Final Report

Evaluation of the 2005 SmartRinse Program

Prepared for:
Ecology Action

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CALMAC Study ID EcA0003

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Executive Summary

The SmartRinse Program was established in 2005 to offer commercial food service establishments new, high efficiency pre-rinse spray valves (PRSVs). The Program has a total of 11 installers who primarily rely on in-person direct solicitation to enroll customers. At the end of December 2005, the Program had served a total of 2,961 customers, installing a total of 4,237 efficient PRSVs. Customers were in three broad geographic regions in California: the Redwood Empire, the Central Valley, and the Santa Cruz/Monterey area. In addition, the Program serves customers in a variety of food service businesses, including full service restaurants (38% of participants) limited service restaurants (35%), institutional sites (10%), and cafeteria/buffets (7%).

The goals of this evaluation are to understand participant satisfaction with the Program and the PRSV, verify that the efficient PRSVs are installed and operating properly, and estimate water and energy savings resulting from the installation of the efficient PRSV.

Process Evaluation

A survey of 103 SmartRinse participants was conducted in July and August 2005. The findings from the survey revealed that:

- ***Lower energy bills/savings money are the primary drivers of Program participation***. Some respondents also expressed an interest in saving water, a message that might also resonate with potential participants in a state with a history of droughts.

- ***Participants were extremely satisfied with the installation process.*** Field staff are clearly fostering professional, well-managed customer relations.

- ***The majority of customers are extremely satisfied with the new spray valves.*** More than two-thirds (69%) of the respondents said that the new valve cleans much better (21%) or somewhat better (48%) than the previous valve.

- ***There is little evidence of freeridership or spillover***. Nearly all participants were either not aware of the efficient PRSV or had no time to investigate it without the Program.

Installation Verification

To verify that the efficient PRSVs were installed and operating as predicted under the *ex ante* assumptions, a total of 42 site visits, with 59 reported PRSV installations, were conducted using stratified random-sampling approach. The site visits revealed that the majority of spray valves are installed and operating properly. Only three of the 42 sites visited reported that the efficient spray valves were removed and replaced with standard valves. Ecology Action might want to consider sending a postcard to participants reminding them that if the valve breaks they will repair or replace it for no cost. There were also six sites that were reported (by one installer) but not installed; Ecology Action has put procedures in place to ensure that all reported installations

are now actually completed. In total, 45 of the 48 efficient PRSVs from the valid site visits (excluding those that were adjusted because of the one installer that failed to complete his installations) were in place in operating properly, indicating a first year retention rate of 93.9%.

Assessment of Energy Savings

To assess the energy savings resulting from the installation of the efficient PRSVs, flow meters were installed on a sample of 15 participant sites. These installations obtained measurements on the total water used by both the efficient PRSVs and the older PRSVs, which were reinstalled during the study. Data were also collected on dishwasher loads so that the PRSV usage could be normalized to account for any seasonal impacts in customer traffic.

The findings revealed that estimated savings from the efficient PRSVs are 85 therms/year, well below the assumed savings of 335 therms/year per valve. The deemed savings are based on an earlier study that did not field-meter water use for both the existing and efficient PRSVs. Two additional studies provide support that the assumed savings value may be too high: one study estimated savings of 126 therms/year, and another estimates savings of 134 therms/year. Differences in study methodology, seasonal effects, input water temperatures, and small samples may all contribute to these differences. However, there is ample evidence that the deemed savings of 335 therms/year is too high and should be reduced for future programs to, at most, 130 therms/year. Note also that these studies focus only on restaurants: only one study included groceries, and actually found little savings (5 therms/year) for these sites.

1. Introduction

The SmartRinse Program was established in 2005 to offer commercial food service establishments new, high efficiency pre-rinse spray valves (PRSVs). The Program was originally a small subcomponent of the RightLights Program with a goal of just 179 spray valve installations; however, this was significantly expanded to a planned 3,379 spray valve installations by June 2005. At the end of December 2005, the Program had served a total of 2,961 customers, installing a total of 4,237 efficient PRSVs.[1] The Program plans had assumed savings of 335 therms/year per valve and resulted in gross savings are 1,419,395 therms/year.

The Program has a total of 11 installers who primarily rely on in-person direct solicitation to enroll customers. Customers who are interested in the Program can receive the PRSVs at the time of the initial contact or at a time that is more convenient for them. The old valves are collected, catalogued, and stored by Ecology Action. This ensures that the valves are not reused, that all the reported installations are actually completed, and that the valves are eventually recycled.

As shown in Table 1, the Program serves counties in three broad geographic regions: the Redwood Empire, the Central Valley, and the Santa Cruz/Monterey area. More than half of the participants and valves installed (54%) were in the Central Valley, followed by Santa Cruz/Monterey (30% of participants and 29% of the valves) and the Redwood Empire (16% of participants and 17% of the valves) (Figure 1). In addition, the Program serves customers in a variety of food service businesses, including full service restaurants (38% of participants) limited service restaurants (35%), institutional sites (10%), and cafeteria/buffets (7%) (Figure 2). When examining the number of valves installed, groceries – which only represented 5% of the participants – accounted for 10% of the PRSVs, due to the fact they averaged 3.2 new spray valves per participant, higher than any of the other business type (Figure 3).

Table 1. Counties Represented in the SmartRinse Program

SmartRinse Coverage Area/ Eligible Counties
Redwood Empire
Humboldt
Nevada
Shasta
Plumas
Butte
Glenn
Mendocino
Central Valley
Sutter
Placer
Sacramento

[1] Participants are also eligible for multiple valves, and on average the Program installed 1.4 valves per participant.

SmartRinse Coverage Area/ Eligible Counties
San Joaquin
Colusa
Solano
Tulare
Yolo
Yuba
Tehama
El Dorado
Fresno
Kings
Stanislaus
Tuolumne
Merced
Santa Cruz/Monterey
Santa Cruz
Monterey
San Benito
Santa Clara

Figure 1. Participation by Region

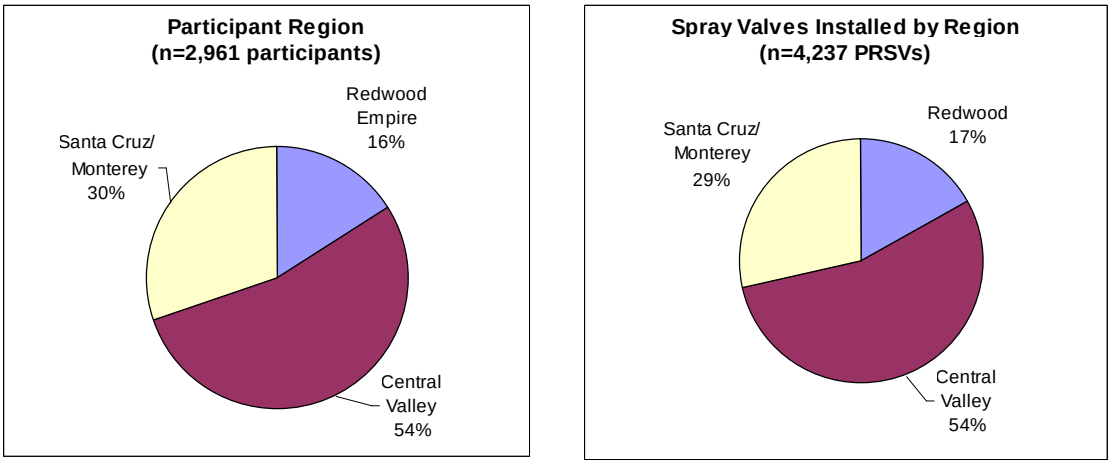


Figure 2. Participation by Businesses Type

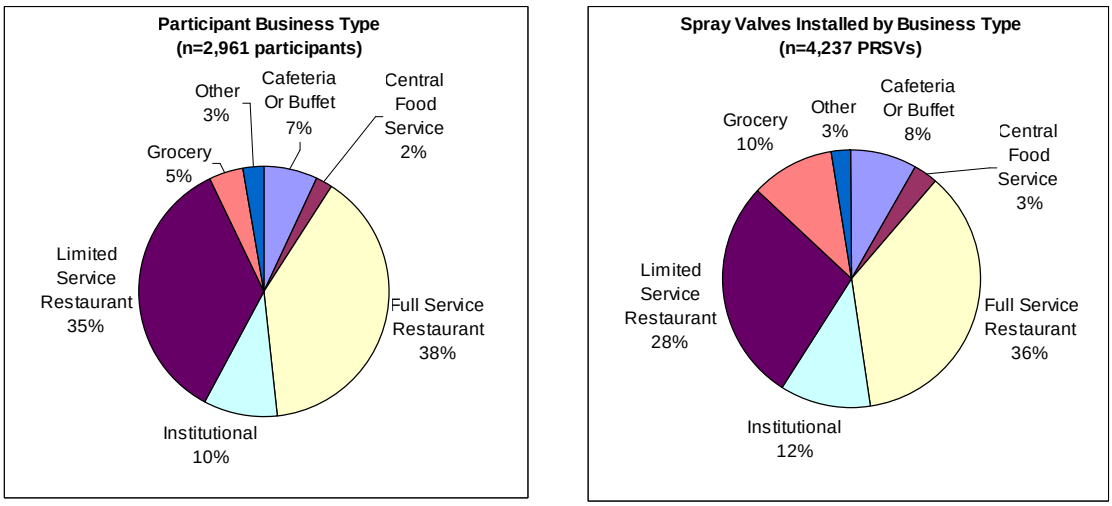
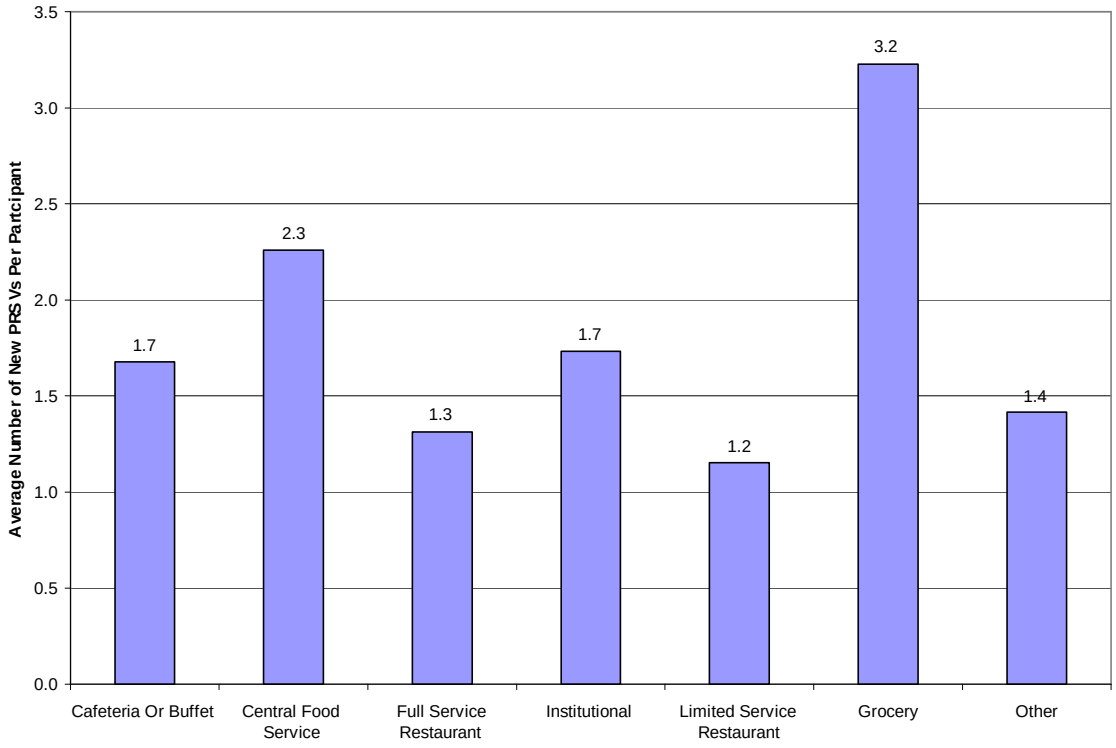


Figure 3. Average Number of New Valves by Businesses Type



Evaluation Approach

This study was conducted at the request of Ecology Action, who also managed the Study. The goals of this evaluation are to:

- Implement a process evaluation to understand participant satisfaction with the Program and the PRSV
- Conduct site visits to verify that the efficient PRSVs are installed and operating properly
- Implement a metering study to estimate water and energy savings resulting from the installation of the efficient PRSV

Chapter 2 presents the findings from the process evaluation, Chapter 3 presents the results of the installation verification site visits, Chapter 4 presents the results of the metering study, and Chapter 5 presents our conclusions and recommendations.

2. Process Evaluation

Quantec conducted a process evaluation of the SmartRinse Program to explore participation drivers; outreach activities; satisfaction with the installation, the spray valve, and the Program overall; and freeridership and spillover among others topics.[2]

Process Evaluation Methodology

A survey of 103 SmartRinse participants was conducted in July and August 2005. The majority of the surveys (67) were conducted over the telephone, while an additional 36 surveys were conducted in-person as part of the installation verification process.[3]

Because the survey was also being conducted to recruit for the metering study, there were a significantly higher number responding restaurants in the Santa Cruz/Monterey region than in the overall Program population. To correct for this, responses were weighted so that the distribution of participants more closely matched the population.

Process Evaluation Findings

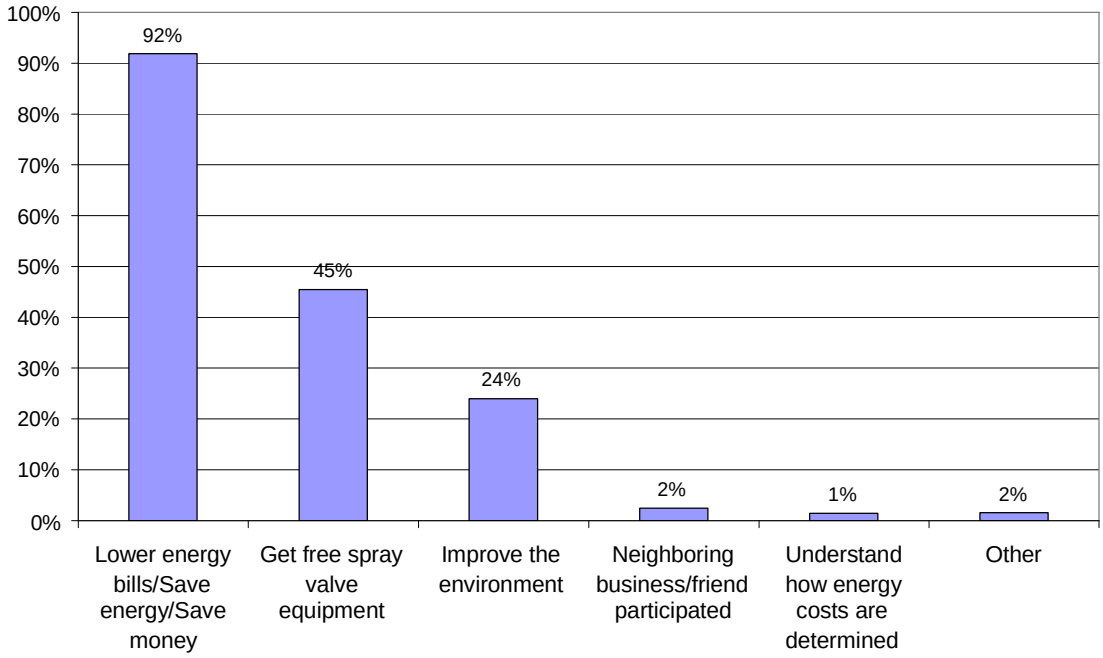
Reason for Participation

Respondents were asked about their decision to participate in the SmartRinse Program. The most common motivator was to save energy/money from lower water and utility bills (92%) (Figure 4). Many participants also chose to participate because the PRSV was free (45%) and as a way of improving the environment (24%).

[2] The final survey instrument is included in Appendix A.

[3] Although there were a total of 42 site visits for installation verification, six participants were unable to complete the survey.

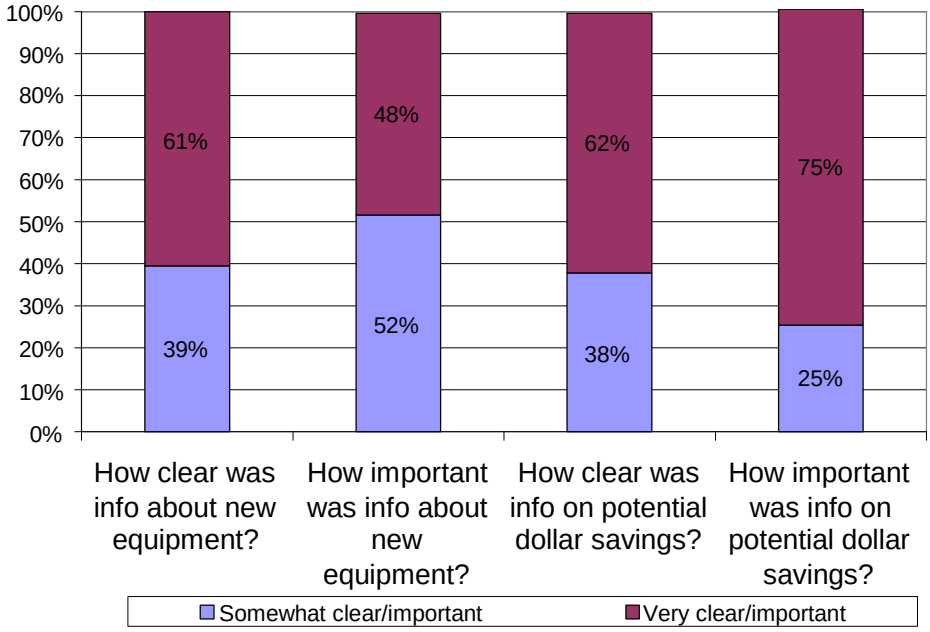
Figure 4. Reasons for Participation



Clarity/Importance of Materials

Every respondent (100%) reported that the materials' description of the equipment and the potential for savings was somewhat or very clear (Figure 5). Consistent with the reasons for participation, respondents reported that the potential for dollar savings was the most important message in the materials (75% rated dollar savings as very important).

Figure 5. Clarity and Importance of Program Materials

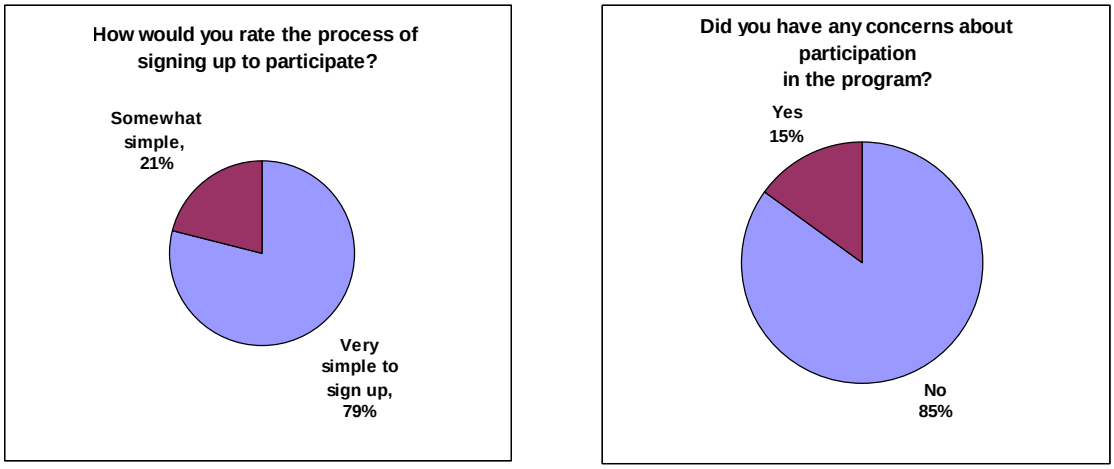


Signup Process

Nearly all respondents (97%) reported that they learned about the Program from walk-in visits by the SmartRinse field representatives; just one respondent mentioned that they learned of the Program through management/corporate offices. Given the recent launch of the Program and the aggressive direct solicitation effort, it is not surprising that other avenues of Program awareness, including word of mouth, have not led to more participants.

The majority of participants (79%) stated that the signup process was quite simple, with no respondents reporting any difficulties signing up for the Program. In addition, only a few respondents (15%) expressed any concerns about participating in the Program, and these focused on concerns about the performance of the PRSV and what actual savings they might achieve (Figure 6).

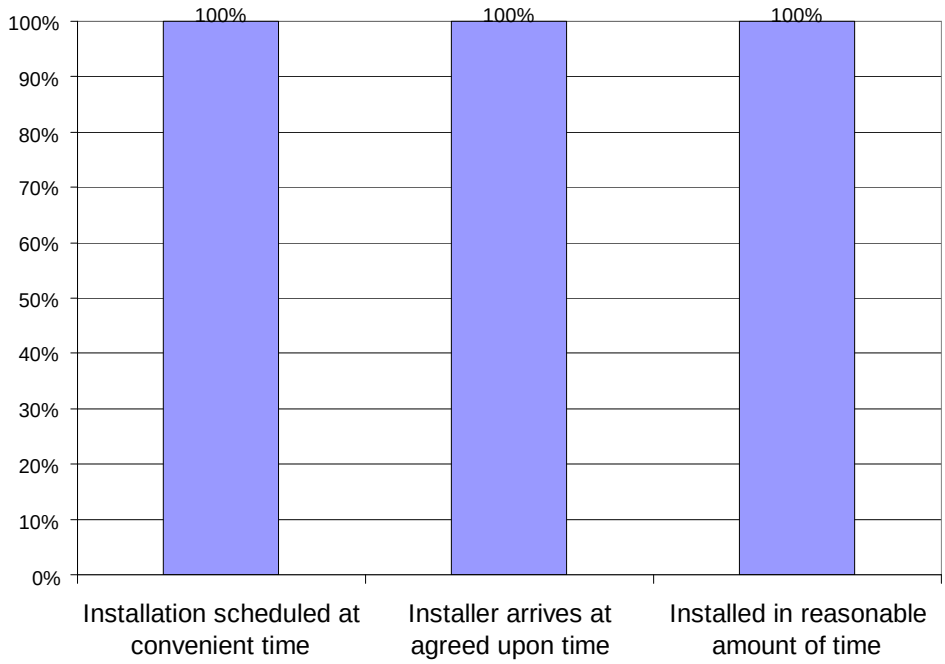
Figure 6. Signup Process and Concerns about Participation



Satisfaction with Installation

Respondents to the participant survey reported that the scheduling and installation process went exceptionally well: all respondents (100%) reported that the installation was scheduled at a time that was convenient for them, the installer arrived on time, and the process was conducted in a reasonable length of time (Figure 7).

Figure 7. Satisfaction with Installation



Satisfaction with the Efficient Spray Valve

Although some respondents initially expressed concern over the performance of the efficiency PRSV, more than two-thirds of the respondents reported that the new valve cleans much better (21%) or somewhat better (48%) than the previous valve (Figure 8). In addition, more than half of the respondents (54%) said the valve actually cleans the dishes in *less* time than their previous valve. Only 19% of the respondents said the efficient valve takes more time.

In addition, the vast majority of respondents are either extremely (53%) or somewhat satisfied (39%) with the efficient PRSV (Figure 9). Respondents reported:

> *"I love it. It works much better, and we do not get wet like we did when using the old sprayer."*
>
> *"Love it. Works better and has way more pressure."*
>
> *"This spray valve cuts like a knife, much better than previous valve."*
>
> *"These are my favorite spray valves I have used . . . they work way better than any one I have tried before."*
>
> *"We love it; it works far better than our old one."*
>
> *"It's nice, it didn't take long . . . and all of our dishwashers love it."*
>
> *"Really like it. It works better and faster – more pressure. Thanks!"*
>
> *"Half of the dishwashers love it and half don't . . . . I like it though. The others probably just don't realize if you bring the dishes closer to the spray valve it works better."*

Only a few respondents were dissatisfied with the new PRSV, and these concerns centered around problems with perceptions of a weaker flow and longer washing times:

> *"We want our old one back. We have such a high volume of dishes to do and it really doesn't keep up"*
>
> *"It's OK . . . . It's just really weak compared to the old one."*
>
> *"The pressure just isn't as high as we would like it to be. Now we briefly hand wash dishes before using the spray equipment . . . . It's just not as powerful as the old head, but we still like them."*

These findings confirm the sentiment of Program staff, who indicated that it is extremely important that kitchen staff be trained on proper usage of the new spray valve. The efficient spray valve outputs a "sharper" spray using far less volume than the older valves, and must be used in much closer proximity to the dishes than before. Most workers, if properly trained on its use, find the PRSV superior to the old valve.

Figure 8. Comparison to Previous Spray Valve

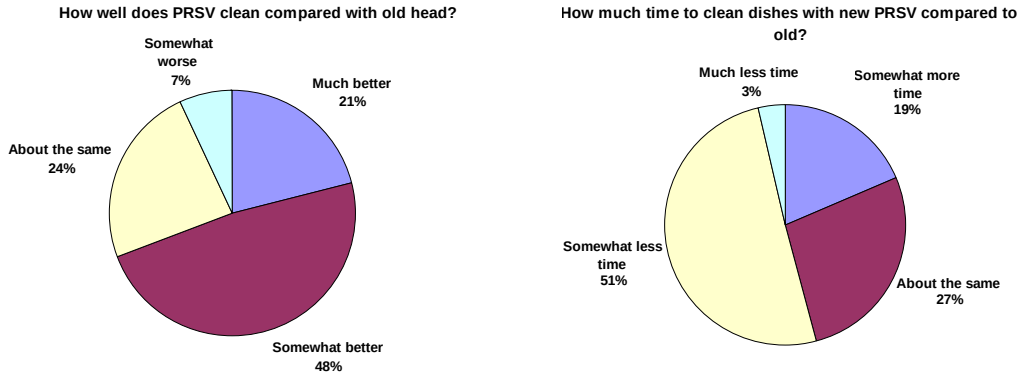
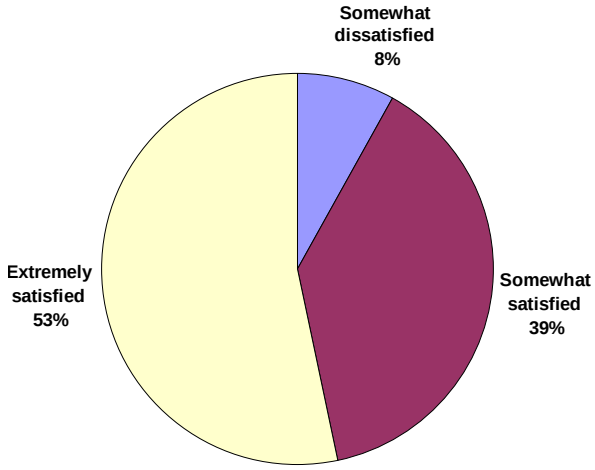


Figure 9. Overall Satisfaction with the PRSV



Freeridership and Spillover

The SmartRinse Participant survey also explored the likelihood that the efficient PRSVs would have been installed in absence of the Program (freeridership) and what, if any, additional savings might have occurred as a result of the Program (spillover, or market effects).

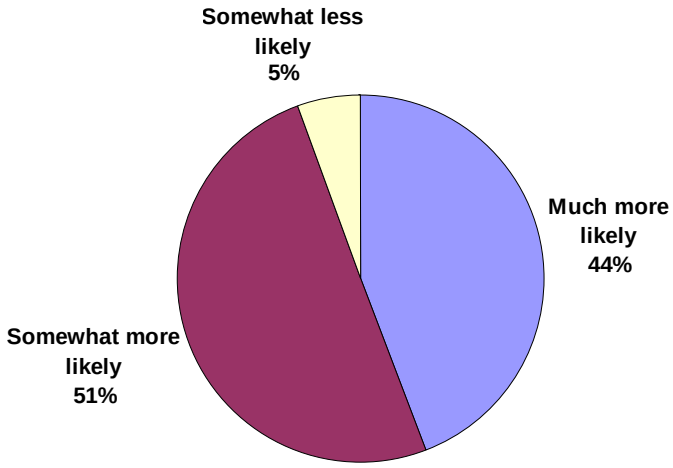
In terms of freeridership, all participants stated that they were very unlikely (98%) or somewhat unlikely (2%) to have installed to have installed the new energy efficient PRSV if the Program had not been available to them. When asked why they wouldn't have installed the new PRSV, respondents generally reported that they hadn't heard of it (62%) or that they were too busy to look into it (19%). Freeridership, therefore, is minimal to non-existent.

There was also little evidence of spillover from the survey: no respondents reported installing any additional non-Program efficient PRSVs or taking any other actions resulting from the Program to save energy. There are, however, at least two reasons for the lack of spillover:

- The Program practices an aggressive "no valve left behind" policy so that all PRSVs at each participant site receive retrofits.
- Field staff pursue referrals to additional sites so that participants with multiple sites (e.g., a chain/franchise restaurant with multiple locations but a single owner or manager) is likely to have all sites participate in the Program.

Despite the apparent lack of spillover, the Program was successful in educating customers about energy efficiency programs and raising their interest in future programs. For example, 44% of the respondents said they are much more likely to take advantage of other energy efficiency programs in the future (Figure 10).

Figure 10. Likelihood of Participating in Future Energy Efficiency Programs



Additional Comments

Respondents were asked to share any additional thoughts they had regarding the SmartRinse Program. Interestingly, a number of respondents focused on the water savings, apparently not aware that the Program was developed with the primary goal of saving energy. Respondents reported:

"Really appreciate opportunity to participate in program and conserve water."

"Glad to know somebody is working on conserving water in practical ways."

"Anything that conserves water, saves us money . . . we like."

In general respondents had overall praise for the SmartRinse Program. Typical comments included:

"Appreciate the program. Glad to know the public's money is being used wisely."

"The installation was very professional."

"We are very pleased with every aspect of the program."

3. Installation Verification

One important goal of Quantec's process evaluation was to verify that the efficient PRSVs were installed and operating as predicted under the *ex ante* assumptions. This chapter describes the site visit activities conducted to complete this task.

Installation Verification Methodology

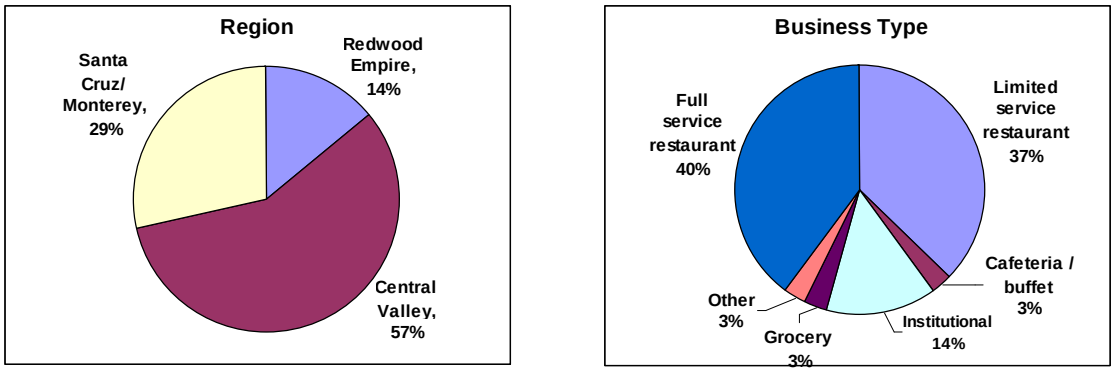
Sample Size

The California Public Utilities Commission requested evaluation estimates with a 90% confidence level and 10% precision (90/10), requiring a sample size of 42 site visits.[4]

Sample Selection and Stratification

To accurately reflect the geographic and business diversity of the Program's participants, Quantec implemented a stratified random-sampling approach to select participants for site visits. A total of 42 site visits, with 59 reported PRSV installations, were conducted using a random sampling approach from the combination of the three broad geographic regions (the Redwood Empire, Central Valley, and Santa Cruz/Monterey) and the seven business types (cafeteria/buffet, central food service, full service restaurant, grocery, institutional, limited service restaurant, and other). The goal was that the final sample size would approximate the mix of participants by both region and business type.[5] As shown in Figure 11, the distributions do not differ significantly from the population of participants (Figure 2).

Figure 11. Site Visit Participants by Region and Business Type (n=42)



[4] The sample size calculations assume a binomial distribution (pass/fail) with an 80% probability that the PRSV is installed and operating properly and a population of 2,500. Note that 80% was selected because of the high retention rates of the equipment installed through the Ecology Action RightLights Program (over 95% installed and operating properly) and the fact that the old PRSV was removed from the site. The population of 2,500 reflects the population at the time of the site visits.

[5] The sample was also selected to supplement on-site visits conducted by both PG&E and Ecology Action.

Scheduling Appointments

Quantec conducted the site visits between August 22 and 26, 2005. For most participants, it was unnecessary to schedule site visits in advance and we were able to gain customer approval and cooperation in person at the time of the site visit. In addition, the flexibility of a walk-in approach allowed Quantec to cost effectively visit sites geographically clustered in commercial districts within the Program area.

Site Visit Protocol

Quantec prepared a site visit worksheet (presented in Appendix A) and examined a number of items, including:

- Are the efficient PRSVs properly installed and functioning?
- For measures no longer in place, when were they removed? What were the primary reasons?

A number of participants requested that the Quantec inspector not enter the kitchen. To minimize potential non-response bias, the Quantec inspector, if possible, stood outside the kitchen and asked the PRSV operator to hold up the valve for him to confirm that it was in place and then to operate the valve.

Installation Verification Findings

Of the 42 sites visited, 34 (representing 81% of the inspected participants and 78% of the inspected valves) had Program-installed PRSVs that were in place and operating properly. The PRSVs that were not installed and operating properly fell into two strata:

- Three sites (with one valve per site) recalled receiving the Program PRSV but replaced it with a standard efficiency valve because the efficient spray valve broke[6]
- Five sites in the Central Valley (representing ten reported PRSVs) recalled neither participating in the SmartRinse Program nor receiving an efficient PRSV

Following the site visits, the detailed information from these sites was shared with Ecology Action, who reported that all sites are left with warranty information in a waterproof envelope to stay dry, but the sites with broken valves may have discarded or misplaced the information.

Investigation by Ecology Action into the second set of sites revealed that one installer failed to complete all of his reported installations. Ecology Action took a number of immediate steps to respond to this finding:

- The company conducted a full reconciliation on every site this installer reported to the Program. Every site was telephoned, and sites where there was any uncertainty regarding

[6] One efficient PRSV was reportedly broken due to abuse by dishwashers frustrated with the performance of the valve.

the installation were visited in-person. Sites with an inefficient PRSV were retrofitted with an efficient valve wherever possible.

- Payment to installers was not completed until paperwork could be matched to the older, inefficient valves that were collected at the time of participation (thus removing the potential for intentional over-reporting).

After its investigation was completed, Ecology Action found that the installer in question had only installed 16% of the PRSVs that he had reported. No other problems were found for the other ten installers. Consequently, Ecology Action removed the remaining 84% of that installer's valves from the database, resulting in an adjusted Program total of 4,237 PRSVs overall. Ecology Action submitted its results to PG&E, who subsequently approved Ecology Action's investigation methodology and findings. We note that even if 100% of the reported valves from this installer were removed from the final total, the SmartRinse Program still exceeded its performance goals by a wide margin.

Retention Rate

Removing the six sites that were eliminated from the population due to the installer that failed to complete all the reported installations leaves a total of 37 valid site visits. As noted above, three of these sites had replaced the efficient PRSV with a standard model, leaving a total of 34 of the remaining 37 sites, or 46 of the 49 inspected valves, installed and operating properly (Table 2). This translates into a first year retention rate of 93.9%.

Table 2. First Year Retention Rate

	Number of Sites	Number of Valves
Total site visits	42	59
Removed due to installer that failed to complete installations	5	10
Total valid site visits	37	49
Efficient PRSV still installed and operating	34	46
Retention rate	**91.9%**	**93.9%**

4. Metering Study

The final task in the evaluation of the SmartRinse Program was an assessment of the energy savings resulting from the efficient PRSVs. Flow meters were installed on a sample of 15 participant sites. The detailed methodology and findings are presented below.

Metering Study Methodology

Sampling

Participants responding to the process evaluation telephone survey were invited to participate in the metering study. To streamline the installation process, the eligible sample was limited to participants in the Santa Cruz, Salinas, and Monterey Bay area. Furthermore, to minimize potential variance in the data (due to the small sample size) the study was also limited to small to medium full-service restaurants.

Metering

A total of 15 restaurants were selected from the eligible sample and visited by Aquacraft, Inc., in September 2005 in order to begin the data collection process. Data were collected using a small turbine water meter that provided one pulse per gallon. Prior to installation, the meters were all tested against a standard utility grade meter (5/8 inch Badger) and a known volume of water to insure that they were accurate over a range both flow rates and durations that we anticipated they would face in the field. A typical installation can be seen in Figure 12, which shows how the existing 5/8 inch riser was replaced with a meter installation. The existing risers were saved for installation at the end of the study. The figure also shows a black wire coming from the meter and heading down to where a data logger was installed to record the time stamp of each gallon of flow.

Figure 12. Pulse-Generating Meter Installed on Riser to PRSV

Figure 13 shows another typical installation in which the data logger was installed above the counter. The loggers were housed in waterproof cases; a close up of a logger and case is shown in Figure 14. These installations obtained measurements on the total water used by the sprayers, and excluded any water that might have been used from the faucet, which are often attached to the fixture for sink filling.

Figure 13. Meter Installation Showing Data Logger Case

Figure 14. Close-Up of Water Logger in Case

Temperature data were obtained from the cold and hot water lines in order to allow the energy savings to be determined based the typical mixing rate of hot and cold at the site. Temperature changes and measured volumes were used to calculate the energy use with the new and old

sprayers, as well as the energy savings that could be attributed to the Program replacements in these sites.

There was also concern that, in a small sample of sites, changes in the number of meals served during either the pre or post period could either mask or exaggerate savings attributed to the sprayers. For example, if for some reason the activity at a restaurant doubled during the new sprayer metering period compared to business during the old sprayer metering period (i.e., a seasonal effect), the site's water use would appear to increase even if the use per load of dishes actually decreased. In order to adjust for this, separate data loggers were installed on the motors of the dishwashers on which the sprayers were used. Since not all of the sprayers were linked to dishwashers, only ten of these were installed. The motor loggers recorded whether the motors were on or off on a real-time basis during the logging period. This allows the water use of the sprayers to be normalized in terms of gallons per minute of dishwasher operation. This turned out to be an important adjustment as the data showed that there was more dishwasher activity during the new sprayer period, which masked a significant amount of savings. This is discussed in the Results section.

Data were collected from each site in successive four-week increments: first with the high efficiency sprayers in place, next with the old sprayers reinstalled (which had been stored by Ecology Action for this purpose), and a third time to pick up missing data with either the old or new sprayer as needed.[7] A total of four trips were made to the area, with the final data collected in November 2005.

The water and motor data were downloaded into Excel spreadsheets and disaggregated into daily tables. The water data from the loggers were verified against the volume recorded by the meters at the time of downloading. Using data loggers in this way allowed each site to provide 28 separate days of data instead of a single meter reading, which allowed both means and confidence intervals to be calculated. It also allowed savings to be calculated on a daily basis by pairing the data on the basis of the day of the week. Where available, the motor data were used to eliminate the affects of changes in kitchen use during the two periods. The tables of daily water use were used to perform statistical analyses of the water use. Due to a combination of reasons, from equipment failure to restaurants going out of business, the final data set included only ten out of the 15 sites, but – because of the data loggers – this included a total of 279 days of paired data with old and new sprayers.

Estimating Energy Savings

Energy savings was calculated using the following equation and inputs:

$$AEU = [(AMWU * Density * SH * (MWT - CWST)] / [TBTU * Efficiency]$$

[7] This post/pre order was instituted because participants needed to be recruited into the metering portion of the study, and all participants already had the efficient spray valve installed. A tight timeline for the Program implementation prevented the possibility of withholding the installation of the efficient valve until after the initial metering was complete. There is potential bias due to the possibility of changed behavior following the experience with the efficient spray valve, described below in more detail.

Table 3. Data Sources, Descriptions

Variable	Description	Source
AEU	Annual energy use	Estimated from equation
AMWU	Annual mixed water use	Flow meters
Density	Density (8.29 lb/gallon)	Assumed
SH	Specific heat (1.0 Btu/lb/°F)	Assumed
MWT	Mixed water temperature for spray head (°F)	Measured during site visit (avg=125° Fahrenheit)
CWST	Average cold water supply temperature (°F)	Measured during site visit (avg=70° Fahrenheit)
TBTU	Btu/Therm ratio (100,000)	Assumed
Efficiency	Gas hot water efficiency	Assumed to be 70%

Metering Study Findings

Water and Energy Savings

As shown in Table 4, the metering study found substantial water and energy savings among the participating sites: the average water savings was 13,052 gallons/year per site (or 36 gallons/day), and the average gas savings was 85 therms/year. As shown in Appendix B, the savings were adjusted based on the difference in dishwasher use between the metering periods. Without this adjustment, energy savings were 76 therms/year, or a 31% reduction from the inefficient PRSV. Even with this adjustment, however, the water and energy savings varied greatly by site, from a high of 53% to no savings at all at one site.

Table 4. Average Water and Gas Savings per Metered Site

	Pre-Program PRSV	High Efficiency PRSV*	Unit Savings (Pre-Post)	Percentage Savings
Average Water Use (Gallons/year per participant)	38,401	25,348	13,052	34%
Average Energy Use (Therms/year per participant)	250	165	85	34%

*Savings are adjusted for volume differences between metering periods based on changes in dishwasher use.

Comparison to Deemed Values and Other Studies

As shown in Table 5, the water and demand savings vary greatly depending on the study. The savings are highest for a 2002-2003 study conducted for the California Urban Water Conservation Council (CUWCC) Rinse and Save Program, which found water savings of 137 gallons/day, unadjusted energy savings of 252 therms/year, and adjusted energy savings of 335 therms/year. Note that this is the only study that field-metered only the new valve, applying an adjustment based on lab flow rates and assumed water pressure to estimate water usage with the original spray valve. This was the deemed savings value used by SmartRinse, since this CUWCC study had comprised the most recent and best data available at the time.

Two more recent studies estimated substantially lower water and energy savings. A 2004 study by the Region of Waterloo analyzed data from six restaurants and estimated that efficient PRSVs save 65 gallons/day and 126 therms/year. This study used a run-time meter for both the pre- and post-retrofit periods, estimating water and energy use by making assumptions about the flow rate and water pressure.

The most recent study from the CUWCC (October 2005), based on metering eight restaurants, estimated savings very similar to the Waterloo study: 63 gallons/day and 134 therms/year. This study used the same methodology as the current study for Ecology Action.

Based on careful review of these studies and discussions with Ecology Action, there may be a few reasons for the lower savings presented in the current study:

- ***There may be a seasonal effect that is not fully being captured by the dishwasher metering.*** The initial metering period took place in August (the peak tourist season in this area) and included the efficient PRSV. The metering of the older spray valve took place in the fall (following the peak season), so there could have been less use of the valve due to seasonal reductions in customer traffic. At the five sites where dishwasher data was used to normalize usage (based on number of dishwasher loads), savings increased by 36%. However, due to the layout of the kitchen, the other five sites were unable to have their dishwashers metered. Although not all of these sites would be expected to have seasonal effects (e.g., a breakfast eatery popular with locals, far from the tourist districts), there might be some effect. Applying the 36% increase observed in the sites where dishwater usage data were available to all of the sites would increase the savings from 85 therms/year to 104 therms/year.
- ***Input water temperature may not reflect the annual average***. The average annual cold water temperature may be lower, particularly for districts that are fed from snowmelt-fed reservoirs.[8] The measurements for this study were taken in the summer/fall, when cold water temperatures will be at the highest (warmest) level for the year. The difference of the average measured mixed water temperature (125° Fahrenheit) compared to the average measured cold water (70° Fahrenheit) was 55°.[9] Assuming a five degree drop in the average annual cold water temperature (to 65°) and no other additional changes, the estimated energy savings would increase to 93 therms/year.
- ***Small sample sizes.*** Due to budget limitations, all of these studies are based on extremely small sample sizes, and are, therefore, prone to the disproportional influence of outliers. For example, in the most recent study for the CUWCC, one of the eight sites had estimated savings of 932 therms/year. Removing this site drops the study's average savings from 134 therms/year to only 58 therms/year.
- ***Possible changes in behavior due to the post/pre methodology of the study***. As noted above, due to the aggressive timeline and immediate nature of the Program it was not possible to meter sites that did not have the efficient PRSV installed. Instead, the first metering period included the efficient valve (essentially a post-retrofit measurement),

[8] The Central Valley, in particular, has a number of districts served by snowmelt from the Sierra Nevada Mountains.

[9] The temperature difference in the 2002-2003 CUWCC study was 52.5°, slightly lower.

while the second metering period included the re-installed previous PRSV (essentially a pre-retrofit measurement). It is possible that the users learned new spraying techniques that were then applied to the old valves.[10]

Table 5. Comparison of Methodology and Savings Estimates from PRSV Studies

	CUWCC Rinse & Save (2002-2003)	Region of Waterloo (2004)	CUWCC Rinse & Save (2005)[11]	SmartRinse (2005)
Comparison of Methods				
Sample size Initial Final	 19 19	 10 6	 16 14	 15 10
Business types	Restaurants	Restaurants	8 restaurants, 6 groceries	Restaurants
Methodology	Metered water use by new valve only; Used ratio of old/new valve flow-rates to compute water old valve would use	Metered old/new valve duration (on/off) Multiplied duration by (max.) flow-rate to get water use	Metered water use by old and new valves	Metered water use by old & new valves
Comparison of Savings				
Initial Savings Gallons/day Therms/year	 137 252	 49 95	 63 134	 32 76
Adjustments	Water supply temperature	Excluded four sites with high water pressure	None presented	Usage based on dishwasher use
Final Savings Gallons/day Therms/year	 137 335	 65 126	 63 134	 36 85
Percentage Savings Gallons of water	 34%	 43%	 46%	 34%

Sources:

"Evaluation, Measurement, and Verification Report for the CUWCC Pre-Rinse Spray Head Distribution Program," Prepared by SBW Consulting, Inc. and ASW Engineering Management Consultants for the California Urban Water Conservation Council, May 2004.

"Region of Waterloo Pre-Rinse Spray Valve Pilot Study Final Report," Prepared by Veritec Consulting, Inc., January 2005.

"Phase 2 of CUWCC Pre-Rinse Spray Valve Installation Program: EM&V DRAFT Interim Report - Round 2," Prepared by SBW Consulting, Inc., October 2005.

[10] Note the Food Service Technology Center (FSTC) performed testing on the "washing" effectiveness of the efficient pre-rinse heads and determined that the efficient heads may take 8% longer to clean a soiled plate, but the difference with the standard head was not statistically significant. Real-world differences, however, may result in learned behavior that does impact the length of time to clean a plate (i.e., the use of efficient PRSV makes dishwashers better and more efficient at their jobs).

[11] Note these are preliminary figures, and do not yet include a third round of metering. In addition, the savings numbers presented are based on restaurants only for comparative purposes with the other studies.

5. Conclusions and Recommendations

A summary of the most significant findings from the process evaluation, installation verification, and metering study are presented below, along with associated recommendations where applicable.

Lower energy bills/savings money are the primary drivers of Program participation. The Program materials clearly communicate these benefits and should continue to do so. Some respondents also expressed an interest in saving water, a message that might also resonate with potential participants in a state with a history of droughts.

Participants were extremely satisfied with the installation process. Every respondent reported that the installation was scheduled at a convenient time, the installer arrived on time, and the installation was completed in a reasonable amount of time. Considering the potentially chaotic pace of the restaurant business and the fear of businesses disruption, this is an outstanding accomplishment. Field staff are clearly fostering professional, well-managed customer relations.

The majority of customers are extremely satisfied with the new spray valves. More than two-thirds (69%) of the respondents said that the new valve cleans much better (21%) or somewhat better (48%) than the previous valve. Customer testimonials also clearly indicate that most participants think the new valve is superior to the previous valve, and Ecology Action should consider using these testimonials in materials and marketing these non-energy impacts to recruit additional participants.

There is little evidence of freeridership or spillover. Nearly all participants were either not aware of the efficient PRSV or had no time to investigate it without the Program. The thoroughness of the Program in retrofitting all possible spray valves, both at each location and any additional locations managed by participants, led to little evidence of spillover, although the Program may lead to participation in future efficiency programs by the participants.

The majority of spray valves are installed and operating properly. Only three of the 42 sites visited reported that the efficient spray valves were removed and replaced with standard valves. Ecology Action might want to consider sending a postcard to participants reminding them that if the valve breaks they will repair or replace it for no cost. There were also six sites that were reported (by one installer) but not installed; Ecology Action has put procedures in place to ensure that all reported installations are now actually completed. In total, 45 of the 48 efficient PRSVs from the valid site visits (excluding those that were adjusted because of the one installer that failed to complete his installations) were in place in operating properly, indicating a first year retention rate of 93.9%.

Estimated savings from the current study are 85 therms/year, well below the assumed savings of 335 therms/year per valve. The deemed savings are based on an earlier study that did not field-meter water use for both the existing and efficient PRSVs. Two additional studies provide support that the assumed savings value may be too high: one study estimated savings of 126 therms/year, and another estimates savings of 134 therms/year. Differences in study methodology, seasonal effects, input water temperatures, and small samples may all contribute to

these differences. However, there is ample evidence that the deemed savings of 335 therms/year is too high and should be reduced for future programs to, at most, 130 therms/year. Note also that these studies focus only on restaurants: only one study (the most recent CUWCC report) included groceries (6), and actually found little savings (5 therms/year) for these sites.

Appendix A. Participant Survey Instrument

INTRO

Hello, my name is _____. I'm calling on behalf of Ecology Action. We are following up with customers who received high-efficiency pre-rinse spray valve equipment recently as part of the SmartRinse Program [also known as RightLights]. Our records show that a representative visited your business in [MONTH] and installed [NUMBER] pre-rinse spray valve(s).

(If not certain, ask for alternative contact that may be familiar with the Program.)

A. Are you the person who worked with the SmartRinse Spray Valve Specialist?

Yes .....1 [GO TO INTRO]
No 0

B. When that person will be available? What is the best way to contact him/her?

_____

We are conducting a survey of customers who received high-efficiency pre-rinse spray valves, to learn about their experience with the SmartRinse Program. This information will help determine the energy savings achieved through the Program and improve similar publicly funded efforts to help small business customers like you. All information will remain confidential. IF NEEDED: This survey will take about 5-10 minutes.

C. Is this a good time to talk?

Yes .....1 [GO TO Q1]

No …….. 0 [Schedule callback]

BACKGROUND AND DECISION MAKING

1. First, I'd like to ask how you learned about the SmartRinse Program? [DO NOT READ, CHECK ALL THAT APPLY]

Walk in contact by technician..... 1
From a friend or business contact (word-of-mouth)..... 2
Other (Specify: _____) 3

2. Why did you decide to participate in the high-efficiency pre-rinse spray valve program? [DO NOT READ; CHECK ALL THAT APPLY]

To lower energy bills/save money/save energy 1
To understand more about how energy costs are determined..... 2
To get free spray valve equipment..... 3
A neighboring business or friend participated 4
A competing business participated 5
To help/improve the environment..... 6
Other (Specify:_____) 8

3. Did you have any concerns about participation in the program?

Yes …… 1
No…….. 0 [GO TO Q 5]

4. What were these concerns? [DO NOT READ; CHECK ALL THAT APPLY]

Time required to participate.....1
Not sure of energy savings.....2
Installation and maintenance new equipment 3
Performance of new equipment 4
Energy efficiency is not a priority 5
Negative experience with previous energy efficiency retrofits 6
Other (Specify:_____) 8

5. How clear was the information provided to you about the new equipment that was installed? Would you say it was:

Not at all clear 1
Somewhat clear 2
Very clear.....3
Don't know/don't remember.....9 (DO NOT READ)

6. How important was the information about the new equipment in helping you decide to install the efficient spray valves? Would you say it was:

Not at all important 1
Somewhat important 2
Very important 3
Don't know/don't remember.....9 (DO NOT READ)

7. How clear was the information on the potential dollar savings?

Not at all clear.....1
Somewhat clear.....2
Very clear.....3
Don't know/don't remember.....9 (DO NOT READ)

8. How important was the information about the potential dollar savings in helping you decide to install the efficient spray valves? Would you say it was:

Not at all important.....1
Somewhat important.....2
Very important 3
Don't know/don't remember.....9 (DO NOT READ)

9. Overall, how would you rate the process for signing up to participate in the program? Would you say it was:

Very simple to sign up.....1 [GO TO Q 11]
Somewhat simple to sign up .....2 [GO TO Q 11]
Not at all simple to sign up 3

10. What difficulties did you encounter in signing up?

_____

_____

INSTALLATION

Now, I would like to ask you about the installation of the high-efficiency pre-rinse spray equipment.

11. Was the installation of equipment scheduled at time that was convenient to you?

Yes 1
No 0
Don't know/Don't remember.....9

12. Did the installer complete the installation in a reasonable length of time?

Yes 1
No 0
Don't know/Don't remember.....9

13. Did the installer arrive at the agreed upon time?

Yes 1
No 0
Not applicable /Drop in.....2
Don't know/Don't remember.....9

RETENTION AND SATISFACTION

I would like to ask you a few questions about the performance of the spray valve and your satisfaction with the equipment and program thus far.

14. Is the high-efficiency pre-rinse spray valve installed still operating in your business at this time?

Yes .....1 [GO TO Q16]
No 0
DK.....9 [GO TO Q16]

15. *For those not operating:* Why is this equipment not operating at this time?

_____

_____

16. How satisfied have you been with the high-efficiency pre-rinse spray valves installed in your business? Would you say have been:

Extremely satisfied .....4 [GO TO Q18]
Somewhat satisfied .....3 [GO TO Q18]
Somewhat dissatisfied 2
Extremely dissatisfied 1

17. Why are you dissatisfied with your high-efficiency pre-rinse spray valve? [DO NOT READ LIST; ENTER ALL THAT APPLY]

Weak flow 1
Takes more time to wash 2
Spray is too wide for sink 3
Employees tend to use incorrectly 4
Other 8
(Specify:_____)

18. How well does the high-efficiency spray valve clean dishes compared to the old head? Would you say …

Much better 1
Somewhat better.....2
About the same 3
Somewhat worse.....4
Much worse.....5
Don't know/too soon to tell 9

19. How much time does it take to clean dishes with the high-efficiency spray valve compared to the old unit? Would you say …

Much more time.....1
Somewhat more time 2
About the same 3
Somewhat less time.....4
Much less time 5
Don't know/too soon to tell 9

PROGRAM INFLUENCE

20. What is the likelihood that you would have installed a high efficiency spray valve in the next year if this program had not been available? Would you say it was [PROBE FOR QUANTITY AND EFFICIENCY LEVELS]:

Very likely .....1 [GO TO Q21]
Somewhat likely.....2 [GO TO Q21]
Somewhat unlikely.....3 [ASK Q21 AND Q22]
Very unlikely .....4 [GO TO Q22]
Don't know/not sure .....9 [GO TO Q22]

21. [IF VERY LIKELY, SOMEWHAT LIKELY, OR SOMEWHAT UNLIKELY THEN ASK RESPONDENT TO EXPLAIN…] What measures were you planning to install, and when? [PROBE FOR QUANTITY, EFFICIENCY LEVELS, AND TIMING]

_____
_____
_____

22. [IF SOMEWHAT UNLIKELY, VERY UNLIKELY, OR DK/NOT SURE] Why do you think you would not have installed an efficient spray valve? [DO NOT READ LIST; ENTER ALL THAT APPLY]

Probably would not have heard of the efficient valves… …1
Efficient spray valve is too expensive .....……2
Insufficient savings benefits .....……3
Incompatible plumbing .....……4
Too busy to look into it.....……5
Energy is not a priority .....……6
Other (specify:_____)……...…8
Don't know .....……..…..9

23. Did you install any additional efficient spray valves, other than the ones supplied by the program, at the participating site or other sites that you own or manage?

Yes .....……1
No .....……0 [SKIP TO Q26]
DK .....……9 [SKIP TO Q26]

24. How many additional efficient spray valves did you install? At what location(s)?

_____
_____
_____

25. Did your participation in the SmartRinse program somehow influence you decision to install these additional measures? [IF YES] Please explain how the program influenced you.

_____
_____

26. As a result of your experience with the SmartRinse Program, are you more or less likely to take advantage of other energy efficiency programs in the future?

Much more likely.....1
Somewhat more likely 2
Somewhat less likely.....3
Much less likely 4
Don't know/not sure 9

ESTIMATED SAVINGS

27. Have you noticed any savings on your utility bill (compared to the same period in the year before your spray valve upgrade)?

Yes 1
No .....0 [GO TO Q29]
Too soon to tell .....2 [GO TO Q29]
Don't know/not sure [DO NOT READ].....9 [GO TO Q29]

28. Are these savings greater than, equal to, or less than what you had expected?

Greater than expected 1
Equal to expected.....2
Less than expected 3
Too soon to tell 8
Don't know/not sure 9

29. Do you have any additional comments or suggestions about the SmartRinse Program?

_____

_____

If the business is classified as a "full-service restaurant" and is in Santa Cruz or Monterey counties… [We need to recruit 30 for the metering portion – we will install at 15 sites]

Finally, as part of the evaluation of the SmartRinse program, we are conducting a study to verify the savings achieved by the program. This involves having a professional install a meter to measure the water usage of the old and new spray valves for four weeks each. Would you be interested in participating in this study?

Yes 1
No 0

If "Yes" or "Maybe":

Great! Here's how the study works: Someone from the contractor company, Aquacraft, will call you within the next 2 weeks to schedule the installation of the meter. First, the meter will be installed to monitor the *new* spray valve. After four weeks, the *old* meter will be re-installed to measure its water usage. After four more weeks, we'll come out to re-install the new meter.

We are metering a limited number of sites, and we're asking a few more people than we actually need– in case someone needs to cancel. So there is a chance that you may not actually have the meter installed. But we will be scheduling the visits within the next 2 weeks.

Those are all the questions I have for you today. I would like to thank you for your time and for participating in the SmartRinse Program.

Appendix B. Detailed Savings Calculations

Table 6. Expected Water and Energy Savings per Site, without Dishwasher Normalization

Site #	Old valve					New Valve WITHOUT dishwasher normalization					Annual Water Savings	Annual Energy Savings (Therms)	Annual Energy Savings (%)	Daily Water Savings
	Water use (metered)	No. metered days	Daily water use (gallons/ day)	Annual water usage (gallons/ year)	Annual Energy Use (Therms)	Water use (metered)	No. metered days	Daily water use (gallons/d ay)	Annual water usage (gallons/ year)	Annual Energy Use (Therms)				
1	2,240	26	86.2	31,446	205	1,131	26	43.5	15,878	103	15,569	101	50%	42.7
2	2,600	19	136.8	49,947	325	1,891	19	99.5	36,327	237	13,620	89	27%	37.3
3	3,355	28	119.8	43,735	285	**2,155**	28	77.0	28,092	183	15,643	102	36%	42.9
4	4,948	27	183.3	66,890	436	2,384	27	88.3	32,228	210	34,661	226	52%	95.0
5	2,028	27	75.1	27,416	179	1,280	27	47.4	17,304	113	10,112	66	37%	27.7
6	1,282	28	45.8	16,712	109	**1,707**	28	61.0	22,252	145	-5,540	-36	-33%	-15.2
7	3,603	28	128.7	46,968	306	3,104	28	110.9	40,463	264	6,505	42	14%	17.8
8	1,302	26	50.1	18,278	119	**894**	26	34.4	12,550	82	5,728	37	31%	15.7
9	984	27	36.4	13,302	87	**852**	27	31.6	11,518	75	1,784	12	13%	4.9
10	3,798	20	189.9	69,314	451	**2,749**	20	137.5	50,169	327	19,144	125	28%	52.5
				384,007	***2,501***				***266,781***	***1,738***	***117,226***	***764***		
			105.2	***38,401***	***250***			*73.1*	***26,678***	***174***	***11,723***	***76***	*31%*	***32.1***

Table 7. Expected Water and Energy Savings per Site, with Dishwasher Normalization

Site #	Old valve					New Valve WITH dishwasher normalization								
	Water use (metered)	No. metered days	Daily water use (gallons/ day)	Annual water usage (gallons/ year)	Annual Energy Use (Therms)	Water use (metered)	No. metered days	Daily water use (gallons/ day)	Annual water usage (gallons/y ear)	Annual Energy Use (Therms)	Annual Water Savings	Annual Energy Savings (Therms)	Annual Energy Savings (%)	Daily Water Savings
1	2,240	26	86.2	31,446	205	1,131	26	43.5	15,878	103	15,569	101	50%	42.7
2	2,600	19	136.8	49,947	325	1,891	19	99.5	36,327	237	13,620	89	27%	37.3
3	3,355	28	119.8	43,735	285	1,900	28	67.8	24,764	161	18,971	124	43%	52.0
4	4,948	27	183.3	66,890	436	2,384	27	88.3	32,228	210	34,661	226	52%	95.0
5	2,028	27	75.1	27,416	179	1,280	27	47.4	17,304	113	10,112	66	37%	27.7
6	1,282	28	45.8	16,712	109	1,303	28	46.5	16,985	111	-273	-2	-2%	-0.7
7	3,603	28	128.7	46,968	306	3,104	28	110.9	40,463	264	6,505	42	14%	17.8
8	1,302	26	50.1	18,278	119	611	26	23.5	8,574	56	9,704	63	53%	26.6
9	984	27	36.4	13,302	87	763	27	28.3	10,316	67	2,986	19	22%	8.2
10	3,798	20	189.9	69,314	451	2,775	20	138.8	50,646	330	18,668	122	27%	51.1
				384,007	***2,501***				***253,484***	***1,651***	***130,523***	***850***		
			105.2	***38,401***	***250***			*69.4*	***25,348***	***165***	***13,052***	***85***	***34%***	***35.8***