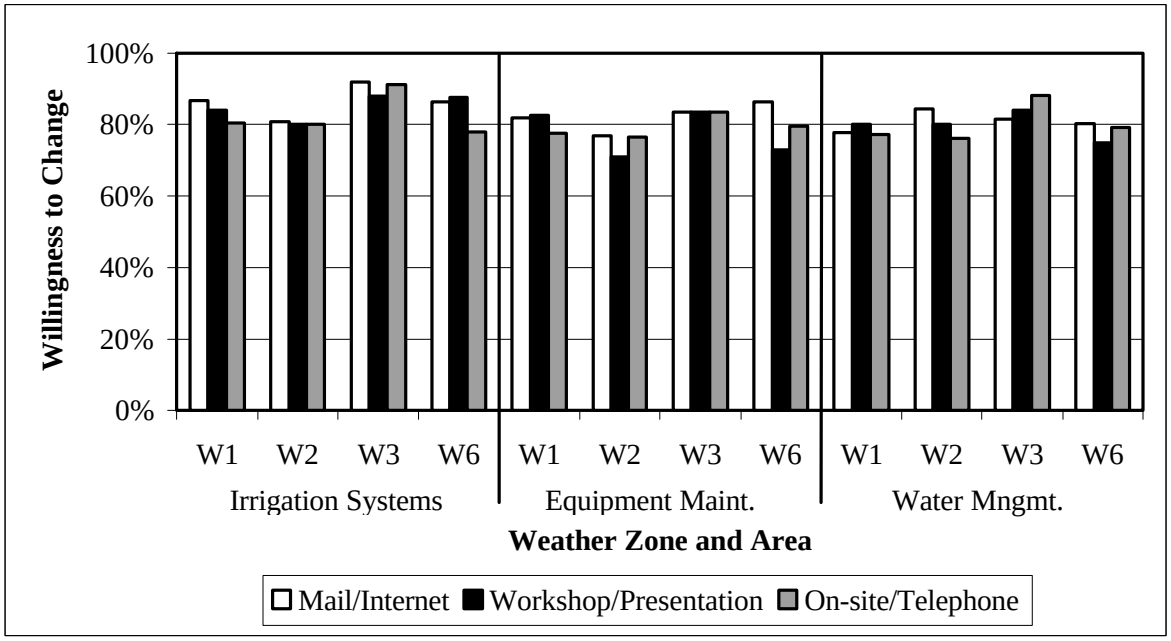
It was important to check how effective these assistance channels would be if they were offered to the customers according to their choice. There are different ways to estimate this. Conjoint analysis was an appropriate choice since it was simple yet sensitive to minor changes in the scale of the customer responses. These analysis results are presented below in section 5.3.4.

Cluster Analysis. Similar to the analysis performed by customer size, a cluster analysis was performed by weather zone. Exhibit 5.26 and Exhibit 5.27 display the results of this analysis.

Exhibit 5.26
Willingness to Change by Weather Zone – Cluster Analysis

	W1	W2	W3	W6
	Irrigation Systems			
Mail/Internet	86.9%	80.8%	91.8%	86.3%
Workshop/Presentation	84.0%	80.2%	87.9%	87.8%
On-site/Telephone	80.6%	80.2%	91.2%	78.0%
	Maintenance			
Mail/Internet	81.9%	76.8%	83.6%	86.3%
Workshop/Presentation	82.6%	71.0%	83.6%	72.9%
On-site/Telephone	77.6%	76.7%	83.6%	79.6%
	Water Management			
Mail/Internet	77.8%	84.5%	81.5%	80.4%
Workshop/Presentation	80.2%	80.2%	84.1%	75.0%
On-site/Telephone	77.3%	76.2%	88.2%	79.2%

Exhibit 5.27
Willingness to Change by Weather Zone – Cluster Analysis Graph



As can be observed from these two exhibits, the overall willingness to change was very high (above 70%) for information regarding any of the three areas. This indicates that at least 70% of customers were willing to change their current technology and practices. The most effective channel type varied by weather zone and by area of interest.

- Mail/Internet channel type was the most effective for weather zones 1, 2, 3 for irrigation systems information, for weather zones 2, 3, 6 for information on irrigation equipment maintenance, and weather zones 2 and 6 for water management information.
- Demonstration/presentation/workshops was the most effective channel type for weather zone 1 for irrigation equipment maintenance and water management information.

These findings were virtually identical to the continuous index analysis findings.

5.3.4 Simulation Using Conjoint Analysis

The analysis was taken one step further after completing hypotheses one, two, and three by combining the results of each hypothesis and performing a simulation using conjoint analysis. This was done in order to provide the effectiveness of an assistance channel if it was offered to the customers according to their channel of choice. From the survey responses, an additive composite Impact Index was constructed based on the stated level of awareness, willingness to learn, and satisfaction in each area of interest. For any specific area, the maximum value of the additive Impact Index for a single customer could be 12 (since responses to the three questions, each with a maximum of four, were added together). If the impact index was 12, then that customer did not need any assistance since the customer was fully aware, willing to learn efficient ways of using resources (i.e., water and electricity), and satisfied with the available information. Using this analysis, customers whose Impact Index was less than 12 for

a specific area could be identified. In order to quantify overall effect, a sum of the Impact Index was calculated at the time when no assistance was offered. It was calculated as shown in Exhibit 5.28.

Exhibit 5.28
Impact Index Algorithm

$$[\text{Impact Index}]_{kt} = \sum_{j=1}^{J} [\text{Awareness}_j + \text{Willingness to learn}_j + \text{Satisfaction}_j]_{kt}$$

Where *J* was the subset of customers whose Impact Index was less than 12 for area *K* at time *t* to represent the time before the assistance channel was offered.

In a hypothetical scenario, after identifying a customer's preferred choice of assistance channel, they were offered that assistance via the channel of their choice. It was assumed that the customer's awareness and satisfaction increased as a result of the assistance offered. To be on the conservative side, the assumption was made that it would affect them by 25% from the scale point they were on before the assistance was offered. Although the survey used a non-continuous a four-point scale, for this example assumes a continuous scale to reflect a more conservative effect of assistance. Thus, if customers were moved from the current scale point to one step higher, the effect would be more than the assumed 25%. However, just to illustrate the effect of the preferred channel type, it was assumed that it may increase by 25%. In other words, those customers who were "not at all aware" moved towards "not too aware" level by 25%. Those who were "not too aware" moved towards "somewhat aware" by 25% and so on. Again to be on the conservative side, it was assumed that the assistance offered did not affect the customer's willingness to learn and could affect only the level of awareness and satisfaction.[7]

On the basis of the above mentioned assumptions, effect in time (*t*+1) could be simulated and compared to the index in time *t*. The effect of each assistance channel for a specific area could be measured by taking the difference between the Impact Index at time (*t*+1) and the Impact Index at time *t*. For comparison across channel types and areas it could be expressed in terms of percentages. For example;

$$(\text{Incremental Impact of Channel (Mail)})_k = \frac{(\text{Impact Index}_{t+1})_k - (\text{Impact Index}_t)_k}{(\text{Impact Index}_t)_k}$$

Where the effect of mail inserts with respect to area *k*, was the difference between the Impact Index at time (*t* +1) (i.e., after the assistance is offered via mail inserts) and Impact Index at time *t* (i.e., before offering the assistance). The effects of each of the three channels were calculated for each of the three areas. The results are summarized below in Exhibit 5.29.

[7] In the market effect studies of 1996 AEMS program and 1997 AEEI programs, it was observed that the motivation to learn about efficient technologies and practices arose out of need. If the cost of energy or water was low as a percentage of the total cost of their business, the customer may not be willing to learn new and efficient technologies and practices. Customers could not be motivated to learn about efficient technologies and practices simply by offering them the assistance of their choice.

Exhibit 5.29
Incremental Impact by Channel and Area

	Mail Inserts /Internet	Demonstration /Presentation/ Workshop	On-site Reviews/ Telephone	Sum of Impact by Area*
Irrigation Systems				
$(\text{Impact Index})_{t+1}$	3962	3881	4115	11958
$(\text{Impact Index})_{t}$	3862	3862	3862	11586
Incremental Impact in %	2.59%	0.49%	6.55%	3.21%
Irrigation Equipment Maintenance				
$(\text{Impact Index})_{t+1}$	3617	3550	3738	10905
$(\text{Impact Index})_{t}$	3533	3533	3533	10599
Incremental Impact in %	2.38%	0.48%	5.80%	2.89%
Water Management				
$(\text{Impact Index})_{t+1}$	3450	3379	3567	10396
$(\text{Impact Index})_{t}$	3359	3359	3359	10077
Incremental Impact in %	2.71%	0.59%	6.2%	3.1%
Sum of Impact by Channel*	2.56%	0.52%	6.19%	4.42%

* Assuming that all customers get assistance via the channel of their choice.

It is important to note that the numbers represented in the table do not represent either kWh savings or number of customers. It was an additive index and, hence, does not have any specific unit of measurement.

If all the customers were offered assistance via the their most preferred channel type, the additional information would reduce the relative need by 4.42% (assuming that assistance can only improve customers' awareness or satisfaction by 25%). This was compared to other simulation scenarios such as what if assistance was offered only via mail/Internet, or only via demonstration/presentation/workshop.

The on-site/telephone channel type would contribute the most in this overall effect. Comparisons of percentage incremental impact across different channels and/or across different areas helped in prioritizing the channels and/or the areas. For example, due to budget constraints, if assistance could only be offered for one of these areas via only one channel, then information on irrigation systems via on-site reviews would help the customers most. The second priority should be information on water management via on-site reviews, and the third

priority should be information on irrigation equipment maintenance via on-site reviews. If on-site reviews are not compatible with budget constraints, the next best delivery channel type would be mail inserts. Thus, the incremental impact can help choose the channel type and the area on which to focus.

It is important to note that if the purpose was to affect the maximum number of customers' level of awareness, and satisfaction, this ranking approach would be appropriate. However, this may or may not hold true if the objective was to save maximum kWh. In fact, in order to achieve maximum kWh savings at minimum costs, it may be more appropriate to focus on the large customers. The large customers preferred a channel type that was estimated to be a less effective channel for small and medium-sized customers. Therefore, small and medium-sized customers may not be likely to change their current technologies and practices if they get the information via those channels. Thus, for appropriate use of this analysis, the objective of providing assistance has to be pre-determined and clearly stated.

Conclusion for Hypothesis 3.

- Analysis of overall effective channel type was in agreement with the preferred channel type in the second hypothesis.
- Analysis using continuous index and cluster yielded comparable results.
- Analysis of most effective channel type by size segments indicated that the most effective delivery channel type was not consistent across size segments; however, it was the same across different areas of interest for a specific segment size.
- Analysis of effective channel type by weather zones indicated that the same channel type was not the most effective across weather zones or across areas of interest. This has important implications for better implementation of assistance programs.
- Simulation results indicated that program costs could be minimized and maximum impacts could be targeted if the customers are offered assistance via their preferred channel types.

5.4 Hypothesis 4 – Willingness to Pay for Assistance by Size and Weather Zone

For the fourth hypothesis, it was projected that a customer's willingness to pay for assistance type would differ by customer size and weather zone. In the changing environment of electric utilities, it was thought that evaluating the possibility of providing assistance by charging a fee would be very useful. This was also important because agricultural customers have been used to getting information at no cost to them for a very long time. In this section, an attempt was made to evaluate whether or not customers were willing to pay for any assistance. Similar to the other hypotheses, this was studied by area, customer size, and weather zone. It was perceived that customers' willingness to pay would be different at different economic times. However, in the process of keeping the survey length optimal for reliable responses, this dimension of the study had to be sacrificed. Though the evaluation team thinks that the availability of funds is an important factor, for the purposes of this study, it was not covered.

The telephone survey included questions to explore customers' willingness to pay for three channels of assistance. Within each of the three areas covered in the study, the willingness to pay for assistance was evaluated using the responses to survey questions 15, 18, and 22. To

make it more intuitive, the scale was again reversed, with the greater number representing a greater willingness to pay. Therefore, if everyone was willing to pay, the average willingness to pay would have been 4.0. If very few customers were willing to pay for a specific channel, the average willingness would have been between 1.0 and 2.0.

As in hypothesis 3, willingness to pay was analyzed for the whole sample, by customer size and by weather zone. The results are presented in the following sections.

5.4.1 Willingness to Pay for Whole Sample

The hypothesis was tested using continuous index method and cluster analysis.

Continuous index. Since responses to the questions used for analysis in this section were on a scale of 1 to 4, it was possible to compare the willingness to pay for three groups of assistance types and for each of the three areas. First, average willingness to pay was calculated and compared for each channel types in each of the three areas. Second, an index of willingness to pay was created for groups of customers based on their size, using the average for the group and the average for the whole sample.

Exhibit 5.30 illustrates that for the three areas (irrigation systems, maintenance of irrigation equipment, and water management), the average willingness to pay for information regarding any of the three areas, via any of the three groups, ranged between 2.027 to 2.325. The average values were lower compared to the values for willingness to change (i.e., hypothesis 3). This indicated that even if customers valued the information and were willing to change their current technologies and practices, they did not consider it necessary. Therefore, they were less willing to pay for it. The low average indicated that the majority of customers were "not at all" or "not too willing" to pay for information about irrigation systems, maintenance of irrigation equipment, or water management. The narrow range indicated that a customer's willingness to pay for information was not significantly different for different channel types or for different areas. This was further confirmed by statistical tests that proved that these averages were not significantly different from each other at the 99% significance level.

Of the three areas, customers were least willing to pay for information about irrigation systems. This could be due, in part, to the fact that PG&E has been offering programs that provided information about irrigation systems at no cost to these customers for over 70 years. This appears to have convinced customers about the benefits of energy efficient technologies and practices; however, they have gotten so used to receiving the information at no cost, they are not willing to pay for it.

Exhibit 5.30
Average Willingness to Pay– Whole Sample, Continuous Interval Analysis

	Mail/Internet	Demonstration/ Presentation/ Workshops	On-site Reviews/ Telephone Assistance
Irrigation Systems	2.027	2.269	2.301
Maintenance of Irrigation Equipment	2.083	2.274	2.325
Water Management	2.119	2.263	2.299

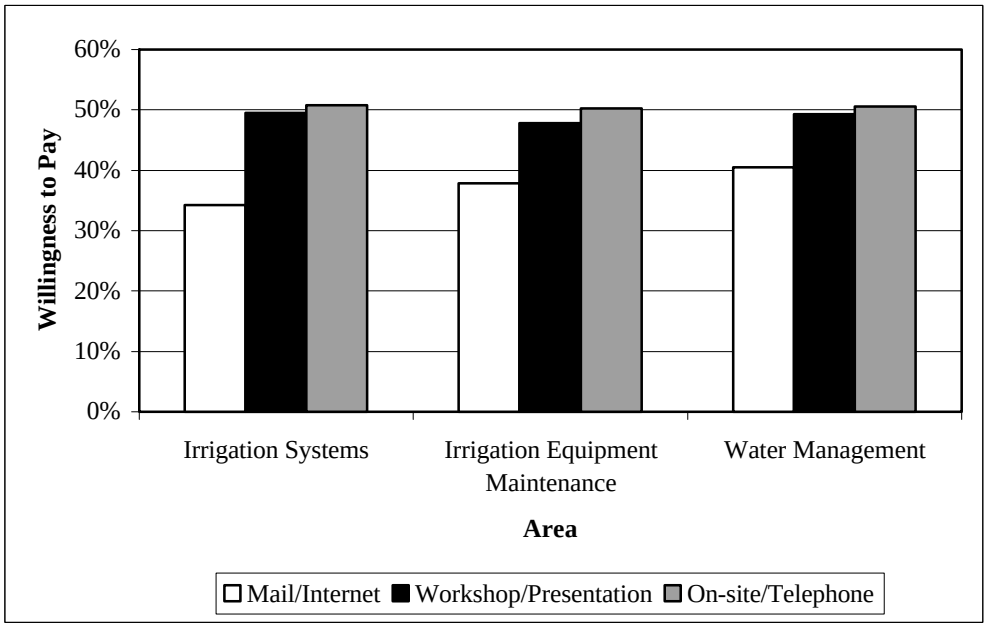
Comparing the assistance channels within any specific area, it appeared that the difference in willingness to pay was not significantly different. In other words, though more customers were willing to get the information and quite a few of them were willing to change their practices based on the information, very few customers were willing or somewhat willing to pay for the information. More importantly, customers were not so willing to pay for any assistance channels. Though all of the channel types are very similar, customers were somewhat more willing to pay for on-sites.

Cluster Analysis. The finding from the continuous index analysis was further confirmed in the cluster analysis where the customers were classified into only two groups on the basis of their responses. The results are shown in Exhibit 5.31 and graphically in Exhibit 5.32.

Exhibit 5.31
Willingness to Pay for Whole Sample – Cluster Analysis

	Mail/ Internet	Workshop/ Presentation/ Demonstration	On-site/ Telephone
Irrigation Systems	34.2%	49.5%	50.8%
Irrigation Equipment Maintenance	37.8%	47.8%	50.3%
Water Management	40.5%	49.3%	50.6%

Exhibit 5.32
Willingness to Pay – Whole Sample, Cluster Analysis Graph



As can be observed from the graph and table, the highest proportion of customers were willing to pay for on-sites. The next channel type customers were willing to pay for was demonstration/presentation/workshop. Though mail/Internet was the most preferred channel type and appeared to be effective, customers were not willing to pay for it. This is may be due to the fact that, currently, they do not pay for most information received by mail or over the Internet and they do not find it so valuable they are willing to pay for it. Though customers have been using PG&E's on-sites at no cost, they are willing to pay for them. This could be primarily because they find on-sites very valuable sources of information.

5.4.2 Willingness to Pay by Customer Size

As with hypothesis 3, the sample was analyzed by size using both continuous index and cluster methods.

Continuous Index. The relative index was calculated as the average willingness to pay for information in a specific customer size group for a given channel and area, divided by the average willingness to pay for information by all customers for a given channel and area. This is presented mathematically in Exhibit 5.33.

Exhibit 5.33
Willingness to Pay Relative Value Algorithm

$$[\text{Relative Index}]_{pg} = \frac{\sum_{i=1}^{pg}[\text{Willingnes s to pay}_{pi}] \Big/ N_{pg}}{\sum_{i=1}^{pI}[\text{Willingnes s to pay}_{pi}] \Big/ N_{pi}}$$

Where Relative Index_{pg} is the willingness to pay for channel *p* by group *g*.

As with hypothesis 3, customers in three size groups were ranked to indicate their relative willingness to pay compared to the remaining groups. For example, if the willingness to pay of medium-sized customers with respect to the mail/Internet channel for getting information about irrigation systems was the highest, then the rank was 1 for that group. The results of this analysis are shown in Exhibit 5.34. As before in Exhibit 5.22, the numbers without parentheses indicate the order of effectiveness *across customer segments* for the channel type within that area. The numbers in parentheses represent the order of effectiveness of a channel type *for a specific group* (i.e., small, medium, or large) within that specific area.

Exhibit 5.34
Willingness to Pay by Customer Size – Continuous Index Analysis

	Mail/Internet	**Demonstration/ Presentation/ Workshops**	**On-site Reviews/ Telephone Assistance**
Irrigation Systems			
Small	2—(2)	3—(1)	2—(3)
Medium	1—(2)	2—(3)	1—(1)
Large	3—(2)	1—(1)	3—(3)
Irrigation Equipment Maintenance			
Small	2—(1)	3—(2)	2—(3)
Medium	1—(3)	2—(2)	1—(1)
Large	3—(2)	1—(1)	3—(3)
Water Management			
Small	2—(1)	3—(2)	2—(3)
Medium	1—(2)	2—(3)	1—(1)
Large	3—(3)	1—(1)	3—(2)

*Note: The numbers without ( ) represent the order of willingness to pay across groups within a channel and within an area. The numbers in ( ) is the order of willingness to pay for a given group across channels within that area.

The results across customer size for the mail/Internet channel showed that small customers were most willing to pay and large customers were least willing to pay. Again, like the previous hypothesis, the channel type for which customers were willing to pay did not change for the three areas of interest. Small customers were most willing to pay for mail/Internet. Large customers were most willing to pay for demonstration/ presentation/ workshops, and the medium-sized customers were most willing to pay for on-sites.

When looking at the results across the same customer size and area, small customers were most willing to pay for demonstration/presentation/workshops on irrigation systems. However, for information on maintenance and water management, customers were most willing to pay for mail inserts. Medium-sized customers and large customers were consistent across areas of interest. The medium-sized customers were most willing to pay for on-sites and large customers were most willing to pay for demonstration/presentation/workshops. Except for minor differences, the overall results were in agreement with the findings of the third hypothesis (where the customer segments were ordered on their willingness to change current technologies and practices).

The relative index values that were used to create the rank order were all very close to one. This indicated that the value of assistance channels for subgroups were not very different from the index for all customers. Overall, the large customers were less willing to pay for information regarding irrigation systems and equipment maintenance. The small customers were least willing to pay for water management information.

Of those customers who expressed the view that they were willing or somewhat willing to pay for information regarding irrigation systems, approximately 30% were already using an outside service that designs irrigation systems.

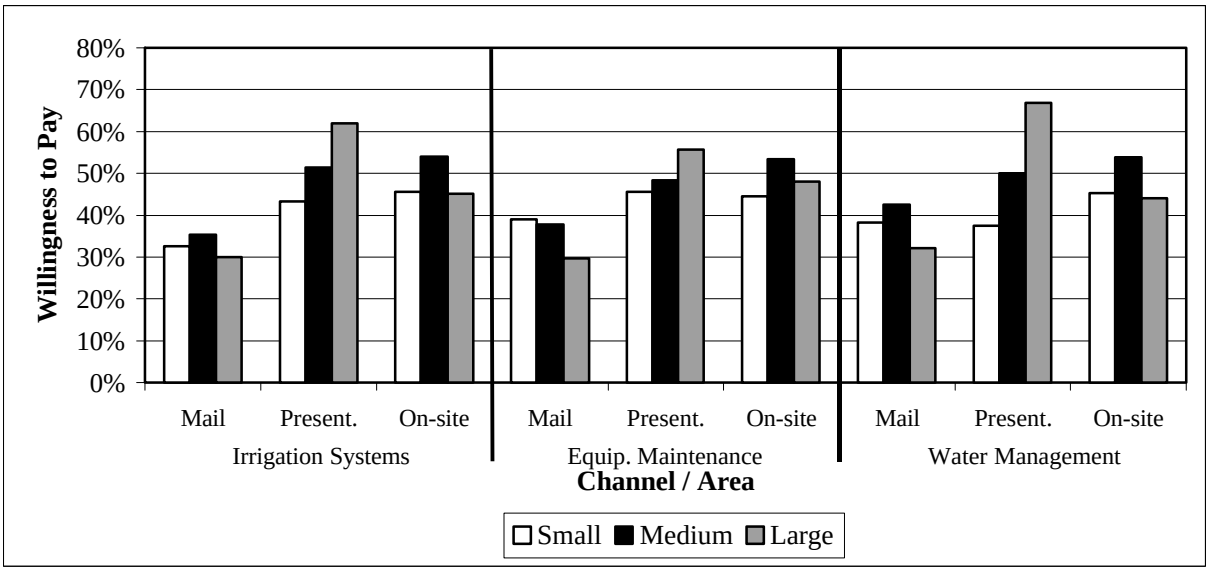
In terms of policy implications, it appeared that small customers with limited available financing could benefit the most from informational assistance provided at no cost to them. The other two groups, if convinced of the value, would be somewhat willing to pay for the information.

Cluster analysis. Using the responses to the same questions (Q15, Q18 and Q22), the hypothesis was tested using cluster analysis. The customer segments were grouped by size into two clusters, one willing to pay and the other not willing to pay. The results are presented in Exhibit 5.35 and again graphically in Exhibit 5.36.

Exhibit 5.35
Willingness to Pay by Customer Size – Cluster Analysis

	Mail/ Internet	Workshop/ Presentation/ Demonstration	On-site/ Telephone
Irrigation Systems			
Small	32.7%	43.2%	45.6%
Medium	35.3%	51.4%	54.0%
Large	30.0%	62.0%	45.0%
Maintenance			
Small	39.0%	45.5%	44.6%
Medium	37.8%	48.3%	53.4%
Large	29.6%	55.6%	48.1%
Water Management			
Small	38.2%	37.4%	45.3%
Medium	42.5%	50.0%	53.9%
Large	32.1%	66.7%	44.0%

Exhibit 5.36
Willingness to Pay by Size – Cluster Analysis Graph



From the cluster analysis, it was observed that medium-sized customers were most likely pay for information regarding irrigation systems via mail/Internet or via on-sites. This finding was confirmed by the continuous index approach. Similarly, large customers were most willing to pay for information on irrigation systems via presentation/demonstration/ workshops, while the medium-sized customers were most willing to pay for on-sites.

For information regarding irrigation equipment maintenance, small customers were most likely to pay for the mail/Internet channel, medium-sized customers for on-sites, and large customers for presentation/demonstration/workshop. This was somewhat different from what was observed in the continuous index approach. In the continuous index approach, medium-sized customers were most likely to pay for mail. The discrepancy was due to the fact that cluster analysis did not differentiate between "somewhat willing to pay" and "very willing to pay."

For information regarding water management techniques, the medium-sized customers were most likely to pay for mail/Internet and for on-sites. The small customers were less willing to pay for this information than medium-sized customers, probably because they may not have perceived water management as a problem. For presentations/workshop/demonstration, the large customers were most willing to pay. This confirmed what was observed from the continuous index approach.

Comparing different channels for a given segment, it appeared that medium-sized and large customers were most willing to pay for on-sites and presentations/workshops/demonstrations, respectively, for all the three areas of interest. However, small customers were willing to pay for mail/Internet for information regarding maintenance and water management, but for on-sites for information regarding irrigation systems. This is different from the continuous index approach. In the continuous approach, it was observed that the small customers were most willing to pay for demonstration/presentation/workshop for irrigation systems information and for mail for maintenance and water management information. The reason for this discrepancy was that the cluster analysis did not differentiate between "somewhat likely" and "very likely" and considered either as "willing to pay."

5.4.3 Willingness to Pay by Weather Zone

The value of assistance channels was calculated for each of the weather zones relative to the whole sample. Similar to the analysis by customer size, the relative value of the assistance channels was compared for customers in each weather zone. Though the index did not vary significantly across different areas and across weather zones, the most effective channel types by area and weather zone are summarized below in Exhibit 5.37.

Exhibit 5.37
Willingness to Pay by Weather Zone – Continuous Index Analysis

	W1	W2	W3	W6
Irrigation Systems	Mail/Internet	On-site Reviews/ Telephone	On-site Reviews/ Telephone	Mail/Internet
Irrigation Equipment Maintenance	Mail/Internet	On-site Reviews/ Telephone	On-site Reviews/ Telephone	Mail/Internet
Water Management	Mail/Internet	On-site Reviews/ Telephone	On-site Reviews/ Telephone	Demonstration / Presentation/ Workshops

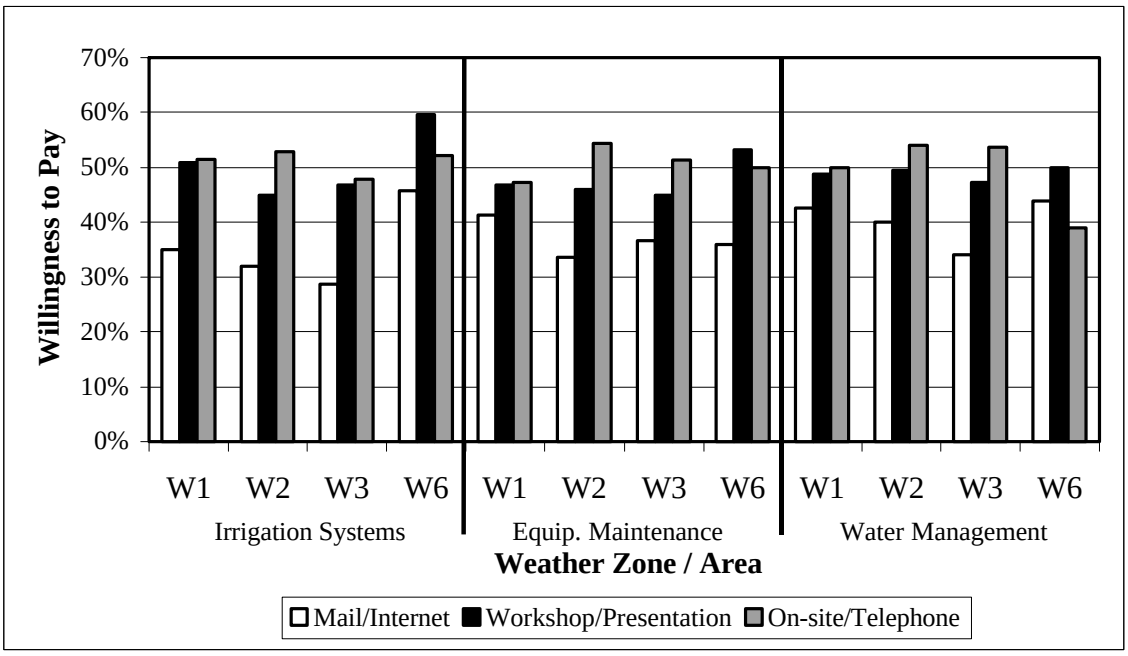
Except in weather zone 6, the assistance channel for which customers were most willing to pay for information did not vary by area. If the market intervener plans to provide assistance by charging a fee, then customers' willingness to pay by channel type summarized in Exhibit 5.37 gives some idea about the potential market. For example, if a demonstration was planned for weather zones 1, 2 or 3, customers may not respond as well as they would in weather zone 6. Similarly, if on-site reviews are planned for weather zone 6 and technical staff is hired to respond to requests for on-site appointments, results indicated that demand may not support the supply costs in weather zones 1 or 6.

Cluster Analysis. Using the weather zone information and customer responses, customers were clustered by weather zones and within weather zones as to whether or not they were willing to pay for information via each of the sources and for each of the three areas of interest. The results are shown in Exhibit 5.38 and again graphically in Exhibit 5.39.

Exhibit 5.38
Willingness to Pay Analysis by Weather Zones – Cluster Analysis

	W1	W2	W3	W6
	Irrigation Systems			
Mail/Internet	35.0%	32.0%	28.8%	45.8%
Workshop/Presentation	51.0%	45.0%	46.8%	59.6%
On-site/Telephone	51.5%	52.9%	47.8%	52.1%
	Maintenance			
Mail/Internet	41.3%	33.7%	36.7%	36.0%
Workshop/Presentation	46.9%	46.0%	44.9%	53.3%
On-site/Telephone	47.2%	54.4%	51.4%	50.0%
	Water Management			
Mail/Internet	42.6%	40.0%	34.0%	43.8%
Workshop/Presentation	48.7%	49.5%	47.2%	50.0%
On-site/Telephone	50.0%	54.0%	53.6%	39.0%

Exhibit 5.39
Willingness to Pay Analysis by Weather Zones – Cluster Analysis Graph



From the table and graph presented above, it was observed that customers' willingness to pay for the assistance type in all four weather zones did not vary across different areas of interest. For example, customers in weather zone 1 were willing to pay for on-sites for information regarding any irrigation systems, maintenance and water management techniques. Similarly, customers from weather zones 2 and 3 were willing to pay for on-sites for information

regarding any of the three areas, and customers in weather zone 6 were most willing to pay for presentations/workshops/demonstrations.

The channel type that they were most likely to pay for was not the same in the continuous analysis approach and cluster analysis for weather zones 1 and 6.

Conclusion for Hypothesis 4.

- Overall, the willingness to pay was less than the willingness to change current practices.
- Analysis using continuous index and cluster yielded comparable results in most instances.
- Analysis of effective channel type by size segments indicated that the same channel type is not the most effective across size segments; however, it was the same across different areas of interest for a specific size segment.
- Analysis of effective channel type by weather zones indicated that customers in each weather zone were willing to pay for the same channel types for information regarding all three areas of interest. This was very different from what was observed for the most effective channel type in the previous hypothesis.

5.4.4 Suggestions from Customers

To get customers' input into the list of channel types that could be explored in efforts to get the customers to move toward energy efficient technologies and practices, the survey included open-ended questions. From the responses to those questions, it was reconfirmed that the list of channel type options included in the survey was an exhaustive one. For example, Exhibit 5.40 summarizes the responses for additional channel types for each area of interest.

Exhibit 5.40
Suggestions Regarding Channel Types

	Irrigation Systems	Irrigation Equipment Maintenance	Water Management
Dealer / Installer	4	11	2
Other Grower	3	5	3
Trade Association / Trade Show / Farm Show	2	2	1
Printed Material	9	5	5
Visual Media	4	2	3
PG&E Representative	11	2	3
Other	5		

In order to assure that customers had sufficient opportunity to provide feedback about any additional types of assistance, two other questions were included in the survey. With respect

to irrigation systems, 37 out of 510 customers responded that they would like to get some assistance, from a spectrum of sources, concerning overall management. For water management, 23 out of 510 customers responded that they would like information or advice from experts. Apart from these two, there were no dominant suggestions. This indicated that the type of assistance channel options offered in the survey exhausted the options customers could suggest.

6. SUMMARY

The approach used in this study was relatively straightforward. Survey responses, along with customer attributes from the billing data, were analyzed to determine trends by customer size and location. These trends can be generalized to the larger population since the precision with which the sample is drawn is high. Once the specific program purpose and objectives are known, further simulations can be done using the results in this study. Such simulations would help the new programs decide the targets of those programs or design an optimum implementation strategy of those programs.

6.1 Potential Demand for Assistance

Overall, only 35% of the agricultural customers feel that they need any type of assistance. The majority of this 35% of customers need more motivation. Unless assistance is designed to motivate customers, the informational programs can only address 15% of the surveyed customers. Of the 35% of customers who may benefit from assistance in any of the three areas, a majority of them need assistance in the irrigation system area.

6.2 Goal Setting

The analysis also identified customers' most preferred channel, the most effective channel for reaching them, and the channel for which customers were most willing to pay. This analysis was not restricted to the 35% of customers who need assistance; therefore, the results can be used/applied for "realistic goal setting" for the whole population. In order to make like comparisons consistent, the channel type preferences were combined into the same groupings used for willingness to respond and willingness to pay.

Findings from the study can be used by market interveners to estimate customer response rates by communication channel type. Exhibit 6.1 summarizes the information regarding which customer segment preferred which channel type, were most willing to respond to each channel type, and were most willing to pay for each channel type. From Exhibit 6.1, depending upon the channel type selected for the program, realistic program assistance goals could be set. For example, if mail/Internet is the channel type selected, Exhibit 6.1 indicates the group that will respond the most. Applying that finding to all customers in that population segment would help in estimating the expectations from that type of assistance.

Exhibit 6.1 illustrates some fairly clear patterns. If the selected channel type is on-sites, the medium-sized customers prefer that channel type, are the ones most willing to change current practices, and are willing to pay for it as well. If the presentation/workshop/demonstration channel type is selected, primarily large customers prefer that channel type, are most willing to respond, and are willing to pay for it. If mail is chosen as a channel type, then the findings from the cluster analysis are different than the continuous index analysis. Since continuous index analysis takes into account differences between "very likely" and "somewhat likely" as well as difference between "not likely" and "not at all likely," it presents a more accurate (than cluster analysis) representation of the choices stated by the customers. Giving more credibility to continuous index analysis, it appears that though small customers are more willing to

respond, they are not more willing to pay for the assistance. It is the medium-sized customers who are more willing to pay for assistance via mail.

Thus, once the selected type of intervention is known, the customers' preferences for channel type by size, and the number of customers in that segment of the population together can help in determining the likely response. Exhibit 6.1 summarizes the information previously presented in Exhibits 5.16, 5.22, 5.23, 5.34, 5.35.

Exhibit 6.1
Segment Preference, Willingness to Respond, and Willingness to Pay by Channel Type

	Mail/ Internet		**Presentation/ Workshop/ Demonstration**		**On-sites/ Telephone**	
	Cluster Analysis	**Continuous Index**	**Cluster Analysis**	**Continuous Index**	**Cluster Analysis**	**Continuous Index**
	Irrigation Systems					
Prefer	Large	-Not Done-	Large	-Not Done-	Medium	-Not Done-
Willing to Respond	Small	Small	Large	Large	Medium	Medium
Willing to Pay	Medium	Medium	Large	Large	Medium	Medium
	Irrigation Equipment Maintenance					
Prefer	Small	-Not Done-	Large	-Not Done-	Medium	-Not Done-
Willing to Respond	Small	Small	Large	Large	Medium	Medium
Willing to Pay	Small	Medium	Large	Large	Medium	Medium
	Water Management					
Prefer	Small	-Not Done-	Large	-Not Done-	Medium	-Not Done-
Willing to Respond	Small	Small	Large	Large	Medium	Medium
Willing to Pay	Medium	Medium	Large	Large	Medium	Medium

It is important to note that at least 65% of the survey sample were willing to respond to any channel type. However only about 30% of the survey sample were willing to pay for information via any channel type.

Another important finding in this study was that though customers' preferences differ by size, they generally did not differ for the area of interest (i.e., irrigation systems, maintenance, water management). This would imply that market interveners can apply the same preferences by customer type for any new technologies or services that are not covered in this study.

Analysis was also done by customer segments within each weather zone. This information can be helpful in setting goals by region. However, since the utility industry does not normally set goals geographically, it is not summarized here.

6.3 Effective Program Planning

The intervention programs are not always limited to a single channel type. There are times when it is possible to select a combination of channel types to achieve responses from the maximum number of customers. In such cases, it is important to determine which channel type is most preferred by each customer segment. This question is subtly different from the question asked in the previous section. The question in the previous section is: "Which segment is most likely to prefer, respond to, and pay for a pre-selected channel type?" In order to answer that question, the percentage of customers from each segment who prefer, are willing to respond to, and are willing to pay for a given channel type are compared across segments. Whichever segment has the highest proportion of customers is stated in Exhibit 6.1. In order to answer the question raised in this section, the percentages of customers who prefer, are willing to respond to, and are willing to pay for a given channel type are compared across *different* channel types for a *specific* segment. If the trends are clear, then the choices in these two sections should coincide. Exhibit 6.2 summarizes the results of the latter analysis.

Exhibit 6.2
Most Effective Channel Type by Customer Segments

	Small		Medium		Large	
	Cluster Analysis	**Continuous Index**	**Cluster Analysis**	**Continuous Index**	**Cluster Analysis**	**Continuous Index**
	Irrigation Systems					
Prefer	Mail	-Not Done-	Mail	-Not Done-	Mail	-Not Done-
Willing to Respond	Mail	Mail	Mail	On-sites	Present.	Present.
Willing to Pay	On-sites	Present.	On-sites	On-sites	Present.	Present.
	Irrigation Equipment Maintenance					
Prefer	Mail	-Not Done-	On-sites	-Not Done-	Mail	-Not Done-
Willing to Respond	Mail	Mail	On-sites	On-sites	Present.	Present.
Willing to Pay	Present.	Mail	On-sites	On-sites	Present.	Present.
	Water Management					
Prefer	Mail	-Not Done-	On-sites	-Not Done-	Mail	-Not Done-
Willing to Respond	On-sites	Mail	On-sites	On-sites	Present.	Present.
Willing to Pay	Present.	Mail	On-sites	On-sites	Present.	Present.

For convenience, "mail" is used to represent the mail/Internet channel group, "presentation" is used to represent the presentation/demonstration/workshop channel group, and "on-sites" represent the onsite/telephone channel group. For the same reasons explained in the previous section, it is more appropriate to use continuous index findings.

Except for the small customers segment concerning the willingness to pay for information about irrigation systems, the channel type choices are consistent across all three areas of interest for small, medium-sized, and large customers. For the channel types that customers are most likely to respond to, and pay for, the choices are also consistent with those stated in the previous section. This suggests that channel type preference remains the same for customer segments across different areas of interest.

Therefore, if the goal of the assistance program is to encourage response from the maximum number of customers, then assistance should be offered via optimum channel type for each customer size (based on kWh usage).

6.4 Potential Response and Market for Services

If the market intervener is planning to charge customers for assistance supplied through any of the channel types, it is important to have a good idea of the size of the potential market. Willingness to pay for assistance via any specific channel indicates the potential market for this type of assistance. Exhibit 6.3 presents the customer responses for each type of assistance delivery channel, by area of interest, further broken down by whether they would prefer the channel, be willing to respond to it, and would be willing to pay for it.

Exhibit 6.3 illustrates two important points.

- Mail, on-sites, and demonstrations showed the highest levels of preference and willingness to respond.
- Only about 30% to 44% of the customers who prefer a certain channel, and are willing to respond, were interested in paying for the information, independent of the assistance channel.

Thus, the potential market is much smaller than the potential response.

Exhibit 6.3
Overall Proportion of Customers Who Prefer, Are Willing to Respond, and Are Willing To Pay, by Assistance Channels

	Mail/ Internet	Presentation/ Workshop/ Demonstration	On-Sites/ Telephone
	Irrigation Systems		
Prefer	90.0%	76.3%	85.9%
Respond	78.8%	68.6%	74.3%
Pay	30.4%	40.6%	43.7%
	Maintenance		
Prefer	81.4%	74.3%	81.8%
Respond	71.8%	66.3%	70.0%
Pay	32.4%	40.4%	42.7%
	Water Management		
Prefer	82.7%	72.5%	81.8%
Respond	70.6%	66.1%	70.4%
Pay	33.9%	41.0%	43.5%

Exhibit 6.3 shows responses of all customers, regardless of the need for assistance. Exhibit 6.4 presents the responses of only the 35% of customers who needed assistance in one or more of

the areas covered by the survey (i.e., irrigation systems, equipment maintenance, or water management). The exhibit values are percentages of the total population. It is included to provide actual potential response and market for services for these three areas only.

Exhibit 6.4
Proportion of Customers Needing Assistance Who Prefer, Are Willing to Respond, and Are Willing To Pay, by Assistance Channels

	Mail/ Internet	Presentation/ Workshop/ Demonstration	On-Sites/ Telephone
	Irrigation Systems		
Prefer	28.4%	21.2%	25.1%
Respond	24.3%	18.0%	21.6%
Pay	7.5%	9.6%	11.6%
	Maintenance		
Prefer	26.7%	21.6%	24.5%
Respond	21.8%	18.0%	19.4%
Pay	8.6%	10.8%	12.4%
	Water Management		
Prefer	27.1%	20.8%	24.7%
Respond	21.4%	17.8%	19.4%
Pay	7.8%	10.0%	11.4%

6.5 Conclusions

The conclusions section is divided into two parts: 1) conclusions of the study and 2) conclusions about the analysis techniques used.

6.5.1 Study Conclusions

The overall conclusions from this study can be summarized as follows:

- Overall, only 35% of the agricultural customers felt the need any type of assistance. The majority of this 35% of customers need more motivation. Unless assistance is designed to motivate customers, the informational programs can only address 15% of all customers.
- From the 35% of customers who could benefit from any type of assistance, a majority of them would benefit from assistance in irrigation system design.
- Though customers' preferences differ by size, they generally do not differ by area of interest (i.e., irrigation systems, maintenance, water management). This would allow

market interveners to apply the same choices for the emerging areas that are not covered in this study.

- Though small customers are more willing to respond to information via mail, they are not more willing to pay for the assistance. It is the medium-sized customers who are more willing to pay for assistance via mail.
- Channel type preference remains the same for customer segments across different areas of interest, indicating that target marketing by customer size is possible.
- Only about 7.5% to 12.5% of all of the customers were interested in paying for the information, independent of the assistance channel.

Of the 35% who needed assistance:

- A majority of these customers would benefit from assistance in irrigation systems.
- Mail, on-sites, and demonstrations showed the highest levels of preference and willingness to respond.

Overall, the above conclusions paint a picture consistent with the two previous PG&E agricultural sector studies. They depict a market that has, for the most part, been transformed through long interaction with PG&E marketing and energy efficiency programs. While there are elements that have still not been adequately addressed, these market sectors represent the minority of the market and are the portion of the market least likely, or least able, to invest in energy efficiency improvements.

6.5.2 Analysis Technique Conclusions

It is important to note that the analyses in this report are examples of how customers' stated preferences can be summarized and used for better planning, targeting and goal setting. Cluster and conjoint analyses were used, as appropriate, for each hypothesis. A version of conjoint analysis, called "continuous index analysis" by the evaluation team, was used to compare responses with only one attribute.

The analysis of the data was conceptually simple, but arduous in practice. There were many ways of combining the data, with interesting conclusions evolving from each combination. It was often challenging to keep the analysis focused and to present the information in a manner that was useful and relatively easy to understand. Therefore, the study presents the information based on the most preferred channel type as the best indicator of customer preference. However, in reality, it does not mean that customers will not respond to other channel types. In fact, depending upon the chosen channel types, many different simulations are possible that can help planners and implementers with appropriate targeting techniques and realistic goal setting. Since it was beyond the scope of this study to assess every simulation possibility, only one example was included. It is important to note that the study demonstrated general trends based on majority rule. The various analysis techniques applied illustrate how survey responses can be summarized and used to better plan, target, and set goals for agricultural sector programs.

This concludes the PG&E Agricultural Sector Market Needs Study. The appendices follow.

TECHNICAL APPENDICES

A. CADMAC WAIVER

B. Final Survey Instrument

C. Final Survey Instrument with Frequencies

D. Rationale for Study

Appendix A
CADMAC WAIVER

PACIFIC GAS & ELECTRIC COMPANY
REQUEST FOR RETROACTIVE WAIVER FOR
PRE-1998 CARRYOVER AGRICULTURAL SECTOR
ENERGY EFFICIENCY INCENTIVES (EEI) PROGRAMS
Study ID #s: 405a (Pumping and Related), 405b (Refrigeration)
Date Approved: May 20, 1999

Summary of PG&E Request

This waiver requests deviations from, or clarifications of, the Protocols[1] by PG&E for the Pre-1998 Carryover Agricultural Sector Energy Efficiency Incentives (EEI) Evaluation[2]. PG&E seeks approval to: (1) use a Simplified Engineering Model supported by telephone surveys and on-site data collection to estimate the gross impacts for the Refrigeration end-use, (2) allow reporting of results in more appropriate DUOMs for the Refrigeration end use, and (3) conduct a market needs study in place of a net-to-gross analysis, applying a default net-to-gross ratio to the sector.

Each of these requests evolve from the evaluation of the 1994 through 1997 PG&E Agricultural programs, the reviews of those program evaluations, the limited size of the participant population, and the limited size of the PG&E agricultural sector in general.

Proposed Waiver

PG&E seeks CADMAC approval to: (see Table A for Summary)

(1) Allow the use of Simplified Engineering Models (as specified in Appendix A, page A-2 of the Protocols) supported by census telephone survey and on-site data collection to estimate impacts for the Refrigeration end use.

Parameters and Protocol Requirements

Table C-6 is unclear as to the method required to compute gross impacts. Under "Participant Group", item 2 would suggest that a Simplified Engineering Model would be adequate, while item 4 suggests that if billing analysis is not used, "the analysis will rely on direct end-use metering".

Rationale

PG&E's Pre-1998 Carryover PG&E agricultural program includes a limited number of refrigeration sites representing approximately 12 percent of the agricultural sector avoided cost. Metering of these sites would be prohibitively expensive and is unlikely to result in improved estimates of savings. Therefore, PG&E seeks approval to use a participant-based engineering model supported by field data collection for a census of all participants to estimate the impacts for these sites.

Similar waivers were granted for the 1995 (approved October 1996), 1996 (approved July 22, 1997), and 1997 (approved June 17, 1998) PG&E's Agricultural Sector evaluations.

(2) Allow reporting of results in more appropriate DUOMs for the Refrigeration end use. PG&E wishes to report the results for this end use on a per project basis and on a relevant per unit basis. For the Refrigeration end use, the proposed per unit DUOM would be "Load impacts per ton of refrigeration affected".

Parameters and Protocol Requirements

[1] Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings for Demand-Side Management Programs
[2] The first year earnings claim for the Pre-1998 CarryoverAgricultural Sector is approximately $400,000.

The current DUOM for Protocol Table C-6 are "Load impacts per acre foot of water pumped".

Rationale

PG&E's Pre-1998 Carryover PG&E agricultural program includes a limited number of refrigeration sites representing approximately 12 percent of the agricultural sector avoided cost. Reporting results for refrigeration projects on a "Load impacts per acre foot of water pumped" would make no sense. PG&E proposes to report them on a per project basis (as is done in the Industrial Process end use in Table C-5) and on a per unit basis. This should maximize the usefulness of the results to users of the reports.

Similar waivers were granted for the Lighting end use in PG&E's 1996 (approved July 22, 1997), and the Greenhouse Heat Curtains and Refrigeration end uses in PG&E's 1997 (approved January 20, 1999) Agricultural Sector EEI evaluation.

(3) Instead of a net-to-gross study, allow the use of a default net-to-gross ratio of 0.75 for the agricultural sector, subject to the condition that PG&E conduct a "market needs" study that would help future program design to yield the best returns. A more complete description of the market needs study is attached. The final report for this study would be submitted to CADMAC by March 31, 2000.

Parameters and Protocol Requirements

Table 5, item B.2. requires the estimate of net impacts. In the Agricultural Sector this has been accomplished by estimating a gross impact and multiplying it by an estimated Net-to-Gross ratio.

Rationale

Allowing PG&E to substitute a forward-looking market needs study for the Protocol required net-to-gross assessment would (1) make the best use of current funding by processing current statewide information into an easily usable form for future administrators, (2) collect key information not currently available to fill in gaps in the information picture, and (3) put that information in the context of the current agricultural market so that decisions can be made on future program design.

This trade-off of a net-to-gross study with a market-based type of study is similar to waivers granted for PG&E's 1996 Agricultural Sector EMS Program evaluation (approved July 22, 1997, modified November 21, 1997) and PG&E's 1997 Agricultural Sector EEI Program evaluation (approved June 17, 1998).

Conclusion

PG&E is seeking retroactive waivers to clearly define, in advance, acceptable methods for performing the Pre-1998 Carryover Agricultural impact evaluation of the EEI programs. Recommendations in this waiver are designed to maximize the quality and value of evaluation results. The proposed waiver allowing engineering modeling clarifies the protocol requirements while supporting reasonable estimations of gross program impacts. The waiver allowing the reporting of results in more appropriate DUOMs for the refrigeration end use maximizes the usefulness of the results to users of the report. The waiver allowing a market needs study rather than conducting a net-to-gross analysis seeks to maximize information useful to future programs.

TABLE A

IMPACT MEASUREMENT REQUIREMENTS - TABLE C-6 AND TABLE 5			
Parameters	**Protocol Requirements**	**Waiver Alternative**	**Rationale**
End Use Consumption and Load Impact Model	LIRM or CE (calibrated engineering) or Simplified Engineering Model	Allow Simplified Engineering Model supported by telephone and field data collection to estimate the impacts for the refrigeration end use.	Small number of sites makes use of LIRM or regression method impossible. End-use metering is prohibitively expensive for the complex sites and effort is disproportionate to savings.
Designated Unit of Measure	Load impacts per acre foot of water pumped	Allow reporting on a per project basis and on a relevant per unit basis for the refrigeration end use. The proposed per unit DUOM would be "Load impacts per ton of refrigeration affected".	The Pumping DUOM is the only one specified in Table C-6. It does not make sense for other end uses. Reporting the results on both a per project and the proposed per unit basis will make results more useful.
Net Load Impacts	Study-based Net Load Impacts	Use of a NTG ratio of 0.75 for sector conditioned on conducting a survey-based market needs study of the pumping and related end-use in the EEI Programs.	A market needs study would supply information that is more useful to future agricultural program design.

PROPOSED AGRICULTURAL MARKET NEEDS STUDY

PG&E proposes conducting a market needs study designed to facilitate the transition from the past PG&E Agricultural program structures to a market transformation type of program structure.

From prior evaluation experience, PG&E recognizes the need to study the market before designing new programs or altering existing programs. For example, the market effect study of 1997 proved that the value of information and incentives programs differ from one segment to the other. To get the best results out of any program, it is necessary to understand the customers' market needs. PG&E proposes to identify these needs for the agricultural market and build a basis to help future program design yield the best returns.

This proposed Pre-1998 Carryover Agricultural Sector Study would draw on (1) the previous two PG&E market effects studies, along with similar studies done by other California utilities, (2) additional end-user data collection, and (3) statewide firmographic data along with utility data. The study would combine these information sources to identify the market sectors that would most benefit from agricultural energy efficiency programs, the types of programs that would likely be the most effective in developing actual savings and transforming the markets, and the projected potential impacts by market sector. This information could then be directly applied by the future program administrators to move swiftly to final program design and implementation.

We believe that the proposed 1998 Agricultural Sector Study would (1) make the best use of current funding by processing current statewide information into an easily usable form for future administrators, (2) collect key information not currently available to fill in gaps in the information picture, and (3) put all of that information in the context of the current agricultural market so that decisions can be made on future program design.

Appendix B
FINAL SURVEY INSTRUMENT

Field Research Corporation Job#161-004

FINAL

Pre-1998 Carryover Agricultural Sector Evaluation Telephone Survey

---Screener---

INTERVIEWER: ASK FOR PERSON LISTED. IF THERE IS NO NAME, ASK FOR THE MANAGER.

A. Introduction

Hello, I'm _____calling from Field Research Corporation on behalf of PG&E. Pacific Gas and Electric is conducting a survey of agricultural customers who irrigate crops. Do you irrigate crops at your business?

Yes.....Go to B
No..... Thank and Terminate
Don't know..... DK
Refused..... Thank and Terminate

B. Would you be the best person to answer basic questions about your irrigation systems?

Yes..... Go to D
No.....Go to C
Don't know.....Go to C
Refused..... Thank and Terminate

C. Who would be the best person to talk to?

New contact person:_____

Telephone number:_____

(Interviewer: Call new contact person and start from A.)

D. This survey should take only about 10-15 minutes. Would you be willing to answer a few questions now?

IF NECESSARY: This survey will provide data to evaluate agricultural customers' needs and potential ways to help them be more efficient. We will be surveying all agricultural customers in PG&E's service territory.

Continue..... Go to Q1, Main Questionnaire
Call Back.....Go to E
Refused..... Thank and Terminate

E. When would be a good time to call you back?

Ask for: _____

Date:_____

Time:_____

1. Which of the following is your largest source of revenue?

   Vegetables or field crops 1
   Livestock 2
   Ornamental nursery 3
   Indoor crops (greenhouse) 4
   Vineyard/winery 5
   Orchard 6
   Dairy farm 7
   Other? (specify) _____ 8
   Don't know (do not read) ..... DK
   Refused (do not read) ..... REF

2. Does your business own this property?

   Yes 1
   No 2
   Don't know ..... DK
   Refused ..... REF

3. Would you consider your business operated by a family or operated by a company?

   Family 1
   Company 2
   Not applicable 3
   Don't know ..... DK
   Refused ..... REF

4. Compared to other businesses similar to yours, would you categorize this business as small, medium or large?

   Small 1
   Medium 2
   Large 3
   Don't know ..... DK
   Refused ..... REF

5. How long has your company been operating at this location?

   1 to 3 years 1
   4 to 10 years 2
   More than 10 years 3
   Don't know ..... DK
   Refused ..... REF

6. Approximately, what percentage of your total annual costs are spent on electricity bills?

   If Percentage
   Specify: _____ (whole number percentage)
   If Range
   From:_____ (whole number percentage) To: _____ (whole number percentage)

7. Approximately, what percentage of your total annual costs are spent on water bills?

   If Percentage
   Specify: _____(whole number percentage)

   If Range
   From:_____ (whole number percentage)To: _____(whole number percentage)

During this survey, I am going to ask you questions about three areas –the energy used by your irrigation system, maintenance of your irrigation equipment, and your water usage.

8. How aware are you regarding each area? Would you say you are very, somewhat, not too, or not at all aware of: (ITEM)?

	Very Aware	Somewhat Aware	Not too Aware	Not at all Aware	Don't Know	Refused
Ways of reducing energy use for irrigation	1	2	3	4	DK	REF
Ways to maintain your irrigation equipment	1	2	3	4	DK	REF
Current water management techniques	1	2	3	4	DK	REF

9. How satisfied are you with the information you have to decide on these areas? Are you very, somewhat, not too, or not at all satisfied with the information you have to decide on: (ITEM)?

	Very Satisfied	Somewhat Satisfied	Not too Satisfied	Not at all Satisfied	Don't Know	Refused
The most profitable choice of irrigation system for your crops	1	2	3	4	DK	REF
The best maintenance practices for your irrigation equipment	1	2	3	4	DK	REF
The most appropriate water management techniques	1	2	3	4	DK	REF

10. How willing are you to put effort into learning about these three areas? Are you very, somewhat, not too or not at all willing to put effort into learning about ITEM?

	Very Willing	Somewhat Willing	Not too Willing	Not at all Willing	Don't Know	Refused
Alternate irrigation systems for your crops	1	2	3	4	DK	REF
Different ways to maintain your irrigation equipment	1	2	3	4	DK	REF
Current water management techniques	1	2	3	4	DK	REF

Now I have a few questions about the electric usage of your irrigation system.

11. Currently, what type of irrigation systems are you using? (READ LIST AND CHECK ALL APPROPRIATE TYPES)

Micro Drip Irrigation 1
Low Pressure Sprinkler Nozzles 2
High Pressure Sprinkler Nozzles 3
Flood 4
Furrow 5
Buried Drip 6
Other Specify 7
Don't know ..... DK
Refused ..... REF

12. When did you last review whether you could use less energy for irrigation? Was it…..

Within last Year? 1
Within last 5 years? 2
Over 5 years 3
Never 4
Do not know ..... DK
Refused ..... REF

13. If you were to obtain information on electric usage by irrigation systems, would you prefer to get such information via: (READ LIST AND RECORD AS MANY AS APPLY)

	Yes	No	DK	REF
Mail	1	2	DK	REF
Internet	1	2	DK	REF
Training workshops during the off season	1	2	DK	REF
Advice on specific questions over the telephone	1	2	DK	REF
Presentation at a trade association meeting	1	2	DK	REF
A demonstration project	1	2	DK	REF
On-site review	1	2	DK	REF
Anything else Specify: _____	1	2	DK	REF

I have grouped the different ways to get information into three groups.

14. If the information regarding energy usage by irrigation systems suggests some changes you could make that are cost beneficial in the long run, how likely would you be to make that change if the information was from: [READ CHOICES]?

	Very Likely	Somewhat Likely	Not too Likely	Not at all Likely	Don't Know	Refused
The mail or Internet	1	2	3	4	DK	REF
A training workshop, a trade association presentation, or a demonstration project	1	2	3	4	DK	REF
Advice over the phone or on-site review	1	2	3	4	DK	REF

15. How willing would you be to pay for **useful** information regarding energy usage by irrigation systems if it were from: [READ CHOICE]?

	Very Willing	Somewhat Willing	Not too Willing	Not at all Willing	Don't Know	Refused
The mail or Internet	1	2	3	4	DK	REF
A training workshop, a trade association presentation, or a demonstration project	1	2	3	4	DK	REF
Advice over the phone or on-site review	1	2	3	4	DK	REF

Now I am going to ask similar questions about maintaining your irrigation equipment. (IF NECESSARY: Irrigation system equipment would include wells, pumps, filters, pipelines and any hardware associated with the irrigation system).

16. If you were to obtain information regarding maintenance of your irrigation equipment, would you prefer to get such information via (READ LIST AND RECORD AS MANY AS APPLY)

	Yes	No	DK	REF
Mail	1	2	DK	REF
Internet	1	2	DK	REF
Training workshops during the off season	1	2	DK	REF
Advice on specific questions over the telephone	1	2	DK	REF
Presentation at a trade association meeting	1	2	DK	REF
A demonstration project	1	2	DK	REF
On-site review	1	2	DK	REF
Anything else Specify: _____	1	2	DK	REF

17. If the information regarding maintenance of your irrigation equipment suggests some changes you could make that are cost beneficial in the long run, how likely would you be to make that change if the information was from: [READ CHOICES]?

	Very Likely	Somewhat Likely	Not too Likely	Not at all Likely	Don't Know	Refused
The mail or Internet	1	2	3	4	DK	REF
A training workshop, a trade association presentation, or a demonstration project	1	2	3	4	DK	REF
Advice over the phone or on-site review	1	2	3	4	DK	REF

18. How willing would you be to pay for **useful** information on maintenance of your irrigation equipment if it were from: [READ CHOICE]?

	Very Willing	Somewhat Willing	Not too Willing	Not at all Willing	Don't Know	Refused
The mail or Internet	1	2	3	4	DK	REF
A training workshop, a trade association presentation, or a demonstration project	1	2	3	4	DK	REF
Advice over the phone or on-site review	1	2	3	4	DK	REF

I am going to ask similar questions on water management; that is, deciding when to water and how much to apply.

19. If you were forced to grow crops with 20% less water, What would you do first? [Read first four options and allow answers to Other – rank all answers]? Which would you do next?

	First	Second
Investigate New Irrigation Systems	1	1
Investigate Water Management Issues	2	2
Grow less acreage	3	3
Change the crops	4	4
Or something else? Specify _____	5	5
Don't Know	DK	DK
Refused	REF	REF

20. What are your preferred ways of obtaining information on water management techniques? Would you like it via : (READ LIST AND RECORD AS MANY AS APPLY)

	Yes	No	DK	REF
Mail	1	2	DK	REF
Internet	1	2	DK	REF
Training workshops during the off season	1	2	DK	REF
Advice on specific questions over the telephone	1	2	DK	REF
Presentation at a trade association meeting	1	2	DK	REF
A demonstration project	1	2	DK	REF
On-site review	1	2	DK	REF
Anything else Specify: _____	1	2	DK	REF

21. If the information about water management techniques suggests some changes you could make that are cost effective in the long run, how likely would you be to make that change if the information was from: [READ CHOICE]?

	Very Likely	Somewhat Likely	Not too Likely	Not at all Likely	Don't Know	Refused
The mail or Internet	1	2	3	4	DK	REF
A training workshop, a trade association presentation, or a demonstration project	1	2	3	4	DK	REF
Advice over the phone or on-site review	1	2	3	4	DK	REF

22. How willing would you be to pay for **useful** information on water management techniques if it were from: [READ CHOICE]?

	Very Willing	Somewhat Willing	Not too Willing	Not at all Willing	Don't Know	Refused
The mail or Internet	1	2	3	4	DK	REF
A training workshop, a trade association presentation, or a demonstration project	1	2	3	4	DK	REF
Advice over the phone or on-site review	1	2	3	4	DK	REF

Now just a few questions about irrigation systems...

23. How likely are you to use an outside service that designs an irrigation system?

Very likely..... 1
Somewhat likely..... 2
Not too likely..... 3
Not at all likely..... 4
Don't Know ..... DK
Refused .....REF

24. How likely are you to use an outside service that maintains your irrigation equipment?

Very likely..... 1
Somewhat likely..... 2
Not too likely..... 3
Not at all likely..... 4
Don't Know ..... DK
Refused .....REF

25. How likely are you to use an outside service that helps you manage your water use?

Very likely..... 1
Somewhat likely..... 2
Not too likely..... 3
Not at all likely..... 4
Don't Know ..... DK
Refused .....REF

The last few questions are more general.

26. In this survey, we've discussed several ways of obtaining information, including mail, phone, the Internet, attending training workshops and presentations and using demonstration projects or on-site reviews. Besides these, what other types of assistance do you think would help you reduce your irrigation electricity usage?

Other (specify)…….1--ASK Q27
Nothing else/no other ……..2--SKIP TO Q28
Do not know (Skip to 28)
Refused (Skip to 28)

27. If you had the assistance you were just discussing, how likely would you be to make the necessary changes to reduce your energy usage?

    Very likely..... 1
    Somewhat likely..... 2
    Not too likely..... 3
    Not at all likely..... 4
    Don't Know ..... DK
    Refused .....REF

28. And, besides the ones we've discussed in our survey, what other types of assistance would help you reduce your water usage?

    Other (specify)…….1--ASK Q 29
    Nothing else/no other ……..2--SKIP TO END
    Do not know – SKIP TO END
    Refused – SKIP TO END.

29. If you had the assistance you were just discussing, how likely would you be to make the necessary changes to reduce your water usage?

    Very likely..... 1
    Somewhat likely..... 2
    Not too likely..... 3
    Not at all likely..... 4
    Don't Know ..... DK
    Refused .....REF

END:

That's all the survey questions I have but before I hang up, may I please verify your name and phone number?

VERIFY NAME

VERIFY PHONE NUMBER

Thank you very much for your time.

Appendix C
FINAL SURVEY INSTRUMENT WITH FREQUENCIES

1. Which of the following is your largest source of revenue?

Vegetables or field crops	29%
Livestock	8%
Ornamental nursery	2%
Indoor crops (greenhouse)	1%
Vineyard/winery	19%
Orchard	33%
Dairy farm	8%
Other (specify) _____	2%
Don't know (do not read)	-
Refused (do not read)	-

Question 1 Other Responses
Commercial Nursery
Commercial
equal livestock field crops
orchard field crops w equal
outside work
Ornamental grape vines
poultry farm
Dairy and farm with each about equal.

2. Does your business own this property?

Yes	90%
No	9%
Don't know	1%
Refused	-

3. Would you consider your business operated by a family or operated by a company?

Family	89%
Company	9%
Not applicable	1%
Don't know	*
Refused	-

4. Compared to other businesses similar to yours, would you categorize this business as small, medium or large?

Small	41%
Medium	47%
Large	11%
Don't know	2%
Refused	-

5. How long has your company been operating at this location?

1 to 3 years	3%
4 to 10 years	14%
More than 10 years	82%
Don't know	*
Refused	-

6. Approximately, what percentage of your total annual costs are spent on electricity bills?

Percent	66%
Range	11%
Don't Know	23%
Refused	-

6a. If Percentage (n giving % = 316)
Specify: 13% (mean)

6b. If Range (n giving range = 54)
From: 9% (mean)

6c. To: 13% (mean)

7. Approximately, what percentage of your total annual costs are spent on water bills?

Percent	74%
Range	6%
Don't Know	20%
Refused	*

7a. If Percentage (n giving % = 363)
Specify: 8% (mean)

7b. If Range (n giving range = 29)
From: 8% (mean)

7c. To: 11% (mean)

** less than 0.5%*

During this survey, I am going to ask you questions about three areas –the energy used by your irrigation system, maintenance of your irrigation equipment, and your water usage.

8. How aware are you regarding each area? Would you say you are very, somewhat, not too, or not at all aware of: (ITEM)?

	Very Aware	Somewhat Aware	Not too Aware	Not at all Aware	Don't Know	Refused
Ways of reducing energy use for irrigation	51%	41%	6%	1%	1%	-
Ways to maintain your irrigation equipment	64%	29%	4%	1%	2%	-
Current water management techniques	61%	31%	5%	2%	1%	*

9. How satisfied are you with the information you have to decide on these areas? Are you very, somewhat, not too, or not at all satisfied with the information you have to decide on: (ITEM)?

	Very Satisfied	Somewhat Satisfied	Not too Satisfied	Not at all Satisfied	Don't Know	Refused
The most profitable choice of irrigation system for your crops	41%	46%	8%	4%	*	-
The best maintenance practices for your irrigation equipment	47%	43%	7%	1%	2%	-
The most appropriate water management techniques	45%	45%	6%	2%	1%	*

10. How willing are you to put effort into learning about these three areas? Are you very, somewhat, not too, or not at all willing to put effort into learning about: (ITEM)?

	Very Willing	Somewhat Willing	Not too Willing	Not at all Willing	Don't Know	Refused
Alternate irrigation systems for your crops	49%	36%	7%	7%	2%	-
Different ways to maintain your irrigation equipment	53%	33%	6%	6%	2%	-
Current water management techniques	55%	33%	4%	5%	2%	-

** less than 0.5%*

Now I have a few questions about the electric usage of your irrigation system.

11. Currently, what type of irrigation systems are you using? (READ LIST AND RECORD ALL APPROPRIATE TYPES)

Micro Drip Irrigation	32%
Low Pressure Sprinkler Nozzles	23%
High Pressure Sprinkler Nozzles	28%
Flood	53%
Furrow	34%
Buried Drip	9%
Other (specify) _____	9%
Don't know	*
Refused	*

**less than 0.5%*

Question 11 Other Responses
Flat Furrow
micro sprinklers
medium pressure sprinkler nozzle 45-50
emitters
surface drip irrigation
high pressure low volume sprinklers
valves
high pressure large irrigation gun
regular drip
surface drip
spitter - low flow
Micro Sprinkler and Drip
sprinklers dk if high or low/drip not sure if micro
just Drip, not micro-drip
row
sprinkler pipe with sprinkler nozzles
spud ditches/sub irrigations
sprinkler system
turbine pumps
deep well, run with a diesel engine, and Buried Drip for all our row crops
wheel lines
Foggers that make the water come out like a fan.
Micro sprinklers, and 35/40 lb pressure
Pipe line from their own well.//
surface drip
checks
upright permanent sprinklers like a rainbird spray water over the whole area/micro sprinkler in greenhouses
Chapin systems
low pressure drip nozzles
fan jet misters and some micro drip
solid set sprinkler, medium pressure
solid set
row irrigation

Question 11 Other Responses
deep well pump irrigation
strip flooding
laser leveling
mini sprinklers
just drawing well.
drip irrigation
|pipeline
pipe
Surface Drip; Micro Sprinkler
sprinkler nozzles
fan jets
sprinkler pipe and low pressure sprinkler
contours
overhead misting system
6 gallons per hour Bow Smith Fan Jet

12. When did you last review whether you could use less energy for irrigation? Was it…..

Within the last year?	41%
Within the last 5 years?	36%
Over 5 years ago?	14%
Never	7%
Don't know	2%
Refused	*

13. If you were to obtain information on electric usage by irrigation systems, would you prefer to get this information through:

	Yes	No	DK	REF
the mail?	89%	10%	1%	*
the internet?	26%	73%	1%	*
training workshops during the off season?	51%	46%	3%	*
advice on specific questions over the telephone?	59%	39%	1%	*
a presentation at a trade association meeting?	46%	52%	2%	*
a demonstration project?	67%	32%	2%	*
an on-site review?	79%	20%	1%	*
anything else? (specify) _____	7%	92%	1%	*

**less than 0.5%*

Bin	Answer to Q13 Other Responses
5	Video tape
4	Article in Three Fruit magazine or other popular farmer's magazine
4	Cut flower commission, trade associations research committee
1	Installers
6	In person from an energy consultant

Bin	Answer to Q13 Other Responses
1	Personal contact with someone who knows what they are doing.
6	PG&E rep calling
4	articles in magazines
5	Video
6	in person from PG& E rep
4	ordering UC Extension info by mail
2	word of mouth - among neighbors
3	trade show or Farm show
3	trade show or Farm show
7	comparative cost diesel vs. electric
6	someone come out here and talk to me.
5	video-tape presentation
4	articles in the ag publications, trade journals
2	Word of mouth from neighbors
7	Honesty from PG&E> They've never been honest with us in |terms of how many programs they have. I've often been told of 6 |programs I could choose from on water and energy savings and then I find out there were 24 more choices never mentioned. After I threatened to go to diesel, then they suddenly offered new programs.
5	public television shows
7	Fresno State phone advice
4	magazine articles
6	someone specifically trained to answer questions about it.
7	to see PG&E somehow get rid of this nasty situation when they charge you for off peak hours, 30 cents a kilowatt on peak and I can't get fields watered properly, if I start at 6pm during peak and then I had to shut it off before noon and it doesn't get to the end
7	information in Spanish
1	Dealers
6	on a personal level
6	personal contact
6	we work with power companies and they come out and do efficiency tests. A state organ comes out to do the same
6	I times past I worked with the PG&E people and they've told me how to regulate the pumps. so on-site would be the best thing to have a team of experts to come out.
2	word of mouth

Bin	Answer to Q13 Other Responses
4	any printed matter is best
6	have meeting with PG&E rep and go over my bills
4	Pamphlets
6	Account Officer at PG&E
1	Through the company that installed my irrigation system
4	Fax

Question 13, 16, 20 Binning Format		N of Bin for Q13
1	Dealer / Installer	4
2	Other Grower	3
3	Trade Association / Trade Show / Farm Show	2
4	Printed Material	9
5	Visual Media	4
6	PG&E Representative	11
7	Other	5
	Total	38

I have grouped the different ways to get information into three groups.

14. (If the information regarding energy usage by irrigation systems suggests some changes you could make that are cost beneficial in the long run,) how likely would you be to make that change if the information was from: (ITEM)? Would you be very, somewhat, not too, or not at all likely?

	Very Likely	Somewhat Likely	Not too Likely	Not at all Likely	Don't Know	Refused
The mail or Internet	34%	47%	7%	6%	6%	*
A training workshop, a trade association presentation, or a demonstration project	35%	43%	7%	7%	7%	*
Advice over the phone or on-site review	39%	39%	9%	8%	5%	*

15. How willing would you be to pay for <u>useful</u> information regarding energy usage by irrigation systems if it were from: (ITEM)? Would you be very, somewhat, not too, or not at all willing?

	Very Willing	Somewhat Willing	Not too Willing	Not at all Willing	Don't Know	Refused
The mail or Internet	6%	26%	26%	35%	6%	*
A training workshop, a trade association presentation, or a demonstration project	9%	37%	17%	29%	7%	*
Advice over the phone or on-site review	10%	38%	17%	29%	6%	1%

** less than 0.5%*

Now I am going to ask similar questions about maintaining your irrigation equipment (IF NECESSARY: Irrigation system equipment would include wells, pumps, filters, pipelines and any hardware associated with the irrigation system).

16. If you were to obtain information regarding maintenance of your irrigation equipment, would you prefer to get this information through:

	Yes	No	DK	REF
the mail?	78%	19%	2%	*
the internet?	26%	71%	2%	*
training workshops during the off season?	54%	43%	3%	*
advice on specific questions over the telephone?	55%	42%	2%	*
a presentation at a trade association meeting?	51%	45%	4%	*
a demonstration project?	67%	29%	3%	*
an on-site review?	77%	21%	2%	*
anything else? (specify) _____	5%	92%	2%	*

Bin	Answer to Q16 Other Responses
1	Installers
1	local irrigation dealer
2	talking to neighbors
4	magazines, trade pubs
1	Their sales person – they are up on it
5	Video
1	Advice from pump installer service
5	Video presentation
1	Repair man for the pump, the one that installed it. Because we just have an underground pipe line

Bin	Answer to Q16 Other Responses
2	Word of mouth
2	coop programs in the area
4	magazine articles
4	Newspaper
1	Dealer
2	personal contacts
6	customer representative
3	a Farm show, that's only about 60 miles away....
4	articles in publications, ag publications ,magazines.
1	irrigation dealer
2	word of mouth by other users
1	local shop who services pumps
6	Account Rep at PGE
1	dealer who installs the system is a good source
1	equipment company
1	go to the manufacturer
4	Fax
3	farm shows

Question 13, 16, 20 Binning Format		N of Bin for Q16
1	Dealer / Installer	11
2	Other Grower	5
3	Trade Association / Trade Show / Farm Show	2
4	Printed Material	5
5	Visual Media	2
6	PG&E Representative	2
	Total	27

17. (If the information regarding maintenance of your irrigation equipment suggests some changes you could make that are cost beneficial in the long run), how likely would you be to make that change if the information was from: (ITEM)? Would you be very, somewhat, not too, or not at all likely?

	Very Likely	Somewhat Likely	Not too Likely	Not at all Likely	Don't Know	Refused
The mail or Internet	28%	48%	10%	7%	7%	*
A training workshop, a trade association presentation, or a demonstration project	29%	44%	7%	11%	8%	*
Advice over the phone or on-site review	34%	39%	8%	11%	7%	*

18. How willing would you be to pay for <u>useful</u> information on maintenance of your irrigation equipment if it were from: (ITEM)? Would you be very, somewhat, not too, or not at all willing?

	Very Willing	Somewhat Willing	Not too Willing	Not at all Willing	Don't Know	Refused
The mail or Internet	7%	27%	23%	35%	7%	*
A training workshop, a trade association presentation, or a demonstration project	9%	35%	20%	27%	9%	*
Advice over the phone or on-site review	11%	35%	18%	28%	7%	*

** less than 0.5%*

I am going to ask similar questions on water management; that is, deciding when to water and how much to apply.

19. a) If you were forced to grow crops with 20% less water, what would you do first? (READ ALL CATEGORIES INCLUDING OTHER BEFORE RECORDING RESPONSE)

b) Which would you do next?

	First	Second
Investigate new irrigation systems	28%	28%
Investigate water management issues	36%	24%
Grow less acreage	9%	8%
Change the crops	9%	10%
Or something else (specify) _____	10%	10%
Don't Know	7%	14%
Refused	*	1%
No Data		7%

Bin	Answer for Q19 Part A (First) Other Responses	Bin	Answer for Q19 Part B (Second) Other Responses
4	investigate different crop techniques	4	management where you would use water certain time s of the year, a better way to say it would be deficit irrigation.
1	Possibly retire	8	do all the above concurrently
7	Different equipment	3	the first three are not viable
5	can't use less water then we do now	7	Investigate irrigation timing
1	sell the land	1	quit farming
3	I would try to put less water on at one time	5	none of the above. I'd figure it out.
6	spread water out over the acreage, if that didn't work cut the acreage back	4	investigate different horticultural processes different management techniques
2	Build another well.	3	use diesel
3	Hope for a wet year	8	water banking program or pay rice farmers to go on vacation
1	move the farm, I farm 15 feet below sea level	4	grow something else
1	sell the farm	5	NOTHING ELSE
1	sell the property	3	it would depend on what is happening
3	SCREAMING	3	lie, tell them I'm irrigating every 10 days
2	change the power source instead of electricity I would go diesel to use the same water.	2	we have our own wells
1	get out of farming	1	move the farm
1	sell out	1	lease the property
2	put on less water	1	go broke
3	Sue whoever was trying to make me reduce my water, since I have aright and reasonable and beneficial to my land, and since I've done all the other things that we've already talked about, and continue to do at great expense.	1	probably quit
1	get out of farming	1	stop farming
8	I might use parts or all of those things at once.	2	do less irrigating
1	Go broke	1	plow it up grow houses on it

Bin	Answer for Q19 Part A (First) Other Responses	Bin	Answer for Q19 Part B (Second) Other Responses
2	change the power supply and go to diesel	5	it doesn't really apply I only grow corn. we recapture all our runoff. non of our water leaves the property and we recycle all our water.
1	terminate completely	3	we would have to look at a lot of things
1	lease the property	5	we are as efficient as we could be, I don't see what we could change.
4	cultivat4e grasses	1	sell the damn place
1	Move everything to the Delta.//	4	adjust through management
1	sell the property	1	go broke
3	I would just use less water...if we had less water...or we would have to drill another well.	4	Change management
3	change the federal gov't water policies	1	find something else to do for a living
1	Retire	4	shut the pump down quicker and don't run it so many hours.
1	sell the ranch	8	Investigate all the issues
1	move to another state where water is more plentiful	4	Investigate change in crops
7	change the nozzle sizes 20% change the nozzle sizes 20%	5	Forget it all
2	id drill a new well	2	I would look for another source of energy
2	second source of water,pump9ing out of the ground or wherever	5	I'm maxed out, I've done everything, from equipment to energy.
2	drilling more wells	7	Look into new technology
1	sell the ranch and move to Alaska	2	Put in new pump
1	quit farming	7	Investigate water saving devices
5	cant do any less than what I'm doing now. I'm watering it down to one gallon per tree per day	2	Does not really apply as they draw from their own wells.//
5	Think they could live with 20% less water (apricots)	1	shut it down
4	Decrease the evaporation-transpiration rate.	4	change farming practices
2	Does not really apply as the draw from their own wells.//	7	put in a different system or use different watering techniques

Bin	Answer for Q19 Part A (First) Other Responses
1	Retire early
4	cut out post irrigation.
5	Nothing.
5	I wouldn't do anything
1	Retire

Bin	Answer for Q19 Part B (Second) Other Responses
3	vote democrat

Bin Number	Bin Response	N for Part A	N for Part B	Total N
1	Leave farming / sell the land	20	11	31
2	Comment indicate a lack of understand of the question or of water usage	8	5	13
3	Unrealistic or non-useful response	6	6	12
4	Change crop, crop techniques	4	8	12
5	Nothing	5	6	11
6	Less acreage	1	0	1
7	Change equipment / investigate new equipment	2	4	6
8	Other	1	3	4
	Total	47	43	90

20. What are your preferred ways of obtaining information on water management techniques? Would you like to receive it through:

	Yes	No	DK	REF
the mail?	80%	19%	1%	*
the internet?	25%	74%	1%	*
training workshops during the off season?	54%	43%	2%	*
advice on specific questions over the telephone?	55%	42%	2%	*
a presentation at a trade association meeting?	55%	43%	2%	*
a demonstration project?	66%	32%	2%	*
an on-site review?	77%	22%	1%	*
anything else? (specify) _____	3%	96%	1%	*

Bin	Answer to Q 20 Other Responses
2	neighbors watching neighbors who are successful
5	university presentation
4	magazines, trade pubs
6	through their sales rep
5	video
5	video presentation

Bin	Answer to Q 20 Other Responses
2	word of mouth
4	newsletters from the company
4	fax
6	personal contact
3	farm shows
1	I seek out them myself, the company I buy my irrigation equipment from is Chico Sprinkler
1	irrigation dealers
2	people who do the same thing as I do.
6	account rep at PG&E
4	dept of agriculture
4	fax

Question 13, 16, 20 Binning Format		N of Bin for Q20
1	Dealer / Installer	2
2	Other Grower	3
3	Trade Association / Trade Show / Farm Show	1
4	Printed Material	5
5	Visual Media	3
6	PG&E Representative	3
	Total	17

** less than 0.5%*

21. (If the information about water management techniques suggests some changes you could make that are cost effective in the long run,) how likely would you be to make that change if the information was from: (ITEM)? Would you be very, somewhat, not too, or not at all likely?

	Very Likely	Somewhat Likely	Not too Likely	Not at all Likely	Don't Know	Refused
The mail or Internet	25%	50%	10%	8%	6%	*
A training workshop, a trade association presentation, or a demonstration project	23%	50%	7%	11%	8%	*
Advice over the phone or on-site review	29%	44%	8%	11%	7%	1%

22. How willing would you be to pay for <u>useful</u> information on water management techniques if it were from: (ITEM)? Would you be very, somewhat, not too, or not at all willing?

	Very Willing	Somewhat Willing	Not too Willing	Not at all Willing	Don't Know	Refused
The mail or Internet	7%	30%	22%	33%	7%	*
A training workshop, a trade association presentation, or a demonstration project	8%	37%	18%	28%	9%	*
Advice over the phone or on-site review	11%	35%	15%	30%	8%	*

Now just a few questions about irrigation systems…

23. How likely are you to use an outside service that <u>designs an irrigation system</u>?

Very likely..... 18%
Somewhat likely..... 20%
Not too likely..... 12%
Not at all likely..... 18%
Already use..... 30%
Don't Know..... 1%
Refused..... *

** less than 0.5%*

24. How likely are you to use an outside service that maintains your irrigation equipment?

Very likely	7%
Somewhat likely	14%
Not too likely	23%
Not at all likely	40%
Already use	14%
Don't Know	2%
Refused	*

25. How likely are you to use an outside service that helps you manage your water use?

Very likely	5%
Somewhat likely	19%
Not too likely	27%
Not at all likely	39%
Already use	8%
Don't Know	2%
Refused	*

** less than 0.5%*

The last few questions are more general.

26. In this survey, we've discussed several ways of obtaining information, including mail, phone, the Internet, attending training workshops and presentations, and using demonstration projects or on-site reviews. Besides these, what other types of assistance do you think would help you reduce your irrigation electricity usage?

Other (specify) _____	25%
Nothing else/no other	70%
Don't know	4%
Refused	1%

Bin	Answer to Question 26 Other Responses
1	better management
2	go to a diesel pump. change to a diesel pump
1	efficiency tests on the equipment
3	incentive discounts for reducing electricity usage. Low-interest loans or grants for equipment that uses less electricity. Help in purchasing more effective pumps, similar to what is offered for home appliances. Research and advice to help farmers select equipment. Give incentives to the equipment manufacturers to produce efficient equipment
2	switching partially to diesel
3	some sort of payment program to help me be more efficient .payment incentives to help me

Bin	Answer to Question 26 Other Responses
	save water and electricity. water measurement devices, measuring moisture in the ground
3	rebates for state variable speed control devices
5	PG&E setting up an energy efficient farm that people could see. This is better than a demonstration project because it has to work over a whole year.
6	bigger supply of surface water bigger supply of surface water
7	statistical service analyzing rainfall over a number of different rainfall periods in the San Joaquin Valley. & tie that in with the most beneficial way of irrigating. Quit charging a standby charge for our electric wind machines after the fifth year of usage. Check voltage and amperage delivery to be sure it is consistent. Pay a lot of attention to delivery lines, such as weak poles or down lines. Take care of them before bad weather. Their service has improved over the past five years, compared to the last twenty years.
1	a field rep going around
7	outside design and installation firm
2	could use diesel power
1	If PG & E would send information regarding off-peak and peak usage regarding what I am doing now. I do off peak and I want to make sure I'm doing it the best way or maybe it would be better to get a different rate and water in the afternoon.
1	energy consultant, have the pump guy check the voltage
7	in the mail
1	probably personal contact, more help from contractors and engineers
10	going into a micro drip system
10	some type of a system ,irrigation system for reasonable price.
6	There are incidents of blinking electricity, so that we have to restart the pumps, clocks, etc. I don't understand why that has to happen.
1	Ag rep from PGE would come out and review free of charge -= that was a pretty good deal
4	PG&E reducing rates
7	Drought tolerant crops
1	water management
1	Continue the PG& E annual pump tests because we do look at those very closely
4	lower electric rates. rebate on more efficient pump motors by PG&E
4	lower rates
1	tests such as pump efficiency
9	articles in trade magazines
4	lower PGE rates
9	magazines, trade publications
10	more efficient electric motors. decrease in electricity price

Bin	Answer to Question 26 Other Responses
1	understanding the rate usage/alternate choices/make sure we are using the right ones based on a 2 year history.
1	field service rep contacting me with info
4	using during certain hours for less cost
6	My hands are tied as a lessee, regarding any changes in existing systems, since those are the responsibility of the landlord. The landlord needs a monetary reason to invest capital.
2	Put in a diesel engine
4	Cheaper rates
6	It seems as though PG & E needs to learn to communicate rather than ask what type of communication method. Lately it's like they put a wall up around themselves. They use to have a series of numbers we could call that connected to different areas of inquiries. Now they don't have that. They use to contact us on a regular basis, generally in person. Now they don't even call and it's hard for us to reach them when we call. So to answer the question regarding assistance, I think first PG & E needs to learn to once again give assistance, then they can worry about in what form.//
6	I'd like to sea PG&E to work closer with wild life in moving power lines so we don't get the bird kill I have to live with
1	a gal came by to test the pump...from PG&E...her name was Dana...she told me that I had a boost pump that was causing friction, so I took it out and I feel that I'm saving money
4	cut the cost of energy that they charge for using electricity
4	lower costs
10	low pressure might help, but I don't think so. more up to date motors and the right horsepower.
2	more natural gas wells
2	conversion to some other source of getting the water off the ground, solar wind, fossil fuel
9	information in farmers' magazines
10	should have put in a drip system 20years ago
1	if PG&E had seminars or trade shows or meetings, workshops what it would be
4	PG & E could give some customers different days of the week from other customers for doing irrigation. Then maybe peak and non-peak hours would not be needed
2	converting electric wells to diesel wells, for which we don't need assistance
3	rebate or tax deduction on stuff you put in.
4	PG&E cut their bill
2	making my own electricity with solar panels.
9	articles in trade journals
8	information from other farmers Information from other farmers
8	watch what our neighbors are doing

Bin	Answer to Question 26 Other Responses
10	more efficient equipment
2	switch to another source of energy, we're switching to natural gas.
8	interaction with other farmers
1	we use private and scientific engineering consultants
1	seminars
4	lower the rates
4	cents per KW - stand by charges and line charges spread throughout the years - I would rather pay for the KW used = for example KW would have been 297. - out of 1800$ bill only 300 is for KW used. stand by charge for wells are $665 a month for a stand by charge - maybe lower that
4	having PG&E lower their rates and having them eliminate the standby. For the three months of the year that we use the standby motors PG&E charges us 200% of what they otherwise charge us for the right to be able to turn it on and use it.
4	higher costs
1	better manage tail water
4	lower the price of electricity
6	if commodities go down - that equipment and electricity goes down also
4	Cheaper rates
8	ask other farmers and see what they are using and how they feel about their systems, or a system I was interested in I would find out who was using it and get input
2	converting to natural gas
7	infield dusting and infield reviews
1	Any type of one on one with someone talking about your specific needs
7	by making the people who supply the equipment to the farmers, making them know the choices are
1	on-site testing on-site testing
1	PG & E Efficiency programs - that check pump efficiency
4	for PG&E to lower their rates, and stand by fees. I cannot justify during the off season for having the electricity hooked up to the pump, for 12 months out of the year , even though we irrigate 6-7months.
7	irrigate less
2	alternate energy sources
1	more on-site reviews
8	word of mouth, example of your neighbors word of mouth, example of your neighbors
1	making pump testing more available. Now it's hard to get, because you have to schedule it months in advance with PG& E, and may not be able to wait that long. Assistance in analysis of PG&E rate structures, and assisting the customer in choosing the rate structure for a particular application. There's not enough staff to help with this. Helping us run the pumping

Bin	Answer to Question 26 Other Responses
	plant more efficiently.
5	independent research
2	if i went to solar energy or diesel.
7	laser leveling land
10	more efficient equipment ,more efficient pumps, i don know if you mean cost or pumps
3	more rebates for efficiency
6	being forced to, that would change it being forced to, that would change it.
5	if could work with the university to develop these projects to give them more creditability
2	use diesel fuel
9	magazines, farm related magazines
4	I PG& E would allow the time of use hours to be changed for an earlier start time than 6pm. We could shut off at 11am and start at 5pm. Or the same program as Southern Calif. Edison.
1	Have the electric bill explained better. PG & E needs to be competitive in the sale & distribution of electricity
1	farm advisor, University of California extension service, and probably an irrigation dealer again. if the bill wasn't so high maybe we could spend money on these things
4	to have PG&E get rid of the standby charges.
1	We need more info on soil modification.//
6	farmers are not stupid they are inventive and as new approaches show they are successful the farmers pass on the info
10	MORE ENERGY EFFICIENT MOTORS
6	If I could reduce my usage I would. They should simplify the bills, they have a list of fees and I don't know what all this stuff is and I feel like I am getting the shaft.
1	service representative who represents people like me, I don't have access to PG&E information on rate schedules for orchards
1	ON SITE REVIEWS ARE TOP WITH ME
2	getting away from electricity and going to diesel alternate source of power
1	being on top of rate changes and rate schedules
1	on site is preferred over all other, also demonstration project
4	lower off-hours rates
1	knowledge of how much water the crop
6	cooler weather
10	upgrade the equipment and make it more efficient. my turban in my wall is not as efficient as it should be. silt in the water, microscopic stone, very fine stuff. it creates ware on all the moving parts. I would have to pay $8,000 for a new turbine system.
4	They can always cut the rates.//

Bin	Answer to Question 26 Other Responses
5	U of Calif Cooperative Extension
2	put a diesel pump in
4	lower electricity bills. They should make a flat rate for irrigating any time any day
1	a service people come out and they put a probe in your field and monitor the amount of water the tree uses. it's done electronically.
8	talking to other farmers who do the same type of farming as I do
1	cooperation from the university
9	articles in dairy magazines. I never see nothing in there about electrical and dairy.
1	publish more on rate schedules for off peak irrigating
7	more flexible times of use meters
1	PG&G come out regularly, not just when you ask, to do a pump test, come out once a year or every two years, with appropriate follow up, of how I can improve the equipment.
1	pump test, neutron probe consultants, water use coefficients
4	not having standby charges
9	magazine trade articles
2	change to diesel motor
6	more availability of district water
3	offer a rebate for putting in energy saving irrigation systems.
1	the gallons per minute test. to see how much horsepower per minute. PG&E has a program that they would come out and check.
1	University California Extension, something on irrigation Fresno State has it, and there's local program - they are called Farm advisors
2	low-income loan incentive to upgrade pumping equipment

Question 26 Binning Format		N of Bin for Q26
1	Overall management assistance from various sources	37
2	Fuel Switch	17
3	Incentives	6
4	Change Rates	23
5	Research	4
6	Unrealistic or non-useful comment	11
7	Other	9
8	Other Growers	6
9	Information from magazines	7
10	Equipment Change	9
	Total	129

27. If you had the assistance you were just discussing, how likely would you be to make the necessary changes to reduce your energy usage? (No Data = 75%)

Very likely..... 17%
Somewhat likely..... 6%
Not too likely..... 1%
Not at all likely..... -
Don't Know..... 1%
Refused..... -

28. And, besides the ones we've discussed in our survey, what other types of assistance would help you reduce your water usage?

Other (specify) _____ 14%
Nothing else/no other..... 80%
Do not know..... 5%
Refused..... 1%

Bin	Answer to Question 28 Other Responses
5	learn more about the crop
1	Low head sprinklers for orchards
5	magazine articles
5	we us CIMIS information, that helps in your water scheduling and maybe you could put neutron probes we use those.
5	the actual transformation rates for each crop.
2	crop research regarding how much water is really needed for a successful crop, such as university cooperative extension research.
3	I don't see any reason to reduce water usage further, because we already use sprinkler irrigation instead of flood. It irritates me that they are looking for ways to take water away from farmers. I'm always open to ways of using water more efficiently. We feed the world. We're not using it to fill swimming pools.
2	Same as #26 - PG&E setting up an energy efficient farm that people could see. This is better than a demonstration project because it has to work over a whole year.
8	better commodity prices better commodity prices
1	new irrigation scheduling or equipment. It would be hard to reduce without crop damage.
9	outside design and installation service
5	Same as #26 - If PG & E would send information regarding off-peak and peak usage regarding what I am doing now. I do off peak and I want to make sure I'm doing it the best way or maybe it would be better to get a different rate and water in the afternoon.
8	an attorney

Bin	Answer to Question 28 Other Responses
5	irrigation consultant
1	changing irrigation systems
3	There is no drainage, so we already have to use minimal water. There's nothing else to be done.
9	articles through trade magazines
4	Drought tolerant crops
5	more data as to actual crop water requirements - site specific
4	new variety of crops. new variety of grapes for example, drought resistant.
5	SOIL ANALYSIS PEOPLE TO TELL YOU HOW MUCH WATER IS LEAKING OUT
5	magazines, trade publications
5	show how to line ditches/or show where our losses are and we can increase our water usage if we do x y z
8	I know of free assistance programs, but the problem is in implementing them. If I don't have a long-term lease, it doesn't benefit me to invest capital, and if the owner is elderly, they aren't going to benefit soon enough.
1	invest in tensiometers, instruments that tells you what moisture in ground is
1	I think I have an outdated pump that needs to be updated and the pressure needs to be raised, it wouldn't be running the pump as long. one is old and draws too much and if I replaced it , it would probably pay for itself
7	cutting the rate, lower rate
5	show me how to use it and still be cost efficient
6	subsidies to get non-pressure nozzles
3	more rain. I don't know right now
8	improve water quality, water treatment
4	better quality of the end product of the fruit using less water.
7	lower the cost of power
2	farm bureau or some other type of farm management model, or university study
5	pump dealers, equipment dealers. to ask them about problems
1	change systems to drip from flood
1	modify equipment to be more efficient
6	economic incentives
9	the efficiency testing programs
1	micro sprinklers
9	less irrigation
5	if billing was easier to understand - how much is demand charge and how much is usage - it

Bin	Answer to Question 28 Other Responses
	would be easier to make decisions. We need to understand the numbers in each area better
5	flow test on the wells, and alternate comparisons between energy sources or types, information dealing more with soil, the availability of the soil to retain and release water to the plants
5	information from agricultural experts
4	advice on the crops themselves, change in variety advice on the crops themselves, change in variety
5	seminars on irrigation management, re trees and vines, when to water
6	incentive programs to help make funds available, for getting equipment and utilizing it.
9	soil amendments.
5	information from the extension service, the farm advisors
9	Lasering the land
8	more rain
5	trade magazines
9	if I learn to do it more efficiently
7	take away the demand charges, it is very unfair. They don't charge residents demand charges, it is unfair.
5	ONSITE REVIEWS
5	more soil related type information
5	face to face meetings
9	Same as irrigation systems answer - on site is preferred over all other, also demonstration project
6	financing to help put in these new systems. Low-term loans
5	knowledge of specific of each crop needed - cost analysis related to water usage to crop yields
9	watch the neighbors
7	Increasing the price of electricity.
7	thinks it would help if they would extend the off- peak rate for electricity usage
9	the cost sharing that I've used in the past, it's a big help. And irrigation, Govt. Farm Agency.
7	Lower rates.
9	Windmills
5	Same as question #26 - PG&G come out regularly, not just when you ask, to do a pump test, come out once a year or every two years, with appropriate follow up, of how I can improve the equipment.
8	need more water available - we use deep wells and water is scarce

Bin	Answer to Question 28 Other Responses
7	lower the rates and making the rate set up less complicated lower the rates and making the rate set up less complicated
7	increasing the cost of service
8	larger reservoirs so we have more water

Question 28 Binning Format		N of Bin for Q28
1	New equipment	8
2	Research	3
3	Nothing	3
7	New Crops	4
5	Information / Advice from experts	23
6	Incentives	4
7	Change Rates	8
8	Unrealistic or non-useful comment	7
9	Other	11
	Total	71

29. If you had the assistance you were just discussing, how likely would you be to make the necessary changes to reduce your water usage? (No Data = 86%)

Very likely..... 8%
Somewhat likely..... 4%
Not too likely..... 1%
Not at all likely..... *
Don't Know..... 1%
Refused..... -

END:

That's all the survey questions I have, but before I hang up, may I please verify your name and phone number?

VERIFY NAME

VERIFY PHONE NUMBER

Thank you very much for your time.

** less than 0.5%*

Appendix D
RATIONALE FOR STUDY

Rationale for Study

While the report provides the gist of the process gone through by the evaluation team to arrive at the current study, it does not give the reader a thorough indication of all the possibilities discussed. This appendix details how the study came to be in its current shape – what ideas were discussed, discarded, and why they were or were not retained. In order to make this appendix more readable, portions of this appendix are taken from the report, but with details filled in.

Motivation for Market (Customer) Needs Study

PG&E has been encouraging agricultural customers towards energy efficient technology and practices for over 75 years. Most recently these efforts have been through the Energy Management Services (EMS) and Energy Efficiency Incentive (EEI) programs. One element of the EMS program has been to increase awareness about the benefits of knowing the pump efficiency. This has been done by supplying pump tests at no cost to the customer, and then encouraging pump repairs when the test shows them to be cost effective. The complimentary agricultural EEI program (AEEI) provided information about energy-efficient technologies to agricultural customers and offered incentives for implemented measures. Various evaluations of both the programs during the past six years have indicated that customers were aware of efficient technologies and used the programs to take actions. The free-ridership for the 1994 through 1996 program years for the agricultural sector was relatively steady at around 36%. The market effects studies of 1996 EMS program and 1997 AEEI program indicated that programs that had been offered for such a long time encouraged energy efficient actions not only the participants of the program but also nonparticipating customers. In other words, these programs had significant market effects. A market effects studies of 1996 AEMS[3] program and 1997 AEEI[4] programs both indicated that though market effect of these programs were significant, not all segments of agricultural customers were affected to the same extent. In order to better focus future programs, it was important to determine the customers' needs. Therefore, instead of conducting a net-to-gross study for the Carryover of the 1998 AEEI program, it was decided that PG&E would put this effort into finding out which group of customers needed what services. A market needs study (or more specifically, the customer needs) was useful for two reasons:

- if utilities are required to <u>continue</u> to implement similar programs, (i.e., informational programs and/or incentive programs) focusing program implementation on those customers who are likely to benefit the most from the programs is an effective way to transform the market towards higher efficiency, and
- if utilities are required to <u>change</u> the program design or design new programs, then understanding customers' needs creates a solid platform to base the design of new programs.

[3] PG&E 1996 Agricultural Sector EMS Program Market Effects Study, April 28, 1998

[4] PG&E 97PY Agricultural Energy Efficiency Incentives: Pumping and Related Market Effects Study, Study ID #335A, March 30, 1999.

In this study, the choices of customers in different segments were used to find out what is required in the market and which would be the most effective way of delivering information.

Study Objectives

The focus of this study was to find out what agricultural customers need to help them with energy efficiency.

This study had four objectives:

1. Identify the areas in which customers needed assistance.

2. Identify the type of assistance customer preferred.

3. Determine whether customers would be willing to make a change towards energy efficiency if they got the preferred type of assistance in the area they needed.

4. Find out whether or not customers would be willing to pay for the type of assistance of their choice.

Scope of the Study

The study was based on stated preferences of a sample of agricultural customers as determined through structured telephone interviews. Agricultural sector evaluations from 1994 through 1998 have shown that the length of customer interview on a telephone should be no more than 14 minutes. Along with the survey time constraint, there were four questions discussed amongst the PG&E project manager, agricultural specialists, PG&E agricultural representatives, and the evaluation team (the PG&E Team) to define the scope of this study.

1) What is the geography to be used for the study?
2) What types of equipment should be studied?
3) What types of assistance should focussed on?
4) What are the effects of time on the customer's choices?

A brief summary of each question, choice, and implications of that choice follow.

(1) **What is the geography to be used for the study?**

After discussions with the PG&E Team, it was decided that the study should be limited to PG&E's service territory. It was felt that limiting the study to PG&E's service territory would not limit the generalizability of the study to California since the majority of California's agriculture occurs within the PG&E service territory boundaries.

(2) What types of equipment should be studied?

The analysis of billing data for the years 1995-1998 indicated that, on average, 90% of the agricultural customers were in the pumping end use. Since pumping end users are predominant amongst the agricultural customers, the focus of the study was decided to be on pumping end users and the technologies pump users may consider in the near future.

Different technologies were discussed. Within pumping end use, there are several irrigation technologies (e.g. micro drip system, low-pressure sprinkler nozzles). One option was to ask the customer the type of technology the customer currently uses and if it was not energy

efficient then ask what the customer 'needs' (in terms of assistance) to change it to an energy efficient technology. From PG&E's market transformation studies as part of the 1996 and 1997 program evaluation, it was observed that even within the pumping end use, the factors that discourage the customers from adopting a specific technology could be different. This indicated that if the focus of the study was to be on the currently popular equipment types then the applicability of the study on some other equipment type could have been questioned. Also, equipment specific surveys tend to be quite long, and did not fit the under 14 minute criteria set initially by the evaluation team. Therefore, focussing the study on current irrigation technologies was felt to be inadequate to answer the study objectives and too long for the time criteria.

Ideally, it would have been nice to focus on equipment that was likely to be important for agricultural customers in the near future. This required some projections on the part of the engineers in the field on the basis of their understanding of (*a priori*) what customers may need in the near future and of upcoming technological advancements and innovations as well. The practical problem in this case would be to make the customer imagine this 'new equipment' and then consider what would encourage her/him to adopt that equipment. Taking the example of any consumer durable item and trying to perceive the kinds of problems we as customers would face takes more than 14 minutes, but even after 14 minutes a reliable answer cannot be guaranteed. Therefore, it was decided that asking equipment specific questions; whether set in the present or future, was not a viable approach.

Another option that fit the purpose of the study very well was to ask general questions about 'efficient technologies'. The main purpose of the study would be to find out what type of assistance would be most beneficial to the customers in order for them to think about energy efficiency and take actions. However, past market effects studies have shown that it is difficult for customers to assess what types of problems they may face in the future with respect to unknown energy efficient technologies. Also, problems faced by the customers are different depending upon the technology and therefore the kind of assistance they require to resolve those technology-specific problems can also be different. Thus the survey response rate may be low and the results may be less reliable. This approach was also discarded.

The discussions led the PG&E Team to feel that, instead of thinking about existing or new equipment within pumping end use, it was important to think about the problems/issues that a pump user may face in existing condition, would continue to face in the future, and possible solutions for these issues. Was the customer is likely to select a solution that led to energy conservation and maybe water conservation? If not, then what could be done to educate and convince the customer to make an appropriate choice for conservation? Again in order to keep the survey length less than 14 minutes, it was important to focus on the major issues and not include all the problems faced by the agricultural customers. It was obvious that the pump users faced similar issues. For example, engineers in the field had observed a communication gap between the water management advisors (energy economists) and irrigation system designers. This left customers confused about the types of irrigation system and practices that could better manage energy and water use. There may be a market need for information/advice with respect to the appropriateness of the irrigation system and ways to manage water. A market intervener may be able to step in to provide this advice and assist the customer to think towards efficient use of water and energy.

Again, based upon conversations with the engineers in the field, the evaluation team believed that there was a need to think about conservation of resources in general rather than one resource compared to another. For example, the pumping end users can either improve the existing system or replace the existing system with a better or more efficient system. Either or both of these options may or may not save electricity, but may be chosen because they would save water. According to one of the engineers, the growers are going to be required to reduce their water usage the near future. How they will accomplish this is not currently clear, however it may be possible to couple this with electricity conservation as well.

There is another reason for this perspective of conservation of resources. From past experiences, it was observed that the agricultural customers would be willing to learn about efficient technologies and take actions only if they considered it a necessary investment. (In PG&E's 1996 and 1997 Ag. sector market transformation studies, it was demonstrated that the demand for efficient technologies was need based). Agricultural customers may consider efficient technology as needed only if the electricity costs were a large portion of total costs and if they were convinced that these costs could be reduced by adopting efficient technologies. Although the past surveys have shown that electricity costs, as a percentage of total costs, are less than 10% for at least 60% of agricultural customers in PG&E's service territory, the water and electricity costs together form a larger portion of their total costs. If the customers view the energy efficient options as affecting of both these costs together, then their willingness to learn and adopt the efficient technologies may increase. Therefore, it was beneficial to think about energy conservation and water conservation at the same time and to look at customers' needs for these two together.

These types of questions fulfilled the objective of the study to find out whether or not the customers need any assistance and if they do, then relatively, which type of assistance would be more effective. The evaluation team, with their experience in the field, thought that there were three main issues that a pump end-user currently faces and would continue to face in the near future: (1) water management, (2) irrigation systems, and (3) maintenance of irrigation equipment.

Therefore, the evaluation team moved from thinking in terms of equipment specific types of questions to more general problem areas. Once these areas were determined, the last question could be addressed.

(3) What type of assistance should be focussed on?

To estimate a comparative advantage of assistance and to encourage customers to adopt the technology or select the efficient choice, the team first needed to determine types of possible assistance that could feasibly be offered. One option was to focus on the types of assistance that PG&E had offered to the agricultural customers so far. However, if the focus was only on the information types of assistance or incentive, then the applicability of the study for some other types of assistance may be questioned.

After much debate, the evaluation team thought that a market intervener could offer any combination of following choices for assistance channels: information via mail, or internet, or training workshops during the off season, advice on the phone, presentation at a trade association meeting, a demonstration project, or an on-site review. In addition to these, the

team included open-ended questions in the survey questionnaire to find out if the customer had any other type of assistance channels that they liked.

(4) What are the effect of time on the customer's choice?

Overall, there are a wide range of energy efficiency alternatives for customers to choose from. These choices range from highly energy efficient technologies that are very expensive to begin with to low initial cost technologies that do not use energy efficiently. In order to move towards efficient technologies, utilities could offer information, advice, loans, incentives, and demonstrations to encourage the customers to move towards efficient technologies. However, the customers' choice of the technology probably depended upon the financial conditions at that point in time. If the product (i.e., their crop) was in a 'high demand' time, then the choice may be different than for a 'low demand' time. Similarly the relative importance of the assistance may also be different in a 'low demand' time compared to 'high demand' time. The challenge was to design a survey that could incorporate the choice differences and relative importance of the assistance at different 'times'.

The team did design and pre-test such a survey. However, the average time for this survey was around 25 minutes, much too long based on previous experience. The team went back to the survey and determined that this aspect of the study would be dropped in order to be able to get reliable answers from the rest of the questionnaire.

Summary

The evaluation team used many resources to discuss options for the structured survey. The PG&E service territory was set as the geographic boundary and pump users as the customers for the sample. During discussions, the evaluation team moved from equipment specific types of questions to more general area type of questions. The customers were questioned about three areas – energy use of their irrigation system, maintenance of their irrigation equipment, and water management. The customers were queried about their awareness of each area, their satisfaction with information available to them in these areas, and how willing they were to learn about each area. Preferences for different channels of information dissemination, the likeliness to make a change, and willingness to pay for useful information were explored during the survey. Determining the timeliness of the intervention, with respect to the demand for the customers crop, was attempted. However, the time criteria of a 14 minute survey disallowed inclusion of this aspect of the study.