AB 970, AB 29X and SB 5X PEAK LOAD REDUCTION PROGRAM

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Section 1 Agricultural Peak Load Reduction – 2003 Supplemental Report

1.1 BACKGROUND OF PROGRAM ELEMENT

The Agricultural program element, Harvest the Rewards Program, is funded by SB 5X and provides incentives in the form of grants to the agricultural industry for efficiency and load management measures that reduce peak period electricity demand. The program also provides incentives for retrofitting equipment to burn alternative fuels. The total amount of funding awarded for this program element is $39.7 million. Additional contracts totaling $3.1 million were awarded for application assistance, program evaluation by Nexant, and marketing efforts. Goals for the Agricultural program element were initially set at 105 MW of peak period demand savings, and funding at $75 million. Funding for the program was revised to the current $39.7 million, with savings goals for the contract holders listed below at a total of 86.65 MW. The program is accepting project applications through December 31, 2003.

Major funding for the program element is distributed through two program administrators: the Center for Irrigation Technology (CIT), a division of the California Agricultural Technology Institute at California State University, Fresno; and the Irrigation Training and Research Center (ITRC) at California State University, San Luis Obispo.

The Energy Commission also administers direct contracts with the following organizations:

- Onsite Energy Corporation
- Inland Empire Utilities Agency
- Emeters
- San Diego Gas and Electric Company
- Southern California Edison
- Southern California Public Power Authority
- California Trade and Commerce Agency
- Western United Research Development, Inc.

Nexant is responsible for verifying the savings reported by the two administrators and by Onsite Energy Corporation. Nexant is not responsible for verifying the savings reported by Inland Empire Utilities Agency, but we do report on their project activity. Nexant is not responsible for the evaluation of the other six direct contractors, and their projects are not discussed in this report.

The two program administrators—CIT and ITRC—oversee the implementation of projects that fall into the following four program categories:

1. Purchase and installation of high efficiency electrical equipment and the implementation of load-shifting measures; also conversion of electrically powered agricultural pumps to natural gas engine-driven pumps.
2. Testing of the flow and efficiency of irrigation pumps and the retrofit or repair of such pumps.
3. Installation of advanced metering and telemetry systems that enable facilities to participate in emergency demand response programs.
4. Retrofit of natural gas powered equipment so that the equipment is capable of burning alternative fuels.

Under a direct contract with the Energy Commission, Onsite Energy Corporation has contracted to provide 8 MW of demand savings by implementing load reduction projects that target cooling and refrigeration or process loads. Also under direct contract with the Energy Commission, Inland Empire Utilities Agency will add 1.75 MW of generation capacity by implementing two biogas generation projects.

The Agricultural program element defines peak load reductions as the average load reduction during the hours from 12 p.m. to 6 p.m. on weekdays from June 1 to September 30.

1.2 STATUS OF PROGRAM ELEMENT

1.2.1 Snapshot of Element Status as of December 31, 2002

As of the December 31, 2002 Annual Report, the two independent administrators—CIT and ITRC—had approved applications for 837 projects representing a mix of demand savings and potential demand reductions totaling 78.9 MW.[1] The administrators at the time reported that 529 of these projects, representing 49.9 MW of peak load reductions, were complete. At that time, Nexant's verification of the reported savings was still ongoing, pending project completions and receipt of billing data for a full peak period.

Reports received from the two administrators now indicate a total demand savings of 66.0 MW verified from Category 1 and Category 3 projects, and projects implemented under the Onsite Energy Company contract. A total of 1818 individual projects have now been implemented under the three contracts for a total incentive grant amount of $13,068,590.

Table 1-1 summarizes the program activity of the two administrators, Onsite Energy Corporation, and Inland Empire Utilities Agency. The data presented in this table is from weekly updates provided by the administrators reports provided by Onsite Energy Corporation, and personal conversations with the Inland Empire Utility Agency project manager.

[1] Projects in category 1 (high efficiency equipment installations) result in sustained demand savings; projects in category 3 (metering and telemetry installations), however, result in *potential* demand reductions that are realized only during emergency electricity shortages. Projects in category 2 (pump repair and retrofit) may result in energy and demand savings, but savings are not being reported for such projects at this time. Retrofits that enable equipment to burn an alternative fuel do not result in demand savings, but they do provide facility owners some insulation from price fluctuations in the natural gas market.

Table 1-1: Program Status by Administrator and Project Type as of December 31, 2002

Administrator (or Contractor)	Project Type and Category	Approved Projects		Completed Projects	
		Number	Estimated Savings (MW)	Number	Reported Savings (MW)
Center for Irrigation Technology (CIT) Irrigation Technology Resource Center (ITRC)	High-efficiency equip. installation (1)	193	27.91	193	27.32
	Repair/retrofit of irrigation pumps (2)	747	NA	673	NA
	Metering/telemetry equip. installation (3)	18	50.22	18	29.93
	Retrofit of fuel-burning equipment (4)	20	NA	20	NA
[1]Inland Empire Utilities Agency	Generation	2	1.7	2	0.75
[2]Onsite Energy Corporation	Efficiency and load management	43	8.88	43[2]	8.80
Totals		**1023**	**88.71MW**	**1023**	**66.80MW**

[1]Demand Savings reported for Inland Empire Utilities Agency is not included in the Totals shown above.

[2]Onsite is limited to $2,000,000 in incentive payments. Some projects above the limit may be moved to another program.

Onsite Energy Company submitted final reports for several of their projects, including a multi site project for P&E Cold Storage in the fall of 2004. Demand savings were verified for each project based on the agreed method for M&V. The Onsite contract limits the grant incentive payments to a maximum of $2,000,000; due to the over-performance of some of the projects, Onsite may remove some projects from this contract and move them to another program.

The Inland Empire Utility Agency reported that installation and commissioning of their two bio-waste projects were completed in May 2002. The second phase of the project was predicted to result in increased generation of methane and generation capacity to 1.75 MW.

1.2.2 Project Completion Status

The two independent program administrators (CIT and ITRC) have pre-approved a total of 191 Category 1 projects (high efficiency equipment installations) with a total administrator verified demand savings of 27.32 MW. As of the last report from the CIT administrator, only 16 of the 18 projects were not verified for kW demand savings; many of these projects received late in 2003. Administrators have verified peak demand savings of 10.7 MW for completed Category 1 projects. In addition to the high efficiency electrical equipment projects reported under Category 1, ITRC has reported that two of the three natural gas engine projects were completed as of 12/31/03, the date of the last report update. The totals shown above include the two completed natural gas engine projects in the Category 1 totals for savings and incentive grants.

A total of eighteen Category 3 projects were approved with an estimated demand savings of 50.2 MW, the great majority of which was approved by the ITRC administrator. Final verification of the demand savings resulted in 29.93 MW in load reduction.

As of December 31, 2003 the two program administrators had stopped accepting new project applications, although the report from CIT does indicate a few were received in early January of 2004. Project totals shown in Table 1 above

The administrators reported that a total of 747 Category 2 projects (pump repair or retrofit) had been accepted by year-end. The 62 ITRC pre-approved grant applications are for water districts or agencies, many of which have multiple pumps under a single contract. A total of 72 individual pump repair or retrofit projects have been pre-approved by the ITRC administrator, but had not received final grant payments as of the 12/31/03 report. The CIT administrators more recent report indicates there are 16 of the 429 pump repair projects have not received final grant payments.

Of the original 57 Category 4 project submittals (retrofit of gas-burning equipment) CIT received during the early part of the program has resulted in 20 projects that have been completed. The relatively high rate of project withdrawals was likely due to financing difficulties and the price difference between other alternative fuels such as yellow grease and natural gas or both, especially during the 2001 and 2002 time-period when most of the Category 4 project submittals were received. The program was instituted during a peak in natural gas prices; the large drop in natural gas prices from June 2001 through 2003 is likely a significant factor leading to decisions to abandon alternative fuel projects.

Onsite Energy Corporation contracted directly with the Energy Commission to deliver 8 MW of peak period demand savings by delivering energy efficiency and load shifting projects at food processing facilities. As of October 2004 Onsite had completed 42 measures at 23 project sits. Nexant completed post-installation site inspections at each of the project sites for all of the measures. In some cases Nexant also performed pre-installation site inspections, but for the demand limiting system installations, only post-installation inspections were necessary. Based on individual project savings totals, Onsite Energy Company has completed a total of 8.12 MW of demand savings projects.

In December of 2001, Inland Empire Utility Agency completed installation of two biogas electrical generation projects. Phase I of the dairy waste methane-fueled generation projects are located at two sites--a converted domestic sewage digester at water recycling plant RP1, and at a groundwater desalter plant at the RP5 facility. A large manure digester tank is located a short distance from the desalter plant and provides methane gas for the two Waukesha engine generators and Capstone Microturbines at the desalter.

Phase I of the project was completed and fully commissioned at the RP5 facility in May 2002, and is now generating 0.5 MW. Mr. John Gundlach, the project manager for the Agency's Organics Management Strategy, confirmed that problems with initial start up had been corrected and methane production at the 1.2 million gallon digester tank was at design flow. Manure

delivery from local dairies has now reached full subscription status, and the digester is producing an adequate supply of methane gas to fuel the Chino Desalter engine near the RP5 facility. The Waukesha internal combustion engine at the Desalter plant is capable of producing 1.5 MW, but the production of methane is not sufficient with one digester tank, and so natural gas is currently used to supplement methane production. Phase II of the project will add two additional digester tanks at RP5; once these are complete, methane production will be sufficient to generate 1.5 MW as indicated in the original Energy Commission award and demand savings goal. As of December 1, 2004, the agency has not commenced Phase II of the project.

The conversion of a domestic sewage digester to a dairy manure and bio-solids digester at the RP1 facility is also complete and, according to Mr. Gundlach, seven truckloads of manure per day are hauled from local dairies as feedstock for the digester. The project is producing enough methane to generate 0.25 MW for a combined production of 0.75 MW from the two projects. Ultimately, the utility district intends to run a combined biosolids/manure digester capable of producing enough methane to satisfy all of the electrical needs of the district, as well as market high grade composted material to the public.

1.3 MEASURMENT, VERIFICATION, AND EVALUATION APPROACH

Nexant's general approach to evaluating the program level savings is based on an evaluation of the administrators verified demand savings through a statistical sampling of the projects that were approved by the administrators. A representative sample of projects was chosen for analysis, and the findings from that sample were extrapolated to the population as a whole. The sample population was designed to be large and diverse enough to meet the statistical confidence and accuracy levels established as targets by the Energy Commission. The remainder of this Section 1.3 discusses Nexant's sampling and analytical methods in detail.

1.3.1 Sub-Population Designations and Sampling

Nexant has completed the program level evaluation of the Agriculture element. Time and budget constraints made it impractical to directly monitor and analyze the demand reduction (and as necessary, energy savings, e.g., Category 2 pump repair projects) of the entire population of projects in Categories 1 through 3. Therefore, the measurement, verification, and evaluation (MV&E) plan relied on statistically valid samples of projects within each category for inspection and evaluation of administrator verified savings claims. From the post-installation evaluations of the samples, Nexant infers the estimated demand reductions at all sites in Categories 1 and 3.

Nexant used stratified sampling techniques to identify a sample of projects that meet statistical precision and confidence guidelines for the program element. Effective use of stratified sampling depends on defining sub-populations that are relatively homogenous for a common parameter. Accordingly, Nexant drew random samples from homogenous strata within each project category, resulting in reduced overall variance for category level savings. Each category of project grants was treated separately, and within Category 1, Category 2, and Category 3, each category population is further segmented into relatively homogenous strata. A random sample of projects was selected from each category's strata for post-installation evaluation and verification.

The following paragraphs discuss the process and resulting samples, also listed below in Table 1-2 through Table 1-8.

Nexant's MV&E sampling plans are designed to meet the precision and confidence goals of the program; however, the actual statistics achieved through the MV&E efforts will not be known until post-installation monitoring and analysis of the sample projects are completed.

Equation 1, below is the formula used to calculate the sample size for a hypothetical infinite population of projects that follow criteria for normal distributions:

(1)
$$n^i = \frac{\lfloor C_v^{\,2} \times z^2 \rfloor}{p^2}$$

Where:
n^i = sample size for an infinite population
C_v = Coefficient of variation (assumed to be 0.50 for sampling purposes)
Z = z-statistic (equal to 1.2817 for an 80% confidence level)
P = precision level (set at 20% for 80/20 reliability)

Previous experience with utility-sponsored DSM programs has shown that a starting value for the coefficient of variation of 0.5 is reasonable and conservative for a large variety of project technologies. With C_v set at 0.5, the sample size for a normally distributed, infinite population was found to be 11 from Equation 1 above.

None of the program categories has an infinite population of projects, of course, which requires compensatory adjustments to the sample size. The formula given in Equation 2 below is used to determine the sample size for a finite population of projects, and is used to adjust the sample sizes:

(2)
$$SampleSize = \frac{n^i}{\left[1 + \left(\frac{n^i}{N}\right)\right]}$$

The sampling formulas in Equation 1 and Equation 2 both apply to normal distributions. Sampling with these formulas assumes the populations are relatively similar in the parameters of interest. Approved projects from the two administrators are not similar in typical savings, technology type, and persistence of peak demand savings for Category 3 demand response projects; Category 4 projects do not have electrical savings.

To accommodate the heterogeneity of projects within program categories, sampling within each category of projects helps to ensure that each sub-population is closer to a normal distribution and results of sampling are statistically valid. This in turn ensures inferred sub-population demand savings are statistically valid within the target confidence level and precision interval.

Within each project category there are a wide range of savings and project technologies. A stratified sampling technique was used to identify the sample sizes for Category 1, Category 2, and Category 3. The technique is designed to improve the overall variance of the sampling efforts while reducing the sample sizes to a minimum. The stratified approach assigns sampling efforts for each of the strata in relation to the proportion of demand savings each individual stratum contributes to the overall category level demand savings.

A stratified sample calculator, developed for other energy savings programs by Nexant, was used to estimate the sample sizes for each project category and stratum. A spreadsheet of each of the Category 1, 2, and 3 sub-populations was characterized and populated for an appropriate number of strata for each project category. The defined stratum within each sub-population was examined for the number of approved projects and contribution to category level demand savings in kW; these were input to the calculator with an annual peak period operating total of 522 hours. The operating hours figure was derived from total number of summer peak period hours for this program element; however, the actual number is relatively unimportant – the number serves to reduce bias in the sampling. The resulting sample size for each category of projects is proportioned for each stratum within a sub-population according to its contribution to the project category's demand savings.

Sampling for Category 4 projects was treated in a slightly different manner—an Acceptable Quality Level (AQL) sampling approach was used to identify a representative sample of projects. The AQL sampling approach (ANSI/ASQC Z1.4) is based on sampling for an attribute, in this case the ability of the facility to switch to burning an alternative fuel, and applying the test results to the sub-population of Category 4 projects. If the number of sites that fail is less than the acceptance limit, the sample is accepted and the lot, or sub-population of Category 4 projects, is accepted as installed and presumed able to switch to alternative fuels.

Tables of AQL sample sizes are published for various precision levels. The 10 percent AQL table corresponds to a 20% precision interval, and for the sub-population of 20 approved projects, the sample size is three (3) for a double sample technique when all of the samples pass the test.[2].

For all project categories, after the stratified sample sizes were calculated, each project on a sub-population spreadsheet was assigned a random number from the Excel RAND function. All projects within each stratum were then sorted and ranked by their random numbers. The sample size for the corresponding stratum was next applied to identify the projects for post-installation evaluation. Each stratum of projects in Category 1, 2, and 3 was treated in the same manner. Projects for Category 4 were also identified using this approach; however, there was no initial stratification of the population. For Category 4 projects, the high number of projects that were withdrawn resulted in a significant reduction in the original sample size, as well as replacement of projects that were withdrawn for sampling purposes.

[2] An online AQL sample size calculator is available at: http://iew3.technion.ac.il/sqconline/milstd105.html

The following paragraphs describe the procedures used to identify post-installation samples from the four project categories and individual strata within the project categories. Projects for post-installation evaluation selected with the stratified calculator and random sampling are presented in Table 1-2 through Table 1-8. The entire list of approved projects from the two administrators and Onsite Energy Corporation can be found in the Appendices.

1.3.1.1 Sub-population—Category 1

Category 1 projects include a wide variety of technologies and range of demand savings estimates. The diversity of technology and demand savings in Category 1 approved projects and the need to keep the number of strata at a reasonably low level require that not all strata adhere to the ideal of homogeneity in either technology type or demand savings. In order to identify samples from strata with similar characteristics, five individual strata were defined and populated with projects approved by the two administrators.

Category 1 projects were allocated to the following strata:

1. Lighting efficiency and lighting controls
2. Motors, VFDs, and motor controls
3. HVAC and refrigeration
4. Reservoir improvements and TOU meters for load shifting
5. Drip irrigation conversions, new irrigation wells and booster pumps

Lighting projects of all types, including lighting efficiency, lighting controls, and skylights, have been grouped into the first Category 1 stratum. The second stratum is a broader grouping of motor efficiency, variable frequency drives (VFDs), automated controls and other measures involving installation of high efficiency electrical equipment. Refrigeration, HVAC, evaporative condensers, or other projects leading to refrigeration savings are grouped into the third stratum. The fourth stratum includes projects related to reservoir expansions, and time-of-use (TOU) meters that encourage facility owners to move operations to off peak hours. The fifth and final stratum for Category 1 projects includes conversion to drip irrigation, and irrigation pump equipment installations to offset peak period demand. Individual projects chosen from the five strata in Category 1 are shown in Table 1-2.

Table 1-2: Category 1 Stratified Samples

Stratum #	Stratum Name	Population in Stratum	Projects in Sample	Demand Reduction of Sample, kW
1	Lighting Efficiency/Controls	8	1	48
2	Motors/Drives/Controls	80	2	1,159
3	HVAC&R	29	2	683
4	Reservoir Improvement, TOU meters	40	6	386
5	Drip Irrigation, Boosters, Wells	19	1	45
Totals		168	12	2,320

Some of the approved Category 1 projects fall into multiple strata due to comprehensive retrofits at a facility; all measures for such projects are analyzed, and overall sampling will be revised to reflect the evaluation of the additional measures.

The 12 projects selected for post-installation evaluation are listed in Table 1-3. Each project is identified by its unique APLRP number and is listed in the order of the strata to which it was assigned.

Table 1-3: Category 1 Projects Selected for Post-Installation Evaluation

APLRP	Stratum #	Technology Description	Demand Savings, kW	Applicant
1-0378-A	1	DC Lighting efficiency retrofit	48	Blue Diamond Growers
1-0134-A	2	Comprehensive plant retrofit	1,029	Campbell Soup Company
1-0152-A	2	Power factor correction, lighting voltage reduction	129	Trinchero Family Estates
1-0404-A	3	Increased refrigeration coil capacity	29	Taylor Farms
1-0100-A	4	Lockouts for nursery circulation fans	9	Rote Greenhouses
1-0101E	4	Water pump time controls	168	Sierra View Farms
1-0351-A	4	Install TOU meters	47	Sandhu Bros. Farm
1-0367-A	4	Install TOU meters	2	Ewy Enterprises
1-0367-A	4	Install TOU meters	2	Ewy Enterprises
02-022-47310	4	Expand existing storage reservoir for off peak pumping	158	Belridge Water Storage District
01-269-A	5	Drip irrigation conversion	45	Silva Vineyards
Totals			2,320	

Note: One of the sampled projects that were evaluated by Nexant was later withdrawn, 01-0177-A.

1.3.1.2 Sub-population—Category 2

Category 2 project grants help pay for testing the efficiency and flow of pumps, with a second sub-category for repairing or retrofitting of the pumps. Pump repairs must be followed by a post-retrofit or repair test to establish a new efficiency and capacity point for the motor and pump system. Peak demand savings for the pump retrofit or repair projects are assumed to result from improved load management and by moving pumping energy to off peak hours. This strategy is appealing when combined with telemetry to remotely control pumping equipment while meeting irrigation or other water delivery needs.

Pump test projects are verified by the program administrators through a desk review of submitted documentation, as described on the program administrators' web sites. The grants are paid in full at the completion of the review and approval process. For purposes of program evaluation, these projects are ignored for post-installation inspections or monitoring. With no demand savings attributable to testing alone, there is little need to evaluate these projects for savings.

Peak period demand savings are not reported, and choosing a stratified sample of projects for post-installation evaluation requires a slightly modified approach. The two administrators offer incentives for pump repair projects through one of three options for calculating incentives. There are slight differences in each administrator's documentation and calculation of the project incentives; however, both administrators have comparable grant options, and all pump repair projects are grouped together by grant option.

There is a large sub-population of pump repair projects, with a current total of 590 individual pumps approved by the two administrators. Annual energy use was reported for the majority of the individual project sites for projects approved by the Fresno CIT administrator. CalPoly's ITRC administrator required the submittal of peak period billing from June through September, but has not yet provided energy use data for the projects in their database of approved projects.

Each of the projects was grouped by the grant option number on a spreadsheet for sample selection in four strata that are defined by the three grant options and an additional stratum for the projects paid at 65 percent of repair cost. Projects that had no reported annual energy use were assigned an energy use equal to the average of all other projects in the same grant option, with the exception of the projects that were approved at 65% of cost. The resulting sample sizes are proportioned according to the number of projects approved under each grant option, as well as the relative size of expected energy savings resulting from the pump repairs. Table 1-4 lists the four strata and sample sizes from the stratified calculator.

Table 1-4: Category 2 Stratified Samples

Stratum #	Stratum Name	Population in Stratum	Projects in Sample	Demand Reduction of Sample, kW*
1	Grant Option 1	80	2	6
2	Grant Option 2	33	1	18
3	Grant Option 3	309	8	77
4	65% of Cost	37	1	6
Total		459	12	107

*kW estimates are for sampling size calculations only. Annual kWh was divided by 2000 operating hours per year; with 8% savings assumed for pump repairs. Operating hours and savings rate suggested in utility study of irrigation pump repairs.

The selected projects in Table 1-5 were randomly selected from each of the four strata defined for Category 2 projects.

Table 1-5: Category 2 Projects Selected for Post-Installation Evaluation

APLRP*	Stratum #	Grant Option Description	Annual kWh Use	Applicant
02-0280-A	1	Change in plant operating efficiency	92,560	Tracy Ranch, Inc.
02-0369-A	1	Change in plant operating efficiency	63,633	E&M Dairy
02-0183-A	2	Change in kWh/AF from repairs	447,636	JG Boswell Co.
#27-D-10 #5	3	Grant paid at 25% of kWh	161,003	Delano-Earlimart Irrigation

APLRP*	Stratum #	Grant Option Description	Annual kWh Use	Applicant
				District
02-0266-A	3	Grant paid at 25% of kWh	26,736	A-G Sod Farms Inc.
#19-White #1	3	Grant paid at 25% of kWh	161,003	Reclamation District #548
#32-Area 18-10hp	3	Grant paid at 25% of kWh	161,003	Tulare Irrigation District
#34-C-82	3	Grant paid at 25% of kWh	161,003	James Irrigation District
#31-1R4.OD	3	Grant paid at 25% of kWh	161,003	Westlands Water District
02-0129-A	3	Grant paid at 25% of kWh	870,280	J.G. Boswell Co.
02-0333-A	3	Grant paid at 25% of kWh	217,520	M&C Farms
#13-Station B, Pump 2	4	Grant paid at 65% of cost, kWh use not provided	65% of cost	Cawelo Water District

* APLRP numbers preceded by "#" are from ITRC. The first number corresponds to water district application number for multiple site Category 2 projects.

1.3.1.3 Sub-population—Category 3

Technologies for Category 3 projects include installation of advanced metering and telemetry equipment for agricultural and water pumping load reduction strategies. Approved projects include increases in water storage capacity for load shifting, installation of interval metering for use with the ISO programs, and changes to pipeline systems to reduce head loss. Eleven of the eighteen approved Category 3 projects took part in the CAISO demand response program, and were required to shed load when an emergency signal was received from the CAISO. Two strata were defined for the sub-population: those projects with and those without a CAISO contract.

Projected kW demand reductions are not persistent throughout the summer peak season for projects with CAISO contracts, and the total kW is an estimate of *potential* demand savings if full subscription of an aggregator is achieved.

Table 1-6 lists the strata defined for Category 3 demand responsive projects and calculated sample sizes.

Table 1-6: Category 3 Stratified Samples

Stratum #	Stratum Name	Population in Stratum	Projects in Sample	Demand Reduction of Sample, kW
1	ISO Contracts	11	6	4,550
2	Non-ISO Contracts	7	1	425
Totals		18	7	4,975

Table 1-7 lists the randomly selected Category 3 project sites for post-installation evaluation.

Table 1-7: Category 3 Projects Selected for Post-Installation Evaluation

APLRP*	Stratum #	Project Description	kW Demand Reduction	Applicant
#01-020-47330	1	Interval meters for ISO program	1,000	Solano Irrigation District
03-0064-A	1	Install interval meters and telemetry equipment	1,595	Joseph Gallo Farms
#02-03-47330	1	Install 3 interval meters and telemetry for ISO contract	1,270	Natomas Central Mutual Water District
03-0112-A	1	Artesia Dairy ISO drip irrigation telemetry	450	Artesia Dairy
03-0113-A	1	Triangle-M Dairy ISO drip irrigation telemetry	100	Triangle-M Dairy
03-0118-A	1	Tevelde Dairy ISO drip irrigation telemetry	135	Ralph Tevelde Dairy
03-0095-A	2	Advanced metering/telemetry	425	Diamond D Dairy

*APLRP numbers preceded by "#" are from ITRC. The first number corresponds to the water district application number for multiple site Category 3 projects.

1.3.1.4 Sub-population—Category 4

Category 4 projects include retrofits to convert existing natural gas-powered equipment to burn alternative fuels. There are no kW demand savings for projects in Category 4, nor are the project applicants required to switch to full-time use of an alternative fuel. The test for completion of a project is the successful demonstration that the equipment is capable of burning an alternative fuel.

The post-installation inspection reporting will be based on whether or not the retrofit equipment can utilize an alternative fuel. The sample size calculation for Category 4 projects was based on principles from Acceptable Quality Level (AQL) sampling for attributes (equipment is installed and functional, or not). At the specified precision, the sample size was determined from an AQL table in correlation to the number of approved projects. The sample population to be inspected was then drawn randomly from the overall population without regard to cost of installation, grant amount, or possible natural gas savings from the project.

Based on the current population of 24 Category 4 projects, a sample of five sites was originally selected for inspection. Based on the double sampling technique for AQL sampling, a sample size of three is adequate provided none of the three had any failure (ie, had not been installed). All three projects were found to be installed and functional at the time of the post-installation inspection.

Table 1-8 lists the three randomly selected project sites for Category 4 sub-population post-installation evaluation. All Category 4 projects were submitted to CIT for evaluation and grant funding.

Table 1-8: Category 4 Projects Selected for Post-Installation Evaluation

APLRP #	Project Name	Project Description	Applicant
04-0003-A	Fresno poultry plant yellow grease project	Vegetable oil project proposal #2	J.G. Boswell Co.
04-0012-A	Del Mesa Porterville plant propane project	Cotton gins 2&3 – project proposal #3	J.G. Boswell Co.
04-0034-A	Del Mesa Feed Mill yellow grease project	Cotton gin #5 – project proposal #4	J.G. Boswell Co.

1.3.2 Savings Verification Methods

Using stratification and sampling techniques described above, Nexant selected samples of projects for post-installation evaluation of project savings for the different project-type strata within each program category. Each project in the samples is subjected to post-installation evaluation, and the results are used to extrapolate to the peak period demand savings for each stratum and program category. With the differences in savings types between projects in Category 1 projects (energy efficiency) and Category 3 projects (load shifting and peak clipping), the lack of savings from Category 4 projects (fuel substitution), and unreported savings in Category 2, combining all results into program level demand savings as a single number is difficult and somewhat misleading. Nonetheless, determining a statistically valid estimate of savings from each of the categories of projects is the fundamental goal of the evaluation efforts.

Nexant's savings verification efforts include a variety of methods to estimate baseline demands and document project savings. In general, the approach is based on the M&V methods established for each project by the project sponsor and approved by the program administrator. Nexant attempts to follow the administrator's methods of baseline determination and performance measurement during the independent verification of project savings. When Nexant is not satisfied that the administrator methods were rigorous enough, or when access to monitoring data or power measurements is available, those results are incorporated into the analysis of baseline and savings verification reports.

1.3.2.1 Category 1 Verification Methods and Examples

Electrical efficiency projects in Category 1 were evaluated by the administrators for baseline demand—in most cases through analysis of utility billing data along with evaluation of project descriptions, equipment descriptions and nameplate information, and operating profiles. However, the Category 1 projects have significant diversity, and methods for verification of savings vary accordingly.

Nexant's post-installation evaluation approach of the Fresno administrator project #0101-E (Sierra View Farms), for example, was selected for evaluation. The project included installation of time management controls for a 75 hp turbine pump. Since a TOU utility meter that records peak period energy serves the pump, verification of both baseline and post-installation energy

use for this project is possible through utility billing. A comparison of recorded baseline and post-installation energy use during peak period hours easily yields the average demand savings for the project.

An example of another more complicated project in the sample of Category 1 projects is the Campbell Soup Supply Company project in Dixon. The Fresno administrator project, #01-0134-A, is a project to replace approximately 1,850 hp of electric-driven evaporator motors with steam-driven motors, as well as heat exchangers and other equipment to reduce plant electrical loads. This project cannot be verified through post-installation monitoring equipment, as the motors have been removed. Instead, the entire plant utility billing before and after the project for summer peak periods is used to verify that the savings are accurate. Any increases or decreases in plant production may influence the summer peak period savings; therefore, a review of the plant's production covering the baseline and post-installation summer peak period billings is also required to evaluate the savings. If production has changed, the electrical use and savings will be evaluated on the basis of normalized production volume.

Onsite Energy Corporation's project from Pacific Coast Producers in Woodland included a complete replacement of the existing tomato processing plant in Lodi with a modernized plant in Woodland. Pacific Coast Producers wanted to move closer to the source of the tomatoes used in their products, improve the overall plant efficiency, and increase the plant's production. Robert Mowris & Associates completed a detailed piece-by-piece evaluation of the new plant's equipment and expected peak period demand improvements as well as annual energy savings for Pacific Coast Producers. With production expected to increase approximately 30% compared to the Lodi plant, straight comparison of utility billing data would have resulted in a very low level of savings. If individual equipment loads were evaluated against the new equipment, a similar savings level may have resulted; however, the propagation of uncertainty in evaluation of savings for each piece of equipment would not provide the necessary confidence in the results of the evaluation.

Robert Mowris instead evaluated the existing plant's electrical billing data and production data to establish a measurement of energy and demand per unit production. The same process was completed during the first summer of operation in 2002 for the Woodland plant. To recognize the improvements in efficiency, the difference in kWh per unit was calculated for the two plants, and then multiplied by the existing production at the Lodi plant. The resulting kWh savings were then divided by 504 hours, the length of the 2002 summer peak season to establish the average peak period demand savings for the new plant based on production levels at the Lodi plant.

In another Onsite Energy Corporation project, the project sponsor has been continuously monitoring the system's baseline conditions in an ammonia refrigeration plant for two years, made possible as a result of a previous Standard Performance Contract program at the plant. The addition of a monitoring power meter for a new compressor allowed Onsite to verify demand savings to a high level of accuracy, despite changes in operation at the plant due to increased production. Similar to their project at Woodland, by evaluating energy use per unit of production, the project savings will be normalized to the baseline production level. In this example, the method includes direct monitoring of the refrigeration compressors, pumps, and

evaporative condenser fans and pumps. Nexant independently analyzes monitored data to verify reported savings of the project.

1.3.2.2 Category 2 Verification Methods

Category 2 projects are a much more difficult class of projects for verifying any peak demand savings. Pump repair or retrofit projects might lead to energy and peak period demand savings, *provided that* the peak period operation of the pumps is reduced as a result of an increase in pumping capacity. For TOU-metered pumps, recorded data from baseline and post-installation periods readily establish the basis for calculating average peak demand savings. It would appear to be convenient to use monitored data from TOU-meter equipped pumps as a basis for extrapolating to the entire population of pump repair and retrofit projects, yet this would not be a valid extrapolation of savings data. (In practice, if a pump is not equipped with a TOU meter, the irrigator has little reason to shift pumping hours to off-peak times, and so the non-TOU-metered population is atypical). In other cases, an irrigator may not be able to shift hours, but has been unable to provide sufficient irrigation without the pump repairs partially funded through this program. This potential problem is discussed in more detail below in Section 1.5.1.

1.3.2.3 Category 3 Verification Methods

Verification of project savings for Category 3 projects is typically accomplished through utility billing records of peak period energy use, and for a few of the projects, documented tests of load shedding for electrical emergencies. Projects in Category 3 are equipped with TOU meters, and evaluation of peak period energy savings is accomplished through a comparison of pre-installation and post-installation utility billing records.

1.3.2.4 Category 4 Verification Methods

Verification of Category 4 projects consists solely of visual inspection of equipment installations and their ability to utilize alternative fuels. No peak period savings result from installation of the equipment for these projects.

1.4 PROGRAM ELEMENT MONITORING AND VERIFICATION

1.4.1 Review of Sampling Status

Table 1-9 summarizes the sample size information for the four project categories as submitted in sampling plans developed during the second and third quarters of the year. The total sample sizes in the table were based on a stratified sampling methodology that focused on where the greatest demand savings are to be found. The overall sample kW identified for each project category was calculated for the population based on the estimated demand savings, such that each category's sample size will meet the program's statistical criteria of an 80 percent confidence around a 20 percent precision interval (80/20). Within each of the four project categories, samples have been drawn in proportion to the individual strata defined for various project technologies or M&V.

Table 1-9: Post-Installation Verification Sample Sizes as of December 31, 2002

Project Type/Contractor	Approved Projects	Sample Size
Category 1	194	12
Category 2	747	12
Category 3	18	7
Category 4	20	3
Onsite Energy Corporation	42	All
Inland Empire Utilities Agency	2	N/A

1.4.2 Inspected Projects by Project type

Projects reviewed and contracted by the two administrators were not visited prior to installation of proposed equipment. All baseline demands were estimated and approved by the administrators through a combination of techniques. Nexant did not participate in the process.

Nexant has completed site visits to the sample of Category 1 project sites to verify equipment installations and for evaluation of project savings. Category 2 and Category 3 sites were not visited as determination of project completion for these types of projects was determined to be unnecessary.

Nexant has completed pre-installation for many, and post-installation inspections for all of the Onsite Energy Corporation projects at food processing and cold storage facilities. All of Onsite Energy Corporation's projects are similar to Category 1 projects and feature installation of electrical efficiency equipment and load management controls. Baseline peak period loads have been verified through a combination of techniques including billing histories, pre-installation spot measurements of equipment, auditing of lighting equipment, or monitoring data from previous energy efficiency projects at a facility.

Post-installation inspections have also been completed for all of the Onsite Energy Corporation project sites with completed measure installations. Onsite Energy Corporation in most cases has installed their own monitoring equipment to record peak period energy and demand use, although they have also used consultants to develop the measured savings for a comprehensive plant retrofit in Woodland.

Post-installation inspections for three Category 4 sample projects have been completed. Nexant verified equipment installations and that the equipment was capable of burning an alternative fuel. Original sample size for this category was set at 8, however, due the smaller final population of Category 4 projects, and 100% inspection passes, only three sites were visited for evaluation of these projects.

1.4.3 Projects Inspections

Table 1-10 shows project inspections, project savings for completed measures, and findings based on inspection results, or other data reviews.

Table 1-10: Inspected Sites and Summary Findings

Administrator	Project Name	Location	Project Size	Findings
Category 1 Projects				
Onsite Energy Corporation	Gatorade	Oakland	61	VSD equipped Compressor, blower powered air knives, modified distribution system.
Onsite Energy Corporation	Pacific Coast Producers	Woodland	1,464	Plant wide retrofit and relocation of existing processing plant from Lodi to Woodland. Some adjustment to savings total.
Onsite Energy Corporation	Del Monte Hanford	Hanford	90	Remove four 40hp water pumps for flume system.
Onsite Energy Corporation	Del Monte Hanford	Hanford	179	Replace water based flume tomato handling system with right sized motor driven belt type conveyor system
Onsite Energy Corporation	Del Monte Hanford	Hanford	215	Plant-wide retrofit including hydraulic motor to electric conversion, removal of hydraulic pumps, water flume replacement, high-speed Fenco pulpers, cooling water controls for evaporators are all complete; data for 2002 peak season not yet received
Onsite Energy Corporation	Del Monte Hanford	Hanford	112	Replace Manzini pulpers with Fenco units – higher energy efficiency and throughput
Onsite Energy Corporation	Del Monte Hanford	Hanford	39	Water pump controls to allow shut down during times when only one of the evaporators is in use – approx. 900 hours per season.
Onsite Energy Corporation	Frito Lay, Visalia	Visalia	76	VFDs for boiler feedwater pump (100 hp), and FD fan for boiler (75hp)
Onsite Energy Corporation	Frito Lay, Visalia	Visalia	5	Install 20 power planner, power wave modification equipment
Onsite Energy Corporation	Frito Lay, Visalia	Visalia	29	Replace 16 1.5hp vacuum caser motors with central system
Onsite Energy Corporation	Frito Lay, Visalia	Visalia	140	Expander controls on existing plant air system to eliminate one of electric air compressors
Onsite Energy Corporation	Frito Lay, Visalia	Visalia	115	Replace remaining electric driven air compressor for plant air with nat. gas driven Kaeser compressor
Onsite Energy Corporation	Frito Lay, Visalia	Visalia	127	Install Solatube skylighting for manufacturing floor and office areas
Onsite Energy Corporation	Frito Lay, Visalia	Visalia	160	Install PowerIT Demand limiting system for plant loads
Onsite Energy Corporation	Frito Lay, Modesto	Modesto	146	Installation of 100 Hp VFD compressor will allow shut down of one 250 Hp unit.
Onsite Energy Corporation	Frito Lay, Modesto	Modesto	34	Installed VFDs for pumps in boiler room.
Onsite Energy Corporation	Frito Lay, Modesto	Modesto	350	Installed PowerIT Demand limiting system for plant loads
Onsite Energy Corporation	Frito Lay, Modesto	Modesto	17	Installed Mytech bi-level HID controls for warehouse lighting and skylight/dayligting
Onsite Energy	Frito Lay	Rancho	350	Install PowerIT Demand limiting system for plant loads

Administrator	Project Name	Location	Project Size	Findings
Corporation	Rancho Cucamunga	Cucamunga		
Onsite Energy Corporation	Leprino Foods	Tracy	500	Reduced condenser head pressure from 180 to 155 psig
Onsite Energy Corporation	Leprino Foods	Tracy		Installed new heat exchangers, split brine system
Onsite Energy Corporation	Dreisbach Lighting Controls	Richmond	29	Installed motion detectors and bi-level lighting on existing HID fixtures
Onsite Energy Corporation	Dreisbach Lighting Controls	Oakland	25	Installed motion detectors and bi-level lighting on existing HID fixtures
Onsite Energy Corporation	Dreisbach Lighting Controls	Moss Landing	26	Installed motion detectors and bi-level lighting on existing HID fixtures
Onsite Energy Corporation	Dreisbach Demand Limiting System	Richmond	-	Installed demand limiting system
Onsite Energy Corporation	Dreisbach Demand Limiting System	Oakland	339	Installed demand limiting system
Onsite Energy Corporation	Dreisbach Demand Limiting System	Moss Landing	112	Installed demand limiting system
Onsite Energy Corporation	Del Mar Foods, Watsonville, Plant Side	Watsonville	399	Installed demand limiting system
Onsite Energy Corporation	Del Mar Foods, Watsonville, Cold Storage Rooms	Watsonville	143	Installed demand limiting system
Onsite Energy Corporation	Bonita Pak Foods	Santa Maria	843	Installed demand limiting system
Onsite Energy Corporation	Cool Pacific Foods	Salinas	208	Installed demand limiting system
Onsite Energy Corporation	Richmond Wholesale	Richmond		Installed demand limiting system
Onsite Energy Corporation	P&O Cold Logistics - Vernon #1	Vernon	441	Installed demand limiting system
Onsite Energy Corporation	P&O Cold Logistics - Vernon #2	Vernon	157	Installed demand limiting system

Administrator	Project Name	Location	Project Size	Findings
Onsite Energy Corporation	P&O Cold Logistics - City of Industry #4	City of Industry	441	Installed demand limiting system
Onsite Energy Corporation	P&O Cold Logistics - Dominquez Hills #6	Dominquez Hills	44	Installed demand limiting system
Onsite Energy Corporation	P&O Cold Logistics - Carson #10	Carson	196	Installed demand limiting system
Onsite Energy Corporation	P&O Cold Logistics - Anaheim#11	Anaheim	102	Installed demand limiting system
Onsite Energy Corporation	P&O Cold Logistics - La Habra #13	La Habra	114	Installed demand limiting system
Onsite Energy Corporation	P&O Cold Logistics - Brea #14	Brea	97	Installed demand limiting system
Onsite Energy Corporation	P&O Cold Logistics - Modesto #15	Modesto	198	Installed demand limiting system
Onsite Energy Corporation	P&O Cold Logistics - Salinas #18	Salinas	62	Installed demand limiting system
CSU, Fresno	Rote Greenhouses		9	Installed lockouts for nursery circulation fans
CSU, Fresno	Sierra View Farms		168	Water pump time controls
CSU, Fresno	Campbell Soup Company		1,029	Completed a comprehensive plant retrofit
CSU, Fresno	Trinchero Family Estates		129	Power factor correction, lighting voltage reduction with autotransformers
CSU, Fresno	Silva Vineyards		45	Replace overhead sprinkler system with drip irrigation conversion
CSU, Fresno	Sandhu Bros. Farm		47	Installed a TOU meter for irrigation pumps
CSU, Fresno	Ewy Enterprises		2	Install TOU meter for irrigation pumps
CSU, Fresno	Ewy Enterprises		2	Install TOU meter for irrigation pumps
CSU, Fresno	Blue Diamond		48	Retrofit a High Bay HID system with lower wattage Metal Halide system

Administrator	Project Name	Location	Project Size	Findings
	Growers			
CSU, Fresno	Taylor Farms		29	Increased refrigeration coil capacity
Cal Poly	Belridge Water Storage District		0	Project proposal was to expand an existing reservoir to allow for off peak pumping; the project was not completed due to district financial issues.
Category 4 projects				
CSU, Fresno	Central Valley Coop.	Hanford	N/A	Conversion to Propane for Dual Fuel; all equipment verified
CSU, Fresno	Lone Star Dehydrator	Sanger	N/A	Propane fuel system installed as backup for natural gas
CSU, Fresno	Six Jewels	Fresno	N/A	Ag. Fruit Dehydrator Retrofitted from Natural Gas

1.5 PROGRAM ELEMENT EVALUATION

1.5.1 Evaluation Results

Nexant has completed desk-based reviews of Category 1 and Category 3 projects identified in the sampling plan, and has conducted post-installation inspections and project evaluations for Onsite Energy Corporation projects.

Nexant has completed desk-based reviews of Category 1 applications, billing statements and other documentation provided by the two independent administrators. During this review, Nexant analyzed assumptions, calculations, and billing data used to estimate baselines and demand savings. Nexant's analysis suggests a slightly lower peak period savings total than approved by the administrators, with a realization rate of 89 percent for the sample projects. Nexant has completed field verifications for most of the Category 1 projects in the sample list, although the Belridge Storage District project was cancelled

For one of the sample projects, Nexant conducted post-installation site visits to three of Trinchero Family Estates facilities. Spot measurements of equipment loads were recorded for a sample of the motor and lighting equipment at the three wine industry facilities. Nexant's evaluation of peak period demand savings for the power factor correction and lighting system voltage controls resulted in a recommendation to the Fresno administrator for approval of the project, although with significantly lower savings. The application estimate of 726 kW peak period demand savings was rejected as unrealistic. Nexant revised the savings estimate based on a model of improved power factor savings from reduced I^2R losses and post-installation measurements of equipment at the facilities during the post-installation inspections. The project has not yet been approved or verified by the Fresno administrator, and no payments for the project have been made to date.

Nexant also participated in a post-installation review of demand savings for several projects at the request of the Fresno administrator, including Puritan Ice, and four projects approved for Frito Lay, Bakersfield. Nexant has not visited the sites for these project evaluations, but instead reviewed the application, billing history, and administrator-approved M&V plans. The Puritan Ice project, # 01-0177-A was originally part of Nexant's post-installation evaluation sample, but was withdrawn from the program and replaced by another project for sampling.

In December 2002, the Fresno administrator requested assistance from Nexant for evaluation of demand savings claims based on approved M&V plans for four separate projects at Frito Lay, Bakersfield. Each of the four electrical efficiency projects would be expected to deliver the peak period demand savings claimed in the original applications. However, the plant has a large cogeneration facility that meets the majority of the plant's electricity needs during the summer peak period. Nexant's review of the four projects was outlined in a memo to the Energy Commission and the Fresno administrator. In the review, Nexant pointed out that the M&V approach for each of the projects was based on utility billing data that, in all but one case, failed to support claims for peak period demand savings. In addition, Nexant found that savings claims for the only project for which the contracted grant amounts may be paid were also questionable depending on the choice of the baseline year of utility billing data; the M&V plan was unclear on the year to be used for comparison purposes.

Although none of the four individual projects at the Frito Lay, Bakersfield plant was identified as part of the post-installation random sample for Category 1 projects, Nexant believes the problems associated with the Fresno administrator's approval and payment for these projects is illustrative of problems that can and did occasionally occur while conducting a large scale incentive-based program such as the APLRP. Careful review of the M&V plans for each of the four projects shows that even if the cogeneration facility had not been a factor, demand savings for three of the four projects would have been difficult to determine. Nexant found that for each project, post-installation evaluation of demand savings were questionable with unclear definitions of project baselines, and post-installation validation of savings through peak period utility billing data affected by subsequent project activities.

Evaluation of peak period savings for Category 2 pump repair or retrofit projects has not been completed, nor can it be given the operations of irrigation pumps. To date, administrators have not reported demand savings estimates for the projects. However, the cumulative impact of the 747 pump repair projects for long-term energy and peak period demand savings is an important unknown. Although peak period savings are not reported, Nexant has analyzed pump test data reported by the Fresno administrator and performed a scenario analysis on a relatively large sample of the projects to estimate a potential range of possible peak period demand savings.

Any method used to estimate peak demand savings for an individual pump repair must begin with some basic assumptions regarding effects of the repair(s) on a pump's post-installation operation. When a pump repair is completed, the Operating Plant Efficiency (OPE) for that pump

and distribution system increases. Conrad, Weisbrod, and Samiullah,[3] in a 1999 paper summarizing pump testing efficiency results for thousands of Southern California Edison pump tests, noted that average OPE for a typical turbine pump can be increased from 40 to 68 percent by reducing losses in the bowl assembly, column and shaft, and motor bearings. Overall plant efficiencies as high as 72 percent can be achieved with pumps in the 300 hp range.

From an irrigator's perspective, a repaired well, booster, or surface water pump provides a range of economic benefits including more reliable irrigation equipment, increased flow rate at design delivery pressures, and shorter irrigation intervals for a fixed volume of water pumped. If the baseline condition and efficiency for a pump system is poor, improvements resulting from the pump system repair generally leads to increases in the motor's electrical demand, flow rate, possibly head pressure, or a combination of the three. With an increase in flow from a pump, an irrigator has choices including increasing the area irrigated by the pump during each irrigation set, reducing the interval over which irrigation of the field takes place, or continuing to operate as before—however, with an increased rate of delivery of water to a field.

When the size of an irrigation set is increased, or the irrigation time decreased, the energy use of a pump should decrease relative to the baseline energy use prior to the pump retrofit and repair. Irrigators who are on voluntary time-of-use rates might be expected to reduce irrigation times during the highest-cost peak periods of the summer due to high costs of on-peak irrigation. However, if an irrigator fails to shorten the time intervals for the irrigation schedule, or increases the size of the irrigation set relative to the baseline conditions, the improved pump system may use more energy -despite the improvement in efficiency from pump repairs and retrofits. Even with an improved Operating Plant Efficiency, if the volume of water delivered increases as a result of the project, overall electrical energy use can increase, resulting in little to perhaps negative average peak period demand savings. An irrigator will have to absorb higher electrical costs, but potential benefits that could outweigh energy savings include an improvement in crop yield, quality, or both from the increased amount of water delivered to a field.

To make a reasonable estimate of energy and demand savings from pump repairs, a critical assumption must be made—an increase in OPE for a pump system allows an irrigator to shorten the time interval or the size of an irrigation set to pump the same volume of water on a seasonal basis to a field, and the irrigator is not going to increase the total volume that is delivered to a field. If an irrigator chooses not to reduce the irrigation schedules, or continues to irrigate with the same set size and schedule, the improvement in pump efficiency will, in many cases, result in increased energy use and peak period demand due to a seasonal increase in water delivery to the field and higher input power requirements to the pump[4].

The Fresno administrator database reports include details of pump repairs and retrofits that are useful for analyzing potential energy and demand savings. Included in the reported data are

[3] Thomas Conlon, GeoPraxis, Inc., Glen Wisbrod, Economic Development Research Group, Shahana Samiullah, Southern California Edison, "We've Been Testing Water Pumps for Years – Has Their Efficiency Changed?" April 1999, subsequently published in Proceedings of the 1999 ACEEE Summer Study of Energy Efficiency In Industry
[4] Hanson, Blaine R., "Improving Pumping Plant Efficiency Does not Always Save Energy", California Agriculture, July-August, 2002, 123-127.

listings of the pre-installation energy usage for each pump over the preceding 12 month period, and results of OPE tests for many of the pumps. Nexant sorted the data for all pump repair projects with reported pre-retrofit and post-retrofit OPE tests. From this subset of pump repair projects, information about OPE improvements was calculated for the subset, and then extrapolated to the population.

For the 228 pump repair projects in the Fresno database with both pre-retrofit and post-retrofit OPE tests, the average improvement was 92 percent; increasing approximately 24% from an average of 39 percent pre-retrofit to an average of 63 percent after repairs and retrofits. The OPE improvements are consistent with the potential improvement suggested for a typical turbine pump, although both the baseline and post-retrofit efficiencies were somewhat lower than reported in the long term testing programs conducted by Southern California Edison.

Assuming that each pump operated at or near full load while in operation, the average annual hours of operation for the average sized pump in the subset of data was calculated at 2,967 hours based on an average 12 month electrical use of 187,000 kWh, and average pump size of 101 hp. Assuming a motor loading of 80 percent, and average motor efficiency of 89 percent, the pre-installation demand for each pump would have been approximately 67.9 kW. As calculated, the average annual pump hours exceeds the total number of hours (2,978 hours) in an assumed 4-month irrigation season of June through September, including 504 summer peak period hours.

Again emphasizing the assumption that the seasonal volume of water pumped to a field is constant after pump repairs, an efficiency savings per pump of approximately 45,700 kWh per year could be expected based on average OPE improvements. Following through with the analysis, if all energy savings from OPE improvements are assumed to occur during the summer peak period by turning pumps off, the average number of hours that can be offset is greater than the full summer peak period. For the extreme case where it is assumed that all pumps are on time-of-use utility rates, and that all operational changes are reductions in peak period pumping, the change in average OPE for the entire population of pumps could result in up to 47 MW of peak period demand savings for all pump repair projects approved for the program.

As repeatedly noted, any energy or demand savings that might be attributed to the repair of agricultural pumps must be accompanied by a change in the use of the pumping plants. Irrigators have claimed in previous utility sponsored pump programs that repairs have led to increased energy use[5]. Without changes to the length of irrigation intervals, or in the size of an irrigation set to reflect the new system capacities, overall water delivery tends to increase for a given size field. The increased water delivery is accomplished more efficiently, but nonetheless results in higher overall water and energy use, and increased electrical demand. Changes to system head pressure can also lead to higher pump energy use, even in the absence of an increase in seasonal water delivery to the field.

Pump testing for agricultural customers has been supported by California utilities for decades. Prior to the energy efficiency and DSM programs, pump testing and repair programs were

[5] Hanson, Blaine R., "Improving Pumping Plant Efficiency Does not Always Save Energy", California Agriculture, July-August, 2002, 123.

largely viewed as an economic tool to help farmers increase crop yields and quality, and were seen as a valuable service to the agricultural sector. Increases in energy use were seen as a slight negative when compared against higher revenues from increased yield and quality. There was and continues to be a significant positive economic impact to a grower when the pumping plant is operating at higher OPE.

Given the current environment, including relatively few water meters for measuring flow rates or total flow to a field, a low participation rate for time-of-use rates, and the reportedly common practice of neglecting to change irrigation schedules after pump repairs, it is unlikely that the best case condition of 47 MW of savings will be achieved.

The calculations for potential Category 2 demand savings suggest that potentially large savings could be achieved; however, these savings are not likely to occur without additional intervention to insure that additional volumes of water are not applied to a field. Nexant believes that economic incentives from higher crop yields or potentially improved quality are more likely to influence an irrigator's behavior than are increases in utility bills due to slightly higher energy use.

Nexant's post-retrofit evaluation of the sample of pump repair projects is based on a review of OPE tests, invoices for pump repairs, and billing data. Nexant does not believe that this approach will be sufficient to determine energy and peak period demand savings that have been achieved, except for pumps that are on time-of-use rates. A follow up study that investigates the change in irrigation practices and measures flow rates over a growing season after pump repairs would provide the data necessary to better estimate actual load savings from pump repair projects.

The post-installation projects identified for the sample of Category 3 projects have all been completed and paid in full by the administrators. Many of these projects were based on ISO contracts to deliver demand savings during emergency conditions. Two tests were conducted for a small number of the projects, however the projects have not been called on to shed load under real world conditions. Other projects within the Category 3 classification are based on Time of Use rates and advanced telemetry to enable load shifting. These projects can be expected to continue to deliver on peak demand savings continuing into the future. Demand savings from projects with ISO contracts are no longer under the original ISO contracts, and the demand savings are unavailable at this time.

No additional Category 4 projects have been accepted for grant contracts since the first quarter of 2002 and the overall population of approved projects has been reduced from the 2002 report. Of the 24 approved projects reported in the 2002 Report, only 20 are still in the program. All have now been completed and paid all incentives. Nexant has field-verified three of the projects, and the Fresno administrator has verified an additional six projects.

Onsite Energy Corporation has completed all of the projects proposed under their contract with the CEC. Each project was approved with a project specific M&V plan, and reports for the peak period demand savings have been reviewed and approved by Nexant. The M&V plan for each project was specific to the project and included a combination of pre-and post-installation

monitoring, utility bill analysis, or engineering model(s). Onsite Energy Corporation staff engineers are responsible for most of the M&V activities but sub-contractors have completed some of the analysis and modeling work. As an example, Robert Mowris Associates provided an analysis of the utility billing and plant production at an existing tomato processing plant in Lodi as the baseline for a plant upgrade and relocation to Woodland.

In contrast to problems the Fresno administrator encountered with the Frito Lay, Bakersfield projects, the upgrade of the Pacific Coast Producers, one of Onsite Energy Corporations projects at a tomato production facility included a clear baseline and post-installation measurement approach outlined prior to pre-approval of the project. The PCP Woodland project presented other significant problems, including an expected increase in production relative to the existing Lodi facility. The problem of measuring demand savings for a large complex with increased production was resolved by normalizing savings results to the pre-retrofit production levels.

For Leprino foods, Onsite Energy Corporation was able to utilize post-installation monitored results for a previous refrigeration plant upgrade to establish a baseline for the refrigeration facility. Onsite continued to monitor compressors and other equipment in the engine room to develop the post-installation energy and demand. Energy savings were thus based on measured pre- and post-installation performance data.

Many of Onsite Energy Corporations projects included installation of a demand limiting system from Powerit Solutions. The Energy Director hardware does not typically result in significant energy savings, but results in large reductions in peak period demand charges that are based on a 15-minute moving average of facility demand. Energy savings may be minimal for these projects, and thus calculation of demand savings using the average peak period energy savings divided by the on-peak hours in the summer peak period results in very small improvements in the average demand savings. However, analysis of the pre- and post utility billing data reveals that similar to a category 3 type project, this technology lowers the maximum demand that a facility receives through relatively short term and minor control actions initiated through the hardware, and with a rule-based prioritization of equipment loads to control.

1.5.2 Realization Factors and Confidence/Precision Intervals

Realization rates for the administrator-reviewed projects are not available for most of the projects in the samples at this time. Nexant's desk-based review of Category 1 projects in the post-installation sample suggests that a preliminary realization rate for all Category 1 projects is approximately 76%. The realization rate is the rate of verified demand savings divided by the estimated demand savings for all projects in Category 1 and Category 3, plus projects from Onsite Energy Corporation.

Measurement and verification of project savings for Category 1 and Category 3 projects reviewed by the two administrators are not complete, but are substantially complete for reporting purposes. Final savings values are not available at this time, but can be expected to change very little. At the completion of the sample project analyses, all reported savings values contained an associated uncertainty. The "true" value of the demand reductions achieved is reported with an associated precision and confidence level. The precision represents the range of likely values and

the confidence level indicates the probability that the true value is within this range. In this program, MV&E efforts were designed for a program element level precision of 20% at an 80% confidence level; in other words, the documented demand reduction has an 80% probability of being within ± 20 percent of the true value. These levels were chosen to balance the uncertainty with the MV&E costs; decreasing the uncertainty requires significantly more effort and cost.

1.6 PROGRAM ELEMENT COST EFFECTIVENESS

Table 1-11 lists the summary of cost-effectiveness indicators for projects approved by the two administrators and Onsite Energy Corporation. Final peak period savings have not been reported for a few of the projects, and final payments have not been made for a small fraction of the projects. However, due to the large population of projects that have been verified, approved, and paid, the overall calculations for cost-effectiveness are unlikely to change in any significant way.

Table 1-11 is based on contracted savings and corresponding grant payments for approved Onsite Energy Corporation, CIT, and ITRC projects. Levelized cost-effectiveness values were calculated individually for each project with Effective Useful Life values found in Appendix F of CADMAC protocols – Effective Useful Life Values for Major Energy Efficiency Measures[6].

Some of the energy efficiency measures described in the project applications are not shown in the CADMAC protocols. Nexant assigned a conservative 5-year useful life to all energy efficiency measures not listed in the report. For Category 3 projects that are also participating in the CAISO projects, the useful life of load shedding was assumed to be one (1) year, after which time payments cease.

Table 1-11: Project Cost – Effectiveness Summary

Project Category	Administrator Reported Demand Reduction, kW	Paid Grant Amount, ($)	Simple Cost Effectiveness, $/kW	Levelized Cost, $/kW-yr	Number of Projects	Average Grant Amount, ($)
1	27,320	4,382,470	$160.41	$21.55	193	$22,945
2	N/A	$4,049,558	N/A	N/A	747	$5,421
3	29,930	$1,003,514	$33.53	$17.72	18	$55,751
4	N/A	$1,633,048	N/A	N/A	20	$81,652
Onsite Energy Corporation	8,807[1]	$2,000,000	$250[1]	$54.00	43	$47,619
Totals[2]	66,057	$13,068,599	$199.65	$43.47	1021	$12,838

[1]Onsite Energy Corporation has contracted with the Energy Commission to deliver up to 8 MW of peak period demand savings at a price of $250 per kW. Onsite Energy Corporation projects are located at food processor facilities and are typically energy efficiency projects similar to Category 1 projects from the two independent administrators. Project savings above the 8MW contract may be moved to another program.

[6] EULs are available on the CALMAC website: http://www.calmac.org/cadmac-protocols.asp

[2]Totals shown include all projects in all project categories. Simple and levelized costs are calculated with no additional demand savings for Category 2 or Category 4 projects. Both Simple and Levelized costs are calculated with all savings reported by Onsite including savings in excess of 8MW contract limit.

Initial impressions of the final cost-effectiveness values are that Category 3 projects are the most effective projects for delivering peak period demand savings at a low cost, from both a simple and levelized cost-effectiveness basis. Category 1 projects have a relatively large simple cost-effectiveness value, but when calculated on a levelized cost-effectiveness basis, the average value drops by more than a factor of eight due to long useful lives for many of the measures.

Cost-effectiveness is not calculated for Category 2 projects since demand savings estimates from pump repair projects are not available. However, if the pump repair projects approved by the administrators all resulted in reductions in hours of operation during peak periods as discussed in Section 1.5.1, and if the reduced hours resulted in the maximum potential of 47 MW of peak period savings, the levelized cost for pump repair projects is calculated at $18.64/kW-yr for a pump retrofit that has a useful life of 5 years, and the average levelized cost-effectiveness value for all projects drops to $25.38 from the value of $43.47 shown in Table 1-11. Nexant is not suggesting that peak period savings for pump repairs completed under the APLRP are realistic at 47 MW; however, any peak period demand savings resulting from pump repairs or retrofits has a positive impact on overall program element cost-effectiveness indicators, both simple and levelized.

1.7 PROCESS EVALUATION

1.7.1 Audit Plan for Program Element

To gauge performance of the two administrators during the program, Nexant conducted surveys of participants identified in the post-installation sampling plan, and performed on-site interviews with the administrators. Administrator performance was measured in a qualitative manner by examining documentation related to the sample projects and the grant process. Nexant reviewed documents including project applications, billing data, engineering models, calculations of baseline demands, savings calculations and approved M&V plans. Nexant evaluated the timeliness of project reviews, notifications to participants, and the grant contract process. Nexant also noted the administrators' marketing efforts to the agriculture industry, including trade groups contacted, methods of disseminating program information to potential project applicants, and local or regional workshops.

Nexant's administrator audit was not intended to be a fiscal audit, but rather to get a sense of how well each administrator followed program element guidelines and what level of effort was expended to market the program to potential applicants and trade groups. Both administrators are nearing full subscription of incentive funding prior to the close of the program; therefore, they have—by definition—met the overall marketing goals.

Participant audits were also conducted for all sponsors of sample projects in each category. Participant audits previously developed for other program elements were modified as needed and used as a basis for determining overall satisfaction with the program, administrator actions related to each project, and to capture comments that may prove useful in future program design. Participants were contacted by phone for the audit, with answers recorded on forms for each

participant that agreed to talk with Nexant about their project. Nexant also polled a number of participants who did not complete projects, or withdrew the project applications. The results of the participant surveys are presented in Section 1.7.4 below.

1.7.2 Audit Activities

Randy McCall and Jim Herndon, from Nexant, visited the Fresno administrator, Peter Canessa, PE, on December 4, 2002 to collect documentation on sample projects, and to conduct an interview regarding marketing activities and trade group contacts. Mr. Herndon presented the list of sample projects to Bob Hall, P.E, the new administrator for the program, while Mr. McCall interviewed Mr. Canessa, the original program administrator.

Mr. Herndon was assisted in retrieval of all requested files and documentation by Mr. Hall. Copies of all documents including billing histories, site maps, engineering studies and project applications were made on CIT's copier for future analysis and review for the audit. Mr. Herndon reported that all documentation was made available to Nexant, files were well organized and easy to find, and the staff were very helpful in completing his task.

During Mr. McCall's interview with Mr. Canessa, questions were asked and notes recorded related to marketing efforts that CIT had completed or were planning to do in the future to promote the program. Mr. Canessa was asked to provide details of trade group contacts, bill inserts to utilities, workshops that had been conducted, and trade shows that CIT attended.

Mr. Canessa was also queried on CIT's technical process for determining the merits of a project application, how a baseline demand was analyzed and adjusted, how potential savings would be measured and verified after installation, and how technical problems beyond the scope of CIT were handled. In all cases, Mr. Canessa provided detailed answers and discussion of the process CIT uses to review, approve, and contract a project; a description of the process is in the following section.

Mr. Dan Howes of ITRC was also contacted to schedule an interview. However, a visit could not be arranged prior to the end of the year. Mr. Howes indicated that a site visit by Nexant would not be a problem, and Nexant would be given access to project files to conduct a similar process that was completed at CIT. Nexant scheduled the interview with Mr. Howes early in the first quarter of 2003, and will also attempt to schedule an interview with ITRC's program manager, Charles Burt, Ph.D., PE.

The revised final report will include a formal presentation of audit results based on the administrator audit visit to ITRC and a follow-up interview with Bob Hall, the current administrator for CIT.

1.7.3 Evaluation of Administrator Audit Results

Nexant's interview with -Peter Canessa, PE, program manager for CIT's APLRP, was conducted in an informal setting, following an interview guideline to prompt questions about the process of running the program. Notes were recorded for responses to questions.

The interview began with a discussion of marketing of the program and how information was disseminated to the agricultural industry. Mr. Canessa responded that a range of approaches were used, including utility bill inserts to PG&E's agriculture accounts, seminars, trade shows, county fairs, the local Farm Bureau, and the internet with a CIT web site devoted to the program. Bill inserts were also sent to SCE and SMUD, although the dates were not recorded in the notes. The bill inserts were enclosed in PG&E utility bills during June 2001 and again later in the same summer.

Outreach efforts from CIT appeared to be consistent with a large, well-organized program, although participant audits may shed more light on issues related to learning about the program and program details. Nexant has noted that the web site for the Agricultural element of the PLPRP has been updated regularly throughout the program, and information was presented in a clear format with downloadable files in Word and Adobe Acrobat formats.

Once potential participants learned of the program and decided to move forward with a project, they were required to complete applications for projects and follow the program guidelines in the program descriptions found on the CIT's web site. Mr. Canessa explained that he often spent 20 to 30 percent of each day assisting customers in completing project applications. Services that Mr. Canessa claimed were available to applicants included technical assistance to an applicant once they had submitted a project application with a minimum of a basic project description. CIT, unlike ITRC, marketed to the larger community of agriculture, including smaller farmers and food processors not likely to have the engineering expertise of large water districts. Mr. Canessa indicated that he and staff members had conducted training sessions in the local area, as well as in the north valley at Brooks Ranch with slide shows and application advice provided to seminar participants. The trade shows and training sessions were reported to be infrequent, and a schedule of events was not provided during the interview.

Mr. Canessa or one of the CIT staff engineers generally performed the technical review of project applications. When a technology or proposed measure was outside of the expertise level of Mr. Canessa or the staff, consultants retained by CIT were asked to provide additional review for specific issues. Mr. Canessa described several projects and problems that had been encountered relating to poor documentation of operating conditions for baselines, how baselines were evaluated, and typical problems CIT had to solve. Typically, CIT used billing data to establish the baselines, although monitored data was required prior to baseline approval for a few of the projects.

Nexant's review of the project documentation and calculations showed a consistent approach to baseline determination and savings calculations. Measurement and verification for project savings was often based on a full summer peak period billing after project installation, but in some cases monitoring or spot measurements of equipment loads was also required. Nexant's review of the savings approved for Category 1 sample projects was consistent with CIT's methodology, and generally in agreement with savings totals. Only one project appeared to have a minor error in the calculation of savings.

Based on Nexant's interview with Mr. Canessa, and explanations of CIT's approach to marketing techniques, the technical expertise exhibited in project reviews, and follow-through on projects in a timely manner as detailed in progress reports, it is Nexant's opinion that CIT is administering the APLRP in a competent and consistent manner.

The revised final report will include a formal presentation of audit results based on the audit of the ITRC administrator and an additional visit to the CIT administrator. The revised final report will include detailed information about outreach efforts and documentation review of the sample projects.

1.7.4 Evaluation of Participant Surveys

This section summarizes the results of participant audits that were conducted of the Agricultural Peak Load Reduction program. A representative sample of 28 participating customers was surveyed in order to assess key qualitative aspects of program performance that extend beyond typical analyses of reported demand savings. All audit results are for the period of 2003 and were compiled based on participant responses to a set of 18 standardized survey questions.[7] Participant surveys consisted of a combination of closed- and open-ended questions covering such topics as the program application process, notification system, end-user involvement in similar programs, and level of satisfaction in different areas of program administration and implementation. For 11 out the 18 survey questions, participants were provided a numeric five-scale rating to evaluate their satisfaction with key program elements. Key results from the participant surveys are presented below.

1.7.5 Motivation to Participate in the Program

Each of the sample program participants was asked to state the main reason(s) for enrolling in the program. Table 1-12 lists the different responses that were received from end-users segmented by project category. The survey results reveal that participants were primarily motivated by a desire to reduce their energy costs and or get access to grant money to help subsidize investments in a range of efficiency related projects.

Table 1-12: Overview of Customer Motivation to Enroll in the Program

	Category 1 (n=6)	Category 2 (n=10)	Category 3 (n=5)	Category 4 (n=6)	**Total**
Contribute to solving the CA energy crisis (1)	2				2
Access to incentives and grant money(2)		7	2	1	10
Shift load to off-peak periods		1			

[7] A copy of the survey form is contained in Appendix for this report.

	Category 1 (n=6)	Category 2 (n=10)	Category 3 (n=5)	Category 4 (n=6)	**Total**
					1
Reduce energy costs/ achieve economic gain (3)	5	2	3	5	15
Efficient use of energy and water	1	1			1
Provide back-up				2	2

Notes: 1) two respondents noted their motivation was to both lower energy costs and reduce the state's energy burdens; 2) One respondent said their motivation was driven by both the receipt of a grant plus a desire to improve efficiency; 3) two respondents stated that they were motivated by a desire to avoid high gas costs as well as have a back-up source of energy.

Two respondents in Category 1 (energy efficiency projects) stated that they were motivated by the dual goals of saving money and helping minimize the statewide energy crisis. Category 2 customers were almost entirely driven by the ability to access grant money. For Category 4 (conversion to alternative fuels), the vast majority of respondents said their participation stemmed from a desire to avoid paying high natural gas prices.

1.7.6 Administrator Performance

Participant surveys also included a series of questions that used a numeric scale to assess the performance of program administrators. As noted in Section 1.1 the two main administrators for the Agricultural Peak Load Reduction program were the Center of Irrigation Technology (CIT) and the Irrigation Training and Research Center (ITRC). Table 1-13, shown below, provides a breakout of the survey sample by program administrator and project category.

Table 1-13: Breakout of Survey Sample by Administrator and Project Category

Administrator	Category 1	Category 2	Category 3	Category 4
CIT	6	5	4	6
ITRC	0	5	1	0

As illustrated in the table above, CIT accounts for virtually all of the survey respondents in Categories 1, 3, and 4. Further, even in Category 2, which contains an even mix of CIT and IRTC, survey results show little or no difference in responses from participants with different program administrators.[8] Therefore, survey results relating to program administrator performance are assumed to uniform across all project categories. Table 1-14, shown below, lists the average score for selected program administrator related questions on both an individual project category basis as well as for all categories (total sample population).

[8] See Appendices for more detailed results of the participant surveys.

Table 1-14 Program Administrator Results

Q4: On a scale of 1 to 5, rate the overall quality of the communication process with your administrator (5=complete/thorough; 3=sufficient/adequate; 1=absent/wholly inadequate)				
Category 1	**Category 2**	**Category 3**	**Category 4**	**ALL CATEGORIES**
4.3	4.6	4.6	4.5	4.5
Q6: On a scale of 1 to 5, rate the reasonableness of reporting requirements (5=Very reasonable; 3=Somewhat reasonable but some challenges; 1= completely unreasonable				
Category 1	**Category 2**	**Category 3**	**Category 4**	**ALL CATEGORIES**
3.8	4.1	4.2	4.8	4.2
Q14: How would you rate your administrator? (On a scale of 1 to 5; 1 being Unacceptable and 5 being Outstanding)				
Category 1	**Category 2**	**Category 3**	**Category 4**	**ALL CATEGORIES**
4.0	4.9	4.5	4.3	4.5

In general, customer responses indicate that participants (across all four projects categories) felt that the performance of their program administrator was strong and that program reporting requirements and communication procedures were very reasonable.

1.7.7 Administrator Performance

Participant surveys also included questions that were utilized to determine a customer's opinion of the overall program as well as to gage the effectiveness of key operational aspects. The remainder of this section details the results of participant audits relating to these two key areas.

1.7.9 Participant Opinion of the Program

The survey results (average score) listed below in Table 1-15 illustrates that participants had a positive experience with the Agricultural Peak Load Reduction program (Q #13) and would be willing to enroll in similar programs (Q#14).

Table 1-15 Participant Opinion of the Program

Q11: Would have performed peak load-reducing actions without the program? Rating: 5=without question; 3=yes, but under different circumstances; 1=under no circumstances)				
Category 1	**Category 2**	**Category 3**	**Category 4**	**ALL CATEGORIES**
3.2	2.6	2.2	2.5	2.6
Q12: Would you participate again in a similar program? Rating: 5=without question; 3=yes, though under different circumstances; 1=under no circumstances.				
Category 1	**Category 2**	**Category 3**	**Category 4**	**ALL CATEGORIES**
5.0	5.0	4.8	4.5	4.8
Q13: How would you rate your experience with the Peak Load Reduction Program? (On a scale of 1 to 5; 1 being Unacceptable and 5 being Outstanding)				
Category 1	**Category 2**	**Category 3**	**Category 4**	**ALL CATEGORIES**

4.3	4.5	3.8	4.3	4.3

Respondents from Categories 2, 3, and 4 indicated that they would not have likely performed peak load reduction action in absence of the program (Q#11). However, customers that implemented Category 1 projects stated that they would have reduced their load without the program's support—Category 1 results indicate that the inherent economic benefits of energy efficiency measures may already be sufficiently strong to mobilize investment in this sector.

1.7.10 Review of Program Operational Elements

Participants in the survey sample were asked a series of questions relating to key operational elements of the program. Specifically, participants were asked to rate an element of the program, on a scale of 1 to 5 (with 1 being Unacceptable and 5 being Outstanding). Participant responses across the different project categories, displayed below in Table 1-16, illustrate that end-users felt that the program operations were efficient and relatively smooth.

Table 1-16 Participant Reviews of Key Program Operational Elements

Category 1	Category 2	Category 3	Category 4	ALL CATEGORIES
Q15: *How would you rate the application process?*				
4.0	4.3	3.0	4.2	3.9
Q16: *How would you rate the invoicing, billing and payment process?*				
4.3	4.5	3.5	4.2	4.1
Q17: *How would you rate the verification process?*				
4.2	4.6	4.0	4.7	4.4
Q18: *How would you rate the implementation timeline that you were on?*				
4.2	4.5	4.3	4.4	4.4

The average response for all of the categories to each of the above questions was approximately 4 or higher, indicating a high level of customer satisfaction with the program's operations. However, it is important to note that customer responses in Category 3 (i.e., for Q#15 and #16) were slightly below other project categories. These results reflect in part that demand response is a relatively new (and more complex) type of project compared to more traditional energy efficiency and gas conversion measures.

1.8 CONCLUSIONS

1.8.1 Program Element Successes

The success of the Agricultural Peak Load Reduction Program should be considered in context. Agriculture in California is a $27 billion industry using 4 percent of the state's electricity. The agriculture industry is not concentrated in a few large facilities, but instead is made up of thousands of individual farms, dairies, orchards, and food processing facilities. The agriculture industry is a very diverse market segment employing over 4 percent of the state's workforce, and as such, programs directed at the broader market have always experienced difficulties in reaching all segments of the industry. Although a substantial fraction of the overall Peak Load Reduction

Program funded through AB970 and SB 5X/29-X, the $39.7 million allocation to the Agricultural Program is less than 0.16 percent of the value of the agriculture industry as a whole. Compared to the value of agriculture's annual production, incentives and funding for the program element are relatively minor.

But in spite of the modest funding relative to the overall size of the agriculture industry, the 1021 projects contracted by CIT, ITRC, and Onsite Energy Corporation, have achieved 65.5 MW of peak period load reductions for the State's electrical grid. The Peak Load Reduction Program was born under emergency conditions of 2000 / 2001 when, at times, 65.3 MW of capacity might have prevented or reduced the duration of rotating power outages.

What worked, and how well did it work? From a perspective of immediate response to emergency conditions, demand responsive projects were signed up, implemented, and tested within months of the program launch. ITRC contracted with water districts for 45.6 MW of peak period demand savings for a total incentive cost of $899,367. The final analysis shows that much of the estimated savings for the Category 3 projects administered by the ITRC were withdrawn or cancelled resulting in a total of 25.5 MW in potential load relief for ITRC Category 3 projects. The Fresno administrator was similarly successful, contracting for a total of 4,628 kW of peak period savings, with a verified amount of 4.4 MW and a contracted grant total of $104,147. The simple cost-effectiveness value for all Category 3 projects is $33.53/kW in contrast to the calculation for Category 1 projects averaged $160.41/kW on a simple cost basis. However, on a long term basis, the Category 1 projects provide consistent, long lived demand and energy savings that are reflected in the calculation of levelized cost-effectiveness at $21.55/kW-yr for Category 1 projects vs. $17.72/kW-yr for Category 3 projects.

The timeline for the Category 3 project submittals, approvals, and project completions is also of interest in terms of program element successes. In most cases, the projects were received, reviewed, approved, contracted, and constructed by the end of October 2001. This is a phenomenal response, even in light of the fact that many of the projects were also participating in the CAISO voluntary load reduction program. Nearly 30 months after program start-up, the 191 Category 1 electrical efficiency projects still have not achieved the peak period demand savings that 18 Category 3 projects achieved in the first six months. The comparison is somewhat unfair, as the Category 3 projects actually delivered *potential* peak period demand savings. But the speed and low cost for which these projects and savings were delivered is clearly important for the future of load management programs.

Program participants also jumped in early at the chance to diversify their fuel sources through Category 4 project incentives. The projects provided incentives to install equipment that would allow them, but not require them, to burn alternative fuels to natural gas. As this program was rolled out after price increases drove natural gas prices to the highest levels California had ever seen, the level of interest these incentives attracted early in the program is not surprising. Somewhat disappointing was the level of project withdrawals, and cancellation for alternative fuel conversion projects. Of the original 56 projects submitted to CIT, only 20 were approved for contracts, and have been completed with grant payments made. Clearly, the volatile pricing of natural gas and the dramatic drop in price in early 2002 was a factor for some participants in

their decisions to abandon projects. With recent increases in the cost of natural gas, some of the early participants who later withdrew applications may be revisiting their decisions.

While participants with Category 1 electrical efficiency projects were not as swift to sign up for the program, there has been a steady increase in the number of approved projects leading to the current total of 191 approved projects. The two administrators contracted for a total of 27,910 kW in peak period demand savings, of which 27,320kW were verified by the administrators.

The program also appears to be encouraging innovation in the application of energy-saving technologies in the agricultural industry, as evidenced by the increasing diversity of projects in the administrators' portfolios.

A notable success for the program was the installation and commissioning of the dairy manure biogas digester and generation equipment at the Inland Empire Utility Agency's RP1 and RP5 water treatment facilities. The project resulted in one of only two awards of the Governors Environmental Leadership Award to Southern California groups. The award, presented in December 2002 to both the Inland Empire Utility Agency and the Milk Producers Council, recognized their collaboration on the Chino Basin Organics Management Strategy. Phase I of the plan has resulted in continuous generation of 0.75 MW, diversion of 225 tons/day of manure from local fields where it may have contributed to additional groundwater contamination, and improvements to local air quality by preventing the release of methane, ammonia and its decomposition byproducts at the dairies participating in the program.

Leadership demonstrated by the agency in piloting the projects could be rewarded in the near future with increased interest from other concentrated feed operations in California. As regulations governing the storage and disposition of the animal wastes are tightened at the local, state, and federal levels, projects combining energy production, and mitigation of environmental impacts are likely to be implemented in increasing numbers.

Other examples of the success of the program element are not as clear-cut, but include the large number of pump repairs completed with 747 individual pump repair projects. The pump repair projects are significant to the agriculture industry, especially as an economic benefit to irrigators for improved crop yields and profitability. Peak period demand savings may be an outcome of the $4 million in incentive money for improving the efficiency of pumping plants, but the answer to how much demand savings—if any—was achieved is far from clear.

Onsite Energy Corporation was very successful in meeting their contract goals of delivering 8 MW in peak period demand savings. To a large degree, their success is a result of their collaboration with Powerit Solutions, the company that manufactures the Energy Director line of load control hardware for limiting peak period demands for a facility. Unlike other electrical efficiency projects that Onsite Energy Corporation completed, the projects with demand limiting systems provided significant savings totals by integrating a load management device that was designed around the idea that minor control actions to large equipment can result in significant overall facility demand reductions from previous years. These rule based systems are capable of

being tuned to be more aggressive with respect to limiting the overall facility demand, or less aggressive as the situation warrants.

A potential plus for demand limiting systems of this type is their capability to be integrated with future programs to provide Demand Responsiveness for a facility. Because of the design and implementation of the systems, large savings can be accomplished, often with minimal impacts on facility production.

1.8.2 Lessons Learned

The agricultural program had some clear elements of success, as well as elements where a critical review of the process points out lessons for design of future programs. While Nexant believes that improvements could have been made to the program, this is not a suggestion that some elements of the program failed to deliver the intended benefits to the state or the agriculture industry.

Pump repair projects for both administrators make up the largest group of projects approved for grant payments by virtue of the volume of projects; as a group they also received funding that was similar in amount to all projects approved for Category 1. With demand savings for pump repair projects nearly impossible to accurately document without additional follow-up study, the impact of the pump repair projects has primarily been to stimulate the market for repair services, pump testing, and to raise the awareness of irrigators to pumping problems and solutions.

What has been achieved for this allocation of funding? Undoubtedly irrigators have benefited economically from improved pumping plant efficiencies and increased delivery rates of water to fields and crops, resulting in improved yields and quality. However, as was described in Section 1.5, if irrigators increase the amount of water delivered to a field because they neglected to change irrigation schedules or increase irrigation set sizes given the improved flow rates of the newly repaired pumps, the average peak period electrical demand for pumps may actually increase, not decrease as intended. This suggests two areas of improvement for similar or future programs that may be useful: (1) measurement of pre-installation and post-retrofit energy use and water deliveries to intended targets, and (2) intervention with irrigators in the form of education and control systems such that irrigators modify their operations of the repaired pumps and avoid inadvertently increasing the amount of water pumped to a field after the pumping plant efficiency is improved.

When equipped with a time-of-use meter, an irrigator is perhaps more likely to change pumping schedules to avoid high peak period time of use rates. However, TOU meters are not universal for pumps, and alternative real time pricing programs are unavailable in California at this time. In the absence of such programs, education and installation of time controls for pumps might help to mitigate the potential for increased energy use from pump repairs and OPE improvements.

Category 4 project grants were intended to encourage participants to install equipment that would allow a switch to alternative fuels from natural gas. Initial response to the program element was strong, with natural gas prices still at a high level following the early part of 2001

with its record high pricing. By September 2002, 15 of the original 57 applicants had withdrawn their project applications, and the final tally of 20 projects that were completed shows that high level of dropouts, as well as non-compliance with the program guidelines for some projects. A review of natural gas prices from the Energy Information Administration shows that natural gas prices for Commercial and Industrial customers peaked in February and March of 2001, and gradually receded from nearly $14 per thousand cubic feet to less than $6 per thousand cubic feet in February 2002. Only one of the 15 projects that were withdrawn did so prior to the January 2002, an indication that these projects were a hedge against high natural gas prices.

Payments made to Category 4 project participants was approximately 25% less than the total grant payments made by each of the two administrators and Onsite Energy Corporation for all of the Category 1 projects. With only 20 approved projects out of a total 1018 projects approved by the two administrator and for Onsite Energy Corporation, the average grant payment at $81,652 is significantly larger than the size of the next largest payment per project for Category 3 advanced telemetry projects. With no demand savings attributed to fuel switching projects, relatively few agricultural customers participating in the program, and a requirement that the project only provide the opportunity to switch fuels, the question might be asked if this was the best use of limited funding for a peak period demand savings program. This category was not chosen by the Energy Commission, but was included in the SB 5X legislation. The Energy Commission is aware that no electricity peak reduction would occur from these projects.

The last note regarding lessons learned from the program element is related to calculation of post-installation demand and baseline demand for the projects. The two administrators evaluated project applications and approved projects without the benefit of pre-installation inspections to verify equipment loads, or operating conditions. While post-installation M&V was required for some projects, a lack of baseline verification can often lead to errors in savings that are difficult to quantify or even recognize. Projects involving large facilities with many loads on a single utility meter are often where these types of problems occur. When only a small portion of an overall electrical billing is to be offset by an efficiency project, and variability from month to month in the billing data is factored in, peak period demand savings based on differences in the utility bills also may be difficult to justify.

For some of the Category 1 projects, applicants provided nameplate data for calculating baseline loads of motors or other equipment without reporting load profiles for the equipment. The APLRP was required to be implemented in a very short time frame in response to emergency conditions in California, and baseline verification procedures were relaxed in response to the urgency of the situation. However, the lack of good baseline information can easily lead to large errors in demand savings for a given project. Once the proposed equipment is installed, opportunities to verify baseline conditions are gone, and errors in reported savings are not likely to be discovered. Nexant strongly recommends that baseline verification be considered as an integral part of any future programs of this type.

This report on the Agricultural element of the PLRP is Nexant's final report to the Energy Commission and contains the evaluation of the agricultural element of the PLRP. The overwhelming majority of the projects have been completed and verified by the administrators,

and no significant changes to the overall level of savings, or cost-effectiveness calculations is expected.

Section 2 Cool Roofs and Cool Savings Program Elements

2.1 BACKGROUND OF PROGRAM ELEMENTS

The Cool Roofs program element, funded through California Assembly Bill 970 (AB 970), and the Cool Savings program element, funded from Senate Bill 5X (SB 5X), provide incentives to participants for the installation of Energy Commission-approved ENERGY STAR® rated cool roofing products and, in some cases, thermal insulation to reduce buildings' peak electricity demand. The Cool Roofs program was initiated under AB 970 with funds of $9.4 million. The Cool Savings program, an extension of the AB 970 initiative that targets primarily flat or low-sloped commercial and industrial roofs added $14.5 million in funding.

These program elements promote the installation of ENERGY STAR® rated cool roofing products that reduce solar energy absorption by rooftops and rooftop ducts. Cool roofing products lower roof temperatures, decreasing heat transfer into the building thereby reducing air conditioning loads. Cool roofing materials are defined in these programs as those materials with a solar reflectivity greater than 65 percent and an emissivity greater than 80 percent-for flat and low-sloped roofs, and a solar reflectivity greater than 40 percent and an emissivity greater than 80 percent--for high profile tiles on sloped roofs.

The program element consists of Energy Commission contracts with five regional program administrators, who have a combined demand savings goal of approximately 40 MW. The program administrators are directly responsible for: promoting the program, enlisting participants, verifying project eligibility and completion, and paying incentives. Administrators are also responsible for reporting on the progress of their programs to the Energy Commission. The five program administrators are:

1. Local Government Commission (LGC)
2. Los Angeles Department of Water and Power (LADWP)
3. Sacramento Municipal Utility District (SMUD)
4. The Sacramento Tree Foundation (STF)
5. San Diego Regional Energy Office (SDREO)

2.2 STATUS OF PROJECT ELEMENT

As of December 31, 2002, under both the AB 970 and SB 5X-funding sources, Nexant has verified the complete installation of about 33 million square feet of cool roofing materials, representing about 11 MW of verified demand savings. Based on current program enrollment, Nexant expects that, by April 2003, the programs will have delivered about an additional 7.5 MW in verified savings. Since program administrators are continuing to enlist participants, these additional verified savings could be greater.

Of the 7.5 MW, 2.0 MW have already been installed. However, according to Nexant's latest records, program administrators have not yet invoiced these to the Energy Commission. The remaining 5.5 MW represents approved projects that are pending installation. Once the projects are installed, the incentives for these projects will be invoiced to either AB 970 or SB 5X-funds, depending on the funds available, project timing, and project type.

Table 2-1 shows the verified peak savings attributed to the AB 970 and SB 5X-funded elements, current as of December 2002. The table also shows the estimated savings for projects that have been completed but not yet invoiced to either AB 970 or SB 5X-funding source. Finally, the estimated savings for projects with approved contracts that are pending completion are also listed.

Table 2-1: Total Verified and Estimated Demand Savings

Project Category	Savings (MW)
AB 970 verified	5.1
SB 5X verified	5.8
Complete, not invoiced—Estimated for AB 970 and SB 5X	2.0
Contracted, pending completion—Estimated for AB 970 and SB 5X	5.5
Total	**18.4±3.6**

Figure 2-1 illustrates trends in program activity since the program began. The graph shows that cool roofing installations and total participants both grew at a fairly steady pace. The installed roofing averaged approximately 0.6 MW of new cool roofs every month with the number of participants growing approximately 0.9 MW per month. New enrollment, projects dropping out, or being disqualified affected the number of approved projects, and installations completed; therefore, these projects have had more fluctuation in growth. The reported savings from approved projects grew at an average of around 0.3 MW per month.

Figure 2-1: Program Activity over Time

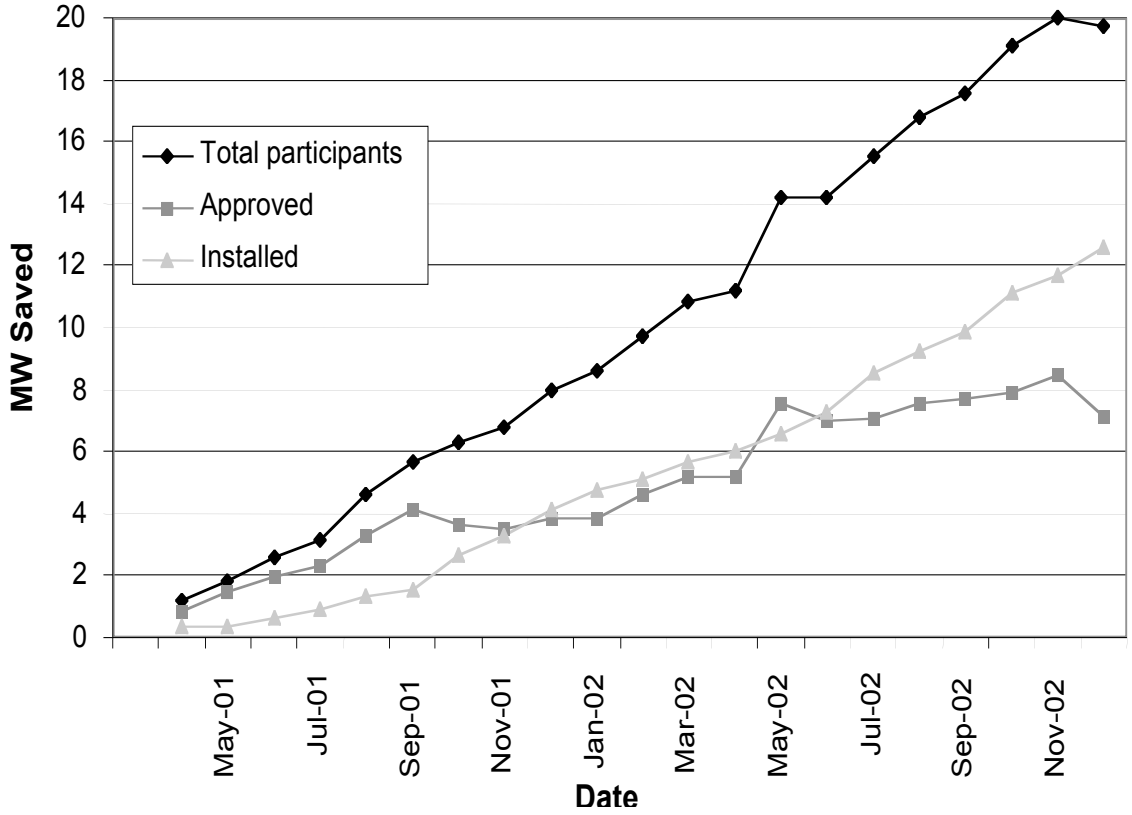


Table 2-2 shows the program accomplishments for each administrator in terms of roof area (combined contracted and installed), the number of sites, and demand savings (combined verified and estimated). The LGC is not listed in these and following tables because they are involved with the promotion of the Cool Savings program and most of their savings are credited to STF and SDREO.

Table 2-2: Projects Completed/Approved by December 31, 2002

Program Administrator	Total Estimated Roof Area (sq ft)	Number of Sites	Total Estimated Savings (MW)
LADWP	2,641,985	214	0.92
SMUD	5,021,221	202	1.62
STF	21,863,748	939	7.14
SDREO	25,626,339	903	8.74
Total	**55,153,293**	**2,258**	**18.42 MW**

2.3 MV&E APPROACH

Nexant's approach to verifying the savings for this program, for both the AB 970 and SB 5X-funding source, involved collecting project data reported by program administrators to the Energy Commission, selecting a sample of projects for which to perform measurements and verify demand savings, performing the measurements and savings calculations for the sample selected, and extrapolating the results from the sample to the entire program population.

Each month, the program administrators sent program databases to the Energy Commission, who, forward those databases to Nexant. The measurement and verification activities were based on the database information forwarded to Nexant.

The program administrator databases contained fields for data from participant applications such as: site location, participant contact information, building type, roof and duct square footage, number of stories, indoor temperature, type of HVAC system, previous and new roofing material, type of roof construction, insulation levels, roofing contractor information, and rebate amount.

The databases also included fields for administrator data such as: dates of requests for information, applications, approvals, installations, invoices sent to the Energy Commission or LGC, and payments made to participants. There were also fields for pre- and post-installation administrator inspection data such as reflectivity and roof and duct square footage, and fields for estimated and actual incentive amounts.

Nexant segmented the total population of projects in the administrator databases into four subpopulations—one for each of the program administrators (except LGC). From each sub-population, Nexant randomly selected a sample of projects; each sample selection was large enough to meet the Energy Commission's requirements for confidence and statistical precision. For the SB 5X program element, Nexant again segmented the total population of projects, this time by building type (industrial, retail, office, etc.). For each of these sub-populations, Nexant calculated the sample size necessary to meet the program requirements for statistical validity. If there were not enough projects of a particular building type in the administrator sample population, Nexant randomly selected more projects of that building type and added those projects to the administrator sample population. In this way, Nexant derived a statistically valid sample population that was representative of the entire SB 5X program population.

For the AB 970-funded element, Nexant also segmented the population into various sub-populations. For a detailed discussion of the AB 970 sampling approach, please refer to Nexant's website, http://www.nexant.com/services/cec.

Table 2-3 shows the breakdown of sample populations by administrator and by program element. LADWP's population size is smaller than that of SMUD because of delays in reporting.

Table 2-3: Sample Populations by Program Administrator

Program Administrator	Total Sites Contracted	AB 970 Sample Size	SB 5X Sample Size	Total Sample Size
LADWP	214	4	9	13
SMUD	202	9	12	21
STF	939	19	21	40
SDREO	903	19	28	47
Total	**2,258**	**51**	**70**	**121**

Table 2-4 shows the breakdown of the SB 5X-funded sample population by building type.

Table 2-4: Sample Populations by Building Type (SB 5X Only)

Building Type	Total Sites Invoiced	Sample Size
Cold storage	16	8
Multifamily	77	9
Industrial	15	10
Office	217	10
Other	98	10
Retail	120	10
Schools	208	13
Total	**751**	**70**

2.4 PROGRAM ELEMENT MONITORING AND VERIFICATION

Program administrators and Nexant used deemed savings values to calculate estimated and verified demand savings. The deemed savings values were derived from research performed by Lawrence Berkeley National Laboratory and approved by the Energy Commission.

In SB 5X the demand savings were calculated by multiplying roof area in square feet by 0.35 watts per square foot (the deemed savings rate). In AB 970, the roof area in square feet was multiplied by one of three deemed rates, depending on the thermal resistance as R-value of the roof. The three AB 970 deemed savings rates were 0.4, 0.3, and 0.2 watts per square foot. More details on the AB 970 approach to savings calculations can be found in Nexant's 2001 program report.[1]

Nexant visited each site in the sample populations to verify the installation of the cool roofing materials and to measure the roof area. Although only the roof area measurements were used to calculate verified demand savings, Nexant also collected data on roof reflectivity with the albedometer and the size and age of existing air conditioner units. Analyses of those findings are presented later in this section.

[1] http://www.nexant.com/services/cec/

To calculate the savings for each sample site, Nexant multiplied the measured roof area by the deemed savings rate of 0.35 watts per square foot.

Table 2-5 lists each site in the SB 5X sample population along with the reported roof area, verified roof area (measured by Nexant), and the verified savings.

Table 2-5: Measurement and Verification Findings for SB 5X Sample Population

Program Administrator	Project Name	Building Type	Reported Roof Area (sq ft)	Verified Roof Area (sq ft)	Verified Savings (kW)
LADWP	Encino Spa East	Multi-Family	75,000	84,390	30
	LAUSD-Buchanan Elem.	School	11,872	12,136	4
	LAUSD-Jordan High	School	29,149	35,849	13
	LAUSD-Nightingale Mid.	School	9,773	10,876	4
	LAUSD-Wonderland Elem.	School	10,877	11,253	4
	So. California Pipe Trades	Office	12,238	14,383	5
	Wilton Wilshire	Multi-Family	21,900	15,763	6
	Sherman Way	Office	18,000	13,558	5
	Gault Apartment	Multi-Family	7,100	5,791	2
	Total LADWP		**195,909**	**203,999**	**73**
SDREO	Art Gallery	School	1,520	1,500	1
	Barstow Community College-Gym	School	9,500	10,320	4
	Bradley Commerce Center	Industrial	5,998	4,148	1
	Brookhurst, Inc.	Industrial	33,892	23,877	8
	Building 11 & 12	Multi-Family	3,456	3,200	1
	Calypso Palms	Multi-Family	10,000	10,285	4
	City of Hope National Medical Center*	Other			
	Claremont New Life Vineyard	Other	9,255	9,067	3
	College of the Desert / Dining*	School			
	Country Club Corporate Plaza, Bldg. "I"*	Office			
	Emerald Center	Retail	72,875	71,253	25
	Maycock	Multi-Family	2,700	2,700	1
	Meyler Elementary LAUSD	School	5,619	5,834	2
	Montclair North Plaza Bldg "A" & "C"	Retail	5,000	14,676	5
	Orlimer Golf Equipment	Industrial	6,968	8,854	3
	Pilot/Broadleaf	Cold-Storage	48,519	47,649	17
	Preferred Freezer Services of Vernon	Cold-Storage	104,870	104,667	37
	Ramona Park	Multi-Family	18,000	15,671	5
	Regency Plaza Hotel	Other	16,427	15,306	5

Program Administrator	Project Name	Building Type	Reported Roof Area (sq ft)	Verified Roof Area (sq ft)	Verified Savings (kW)
	San Diego Tech Center	Office	177,664	142,737	50
	Science Drive	Industrial	98,627	98,000	34
	Sears, Roebuck & Company	Retail	101,032	97,451	34
	Southwestern College Building 220	School	8,500	8,107	3
	Sunrise Country Club H.O.A.*	Multi-Family			
	Target Store	Retail	58,509	44,309	16
	The Gas Company	Other	5,207	6,431	2
	Unocal Hartley Center	Industrial	14,800	18,331	6
	Villa Honda, Mazda, V. W.	Retail	22,249	21,600	8
	Total SDREO		**841,188**	**785,971**	**275**
SMUD	Blue Diamond Growers	Industrial	64,000	58,804	21
	Capital Power Federal Credit Union	Office	7,924	8,008	3
	Correctional Peace Officers Foundation*	Office			
	Crestwood Behavioral Health	Other	36,000	30,397	11
	CT Realty Co	Office	42,914	41,727	15
	Feickert (Elk Grove Unified School District)	School	18,276	14,070	5
	McClellan Park LLC Bldg. 652, City of Sacramento	Other	2,192	1,478	1
	McCreerys Home Furnishings	Retail	63,500	45,462	16
	Meadowview City Service Center Bldg "A"	Office	17,771	13,552	5
	Meadowview City Service Center Bldg "B"	Office	10,145	8,351	3
	Office Max/Joanns Fabrics	Retail	44,950	43,011	15
	Reza Gorgani	Multi-Family	12,210	13,722	5
	Total SMUD		**319,882**	**278,582**	**98**
STF	Ad Club	Office	3,724	3,532	1
	Chico Produce, Inc. DBA: Pro Pacific Fresh	Cold-Storage	68,400	66,120	23
	Commerce Center	Cold-Storage	117,701	131,029	46
	Del Mar Cold Storage	Cold-Storage	30,891	27,247	10
	Delta Brands	Cold-Storage	52,866	51,031	18
	Fitness Quest Health Club	Other	11,190	10,351	4
	GE Building, San Jose City College	School	14,496	14,374	5
	Guittard Chocolate	Industrial	281,891	256,483	90
	Historic Cary House Hotel	Other	5,956	5,257	2
	Lafayette Townhouse Apartments	Multi-Family	2,866	2,591	1

Program Administrator	Project Name	Building Type	Reported Roof Area (sq ft)	Verified Roof Area (sq ft)	Verified Savings (kW)
	Microwave Power, Inc.	Industrial	3,706	3,742	1
	Portage Road	Industrial	18,630	20,238	7
	Quad Wing, Benicia High School	School	10,542	7,373	3
	Rengstorff Ave.	Other	17,236	17,187	6
	Roseville Electric	Other	6,809	6,478	2
	San Leandro Plaza	Retail	47,944	45,905	16
	Sierra Beverage Company	Cold-Storage	37,824	25,537	9
	Sierra Vista Partners	Retail	20,881	11,118	4
	Target, West San Jose T-324	Retail	117,426	120,502	42
	Whiteford School	School	10,324	11,417	4
	Yosemite Meats Co., Inc.	Cold-Storage	7,313	5,092	2
	Total STF		**888,616**	**842,603**	**295**
	Overall total		**2,245,595**	**2,111,161**	741

*Roof area for this project not measured due to difficulties encountered at the site. The absence of roof measurement does not affect the statistical validity of the overall findings.

2.5 PROGRAM ELEMENT EVALUATION

Nexant used the findings from our analysis of the sample projects to determine the verified savings for the program element as a whole. For each project administrator's sample projects, a realization rate was calculated. The realization rate was derived by dividing the sum of the areas measured by Nexant by the sum of the areas reported by the administrators. Table 2-6 shows the realization rates calculated for each program administrator for both AB 970 and SB 5X.

Table 2-6: Realization Rates for the Program Administrators and Program Overall

Program Administrators	Realization rate AB 970	Realization rate SB 5X
LADWP	0.94	1.04
SMUD	0.99	0.87
STF	0.92	0.95
SDREO	1.05	0.93
Overall for program	0.96	0.94

Nexant multiplied the realization rate for each administrator by the total area reported by that administrator (with the exception of LADWP for which numbers reported by the Energy Commission were used. Nexant was required to use the Energy Commission numbers because LADWP did not use the fields in the database required for this analysis.), yielding the administrator's total verified area. These verified areas were determined for each administrator and then summed together to determine the program-wide verified areas. These results were then

multiplied by the deemed savings factor of 0.35 watts per square foot, yielding the verified savings for each administrator and the program as a whole. The reported and verified numbers for projects invoiced to the AB 970 element are shown in Table 2-7 and those for SB 5X are shown in Table 2-8.

Table 2-7: Application of AB 970 Realization Rates

Program Administrator	Reported Roof Area (sq ft)	Realization Rate	Verified Roof Area (sq ft)	Verified Savings (MW)
LADWP	1,220,934	0.94	1,148,655	0.40
SMUD	1,771,137	0.99	1,753,426	0.61
STF	7,891,856	0.92	7,260,508	2.54
SDREO	4,281,736	1.05	4,495,823	1.57
Total	**15,165,663**		**14,661,532**	**5.13**

Table 2-8: Application of SB 5X Realization Rates

Program Administrator	Reported Roof Area (sq ft)	Realization Rate	Verified Roof Area (sq ft)	Verified Savings (MW)
LADWP	1,421,051	1.04	1,479,729	0.88
SMUD	2,420,127	0.87	2,107,665	0.74
STF	5,977,734	0.95	5,668,207	1.98
SDREO	7,908,283	0.93	7,389,175	2.59
Total	**17,727,195**		**16,644,777**	**5.83**

Several projects have been completed, but are not yet listed in the program administrator databases as being invoiced to either the SB 5X or AB 970 funding source. To estimate what the verified savings for those projects are, Nexant used realization rates that are averages of the SB 5X and AB 970 realization rates. Nexant also used these average realization rates to estimate the verified savings for projects that have been approved by the administrator but that are not yet completed. These estimated verified savings for completed projects that have not been invoiced and for approved projects that have not yet been completed are presented in Table 2-9 and Table 2-10, respectively.

Table 2-9: Application of Average Realization Rates (Installed, Not Invoiced Projects)

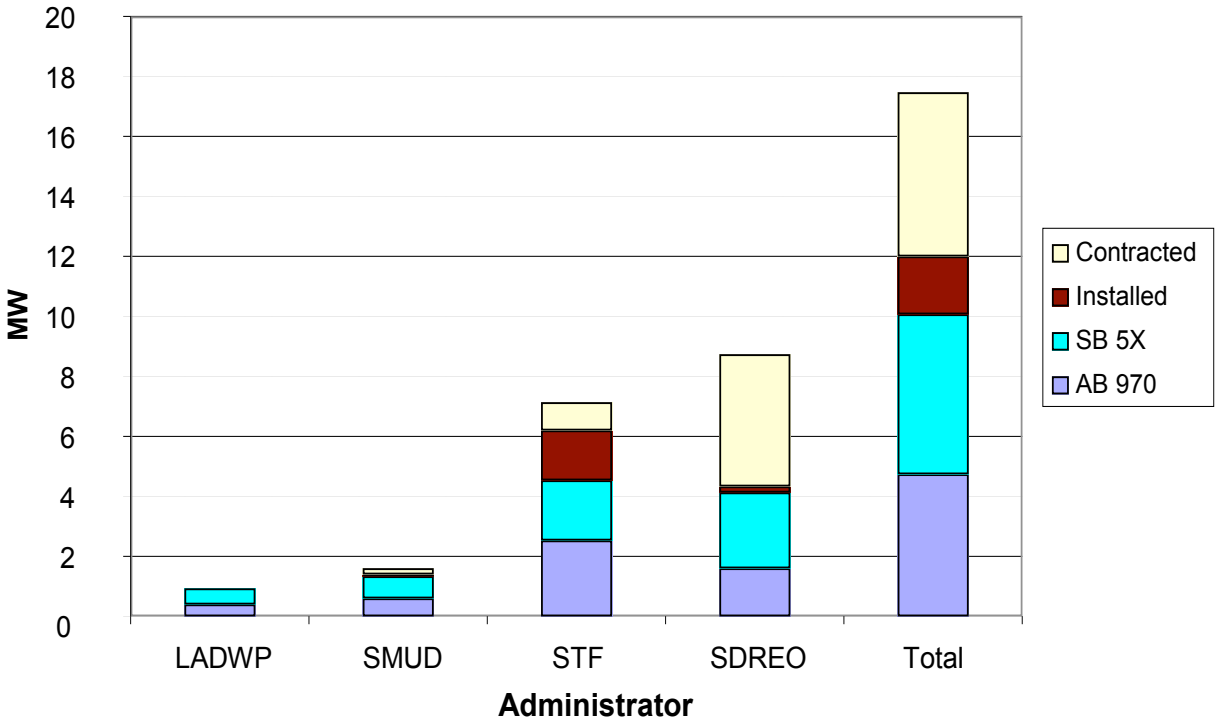
Program Administrator	Reported Roof Area (sq ft)	Realization Rate	Estimated Verified Roof Area (sq ft)	Estimated Verified Savings (MW)
LADWP	0	0.99	0	0.00
SMUD	136,427	0.92	125,680	0.04
STF	5,211,733	0.93	4,858,184	1.70
SDREO	603,350	0.97	588,253	0.21
Total	**5,951,510**		**5,575,367**	**1.95**

Table 2-10: Application of Average Realization Rates (Approved, Pending Projects)

Program Administrator	Reported Roof Area (sq ft)	Realization Rate	Estimated Verified Roof Area (sq ft.)	Estimated Verified Savings (MW)
LADWP	0	0.99	0	0.00
SMUD	693,530	0.92	638,896	0.22
STF	2,782,424	0.93	2,593,672	0.91
SDREO	12,832,970	0.97	12,511,861	4.38
Total	**16,308,924**		**15,739,960**	**5.51**

Figure 2-2 illustrates the verified and estimated savings presented in Tables 2-7 through 2-10

Figure 2-2: Verified and Estimated Savings by Program Administrator



2.5.1 Error in Measurement and Verification Analyses

Nexant verified that we inspected a sufficient number of participating sites by calculating the coefficient of variance (C_v) for each program administrator population and comparing the calculated C_v with the assumed C_v of 0.5. The 0.5 C_v reflects an 80/20 confidence interval (80 percent certainty that the average demand savings calculated from sampled sub-populations are within 20 percent of the actual average for the entire population). Nexant's calculated C_vs were all below 0.5, indicating that our sample populations were of sufficient size.

The C_v is calculated using the following equation:

$$Cv = \frac{SD}{AVG}$$

Where:

C_v	=	Coefficient of variation
SD	=	Standard deviation of project realization rates
AVG	=	Average realization rate

The portion of the population sampled and the standard deviation of the sampled population affect the error for each subpopulation. Nexant calculated this sampling error using the following equation:

$$SE_{samp} = \sqrt{(1 - n / N) * SD^2 / n}$$

Where:

SE_{samp}	=	Sampling error
n	=	Sample size
N	=	Total population size
SD	=	Standard deviation of the realization rates

The precision for each administrator was further affected by errors in verification measurements. Considering the accuracy of the measuring method (within 3 inches) and the number of measurements taken per site, Nexant has assumed a measurement error of five percent.

The C_vs for each of the program administrators are shown in Table 2-11. Also in Table 2-11 are the precisions calculated for each administrator at 80 percent confidence. The five percent measurement error has been included with the calculated sampling for each administrator using the root mean square methodology.

Table 2-11: Coefficient of Variance and Precision Findings

Program Administrator	C_v for AB 970	C_v for SB 5X	SB 5X Overall Error
LADWP	0.07	0.19	± 8%
SMUD	0.39	0.16	± 6%
STF	0.16	0.16	± 6%
SDREO	0.36	0.15	± 6%

Table 2-11 shows that the precision for all the administrators is well within the 20 percent target, even including the measurement error. In part due to the large sample size taken for STF and SDREO, Nexant is 80 percent confident that the calculated realization rate is within 6percent of the actual for these two administrators.

The measurement error of five percent and the overall errors presented in Table 2-11 were used to determine the standard error for this element using the following equation:

$$SE_{Cool} = \sqrt{\sum (kW_{Vsamp} * ME)^2 + \sum (kW_{Vnonsamp} * OE)^2}$$

Where:

SE_{Cool}	=	Standard error for the Cool Savings element
kW_{Vsamp}	=	Verified savings from each project in the sampled population
$kW_{Vnonsamp}$	=	Verified savings from non-sampled population for each administrator
ME	=	Measurement error
OE	=	Overall error

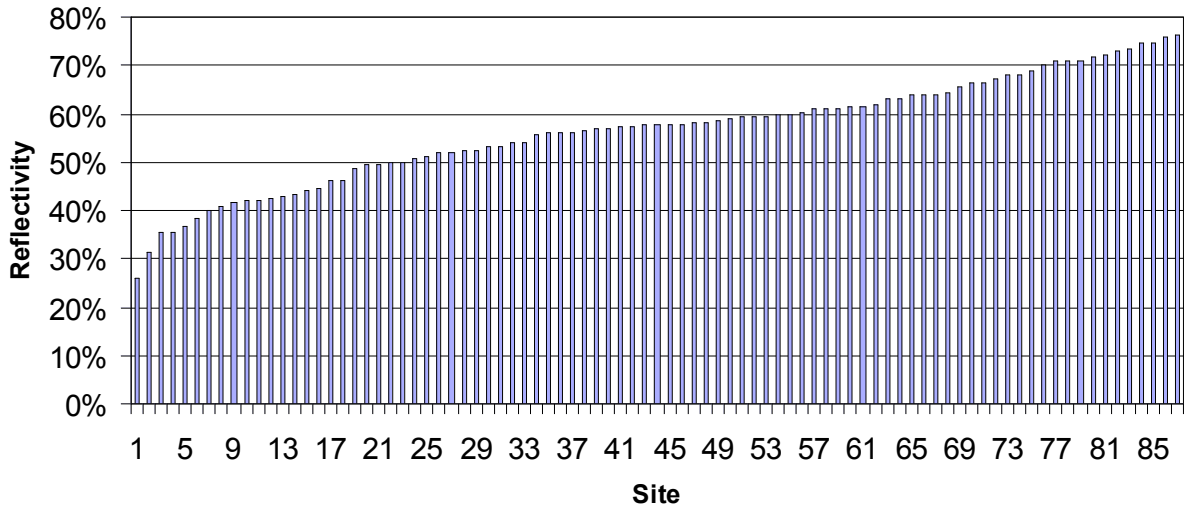
Also part of the error analysis is the addition of the intrinsic error to the deemed savings factor used to convert square feet to watts of peak savings. Nexant assumed an error of 15 percent for the deemed savings value. The deemed savings value is based on expert opinion and has an inherently large error when applied to a single site (potentially over 100 percent). When applied to an average of a population of several thousand the error is reduced to more on the order of 10 percent to 20 percent. This value was applied to the verified savings for the entire population of Cool Savings projects. It should be noted that most of this error is due to the uncertainty of the deemed savings factor. The measurement and sampling errors alone would have a standard error of only 0.7MW.

The results of these calculations were multiplied by 1.28, the z-statistic for an 80 percent confidence, to yield a total standard error for the combined AB 970/SB 5X Cool Roof program plus or minus 3.6 MW or slightly better than 20 percent error at 80 percent confidence.

2.5.2 Reflectivity Analysis

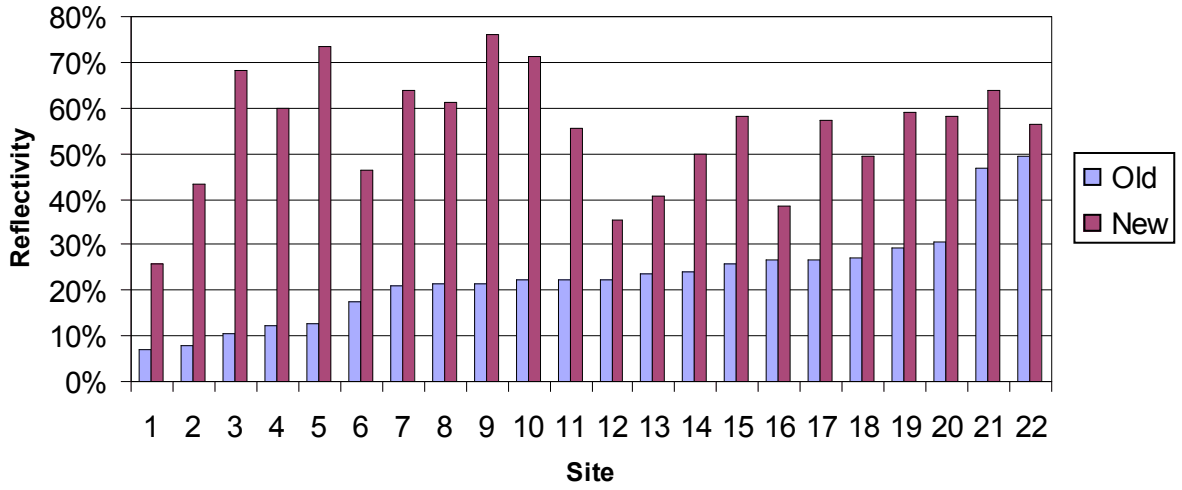
Between the AB 970 and SB 5X elements, Nexant took reflectivity measurements on installed cool roofs at 87 sites. The reflectivity at these sites ranged from 25 to 76 percent, and averaged 56 percent. This average reflectivity measurement of aged roofs (see below) is 20 percent less than the 76 percent average for the laboratory measured reflectivity for the materials used at these sites. The average reflectivity measurement is also nine percent less than the 65 percent reflectivity requirement of the program. Twenty-three of the sites had a reflectivity of less than 50 percent. As discussed in detail later in this section, Nexant attributes the low reflectivities to the ages of the measured roofs; the decrease in reflectivity is accounted for in the deemed savings rate of 0.35 watts per square foot. Figure 2-3 shows the post-installation reflectivity for each of the 87 sites.

Figure 2-3: Post-Installation Percent Reflectivity



Of the 87 sites where post installation reflectivity measurements were taken, 22 had pre-installation data available. The pre-installation roof reflectivities ranged from 7 to 49 percent and averaged 25 percent. The reflectivity increase for these 22 sites ranged from 7 to 61percent and averaged 32 percent. Figure 2-4 shows the old and new reflectivity for each of the 22 sites.

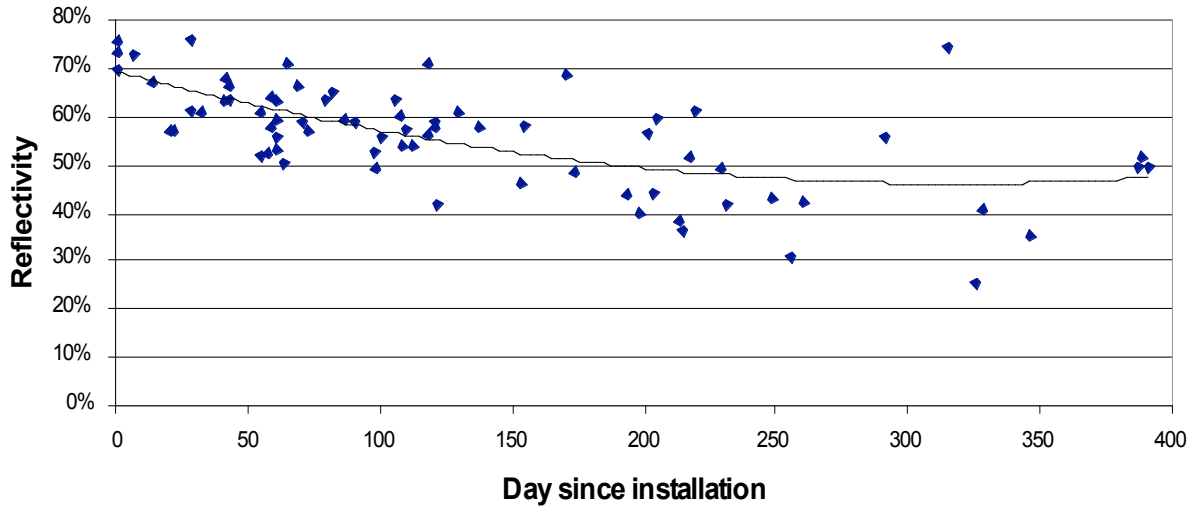
Figure 2-4: Percent Reflectivity for Old and New Roof Surfaces



Nexant noted a significant difference in verified reflectivity between AB 970 and SB 5X sites. The average reflectivity for the 40 sites measured in 2001 under AB 970 was 61 percent, while the average reflectivity for the 47 SB 5X sites was 53 percent. Similarly, for those projects with both pre-and post-installation data, the increase in reflectivity for AB 970 projects averaged 42 percent while for SB 5X projects the average increase in reflectivity was only 25 percent.

An analysis of the relationship between the measured reflectivity and the age of the new roof showed a trend of reduced reflectivity over time. On average, the longer the roof had been installed, the lower the reflectivity. Figure 2-5 shows the reflectivity measured during the Nexant evaluation of the site plotted against the number of days after installation the measurements were taken. Each point on the plot represents one of the 73 sites for which the installation date and reflectivity were available (the date of installation was not available at 14 sites). The average time between installation and measurement is 142 days for these sites. The trend line in Figure 2-5 shows a steady decline in reflectivity over time with a drop from the high 60s to the high 40s over the first 200 days. The trend line also shows that decline slows and levels out after 10-12 months with average reflectivity holding steady in the high 40s from 200 to 400 days after installation.

Figure 2-5: Reflectivity Over Time



The weather and time of day were not significant factors in these results. The albedometer used measured light from a hemisphere and thus was not affected by the angle of the sun or diffuseness of the light. Furthermore the most of the readings were taken between 10am and 4pm on sunny days further reducing the impact of these factors.

This observed reduction in reflectivity had been accounted for in the deemed savings rate of 0.35 watts per square foot. The final average reflectivity presented, around 50 percent, is consistent with that expected by researchers at Lawrence Berkeley National Laboratory who derived the deemed savings rate.

2.5.3 Building Type Analysis

Nexant analyzed collected data in terms of building type to determine the existence of any notable trends. The findings of this analysis, specifically the realization rates, were not used in the verification of savings for the Cool Savings program element. Realization rates and savings values in this section are intended for demonstrating the differences among building types and cannot be compared to values in other sections. This analysis reflects all projects listed in administrator databases, including those still pending approval. Thus, the totals here will be different from other sections.

As discussed earlier, Nexant sampled a sufficient number of SB 5X projects to evaluate projects by their building type. Listed in Table 2-12 are the seven building types evaluated, the total estimated number of enrolled participants in each, and their resulting realization rates (determined using the same methodology as for the administrator subpopulations). The total number of enrolled participants is slightly larger than the contracted number because it includes 40 sites that have not yet been approved.

Table 2-12: SB 5X and AB 970 Projects by Building Type

Building type	Total Enrolled Participants	Realization Rate	Reported Area Enrolled (sq ft.)
Cold storage	63	0.98	3,359,968
Multifamily	195	0.93	7,694,092
Industrial	289	1.01	6,318,882
Office	595	0.85	13,963,747
Other	302	0.92	5,885,102
Retail	366	0.93	13,149,517
Schools	510	1.02	8,381,012
Total	**2298**		**58,752,320**

The realization rates and reported areas for each building type were multiplied together to get the verified area for each building type. The resulting verified areas were then multiplied by the deemed savings factor of 0.35 watts per square foot, yielding verified savings. The resulting numbers are shown in Table 2-13.

Table 2-13: Measurement and Verification Findings by Building Type

Building Type	Reported Area (1000 sq ft)	Realization Rate	Verified Area (sq ft)	Verified Savings (MW)
Cold storage	3,359,968	0.98	3,292,769	1.15
Multifamily	7,694,092	0.93	7,155,506	2.51
Industrial	6,318,882	1.01	6,382,071	2.22
Office	13,963,747	0.85	11,869,185	4.14
Other	5,885,102	0.92	5,414,294	1.90
Retail	13,149,517	0.93	12,229,051	4.28
Schools	8,381,012	1.02	8,548,632	2.99
Overall	**58,752,320**	**0.98**	**54,891,508**	**19.19**

Figure 2-6 compares the contribution of each building type as a percentage of total enrolled participants and total area. This figure shows that schools and offices had the greatest participation, each with about one quarter of the total number of participants. Cold storage and industrial sites had the fewest participants. Offices and schools each have a smaller portion of the savings than of the number of participants. Cold storage, industrial, and retail each have a larger portion of the savings than of participants. This discrepancy in savings verses participation is due to the average size of roof areas for each building type; cold storage, industrial, and retail have larger roof areas on average than offices or schools. The size translates directly through the deemed savings value to the savings for each building type. The average savings per participant by building type is shown in Table 2-14.

Figure 2-6: Comparison of Percentage of Participants and Savings by Building Type

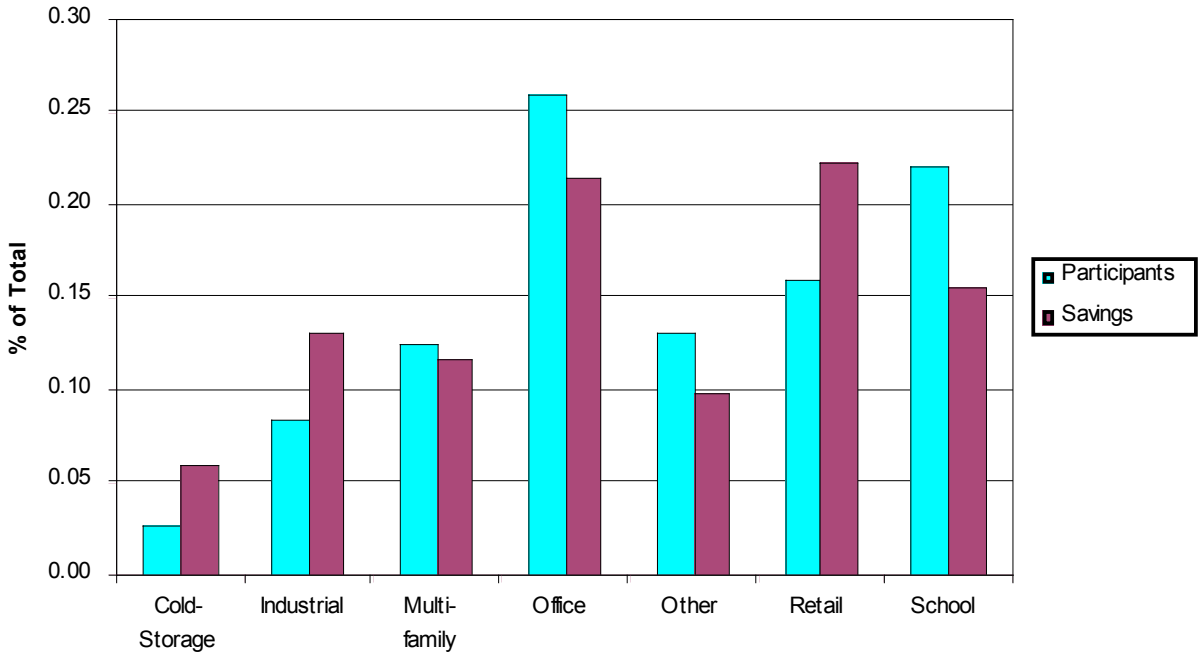


Table 2-14: Average Savings per Project by Building Type

Building type	Average savings (kW/site)
Cold storage	18
Multifamily	13
Retail	12
Industrial	8
Office	7
Other	6
Schools	6
Overall average	**8.3**

These findings can be used in the design and implementation of future programs. Programs can focus more on the sites with a larger average savings—cold storage, multi family, and retail—to get the most savings from the fewest sites and save on administration fees. Or they can target a high number of participants by focusing on offices, schools, and retail sites. Retail sites, with a high average savings per site and participation, should be included in any program.

2.5.4 Air Conditioner Stock Analysis

The MV&E plan called for using data gathered on HVAC systems to determine a population average coefficient of performance. Unfortunately, Nexant was unable to identify a source of either initial coefficient of performance values or degradation factors for the older units, which make up most of the population. The information was thus not usable in our analysis and is presented here to show what was learned about the HVAC population.

Nexant gathered data on air conditioner characteristics at 57 of the 70 sites evaluated under the SB 5X program. Of those analyzed, 42 had package units and 17 had chillers (2 had both package units and chillers). Data was gathered on the age and size of the units. In some cases, only the age or only the size was discernable or available. The 46 sites with age data have an average age of 13.4 years and an age distribution as shown in Figure 2-7. Three of the sites had units of widely different ages and are not included in Figure 2-7

Figure 2-7: Age of AC Units by Site

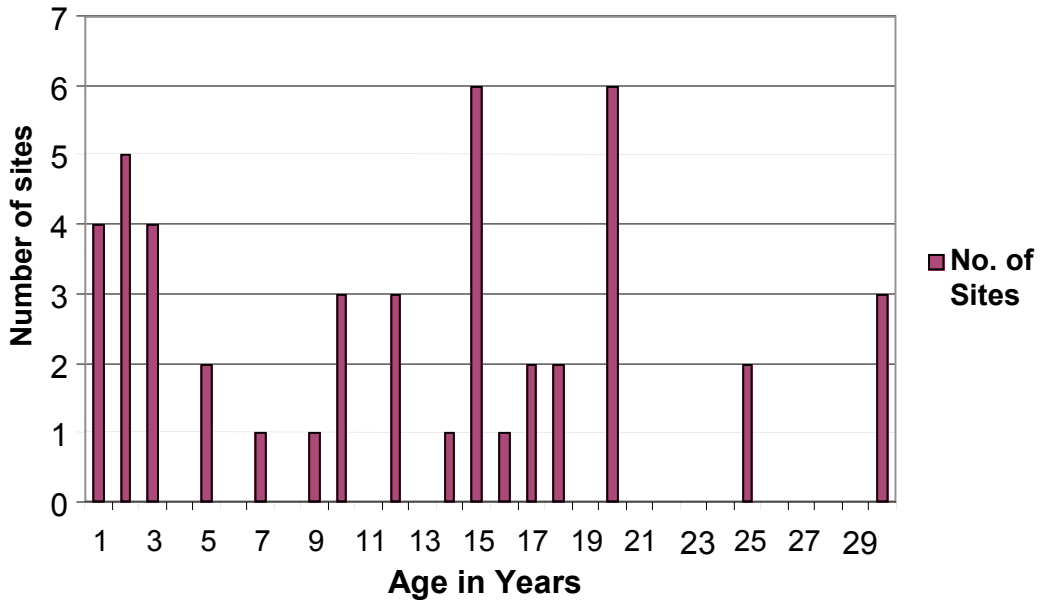
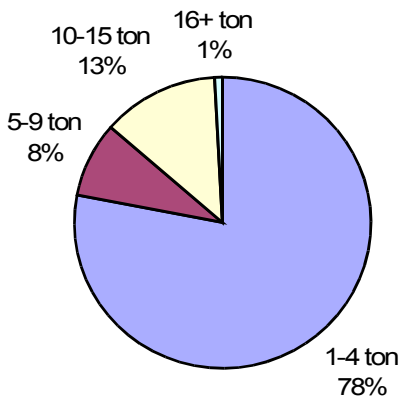


Figure 2-8 breaks the population of package unit down by size. This figure shows that, of the 585 units on which Nexant was able to gather size data, 78 percent were less than 5 tons.

Figure 2-8: Size Distribution of AC units



2.6 COST-EFFECTIVENESS

Program cost effectiveness is calculated as levelized cost per unit of demand reduction and expressed as $/kW-yr. The general equation for calculating levelized costs of demand reductions is taken from the Energy Commission's *Standard Practice Manual: Economic Analysis of Demand-Side Management Programs,* (1987). The formula for levelized cost at the project level is as follows:

LC = C/DR

Where:

LC = Levelized cost
C = Total Energy Commission costs
DR = Total discounted demand reductions of the project

Since almost all funding has occurred up front, no discounting of the cash flow is required. Demand reductions are expected to persist for 10 years. Thus, each project requires discounting the annual expected demand reductions as follows:

$$kW_{total} = \sum_{n=1}^{t} \frac{kW}{(1+d)^{(t-1)}} = kW\left[1 + \frac{(1+d)^{(t-1)} - 1}{d(1+d)^{(t-1)}}\right]$$

Where:

kW_{total} = Project discounted kW years (DR)
kW = Expected demand reduction each year
d = Discount rate, 4.1percent
t = Project lifetime in years (10 years for Cool Roofs)

This equation does not discount demand reductions in the first year. Using this methodology, and assuming a product life of 10 years, Nexant estimated the levelized cost of the $0.15/sq.ft

incentive (about $430/kW) to be $51/kW-year. This $51 is the minimum expected since it reflects only incentives paid and not the costs of administering the program. It is used as a benchmark to evaluate the results from the analysis of reported costs.

Nexant analyzed the accounting numbers provided by the Energy Commission. The accounting numbers reflect the Energy Commission's costs associated with designing and administering the program reported by the middle of January 2003 so they savings are slightly larger than those reported by the administrators in mid December. Tables 2-15 and 2-16 show the levelized cost for the verified savings for AB 970 and SB 5X based on the data provided by the Energy Commission.

Table 2-15 AB 970 Cost Effectiveness Based on Energy Commission Data*

Project Administrator	Amount Invoiced	Verified Savings**	Simple Cost	Levelized Cost
LADWP	$248,119	405 kW	$613/kW	$73/kW-yr
SMUD	$463,550	653 kW	$668/kW	$80/kW-yr
STF	$1,831,826	2561 kW	$715/kW	$85/kW-yr
SDREO	$1,005,597	1709 kW	$588/kW	$70/kW-yr
Overall	**$3,557,854**	**5378** kW	**$665**/kW	**$79**/kW-yr

*Reflects both incentive payment costs and program administration costs.

** The realization rates calculated for the administrators were applied to the savings in the Energy Commission report to yield a verified savings.

Table 2-16 SB 5X Cost Effectiveness Based on Energy Commission Data*

Project Administrator	Amount Invoiced	Verified Savings	Simple Cost	Levelized Cost
LADWP	$111,858	520 kW	$512/kW	$26/kW-yr
SMUD	$328,630	713 kW	$461/kW	$55/kW-yr
LGC	$3,118,649	5,170 kW	$603/kW	$72/kW-yr
Overall	**$4,032,285**	**6,403 kW**	**$629/kW**	**$75/kW-yr**

*Reflects both incentive payment costs and program administration costs.

The AB 970 levelized cost in Table 2-15 for the program administrators are reasonably close to the average, and since the program is near completion with relatively few new projects, these are likely the final values. The SB 5X overall levelized cost in Table 2-16 is higher than any of the administrator rates because it includes several additional charges associated with the program, but performed by other entities. These other charges did not result in any significant energy savings. The low LADWP number is likely due to delays in reporting.

Nexant estimates the overall program level cost effectiveness for the Cool Roofs/Cool Savings program element to be $78/kW-yr. This estimate is based on the near-complete status of AB 970 reporting and the expectation that the SB 5X value will increase as more invoices are reported.

2.7 PERSISTENCE VERIFICATION

The purpose of persistence verification is to determine whether the verified savings for projects installed in 2001 persisted until the end of 2002. Nexant conducted persistence verification in November of 2002 for 42 of the 51 projects that were in the AB 970 sample population to determine whether the savings had indeed persisted. The remaining nine projects had either dropped out of the program or their implementers were unable to be reached. The demand impacts of withdrawn projects are accounted for in reduced square footage, and do not affect savings persistence.

Nexant's methodology for persistence verification involved site visits (for 10 projects) and telephone surveys (for 32 projects). During the site visits, Nexant measured the solar reflectivity of the roofs and compared these readings to those taken previously in 2001 to see if there was any solar reflectivity deterioration and, if so, how much.

During the telephone surveys, Nexant asked participants the following questions:

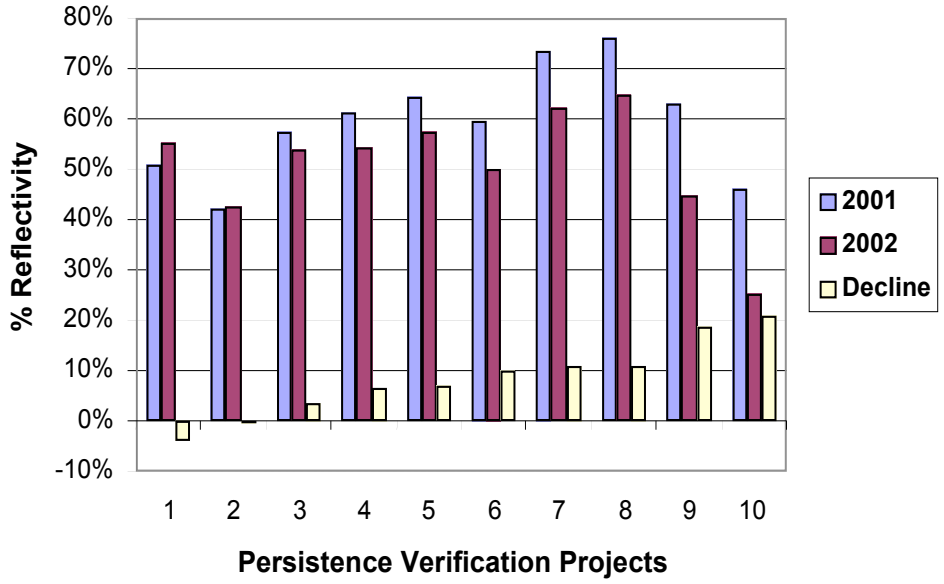
1. Is the space on the floor below the roof still in use?
2. Is the space still air-conditioned?
3. Has the roof been repaired or added to since the original cool roof was installed?
4. Does the roof still appear to have reflective qualities remaining?
5. Were there any problems with the roof performance?

Nexant used the answers to Questions 1 and 2 to determine whether or not any significant operational changes occurred at the site. If Nexant determined that the space below the roof was no longer being conditioned, we assumed the savings for that site had not persisted at the level verified in 2001. Nexant used the answers to Questions 3 through 5 to determine whether or not there were any changes in the physical properties to the roof. If significant changes had occurred, Nexant assumed that the savings at the site had not persisted at the same level as verified in 2001. Examples of significant changes include the roof having been pulled up or covered over, the roof having undergone extensive repairs, the addition of new roof-mounted equipment, or the roof having otherwise been deemed unreflective by the respondent.

2.7.1 Summary of Results

During the 10 site visits, Nexant obtained solar reflectivity measurements. The measurements showed that the average solar reflectivity readings for the visited sites dropped from 59 percent in 2001 to 51 percent in 2002. Figure 2-9 shows the percent change in roof reflectivity for each of the 10 sites.

Figure 2-9: Percent Reflectivity Change per Project



The cause of this decrease in reflectivity is likely the accumulation of dirt on the roofs. The large increase seen at site 1 may be due to the roof being cleaner during the second visit than it was during the first in 2001 (the 2001 site inspector noted significant dirt on the roof). It might also be possible that the 2002 measurements were taken on a different roof, as there were several participating buildings at the site. The slight increase in reflectivity at site 2 is within the measurement error of the albedometer, used for measuring roof reflectivity. During each site visit, Nexant also verified that no significant operational changes or changes to the physical properties of the roof had occurred that would have affected the persistence of savings from 2001 to 2002.

In the telephone surveys, all but one of the 32 participants reported that they are still using the space in the floor just below the roof as they had previously and are still air-conditioning these spaces. One participant, the Saratoga Office Center, told Nexant that only 25 percent of the originally included space was still used and air-conditioned. The 75 percent drop in affected space at the Saratoga Office Center accounts for a 2 percent drop in the total square footage of the AB 970 sample population. Based on this change, Nexant reduced the realization rate for the AB 970 program by 2 percent and adjusted the verified savings accordingly.

Five participants reported that roof repairs had been required in the last year. However, Nexant determined that none of the repair work was significant enough to have affected savings persistence. Thirty respondents reported that the roof still appeared to be reflective; two said they didn't know.

Twenty-nine said that the roof performance was generally satisfactory, with three reporting the occurrence of small leaks. Based on participant's description of the leaks, Nexant determined that the leaks did not have an affect on savings persistence.

2.7.2 Participant Feedback

In addition to the survey questions and site visits, Nexant also solicited and recorded general feedback about the program.

Most respondents had positive comments. These respondents said they appreciated the rebate and the energy savings and that the program and the product work well. One said that he believes it enhances the building's value. A couple others noted that occupants could tell the space was not as hot. One participant was happy that it reinforced the roof. Regarding the program itself, one respondent stated that, when compared to Energy Commission's program, other rebate programs weren't worth the time. A number of participants used the term "smooth" to describe the process. Some said they would readily participate if the program were to be extended.

Nexant received a handful of negative comments about the program and the energy savings, but none about the products themselves. A few participants felt that savings from the program were hard to confirm. Comments included the fact that they couldn't quantify savings on bills or they saw energy savings but had a hard time showing cost savings because overall energy bills rose due to prices rising. One participant felt the program was too bureaucratic. A few participants had issues with contractors. The most negative experience seemed to be from the San Juan Car Wash project representative; the respondent said that he had not received his rebate when we spoke in November and that his contractor went out of business. His impression was "not good."

2.7.3 Persistence Verification Conclusions

Nexant's persistence verification findings indicate that 98 percent of the savings we verified in 2001 have persisted through to the end of 2002. The two percent drop is attributed to the 75 percent reduction in covered square footage at the Saratoga Office Center. This reduction also translates into a two percent reduction in the overall realization rate for the AB 970 program, from 98 to 96 percent.

The comparison of reflectivity readings shows that, on average, reflectivities dropped an average of eight percent from 59 to 51 percent in the program year 2001-2002. This drop is consistent with what was expected under the program, and is not an indication that verified savings have not persisted.

Dirt accumulation on roofs is suspected to be a major factor in reduction of reflectivity over time. The rainy season in the winter acts as a natural cleaning cycle, but during the peak season, there is typically little rain to perform that function. The reduction in reflectivity is not expected to compound over the years, as the winter rains should remove most of the annual dirt accumulation. In order to verify this assumption Nexant, recommends that a few of the sites whose reflectivity was tested for persistence be re-tested again in 2003 along with up to 10 additional sites that have been in place over one year.

2.8 ADMINISTRATORS AUDIT AND PARTICIPANTS AUDITS

2.8.1 Administrator Audits

The purpose of the program administrator audit was to determine the effectiveness of third-party program administration for the Energy Commission's Peak Load Reduction Programs. In the Cool Roof program element, there are five administrators, four of which were audited. LGC was not audited because STF and SDREO dealt with and maintained the records for LGC participants.

The audits took place between December 2002 and the end of January 2003 and were performed by Nexant staff members in person at the designated administrator's office. Administrators were required to allow a review of a random sample of their program files to verify that a paper tracking-system was in place.

Thirteen questions were asked of administrators. The first seven questions covered each area of the administrator's responsibilities throughout the program process. The last six questions were about the administrator's record-keeping practices to discern their level of organization and to check that the procedures and responsibilities, where required by the Energy Commission, had been followed. For Questions 1, 2, and, 7, respondents could give more than one answer.

2.8.2 Methodology for Audits

A checklist form was developed for use in the administrator audits. This checklist was based on the administrator requirements as laid out in their Energy Commission contracts, and on key performance indicators such as participant recruitment, customer service, M&V, and delivery of demand savings. Each of the four administrators was evaluated based upon the criteria outlined in this checklist below. Information to complete the checklist was gathered through administrator interviews and audits of administrators' records.

2.8.3 Administrator Audit Checklist

The administrative audit encompassed six categories, each with its own focus. These categories were:

1. *Participant Recruitment*–determined what methods and materials administrators used to market the program and how successful they were. Criteria considered included use of sales force, communication with vendors, use of flyers and websites, and number of participants and dropouts.
2. *Customer Service*–determined what offerings administrators made to participants to assist them in project implementation. Criteria considered included incentives, equipment, services, and training.
3. *Project Eligibility*–determined whether projects were eligible as defined by the administrator's program guidelines. Criteria considered included demand reduction or supply augmentation, prior project operability, duration of project, measurability of savings, and size of the participants' facilities.

4. *Verification Requirements*–determined the breadth and depth of the administrators' verification process. Criteria included cooperation with third-party verification contractor M&V efforts, method of verification (site visit, data monitoring), and verification sampling plans.
5. *Reporting*–determined the administrators' compliance with program reporting requirements, including participation and savings updates and general communication with contract manager.
6. *Documentation*–determined whether the administrator kept proper records for participating projects. Criteria considered includes: hardcopy and electronic filing systems, invoices, and incentive payment tracking.

2.8.4 Summary of Responses

Following is a discussion of the responses to the 13 questions used as part of the administrative audits. The first six questions are qualitative in nature; the latter seven are quantitative, and ask for a rating of between one and five, with five being the best rating a respondent could give.

Question 1: How were participants recruited?

All of the four administrators held seminars for vendors and customers to inform them about the program. SDREO held publicly announced workshops in five counties; STF held three seminars; SMUD focused on workshops for vendors to help them learn program requirements and paperwork. Of the four administrators, three also ran direct mail campaigns for prospective participants. SMUD sent direct mail to property owners and its small commercial and industrial accounts. STF and SDREO went through industry associations to reach vendors and customers.

Question 2: What marketing material was used to attract participants?

All administrators used a flyer or brochure to market the program. In addition SDREO developed case studies and SMUD used their website.

Question 3: (a) How many participants are participating as of December 31, 2002, and
(b) How many participants dropped out since the program's inception?

As Table 2-17 shows, all of the administrators reported some loss of participants in the year and a half since the program's inception.

Table 2-17: Reported Number of Participants and Dropouts

Administrators	Participants	Number Dropped Out	Percent Dropped Out
LADWP	214	<20	<10%
SDREO	903	101	9%
SMUD	201	15	7%
STF	939	136	15%

Question 4: Were participants offered training or any other instructional help during any time of their participation?

SMUD trained their contractors on program requirements, since their program relied on these contractors for marketing and evaluation efforts. Other administrators made themselves available to answer participants' questions as they came along. LADWP estimated that about 5percent of participants had questions beyond those associated with application processing.

Question 5: How did you evaluate your projects?

All administrators used application forms to determine initial program eligibility. SDREO and STF noted that they initially performed site inspections but had stopped this practice due to the expense. All administrators reviewed applications for reasonableness. LADWP did telephone reviews, while SMUD had the approved roofing contractors evaluate projects.

Question 6: a) How did you verify installations?
b) How many participants or sites were verified, and
c) Was a sampling plan used for this?

As shown in Table 2-18, the administrators used site visits to verify installations to varying degrees: two performed visits for all projects while the other two only visited questionable projects.

Table 2-18: Administrator Verification Methods

Administrator	How Verify	How Many	Sampling Plan?
LADWP	Pre-and post-field inspections	All	Verify all
SDREO	Paperwork, site inspection if questionable	N/a	None
SMUD	Visit	All	Verify all
STF	Initial site visits to all, then to questionable ones, then by phone	N/a	None

Question 7: What method was used to track and report project progress to the Energy Commission and/or the M&V contractor?

All administrators utilized the database designed by the Energy Commission to different extents. All administrators also maintained separate spreadsheets to track the progress of each participant through their process. The Energy Commission database did not seem to meet their needs, so they captured data in their own ways and uploaded whatever was necessary to the Energy Commission database for reporting.

Questions 8-13 are about record keeping, and are answered with ratings based on a 5-point scale, with five being highest. For each the four administrators, Nexant randomly selected 10 participants and reviewed the project files (40 projects total). Nexant gave each administrator a rating of 5 for each of the questions in Table 2-19.

Table 2-19: Questions 8-13

Question Number	Question
8	Are documents available for the sampled projects in question?
9	Were invoices valid with proper documentation and consistent with the initial between parties involved and the program requirements?
10	Was the verification process noted above followed?
11	Did the installed equipment agree with the invoice?
12	Were participants paid according to the customer agreement?
13	Was the tracking/reporting method noted above maintained?

2.8.5 Administrator Audit Conclusions

Marketing and recruitment were primarily done through workshops and direct mailings. Administrators observed that marketing the program to product vendors, roofing contractor, and rather than directly to building owners was a more efficient means of advertising the program. Each vendor, contractor, and roofing contractor served as a distributor for program information to the respective client base.

Initially, administrators tried to do pre-and/or post-inspection on most of the participants however this method of site verification proved to be cost prohibitive exceeding the 10 percent administration fee imposed by the Energy Commission. Therefore site visits and inspections stopped all together or were used only with participants with more unusual or complicated applications.

Nexant's audit discovered that all the administrators kept good paper files while also maintaining their own project-tracking databases. The level and quality of data entered into the Energy Commission database varied. While all administrators used this database to some extent it was found to be less familiar than the one each administrator developed for to track the day-to-day progress of projects.

2.9 PARTICIPANT AUDITS

Nexant conducted participant audits for the Cool Savings program. The purpose of the audits was to evaluate participants' compliance with the programs' various rules and requirements. These interviews also provided an indication of the level of satisfaction with the administrator's program process design. All participant audits for the Cool Savings program were conducted over the telephone.

2.9.1 Methodology for Audits

Participants audited were selected from the approved MV&E sample for SB 5X. Nexant's audit plan called for sampling sufficient participants from each administrator to reach the required 80/20 confidence. Using the same methodology for determining sample sizes in our demand impact evaluation, Nexant determined the required number of audits for each administrator based on the number of participants. Nexant continued attempting to recruit participants for the audit activities until the sample size population had been met. Table 2-20 below shows the breakdown of audited participants by program administrator..

Table 2-20: Audited Projects by Program Administrator

Program administrators	Participants in SB 5X sample population	Participants in audit population
LADWP	6	4
SMUD	11	4*
STF	21	7
SDREO	28	7
Total	**66****	**22**

*Nexant attempted to audit six of SMUD's participants, but some participants were unable to be reached and others refused to be audited.

**Note that some of the participants had multiple projects in the sample so there are fewer participants listed here than projects in Table 2-3

2.9.2 Participant Audit Checklist

Nexant developed 16-question telephone survey for participants. The first seven questions ask participants about aspects of the program's process. Questions 8-10 ask about how this process went and if participants would again participate in a like program in the future. Questions 11-16 ask participants to rate their level of satisfaction with each aspect of the program on a scale of one to five, with a five indicating the highest level of satisfaction. It should be noted that not every respondent answered every question, so question totals may not always add up to 22 responses. Additionally, several of the questions received multiple answers.

Question 1: How did you find out about the Energy Commission Cool Savings Program?

Twenty-one respondents answered. Nearly half of respondents listed their roofer or contractor as their source of knowledge about the program. Other answers were: learned about the program through a utility, from an employee, from a neighbor, or through other unnamed sources.

Table 2-21: Source of Program Information

Source	No. of Responses
Roofer/Contractor	10
Utility	4
Consultant	1
Energy Commission	2
Advertisement	2
Other	2
Total	**21**

Question 2: Why did you participate in the program?

For this question, participants gave more than one answer. The financial incentives were clearly the greatest motivator among respondents. Numeric results are shown in Table 2-22.

Table 2-22: Question 2 Reasons to Participation

Source	No. of Responses
Rebate	18
Save energy	6
Fix roof	3
Building climate	2
Total	**29**

Question 3: Did you participate in any other similar roofing or peak load reduction programs?

Of the 22 responses, 13 answered no and nine yes. The additional detail Nexant received confirmed that "yes" respondents also participated in various statewide utility programs.

Question 4: Rate the overall quality of the communication process with your administrator

Nexant received answers from 20 respondents. Some of the difficulties that were mentioned included difficulty in defining the nature of the program and disagreeing with the administrator's calculations for qualifying spaces and square footage. The average rating was 4.1.

Question 5: By what means did you most often communicate to your administrator?

All of the 22 respondents answered this question. The answers were as would be expected. Communication about the program was carried out by telephone, surface mail, email, and fax. Many of the respondents used more than one form of communication.

Question 6: How long did it take for you to be notified about your application status after you submitted it?

Of those responding, the answers varied from not remembering to several weeks as shown in Table 2-23.

Table 2-23: Question 6 Response Time

Source	No. of Responses
Days	2
Weeks	11
Months	3
Called the Energy Commission	3
Could not remember	3
Total	**22**

Question 7: Did your program administrator visit your project to verify project completion?

All participants answered yes.

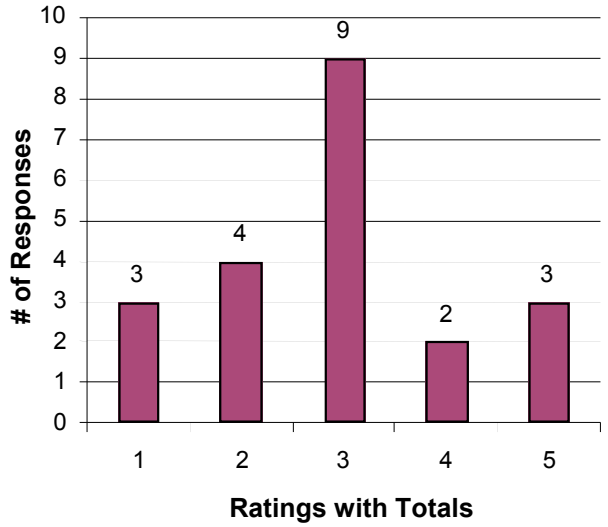
Question 8: Rate the obstacles you encountered as if you were to implement the project again on a scale of 1 to 5, where a 5 indicates that no significant obstacles encountered; 3 indicates that significant obstacles were encountered, but you would conduct the project again; and 1 indicates that significant and prohibitive obstacles were encountered.

Twenty-one respondents answered. One respondent rated this question a 1, saying they ran into a lot of obstacles to project completion. No additional explanation was given. The average response was 4.2.

Question 9: On a scale of 1 to 5, rate the likelihood that you would have performed peak load-reducing actions without this program, where a rating of 5 represents yes, without question; 3 represents yes, but under different circumstances; and 1 represents no, not under any circumstances.

Twenty-one respondents answered. The average was 2.9 with the distribution shown in Figure 2-10.

Figure 2-10: Question 9, Likelihood of Acting without the Program



Question 10: On a scale of 1 to 5, based on your experience with this program, would you participate again in a similar program? A rating of 5 is yes, without question; 3 is yes, but under different circumstances; and 1 is no, not under any circumstances. None of the 22 respondents rated this question below three. The average was 4.8.

Questions 11-16 used a 5-point scale to rate participant satisfaction with various aspects of the program, with five being the highest level of satisfaction. The questions are:

How would you rate your experience with the following?

11. The Cool Savings program as a whole?

12. Your administrator?

13. The application process?

14. The invoicing, billing, and payments process?

15. The verification process?

16. The implementation timeline you were on?

Every participant replied to every question, except for Question 14, which one respondent skipped.

The overall program got the highest average rating, followed closely by the verification process. The payment process was the only category to receive an average below four. Table 2-24 below shows the count of each rating for Questions 11-16.

Table 2-24: Program Component Ratings Count

Question Number	Question	Ranking Scale					Average
		1	2	3	4	5	
11	Overall program	0	0	3	8	11	4.4
12	Administrator	0	0	6	5	11	4.2
13	Application process	0	2	2	10	8	4.1
14	Payment process	2	1	4	7	7	3.8
15	Verification process	0	0	4	7	11	4.3
16	Timeline	2	0	2	7	11	4.1

2.9.3 Participant Audits Conclusions

Most of the respondents heard about the program from roofers and contractors who did self-promoting because they installed cool roofs. Incentives, as would be expected, did also drive participation. Respondents seemed generally happy with the communication process. Most participants received responses to their applications within a matter of weeks, which was acceptable to them. Participants did not encounter any major obstacles to project installation overall.

Although almost all of the participants were interested in being part of another similar program, they were unsure whether they would have implemented their project without the support of the Cool Roof and Cool Savings programs.

2.10 CONCLUSIONS

The Cool Roof and Cool Savings program elements can be considered a success. As of mid-December 2002, the AB 970 and SB 5X program elements combined had enrolled over 2,250 customers and achieved 11.8 MW of verified savings through the installation of over 35 million square feet of cool roof material, all at a cost of only around $80/kW/year.

During the course of the program, both STF and SDREO were able to enroll almost 1,000 participants each, indicating that small public or private organizations can have the resources and motivation to make a program attractive and successful.

The program administrators have invested considerable time in public outreach and education to increase awareness among building owners, roofing companies and contractors, property management firms, and facility managers about the benefits and savings associated with cool roofing materials. Changes in consumer and producer viewpoint will, however, take more time and continued effort.

Contributing factors to the slow penetration of the cool roof products include the time needed by participants to become educated on this new technology, and the difficulty of changing peoples' perceptions of what color their roofs should be.

As a potential cost saving measure, Nexant recommends investigating the use of contractors to promote the program and the use of cool roofing materials. Most roofing projects are specified in consultation with contractors and nearly 50percent of the participants surveyed learned of the program from their roofing contractor. Moreover, SMUD is very satisfied with the results of their program that trained and certified contractors to promote the program.

Changes in program guidelines, even ones intended to simplify a process, can cause confusion. Keeping program guidelines as consistent as possible, and being prepared to manage confusion when changes are required, is recommended. All of the administrators and several of the participants noted that the changes in the program guidelines, while clarifying, did cause some confusion, especially for those that learned of the program under one set of guidelines, and applied under the changed guidelines. However the changes did simplify the process and likely led to a larger number of participants. The primary focus in such a situation should be to be prepared to address any participant confusion that could arise when changes are required.

Development of a simplified database and enforcing its consistent use would greatly simplify the reporting and MV&E processes. The database developed for this program included numerous data fields that were not used by the administrators. It also lacked reporting abilities that the administrators felt were necessary for internal tracking of projects. Because of these factors, the database was used inconsistently, significantly complicating the analysis of the data it contained.

The potential effects of the accumulation of dirt could have a significant impact, over time, on the effectiveness of the cool roofing materials, and should be investigated. California summers are dry and dusty which leads to the accumulation of reflectivity reducing dirt on roofs. Also this program targeted buildings with flat roofs and, in many cases, it was observed that low spots had led to the pooling of rainwater and a concentrated accumulation of dirt. In these areas the reflectivity could be as much as 30percent less than the rest of the roof. Determining the long-term effect of dirt accumulation will help determine the effectiveness of this and future roofing programs.

The data gathered for the MV&E analysis is a benefit to the program. A considerable amount of information on HVAC systems, roofing material, and reflectivity was gathered during the AB 970 and SB 5X program evaluations. This information could be useful in future studies on the effects of cool roofing projects.

3.1 BACKGROUND OF PROGRAM ELEMENT

The Demand Responsive (DR) program element covers the full spectrum of end-user markets in California, ranging from small residential and commercial customers to large commercial and industrial (C&I) facilities. This report documents the 2003 performance of small C&I and residential program elements, and presents an integrated summary of results that also covers large C&I related activities. In total, the DR program consists of four sub-elements that have been funded by the following two successive state legislative actions over the last three years:

- *Assembly Bill 970 (AB 970)*: Passed in September of 2000 with a total funding of $11.45 million. AB 970 targeted 50 MW of peak demand savings during the summer of 2001 from contractors that aggregated load reductions at large C&I facilities (Sub-element 1) and from individual C&I or government entities that were direct program grantees (Sub-element 2).
- *Senate Bill 5X (SB5X)*: Passed in April of 2001 adding $27.28 million to increase the targeted peak demand savings of AB 970 by an additional 164 MW through the summer of 2002. SB 5X added two new groups to the DR program—small C&I customers (Sub-element 3) and residential end-users (Sub-element 4) that provided load curtailments through contractors.

Figure 3-1 illustrates the timing and level of funding provided to the DR program sub-elements.

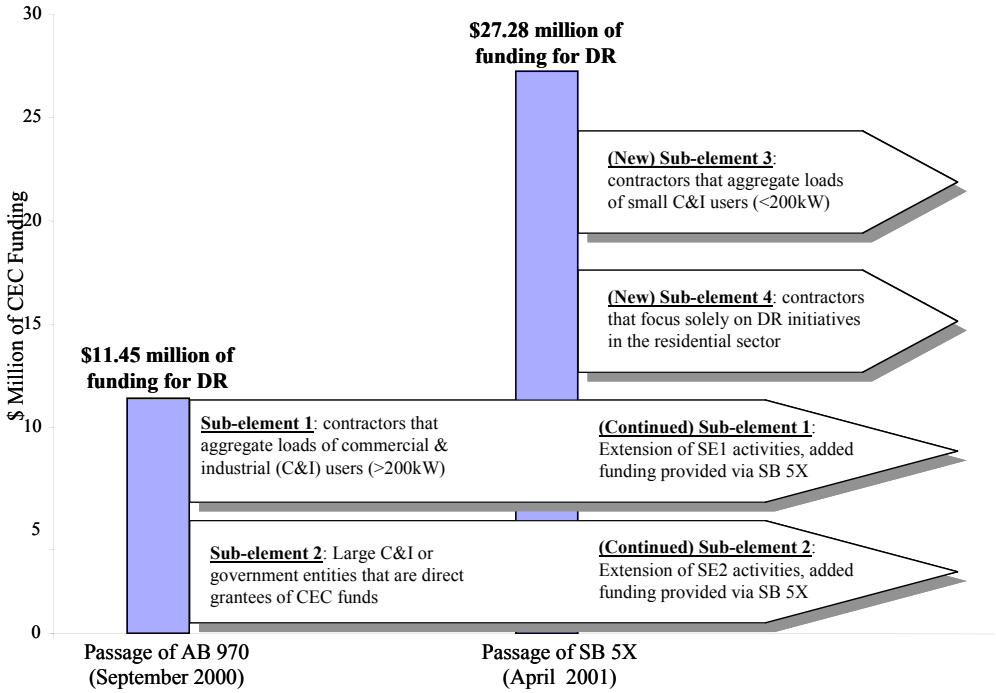


Figure 3-1: DR Funding Sources By Program Sub-element

This report supplements the Demand Responsive Section (3) of the 2002 Year-End Peak Load Reduction Program report. As previously noted, however, the focus of this report is on the 2003 evaluation of DR program Sub-elements 3 and 4 for the summer period. In order to provide cumulative results for all four DR program elements as of the end of 2003, this report also contains results from other sub-elements that were provided in the 2002 Year-end report.

The remainder of this document details the planning, execution, and key results of Nexant's measurement, verification and evaluation (MV&E) methodology for Sub-elements 3 and 4. The main sections of this report are broken out as follows:

- Section 3.1 provides an overview of the four sub-elements and describes the program funding cycles and administrative hierarchy. Descriptions of Sub-elements 3 and 4 are provided along with an overview of the purpose and process of program pilot tests.
- Section 3.2 summarizes the performance of each of the four DR program sub-elements. Key performance indicators such as cumulative program participation and total demand savings are presented. However, additional summary results are provided for Sub-elements 3 and 4, given this report's focus is on the evaluation of small C&I and residential programs.
- Section 3.3 outlines Nexant's MV&E approach that utilizes automated and manual analysis tools and surveys.
- Section 3.4 identifies the key evaluation (research) objectives for Sub-elements 3 and 4, and describes how the actual MV&E process was carried out in order to answer the evaluation objectives. A review of specific data collection and analysis techniques that were applied to help achieve Sub-element 3 and 4 research objectives are explained.
- Section 3.5 presents the summary results of Nexant's evaluation of all DR program sub-elements. Total demand savings achieved during pilot tests and Stage II emergency curtailments are reported for Sub-elements 3 and 4. Program participation levels are also examined along with significant findings pertaining to program evaluation objectives.
- Section 3.6 evaluates the cost-effectiveness of the DR program as a whole and by program sub-element. Analysis is also presented of Sub-element 3 and 4 program administrators.
- Section 3.7 presents the results of surveys and audits that were conducted of Sub-element 3 and 4 program administrators and participants. Administrator survey results chronicle program implementation successes and challenges, while participant surveys offer insight into customer perceptions of the DR program and how it was administered.
- Section 3.8 states the main conclusions of the 2003 program evaluation of Sub-elements 3 and 4. Key findings from previous sections and the fundamental lessons learned from the implementation of DR programs are summarized.

The balance of this section provides further background on the DR program element before moving on to subsequent discussions of the MV&E process and key program results.

3.1.1 Program Goals and Administration

In the summer of 2001, the program targeted a total of 65 MW of peak savings, 50 MW from AB 970 participants and 15 MW from SB 5X. Although additional funds were provided through the passage of SB 5X, the principles of the DR program's design remained the same. However, the composition of the program was expanded to include two new market segments, namely: Sub-element 3 covering small commercial participants with connected loads of 200 kW or less, and Sub-element 4 covering residential customers.

The goals of the state-funded DR program element are accomplished through participant load shedding during power emergencies signaled by the California Independent System Operator (CAISO) Stage II and III alerts.[1] These emergencies were expected during summer, non-holiday weekdays from June 1 to September 30, between the hours of 2:00 to 6:00 pm, when air conditioning loads are high.

To achieve the program's shedding objectives, funding and technical assistance were provided to participating electricity end-users to assist with the installation of the metering and communication equipment that is necessary to respond to CAISO emergency curtailments and/or to participate in CAISO or utility DR incentive programs. As a prerequisite to participating in this program, participants had to perform pilot tests to demonstrate the load shedding capability of their DR equipment. Program participants included commercial, institutional, industrial, and residential facilities. Program funds were allocated to these entities in the form of contracts and grants. Administration of the program was carried out through either program contractors or direct grantees that consisted of the following entities:

- Program Contractors: Responsible for recruiting and managing projects for customers with one or more participating facilities. Contractors served as aggregators of curtailable load across program participants. Program contractors represented a diverse group of organizational entities, including municipal utilities, investor-owned utilities (IOUs), power retailers, and non-profit and for profit private enterprises. Contractors' customers included college campuses; federal, state and local public agencies; corporate retail and restaurant chains; and office complexes.
- Program Grantees: Participants that were directly responsible for administering the implementation and performance of DR systems in one or more of their own facilities. Program grantees included college campuses; federal, state and local public agencies; corporate retail chains; and office complexes.

3.1.2 Program Sub-elements

As noted earlier, following the adoption of SB 5X, there were four DR program sub-elements covering several key end-user segments. Listed below is a description of the main participants for each DR program sub-element.

[1] Stage II events occur when generation reserves are less than 5% of system requirements. Stage III events occur when reserves are below 3%.

- **Sub-element 1**: Contractors were responsible for aggregating loads at medium and large commercial and industrial (C&I) facilities with peak demands of 200 kW or greater. Contractors recruited customers that can host projects at facilities under their management. Typical Sub-element 1 customers include offices campuses, colleges, hotels, and retail chains. Participating facilities or customers with one or more building sites under the management of the customer organization negotiated a sub-contract with contractors.
- **Sub-element 2**: Grantees that are comprised of medium and large commercial and governmental entities with building sites directly under their management. Grantees were typically office campuses of technology firms, or retail, hotel and restaurant chains with facilities distributed across California. For grantees, the Energy Commission holds grant agreements directly with the public or private entity responsible for the managed facilities. One aspect of Sub-element 2 is that there is a direct institutional relationship between the grantee and the facilities from which demand responsive loads are aggregated.
- **Sub-element 3**: Contractors were responsible for aggregating loads at small commercial facilities with connected loads of less than 200 kW. Sub-element 3 contractors, ICF and Webgen, recruited commercial customers that could manage energy projects in a large number of similar or identical facilities, such as commercial restaurant and retail chains. The homogeneity of customer facilities in this sub-element allows for economies of scale in the replication of installed DR projects. A high degree of automation during curtailments and the selection of DR projects with a relatively easy level of implementation were essential to successfully aggregating loads for Sub-element 3 customers.
- **Sub-element 4**: Contractors were responsible for implementing projects for residential customers. Sub-element 4 involved two contractors, Energyn and Sacramento Municipal Utility District (SMUD). Energyn operated a single pilot program within the PG&E service territory, while SMUD operated two individual programs within their own service territory. Unlike Sub-elements 1 and 3, there are no customer-level entities in Sub-element 4 that act as intermediaries between contractor and residential program participants. However, program implementation did require active program marketing, recruiting, and signing participant agreements for projects to proceed. Given differences in the energy use patterns in the residential sector and the unique implementation structure of this sub-element, the evaluation methodology for Sub-element 4 is different from the other sub-elements.

All of the contractors and grantees of Sub-elements 1, 2 and 3 were obligated to implement and test their systems to demonstrate a capability to respond to CAISO Stage II and III emergency curtailment signals. In these pilot tests, each grantee and contractor had to demonstrate a simultaneous activation of curtailments across all participating buildings within 30 minutes of receiving the test signal. Although most participants were not obligated to participate in any actual CAISO emergency curtailments during summer months, all were required to test and maintain the installed systems throughout the four summer months of June through September.

Sub-element 4 contractors were not required to conduct pilot tests, but they did need to demonstrate and record the results of demand responsive load shedding through operation of their respective programs. Figure 3-2, shown below, illustrates the administrative hierarchy of the DR program, and displays how responsibility for program implementation is assigned across the four sub-elements.

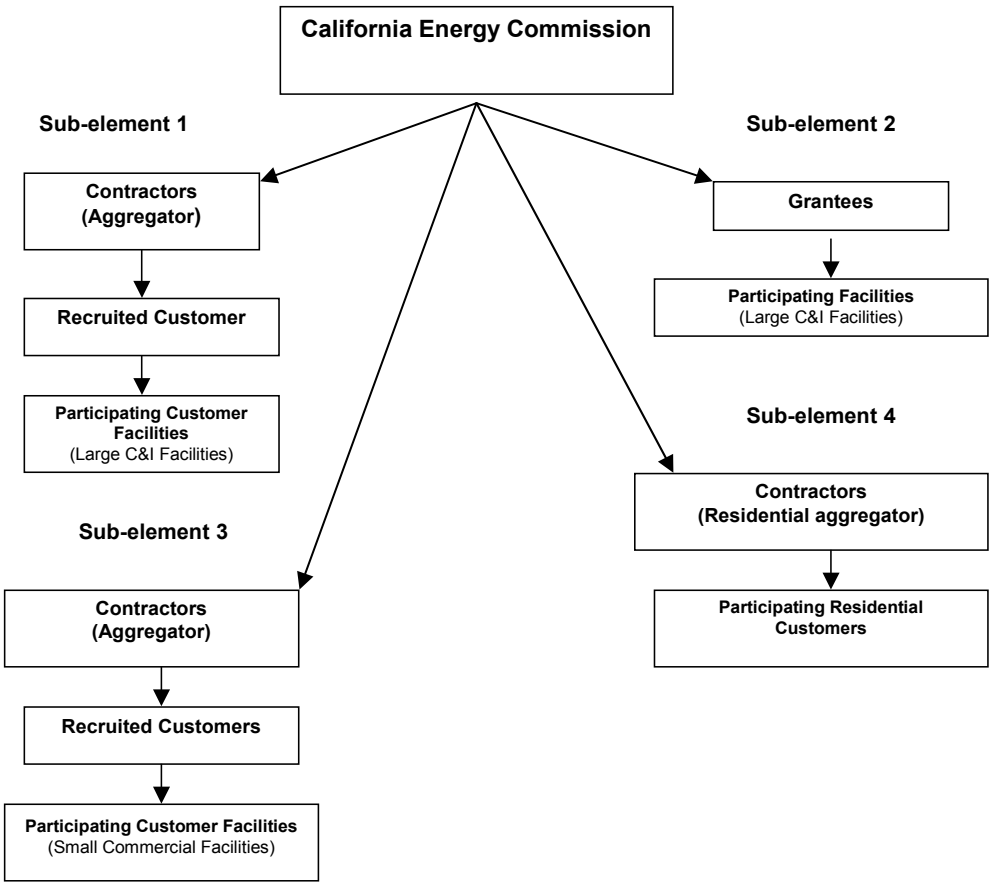


Figure 3-2: Administrative Hierarchy and Program Sub-Elements

Listed below is a brief description of the Sub-element 3 and 4 pilot programs that are evaluated in this 2003 report.

3.1.3 Sub-element 3

The focus of Sub-element 3 is on achieving peak demand reduction at small commercial facilities with connected loads of less than 200 kW. The ICF and Webgen programs that were carried out for Sub-element 3 participants are described below:

<u>ICF Program</u>
This program funds the installation of control and communications technologies that can help end-users monitor their electricity use and respond to program events that call for reductions in demand. Customers installed energy management and control systems to help reduce their loads

(most often lighting and HVAC) from a central location. By curtailing peak energy use, program participants lowered their energy bills and helped improve system reliability.

Webgen Program
This program aims to achieve load reductions at participating facilities through the installation of Intelligent use of Energy Systems (IUE). IUEs are an energy-management system that can help end-users monitor and control their use of electricity. IUEs utilize advanced metering, internet interface (Ethernet, SCADA), and other energy monitoring / controls services.

3.1.4 Sub-element 4

Two contractors, SMUD and Energyn, were selected by the Energy Commission to operate three separate residential pilot programs. The objective of these programs was to install DR systems in a pilot group of new and existing homes in order to test homeowners' responses to one or more of the following types of signals to reduce peak loads:

- Dynamic curtailment signals triggered by SMUD according to internal criteria including wholesale price hikes, high temperatures, and capacity constraints (SMUD PowerStat and PowerChoice Programs);
- Static time-of-use price signals in a 3-tiered rate block (PowerChoice Program); and
- CAISO signals issued during Stage II and III emergencies.

PowerStat
A direct load control program run by SMUD that relies on the use of electronic signals that are sent out to cycle residential air-conditioning systems and spa and pool pumps at participants' homes during curtailment periods. Of the Sub-element 4 residential pilot programs only PowerStat was implemented by the end of summer 2002.

Energyn Program
A program offered in PG&E's service territory with Energyn serving as a program administrator/aggregator. Program participants respond to automated signals by pre-programming higher thermostat set-points for curtailment periods.

PowerChoice
A program offered by SMUD that includes three-tiered TOU rate blocks that provide fixed price signals to encourage participants to shift residential loads to off-peak periods. In addition, a fourth, highest-priced tier, designated as a "critical period", serves as a dynamic price signal. This critical period may occur at any time during the peak afternoon hours of summer weekdays.

The remainder of this report details the methodology that was utilized to evaluate Sub-element 3 and 4 programs, and presents key performance related results for each program during the 2003 summer peak period.

3.2 STATUS OF PROGRAM ELEMENT

This section provides a summary of final demand savings for projects completed under the Energy Commission's DR program. Key findings for the 2003 summer peak demand period are presented for Sub-elements 3 and 4. Results are also listed for Sub-elements 1 and 2. Contractors and grantees of AB 970 and SB 5X for Sub-elements 1 and 2 have completed all phases of their programs prior to 2003.[2] Verified demand savings of Sub-elements 3 and 4 have been updated in this supplemental report to reflect program results obtained up to September 30, 2003. Other key results discussed below include a summary of program participants and a description of program activity for Sub-elements 3 and 4 (i.e., test dates, number of tests conducted, and recruitment of participants by contractors).

3.2.1 Program Overview

Program Participation

At the end of the 2003 summer peak demand period, 2,128 participants had been enrolled in programs under the four DR sub-elements. Table 3-1, shown below, breaks out total participant recruitment levels by sub-element as of September 30, 2003.

Table 3-1: Summary of Program Participation by Sub-element as of September 30, 2003

Sub-element	Sub-element description	Current number of participants
1	Contractors, med–large C&I	820
2	Grantees, med–large C&I	512
3	Contractors, small C&I	473
4	Contractors, residential	323
Total		**2,128**

Between September 30 and December 31, 2003, there was little or no change in the total number of participants for all of the sub-elements, with the sole exception of Sub-element 3. For Sub-element 3, ICF recruited an additional 645 participants during the fourth quarter of 2003—representing a 136% increase over the Sub-element 3 total as of September 30. If these additional participants were to be added to the figures listed above in Table 3-1, the total participants for Sub-element 3 would rise to 1,118, and the total participants for all DR program sub-elements would increase to 2,773 as of December 31, 2003.

Demand Savings by Program Sub-elements

Table 3-2, shown below, summarizes the demand savings that were achieved as of September 30, 2003 for all of the AB 970 and SB 5X funded programs combined. Reported and verified demand savings are given for all sites completing pilot tests as of the end of the 2003 summer peak demand season. As discussed in more detail in subsequent sections of this report, reported

[2] Verified demand savings from these sub-elements are the same as those reported in Nexant's 2002 report.

demand savings for the Webgen and Energyn programs are not presented as part of the results for Sub-elements 3 and 4.

Table 3-2: Demand Savings by Program Sub-element as of September 30, 2003

Sub-element		Contracted demand savings (MW)	Reported demand savings (MW)	Verified demand savings (MW)	Realization rate
1	Contractors (Large Commercial & Industrial)	184.4	190.8	175.1	91.8%
2	Grantees (Large Commercial & Industrial)	33.6	33.7	26.9	79.8%
3	Contractors (Small Commercial)	40.0	NA[1]	13.8	99.0%[3]
4	Residential Pilot	3.0	NA[2]	0.39	87.4%[4]
Totals		**261.0**	**NA**	**216.2**	**91.5%**[5]

[1] ICF had reported savings of 11.5 MW. Webgen did not have reported savings (only verified savings were submitted).

[2] PowerChoice and PowerStat had combined reported demand savings of 0.273 MW, while Energyn did not have reported demand savings. Since no reported figures were received for the Energyn program, only verified savings are reported.

[3] Sub-element 3 realization rate calculated based on ICF reported and verified savings.

[4] Sub-element 4 realization rate calculated based on SMUD PowerChoice and PowerStat reported and verified savings.

[5] Total realization rate is calculated based on reported and verified demand savings for all Sub-element 1 and 2 programs, for ICF only in Sub-element 3, and for SMUD PowerChoice and PowerStat only in Sub-element 4.

Further discussion regarding demand savings results, and the methodology used to calculate these savings, is presented in greater detail in Section 3.3, 3.4, and 3.5 of this report.

Cumulative Demand Savings for Summers 2001, 2002, and 2003

Table 3-3, shown below, lists the cumulative verified demand savings for contractors that completed pilot tests as of the end of the summer peak periods ending on September 30 in 2001, 2002, and 2003. At the end of summer 2001, verified demand savings across Sub-elements 1 and 2 were almost exactly as contracted, at just over 155 MW. At the end of summer 2002, verified demand savings of 203.8 MW were 24% below the contracted amounts, largely because Sub-element 3 and 4 contractors had only tested a small proportion of their program participants.

Table 3-3: Cumulative Demand Savings for Summer 2001, 2002, and 2003

	Total facilities contracted	Cumulative contracted demand savings (MW)	Cumulative verified demand savings (MW)	% Difference between contracted and verified savings
Summer 2001	734	155.6	155.1	-0.3%
Summer 2002	1,644	253.0	203.8	-24.0%
Summer 2003 (as of 9/30/03)*	2,128	261.1	216.2	-20.9%

* Does not include expected additional projects by ICF.

At the end of the 2003 summer peak demand period, total verified demand savings were approximately 20% below the cumulative contracted demand level. Similar to the 2002 results, the shortfall in 2003 is driven in part by the lower than expected annual savings from the residential programs in Sub-element 4. Further elaboration on the findings listed above in Table 3-3 is contained in Section 3.5.

3.2.2 Program Activity Summary of SB 5X

Although Sub-elements 1 and 2 were completed at the end of 2002, the final outcome of Sub-elements 3 and 4 were not realized until the end of the 2003 summer peak period. Table 3-4, shown below, displays the results for all four sub-elements of the SB 5X program.

Table 3-4: Summary of SB 5X Program Activity as of September 30, 2003

Sub-element		Program sub-element status	Contracted curtailable load	Reported curtailable load from pilot tests	Verified demand savings as of September 30, 2003	Number of facilities as of September 30, 2003
1	Contractors, med–large C&I	Completed, 2002	90.5 MW	87.8 MW	85.2 MW	309
2	Grantees, med–large C&I	Completed, 2002	19.6 MW	19.7 MW	16.0 MW	334
3	Contractors, small com.	Implementation expected to be completed by 6/1/03	40.0 MW	11.5[1]	13.8 MW	473
4	Contractors, residential	Implementation expected to be completed by 6/1/03	3.0 MW	0.27[2]	0.391 MW	323
Totals			**153.1 MW**	**NA**	**115.4 MW**	**1,439**

[1] Reported savings are for ICF only. Webgen did not have reported demand savings.

[2] Reported demand savings include results for only the PowerChoice and PowerStat programs (not Energyn).

As Table 3-4 illustrates, the total Sub-element 1 contracted demand savings of 90.5 MW represents 60 percent of the total SB 5X contracted demand savings, while Sub-element 2 represents 13 percent (19.7 MW). Sub-element 1 and 2 participants have finalized program implementation and have performed at least one pilot test. Sub-element 1 contractors reported achieving 97 percent of their contracted goal. Nexant was able to verify a 94 percent accomplishment. Sub-element 2 grantees reported achieving 100 percent of their contracted demand savings, while Nexant's verification was 82 percent. The combined reported demand savings of 107.5 MW for Sub-elements 1 and 2 is 96 percent of the combined contracted demand savings of 110.1 MW. Nexant has verified 101.2 MW in demand savings for Sub-elements 1 and 2, or 92 percent of contracted demand savings for these two sub-elements.

Total Sub-element 3 contracted demand savings of 40 MW represents approximately 26% of total SB 5X contracted demand savings, while Sub-element 4 represents only 2 percent (3 MW).

For Sub-element 3, 13.8 MW of verified demand savings were achieved. This represents only 35% of the contracted 40 MW that was initially set at the outset of these programs. The primary reason for this shortfall is that Sub-element 3 enrollment was below initial expectations. For Sub-element 4, the 0.391 MW of verified savings from residential pilot programs represent only 3% of the total contracted demand. The large disconnect between the verified and the contracted demand savings reflects in large part the experimental nature of the residential DR pilots.

3.2.3 Summary of Program Status of Sub-elements 3 and 4

Sub-element 3 Contractors

Webgen and ICF Consulting, the two contractors for Sub-element 3, conducted recruitment of small commercial participants throughout 2002 and 2003. By working primarily with large chains of restaurants, retail outlets, and banks, they recruited 473 participants as of September 30, 2003. As noted above, ICF continued the aggressive recruitment and testing of participants, adding 645 additional sites between the end of the summer peak season and the end of the 2003 calendar year. Table 3-5, shown below, summarizes the activity of Sub-element 3 as of September 30, 2003.

Table 3-5: Program Activity for Sub-element 3 as of September 30, 2003

Contractor	Total of customer sites recruited	Total facilities conducting pilot tests	Contracted curtailable load (MW)	Reported curtailable load (MW) [1]	Verified curtailable load (MW)	Realization rate
ICF Consulting	392	392	30.0	11.53	11.41	99.0%
Webgen	81	81	10.0	NA	2.39	NA
Totals	**473**	**473**	**40.0**	**NA[1]**	**13.80**	**99.0%**

[1] In Sub-element 3, Webgen used the DR tool and therefore had no reported demand savings-- preventing a realization rate calculation. The reported demand savings of 11.53 MW is for ICF only.

All 473 of the participating sites conducted pilot tests in 2003. ICF Consulting conducted pilot tests for all of their 392 sites and reported a total demand savings of 11.53 MW.

Sub-element 4 Contractors

SMUD and Energyn were selected by the Energy Commission to operate pilot programs that aggregate curtailable loads for residential participants under Sub-element 4. Energyn operated one residential pilot program, whereas SMUD originally intended to operate three programs—two Time-of-Use (TOU) programs called PowerChoice and one direct load control program called PowerStat. The two intended TOU programs were to cover existing and new residential customers, although the program for new residential customers was dropped. Table 3-6, presented below, summarizes program activity as of September 30, 2003.

Table 3-6: Program Activity of Sub-element 4 as of September 30, 2003

Contractor	Number of customers recruited	Number of customers tested	Expected demand savings (MW)	Reported demand savings (MW)	Verified demand savings (MW)	Realization rate
SMUD—PowerStat	178	178	0.15 –0.30	0.241	0.19	82.7%
SMUD--PowerChoice (TOU)	73	73	0.15 –0.30	0.032	0.039	123%
SMUD —Total	251	251	0.39–0.79	0.273	0.239	87.4%
Energyn	72	69	0.15–0.29	NA	0.153	NA
Totals	**323**	**320**	**0.15–0.79**	**NA**	**0.391**	**87.4%**

Pilot tests were conducted for 320 of the 323 customers recruited for Sub-element 4 programs as of the end of the 2003 summer peak demand season. During 2002, SMUD conducted pilot tests at all 178 PowerStat customers, achieving 0.19 MW of verified demand savings. During the 2003 peak demand season, SMUD conducted pilot tests at all of its 73 PowerChoice customers, achieving a total verified demand savings of 0.039 MW. For Energyn, pilot tests were conducted at 69 of their 72 customers, generating a verified demand savings of 0.15 MW.

The realization rate for the Sub-element 4 is 87.4%. As noted earlier, this realization rate was calculated using the total reported and verified demand savings for the PowerStat and PowerChoice programs only. Given that these two SMUD programs account for over 60% of the total verified savings for the entire sub-element, it was assumed the combined PowerStat and PowerChoice results were representative of the Sub-element 4 population.

3.3 DISCUSSION OF MV&E APPROACH

The MV&E methodology that has been utilized by Nexant for the DR program has evolved over time to reflect both expanding levels of participation and the addition of new market segments. Nexant's original evaluation objectives under the AB 970 program focused on: 1) documenting the program's potential demand savings, 2) measuring the program's cost effectiveness, and 3) analyzing key attributes of the program participant population and their DR systems.

With the passage of SB 5X, however, it was necessary to develop two separate MV&E plans in order to address the growing population of the state's DR program. Given that the population of Sub-elements 1, 2, and 3 include small and large C&I end-users, it was decided that these sub-elements would utilize a common MV&E plan.[3] For Sub-element 4, a separate methodology was required to address its residential population.[4] The MV&E plan used for the SB 5X-funded program Sub-elements 1, 2, and 3 expanded upon the methodology used to evaluate the AB 970

[3] The MV&E plan for Sub-element 3 mirrors the plan utilized for Sub-elements 1 and 2. A copy of the MV&E plan for Sub-elements 1 and 2 was submitted as part of the 2002 Demand Responsive Program Element report.
[4] A copy of the MV&E plan for Sub-element 4 is presented in Appendix A.

Sub-elements 1 and 2 in previous reports. The MV&E plan used for Sub-element 4 required new approaches to evaluating demand savings and addressing a modified list of research objectives, described in Section 3.4 of this report.

3.3.1 Approach to Data Collection and Analysis

Nexant adopted a three-pronged approach to obtain raw data from program participants and to verify demand savings claims. To evaluate the large and diverse group of customers that make-up the DR program population, Nexant designed the DR Tool, which is a web-based automated process for data gathering and analysis. The DR Tool was developed to make program evaluation analysis more robust and to help minimize the costs associated with sampling, data acquisition, project tracking, and program analysis. However, given the complexities of evaluating DR programs, alternate approaches for data collection and analysis were also identified. Listed below is a summary of the three main evaluation approaches that were utilized by Nexant to assess the performance of the various DR program sub-elements:

- Automated analysis—uses Nexant's DR Tool and is the preferred method
- Manual analysis—relies on statistical, manual analysis and is the backup approach
- Administrator and participant surveys—a supplemental data collection approach for SB 5X programs only.

Figure 3-3, shown below, illustrates how these three approaches were utilized to meet the different sets of research objectives, discussed in Section 3.4, that were outlined for the DR program sub-elements. Each of the three MV&E approaches is discussed in Section 3.4.

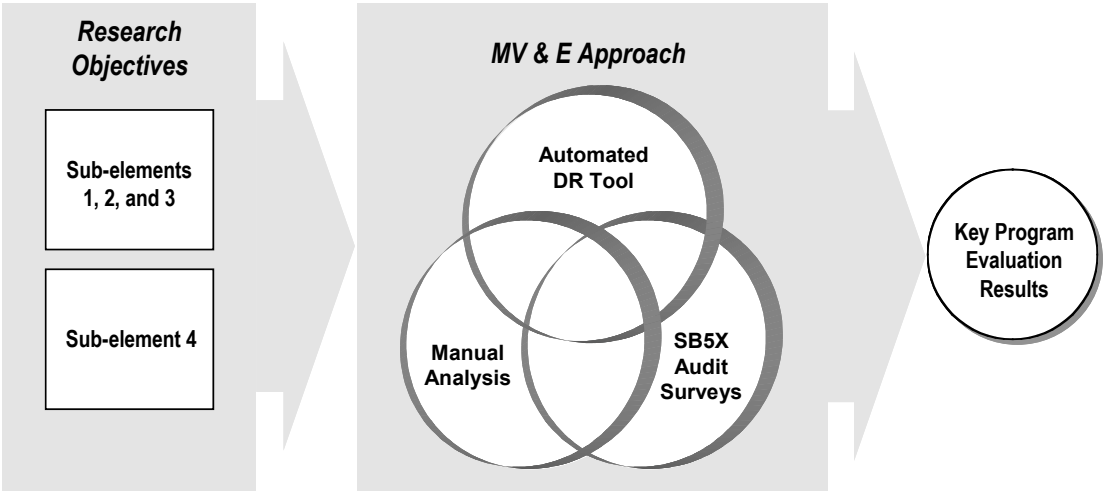


Figure 3-3: Three-Pronged Analytical Approach

3.3.2 Sampling Plan and Statistical Analysis

The M&VE sampling process and statistical analysis approach relies heavily on participant data collected through the DR Tool during pilot tests. This data is then sorted into strata based on

administrator, load usage, geographic location, building type, etc. Although Nexant requested data for all curtailments from each program administrator, administrators were not contractually required to provide this data.[5] If an administrator provided a complete set of (pilot test) meter data for all program participants, no sampling was required. However, in cases where administrators supplied meter data for only a subset of program participants (and when manual analysis was required for analysis of these participants) sampling techniques were utilized in a manner that seeks to achieve an 80/20 reliability level.

3.3.3 Methods for Peak Demand Savings Analysis

Peak demand savings are calculated by comparing the difference between the actual load demand and the baseline (average) demand. Demand savings for a particular curtailment event (e.g., a pilot test or a Stage II and III emergency curtailment), can be calculated using Equation (1), shown below.

(1) Peak Demand Savings = Baseline Demand – Actual Event Demand

An example of how this equation can be used to measure peak demand savings is presented below in Figure 3-4.

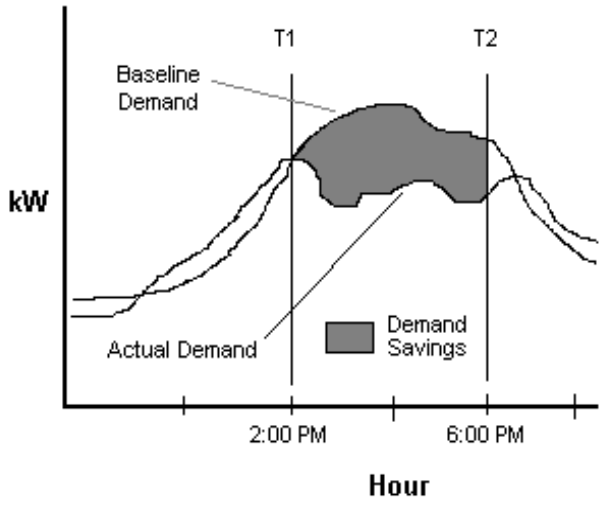


Figure 3-4: Graphical Illustration of Measured Demand Savings

Equation (2), shown below, is used to calculate average demand savings over a curtailment period. The demand savings calculation is based on the actual start time and duration of the event, with the peak demand period defined as the hours of 2:00 pm to 6:00 pm on non-holiday weekdays from June 1 through September 30.

[5] Including the date, time, type of curtailment, and performance.

$$(2) \qquad kW_{saved} = \frac{\sum_{StartTime.}^{EndTime.} kW_{Meter} - \sum_{StartTime.}^{EndTime.} kW_{Baseline}}{CurtailmentPeriod}$$

Where:

StartTime	=	The start time of the curtailment
EndTime	=	The end time of the curtailment
CurtailmentPeriod	=	Difference between End Time and Start Time of the curtailment.
kW_{saved}	=	Average kW demand savings over the curtailment period.

Since there is no difference between a pilot test day and a curtailment in terms of the methodology that should be used to calculate demand savings, the same MV&E procedure was used for both types of events.

3.3.4 Baseline Calculation Methods

Baseline demand savings is a critical element of Equations (1) and (2). Nexant's MV&E plan calculates demand savings using three different baseline methods, all of which require the availability of 15-minute interval meter data at the facility level. The three baseline methods include: (1) the CAISO baseline method, (2) Nexant's modified CAISO-baseline method, and (3) Nexant's temperature-load adjusted (TLA) baseline method.

<u>CAISO Baseline Method</u>
The CAISO baseline is a compilation of average daily (24-hour period) load profiles for each facility approximating the seasonal patterns of building energy use. Each 15-minute baseline demand value is calculated by averaging daily energy (kW) demand (within the same 15-minute time intervals) occurring over the previous ten consecutive, non-holiday, non-curtailed, business days, prior to the curtailment day.

<u>Modified CAISO Baseline Method</u>
Since it is not always possible to receive 10 consecutive days of meter data from participants, a number of parameters in the CAISO baseline method must be relaxed to create a proxy approach. For the purposes of evaluating the DR program, Nexant developed a modified CAISO-baseline that was used when strict adherence to the CAISO method was not possible. The minimum data needed for this method is only five days of usable interval data from the time period prior to the event. Nexant uses as many days as possible, up to the CAISO maximum of ten. The days used in this calculation need not be consecutive business days, but they must fall within the 30-day period immediately preceding or surrounding the curtailment day. Nexant assigned priority to consecutive days preceding the event.

<u>Temperature-load Adjusted (TLA) Baseline Method</u>
Neither the CAISO nor the Nexant-modified CAISO baseline method takes into account the connection between ambient air temperatures and increases in electrical demand due to higher HVAC loads. Therefore, Nexant developed a pre-curtailment, temperature load-adjusted (TLA), baseline that could be used as a proxy for either of the previously discussed baseline methods.

The TLA baseline method more accurately calculates the demand savings during curtailment events by adjusting the CAISO baseline to reflect actual load conditions present on an event day.

3.3.5 Realization Rates

To assess the ability of program administrators and participants to realize potential demand savings, a realization rate was calculated (when possible) for each program sub-element. Equation 3, shown below, lists the key components that were utilized to derive realization rates.

$$(3) \qquad Realization\ Rate = \frac{VerifiedDemand\ Savings, kW}{Reported\ Demand\ Savings, kW} X100\%$$

The realization rate provides an idea of how accurate participants' claims of reported savings are in comparison with Nexant's verified savings. A value of 100% indicates that the participant-reported savings match the Nexant verified savings.[6] Realization rates may be used to draw inferences about the general population, subject to statistical inaccuracies, based upon analyses performed using a sample of the population. Nexant utilizes realization rates in statistical analyses because it provides an accurate assessment of curtailment performance.

3.3.6 Additional MV&E Elements Included in Sub-element 4 Analyses

The SB 5X evaluation of Sub-element 4 residential pilot programs required modification to the methodology that was used for Sub-elements 1, 2 and 3. A key MV&E methodology distinction included differentiating between critical and non-critical curtailment signals. Critical curtailment signals may be triggered at any time, activating single events based on emergency price or system capacity conditions as established by the CAISO or SMUD. Non-critical signals associated with TOU-rate blocks are static price signals designed to encourage routine peak period demand savings. This distinction is important because the Sub-element 4 MV&E plan uses different analytical techniques for static price (critical) and dynamic price (non-critical) curtailment signals. Table 3-7, given below, summarizes the MV&E approach for each Sub-element 4 program, and identifies baseline calculation methods and key data requirements.

[6] The realization rates used in this report are equivalent to the reliability rates reported in the 2001 year-end report.

Table 3-7: MV&E Approaches for Sub-element 4

Program Administrator and program	Baseline	Data required for demand savings calculation
SMUD—PowerChoice	*For critical signals:* CAISO baseline, Nexant's TLA Baseline Method *For non-critical signals:* Nexant's method for pre- and post-implementation baselines, or alternative method using representative price elasticity	*For critical signals:* Aggregate 15-minute interval kW usage data for previous 10 consecutive, non-holiday, and non-event day weekdays. Aggregate 15-minute interval kW usage data for event days associated with "critical period" TOU signals. *For non-critical signals:* Aggregate 15-minute interval kW usage data for 10 consecutive, non-holiday, non-event, and pre- and post-implementation days. Price elasticity data literature search.
SMUD—PowerStat	*For critical signals:* CAISO baseline, Nexant's TLA Baseline Method	*For critical signals:* Aggregate 15-minute interval kW usage data for previous 10 consecutive, non-holiday weekdays. Aggregate 15-minute interval kW usage data for event days.
Energyn	*For critical signals:* CAISO baseline, Nexant's TLA Baseline Method	*For critical signals:* Same as SMUD—PowerStat

Pilot tests are not required for Sub-element 4 programs. However, participants are required to demonstrate their demand savings capability in response to critical curtailment signals. If pilot tests were conducted, calculations were performed to verify potential peak demand savings for a sample set of participating facilities. The results for the sample facilities were then applied to the entire population. Pilot tests were not used for evaluating non-critical curtailment signals.

Measurement of demand savings from critical signals occurring on curtailment days followed the same procedure as for pilot tests. As noted earlier, from an MV&E perspective, there is no difference between a pilot test and a curtailment in terms of calculating demand savings for individual participants.

3.4 PROGRAM ELEMENT MONITORING AND VERIFICATION

This section summarizes how program element monitoring, verification, and evaluation (MV&E) tasks were executed in relation to the tasks set forth in the two MV&E plans covering Sub-elements 3 and 4. The actual process of data collection, sampling, and analysis of program participants is described, along with a review of how each of the evaluation (research) objectives was addressed. Specifically, this section contains a review of the following elements:

- Summary of research objectives for Sub-elements 1 through 4;
- Overview of key MV&E assumptions
- Description of general MV&E approaches;
- Review of MV&E elements at the individual program level; and

- Description of statistical uncertainty analyses.

The presentation of MV&E results for the 2003 summer peak demand period (for Sub-elements 3 and 4) is subsequently presented in Sections 3.5, 3.6, and 3.7 of this document.

3.4.1 Summary of Research Objectives for Sub-elements 1, 2, and 3

Over and above the core objectives of measuring potential demand savings and DR program cost-effectiveness, Nexant and Energy Commission representatives developed a set of research objectives for SB 5X activities that called for: (a) an analysis of program population characteristics; (b) assessment of the influence of ambient temperature on demand savings; (c) evaluation of building occupants' comfort responses to curtailments; and (d) the persistence of demand savings during the peak period one year after implementation. To achieve these goals, the following research objectives (questions) were established for sub-elements 1, 2, and 3:

1. What were the Nexant verified (total) peak demand savings from all customers from their DR systems during the pilot tests?
2. Are there differences between program administrators' reported potential peak demand savings and Nexant's verified potential peak demand savings from pilot tests? What is the source of any difference?
3. What are the factors, if any, contributing to the differences between the verified potential peak demand savings achieved during the pilot test and the program or contract goals?
4. What was the peak demand savings verified by Nexant achieved by operating demand responsive systems during Stage II and III curtailments in the peak summer months?
5. How do the Stage II and III curtailment documented peak demand savings numbers taken during the summer peak period compare to the demand savings goals stated in the contract or grant?
6. What percentage of documented potential peak demand savings, demonstrated in verified pilot tests, were achieved during Stage II or III curtailments in the summer peak period?
7. Did the level of peak savings vary any within the 4-hour (peak) pilot test times?
8. What level of demand savings, during a curtailment, was achieved for each major building system (e.g. HVAC, lighting, process, onsite generation)?
9. What were the overall realization rates for each major building system that was curtailed?
10. Did curtailment measures used to achieve MW goals have an impact on building occupant comfort? If so, what was the impact?
11. What are building type and location characteristics of the program participants population, and how do these characteristics compare to those found in the general population?
12. What were the differences in peak demand savings resulting from curtailments on "hotter" days relative to demand savings from curtailments occurring on "cooler" days?
13. What proportion of program participants allowed automated responses to curtailment signals?

14. Did the automated signals provide lower or higher levels of demand savings compared to manual systems?
15. What is the level of cost effectiveness expressed as $/kW ($ = Energy Commission payments to program administrators; kW = pilot test demand savings)?
16. What is the persistence of the load reductions?

3.4.2 Summary of Research Objectives for Sub-element 4

Although the objectives contained in the Sub-element 4 MV&E research plan are similar to those utilized for Sub-elements 1, 2 and 3, several research objectives were modified to account for the inherent differences in the structure of residential programs. To help prioritize the analysis of Sub-element 4 objectives, three priority-based tiers were defined by the Energy Commission—Tier 1 represents the highest priority and Tier 3 the lowest.

Tier 1 (Research Objectives 1 and 2)

1. Define and evaluate peak demand savings achieved for each of the four residential programs based on sampling techniques needed to obtain a minimum 80/20 statistical accuracy level.
2. Determine the cost-effectiveness of the program in dollars spent per kW of demand savings and estimate a projected cost per kW for the post-pilot test phase[7].

Tier 2 (Research Objectives 3 to 7)

3. If pilot tests are conducted, provide comparisons between measured peak demand savings documented during the pilot test and peak demand savings from subsequent curtailment events (price, static or dynamic signals) between these events.
4. Determine how levels of demand savings vary across the peak demand period or specified hours of a curtailment period if different than the peak demand period. Identify factors that explain any hourly variation in demand savings.
5. Did the operation of demand responsive systems during curtailment events impact residential occupant comfort?
6. Determine if there are significant differences in peak demand savings on high ambient air temperature days versus cool days for each type of residential pilot program.[8]
7. Characterize relevant household demographics, residential building types, and climatic characteristics of the program participant population.

Tier 3 (Research Objectives 8 and 9)

8. Determine the reasons and the extent to which customers chose to exercise overrides of automated systems during curtailment events.

[7] Research Objective 2 depends on whether pilot tests are conducted as a part of program implementation.
[8] Research Objective 6 can only be met for program participants responding to critical curtailment signals, because no practical method is available that measures the effects of temperature on demand savings from TOU rates.

9. Compare demand savings from curtailment events involving price and/or emergency signals and explain the differences.[9]

3.4.3 Overview of Key MV&E Assumptions

Listed below is a set of key assumptions that were made in an effort to streamline MV&E analyses conducted by the Nexant team:

- It was assumed that the occurrence of peak demand emergency curtailments were strongly correlated to increases in outdoor air temperatures and increases in summer peak loads that are brought on by high levels of air conditioner use. Given the importance of this assumption, the MV&E plan differentiates between heat-sensitive and non heat-sensitive participants. Heat-sensitive participants were defined as those whose facilities include HVAC equipment in their curtailed loads; non-heat sensitive facilities do not. [10]
- It was also assumed that participants would not implement DR systems in facilities that they own, but that are not part of the DR program.
- It was determined that statistical analyses of free-driver and associated conditions are beyond the scope of Nexant's MV&E plan.
- In order to measure potential demand savings, it was necessary to establish suitable and reliable baseline methods against which actual demand savings achieved during pilot tests and emergency curtailments could be measured. Baseline values are difficult to calculate, as they are indicative of energy demand that would have occurred on the day of curtailment in the absence of a curtailment. Therefore, Nexant utilized two principle baseline methods, which are assumed to be the best available methods to be universally applied to a diverse DR program population. The two methods, a modified CAISO-baseline method and a temperature-load adjusted baseline method, were described in Section 3.3.4 of this report.
- Nexant has assumed that all the meter data provided by program administrators for their facilities' pilot tests is accurate. Further, it is assumed that verified demand savings figures from pilot tests are reasonable estimates of the potential demand savings that would occur during Stage II and III emergency curtailments.[11]

[9] Research Objective 9, which compares responsiveness to curtailments involving price signals and emergency signals, may be difficult to differentiate as the SMUD programs have a set of criteria for sending critical curtailment signals that combine price and capacity constraints.

[10] The MV&E methodology used by Nexant also allows for demand savings verification under other curtailment scenarios (e.g., emergency curtailments triggered by events unrelated to high temperatures); however, further analysis of non-temperature related curtailments is beyond the scope of Nexant's MV&E tasks.

[11] The DR program required all Sub-element 1, 2 and 3 participants to conduct at least one pilot test during the summer non-holiday weekdays between June 1 and September 30 between the hours of 2pm to 6pm. These pilot tests demonstrated the ability of participants to reduce or shed load (i.e., by showing that each tested site has established and maintained the ability to respond to a CAISO Stage II or III curtailment signal).

3.4.4 Description of General M&V Approaches

As previously noted in Section 3.3, Nexant utilized a three-pronged approach to analyze the performance of the various DR program elements. Listed below is a summary of the key elements of each demand savings analysis approach.

Automated DR Tool

The DR Tool, which was the preferred MV&E approach in analyzing program results, assumes that program participants can provide 15-minute interval meter data for both baseline and demand savings calculations. Under this approach, the automated secure DR Tool website is used by program participants to upload data from their customer sites, including interval meter data for pilot tests and similar events. The DR Tool consists of a suite of software components, including a website interface, program participant database (PPD), meter data database (MDD), and an analysis engine. All data, regardless of the M&V approach, is entered into the PPD, which forms the basis for all queries, sampling, audits, and subsequent analysis and reporting.

The DR Tool's different components facilitate the process of obtaining participant information, meter data uploads, data analysis, demand savings calculations, and reporting. Analysis using this software tool allows for the use of different baselines against which Nexant compares curtailment data for any program participant. This provides the basis for the demand savings calculations. The software performs the following specific functions:

- Allows program administrators to add, modify, or delete records in the PPD,
- Enables administrators to upload 15-minute interval data to the MDD,
- Performs error checks and reporting at several stages of data input,
- Allows Nexant to tabulate and analyze the data using several different baseline methods,
- Executes custom queries on research objectives or facility results, and
- Eliminates the need for sampling and the application of statistical inference.

The DR tool was used to analyze demand savings based on data that was provided by contractors or grantees for all participating sites. This automated approach allowed Nexant to analyze data without introducing errors as a result of population sampling or statistical inferences.

Manual Analysis

Nexant's experience with past evaluations of the AB 970 DR program revealed that some administrators could not provide 15-minute interval data for their participants, and/or would not be likely candidates to use the automated DR Tool. In many cases, only 30-minute or 60-minute interval meter data was available and data could only be provided for a subset of participant sites. In either case, the automated approach (DR Tool) could not be effectively utilized.

For the segments of the program population that were not valid DR Tool candidates, a manual statistical approach was used with the DR Tool serving as a guide in listing participants and devising a sampling approach based on standard M&V practices. In cases where data availability

was a problem, facilities without interval meter data were grouped together and a representative sample was drawn from the whole. Using the manual analysis method, Nexant then verified demand savings by applying realization rates of similar sites (within a given administrator's portfolio of customers) that supplied usable meter data.

Sampling and verification of savings results under the manual approach were performed in a manner that adhered to the 80/20 criteria (i.e. confidence intervals and accuracy of estimates) as applied to each sub-element. Manual calculations of savings for participants who could provide 30-minute or 60-minute interval meter data were performed using analogous procedures to those used in DR Tool analyses. In cases where no meter data could be provided, demand savings were calculated using evaluation techniques that leverage quantitative and qualitative responses to the M&V objective questions. These techniques involved one or more of the following tasks:

- Taking reported demand savings from participants and extrapolating a correction factor based on realization rates taken from similar sites within an administrator's portfolio,
- Obtaining information through quantitative and qualitative responses to supplemental questions put forth in administrator and participant audits, and
- Performing engineering calculations.

Using techniques of correlation and inference, the results obtained from a limited number of samples from the population without 15-minute meter data was generalized to describe the entire subpopulation of participants with limited data for each administrator. Statistical results estimating the demand savings from this group were then added to the results for the 15-minute interval data group as calculated by the DR Tool. Since most of the program participants have access to 15-minute interval data at their facilities, the use of the manual statistical approach was limited. Since this subpopulation was the primary, if not exclusive, source of statistical error for the whole population, demand savings estimates for the whole population are expected to fall well within the required 80/20 criteria.

Audit Surveys

Although both the DR Tool and the manual analysis method were effective in estimating demand savings for a large number of program participants, a segment of the program population did not have a sufficient level of site and meter data to be evaluated under either of these approaches. In order to evaluate this remaining segment of participants, an audit/survey was utilized to collect required data and to garner additional information on program performance.[12] Responses to additional (supplemental) questions were used to answer, confirm, or correct site data found in the PPD, while providing a method to enhance the statistical accuracy of results.[13] This third approach for supplemental data collection was a key factor in addressing the research objectives stated in the SB 5X MV&E plan for Sub-elements 1, 2, and 3.

[12] A copy of the audit forms (survey guides) that were utilized for Sub-element 3 & 4 programs is presented in Appendix B.

[13] Audit surveys were a new addition to Nexant's MV&E plan for the DR program (i.e., were used only for the SB 5X evaluation), and were conducted for administrators of Sub-elements 1 and 3, and participants of all sub-elements.

Table 3-8 lists the data that Nexant initially requested from program administrators for each of their respective participants. If this data was not provided in the initial request, Nexant made additional requests with program administrators to be able to obtain as much of the requested data as possible. As a final option, Nexant obtained missing data for a sample of sites within each sub-element by asking supplemental questions in the participant audit process.

Table 3-8: Requested Data from Sub-element 3 and 4 Participants and Administrators

Requested Data	Data required	Sub-element 3	Sub-element 4
Participant Facility Data			
Facility name	Yes	☒	☒
Site contacts	No	☒	☒
Building age, size (sq.ft.), address and zip code	No		☒
Building function and type	Yes	☒	
Total summer peak or connected load	No		
Total curtailed load estimated by end use (by end use if available)	Yes	☒	
Curtailment Event Data			
Type of curtailment (pilot test or emergency)	Yes	☒	
Date, start and stop times of curtailment	Yes	☒	☒
Total curtailed load claimed (by end use if available)	Yes	☒	
Type of curtailment signal received	Yes	☒	
Type of load control system used (level of automation)	Yes	☒	
Occupant complaints received during curtailment (lighting and/or HVAC)	No	☒	
Daily high and low temperatures on day of curtailment	No	☒	☒
Interval meter data for baselines, pilot test, and curtailments	Yes	☒	☒

3.4.5 Review of MV&E Elements at the Individual Program Level

This section reviews how the three MV&E approaches were applied to each of the individual programs within Sub-elements 3 and 4. For each sub-element, a brief description of program specific MV&E issues is presented.

Sub-element 3

Table 3-9 illustrates the means by which data was obtained and analyzed by Nexant for each program administrator (contractor). Facilities listed below as *analyzed (sampled)* are those for which the contractor provided usable meter data for pilot tests, either via the DR Tool or by manual submissions. All of these facilities analyzed became part of Nexant's sample.

Table 3-9: Sub-element 3 Data Submissions, Sampling, and Analysis of Participants

Contractor	Total participant facilities	Facilities pilot tested	Facilities analyzed (sampled)	Process for data collection & analysis	Status of pilot test analysis	Completion of audits
ICF Consulting	392	392	15	Manual	Verified	Participant & Administrator
Webgen	81	81	81	Manual	Verified	Administrator only
Totals	**473**	**473**	**96**			

Administrator audits were completed for both the ICF and Webgen programs. However, as is discussed in Section 3.7, participant audits were only completed for the ICF program.

Among all Sub-element 3 contractors, only Webgen conducted pilot tests among all facilities and provided meter data for all of these sites. In most instances, the contractor only reported demand savings for sites where meter data was available, even though additional sites were known to have conducted pilot tests. Listed below is a brief description of the demand savings evaluation methodology that was applied to each of the Sub-element 3 programs.

ICF Consulting

The manual method was applied to the analysis of demand savings for the ICF program. Key steps that were conducted to analyze demand savings include: 1) calculating an average realization rate from the 15 sample participants (4% of the total program participants), 2) verifying that the realization rate used adheres to the 80/20 confidence interval requirement for data relating to the entire sub-element, and 3) multiplying the reported demand savings by the average realization rate to calculate an estimated "verified MW to date" value for each participant and the program as a whole. ICF did not use the TLA method.

Webgen

This program was unique in that verified data was collected for all of the 81 participants using the DR Tool (automated method). The receipt of data via the DR Tool enabled Nexant to collect metered data on a site-by-site basis—the calculation of a realization rate for the program was not needed since each project's calculated demand savings for the Wegben program was in essence "verified." Some manual calculations were performed to ensure the accuracy of the data collected using the DR Tool. Webgen utilized the TLA method in reporting data to Nexant.

Overall, Nexant was able to analyze pilot test data from 96 facilities, representing 20 percent of all tested facilities and the entire Sub-element 3 population.

Sub-element 4

Table 3-10 summarizes the extent to which Sub-element 4 contractors were able to fulfill Nexant's data requests. This table also shows the means by which data was obtained and the manner in which Nexant's pilot test analysis was performed for each administrator.

Approximately 13% (41 households) of total Sub-element 4 participants were sampled as part of this analysis.

Table 3-10: Sub-element 4 Data Submissions, Sampling, and Analysis of Participants

Contractor	Total participant facilities	Facilities pilot tested	Facilities analyzed (sampled)	Process for data collection & analysis	Status of pilot test analysis	Completion of audits
SMUD: PowerStat	178	178	13	Manual	Verified	Participant
SMUD: PowerChoice (TOU)	73	73	18	Manual	Verified	Participant
SMUD —Total	251	251	31	Manual	Verified	
Energyn	72	69	10	Manual	Verified	Participant
Totals	**323**	**320**	**41**			

In accordance with Nexant's contract, participant audits were conducted for the PowerStat, PowerChoice, and Energyn programs.[14] Listed below is a summary of the MV&E methodology that was utilized to estimate the demand savings for each of the Sub-element 4 programs.

Power Stat

Demand savings were evaluated by comparing the aggregate baseline and curtailed loads for a sample of up to 13 PowerStat program participants per cycling event day. Baseline days were selected based on the observation of daily temperatures that were similar to those of the cycling event days. By selecting baseline days based on temperature related conditions, the demand savings analysis applied a *defacto* temperature adjustment in estimating demand savings, albeit in a manner different than the standard TLA baseline method that was outlined earlier.

In order to calculate the demand savings, 15-minute interval meter data was aggregated among sampled customers participating in a given cycling event. This data was then compared to a baseline profile compiled (from temperature-similar days) for the same set of participants. Aggregation of participant metered loads was performed in recognition of the high level of variability in daily load profiles for individual residential customers. Nexant also recognized the strong influence of outdoor temperature on average daily residential loads. Consequently, days similar in average high temperatures (within ±2 degrees) to the given event day were selected for inclusion in aggregate baseline load profiles for program participants.

Treating each cycling event as an aggregate customer profile, Nexant's temperature-load-adjusted baseline method was used to calculate demand savings for each cycling event. Average per customer demand savings results of each cycling event were extrapolated to the entire PowerStat program population to estimate program demand savings. Results of the adapted MV&E methodology applied to SMUD's PowerStat program are reported in the next section.

[14] As noted in Section 7, Nexant was not contracted to perform administrator audits for Sub-element 4.

Reported demand savings for the PowerStat program were not provided in a format similar to what was received by Nexant from other programs. However, an approximated reported demand savings for the program was calculated based on information contained in the PowerStat evaluation report.[15] Operating under the assumption that temperature-dependant curtailments would occur during the hottest temperatures, Nexant averaged the reported pilot test impacts for the highest two temperature groups (outdoor temperatures in Sacramento above 96 degrees). The evaluation report listed average impacts, in kW saved per household, for each cycling strategy in the program (25%, 50%, etc.). The average of these kW per household values at the highest two temperature groups was calculated (1.35 kW/household) and then multiplied by the number of participating households to determine the reported demand savings for the entire program.

PowerChoice

The SMUD PowerChoice Program was implemented during the 2003 summer peak demand season. Total demand savings for the program were calculated by extrapolating an average verified demand savings per household for the sample group to the entire program population. The methodology employed used a sample of 18 households out of the 73 participating households to extrapolate an aggregate demand savings for the total population of participants.

All 18 sample households responded to the three curtailment CAISO events on July 19, 2003, August 18, 2003, and September 12, 2003. A temperature load adjusted (TLA) demand savings for the three curtailments was used to determine an average TLA curtailment in Watts per household. The average TLA curtailment per household was then averaged for the 18 sample households. The sample average TLA curtailment in Watts per household was then extrapolated for all 73 participating households to calculate a total verified MW demand savings to date for the SMUD PowerChoice program.

Similar to the PowerStat program, reported demand savings for the PowerChoice program were not provided in a format similar to what was received from other programs. Nexant was able to approximate the reported demand savings for the program from information contained in the PowerChoice evaluation report.[16] The report provided average kW/household impacts for each SMUD time-of-use (TOU) period. Operating under the assumption that temperature-dependant curtailments would occur during the peak (2 pm to 8 pm weekdays) and critical price TOU periods, Nexant averaged the reported kW/household impacts for these two TOU periods, and then multiplied this value (0.415 kW/household) by the total number of households participating in the program to determine the reported demand savings for the PowerChoice program.

Energyn

The Energyn Program was implemented in the PG&E service territory during the 2003 peak demand season. Due to poor participant survey results, only seven sample households had acceptable responses to curtailment signals. The small sample size required that Energyn program results rely on verified demand savings figures. The absence of reported demand savings meant that realization rates could not be calculated for the Energyn Program. To

[15] "PowerStat Pilot Program Evaluation Report", SMUD and Summit Blue Consulting, October 2003, p. 2.
[16] "PowerChoice Pilot Program Evaluation Report", SMUD and Summit Blue Consulting, May 2004, p. 3.

determine the total demand savings for the program, an average savings per household was calculated for the sample and then extrapolated to the entire program population.

The methodology employed used a sample of seven out of the 72 participating households to extrapolate a total demand savings for the total population of participants. Of the seven households, there were ten successful responses to the two curtailment signals on July 28, 2003 and September 22, 2003. TLA demand savings was used to determine an average curtailment in Watts per household. The average curtailment per household value was extrapolated for all 72 participating households to calculate a total verified MW demand savings to date for the Energyn program

3.4.6 Uncertainty Analysis

A discussion of the statistical uncertainty results of Sub-elements 1 and 2 was presented in the 2002 DR report. In summary, at an 80 percent level of confidence, accuracy of verified demand savings for SB 5X Sub-elements 1 and 2 is 3.4 percent, indicating that the 80/20 statistical goal has been met. Table 3-11 summarizes the sampling and error analysis for Sub-elements 3 and 4.

Table 3-11: Sampling and Error Analysis of Sub-elements 3 and 4

Sub-element	Total participant facilities	Facilities pilot tested	Facilities analyzed (sampled)	Realization rate	Precision at 80% confidence	Verified potential curtailable load
Sub-element 3	473	473	96	98.7%	0.016%	13.8 ± 0.00220 MW
Sub-element 4	323	320	41	87.2%	1.27%	0.391 ± 0.00497 MW
Totals	**796**	**793**	**137**			

The Energy Commission provided Nexant with a goal of verifying program element peak demand savings within a level of 80/20 statistical accuracy. This statistical level implies that the demand savings *at the program element level* should be accurate to within plus or minus 20% at a fixed confidence interval of 80%. Determination of whether or not the 80/20 statistical goal has been reached can only be made *after* the sample results have been analyzed.

Nexant designed its sample populations with the goal of reaching 80/20 statistical accuracy within each sub-element. Reaching this level within each sub-element ensures that the demand savings at the DR program element level exceeds the 80/20 goal. Nexant assumed that sampling rates for the Sub-element 3 and 4 populations exceeded what was needed to meet the 80/20 statistical goal. This assumption was met, as indicated by the "Precision at 80% Confidence" figures in Table 3-11. The precision values for both sub-elements are far less than 20%, easily meeting the 80/20 statistical goal. Combined with the results from Sub-elements 1 and 2, the SB 5X results satisfy the 80/20 statistical goal. Taking into account the calculated errors, the verified potential curtailable loads are given for each sub-element in the last column of Table 3-11.

3.5 PROGRAM ELEMENT EVALUATION

This section presents both historical (dating back to 2001) and current evaluation results for the four sub-elements of the Energy Commission's Demand Responsive Program. Cumulative verified demand savings results for 2001, 2002, and 2003 covering Sub-elements 1 through 4 are presented in this section; however, given that Sub-elements 1 and 2 did not have any activity during 2003, a major emphasis is placed on presenting the performance of Sub-elements 3 and 4.

For the summer 2003 peak demand season, Sub-element 3 programs were contracted to provide 40 MW of demand savings, representing 15 percent of the 261 MW total contracted demand savings for all DR programs. The Sub-element 4 residential pilot programs were contracted to provide 3 MW of demand savings, or one percent of the total contracted demand savings. As is discussed below in more detail, the verified demand savings achieved under both Sub-element 3 and 4 programs fell short of their initial contracted MW targets.

3.5.1 Comparison of Cumulative Demand Savings in 2001, 2002, and 2003

Table 3-12, below, shows the cumulative verified demand savings for all program administrators who have completed pilot tests and provided demand savings estimates as of the end of the summer peak periods in 2001, 2002, and 2003.

Table 3-12: Levels of Cumulative Demand Savings at Summers End 2001, 2002, and 2003

	Total facilities evaluated	Contracted demand savings (MW)	Reported demand savings (MW)	Verified demand savings (MW)
Summer 2001	734	155.6	174.7	155.1
Summer 2002	1,644	253.1	223.1	203.8
Summer 2003 (as of 9/30/03)	2,128	261	236*	216

* For Sub-element 3, Webgen only has verified savings. For Sub-element 4, Energyn only has verified demand savings; Reported demand savings for these two programs are not available. For Sub-element 3, only ICF and for Sub-element 4, only SMUD PowerChoice andPowerStat have both reported and verified demand savings.

As of September 30, 2001, total verified demand savings across Sub-elements 1 and 2 was almost exactly as contracted for 734 evaluated facilities, at just over 155 MW. No Sub-element 3 and 4 facilities were tested by this date. Sub-element 1 and 2 program administrators had reported cumulative demand savings of 174.7 MW, yielding an overall realization rate of 88.8 percent for all tested facilities at the end of summer 2001.

At the end of summer 2002, cumulative verified demand savings had risen to 203.8 MW, although this is below contracted amounts largely due to the fact that one Sub-element 1 contractor and several Sub-element 3 and 4 contractors had not completed pilot tests by September 30, 2002. However, for all facilities tested before September 30, 2002, a realization rate of 91.5 percent is higher than that observed for summer 2001.

Cumulative verified demand savings for 2003 were 216 MW, falling 42 MW short of the 261 MW contracted demand savings goal for all sub-elements. This is due to significant shortfalls in verified demand savings for both Sub-elements 3 and 4.

3.5.2 Summary of Demand Savings and Realization Rates

Table 3-13 provides realization rates and total contracted, reported, and verified demand savings by sub-element and by program funding source. Nexant has analyzed pilot test demand savings for 576, or 43 percent, of the 1,332 total customer sites in Sub-elements 1 and 2 of AB 970 and SB 5X. Nexant analyzed 96 of the 473 total customers, or 20%, for Sub-element 3.

Table 3-13: Demand Savings and Realization Rates by Sub-element

Sub-element	Program funding source	Total customer sites	Facilities analyzed (sampled)	Contracted demand savings (MW)	Reported demand savings (MW)	Verified demand savings (MW)	Realization rate
Total Sub-element 1	AB 970 SB 5X	820	243	184.4	190.8	175.1	91.8 %
Total Sub-element 2	AB 970 SB 5X	512	333	33.6	33.7	26.9	79.8%
Total Sub-element 3	SB 5X	473	96	40	NA	13.8	99.0%[1]
Total Sub-element 4	SB 5X	323	41	3	NA	0.39	87.4%[2]
Totals – DR Program Element		**2,128**	**713**	**261**	**NA**	**216.2**	**91.5%[3]**

[1] This estimated realization rate for Sub-element 3 is based on the realization rate that was calculated for the ICF program.

[2] This estimate is based on the results of realization rate calculations for the PowerChoice and PowerStat programs only.

[3] Total realization rate is calculated based on reported and verified demand savings for all Sub-element 1 and 2 programs, ICF only for Sub-element 3, and for SMUD PowerChoice and PowerStat only for Sub-element 4.

The Demand Responsive Program Sub-elements 1 and 2 have achieved a combined realization rate of 90% percent, where total verified demand savings of 202.0 MW represents 92.6 percent of the total contracted savings and 94.4 percent of the combined legislative goals (214 MW) for AB 970 and SB 5X.

As noted earlier, reported demand savings estimates were not available for the Webgen and Energyn programs. This complicated the calculations of realization rates for both Sub-elements 3 and 4. Therefore, in order to estimate realization rates for Sub-elements 3 and 4 (at the entire sub-element level), the following assumptions were made:

- For Sub-element 3, it was assumed that the realization rate for the ICF program (99%) was representative for the entire sub-element. This reflects that the ICF program accounts for over 80% of total verified demand savings for Sub-element 3. It is assumed that the

realization rate calculated for the ICF program is representative for the sub-element as a whole.

- For Sub-element 4, it was assumed that the combined weighted realization rate for the two SMUD programs (87%) was representative for the entire sub-element. This reflects that the PowerStat and PowerChoice programs account for over 60% of total verified savings for Sub-element 4.

Heat-Sensitive versus Non-Heat-Sensitive Facilities

Table 3-14, below, shows 793 program participants drawn from the SB 5X program population categorized into two sub-groupings by load type. Groups labeled "HVAC only" and "HVAC and Lighting" are characterized as heat-sensitive facilities.

Table 3-14: Comparison of SB 5X Facility Load Types

Facility load type	Sites	Average facility demand savings (kW)	Average realization rate (%)
HVAC only	401	6.93	NA*
HVAC and lighting	392	29.11	99.0%
Total	**793**		

*For Sub-element 3, Webgen was HVAC only, while ICF was HVAC and lighting. For Sub-element 4, SMUD PowerStat, SMUD PowerChoice, and Energyn were HVAC only. Webgen had no reported demand savings, preventing calculation of a realization rate.

The "HVAC and lighting" classification represents the ICF portion of Sub-element 3 only, and had 392 sites represented, with an average facility demand savings of 29.1 kW. The "HVAC only" classification represents the Webgen portion of Sub-element 3 and all participants in Sub-element 4, which were residential households. The "HVAC only" classification had 401 sites, with an average facility demand savings of 6.93 kW. Research Objectives 8 and 9 for Sub-element 3 deal with facility load types, but verified curtailment savings cannot be ascertained since there were no curtailments in 2003. Table 3-14 provides a partial answer to these two research objectives, in the form of reported demand savings by facility type.

3.5.3 Sub-element 3 Results and Research Objectives

Table 3-15 shows contracted, reported, and verified demand savings, along with their associated realization rates, for each of the Sub-element 3 contractors for the SB 5X programs. As of September 30, 2003, the total verified program demand savings potential of Sub-element 3 was 13.8 MW. Total verified demand savings account for 34.5 percent of the total contracted savings. The overall realization rate for the Sub-element 3 contractors is 105.6 percent, leading to an overall realization rate of 91.7 percent for the SB 5X demand responsive program as a whole.

Table 3-15: Demand Savings and Realization Rates for Sub-element 3 by Contractor, as of September 30, 2003

Contractor	Customer sites recruited	Customer sites conducting pilot tests	Contracted demand savings (MW)	Reported demand savings (MW)	Verified demand savings (MW)	Realization rate
ICF Consulting	392	392	30	11.5	11.4	99.0%
Webgen	81	81	10	NA*	2.4	NA[1]
Totals	**473**	**473**	**40**	**NA**	**13.8**	**99.0%[2]**

[1] Webgen used the DR tool and therefore had no reported demand savings, preventing a realization rate calculation.

[2] As noted earlier, this estimate is based on the realization rate that was calculated for the ICF program.

The realization rate for ICF is 99%. Nexant's total verified demand savings of 13.8 MW represents 34.5 percent of the total 40 MW contracted demand savings for Sub-element 3.

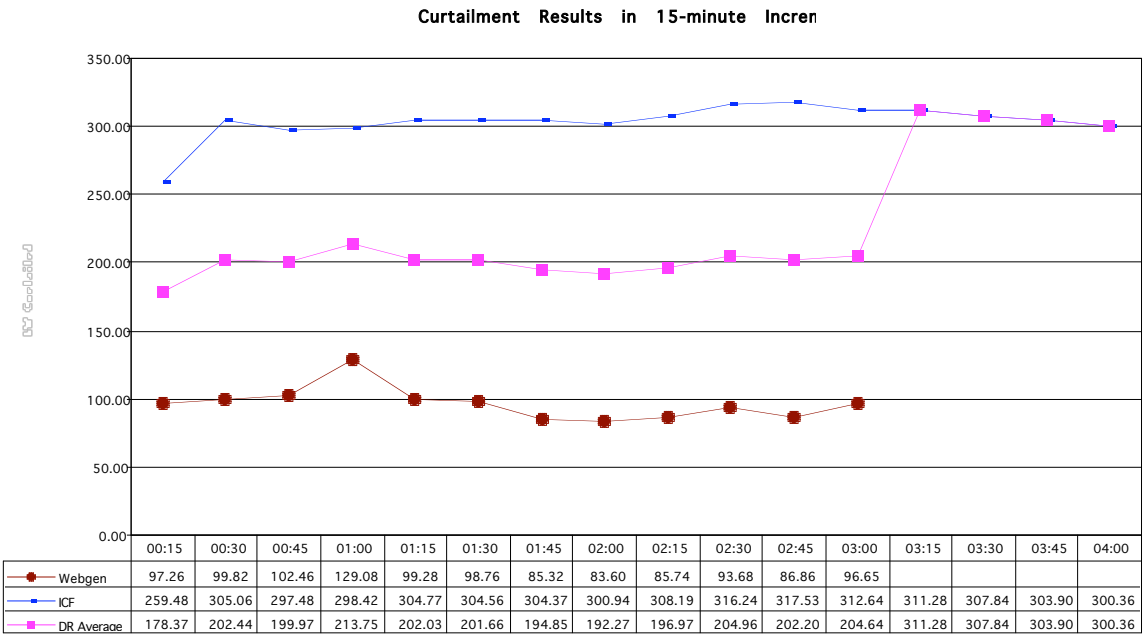
The verified demand savings for ICF Consulting are almost exactly the same as the reported savings. For Webgen, however, reported demand savings were not available due to the method Webgen used to calculate their baseline values. Webgen used temperature-adjusted baseline methods for calculating demand savings for all of their sites, and it is expected that this method varied from Nexant's method. It is also possible that Webgen used different sets of days for their baseline calculations.

Research Objectives 1, 2, and 3 for Sub-element 3 have been answered above. Research Objectives 4, 5, 6, 8, 9, 10, and 12 are dependent on curtailment activities. As there were no curtailments during 2003, these research objectives cannot be addressed. Research Objectives 8 and 9 were discussed briefly in the preceding Section 3.5.2. The remaining research objectives, 7, 11, and 13-16 are answered in the remainder of this section.

Stability of Curtailed Loads Across Pilot Test Period (Research Objective 7)

Research Objective 7 examines the stability and reliability of the aggregate curtailed loads across the four-hour pilot test period relative to capacity margins on the California power grid at large. Data was taken from curtailed loads observed during pilot tests aggregated across 98 sampled program participants from Sub-element 3. Figure 3-5 shows the fluctuations, in 15-minute intervals, of aggregate curtailed loads for this population.

Figure 3-5: Variation in Demand Savings Across Four-Hour Pilot Test Period



	00:15	00:30	00:45	01:00	01:15	01:30	01:45	02:00	02:15	02:30	02:45	03:00	03:15	03:30	03:45	04:00
Webgen	97.26	99.82	102.46	129.08	99.28	98.76	85.32	83.60	85.74	93.68	86.86	96.65				
ICF	259.48	305.06	297.48	298.42	304.77	304.56	304.37	300.94	308.19	316.24	317.53	312.64	311.28	307.84	303.90	300.36
DR Average	178.37	202.44	199.97	213.75	202.03	201.66	194.85	192.27	196.97	204.96	202.20	204.64	311.28	307.84	303.90	300.36

In Figure 3-5, it can be seen that the shape of curtailed loads over the four-hour curtailment period does show some fluctuation. Most of the sampled facilities' curtailed loads include HVAC systems, where the level of curtailment is partially influenced by outdoor temperatures; these are referred to as heat-sensitive or temperature-dependant loads. Nearly all of the sites represented in this analysis performed pilot tests during the summer months, with pilot tests occurring before September 30, 2003.

Distribution and Demand Response of Building Types (Research Objective 11)

The purpose of this analysis is to examine the distribution of program participants by building types, and to evaluate the demand response potential of the most common building types represented in the program populations. Table 3-16 shows the distribution of building types for the Sub-element 3 population.

Table 3-16: Distribution of Major Building Types for Sub-element 3

Building type	Number of buildings	Average realization rate
Office Buildings	79	103%
Retail	367	99%
Hotel & Lodging	1	NA
Grocery	0	NA
Restaurant	22	100%
Industrial & Mining	0	NA
Water / Wastewater	0	NA
Hospital & Healthcare	0	NA
Schools & Colleges	1	100%
Warehouse	1	96%
Other Public Institutional	0	NA
Miscellaneous / Unknown*	2	NA*
Total	**473**	

*Miscellaneous buildings did not have accurate realization rates.

Distribution and Demand Response of Facility Load Control Types (Research Objectives 13 and 14)

The purpose of this analysis is to examine the distribution of program participants by load control systems used to operate emergency load curtailments, and to evaluate the effectiveness of different load types by examining realization rates within each category.

A brief description of load control types is necessary in advance of the discussion of results. Manual load control requires one or more onsite personnel to physically shut down curtailed end uses without automated control systems being operated at a central location within a facility or at a remote location. Direct Load Control technologies are characterized as highly automated systems where offsite personnel remotely signal pre-programmed curtailment sequences of designated end-uses in one or more facilities without the involvement of personnel at the facility. Onsite types of automated load control systems also include automated Energy Management Systems (EMS) and manual EMS systems. Automated EMS systems are typically pre-programmed curtailment sequences initiated by personnel at the facility who do not actively manage curtailed loads after the curtailment is initiated. Manual EMS systems do require the active management of curtailed loads by onsite personnel for the duration of the curtailment. Both automated and manual EMS systems are typically operated from a single control console or location at the participating facility.

Table 3-17, below, shows the distribution and average realization rates of the different load control types.

Table 3-17: Distribution and Realization Rates by Facility Load Control Types

Load control type	Sub-element 3	
	No. of sites	Average realization rate*
Automated	0	NA
Direct Load Control	470	99.7%
Automated EMS	2	97.8%
Manual EMS	0	NA
Manual	1	99.0%

* Average realization rates are calculated from a sample of the total number of sites within category; sample was determined by sites where meter data was available.

Cost Effectiveness and Persistence (Research Objectives 15 and 16)

Results for Research Objective 15, Cost Effectiveness of Sub-element 3, are presented in Section 3.6 of this document. The Sub-element 3 cost effectiveness is $484/kW, which is significantly higher (less cost effective) than the cost effectiveness of Sub-elements 1 and 2. This is discussed in detail in Section 3.6.1.

Research Objective 16 is concerned with the persistence of load reductions. Analyses related to this research objective were not completed in large part due to the following two reasons: 1) Sub-element 3 contractors had not fully completed the testing of their entire population for year 2002 in order to allow a persistence analysis to be conducted; 2) With the exception of PowerStat, Sub-element 4 programs did not start-up until 2003 and were not completed before the end of summer 2003. To conduct a persistence analysis of these programs, MV&E activities would have had to run through the summer 2005 peak demand period, which is beyond the scope of this report.

3.5.4 Sub-element 4 Results and Research Objectives

Table 3-18 provides contracted, reported, and verified demand savings values, along with their associated realization rates, for each of the Sub-element 4 grantees for the SB 5X program.

Table 3-18: Demand Savings and Realization Rates for Sub-element 4 by Contractor, as of September 30, 2003

Contractor	Customer sites recruited	Sites conducting pilot tests	Contracted demand savings (MW)	Reported demand savings (MW)	Verified demand savings (MW)	Realization rate
SMUD PowerStat	178	178	1.0[1]	0.241	0.199	82.7 %
SMUD PowerChoice	73	73	1.0[1]	0.032	0.039	123.0%
Energyn	72	69	1.0	NA[2]	0.153	NA[2]
Totals	**323**	**320**	**3.0**	**NA[3]**	**0.391**	**87.4%[4]**

[1] SMUD total contracted demand savings are 2 MW (individual program contracted demand savings not specified).
[2] Energyn did not have reported demand savings, so no realization rate can be calculated.
[3] Since Energyn did not have reported demand savings, a total reported demand savings value is not meaningful.
[4] The total realization rate is based on SMUD PowerChoice and PowerStat reported and verified demand savings.

As mentioned before, the Sub-element 4 realization rate (87%) is based on reported and verified demand savings that were recorded for the PowerStat and PowerChoice programs. The Energyn program was excluded from realization rate calculations, since no reported demand savings data for the program was received. The decision to utilize solely PowerStat and PowerChoice data for this calculation reflects that these two programs account for over 60% of total Sub-element 4 verified demand savings.

The aggregate verified demand savings of 0.39 MW for Sub-element 4 represents 13 percent of the total contracted demand savings of 3 MW. Lower verified demand savings are explained by technical difficulties with the receipt of curtailment signals that limited the demand response potential in many facilities.

Tier 1 Research Objectives

In this section, results of the Sub-element 4 Tier 1 research objectives are updated from the 2002 Report, based on all data received through September 30, 2003. Research Objective 1 is to define and evaluate peak demand savings achieved for each residential program. Table 3-25, above, summarizes this information. As of September 30, 2003, the verified Sub-element 4 peak-demand savings is 0.39 MW.

Research Objective 2 is to determine the cost effectiveness of the program. Nexant's calculations indicate the Sub-element 4 cost effectiveness is $2958/kW, which is far higher than any other sub-element in DR. The cost is largely due to the fact that a residential DR program is an innovative and mostly untested idea. As experience is gained in implementing residential DR programs, costs should decrease; however, Nexant expects residential DR programs to remain costly compared to non-residential DR programs due to the fact that residential loads—and thus potential curtailment capacities—are small compared to those at commercial and industrial facilities. Additional information about cost effectiveness is given in Section 3.6 of this Chapter.

Tier 2 Research Objectives

The Tier 2 and Tier 3 research objectives presented in this document pertain only to information received in 2003, to remain consistent with the focus of this 2003 Update Report. Additional information on these research objectives can be gleaned from the 2002 report, based on information received during 2002. In particular, several curtailments took place in 2002, and analyses based on these curtailments are presented in the 2002 Report. To summarize the 2002 Report results, average 2002 curtailment demand savings per meter for seven cycling events varied from 0.69 kW to 1.57 kW, with an average demand savings of 1.12 kW per residence.

Research Objective 3 for Sub-element 4 attempts to compare measured peak demand savings documented during pilot tests with peak demand savings from subsequent curtailment events. As there were no curtailment events during 2003, this objective cannot be completed.

Research Objective 4 focuses on any variations in demand savings across the peak demand period of a curtailment period. This objective cannot be answered for 2003, as there were no curtailment events during this period.

Research Objective 5 asks if there were impacts on residential occupant comfort during curtailments. Again, since there were no curtailment events in 2003, this question cannot be answered.

Research Objective 6, which seeks to identify any significant differences in peak demand savings based on ambient air temperatures, cannot be evaluated. This objective can only be met for program participants responding to critical curtailment signals, of which there were none, because no practical method is available that measures the effects of temperature on demand savings from TOU rates.

Research Objective 7 focuses on the analysis of the characteristics of relevant household demographics, residential building types, and climatic characteristics of the program participant population. To address this research objective, interviews were conducted with a sample of representative participants from each of the Sub-element 4 programs as part of the audit process. Based on the audit results, the participant populations of the different Sub-element 4 programs share the following common characteristics:

- Program participants are well-educated, with over 70% of sample respondents having earned a college level degree or higher;
- The majority of participants have a relatively high level of income (i.e., annual income above $75,000); and
- Participants live in relatively large-size gas heated homes.

Table 3-19 provides an overview of selected results from Sub-element 4 participant audits.

Table 3-19: Sub-element 4 Sample Population Characteristics

	PowerStat (n=13)	PowerChoice (n=11)	Energyn (n=9)
House/Dwelling Characteristics			
Avg. Size (sq. ft.)	1,710	2,461	2,371
Age of House (years)	25	47	17
Avg. No. of Stories	1.2	1.5	1.6
Education Level (% of sample)			
Graduate Degree	21%	42%	44%
College Degree	50%	42%	33%
High School or below	29%	16%	0%
Did not respond	0%	0%	23%
Household Income (% of sample)			
>$125 k	No data	25%	23%
>$100 k	collected	17%	11%
>$75 k		25%	33%
$75k or less		17%	0%
Did not respond		16%	33%

Given the importance of climate related issues in evaluating customer responses to program events, a review of the climate characteristics for each of the Sub-element 4 programs was conducted to meet the requirements of Research Objective 7. Specifically, Sub-element 4 programs were segmented into climate zones by utilizing the participating sample project site's zip code and the pre-existing California Energy Commission Demand Forecasting Climate Zones.[17] The majority of the projects are in Climate Zones 4, 5, and 6. The average July temperature for the zones covered as part of Sub-element 4 programs are listed in Table 3-20.

Table 3-20 Average July Temperatures over a 20-year Period

Program	Climate Zone	Average	Max	Min
PowerStat & PowerChoice	6	75.2	93	58
Energyn	1	56.3	60	52
Energyn	4	72	86	57
Energyn	5	58.5	64	53
Energyn	6	75.2	93	58

Source: California Solar Data Manual, CEC. 1987

PowerStat & PowerChoice: As listed in Table 3-20, all sample projects in these SMUD programs are in Climate Zone 6 (i.e., Sacramento weather data). Sacramento is a mild weather climate with an abundance of sunshine. Cloudless skies prevail during the summer and largely in spring and autumn. The summers are remarkably dry, with warm days and pleasant nights.

[17] The number of actual weather stations in a given forecast area limits the climate zones and makes the boundaries approximate. Depending on local features (i.e., trees, fog, lakes, mountains) a microclimate might exist for an individual site that affects its energy consumption compared to another similar site in the same climate zone.

Energyn: The majority of projects for the Energyn program were located in Climate Zones 4 and 5 (San Francisco and Fairfield, respectively). The Pacific Ocean fog being drawn into the warmer Central Valley cools San Francisco in the summertime. This reduces the cooling requirement during peak demand times. For Fairfield, temperatures are warmer and the air is dryer, so more cooling is needed.

Tier 3 Research Objectives

Sub-element 4 Research Objective 8 is to determine the reasons and the extent to which customers chose to exercise overrides of automated systems during curtailment events in 2003. This objective cannot be evaluated since there were no curtailment events in 2003.

Research Objective 9 attempts to explain any differences in demand savings from curtailment events involving price with those involving emergency signals. As there were no curtailment events in 2003, this objective is impossible to evaluate. Even if curtailment events had taken place, this objective would be difficult to differentiate, as the SMUD programs have a set of criteria for sending critical curtailment signals that combine price and capacity constraints.

3.6 PROGRAM ELEMENT COST EFFECTIVENESS

In order to evaluate the cost effectiveness of the DR program element, Nexant calculated the simple cost, in dollars-per-kilowatt of curtailable load ($/kW), for each program administrator. No annualization of project costs and demand savings were applied because the DR program is structured such that program administrators are compensated for securing demand savings potential. They are encouraged, but not obligated, to demonstrate this savings over several years. Pilot tests, conducted in the initial year of program implementation, were the only way the demand savings potential was measured to determine administrators' compensation.

Cost effectiveness is calculated by dividing the total dollar amount invoiced to the Energy Commission per administrator by the Nexant verified demand savings resulting in a $/kW figure. The dollar amounts invoiced and the verified demand savings by administrator are then aggregated to a sub-element level, and the cost effectiveness at the sub-element level is then determined. Cost effectiveness results are presented by program sub-element, and for the program element as a whole.

The four sub-elements had a large variance in the cost effectiveness performance of the programs. Table 3-21 shows the cost effectiveness for Sub-elements 1 through 4 ranges from $80/kW to $2,958/kW.

Table 3-21: Cost Effectiveness by Sub-element

Sub-element	AB 970 ($/kW)	SB 5X ($/kW)	Totals by program funding ($/kW)
Sub-element 1	72	88	80
Sub-element 2	191	246	233
Sub-element 3	NA*	484	484
Sub-element 4	NA*	2,958	2,958

*AB970 did not fund SE3 & SE4.

AB 970 and SB 5X had a combined budget of $44.3 million and a legislated demand savings goal of 214 MW. Nexant used these numbers to establish a program cost effectiveness target of $209/kW[18]. The verified projected cost effectiveness for Sub-element 1 is $80/kW, which is less than half the cost effectiveness target of $209/kW. The Sub-element 2 cost effectiveness of $233/kW falls in between a national benchmarking survey of DR programs[19] where self-reported DR program averages were $487/kW in 2001 and $85/kW for 2002. Sub-element 3 had a cost effectiveness of $484/kW, representing a significant increase between Sub-element 1 and 2. Meanwhile, Sub-element 4 had a cost effectiveness of $2,958/kW, demonstrating the challenges of implementing a demand responsive program at the residential level.

3.6.1 Cost Effectiveness of Sub-element 3

The contracts in Sub-element 3 were awarded based on a cost effectiveness of $250/kW. If the sub-element goal of 40 MW was attained, the cost effectiveness would meet this target, as shown in Table 3-22.

Table 3-22: Cost Effectiveness Results for Sub-element 3 Contractors

Contractor	Contract award (Millions)	Expected cost effectiveness ($/kW)	Total invoiced payments (Millions)	Verifed demand savings (MW)	Verified cost effectiveness ($/kW)
Webgen	$2.5	$250	$0.831	2.39	$348
ICF Consulting	$7.5	$250	$5.849	11.4	$512
Totals	**$10.0**	**$250**	**$6.680**	**13.8**	**$484**

Sub-element 3 had verified demand savings of 13.8 MW, which was 66% lower than the sub-element goal of 40 MW of demand savings. Webgen had a target of 10 MW of demand savings, while ICF had a target of 30 MW of demand savings, resulting in Webgen meeting 24% of its contracted goal and ICF meeting 38% of its contracted goal. When measured by verified cost effectiveness, Webgen had a cost effectiveness of $348/kW, while ICF had a higher cost effectiveness of $512/kW.

3.6.2 Cost Effectiveness of Sub-element 4

The cost effectiveness for Sub-element 4 programs is shown in Table 3-23. The Energyn and SMUD pilot programs had cost effectiveness results of $2,830/kW and $3,040/kW, respectively. Sub-element 4 had a goal of producing 3 MW of demand savings, with SMUD representing 2 MW and Energyn representing 1 MW of demand savings. SMUD achieved 12% of its target, and Energyn achieved 15% of its target.

[18] This figure will be used as a comparison to actual results achieved.

[19] EEI/PLMA Demand Response Benchmarking Survey as reported in a presentation on March 27, 2003 at the CBI DR Conference, Washington, DC.

Table 3-23: Cost Effectiveness Results for Sub-element 4 Contractors

Contractor	Contract award (Millions)	Expected cost effectiveness ($/kW)	Total invoiced payments (Millions)	Verifed demand savings (MW)	Verified cost effectiveness ($/kW)
SMUD	$1.142	$547	$0.726	0.239	$3,040
Energyn	$0.5	$547	$0.432	0.153	$2,830
Totals	**$1.642**	**$547**	**$1.158**	**0.391**	**$2,958**

The expected cost effectiveness, based on a contract award of $1.642 million and a demand savings of 3 MW, is $547/kW. The expected cost effectiveness for the Sub-element 4 programs is expected to be high, since these are pilot programs. If the program succeeds and matures, these costs will go down due to an increase in economies of scale and improvements in levels of efficiency. The total contract awards and demand savings for Sub-element 4 are a small proportion of the DR program element overall, so the lower program savings and cost effectiveness results do not impact the program element significantly.

3.7 ADMINISTRATOR AND PARTICIPANT AUDITS

This section summarizes the results of administrator and participant audits of Sub-element 3 and 4 programs that were conducted by Nexant to assess key qualitative aspects of individual program performance that extend beyond typical analyses of reported demand savings. All audit results focus on the 2003 summer peak demand period with the exception of the PowerStat program that was completed in 2002. Audit results were compiled based on feedback from program administrator and participant responses to a standardized set of survey questions. Although minor adjustments were made to the questionnaires used for each program, a common template was applied in order to facilitate the comparison of audit results across all of the various peak load reduction programs. As outlined below in Table 3-24, Nexant was contracted to perform administrative audits on Sub-element 3 participants only, while program participant audits were carried out for all Sub-element 3 and 4 participants.[20]

[20] Nexant attempted to interview representatives for BofA as part of the assessment of the WebGen program. However, after several attempts to collect this data, no response was received.

Table 3-24 Coverage of Participant and Administrator Audits

	Program participant audits	Program administrator audits
Sub-element 3		
ICF	✓	✓
Webgen*		✓
Sub-element 4		
PowerStat	✓	
PowerChoice	✓	
Energyn	✓	

*No responses were received following several attempts to interview WebGen participants.

Common to all of the audits was use of a five-point evaluation scale for questions that were not open-ended. The five-point scale was used to gauge positive and negative responses surrounding a neutral response. In the case of administrator audits, the five-point scale was also used by Nexant to rate their observations of administrators' competencies. Listed below is an overview of the structure and main components of the administrator and participant audits.

- Administrator audits were conducted with Sub-element 3 contractors. Nine questions were used to address program marketing, recruitment, participation, equipment, and services-related aspects. Other questions addressed processes used for project verification, record keeping, and pre- and post-evaluations of measures. Administrators were also asked to produce project records and invoices for their selected participants.
- Participant audits consisted of 18 open-ended questions covering topics such as program notification, involvement in similar programs, level of satisfaction in different areas of the program administration and project implementation. For 10 of the 18 questions, participants provided numeric five-scale ratings to evaluate their satisfaction with key program elements. For Sub-element 3 participants, supplemental questions were asked to corroborate administrator responses to similar questions.

Performing administrator and participant audits enabled Nexant to compile information necessary to address Sub-element 3 and 4 MV&E research objectives. The remainder of this section presents the key results of administrator and participant audits.

3.7.1 Administrative Audits

Nexant conducted administrative audits for the Sub-element 3 contract administrators, ICF Consulting and Webgen, at the end of July 2003. These audits measured and recorded the effectiveness of each program administrator as evaluated by the following criteria: (1) level of success in participant recruitment and providing participant support services; (2) extent to which project equipment was ordered, delivered, and installed on time; (3) on-time pilot testing, monitoring, and reporting of participant activity; and (4) level of contractual compliance and appropriate spending and allocation of Energy Commission funds.

All administrative audits were conducted through a telephone or in-person questionnaire with the lead administrator. Nexant also requested a sample of each administrator's program files corresponding to their respective program participants selected for program participant audits, as described further in this section. This was done to observe and confirm the viability of paper record-keeping systems which contractors used to justify payments on completed projects.

Appendix B contains a full copy of the questionnaire that was utilized to perform administrative audits for Sub-element 3. In answering many of the questions, administrators deferred to information in their interim or final project reports. In these instances, Nexant conducted report reviews in order to complete answers to the audit questions. Other questions included a standardized five-point scale for rating an administrator's quality of project documentation and standards of program compliance (as set forth by the Energy Commission). To provide these ratings, project documentation of four to seven administrator's customers were requested for review at administrator's offices by Nexant to gauge the effectiveness of the administrator's project documentation.[21] A rating of five on a five-point scale represented full record retention, whereas a one represented a complete lack of documentation. Listed below is a summary of key results from the administrative audits on the following areas:

- Marketing and customer recruitment;
- Customer services and training;
- Project evaluation and verification of pilot test demand savings; and
- Program tracking and reporting.

Marketing and Customer Recruitment

Administrative audits included open-ended questions on marketing and customer recruitment methods. Table 3-25, shown below, lists the different marketing and recruitment techniques that were utilized by ICF and Webgen to promote their respective Sub-element 3 programs.

Table 3-25: Sub-element 3 Administrator Recruiting and Marketing Methods

	ICF	Webgen
Direct mail campaigns (e.g., brochures and emails)	✓	
Website promotions	✓	
Magazine, Newspaper ads		✓
Software-based marketing tools	✓	
Discussions with utility account representatives	✓	
Meetings with equipment vendors	✓	
Discussions with building managers and engineering staff		✓
Word of mouth from existing customers		✓

[21] Administrators were asked to present project invoices, equipment orders, and other documentation for customers that were selected for participant audits. If administrators were able to provide project documentation, Nexant reviewed the documents and rated the administrator on the thoroughness of project documentation.

Although there was no overlap in terms of the specific marketing methods that were utilized by the contractors, both ICF and Webgen did conduct direct meetings with key stakeholder groups, such as equipment vendors, utility representatives, facility owners, and building managers. In addition, ICF relied more heavily on the use of the internet- and software-based marketing tools, while Webgen utilized more traditional methods such as advertisements in trade journals

Customer Services and Training

Each of the Sub-element 3 contractors offered a range of services to support customer participation in their program. This included conducting training courses and help-desk services. Listed below is a summary of key services that were provided to customers:

- Provision of online training (Webgen);
- Set-up of a 1-800 help-desk (Webgen);
- Training to customers/assistance with program applications (ICF and Webgen);
- Web-site description and documents on financial incentives (ICF);
- Direct assistance to customers (ICF and Webgen);
- Due diligence analysis for customers on potential vendors (ICF); and
- Assistance in developing curtailment plans (ICF).

Project Evaluation and Verification of Pilot Test Demand Savings

A series of project evaluation and verification procedures were employed by ICF and Webgen to facilitate the realization of demand savings from Sub-element 3 programs. Listed below is an overview of procedures that were reported by contractor representatives.

Webgen: First, an evaluation was conducted of a customer's bill (kWh and kW analysis). This was completed for both facilities with an individual meter as well as for aggregated sites. Analyses were completed using the capabilities of the IUE systems, including tariff modules, baseline data analysis, weather adjustments, and occupancy adjustments. Second, pilot test analyses were completed. Data for the previous 10 days (weather adjusted) was exported per the Nexant evaluation method (DR tool). Verification of reported results was then conducted. The results were then exported for CEC/Nexant M&V analysis.

ICF: Evaluation procedures focused on two main areas: customer/project applications and project testing. For customer/project applications, the following steps were conducted: 1) targeting of customers, 2) receipt of applications on a first come, first serve basis, and 3) application review and approval (internal ICF review sent to Energy Commission for final approval). For pilot testing, the following steps were followed: 1) collection of data from customers and vendors, and 2) verification of pilot tests by ICF staff, including taking photos of lighting systems, tracking indoor/outdoor temperatures, and assessing occupancy comfort.

Program Tracking and Reporting

ICF and Webgen provided monthly program reports as required to the Energy Commission contract managers. Nexant was able to obtain requested monthly and final program reports when requested from either the Energy Commission contract managers or the program administrators themselves. The following summarizes each administrator's process for conducting ongoing project tracking activities to support their monthly and final reports.

- ICF conducted internal meetings and conference calls with Energy Commission staff, and progress was reported on a monthly basis until all projects were completed and tested. Monthly reports were sent to the Energy Commission, and regular contact was maintained with Nexant.
- Webgen developed monthly reports that were provided up to November 2003 (Phase I). The preparation of reports then resumed in June 2003. Invoices from Bank of America (BofA) were also used to monitor projects.

3.7.2 Participant Audits

Participant audits were performed by Nexant to evaluate the implementation and administrative experience of Sub-element 3 and 4 program participants. The purpose of the participant audits was to: (1) confirm the installation of demand responsive equipment, (2) confirm pilot test results, (3) evaluate program administrative experience, and (4) to obtain missing data through the use of supplemental questions. Participant audits were successfully conducted for all Sub-element 3 and 4 programs with the sole exception of the Webgen program.[22]

End-user facilities that were selected for participant audits were drawn from a random stratified sample. Stratification of the sample was performed by allocating sample sites in proportion to the total number of sites associated with either contractors or grantees. Participant audits were conducted as part of phone interviews with representatives from the sample facilities.

The remainder of this section summarizes key results of Sub-element 3 and 4 participant audits. Sub-element 3 participant questionnaires included a series of 15 questions, while the Sub-element 4 questionnaire included 17 questions. Although a common (standardized) set of questions was utilized, questionnaires for each individual program were slightly customized in order to take into account the needs of different end-user groups and the use of different technologies. A copy of the questionnaire for each program is presented in the Appendix.

Sub-element 3 Results

Participant audits for Sub-element 3 were conducted for the ICF program only. Table 3-26 lists responses to numeric (rating) questions that were asked to four program participants representing seven facilities. Specifically, the minimum, average, and maximum value of responses to selected questions are provided. In general, the results indicate that the sample participants had a high level of satisfaction with the program—with above average ratings being given for program

[22] As noted earlier, after several attempts to contact Webgen participants, no responses were received.

performance, communication procedures, reporting requirements, and invoice and billing process.

Table 3-26 Sub-element 3 Participant Audit Results

Question	Min.	Avg.	Max.
No. 4: Rate the overall quality of the communication process with your administrator (5=complete/thorough; 3=sufficient/adequate; 1=absent/wholly inadequate)	3	4.5	5
No. 6: Rate the reasonableness of the reporting requirements you were required to fulfill (5=Very reasonable/easy; 3=somewhat reasonable/some significant challenges; 1=completely unreasonable)	3	4.1	5
No. 11: Likelihood that you would have performed load-reducing actions without the program (5=without question; 3 =yes, but under different circumstances; 1=under no circumstances)	1	1.3	2
No. 12: From your experience with this program, would you participate in a similar program? (5=without question; 3 =yes, but under different circumstances; 1=under no circumstances)	3	4.5	5
Questions 12 to 16 asked participants to use a five point scale as follows: 5=Outstanding; 3=Average; 1=Unacceptable			
No. 13: How was your experience with the program on the whole?	4	4.25	5
No. 14: How was your administrator?	3	4.5	5
No. 15: How was the program application process?	2	3.6	5
No. 16: How were the invoicing, billing, and payments process?	4	4	4
No. 17:How was the verification process?	3	4	5
No. 18: How was the implementation timeline that you were on?	3	3.8	5

In addition, ICF customer audit results illustrate the importance of the program in generating load reductions. Specifically, the average rating of 1.3 to question No. 11 indicates that few customers would have performed load reduction actions absent their participation in the program. Additional audit results that provide insight to the program's performance include that:

- Respondents first heard about the program through either vendors or consulting firms;
- The primary reason for participating in the program was to save money. However, respondents also noted that they wanted to help the state conserve energy;
- Communications between ICF and program participants was primarily through emails, with some phone calls to follow-up on specific items; and
- All respondents stated that they believed that they achieved their peak demand savings goals.

Sub-element 4 Results

As noted above, participant audits were completed for all of the Sub-element 4 programs. However, it is important to note that participants did not always answer all questions because they either felt the questions were not relevant to their project or they did not recall enough detail to feel confident about a response. Given the use of some customized questions, the numbering

of questions is slightly different for each program. Sub-element 4 audits included some questions that asked end-users to respond with a numerical rating, where 1 is "*Unacceptable"* and 5 is "*Outstanding.*" Answers to these numerical rating questions, as well as other selected questions, are detailed below for the Energyn, PowerChoice, and PowerStat programs.

Energyn

Nine Energyn program customers were sampled as part of the Sub-element 4 participant audit process. Overall, respondents had a positive experience participating in the program, as exhibited by the 4.0 average ratings to questions No. 13 and 16. Additional key results from Energyn participant audits are summarized below:

Question 1: How did you find out about the program? How long after you first learned of the program did you decide to become a program participant?

Response: Four participants enrolled after a phone solicitation, 4 participants enrolled at a farmers market, and 1 participant enrolled after an email solicitation.

Question 2: What were your reasons for participating in this program?

Response: Five participants enrolled due to interest in reducing energy costs, and 4 participants enrolled due to interest in energy conservation and energy efficiency.

Question 6: On scale of 1 to 5, evaluate the quality of the communication process with Energyn or other program personnel.
Response: Avg. = 3.94, Max. = 5, Min. = 1

Question 12: On a scale of 1 to 5, what is the likelihood that you would have carried out similar energy saving measures without the Energyn program?
Response: Avg. = 3.22, Max. = 5, Min. = 2

Question 13: On a scale of 1 to 5, rate your experience with the Energyn Program.
Response: Avg. = 4.0, Max. = 5, Min. = 3

Question 14: On a scale of 1 to 5, rate the overall quality of customer service provided by the Energyn or other project personnel that you had contact with.
Response: Avg. = 4.44, Max. = 5, Min. = 3

Question 15: On a scale of 1 to 5, rate the quality of your experience with technical aspects of the Ipower equipment and Energyn website?
Response: Avg. = 3.75, Max. = 5, Min. = 2

Question 16: Based on your experience with the Energyn program, rate your likelihood of repeating this program experience or participating in a similar program (scale of 1-5 scale)?
Response: Avg. = 4.7, Max. = 5, Min. = 4

PowerChoice

A total of 12 PowerChoice program customers were interviewed as part of Sub-element 4 participant audits. The sample customers reported a high level of satisfaction with technical aspects of the program as exhibited by their responses (average ratings > 4) to Questions 4 and 5. Further, PowerChoice participants expressed a strong sentiment that, given the opportunity, they would participate again in a similar program. Listed below is a summary of additional audit results that provide further insight into customer perceptions of the program.

Question 1: How did you find out about the PowerChoice Program?
Response: The majority of sample participants (10 out of 12 customers) enrolled after a SMUD solicitation. Other customers learned about the program through direct contact with a SMUD employee.

Question 2: During the program, did you override the thermostat?
Response: Six participants reported overriding their thermostats during curtailment periods, while 6 participants reported not touching their thermostat during curtailment periods.

Question 3: On scale of 1 to 5, evaluate the quality of the communication process with PowerChoice or other program personnel (with all 12 survey participants responding).
Response: Avg. = 4, Max. = 5, Min. = 2

Question 4: On a scale of 1 to 5, rate the quality of your overall experience with technical aspects of the PowerChoice website (with 5 survey participants responding).
Response: Avg. = 5, Max. = 5, Min. = 5

Question 5: On a scale of 1 to 5, rate the quality of your overall experience with technical aspects of the PowerChoice thermostat (with all 12 survey participants responding).
Response: Avg. = 4.1, Max. = 5, Min. = 2

Question 6: On a scale of 1 to 5, rate your overall experience with the PowerChoice Program on the whole (with all 12 survey participants responding).
Response: Avg. = 4.6, Max. = 5, Min. = 4

Question 7: On a scale of 1 to 5, rate the overall quality of customer service provided by the PowerChoice program (with 10 survey participants responding).
Response: Avg. = 4.4, Max. = 5, Min. = 3

Question 8: On a scale of 1 to 5, rate the quality of your overall experience with technical aspects of the PowerChoice program (with 5 survey participants responding).

Response: Avg. = 4, Max. = 5, Min. = 3

Question 9: Based on your experience with the PowerChoice program, rate your likelihood of repeating this program experience or participating in a similar program on a scale of 1 to 5 (with all 12 survey participants responding).

Response: Avg. = 4.4, Max. = 5, Min. = 4

PowerStat

Listed below is a summary of results from a sample of 14 PowerStat customers. Unlike the results for the Energyn and the PowerChoice program, audit results for PowerStat reflect the program performance during the summer peak demand period of 2002. Audit results highlight that most sample customers encountered initial difficulties with their thermostat. However, participants had an overall positive experience, as indicated by the average rating of 4.4 that was reported for Question 4.

Question 1: During the program, did you override your thermostat?

Response: Nine participants reported overriding their thermostats during curtailment periods, while 5 participants reported not touching their thermostat during curtailment periods.

Question 2: On a scale of 1 to 5, rate the quality of your overall experience with technical aspects of the PowerStat thermostat.

Response: Avg. = 3.8, Max. = 5, Min. = 1

Question 3: Did the PowerStat thermostat technology prove to be an obstacle in participating in the program?

Response: Six participants reported having problems with the PowerStat thermostat, of which 5 reported having SMUD fix the thermostat.

Question 4: On a scale of 1 to 5, rate your experience with the PowerStat Program on the whole.

Response: Avg. = 4.4, Max. = 5, Min. = 1

Question 5: Based on your experience with the PowerStat program, would you continue participation or recommend the program to others?

Response: The majority of respondents (11 of 14) reported yes, while only 3 reported no.

3.8 CONCLUSIONS

The Demand Responsive program element has been successful in achieving potential peak demand savings. The four sub-elements—with over 2,100 participants, including small, medium, and large commercial sites, as well as residential customers—have a combined verified demand savings of 216 MW. The DR program element overall realization rate is 91.5%, attesting to the success of the program design and implementation. However, the results presented in this report highlight some of the challenges associated with capturing demand savings from the type of small C&I and residential end-users that were targeted in Sub-element 3 and 4 programs. Demand responsive programs, such as those in Sub-elements 1 and 2, have traditionally focused on medium and large commercial and industrial facilities, which consume large amounts of energy. The small-sized Sub-element 3 and 4 participants use relatively less amounts of electricity per customer, although in aggregate they account for a substantial portion of demand usage. Listed below is a summary of key conclusions from MV&E analysis results for Sub-elements 3 and 4 during the summer peak demand period of 2003:

- **Participants motivated by dual desires to save money and conserve energy**
  Survey audit results for Sub-elements 3 and 4 reveal that saving money on energy bills was a major motivating factor in end-user decisions to participate in a given DR program. However, participants also stated that a desire to conserve energy and help avoid blackouts was also a key driver (e.g. almost half of the Energyn participants that were surveyed listed conserving energy as the top reason for participating in the program).
- **Marketing efforts for Sub-element 3 gained traction over time**
  The two Sub-element 3 programs were able to recruit 473 small commercial facilities to install demand responsive equipment capable of shedding 13.8 MW of load during an emergency curtailment. ICF was particularly successful at recruiting facilities to join in the program. During the 4th Quarter of 2003 (i.e., post the summer peak demand period evaluated in this report), ICF recruited an additional 645 customers—representing a 136% increase over total Sub-element 3 enrollment as of September 30, 2003.
- **$/kW costs for Sub-element 3 and 4 programs were higher than expected**
  The verified cost effectiveness results of all Sub-element 3 and 4 programs were well above the expected levels. For Sub-element 3, the verified cost effectiveness of $484/kW was almost double the $250/kW projected cost. For Sub-element 4, the $2,958/kW was five-fold greater than the projected $547/kW level. These results underscore the following: 1) Sub-element 3 and 4 programs were highly experimental with little or no track record in California; results indicating higher than projected costs are not entirely surprising; 2) initial cost projections underestimated the significant cost of marketing and implementing DR projects to residential customers and small C&I end-users; 3) early estimates of the demand savings (on a kW per participant basis) were also overly ambitious given the experimental nature of these programs; and 4) the realization of actual demand savings was more challenging than expected, reflecting the more uncertain nature of securing responses from smaller sized end-users.

- **Sub-element 3 and 4 program participants had positive experiences**
  Participant audit results illustrate that the sample customers had a high level of satisfaction with the program—above average ratings were given for program performance, communication procedures, reporting requirements, and the invoice and billing process.

APPENDIX A

DEMAND RESPONSIVE BUILDING PROGRAM ELEMENT MV&E PLAN, SUB-ELEMENT 4

DEMAND RESPONSIVE BUILDING PROGRAM ELEMENT MV&E PLAN, SUB-ELEMENT 4

Introduction

This document provides information about the Measurement, Verification and Evaluation (MV&E) of residential pilot programs within sub-element 4 of the SB 5X Demand Responsive (DR) building program. The MV&E objectives, along with the methodologies to address these objectives, are contained in this document. The objectives are:

- The verification of demand savings
- The characterization of the program population
- The influence of ambient air temperature and curtailment duration on demand savings
- Building occupant comfort issues and responses to automated curtailments

The MV&E methodology is based on a statistical sampling approach where specific methods for calculating demand savings are adapted and applied to the different programs in this sub-element. Implementation details and the mechanics of conducting the verification process are also provided along with reporting requirements.

Program Element Description

The CEC has allocated $2 million for sub-element 4, residential demand responsiveness, of which $1.642 million has been awarded to two program administrators implementing four different and separate residential pilot programs. These programs are expected to capture demand savings of 0.54 to 1.08 MW. A summary description of each program along with program acronyms used throughout the remainder of this report is provided in Table 1.

SMUD's total programs are expected to show demand savings of 0.75 to 1.50 kW per household. Energyn's single program is expecting 0.50 to 1.00 kW per household. In the four programs the expected number of participants multiplied by the expected range of per household demand savings equals the expected range of values for cumulative program demand savings as provided in Table 1.

Table 1. Residential Pilot Sub-element 4 Programs

Program Administrator	Program name	Expected no. of participants	Demand savings goal (MW)	Program description
Sacramento Municipal Utility District (SMUD)	Time-of-use (TOU) energy management system pilot - residential retrofits (TOUR)	200	0.15 - 0.30	▪ Automated control of central air conditioning (CAC), electric domestic hot water heaters and pool pumps by program participant ▪ Based on static and dynamic price and/or emergency signals ▪ Works on a tiered TOU rate structure

Program Administrator	Program name	Expected no. of participants	Demand savings goal (MW)	Program description
	TOU energy management system pilot—residential new construction (TOUN)	125	0.09 - 0.19	▪ Same as above but in new construction
	Radio controlled thermostat pilot (RCTP)	200	0.15 - 0.30	▪ Radio-signaled direct load control CAC program ▪ Customers select from three cycling options activated by SMUD signals.
Energyn	(EGYN)	290	0.15 - 0.29	▪ Customer controlled energy management systems ▪ Responds to CAISO emergency signals through Energyn
TOTAL		**815**	**0.54 - 1.08**	

The program objective is to install DR systems in a pilot or test group of new and existing, homes, testing homeowners' responses to one or more of the following types of curtailment signals to reduce peak loads:

- Signals by the SMUD according to internal criteria including wholesale price hikes, high temperatures and capacity constraints (TOUR, TOUN, RCTP)
- SMUD's TOU 3-tiered static rate block (TOUR, TOUN)
- Signals originating from the California Independent System Operator (CAISO) issued during Stage II and III emergencies

SMUD's Radio Controlled Thermostat Program (RCTP) is a direct load control program where curtailment signals are sent to activate automated curtailments of residential air-conditioning systems as described in number one above.

In addition to the three-tiered TOU rate blocks, SMUD may activate a fourth tier, designated as a "critical period" included in number one above. The critical period has the highest tariff in relation to the three fixed TOU blocks, and it is "dynamic" signal meaning that it may occur at any time. The three fixed tiers within SMUD's TOU programs are based on pre-set, "static"intervals during the day, included in number two, above.

The only established signal that Energyn's program participants will be responding to are those sent by Energyn in their response to the CAISO's Stage II and III emergencies.

For the purposes of this MV&E plan, there is a distinction between the two basic types of curtailment signals, in Table 2, below. Critical curtailment signals may be triggered at any time activating single events and are based on emergency price or system capacity conditions sent by the CAISO or SMUD. These are the only type of signals used in the EGYN and RCTP programs.

Table 2. Types of Program Curtailment Signals

Program	Curtailment Signal	Examples
TOUR, TOUN RCTP EGYN	Critical	SMUD direct load control signals SMUD 4th-tier TOU rate CAISO Stage II and III emergency alerts forwarded from Energyn.
TOUR, TOUN	Non-critical	Static price signals in SMUD's 3-tierTOU rate

Curtailment signals that are associated with daily time intervals are referred to as "non-critical". Within this sub-element, non-critical signals include only those associated with SMUD's two TOU programs. These TOU-rate blocks are static price signals, which cause participants to initiate the programming of home energy management systems to achieve daily demand savings during peak periods.

The identification of critical and non-critical curtailment signals is important because this MV&E plan uses two different analyses of curtailments methodologies according to the signal type. Unlike the other sub-elements, in sub-element 4 program administrators and program participants are not required to conduct pilot tests to demonstrate their ability to reduce peak demand. However, all SMUD TOU program participants are expected to respond to both critical and non-critical curtailment signals. SMUD RCTP and Energyn program participants are expected to respond only to the critical signals of their respective programs.

Program administrators are required to obtain all relevant information from program participants and then supply this data to Nexant. Nexant will coordinate with the program administrators on how to collect and evaluate the demand savings data according to the developed MV&E objectives discussed below.

MEASUREMENT, VERIFICATION AND EVALUATION (MV&E) PLAN

Objectives

The objectives of the MV&E plan are grouped into three CEC defined tiers and described below.

Tier 1

1. Define and evaluate the peak demand savings achieved for each of the four residential DR programs based on sampling techniques necessary to obtain a minimum 80/20 level of statistical accuracy.
2. Determine the cost-effectiveness of the program in dollars spent in this program per/ kW of demand savings and estimate a projected cost per kW for the post pilot test phase.

Tier 2

3. If pilot tests are conducted, provide comparisons between measured peak demand savings documented during pilot test and peak demand savings from subsequent curtailment events (price, static or dynamic signals) between these events.

4. Determine how levels of demand savings vary across the peak demand period or specified hours of a curtailment period if different than the peak demand period. Identify factors that explain any hourly variation in demand savings.
5. Did the operation of demand responsive systems during curtailment events impact residential occupant comfort?
6. Determine if there are significant differences in peak demand savings on high ambient air temperature days versus cooler days for each type of residential pilot program.
7. Characterize relevant household demographics, residential building types and climatic characteristics of the program participant population.

Tier 3

8. Determine the reasons and the extent to which customers chose to exercise overrides of automated systems during curtailment events.
9. Compare demand savings from curtailment events involving price and/or emergency signals and explain the differences.

All the objectives above apply to each of the four residential programs, with the following exceptions:

- Meeting objective 2 depends on whether pilot tests are conducted as a part of program implementation.
- Objective 6 can only be met for program participants responding to the critical curtailment signals because no practical method is available that measures the effects of temperature on demand savings from TOU rates.
- Objective 9 which compares responsiveness to curtailments involving price signals and emergency signals, may be difficult to differentiate as the SMUD programs have a set of criteria for sending critical curtailment signals that combine price and capacity constraints.

Assumptions

Because of the strong correlation between high ambient temperatures and peak summer loads, this study assumes the primary reasons for time-of-use price signals and emergency curtailments are to reduce system capacity demands caused by increased central air conditioner (CAC) use.

It is assumed that curtailment signals will occur on hot days, and program participants will control home AC systems as a primary means for providing demand savings. It is also assumed that participants in this program would not have implemented demand responsive systems in their homes had they not been induced to do so by program offerings.

Statistical analysis of free driver, free rider conditions are beyond the scope of this MV&E plan. Any anecdotal evidence of these phenomena may be discussed in the final year-end reporting. No identified double counting of demand savings by program participants will be included in the reported program results.

Nexant will assume that the demand savings reported are only the result of program participant responses to specific critical and non-critical curtailment signals, as specified in each program.

For the purpose of the baseline calculations, it is also assumed that all program administrators will be able to provide necessary 15-minute interval meter data for any conducted pilot tests and curtailment events.

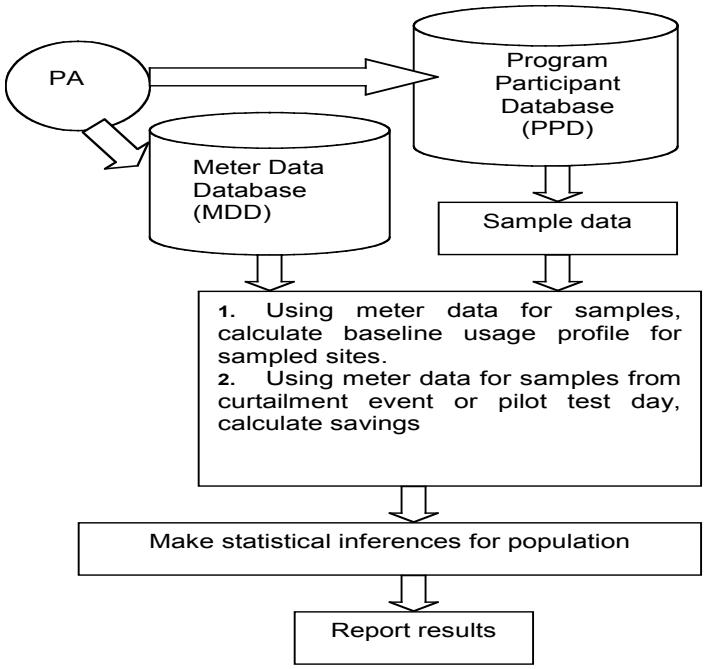
Approach

Nexant will analyze all available data from all the program specific participants. If data is not available, a statistical approach will be used to address the objectives of the plan based on sampling and calculation of demand savings at a sufficient number of sites to satisfy the 80/20 reliability criteria.

Figure 1 is an overview of the sub-element 4 MV&E process. Since each of the programs uses a different set of curtailment signals to achieve peak demand reduction, the definition and the methods for verification of demand savings will differ by program. However, the same basic statistics are common to the entire MV&E process.

As shown in Figure 1, information pertaining to both qualitative and quantitative aspects of the MV&E objectives is stored in the program participant database (PPD) and the meter data database (MDD).

Figure 1. MV&E Plan Flowchart



If selecting samples is necessary, information in the PPD will help and will be used for satisfying qualitative aspects of the MV&E objectives. Information in the MDD will be used to answer quantitative questions about demand savings. Information about all program participants will be in the PPD

Statistical Analysis

Data from both the sampled sub-population and the entire set of program participants will be used to address each of the questions listed in the MV&E objectives. If required a suitable sampling regime will be applied to data in the PPD so that pre-established 80/20 criteria are satisfied.

Demand savings calculations for each of the four contractor programs will be computed by one or more methods depending on the type of program and the available data. Using suitable techniques, the results obtained from a limited number of samples within the population will be generalized to describe the overall program population.

Suitable demand savings calculations will be performed with available aggregated meter data from each of the sampled participants. The demand savings is the difference between actual usage during curtailment or pilot test event and a baseline curve. The baseline curve is calculated

in different ways depending on the type of curtailment signal and data availability. This is discussed in more depth in the following sections.

Method for Analysis of Peak Demand Savings

As described in Table 2 above, there are two basic categories of demand responsive curtailment signals each requiring a different methodology for the evaluation of demand savings.
In SMUD's 3-tiered TOU rate schedule, non-critical signals are retail price signals assigned to specific weekdays hours. The demand savings from critical signals will be in added to those resulting from non-critical signals. Verification of demand savings from critical and non-critical curtailment signals within SMUD's TOUR and TOUN programs will be measured separately.

Method for Calculation of Demand Savings from Critical Signals

The analysis of peak demand savings to critical signals consists of the difference between the aggregated curtailed loads and baseline average loads. Depending on the type of critical curtailment event, demand savings for a particular event may be calculated by Equation (1).

How demand savings is measured is illustrated in Figure 2 below, where the shaded area represents demand savings in curtailed energy use (kWh), which can be converted to average demand savings (kW) within the curtailment event period.

$$(1)\quad \textit{Demand Savings} = \textit{Baseline Demand} - \textit{Actual Demand}$$

Equation (2) provides the formula for the calculation of the average demand savings over the curtailment period. The demand savings evaluation period is referred to as the event period and it is based on the actual start and end times of discreet curtailment events as triggered by critical curtailment signals.

$$(2)\qquad kW_{saved} = \frac{\sum_{StartTime.}^{EndTime.} kW_{Baseline} - \sum_{StartTime.}^{EndTime.} kW_{Event}}{EventPeriod}$$

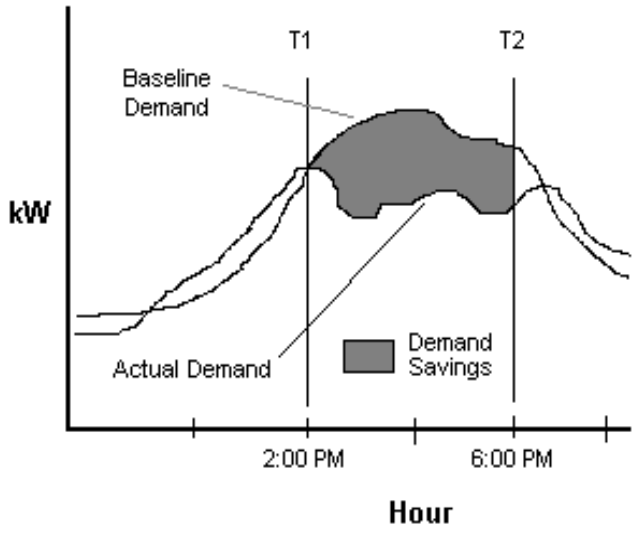
Where:

StartTime	=	Start time of the event period
EndTime	=	End time of the event period
EventPeriod	=	The Demand Savings Evaluation Period; the difference in hours between End Time and Start Time of curtailment signals.
kW_{saved}	=	Average kW demand savings over the event period.

When hours of the event period from a critical curtailment signal are not specified, Nexant will assume that the summer peak demand period is defined as start and stop times are 2:00 PM start to 6:00 PM stop on non-holiday weekdays.

3.4.7 A key component of Equation (2) is the availability of the baseline load demand profile. For critical curtailment signals demand savings will be calculated using two different baseline methods which will be subject to the availability of facility level 15-minute interval meter data.

Figure 2. Illustration of Demand Savings



CAISO Baseline

The CAISO will be used when program administrators have not used any method for adjusting reported demand savings for ambient temperatures

When applied to critical curtailment signals, the CAISO baseline method is used to compile an aggregate or average 24-hour daily load profile for the entire program population or a sampled sub-population in a manner that approximates the current seasonal patterns of building energy use. Each 15-minute baseline demand value is calculated by averaging the daily energy demand values within the same 15-minute time intervals occurring within five to ten previous consecutive, non-holiday, non-curtailed weekdays, prior to the event day.

The CAISO baseline method is vulnerable to daily variability in residential loads caused by temperature changes. Therefore where CAC systems are included in load reductions this method may incorrectly assign demand values for a curtailment event if event day temperatures are significantly different than the average of the other baseline days.

Nexant's Temperature Adjusted Baseline

Nexant's temperature-load adjusted (TLA) baseline method is applied only to analysis of demand savings resulting from critical curtailment signals, and only for facilities which include CAC systems in their curtailments. This TLA method is based on the CAISO baseline technique described above but includes the effects of ambient temperatures on building loads. Because

summer peak load at many facilities is the result of increased air-conditioning loads, ambient temperatures can significantly affect the total demand and the demand savings during a critical curtailment. The Nexant TLA method may be summarized as follows:

- Calculate the CAISO baseline.
- Normalize all load values in the baseline curve of Equation (1) by dividing by the maximum average daily load value such that the normalized baseline load profile has a maximum value of 1.0, and all other load values are expressed as a proportion of the maximum demand value.
- Scale the curve in Equation (2) by multiplying each value on the curve by the average load value in the hour prior to initiation of the critical curtailment event. This scaled curve is the temperature load adjusted baseline curve.

This creates a proportional shift in the CAISO baseline curve to reflect actual load conditions on the event day. This adjustment provides a more accurate load value at the starting point of a curtailment from which load reductions are measured. The TLA baseline allows the relationship between outdoor temperatures and CAC loads to be indirectly incorporated thereby providing a more accurate assessment of absolute load reductions triggered by critical curtailment signals.

Calculation Method for Demand Savings from Non-Critical Signals

The method for evaluating demand savings for the SMUD TOUR and TOUN programs requires analysis of load reductions stemming from non–critical curtailment signals in three fixed TOU pricing blocks. TOU prices are intended to promote load shifting by program participants during peak periods using home energy systems that are provided as a part of TOUR and TOUN program. Demand savings will likely become a learned behavior because program participants will probably experiment with their energy control systems for some time before the system is fully programmed, and levels of household demand is stabilized.

Establishing a CAISO baseline in this program is slightly problematic because it would require participants to refrain from experimenting with their energy systems for 10 business days while baseline data is recorded. It is not known how long experimentation may last before participants make their final system modifications. Since this analysis of non-critical signals is not straightforward and taking budgetary and time constraints into consideration, the following method to measure demand savings due to non-critical curtailment signals has been developed.

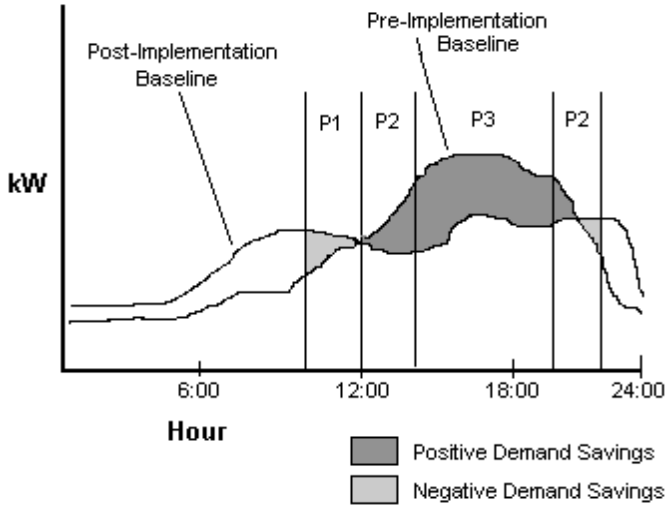
For the analysis of demand savings from non-critical curtailment signals, program administrators will be asked to provide a 5 to 10-day aggregated baseline load profile for the entire population or a sampled sub-population. This load profile is similar to a CAISO baseline used for analysis of curtailments from critical signals because it is aggregated across all participants or a sampled sub-population. This load profile will be used as a *pre-implementation baseline*. It will show daily weekday patterns of residential energy use prior to implementation and participant response to SMUD's non-critical signals.

Nexant will coordinate with SMUD to determine the appropriate duration for program implementation and participant experimentation responses to TOU rates structures. After the implementation period has ended, an aggregate, *post- implementation baseline* will be generated for the same population or sampled subpopulation, as defined by the pre-implementation baseline. If SMUD is unable to provide a post-implementation baseline as described here, an alternative will be used. This is described in the MV&E section "Alternative Method for Evaluation of Demand Savings from Non-Critical Signals".

When comparing the pre-and post-implementation baselines, demand savings will be calculated as in Equation (3). Figure 3 below, provides a illustrated example of the method indicated in Equation (3):

(2) Demand savings = Pre-implementation demand – Post-implementation demand

Figure 3. Illustration of Demand Savings with Non-critical Curtailment Signals



In Equation (4) below, demand savings will be measured within each of SMUD's rate blocks. It is expected that there will be 15-minute intervals within each TOU block that reveals either positive or negative demand savings, as suggested in the example of Figure 3. Nexant will report demand savings within each TOU block and add demand savings across all three, rate blocks. The shaded area in Figure 3 represents demand savings in curtailed energy use (kWh), which can be converted to average demand savings within each of the TOU rate block periods. It is assumed that demand savings in the third rate block (P3) will be the single most important time period for realizing and reporting demand savings because it includes peak demand period hours of 2:00 PM to 6:00 PM.

$$(4) \qquad kW_{saved} = \frac{\sum_{StartTime.}^{EndTime.} kW_{Pre-implementation} - \sum_{StartTime.}^{EndTime.} kW_{Post-implementation}}{TOUBlockPeriod}$$

Where:

StartTime	=	Start time of the TOU block period
EndTime	=	End time of the TOU block period
TOUBlockPeriod	=	The Demand Savings Evaluation Period; the difference in hours between End Time and Start Time of the TOU block period.
kW_{saved}	=	Average daily kW demand savings over the TOU block period.

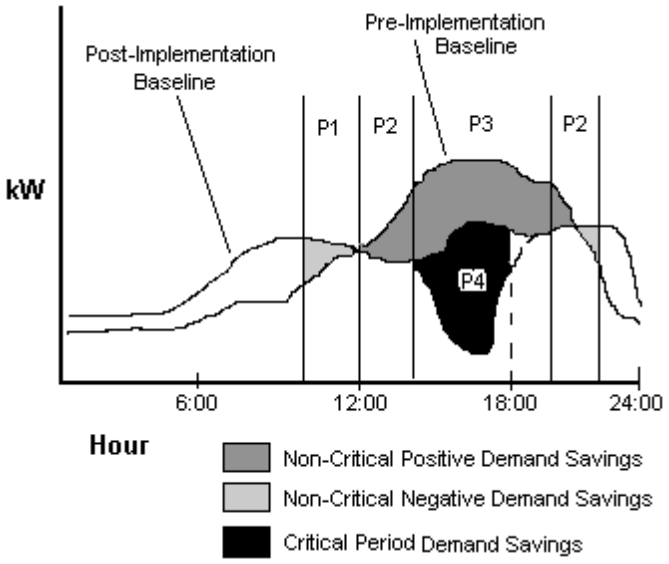
Any curtailments resulting from signals for SMUD's critical period--the fourth TOU rate block-will be measured separately from the non-critical signals associated with the three fixed TOU rate blocks as explained above in "Method for Calculation of Demand Savings in Critical Signals". If the signal for the critical period is issued in the post-implementation period of the three fixed TOU Rate blocks, the post-implementation baseline will be used for measuring demand savings within the critical period (P4) according to equation (5), below, and as illustrated in the example of Figure 4.

$$(5) \qquad kW_{saved} = \frac{\sum_{StartTime.}^{EndTime.} kW_{Post-implementationBaseline} - \sum_{StartTime.}^{EndTime.} kW_{P4Event}}{P4EventPeriod}$$

Where:

StartTime	=	Start time of the "critical period" (P4)
EndTime	=	End time of the "critical period" (P4)
P4EventPeriod	=	The Demand Savings Evaluation Period; the difference in hours between End Time and Start Time of critical period (P4).
kW_{saved}	=	Average kW demand savings over the event period.

Figure 4. Illustration of Demand Savings from Simultaneous Critical and Non-Critical TOU Curtailment Signals



Alternative Method for Evaluation of Demand Savings from Non-critical Signals

In the event that actual load profile data is not available for the pre and post-implementation periods an alternative method will be applied. This method relies upon external price elasticity data obtained from literature on similar programs in the United States. An emphasis will be placed on obtaining price elasticity data from programs operating within similar demographic and climatic service territories as SMUD's. Price elasticity values will only be used for to predict changes in residential demand resulting from non-critical price signals associated with SMUD's TOU rate structure.

The steps of the alternative method are as follows:

1. Obtain a seasonal weekday load profile from SMUD that is representative of the residential program population (Figure 5-A).

2. Scale the seasonal weekday load profile to the approximate levels of demand for the TOUR and TOUN program populations.

3. Group the time periods of the load profile according to the three TOU time blocks to be implemented within the programs. Evaluate kWh usage within each time period of TOU block (Figure 5-B).

4. Research and apply appropriate price elasticity values to changes in prices occurring within each TOU block to obtain predicted change in kWh usage (Figure 6-A).

5. Convert predicted kWh usage values for each TOU block to average demand (kW) values (Figure 6-B).

6. Evaluate demand savings by calculating differences between demand values of the representative seasonal load profile and the predicted average loads in each TOU block (Equation 4 above).

Figure 5. Illustration of Pre-implementation Demand and Energy Use

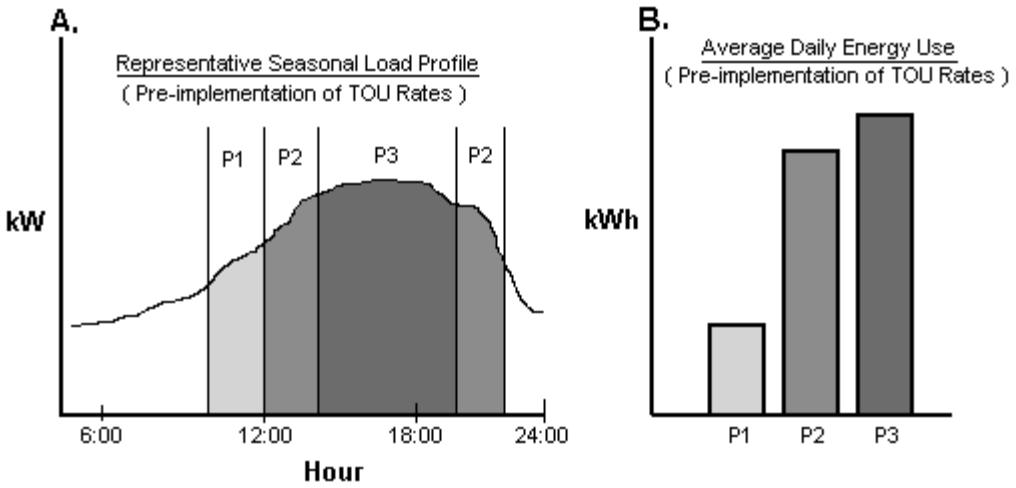
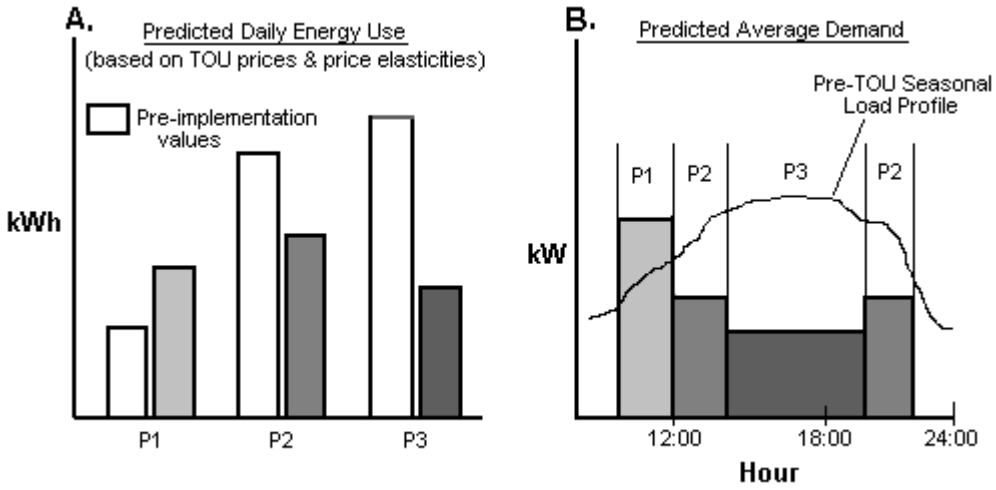


Figure 6. Illustration of Predicted Post-implementation Energy Use and Average Demand



While this alternative method is limited by the absence of actual measured data from program participants an advantage to it is that it can be used to predict expected shifts in residential demand from adjustment made to prices within the TOU blocks.

If actual pre and post-implementation baselines are available from SMUD, price elasticity for the TOUR and TOUN programs could be calculated through adaptations of this method. Actual price elasticity for the TOUR and TOUN programs could be applied for the purpose of more accurately predicting change in demand from changes in TOU Rates.

Table 5 summarizes the MV&E approach to each of the four programs within this sub-element. It also identifies the baseline methods and the data requirements for the successful implementation of each case.

Table 3. MV&E Approaches

Program administrator and program	Baseline	Data required for demand savings calculation
SMUD--TOUR	**For critical signals--** CAISO baseline, Nexant's TLA baseline **For non-critical signals--** Nexant's method for pre- and post-implementation baselines, or alternative method using representative load profiles	**For critical signal--** Aggregate 15-minute interval kW usage data for previous 10 consecutive, non-holiday, non-event day weekdays. Aggregate 15-minute interval kW usage data for event days associated with "critical period" TOU signals. **For non-critical signals--** Aggregate 15-minute interval kW usage data for 10 consecutive, non-holiday, non-event, pre-implementation days. Aggregate 15-minute interval kW usage data for 10 consecutive, non-holiday, non-event, and post-implementation days.
--TOUN	**For critical signals:** same as TOUR **For non-critical signals :**same as TOUR	**For critical signals:** same as TOUR **For non-critical signals:** same as TOUR
--RCTP	CAISO baseline, Nexant's TLA Baseline Method	Aggregate 15-minute interval kW usage data for previous 10 consecutive, non-holiday weekdays. Aggregate 15-minute interval kW usage data for event days.
Energyn--EGYN	CAISO baseline, Nexant's Load Adjusted Baseline Method	Same as SMUD--RCTP

REALIZATION RATES

The realization rate is a percentage that is used to indicate how successful a project or program is. A realization rate of 100% indicates that program administrators provided accurate values for the demand savings achieved. The percentage is calculated by taking the Nexant verified savings number and comparing it with savings reported by the program administrator. In sub-element 4, a single program realization rate will be calculated as an aggregate figure for each implementation program based on data from either the entire program population or a sampled sub-population.

Mathematically, the realization rate is defined as:

(5) $$Realization\ Rate = \frac{VerifiedPeakDemand\ Savings, kW}{\mathrm{Re}\ portedDemand\ Savings, kW} X100\%$$

If baseline and curtailed load data is available for the entire population, greater accuracy will available for the program realization rates. When peak demand savings verification is only possible from sampling the realization rate is calculated for a sub-population sample, which is then used to infer levels of demand savings obtained by the entire population. In this case, the realization rate is used as a normalized measure of project success extrapolated to all projects, subject to the limitations on statistical accuracy imposed by measurement error, sample size and other parameters.

PILOT TEST RESULTS VERIFICATION

Pilot tests are not required as part of this sub-element. However, participants are required to demonstrate their demand savings in response to critical curtailment signals. Pilot tests are not possible for evaluating non-critical curtailment signals. If pilot tests are conducted, Nexant will perform demand savings calculations and make the results available to the CEC.

Evaluation of pilot test may entail calculation of verified potential peak demand savings for a sample set of participating facilities, whereby an extrapolation of these results will be applied to the entire population. All demand savings calculations will be done according to the methods presented in this MV&E plan.

CURTAILMENT ANALYSIS

Measurement of demand savings from critical signals occurring on curtailment days will follow the same procedure as for pilot tests. From a MV&E point of view, there is no difference between a pilot test and a curtailment in terms of the method of calculation for demand savings for individual participants responding to critical curtailment signals.

Demand savings due to critical signals may be calculated by use of the CAISO or TLA baseline methods described above. Curtailment analysis will not include evaluation of demand savings stemming from non-critical curtailment signals because these are not dynamic curtailment signals.

PROGRAM PARTICIPANT AUDITS

The program participant audit will be performed to determine whether participants complied with program requirements. This includes correct, on time installation of DR equipment; confirmation of pilot test actions; comparisons of reported demand saving figures; and how CEC allocated funds were spent. It is expected this audit will provide a vehicle for supplemental questions to help answer some of the research questions identified in the MV&E objectives.

Facilities participating in these audits will be selected at random. Audit questionnaires will preliminarily be conducted by phone. In cases where anomalies are found or data is considered suspect, site visits will be conducted for up to 25% of audits.

PROGRAM ADMINISTRATOR AUDITS

To help the CEC evaluate program administrators, Nexant will conduct an audit. This audit will measure and record the effectiveness of each program administrator. Criteria for examination include the confirmation of:

- The number of participants recruited by a set date for contractors
- Project equipment was ordered and installed on-time
- On-time execution of pilot tests and reporting of net demand savings over all program participants and
- Allocated CEC funds were appropriately spent

All program administrators will participate in this process by telephone. In cases where anomalies are discovered, or data is considered to be suspect, site visits will be conducted for up to a 33% of the program administrators.

Similar to the program participants audits, the program administrator's audits will be used to help answer some of the qualitative questions identified in the MV&E objectives.

MV&E PLAN IMPLEMENTATION

As in Figure 1, above, the MV&E process involves collection of information about participants and their meter data, data analysis and verification of demand savings. Since there are a large number of participants and 15-minute interval data will not be available at all participating sites, a statistical method will be applied to achieve the objectives of this MV&E plan. The implementation of this plan as in Figure 1 and described below. Table 4 presents a summary of the MV&E method used to satisfy each objective.

Table 6. Summary of MV&E Approach By Objective

MV&E Objective	MV&E Method	Comments
Define and evaluate peak demand savings achieved for each of the four residential DR programs. If data is not available for all program participants, the evaluations will be based on sampling techniques necessary to obtain a minimum 80/20 level of statistical accuracy.	Statistical method using samples from program participant database and meter data in meter data database. Comparison of event data to CAISO and TLA baselines for critical signals per Equations 1 and 2. For non-critical signals, method will compare pre and post-implementation baselines per Equations 3 and 4	For analysis of demand savings from non-critical curtailment signals, price elasticity will be used to estimate demand savings in the absence of actual load data for program participants.
If pilot tests are conducted, provide comparisons between measured peak demand savings documented during pilot test and peak demand savings that result from subsequent curtailment events (price or static or dynamic signals) between these events.	Using the same method for calculation of demand savings for test data and curtailment events, differences between events will be explained on the basis of anecdotal information obtained in the PPD and via phone calls to program administrators	Pilot tests are not required by participants. If pilot tests are conducted, they only apply to critical curtailment signals.
Determine how levels of demand savings vary across the hours of the peak demand period or specified hours of a curtailment period (if different than the peak demand period). Identify factors that explain hourly variation in demand savings.	Demand savings will be calculated using 1-hour event periods and plotted as a function of time. Variations will be correlated with usage.	15 minute, 30 minute or 1 hour interval data is definitely required for this step.
Did the operation of demand responsive systems during curtailment events impact residential occupant comfort?	Query of data entered in the PPD by Administrators*	This information is optional in the PPD.
Determine the primary reasons and the extent to which customers chose to exercise overrides of automated systems during curtailment events.	Query of PPD. Anecdotal information from PAs via telephone calls*	This information is optional in the PPD.
Determine if there are significant differences in peak demand savings on “hot days” versus “cool days” for each type of residential pilot program.	Query of PPD and perform correlation between demand savings and ambient temperature for event days.	Temperature data for event days is obtained from the weather bureau based on the zip code of the facility.
Compare demand savings achieved during curtailment events involving price and/or emergency signals and determine factors that explain the differences.	Comparison of demand savings from critical and non-critical signals within TOUR and TOUN programs will allow for standardized comparison of emergency and price signals.	Demand savings due to TOU signals for critical and non-critical periods will be calculated.

MV&E Objective	MV&E Method	Comments
Characterize relevant household demographics, residential building types and climatic characteristics of the program participant population.	Query of PPD.	PPD contains fields to satisfy this objective. It is optional for PA to provide some of this data.
Determine the cost-effectiveness of the program in dollars spent in this program per/ kW of demand savings and estimate a projected cost per kW for the post pilot phase.	Calculate demand savings by one of specified methods. Using invoice information, calculate $/kW (saved) value.	Cost-effectiveness is based on Nexant's calculated demand savings and the money paid to the PA by CEC.

DATA COLLECTION

Nexant will use a secure, Internet-based, on-line, data, upload process called the DR-Tool. The DR-Tool allows for data storage, input and analyses. Data storage is done in two stages. The program participant database (PPD) contains all the information about program administrators, participating facilities and their assigned meters and metering capabilities.The meter data database (MDD) contains numerical data pertaining to each 15-minute interval meter identified in the PPD. The PPD and MDD are integrated in such a way that only meter data pertaining to an existing participant in the PPD may be stored. That is, meter data is uniquely associated with an existing participant in the PPD. Data input is performed online by program administrators using web-enabled "Landing Zone" software which provides on-line forms for uploading participant and 15-minute interval meter data into the PPD and MDD.

Each PA will be provided access to the secure web site (http://efficiencylink.com) via a user name and password. Upon logging in the program, administrator must first enter participant data into the PPD and then upload meter data for specified curtailment events into the MDD. Detailed descriptions of the data upload process and required data fields are provided at this web location, under "Help".

The PPD forms the basis for all the sampling, queries, audits and subsequent analyses and reporting for all the qualitative objectives of the MV&E plan. The supporting meter data in the MDD provides answers to all the quantitative objectives of the plan, and the integration of the MDD. All meter data pertaining to events will be obtained from the program administrator for each of the participants forming the sample. Requirements for meter data from each participant may be relaxed if it is determined that aggregate meter data for the population or sampled sub-population is sufficient to address the MV&E objectives.

Once all the relevant information is collected in the PPD, a sample will be drawn based on the 80/20 sampling criteria and data analyses will either be performed on a case-by-case basis using the corresponding meter data from the MDD, or by analysis of aggregated meter data. The next step will involve calculation of realization rates and drawing inferences to the entire population. Sampling will not be necessary if meter data is available for the entire program population.

DATA ANALYSIS-SAMPLING PLAN AND STATISTICAL ANALYSIS

Data collected in the PPD is relevant to the statistical analyses, as it allows characterization of the program population and population segmentation based on load usage, geographic location, building type etc.. The PPD provides necessary data to carry out a random stratified sampling regime, if required.

An 80/20 reliability level is used as a target for accuracy for estimates of the whole population. This criterion assures that there will be an 80 percent probability that the actual demand and energy savings achieved by the sites will be within 20 percent of the estimate. This target level of accuracy will be exceeded in the event that meter data is available for entire populations.

Because of the size differences between subgroups, and the likelihood of incomplete data, the 80/20 criteria for estimate quality will not be attempted in the analysis of specific segments of the population. To determine the necessary sample size of sites, Equations (6) is used:

$$n = \frac{z^2 \times cv(y)^2}{p^2}$$

(6)

$$n^* = \frac{Nn}{(N+n)}$$

Where:

n	=	Sample size for an infinite population
n^*	=	Required sample size based on finite population correction; values of n^* should be rounded up to the next higher integer.
z	=	z-statistic (equal to 1.282 for an 80% confidence level)
$C_v(y)$	=	Coefficient of variation of hours of use y (assumed to be 0.5 in this case)
p	=	The required precision level (set at 20%)

These equations are also applied to each of the four programs to determine if it is possible to generate estimates within the criteria. In order to achieve 80/20 in estimating the demand reduction, a "z" value of 1.282 and a "p" value of 0.2 are constants used above. The actual sample size for the population and subgroup analyses will be determined upon selection of the final population of participants.

CALCULATION OF DEMAND SAVINGS

For each of the chosen participants, demand savings are calculated using methods described above for calculating demand savings. Depending on the program, demand savings are calculated in response to critical and non-critical curtailment signals.

COST EFFECTIVENESS ANALYSIS

Included as one of the research objectives, the cost-effectiveness analysis is considered to be of critical importance to the CEC. Using the total costs invoiced and incurred by the CEC, Nexant will calculate a figure that will result in a dollar cost for achieving a unit of demand savings (kW) for the different program administrators and for the program as a whole.

Important, but secondary is the evaluation of participation rates, the related topics of free-driver/free rider and the potential for double counting savings. While these issues will be addressed if discovered as part of the analysis, Nexant's emphasis is on program impacts. Therefore, any findings around these issues will be anecdotal rather than quantitative in nature.

MV&E REPORTING

Nexant's final report will consist of the results of all MV&E activities. Quarterly reports will describe the progress made toward MV&E objectives each quarter.

CONCLUSION

Verification of demand savings will be performed separately for critical and non-critical curtailments. Temperature-load adjusted baseline methods are proposed for the calculation of demand savings for curtailment events involving CAC systems that respond to critical signals including SMUD's dynamic TOU price and other emergency signals from SMUD's RCTP program and the CAISO.

Answers to all quantitative questions in the objectives will be obtained by analysis of participant and meter data within the PPD and MDD. If population sampling is required to complete Nexant's analysis, all inferences and generalizations drawn from sampled subpopulations will be supported by statistical analyses at an 80/20 level of statistical accuracy for the entire sub-element 4 population.

All qualitative answers to the objectives will be addresses by the solicited information in the PPD. Missing data in the PPD will be augmented by supplementary questions in participant and administrator audits.

APPENDIX B

SUB-ELEMENT 3 AND 4 AUDIT FORMS

SUB-ELEMENT 3 AUDIT FORMS

Shown below are a series of questions that were asked to both program administrators and participants of Sub-element 3 programs.

Program Administrator Audits (SE.3)

1. Describe how you recruited participants?

2. What marketing materials did you use to attract participants?

3. How many participants did you sign up?
(____customers _____facilities recorded by Nexant to date)

4. From these participants, what did you reported in total MW demand savings?
(____MW as reported for Pilot test by Nexant to date)

5. What equipment and/or services did you offer to participants?

6. Did you offer participants training or other instructional help during any point in their participation? Explain.

7. Describe your process for evaluating projects? This would include evaluating demand saving from pilot tests or any other type of evaluations.

8. Did you verify equipment installations and/or curtailment processes at project sites?

   If yes, how? On how many participants _____?

   Did you have a particular sampling plan for this?

9. What method was used to track/report project progress (to the CEC, to the M&V contractor)?

The general guidelines for the rating scale for these questions ranges between:
5=Complete/thorough; 3=Sufficient/adequate; 1=Absent/ wholly inadequate.

10. Are verifications documents available and adequate for the sampled projects?

Scale: 5=all requested documents available; 3=half of requested documents available; 1=no documents available.

11. Were invoices valid? (as shown by proper documentation and consistent with the initial agreements between parties involved and the program requirements)

Scale: 5=All invoices consistent; 3=Half of invoices are consistent; 1=Invoices completely inconsistent or not available.

12. Was the verification process as described above followed? Was it consistently applied?

Scale: 5=Thorough verification process with full documentation; 3=Observed two or more significant deviations from verification process with sound explanations; 1=No verification process or not at all according to plan.

13. Did installed equipment agree with the invoices or other verification documents ?

Scale: 5=Complete consistency between invoices and equipment; 3=Observed two or more discrepancies between invoices and equipment; 1=Invoices completely inconsistent with equipment or not available.

14. Were participants paid what they had been promised? Out of project funds?

Scale: 5=All payments made according to customer agreements; 3=Most payments made according to customer agreements, two or more discrepancies; 1=Payments not made at all, or are not made according to agreements, or all payments made are in dispute.

15. Was the tracking/reporting method noted above maintained?

Scale: 5=Actual tracking/reported method is consistent with planned method, with data available for all requested participant sites; 3=One or more deviations from planned method or half of records inadequate or missing; 1=No effective tracking method observed or data found to be completely inaccurate.

Program Participant Audits (SE.3)

1. How did you find out about the CEC Peak Load Reduction Program?

2. Why did you choose to participate in the program?

3. Did you participate in any other similar or related programs? Which? What? When or for how long?

4. How often did your program administrator communicate with you during your participation in the program? This includes from program onset through application processing and routinely throughout the your participation.

   Rating Question: On scale of 1 to 5, rate communication process with administrator

5. By what means did you most often communicate?

6. What types of reporting requirements were you responsible for? How often?

   Rating Question: On scale of 1 to 5, rate the reasonableness of the reporting requirements

7. How long did it take for you to be notified about your application status after you submitted it?

8. Did your program administrator visit your site to verify that the project was completed? If not, was verification done in another manner rather than a site visit? Explain.

9. Did you achieve your peak demand savings goals?

10. Did you encounter any obstacles to achieving your peak demand savings?

    Rating Question: On scale of 1 to 5, rate the obstacles you encountered

11. What is the likelihood that you would have performed peak load-reducing actions without this program?

    Rating Question: Rate on 1-5 scale

12. From your experience with this program would you participate again in a similar program? If not, why?

    Rating Question: 5=without question; 3=yes, though under different circumstances 1=under no circumstances. (Note: recipients could be asked for a percent probability; then convert figure to 1-5 scale)

Please rank the following questions on a scale of 1 to 5; 1 being *Unacceptable* and 5 being *Outstanding*:

13. Your administrator? (Note: administrator may refer to CEC grant/contract personnel if participant is a CEC grantee)
14. The application process?
15. The invoicing, billing and payments process?
16. The verification process?
17. The implementation timeline that you were on?

<u>Sub-Element 4: Program Participant Audits</u>

SMUD PowerStat– Sub-element 4 Residential Pilot

1. How did you find out about the SMUD PowerStat Program? How long after you first learned of the program did you decide to become a program participant?

2. What were your reasons for participating in this program?

3. Are you participating in any other type of energy efficiency or related programs?

   If YES, what are the other programs and for how long have you participated in them?

4. After you notified SMUD of your decision to participate, how long did it take SMUD to confirm your enrollment in the PowerStat program?

5. How long after your enrollment was confirmed did SMUD install PowerStat equipment in your home?

6. How often did SMUD or other program personnel communicate with you about the PowerStat program since you enrolled? By what means did you communicate with SMUD or other project personnel regarding this program? (i.e. face-to-face, telephone, e-mail, etc.)

   On scale of 1 to 5*, evaluate the quality of the communication process with SMUD or other program personnel

7. Was there any type of feedback information, data or reporting that was required of you by SMUD? If YES, What feedback or reporting information was required and how frequently were you asked to provide information?

   On scale of 1 to 5*, rate the reasonableness of the feedback or reporting requirements

8. After installation of the PowerStat system in your home, did SMUD or other project personnel contact you to verifythat the PowerStat equipment was functioning properly?

9. Did you encounter any obstacles to operating the installed PowerStat equipment, using of the program website, or changing the way you use electricity in your home? If YES, please briefly describe the problems encountered. (if NO, please skip to question 12)

   On scale of 1 to 5*, rate the obstacles you encountered.

10. Did the problems or obstacles you encountered permanently limit your ability to carry out energy saving measures or the achievement of your energy saving goals?

11. Did SMUD or other project personnel assist you with solving any problems you encountered?

12. On a scale of 1-5*, what is the likelihood that you would have changed the way that you use electricity in your home without the SMUD PowerStat program.

13. On a scale of 1-5*, rate your overall experience with the SMUD PowerStat Program on the whole.

14. On a scale of 1-5*, rate the overall quality of customer service provided by the SMUD or other project personnel that you had contact with.

15. On a scale of 1-5*, rate the quality of your overall experience with technical aspects of the PowerStat equipment and SMUD website?

16. Based on your experience with the SMUD PowerStat program, rate your likelihood of repeating this program experience or participating in a similar program on a scale of 1-5* scale? If your answer was 1 or 2, please explain why you would not be inclined to repeat the experience

    * 1 being *Unacceptable* and 5 being *Outstanding*:

SMUD PowerChoice – Sub-element 4 Residential Pilot

Nexant's Participant Audit Questions to be INCLUDED in SMUD online survey:

1. (priority: medium) Are you participating in any other type of energy efficiency or related residential energy programs?

2. (priority: medium) How long after your enrollment was confirmed did SMUD install PowerChoice equipment in your home? ___< 1 week ___ between 2-3 weeks ___>3 weeks

3. (priority: high) Did you encounter any obstacles to operating the installed PowerChoice thermostat, or using of the program website during critical peak price events? Y/N

4. (priority: high) On scale of 1 to 5*, rate the obstacles you encountered (from above question).

5. (priority: high) Did the problems or obstacles you encountered permanently limit your ability to carry out energy saving measures and/or reduce your energy bill? Y/N

6. (priority: medium) Did SMUD or other project personnel assist you with solving any problems you encountered? Y/N

RATING QUESTIONS: (* 1 being *Unacceptable* and 5 being *Outstanding*)

7. (priority: high) On a scale of 1-5*, rate your overall experience with the SMUD PowerChoice Program on the whole.

8. (priority: high) On a scale of 1-5*, rate the overall quality of customer service provided by the SMUD or other project personnel that you had contact with.

9. (priority: high) On a scale of 1-5*, rate the quality of your overall experience with technical aspects of the PowerChoice thermostat and SMUD website?

10. (priority: high) Based on your experience with the SMUD PowerChoice program, rate your likelihood of repeating this program experience or participating in a similar program on a scale of 1-5* scale?

Energyn –Residential Pilot Program

1. How did you find out about the Energyn / Ipower Program? How long after you first learned of the program did you decide to become a program participant?

2. What were your reasons for participating in this program?

3. Are you participating in any other type of energy efficiency or related programs?

   If YES, what are the other programs and for how long have you participated in them?

4. After you notified Energyn of your decision to participate, how long did it take Energyn to confirm your enrollment in the program?

5. How long after your enrollment was confirmed did Energyn install Ipower equipment in your home?

6. How often did Energyn or other program personnel communicate with you since you enrolled in the program? By what means did you communicate with Energyn or other project personnel? (i.e. face-to-face, telephone, e-mail, etc.)

   On scale of 1 to 5*, evaluate the quality of the communication process with Energyn or other program personnel

7. What types of feedback information, data or reporting was required of you by Energyn? (please describe briefly) How frequently was feedback or reporting required?

   On scale of 1 to 5*, rate the reasonableness of the feedback or reporting requirements

8. After installation of the Ipower system in your home, did Energyn or other project personnel contact you to verify:

   A) that the Ipower equipment was functioning properly?

   B) that Ipower equipment was being used to implement energy saving measures?

9. Did you encounter any obstacles to operating the installed Ipower equipment or use of the program website? If YES, please briefly describe the problems encountered.

   On scale of 1 to 5*, rate the obstacles you encountered.

10. Did the problems or obstacles you encountered permanently limit your ability to carry out energy saving measures or the achievement of your energy saving goals?

11. Did Energyn or other project personnel assist you with solving any problems you encountered?

12. On a scale of 1-5*, what is the likelihood that you would have carried out similar energy saving measures without the Energyn Ipower program.

13. On a scale of 1-5*, rate your overall experience with the Energyn / Ipower Program on the whole.

14. On a scale of 1-5*, rate the overall quality of customer service provided by the Energyn or other project personnel that you had contact with.

15. On a scale of 1-5*, rate the quality of your overall experience with technical aspects of the Ipower equipment and Energyn website?

16. Based on your experience with the Energyn / Ipower program, rate your likelihood of repeating this program experience or participating in a similar program on a scale of 1-5* scale? If your answer was 1 or 2, please explain why you would not be inclined to repeat the experience

    * 1 being *Unacceptable* and 5 being *Outstanding*:

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Innovative Program Element Peak Load Reduction Program
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Appendix A: Summaries of Sampled Projects

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Project Number:	SB5X3001
Project Name:	Novatia

Project Overview

Project Summary

Novatia contracted with the Energy Commission to develop and run a rebate program that would provide rebates of $1/square foot of installed solar window screens to California ratepayers. The total demand savings were estimated to be 9.0 MW with $3,455,738 in incentives.

Key Participants

Allan Goff, Novatia's president, submitted the original application, which included the demand savings calculations and project work plans. For this project, Novatia chose to exclusively use solar screen products from Phifer Wire Products, Inc.

Technology Overview

Solar radiation entering through windows can contribute significantly to residential heat gain. Using solar screening devices over existing window openings can mitigate these solar heat gain effects. This results in increased comfort levels and decreased residential air-conditioning (AC) demand load and usage, especially during summer peak periods.

Evaluation

Monitoring and Evaluation Procedures

Nexant engineers worked closely with the Energy Commission staff to develop a reasonable evaluation method for the potential demand reduction impacts of this project. The evaluation method focused on determining the average demand savings per installed unit of product (i.e. square foot of solar screen). Nexant conducted pre- and post-installation site surveys of participating homes. Calculated demand savings included evaluation of the following variables: solar insolation levels for various locations, average residential AC-unit efficiency, existing internal and external shading devices, and occupancy levels.

Novatia reported, via the Energy Commission, the total square footage of installed product; Nexant accepted this figure.

Program Savings

Program savings are calculated as in equation (1) below: the product of the average demand reduction per square foot and the total reported quantity of installed product:

$$(1) \qquad (2.44W / ft^2) \times (1{,}700{,}000\, ft^2) = 4.148MW$$

Error Analysis

Pursuant to the project's MV&E efforts, the following section and table describe the magnitude and nature of error in the demand savings analysis.

- Modeling error: Nexant assumed 15 percent error in the demand savings calculation methodology.
- Assumptions of stipulated factors: Assumptions made in the analysis include average usage patterns and efficiencies of typical residential AC-units. Nexant assumed 15 percent error in stipulated factors.
- Sampling error: reporting of 1.7 million square feet of installed solar screens is assumed to contain an error of 1 percent.

Table 1: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	0.0
Modeling Error	15.0
Sampling Error	1.0
Assumptions of Stipulated Factors	15.0
Project Total Error	21.2

Program Effectiveness

Verified savings	=	4,148 kW
Reported savings	=	2,361 kW
Realization Rate	=	175.7 percent

Project Number:	SB5X3002
Project Name:	SCS Engineers

Project Overview

Project Summary

The contracted goal for this project was to install 2.49 MW of electric generation capacity statewide by installing microturbines. The Energy Commission contracted value for this project was $622,500.

The microturbines were to run off fuel from waste landfill gas. The microturbines use a portion of the landfill gas to produce electricity to meet the landfill facility's existing power requirements. This gas would otherwise be flared into the atmosphere.

SCS Engineers completed installations of three sites: 420.0 kW of nameplate capacity at the OII Landfill in Monterey Park, 300.0 kW of nameplate capacity at the Calabasas Landfill, and 210.0 kW of nameplate capacity at the ACME Landfill in Martinez, for a total of 930.0 kW of installed nameplate generation capacity at all three landfill sites.

Several factors contributed to SCS Engineers being unable to reach their initial generation capacity goal—a weak economy and regulatory hurtles contributed. These two factors caused SCS Engineers to have a difficult time recruiting program participants. In addition, SCS's original microturbines suppliers, Honeywell Power Systems, withdrew from the market, forcing SCS to find a new supplier.

Key Participants

Jeff Pierce, Vice President of SCS Engineers is the authorized representative on the grant application. Benny Benson, Project Manager for SCS Engineers, has been the primary contact for project and scheduling inspections information.

Technology Overview

The project uses modified natural gas microturbines to generate electricity using landfill gas as the combustion fuel. The modification consists of first sending the gas through a pre-treatment plant, which dries and pressurizes it, and then increasing the turbine throughput to account for lower methane content of landfill gas.

Evaluation

Monitoring and Evaluation Procedures

The project M&V plan consisted of pre- and post-installation inspections at the OII Landfill in Monterey Park and ACME Landfill in Martinez. However, a post-installation inspection at the ACME Landfill site was not possible due to project delays. Consequently, Nexant evaluated project savings based on control system and generation data obtained from the OII Landfill site during pre- and post-installation inspections.

Program Savings

Nexant based the approved savings for the project on the observed average power production of the units operating under typical summer peak period conditions at the OII

Landfill. At the OII Landfill, the claimed savings were 420 kW from the six 70 kW-rated turbine units. However, as the efficiency of the units degrades at higher outdoor air temperatures, power output during peak period summer conditions is frequently below rated capacity.

Table 1: Notes from Post-Installation Inspection at OII Landfill

Nameplate data	Ingersol Rand, Powerworks, M/N: 70LW		
Unit Number	**S/N**	**Run Hours**	**Inst. Output**
1	PW00124D1201	Offline,	Data unavailable
2	PW00126D1201	1181	63 kW
3	PW00122D1201	1173	Temperature offline
4	PW00121D1201	972	62 kW
5	PW00123D1201	1116	Offline
6	PW00128D1201	1277	50 kW

During the post-installation inspection, the project manager stated that under normal operating conditions, five of the six units are operational. The five units are reportedly able to supply the necessary power to the treatment facility. However, the landfill was unable to obtain a contract to sell excess power back to the utility. During the post-installation inspection, the three fully operational turbines were producing an average of 58.33 kW each. Nexant assumed that during normal operating conditions, each of the five turbines would be operating at this average of 58.33 kW, for total generation capacity of 291.7 kW.

This average power output of 58.33 kW is only equal to 83.3 percent of the rated nameplate power output of 70.0 kW due to three factors: the relatively lower efficiency at higher ambient air temperatures, the parasitic power consumed by the turbine itself, and the power consumed by the gas pre-treatment equipment. Since the inspection coincided with summer peak demand conditions, Nexant determined that the observed power generation data was representative of normal operating conditions during summer peak periods.

Nexant determined the level of verified peak power generation capacity based on the percentage of nameplate generation capacity actually realized under normal peak period operating conditions. This level of verified peak demand savings is equal to 83.3 percent of the installed nameplate generation capacity, based on the realized peak power generation of 58.33 kW for the 70.0 kW nameplate capacity microturbines at the OII Landfill site. The two remaining sites have a cumulative installed nameplate capacity of 510.0 kW. Consequently, 425.0 kW of peak generation capacity is the verified peak demand savings for the Calabasas Landfill and the ACME Landfill in Martinez.

The total nameplate capacity claimed for the three installed sites was 930.0 kW. The total verified peak demand savings at the OII Landfill in Monterey Park are equal to 291.7 kW. The total verified peak demand savings at the Calabasas and ACME landfills are equal to 425.0 kW. The total verified peak demand savings at all three completed landfill sites are equal to 716.7 kW.

Using their own calculations, SCS Engineers determined that of the 930 kW of installed nameplate generation capacity, approximately 720 kW would be operating during peak period conditions; SCS Engineers reported this number to the Energy Commission.

SCS Engineers continues to install microturbine power generation units at other landfill sites throughout California. Feasibility studies for some of their projects were initially conducted when CEC funding was still available though the Innovative program element. However, only the three projects detailed herein were completed through the Innovative program element. Other landfill sites that were later completed have not been quantified, and should be considered ancillary benefits of the Innovative program element. Through March 31, 2003, a total of 1000.0 kW in peak demand savings had been reported to the Commission.

Error Analysis

Three sources of error in the demand savings were identified: (1) instrumentation error, (2) sampling error, and (3) assumption errors. The instrumentation error is assumed to be small and is estimated at two percent. At the time of the inspection, Nexant was able to obtain demand readings on three of the six units. The resulting sampling error was five percent. Nexant was able to obtain demand readings at one set of outdoor air conditions. Nexant assumed that the ambient conditions at the time of the inspection would conservatively estimate the average summer peak period operating conditions of the units; this assumption error is estimated at ten percent.

Table 2: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	2.0
Modeling Error	0.0
Sampling Error	5.0
Assumptions of Stipulated Factors	10.0
Project Total Error	11.4

Program Effectiveness

Verified savings	=	716.7 kW
Reported savings	=	1,000.0 kW
Realization Rate	=	71.7 percent

Project Number:	SB5X3003
Project Name:	ECS Energy

Project Overview

Project Summary

ECS Energy contracted with the Energy Commission to develop and run a program to provide rebates to hotels and motels for installing guestroom energy management (GEM) systems. The GEM systems monitor guestroom occupancy, providing local control to room lighting and HVAC systems. The total demand savings were estimated to be 7.4 MW with an incentive of $1,850,000.

Key Participants

Marc Koehler of ECS Energy submitted an application with demand savings calculations and project work plans. Mr. Koehler also coordinated with Nexant staff to conduct site inspections of participating facilities.

Technology Overview

The GEM system consists of an occupancy sensor, which monitors guestroom activity, and a local controller, which curtails room lighting and HVAC when rooms are unoccupied. Manual overrides are available and allow guests individual control during times of occupancy.

Evaluation

Monitoring and Evaluation Procedures

ECS Energy provided detailed peak demand savings calculations as part of their original application. Nexant evaluated and performed due diligence review on the savings calculations that were submitted. The calculations claimed an average potential demand savings per guestroom. Variables in the analysis included: a stipulated potential savings factor, a calculation of average peak electrical demand per room, and the disaggregation of electrical demand for lights and HVAC systems. As part of its M&V efforts, Nexant conducted both pre- and post-installation site inspections of participating facilities.

Program Savings

Program savings were calculated as the product of: (1) number of guestrooms retrofitted with a GEM system, (2) average peak electrical demand per room, and (3) potential demand savings:

$$\boxed{(12{,}683 rooms) \times (0.923 kW / room) \times (35\%) = 4.097 MW}$$

ECS Energy tracked the number of rooms included in the program. Nexant applied an assumed sampling error of two percent to the total number of reported rooms. ECS Energy calculated the value of 0.923 kW/room based on average lodging industry summer peak power demand and total number of rooms. ECS Energy assumed room

lighting and HVAC systems account for approximately 50 percent of the total facility load. Equation (1) below:

(1) Average Summer Peak Load = 1.84 kW/Room.

A stipulated 35 percent potential savings factor represents the extent to which conditions exist where the GEM systems can curtail load (e.g. in the case where a room tenant does not turn off lighting and air-conditioning systems when leaving a room, the GEM system will have the potential to curtail load).

Nexant reviewed the calculations submitted by ECS Energy and found them to be accurate and reasonable, given the lodging industry data available. However, due to lack of more comprehensive data regarding potential for demand savings using the GEM systems, assumptions were made that introduced large uncertainty factors.

Error Analysis

Pursuant to the project's M&V efforts, the following table describes the error in the demand savings analysis. For the 12,683 installed units, reporting error of two percent was assumed. For the 35% savings potential per room, an assumption error of 30 percent was applied for use of this stipulated factor. Nexant assumed a 30 percent modeling error for use of the kW/room demand savings model. The large error inherent in the verified savings is due to assumptions made by ECS Energy regarding GEM system savings potential and room loads relative to lodging facility loads.

Table 1: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	0.0
Modeling Error	30.0
Sampling Error	2.0
Assumptions of Stipulated Factors	30.0
Project Total Error	42.5

Program Effectiveness

Verified savings	=	4,097 kW
Reported savings	=	4,098 kW
Realization Rate	=	100.0 percent

Project Number:	SB5X3044
Project Name:	ConSol – HVAC ComfortWise Homes

Project Overview

Project Summary

This project was intended to promote and administer ConSol's ComfortWise homes program. The ComfortWise homes program requires builders of new California homes to: (1) seal ducts, (2) have the duct system professionally designed using Air Conditioning Contractors of America (ACCA) Manuals J, D, and S, and (3) install spectrally selective glass to meet or exceed ENERGY STAR® Home requirements. As a result of these energy efficient measures, home cooling loads are reduced, allowing installation of smaller AC units that require less power.

ConSol was awarded a contract of $3,160,000 for a goal of 10.5 MW of demand savings that would result from the enrollment and certification of approximately 10,500 new construction homes in the ComfortWise homes program.

Key Participants

Rob Hammon, a principal at ConSol, was the primary contact for this project. Site inspections were coordinated with Rex Hammon; inspections were conducted with Skip McGee, Dennis Rooker, and Shawn Seims. Nexant gathered additional information about energy simulation models from Rob Tamayo of ConSol.

Technology Overview

ConSol inspectors, who are California Home Energy Efficiency Rating System (CHEERS) certified raters, verified that all ComfortWise homes had ACCA approved ducts systems, that the ducts were sealed properly, that spectrally selective low E glass was used in the windows, that homes were properly insulated and sealed, and that the mechanical equipment met minimum California Title 24 standards. The ComfortWise homes program ensured proper sizing of residential air-conditioning units, which typically resulted in a one-ton downsizing from a non-ComfortWise home. All measurements were verified twice, during initial and final inspections. ConSol required that one out of every seven homes built were inspected and at least one of each construction plan type was included in the sampling protocol.

ComfortWise homes are reported to be 30 percent more energy efficient than Model Energy Code (MEC), and at least 15 percent more energy efficient than Title 24 compliant homes.

Evaluation

Monitoring and Evaluation Procedures

The MV&E procedures consisted of three steps: (1) observe initial and final site inspections by ConSol raters, (2) verify assumptions and calculations (1 kW/home reduction in load), and (3) establish an average coincident peak use of residential AC

units. Nexant then used this estimate to determine the project's average peak load reduction.

Nexant staff accompanied ConSol's raters during final site inspections on May 23, 2002 and September 9, 2002. During these site inspections, raters adhered to the guidelines and protocols set forth by the ComfortWise homes program. The homes' insulation, AC unit, duct sealing, duct layout, and windows were also inspected during the initial inspections.

Raters performed blower door and duct leakage tests. Additionally, manufacturer specifications of AC units were verified during final inspections. During inspections, the raters fill out inspection forms detailing all ComfortWise requirements. In order to receive a ComfortWise home rating, a home must have satisfied ComfortWise program requirements.

ConSol calculated a peak load reduction per home of 1 kW, resulting from a one-ton downsizing of each residential AC unit. ConSol calculated these demand savings by comparing new homes built to code, according to 30-year engineering practice principles, with homes built according to the ComfortWise home standards. ConSol used software simulation models to size mechanical systems. Micropass was used to check for Title 24 compliance. This yielded a load for a given house. The AC was sized accordingly. Each room's load was checked against ACCA manuals, and all room loads were integrated in order to assure proper duct sizing.

Nexant verified assumptions in ConSol's simulation software for determining cooling loads for ComfortWise homes versus Title 24 compliant homes. Because the majority of the homes participating in the program were in climate zones 10, 12, and 13 (Climate Zone 12 – Sacramento, Climate Zone 10 – Inland LA, and Climate Zone 13 – Fresno and Bakersfield), these houses were selected for testing ConSol's cooling load calculations and assumptions.

The ComfortWise minimum requirements are spectrally-selective glazing, ACCA duct design with tested leakage of less than 2 percent, and inspections of other envelope installations, such as window sashes, caulking, and insulation. The one ton cooling load reduction for each ComfortWise home AC unit was calculated by averaging the rated power differences between 3, 4, and 5 ton units from three major manufacturers of HVAC equipment (Bryant 561C AC condenser (10 SEER), Carrier 38BRB AC condenser (10 SEER), and Lennox HS21 AC condenser (12 SEER)). ConSol's calculated demand savings from these manufacturer specifications were 1.2 kW/ton after dropping the outlier data; they conservatively claimed savings of 1 kW/ton. Nexant concluded that the one ton cooling load reduction per ComfortWise home, and the 1 kW/ton demand reduction for each ComfortWise home is conservative and appropriate for use in ComfortWise home demand savings calculations.

Power monitoring of AC units in ComfortWise homes proved infeasible, as limited resources prevented Nexant from installing monitoring equipment on a statistically valid sample of AC units in participating homes.

In order to determine a coincident diversity factor (CDF) for residential AC units in California climate zones during summer peak demand hours, Nexant compiled information from the Proctor Engineering Group (PEG) report, "Effects of Occupant Control, System Parameters, and Program Measures on Residential Air Conditioner Peak Loads," to determine the most appropriate CDF. Based on information provided in the

PEG report, and Nexant's assumption that AC units in cycling mode are on 50 percent of the time, the CDF for AC units within the peak period for all ComfortWise homes was calculated at 56.7 percent. See Table 1 below:

Table 1: Coincident Diversity Factor for Residential AC Units

Compressor Mode	Average Mode Frequency*	Compressor % On Time	Coincident Diversity Factor
Continuous Off	14.1	0%	0.0
Cycling	58.0	50%	29.0
Continuous Cycling	6.6	100%	6.6
Continuous On	21.1	100%	21.1
Total	99.9	-	56.7

* Calculated from PEG report of seven different residential CDF studies

Program Savings

Nexant applied the CDF of residential AC units during the summer peak demand period to the 4,991 ComfortWise homes that had been completed through March 31, 2003; this is shown in the equation below:

$$(4{,}991 houses) \times (1 kW / house) \times (56.7\%) = 2.830 MW$$

The program realization rate is low due to the fact that ConSol assumed demand savings of 1 kW/ home, and did not apply a coincident diversity factor to those homes that participated in the program. Nexant engineers determined that applying the CDF results in a more accurate calculation of realized peak period demand savings.

Error Analysis

Nexant conducted an error analysis of the evaluation methodology. The following identifies the equation used to calculate the demand savings for this project:

(1 kW/Home) x (Number of Homes) x (CDF) = Total kW Saved

The following errors were recognized for the above equation, and are listed with their respective error. Modeling error of 10 percent was attributed to use of Micropass. A sampling error of 2 percent was assumed for reporting (sampling) error. Error of 25 percent was assigned for use of the calculated coincident diversity factor.

Table 2: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	0.0
Modeling Error	10.0
Sampling Error	2.0
Assumptions of Stipulated Factors	25.0
Project Total Error	27.0

Program Effectiveness

Verified savings	=	2,830 kW
Reported savings	=	4,891 kW
Realization Rate	=	57.9 percent

Project Number:	SB5X3010
Project Name:	Quantum Consulting

Project Overview

Project Summary

Quantum consulting and BacGen Technology proposed to launch a three-tiered program called The Municipal Wastewater Retro-commissioning Program (MWRP). The three tiered approach included (1) fully funded implementation at 10 facilities, (2) partially funded implementation at an additional 10 facilities, and (3) technical assistance at 100 facilities. In total, the program was expected to attain 6 MW of peak demand reduction, for a contracted incentive amount of $1,248,390.

The program focused on small and medium size wastewater treatment facilities (flows of 0-5 MGD). Specific measures depend on the type of wastewater treatment process at a given plant. However, most measures encountered during Nexant's M&V activities were aimed at reducing blower motor energy consumption by monitoring dissolved oxygen (DO) levels and controlling the blower motors (via variable frequency drives or inlet guide vanes) to maintain DO concentration set-points.

Key Participants

- Derrick Rebello- Principle, Quantum consulting contact
- Martin J. Shain – President, BacGen Technology
- Joe Jackson- Fallbrook Waste Water Treatment Plant, facility contact for Nexant M&V activities
- Michael Fan – UC Davis Waste Water Treatment Plant, facility contact for Nexant M&V activities
- Mitri Muna – Moorpark Waste Water Treatment Plant, facility contact for Nexant M&V activities

Technology Overview

The first step in the MWRP program was to monitor dissolved oxygen (DO) concentrations over time at selected fully and partially funded implementation sites. Installation of DO sensors and a Supervisory Control and Data Acquisition (SCADA) system at each facility was required for DO levels monitoring. BacGen installed sensors and the data acquisition system. The next step was for BacGen staff to analyze the DO concentration profiles and come up with a method for (a) optimizing DO concentrations, and (b) controlling aeration equipment so that optimum DO concentrations are automatically maintained. Past studies have shown that DO concentrations are generally excessive, and therefore turndown of blower motors can be achieved with automated blower motor control.

Evaluation

Nexant's M&V plan treated projects falling in the first two tiers as *Population A* and programs falling in the third tier as *Population B*. Tiers 1 and 2 represented fully and partially implemented projects, respectively.

Nexant used a different M&V approach for each population. The goal of the M&V activities was to quantify the peak demand reduction for the two populations and use the figures to calculate a realization rate for the MWRP. Table 1 shows the results of Nexant's evaluation for the entire MWRP program:

Table 1: MWRP Program M&V Results

Total Reported Peak Load Reduction (kW)	Total Verified Peak Load Reduction (kW)	Realization Rate	Percent Error
1,345	351.6	0.261	45

Population A (Tiers 1 & 2) M&V Activities

A project list was obtained from Quantum Consulting and is shown in Table 2 below:

Table 2: Verified Projects, Population A (Tier 1 & 2)

Tier Number	Implementation Description	Installed facilities Verified	Installation in Progress
1	Fully funded aggressive implementation	6	4
2	Partially funded aggressive implementation	0	0
	Total	6	4

The M&V plan for *Population A* required pre- and post-installation measurements; therefore, only sites where installation had not already been completed could be selected for M&V activities. Of the four in-progress projects, one was on hold; Nexant therefore selected the remaining three for M&V activities. The goal of the M&V activities was to (a) verify project installation, and (b) quantify peak demand reduction resulting from each project. The projects selected for M&V activities were: UC Davis WWTF, Moorpark WWTF, and Fallbrook WWTF.

An average peak demand savings for the three facilities, along with the number of verified installed projects, was used to determine the total peak demand savings of 351.6 kW for *Population A* as follows:

$$kW_{verefied,\,population\,A}(351.6\,kW) = kW_{average\,sampled\,projects}(58.6kW)\,\text{*Number of Verified Projects}\,(6)$$

$$Where:$$

$$kW_{average\,sampled\,projects}(58.6kW) = \frac{kW_{verified-UCDavis}(30.7kW) + kW_{verified-Moorpark}(43.0kW) + kW_{verified-Fallbrook}(102.0kW)}{3}$$

Nexant inspected the three selected project sites and conducted activities to define the baseline peak power demand. Activities included:

- Instantaneous power draw measurements of blower motors using a Summit PowerSight PS3000 meter
- One week monitoring of blower motor current using Hobo 4-channel loggers and 150 amp current transducers.
- Facility staff interviews to determine baseline operation of blowers and seasonal effects on blower power draw. Seasonal effects were discussed with staff to asses how the plant would operate during the summer; adjustments to the measurements were made as required.

Installation of controls at all facilities has been delayed, and current forecasts for project installation suggest completion dates of August 2003 for all three projects. Due to the delays in project installation, Nexant and Beverly Duffy of the Energy Commission agreed to the assumption that the project would lead to a 50 percent reduction in the peak baseline power demand to quantify savings for projects in *Population A*.

Table 3 shows results of M&V efforts to date for projects from *Population A*.

Table 3: M&V Results for Population A (Tier 1 & 2)

Site	Verified Baseline Peak kW	Assumed Post Peak kW*	Peak Period Reduction kW
UC Davis	61.3	30.65	30.65
Fallbrook	86	43	43
Moorpark	204	102	102
Average	**117.1**	**58.55**	**58.55**

*Due to the fact that the projects have not been installed, Nexant has assumed that post-installation peak kW draw will equal 50 percent of the baseline peak kW.

Population B (Tier 3) M&V Activities

Nexant requested a project list for projects falling under the title of technical assistance sites (Tier 3) from Quantum. Quantum sent Nexant two sample reports, but did not send a project list for the Tier 3 sites. Quantum supplied Nexant with information on only two technical assistance (Tier 3) sites.

Table 4: Verified Projects for Population B (Tier 3)

Tier Number	Implementation Description	Installed Facilities Verified	Installation in Progress
3	Technical assistance	2	0
	Totals	2	0

The M&V plan for *Population B* required that reports be reviewed using the information therein to estimate the peak demand reduction resulting from each project. The two technical assistance sites reported were: Arvin WWTF and Sonoma Valley WWTF.

Arvin WWTF

Nexant reviewed the technical assistance report submitted to Mike Popichak, Chief Operator at the plant. Recommendations in the report included (1) a DO Monitoring & Aeration Control Strategy, and (2) a Sludge Processing Simplification. Through March 31, 2003, none of the measures recommended in the technical assistance report had been installed. Furthermore, Mike Popichak did not believe that any of the measures would be installed in the foreseeable future. Therefore, no peak demand reduction was verified for the Arvin technical assistance project.

Sonoma Valley WWTF

Nexant reviewed the technical assistance report submitted to Jim Zambenini, Chief Operator at the plant. Recommendations in the report included (1) replace diffusers, (2) DO control, and (3) shut down one aeration basin during summer. Through March 31, 2003, none of the above measures had been installed. Jim Zambenini informed Nexant that Sonoma Valley WWTF did not have plans to implement these measures in the future. Therefore, no peak demand reduction was verified for the Sonoma Valley technical assistance project.

Error Analysis

Population A Error Analysis

There are two sources of error in the quantification of peak demand savings associated with *Population A*.

Error in measuring baseline power draw was equal to 1.5 percent per PowerSight literature. Error associated with Hobo current transducers did not require quantification because the current monitoring data was only used for schedule verification. Based on a worst-case saving scenario of zero percent savings, and a best-case saving scenario of 80 percent savings, Nexant assigned a 45 percent error for the assumption that total verified savings are equal to one half of the peak period baseline power load.

Table 5: Error Analysis, Population A

Source of Uncertainty	Percent Error
Instrumentation Error	1.5
Modeling Error	0.0
Sampling Error	0.0
Assumptions of Stipulated Factors	45.0
Project Total Error	45.0

Population B Error Analysis

Currently there is no source of error for *Population B* because no verified savings are attributed to this population.

Program Effectiveness

Verified savings = 351.6 kW

Reported savings = 1,345 kW

Realization Rate = 26.1 percent

Project Number:	SB5X3012
Project Name:	BOMA of Los Angeles

Project Overview

Project Summary

The Building Owners & Management of Greater Los Angeles (BOMA of Greater Los Angeles) is a network of commercial real estate professionals that includes building owners, managers, developers, leasing professionals, medical office building managers, corporate facility managers, and asset managers. BOMA of Greater Los Angeles designed a number of demand saving measures for implementation at commercial offices, supermarkets, department stores, industrial facilities, and smaller municipalities.

The project consisted of six different measures used to achieve demand reductions during the summer peak demand period. Installation of every measure at a given site was not a requirement of the program. The six possible measures included:

- Applying window film
- Installing HID lighting controls
- Power Factor corrections
- Installing packaged HVAC and refrigeration energy management controllers
- Installing energy efficient lighting systems
- Upgrades to EMS, VSDs and HVAC systems

The total project demand reduction goals were 17 MW. With an incentive of $250/kW, the corresponding contracted incentive budget was $4.25 million. BOMA's incentive passed onto participants was $213/kW. BOMA issued the balance of the incentive, $37/kW, to CCA Management for project management and coordination services.

Key Participants

Sidney Pelston – BOMA Energy Program Coordinator

Enertech Systems – Lighting retrofit contractor

Accurate Energy – Lighting retrofit contractor

Bristol Park Industries – Manufacturer and engineering firm performing installation and commissioning of HID lighting control systems

Energy Saving Products – Engineering firm performing installation and commissioning of power correction systems

Encon International – Manufacturer and engineering firm performing installation and commissioning of package HVAC system energy recovery

V-Kool – Manufacturer and engineering firm performing installation of window film products

Halco Electric – Electrical contracting firm

Control Air – Firm handling comprehensive energy retrofits

Royal Window Film – Surveyor and installer of window film

Cal Air – Firm handling comprehensive energy retrofits

Technology Overview

Demand savings estimates and potentials detailed below are from documentation provided in BOMA's contract.

Application of window film

Conventional window films reduce solar gains by reflecting the sun's radiation. However, the visible light spectrum is also reflected, resulting in the need for additional internal lighting. The proposed window film technology is designed to block harmful ultraviolet rays and infrared radiation from the sun while allowing useful visible light to pass through. It is estimated that this technology reduces total solar heat gain by 50 percent.

Installation of HID lighting controls

This control allows lighting to reach full light level after a twenty minute warm-up period. After the warm-up period, lighting power demand is reduced by the controller, which limits the voltage input on the HID lighting systems. The estimated reduction is 20 percent of total power demand for the HID lighting.

Corrections of the electrical system power factor

Power factor corrections generate demand savings by reducing line losses. This measure was proposed for buildings with power factors below 90 percent. The power factor correction system is automatic, and continuously adjusts to provide the correct power factor for any demand condition. The estimate of savings is approximately 1 percent of the total building load.

Installation of packaged HVAC and refrigeration energy management controllers

Package unit controllers optimize the components of a HVAC system by overriding existing thermostats. The controllers prevent the HVAC system from exceeding a given temperature set-point once it is met, and prevent compressors from having unnecessarily long running cycles. A 20 percent reduction in operation of compressors has been estimated during high load periods.

Installation of energy efficient lighting systems

This measure proposed the replacement of existing T-12 magnetically ballasted lighting fixtures with T-8 electronically ballasted lighting fixtures. The expected reduction in demand was approximately 85 kW per 100,000 square feet of retrofit floor area.

Installation of energy management systems (EMS) and variable speed drives (VSDs) and upgrades of HVAC systems

Installing EMS systems can reduce the energy consumption of HVAC equipment through a variety of methods including start/stop technologies and temperature set-point optimization. Installation of VSDs on fan and pump motors reduces power demand by varying the speed of the motor to match the VSD output with the required load. While demand reductions result when equipment is constantly loaded, the greatest demand reductions for this measure occur during periods of partial loading. Since the total demand of HVAC systems varies based on the cooling load, the highest demand

reductions are during summer peak demand periods. BOMA provided no estimate of savings for this measure.

Evaluation

Monitoring and Evaluation Procedures

Approximately 71 percent of the total demand savings were due to lighting measures. Thus, the primary evaluation of claimed demand reductions was focused on this measure. The M&V plan for determining the accuracy of the claimed kW reduction consisted of an evaluation of five sites. Four lighting retrofit sites were randomly selected for inspection. An additional site was randomly selected from the remaining measures. This site included a VSD installation measure, which accounts for 5 percent of the program's claimed savings.

Lighting M&V

The M&V for the installation of energy efficient lighting fixtures consists of an in-depth evaluation of the submitted lighting schedule and monitoring of a statistically valid set of fixtures to determine the operation within the peak period. Both of these activities were performed on each site to ensure a complete assessment of the claimed demand reduction.

For each of the four sites selected, a lighting equipment (LE) table was requested from BOMA. This spreadsheet provides a breakout of the existing and proposed equipment. In addition, distinct fixture wattages are applied to determine the connected kW reduction due to the lighting retrofit.

Site inspections were conducted to evaluate the submitted fixture counts and types in the LE tables. In the evaluation process, both pre- and post-installation inspections were conducted. However, all sites may not have had a complete verification of both systems. This is due in part to the timing of the completion of the BOMA projects in correspondence with the M&V activities. An analysis of the LE Tables indicates that the retrofits consisted of one-for-one change-outs. However, slight errors were found in fixture counts. The inspection results indicated that the LE Tables were within reasonable accuracy (±5 percent of the connected kW).

The fixture wattages included in the LE Tables were verified using a Standard Table of Fixture Wattages used in California's State-wide Performance Contracting Programs. The wattage table consists of a set of unique lamp and ballast combinations. Variations in factors such as efficacy and ballast factor ranges result in unique fixture codes. Each combination has an associated wattage that is determined based on an average of several different manufacturer specifications. For the purposes of this evaluation, the wattage table was only used as a guide to assess the reasonableness of the submitted wattages. It was assumed that the submitted wattages reference actual specification sheets from specific manufacturers.

While the LE Table provides a thorough breakout of the equipment, the necessary information to assign exact Standard Table fixture codes is not always represented. Therefore, in some cases, exact fixture codes could not be assigned. Whenever this occurred, the claimed wattages were verified to be in a range of wattages for similar fixture codes.

Monitoring of operating hours was conducted on a statistically valid set of fixtures. A precision-confidence level of 80/20 was used to determine the number of fixtures that would be monitored at each site. For an infinite population, this results in eleven (11) total points. Thus, twelve (12) points were monitored to account for the possibility of logger malfunction. All obtained data was used in the analysis for each site. The fixtures were randomly selected with a random number generator function. Since it is assumed that, in general, the usage groups with the largest demand savings will consist of the most fixtures, the total fixture counts were used as the population for the random selection. This feature encompassed all different usage types.

Monitoring took place in the months of January, February and March. While this period is obviously not in the peak period, the results provide an accurate account of the operation in the summer months, as it is assumed that all inspected sites maintain similar hours of operation throughout the year during peak demand hours. The logger data was analyzed to ensure that lighting operation was not reflective of change in daylight hours but solely on the time of day. The percent on time for each logger was calculated for the Monday through Friday, 2:00 pm to 6:00 pm time period, and was multiplied by the kW saved on each circuit. Summing up the monitored kW saved and dividing by the total connected kW saved results in the coincidence factor based on a weighted average of the circuits monitored. The average of this factor for the four sites is used for the program wide coincidence factor.

Installation of HID lighting controls

Claimed savings were approximately 2.4 percent of the total BOMA Program's savings. This measure was not included in Nexant's savings analysis. Inspections were not required for this measure.

Lighting efficiency interactive factor analysis

Lighting system retrofits reduce the connected load of the lighting system, and result in a decreased internal cooling load within the retrofitted space. To account for this effect, a default interactive savings factor of 10 percent has been applied to the verified demand reduction for the program's lighting measure. This factor is consistent with the evaluation of similar program elements.

HVAC M&V and analysis

Claimed savings were approximately 13.4 percent of the total BOMA Program's savings. This measure was not included in Nexant's savings analysis. Inspections were not required for this measure.

Power factor M&V and analysis

Claimed savings are approximately 3.6 percent of the total BOMA program's savings. This measure was not included in Nexant's savings analysis. However, for this measure, inspections were conducted at three sites on February 20, 2002, to verify project installation. Automatic power factor correction capacitors (PFCCs) help facilities to reduce amperage levels and overall power demand. At the time of these inspections, each PFCC unit maintained a PF of 0.98-0.99.

VSD installation M&V and analysis

M&V activities were conducted by a third party contractor, ASW Engineering, for all HVAC measures in the BOMA Program. Nexant utilized the results from ASW Engineering to assess the reasonableness of the claimed reduction in demand. The

method used by ASW is based on manufacturer specifications, equipment performance curves and monitoring data. Nexant performed due diligence review on peak demand savings figures from ASW Engineering.

CO sensor installation M&V and analysis

Claimed savings are approximately 1.1 percent of the total BOMA program's savings. This measure was not included in Nexant's savings analysis. Inspections were not required for this measure.

Window film installation M&V and analysis

Claimed savings are approximately 6.4 percent of the total BOMA program's savings. This measure was not included in Nexant's savings analysis. However, a post-installation inspection was conducted at a Brookshire apartment high rise to verify the installation of the proposed window film. The window film had been installed at the time of inspection.

Thermal energy storage M&V and analysis

Claimed savings are approximately 0.4 percent of the total BOMA program's savings. This measure was not included in Nexant's savings analysis. Inspections were not required for this measure.

High efficiency motor M&V and analysis

Claimed savings are approximately 0.2 percent of the total BOMA program's savings. This measure was not included in Nexant's savings analysis. Inspections were not required for this measure.

Program Savings

Lighting efficiency savings

BOMA's claimed kW savings were based on the total connected load of the baseline and retrofit lighting systems. This assumes that all lighting in each building is on during the duration of the peak period. This is not a valid assumption. It is clear that some spaces will be unoccupied and the lights will not be operating. Thus, a coincidence factor has been applied to the total lighting load reduction. This factor is based on the monitoring activity previously described. The average coincidence factor is used as the program wide coincidence factor.

BOMA did not claim any savings for interactive effects resulting from a decrease in thermal load on the building. The default interactive factor has been applied to the verified demand reduction. The table below provides a summary of the site-specific demand savings determined by Nexant.

Table 1: Summary of Program Savings and Verified Demand Savings by Site

Site	Connected kW Saved	Coincidence Factor	Actual kW Saved	Interactive Factor	Interactive kW Saved	Total kW Saved
Pomona Library	101.8	0.94	96.1	0.10	9.6	105.7
Brookshire	38.4	0.97	37.2	0.10	3.7	40.9
1111 Broadway	105.0	0.92	96.4	0.10	9.6	106.0
Hookston Square	112.8	0.72	80.9	0.10	8.1	88.9
Program	**11,644**	**0.89**	**10,328.2**	**0.10**	**1,032.8**	**11,361.1**

VSD Savings

The management of Sony's Metreon facility retrofitted 13 air-handling units with variable speed drives. The air-handling units are located on the second and fourth floors of the facility. The previous fan-systems were constant-volume units with fan-motors varying from 7.5 to 25 horsepower.

Baseline data was taken on these fans before the variable-speed drives were installed. The total kW for all the fans was calculated to be 118.4 kW.

Management of Sony Metreon acquired data representative of the fan-system's operation after the VSDs had been installed. This data indicated that the fans were considerably oversized for the cooling loads of the structure, in that these fans are now running at the programmed minimum speed of 50 percent during the peak demand period. The energy and demand savings associated with this speed reduction are quite significant, as the power required to operate a fan at one-half speed is only one-eighth of that required at full speed. Post-installation data received from the Sony Metreon in San Francisco included data from September 20, which showed an outside air temperature of 85.9 degrees at one o'clock in the afternoon. The data indicated that every one of the fans was operating at the minimum 50 percent speed at that time.

ASW Engineering calculated the total kW demand reduction for VSD-equipped fans at the Sony Metreon. ASW Engineering concluded that conservatively placing the average speed of the fans during the on-peak period at two-thirds (66.7 percent) speed, an average demand savings of (1-.296) or 70 percent results. The average demand reduction for the facility then is equal to 70 percent of the baseline peak fan load, or 83.3 kW. The value of 0.296 is derived from the relationship between motor speed and motor load.

BOMA's claimed savings for this project are based on ASW Engineering's demand reduction calculations. Nexant reviewed, and approved, all VSD demand reduction and engineering calculations made by ASW Engineering. As a result, the reported peak period demand reduction for the VSDs measure is identical to Nexant's verified savings figure.

Program Savings

The following table provides a measure specific summary of the claimed and verified savings.

Table 2: Summary of Program Savings by Measure

Measure	Claimed Savings (kW)**	Verified Savings (kW)
Lighting Efficiency	11,644	11,361
HID Lighting*	409	409
Power Factor*	610	610
HVAC*	2,287	2,287
VSD	713	713
CO Sensors*	181	181
Window Film*	1,087	1,087
Thermal Energy Storage*	65	65
High Efficiency Motors*	26	26
Total	17,022	16,739

* Formal evaluation of the claimed savings was not done for this measure. In certain cases, inspections were conducted to verify program participation and installation of proposed equipment.

** "Claimed Savings" are based on activity reports prepared by BOMA and submitted to the ENERGY COMMISSION and Nexant.

Error Analysis

Assumption and sampling error for non-lighting measures is high due to the extensive number of measures that could not be directly inspected by Nexant for formal evaluation. Table 3 below details project error.

Table 3: Error Analysis

Source of Uncertainty	Lighting	Other
Instrumentation Error	5.0	2.0
Modeling Error	5.0	1.0
Sampling Error	15.0	44.7
Assumptions of Stipulated Factors	10.0	20.0
Total Measure Error	19.4	49.0

Program Effectiveness

Verified savings = 16,739 kW

Reported savings = 14,200 kW

Realization Rate = 117.9 percent

Project Number:	SB5X3014
Project Name:	Proctor Engineering Group

Project Overview

Project Summary

This project consists of a systematic evaluation and upgrade of residential and small commercial AC units to improve efficiency through proper system maintenance. Specifically, savings are achieved by ensuring that AC units have proper refrigerant charge and correct airflow. The total demand savings were estimated at 26 MW, with an incentive of $5,180,000.

Key Participants

John Proctor, the president of Proctor Engineering Group (PEG), was the authorized representative listed on the grant application. Tom Downey, the Senior Project Manager, was the primary project contact that prepared the monthly status reports for the project. Mike Sims, the Field Manager, performed the training sessions for the participating contractors who serviced the HVAC units.

Technology Overview

This project focused on demand savings through proper maintenance of small packaged and unitary air-conditioning (AC) units. Savings were modeled from two types of repairs: (1) correction of refrigerant charge, and (2) correction of airflow restrictions.

PEG created a computer software program to analyze key performance parameters obtained during routine service visits. The software determined if the unit had the correct charge (refrigerant) levels and air flow settings.

Evaluation

Monitoring and Evaluation Procedures

Nexant's monitoring and evaluation consists of evaluating the data for the 21,123 AC units that were repaired as part of this program. Of the repaired units, 18,750 had refrigerant added or removed. Of the units with refrigerant adjustments, only 11,372 included both what appeared to be valid unit size and correct charge data. Therefore, 54 percent of the units that received charge adjustments had data complete enough for a quantitative demand savings analysis.

Program Savings

Nexant's savings analysis was based on PEG's assumption that all AC units had an average EER of 8. Nexant calculated the load for each analyzed unit at 8 EER using PEG's published formula for adjusting efficiency based on charge:

EER adjusted = EER 8 * EERnorm1,

Where EERnorm1 = EER at measured charge / EER at correct charge, and

Where Savings (Measured as a Percentage of Full Load) = 1 – EERnorm1.

The savings were summed for all the analyzed units, and results were extrapolated to the units that were shown as having refrigerant added or removed, but did not have enough information for full analysis. The result was an estimated savings from charge correction of 11,011 kW.

According to John Proctor, 55.5 percent of the stipulated savings for the project were due to charge correction. Based on this value and the total submitted savings for the project of 30,108 kW, the submitted savings for the charge correction totaled 16,710 kW.

Table 1: Refrigerant Charge Savings

Building Type	# Mischarged Units	Average kW Savings/Unit	Extrapolated kW Savings
Residential	6,920	0.58	4,029
Commercial	11,830	0.59	6,982

During its M&V review, Nexant noted that the formula used by PEG showed that AC units perform at peak efficiency when slightly overcharged. Therefore, if refrigerant was removed from serviced AC units to match nameplate data, efficiency would actually decrease. Nexant does not know whether PEG took this factor into account.

Nexant was not able to obtain enough quantitative test data to validate PEG's demand savings calculations for airflow correction on repaired units.

Due to the lack of quantitative test data for airflow correction, Nexant assumed that PEG's stipulated savings were correct for the remaining 44.5 percent of total submitted savings (30,108 kW). Demand savings for airflow correction are approved at 13,398 kW with high error due to the assumption that PEG's airflow correction demand savings calculations are correct. The total project error was calculated to be 55.0 percent.

PEG reported savings of 22,319 kW for commercial buildings and 7,789 kW for residential buildings. Total savings were reported as 30,108 kW.

Table 2: Submitted and Verified Savings and Realization Rates

Element	Savings (kW or %)
Verified Charge Savings	11,011
Submitted Charge Savings	16,710
Charge Realization Rate	65.9%
Submitted Flow Savings	13,398
Verified Flow Savings	13,398
Flow Realization Rate	100%
Total Verified Savings	24,409
Total Submitted Savings	30,108
Total Realization Rate	81.1%
Total Project Error	55.0%

Table 3: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	0.0
Modeling Error	0.0
Sampling Error	0.0
Assumptions of Stipulated Factors	55.0
Project Total Error	55.0

Program Effectiveness

Verified savings	=	24,409 kW
Reported savings	=	30,108 kW
Realization Rate	=	81.1 percent

Project Number:	SB5X3019
Project Name:	SCE Electrodrive

Project Overview

Project Summary

This project is an incentive program to encourage the users of battery-powered non-road vehicles, specifically golf-carts and electric forklifts, to install energy management systems (EMS) on their battery chargers. These EMS systems are capable of curtailing battery charging during peak electrical demand periods.

The contracted demand savings for the project was 8 MW at $250/kW for a total contract value of $2,000,000.

Key Participants

William West is the authorized representative for this project on the grant application. Greg Kozykoski is the Honeywell DMC contact; Honeywell assisted SCE with program administration. Richard Cromie of Southern California Edison (SCE) is the Program Manager for the project and has primary contact responsibilities. His duties include marketing the program and acting as a liaison between the customer, contractor, and Honeywell.

Customers wanting to install EMS systems chose their own various contractors. In Nexant's sample sites, VaCom Technologies and Delta Pacific Energy were the contractors.

Technology Overview

The EMS battery charger systems allow for curtailment during peak demand periods. The system electronically logs when the chargers are disabled and notes if controls have been overridden. The EMS systems can be accessed via the Internet or modem to allow SCE to periodically check whether the controls have been functioning correctly or not.

Evaluation

Monitoring and Evaluation Procedures

The M&V plan consisted of dividing the sites into two population groups, (1) golf cart sites and (2) warehouse/storage sites. In each of the two groups, baseline monitoring was performed at three randomly selected sites to determine average peak battery charger demand. At each site, Nexant compared the monitored peak period demand to the reported peak demand curtailment savings so as to develop a site-specific realization rate. Nexant then used the average realization rate for the two groups to estimate the overall demand savings for the groups and, ultimately, the project's overall realization rate.

At the request of the Energy Commission, Nexant performed additional monitoring of the warehouse/storage sites. SCE identified eight sites that had discontinued peak curtailment for the off-peak season. Nexant monitored these sites to obtain additional baseline peak period power demand data. Nexant obtained valid data for seven of the eight monitored

sites and calculated the realization rate for each site. These realization rates were combined with the three previously monitored sites to develop a more precise realization rate for the warehouse/storage group.

Program Savings

The demand savings claimed by SCE were based on savings calculations submitted by the EMS installation contractors. These savings were based on individual charger nameplate data rather than monitoring data. The total claimed savings amount was 3,149.1 kW for group 1, the golf cart group, and 5,952.8 kW for group 2, the warehouse/storage group.

In the warehouse/storage group, it appears as if most of the program participants included just enough chargers in the curtailment program to cover the cost of the EMS installation. However controls were installed on all the chargers at the site and, according to the SCE Project Manger, most of the sites curtailed all of the chargers. Therefore, Nexant assumed that the full monitored peak demands at the facility were curtailed.

Nexant determined that the average realization rate was 35.6 percent for group 1, and 27.3 percent for group 2. The corresponding verified savings were 1,120.7 kW for the golf cart group and 1,625.5 kW for the warehouse/storage group.

Error Analysis

Nexant identified three sources of error in the demand savings: (1) instrument error, (2) sampling error, and (3) assumption error.

The manufacturer guaranteed the instrumentation error to be within 3 percent of the full scale of the units. Due to the high savings claims relative to the actual energy usage of the battery charging circuits, most of the logging equipment was oversized. Most of the readings were in the range of 10 percent of the full design rating of the logging equipment. Nexant determined that this resulted in an instrumentation error of approximately 30 percent.

Nexant assumed that supply voltage and power factor of the units were constant for purposes of calculating the power from the monitored current. Nexant assumed the combined error of these two assumptions as being equal to 10 percent.

In total, 13 of 59 sites were monitored. The resulting sampling error is 2.9 percent. The resulting total error is 31.8 percent.

Table 1: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	30.0
Modeling Error	0.0
Sampling Error	2.9
Assumptions of Stipulated Factors	10.0
Project Total Error	31.8

Program Effectiveness

Verified savings	=	2,746 kW
Reported savings	=	9,260 kW
Realization Rate	=	29.7 percent

The observed realization rates for all of the monitored sites were low. Nexant believes that there are three main reasons for the low realization rates:

1. To determine the peak curtailment load, the control vendors multiplied the total charger load by a duty cycle, ranging from 21 percent to 85 percent, in the monitored sample. Based on our observations, Nexant believes that most of the estimated duty cycles were overestimated.

2. Nexant observed that at several of the sites, the savings calculations were in kVA nameplate data rather than kW. The true kW spot measurements indicate that the power factors for the chargers average 0.75. As a result, calculating power savings using kVA nameplate ratings will result in an over-estimation of savings by about one third.

3. Most of individual charger load data, including volts and amps, appears to have come from the battery charger nameplate. Nameplate data are “ideal ratings” and tend to be overestimated. It would be necessary to perform spot measurements of individual chargers to bring this nameplate data into line with the “real case” situations.

Project Number:	SB5X3029
Project Name:	Solatube

Project Overview

Project Summary

This project is to reduce California peak electrical demand by installing Solatube skylights (SolaMaster 21 inch model) in commercial office and warehouses spaces. In addition to the Solatubes, lighting controls are installed to ensure that existing lighting operates only when the additional light is needed. The total demand goal was estimated at 2.462 MW with an incentive of $596,512.

Key Participants

Solatube contracted directly with the Energy Commission to provide financial incentives to participating facilities.

Technology Overview

The addition of skylights to existing facilities helps to lessen the need for lighting. When properly located, skylights can provide sufficient natural illumination to significantly reduce the overhead lighting. Photo sensors can be added to monitor light levels and lockout the lighting when ambient conditions are adequate.

Evaluation

Monitoring and Evaluation Procedures

Solatube provided detailed peak demand savings calculations in their original application. Nexant based the verification effort on the evaluation and review of these calculations. Verified savings were based on Solatube's testing for the 21" Suspended/Hard Ceiling Solatube fixture. Solatube's testing indicated that each installed skylight provides, on average, the light output of two fixtures, each using (3) F032T8 compact fluorescent lamps.

Solatube estimated peak power savings at 0.224 kW per installed fixture installed. However, a peak power demand of 0.224 kW is not consistent with the fixture description determined by Solatube testing. From its own standard fixture wattage table, Nexant determined that two three-lamp fixtures operating with F032T8 lamps requires 87 watts per fixture, or 174 watts total. Based on Solatube's testing and Nexant's review, the value of 174 watts per installed skylight fixture is the verified peak power demand savings.

Additionally, Nexant conducted both pre-and post-installation site surveys of participating facilities. Through the writing of this report, Solatube reported that a total of 1,809 fixtures had been installed through the program.

For a total of 799 fixtures, installations were completed and rebates were issued. For a total of 1,010 fixtures, installations were completed, but rebate applications were incomplete, and rebate issuance was pending application completion and approval.

Program Savings

Program savings are calculated as:

$$(0.174kW / skylight) \times (1809 skylights) = 0.315MW$$

Error Analysis

Pursuant to the project's MV&E efforts, Table 1 describes the magnitude and nature of the error in the demand savings analysis. Due to the fact that lighting levels from the Solatube fixtures are not constant, 20 percent error has been assigned to the value of 174 watts per skylight. Reporting error was assumed to be 1 percent.

Table 1: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	0.0
Modeling Error	0.0
Sampling Error	1.0
Assumptions of Stipulated Factors	20.0
Project Total Error	20.0

Program Effectiveness

Verified savings	=	315 kW
Reported savings	=	618 kW
Realization Rate	=	51.0 percent

Project Number:	SB5XL001
Project Name:	Tenet Health Systems

Project Overview

Project Summary

This project consists of a comprehensive lighting retrofit at 32 Tenet Health Care facilities throughout California. The total demand savings estimated were 2.2 MW with an incentive of $454,576.

Key Participants

David P. Garman, Director of Engineering Services for Construction & Design, served as the project-authorized representative.

Jo Carter of JC Consulting served as the primary contact.

Randy Decker and Chris Barrette of ES Performance managed the project installation.

Technology Overview

The retrofit measure consisted of retrofitting 4-lamp 4-foot T-12 magnetic ballast lighting fixtures with 4-lamp 4-foot T-8 electronic ballast fixtures. In addition, all exit signs with two 15-watt incandescent bulbs were retrofit with a single 2.5-watt LED array.

Evaluation

Monitoring and Evaluation Procedures

The M&V plan consisted of performing pre-and post-installation inspections. Pre-installation inspections were performed at five facilities to sample baseline equipment. The inspections consisted of verifying a random sample of line items from the submitted lighting tables and comparing the equipment list to the observed equipment.

Post-installation inspections were conducted at three sites: (1) JFK Hospital in Indio, (2) the Los Alamitos Medical Center, and (3) Desert Regional Medical Center in Palm Springs. The first two locations passed the inspection. However, in the case of Desert Regional Medical Center in Palm Springs there were several failed issues: lighting schedule descriptions were vague and lacked detail, and several fixtures listed on the lighting schedule were not retrofitted.

Program Savings

Nexant did not obtain detailed savings estimates for the Desert Regional Medical Center, upon request from the participant. As a result, Nexant was not able to verify whether or not demand savings calculations included coincidence factors, correct fixture power demands, or interactive HVAC savings calculations.

Verified demand savings were based strictly on the accuracy of the verified fixture counts recorded during the post-installation inspections performed by Nexant. Based on the post-installation inspection results, JFK Hospital and Los Alamitos Medical Center were assigned a 100 percent realization rate. Due to inaccurate lighting schedules, and based on Nexant's post-installation inspection, Desert Regional Medical Center was assigned a 60 percent realization rate.

The average realization rate for all inspected sites was equal to 72.5 percent; Nexant applied the verified, sample population realization rate to the entire project population. Total verified project savings were calculated at 1.316 MW.

Error Analysis

The Desert Regional Medical Center comprised approximately 68.8 percent of the estimated savings at the three inspected sites (267.9 kW of an estimated 389.2 kW). Consequently, error associated with the verified savings is high due to erroneous and inaccurate lighting schedules and data for the lighting retrofit at the Desert Regional Medical Center. The total calculated error for the three post-installation inspection sites was 38.8 percent. The value of 38.8 percent includes all error associated with an 80 percent assumed coincident factor and a 10 percent assumed AC cooling interactive factor. There is a five percent error attributed to standard fixture wattage values. Sampling error for the project was calculated at 12.9 percent. The total cumulative project error is 41.2 percent.

Table 1: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	5.0
Modeling Error	38.8
Sampling Error	12.9
Assumptions of Stipulated Factors	0.0
Project Total Error	41.2

Program Effectiveness

Verified savings	=	1,316 kW
Reported savings	=	1,816 kW
Realization Rate	=	72.5 percent

Project Number:	SB5XL009
Project Name:	Los Angeles Valley College

Project Overview

Project Summary

The Los Angeles Valley College project included lighting and HVAC retrofits designed to reduce peak electrical demand. The total demand savings were estimated at 0.433 MW with an incentive of $108,250.

Key Participants

The Los Angeles Community College District, through a competitive process, selected CMS Viron Energy Services (Viron) to provide turnkey energy related facility improvements. In addition to the project technical analysis and implementation, Viron provided project cost and savings guarantees, and project financing assistance.

Technology Overview

The campus-wide efficiency retrofit program included three main stages: (1) a compact fluorescent lighting retrofit, (2) a thermal energy storage (TES) system and central chilled water plant, plus new boilers, and (3) direct-digital controls (DDC) system.

For this project, the existing central boiler plant was decommissioned, and the plant building was renovated to include both a chiller room and a boiler room. The previous boiler produced steam, which was piped to various campus buildings through an underground pipe system. The new boiler produces hot water. The pipes previously used for steam distribution were upgraded for chilled water distribution, and new piping was installed for hot water distribution. All pneumatic controls were converted to a central DDC system.

The retrofit included eleven buildings that had pre-existing cooling systems that were displaced by the new central chilled water plant and thermal energy storage system. There were an additional four buildings that did not previously have central cooling which are now served by the central chilled water plant. Of the buildings with pre-existing cooling, five had obsolete systems that were completely removed. The other six buildings received HVAC retrofits in 1999 and 2000, and were equipped with Trane air-cooled chillers. These newer units were left in place and can be use if the central chilled water plant fails.

In total, eighteen buildings (all large, permanent structures) were included in the central plant/DDC upgrade. For the lighting retrofit, every campus building was involved. The retrofit consisted of changing out T-12, magnetically ballasted fixtures, with T-8 electronically ballasted fixtures. In addition to the eighteen main buildings, the lighting retrofit included approximately forty bungalow-type buildings installed as temporary structures in the late 1940s; these buildings did not receive DDC or HVAC upgrades.

Evaluation

Monitoring and Evaluation Procedures

Viron provided peak demand savings estimates in their original application. Estimates were based on the Trace 700 simulation model, a comprehensive whole-building energy simulation tool designed by Trane. Nexant endorses the use of this software as an approved M&V method for calculating verified demand savings.

Pre-existing chiller systems at 10 campus buildings were inspected during a pre-installation tour of the campus. All relevant information is summarized below in Table 1:

Table 1: Pre-Installation Inspection Notes, May 9, 2001

Building Number/Name	Chiller Information
16/Math/Science	Outdoor air-cooled chiller installed 2000. Trane model #RTAA0804XL01A3DOB
15/Business/ Journalism	Outdoor air-cooled chiller installed 2000. Trane model #RTAA0804XL01A3DOB
Chemistry	Outdoor air-cooled chiller installed 2000. Trane model #RTAA0804XL01A3DOB
Physics	Outdoor air-cooled chiller installed 2000. Trane model #RTAA0704XL01A3DOB
Engineering	Outdoor air-cooled chiller installed 2000. Trane model #RTAA0904XL01A3DOB
Administration	Outdoor air-cooled chiller about 20 years old. Carrier model #30GA105400AA
12/Theater Arts	Outdoor air-cooled chiller installed 1999. Trane model #CGAFC604ACA1000000
13/Music	Served by 10 small gas-fired absorption chillers installed in 1972. Only 2 are working at this time.
18/Campus Center	Served by 30-year old Carrier centrifugal units, one in use and one for back-up
Library	Served by 6 DX split systems and several packaged units

Nexant staff completed a post-installation inspection on March 27, 2002. All pump nameplate data for the installed chiller plant is summarized below in Table 2:

Table 2: Post-Installation Pump Motors Nameplate Data

Pump Purpose	Make	Model	Horsepower	Efficiency
Condenser Water*	Baldor Super-E	EM2531T	25	94.1%
Chilled Water*	Baldor Super-E	EM2543T	50	94.5%
Glycol Circulation	Baldor Super-E	EM2535T	30	94.1%

* Have Variable-Speed Drive Motors

All compressor nameplate data is summarized below in Table 3:

Table 3: Post-Installation Chiller Compressors Nameplate Data

Compressor	Make	Model	MAWP	MDMT
1	McQuay International 41691	C3616TLYY2RA	225 psi @ 250 F	20 F @ 225 psi
2	McQuay International 41689	E3616TE2RA	180 psi @ 180 F	20 F @ 180 psi

The frame-and-plate heat exchanger was a Laval Model MX25-BFG.

Program Savings

Verified peak demand savings impacts are approved as submitted by Viron; this is based on Nexant's review and approval of the Trace simulation model. Verified peak period demand savings are equal to 433 kW.

Error Analysis

Nexant identified two sources of error for this project: (1) modeling error of 15 percent using an uncalibrated Trace 700 simulation model, and (2) 15 percent error for stipulations of unknown parameters in the Trace 700 simulation model.

Table 4: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	0.0
Modeling Error	15.0
Sampling Error	0.0
Assumptions of Stipulated Factors	15.0
Project Total Error	21.2

Program Effectiveness

Verified savings = 433 kW

Reported savings = 433 kW

Realization Rate = 100.0 percent

Project Number:	SB5XL027
Project Name:	EBMUD Wastewater

Project Overview

Project Summary

The East Bay Municipal Utility District (EBMUD) proposed to install new equipment and make modifications at their Main Wastewater Treatment Plant (MWWTP) to improve the system efficiency. The total demand savings were initially estimated at 0.224 MW, for a contracted savings of $22,400.

Key Participants

Dennis Diemer and Vince De Lange, of EBMUD, are the authorized representatives on the application form.

Technology Overview

The EBMUD Main Wastewater Treatment Plant is a high purity oxygen activated sludge treatment plant with an average flow of 80 million gallons per day (MGD). The secondary treatment process utilizes eight aeration reactor trains, each divided into four equal stages, to remove contaminants from the wastewater stream. Stages 1 and 2 are equipped with 100-hp surface aerators, which promote oxygen transfer and biological activity in the reactor trains. Typical plant operation requires six aeration reactors in service with the mixers in all four stages operating continuously.

This project included conversion of the first stage on each reactor train to an anaerobic "selector" compartment. Installation of the selector compartment was necessary to help control the growth of filamentous organisms which hinder the solids separation process in the secondary clarifiers, which are located immediately downstream of the aeration reactors. The selector compartment is anaerobic, meaning that oxygen is no longer fed to this stage for mixing with the incoming wastewater.

This project included the replacement of two 100 hp surface aerators with two 25 hp submerged mixers on reactor trains 1 and 2. The smaller mixers are designed to provide more uniform mixing and efficient oxygen transfer in the selector compartment, while requiring less power than the previous surface aerators.

Evaluation

Monitoring and Evaluation Procedures

Project savings were determined via EBMUD's reported metered demand data; consequently, the M&V effort for this project consisted of validating the accuracy of EBMUD's onsite data collection system.

Nexant installed portable Hobo data loggers on reactors #3 and #5 for a period of approximately three months. While the loggers were placed on reactors #3 and #5, the actual motor retrofits occurred at reactor trains #1 and #2; this choice was deliberate as the monitoring was performed to verify the accuracy of EBMUD's onsite data collection system, and not the demand load for any specific aeration motor. The monitored kW

power data was compared to similar data from the same period collected using EBMUD's onsite data collection system. Nexant's review of the two independently recorded data sets confirmed the accuracy and validity of EBMUD's onsite data collection system. Results of Nexant's M&V monitoring activities are presented in Table 1 below:

Table 1: Average Daily kW Power Demand, Reactor Trains 3 & 5.

	Reactor Train 3		Reactor Train 5	
Date	EBMUD DDC Average kW	HOBO Average kW	EBMUD DDC Average kW	HOBO Average kW
Daily Averages	89.7	89.1	83.9	84.0

*Monitoring was performed from September 20 to December 4, 2001.

Program Savings

Nexant's M&V efforts confirmed the reliability, validity, and accuracy, to within less than one percent, of EBMUD's data collection system and allowed approval of the reported demand savings. The verified demand savings are approved at 0.0896 MW.

Error Analysis

Due to the extremely high correlation between Nexant's power monitoring and EBMUD's data collection system, modeling error is minimal, and assumed at 5 percent. Instrumentation error of 2 percent is applied to EBMUD's data acquisition system.

Table 2: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	2.0
Modeling Error	5.0
Sampling Error	0.0
Assumptions of Stipulated Factors	0.0
Project Total Error	5.4

Program Effectiveness

Verified savings = 89.6 kW
Reported savings = 89.6 kW
Realization Rate = 100.0 percent

Project Number:	SB5XL034
Project Name:	EBMUD Aqueduct

Project Overview

Project Summary

The scope of this project included installation of a concrete weir in order to more equally distribute the hydraulic gradient on the East Bay Municipal Utility District's (EBMUD) raw water aqueduct. This weir was designed to reduce peak electricity demand from two of the three 2,500 hp rated pumps. This weir was installed next to the existing Lafayette Aqueduct #1 concrete weir. The total demand savings were reported at 2.163 MW with an incentive of $540,750.

Key Participants

Michael Wallis, of EBMUD, served as the representative on the application form. Diosdado Hernandez, EBMUD Associate Electrical Engineer, met with personnel from Nexant and the Energy Commission during the pre- and post-installation inspections.

Technology Overview

Working together, pumps and weirs maintain the desired pressure in a pipe. A pump increases the pressure mechanically, while a weir raises the pressure by creating a pressure gradient (height differential). For this project, a weir in the Lafayette Control Center was constructed so that two pumps in the Mokelumne Aqueduct could be taken off-line for June and September (the pumps remain operational in July and August). The pumps, Westinghouse 2500-hp, have an average power demand of 2 MW each.

Evaluation

Monitoring and Evaluation Procedures

EBMUD provided detailed peak demand savings calculations in their original application. Nexant's M&V efforts consisted of pre- and post-installation inspections, as well as due diligence review of the peak power savings calculations that were submitted by EBMUD.

Verified savings are based on the assumption that the new weir will reduce the need for mechanical pumping during the months of June and September, thereby allowing the two 2500-hp pumps to be shut down during those months.

Nexant also conducted pre-and post-installation site inspections to confirm the condition of existing and installed equipment. During the pre-installation inspection, Nexant verified pump-motor electrical demand based on nameplate data and utility billing data from EBMUD. Pump motor voltage and current ratings were too high for direct measurement and monitoring by Nexant staff.

Program Savings

Peak demand savings were calculated by comparing the pre-and post-installation operating conditions, meaning the difference between the two pumps operating at full

load June through September versus the two pumps operating at full load only during July and August.

Equation 1: $$kW_{AvgPeak} = \frac{(kW_{Peak}) \times (Runtime_{Peak})}{(TotalDays_{Peak})}$$

Where:

$kW_{AvgPeak}$ = average peak demand (kW)
$Runtime_{Peak}$ = number of days pumps operate during peak period (days)
$TotalDays_{Peak}$ = total number of days during peak period (days)

The number of non-holiday weekdays during peak period is 83 (June thru September). The number of non-holiday weekdays during which the two pumps operate in the post-installation case is 44 (July and August only).

Table 1: Project Statistics

	Pre-Installation	Post-Installation
Number of operating days	83 days	44 days
kW of two 2,500-hp pumps	4,080 kW	4,080 kW

Using Equation 1 above:

$$kW_{PreAvgPeak} = \frac{(4080kW) \times (83days)}{(83days)} = 4080kW$$

$$kW_{PostAvgPeak} = \frac{(4080kW) \times (44days)}{(83days)} = 2163kW$$

Verified peak demand savings are then: $4080kW - 2163kW = 1917kW$.

The above demand savings are an average for non-holiday summer weekdays, June through September. The actual observed demand savings will vary depending on the month. During the months of July and August, no peak load demand reductions occur.

However, during June and September, the actual peak load demand reduction is 4.080 MW. EBMUD's reported demand savings were based on average peak load reduction.

Error Analysis

Two sources of error were identified for this project: (1) 8 percent for the assumption that power demand for the two pump motors is constant, and (2) 15 percent for stipulation that the two pumps will be turned off in June and September.

Table 2: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	0.0
Modeling Error	8.0
Sampling Error	0.0
Assumptions of Stipulated Factors	15.0
Project Total Error	17.0

Program Effectiveness

Verified savings	=	1,917 kW
Reported savings	=	2,163 kW
Realization Rate	=	88.6 percent

Project Number:	SB5XL037
Project Name:	State Center Community College District

Project Overview

Project Summary

The State Center Community College District (SCCCD) project originally included three retrofits. These retrofits were to be installed at Fresno City College and Reedley College campuses. The planned retrofits were: (1) replacement of existing centrifugal chillers with new high efficiency air conditioning units, (2) installation of a thermal energy storage (TES) system, and (3) a lighting efficiency retrofit. The project had a contract goal of 1.333 MW, with a contracted savings of $333,250. Ultimately, State Center Community College District eliminated the TES system from its work scope.

Key Participants

Brian Speece and Carl Simms were the primary contacts for the SCCCD. CMS Viron was the contractor that performed the work associated with the retrofit. The primary point of contact at CMS Viron was Greg Coxsom.

Technology Overview

The lighting retrofit consisted of converting all fluorescent fixtures from T-12 magnetically ballasted fixtures to T-8 electronically ballasted fixtures. In addition, other incandescent lighting was replaced with compact fluorescent lighting. Exit signs were retrofitted with LED lighting fixtures.

Evaluation

Monitoring and Evaluation Procedures

Nexant's M&V efforts included lighting schedule monitoring with Hobo data loggers at the two college campuses. Nexant monitored operating hours of lighting for classrooms, hallways, private offices, and administrative offices. Annual operating hours were established for these fixtures, including operating hours during the summer peak demand period.

Nexant performed post-installation inspections to verify fixture types and quantities in various locations, including those where lighting loggers were installed. Observed lighting was compared with the retrofit lighting schedules supplied by CMS Viron in order to verify the accuracy of Viron's submitted lighting tables.

The loggers monitored light fixture operating hours during regular school session (April 18 – May 25, 2002) and summer session (May 25 to August 15, 2002). The relative number of regular session and summer session days within the summer peak period were taken into account. Lighting operating hours, as determined per monitoring results, were compiled to develop a peak demand savings coincident factor. To calculate the total summer peak demand reduction, this coincident factor was multiplied by the total change in lighting load as calculated by Nexant from the lighting equipment tables for both the Reedley and Fresno State College campuses. It was assumed that all usage groups experienced a similar peak demand savings coincident factor.

The following equations were used to calculate the realized demand savings for this project:

On-peak use (%) = Peak period on hours / Total hours during peak period

Weighted kW (%) = kW_{line} / $kW_{total\ lines\ monitored}$

$(\text{Coincident use})_{line} = (\text{On-peak use } \%)_{line} \times (\text{Weighted kW percent})_{line}$

Coincident peak use factor = $\Sigma(\text{On-peak use percent})_{line} \times (\text{Weighted kW percent})_{line}$

Realized kW = Total kW Saved x Coincident Peak Use factor

Program Savings

Based on the lighting equipment tables, peak power demand savings were calculated as 230 kW at Reedley and 460 kW at Fresno State Center. Based on monitoring results, Nexant determined a coincident use factor of 0.49 during the summer peak period. This atypically low coincident factor results from the fact that many of the retrofitted spaces were classrooms, which generally have lower coincident rates than normal office space, especially during summer months. Thus, the total realized savings during the peak period for this project are equal to 338.1 kW.

The interactive cooling effects realized from the decrease in lighting demand correspond to kW demand savings during the peak period of 33.8 kW. This number was calculated by multiplying the realized lighting peak load reduction by a default value of 10 percent for demand reductions resulting from lighting-HVAC interactive effects.

Thus, the total peak period demand savings realized by the lighting retrofit are equal to 371.9 kW.

This project also included a Phase II HVAC measure involving chiller retrofits at the City College campuses in Fresno and Reedly, California. Total demand savings for chiller retrofits at each campus were originally calculated at 390 kW in the project application submittal, based on the installation of a 350-ton chiller at City College in Fresno, and the installation of a 300-ton chiller at City College in Reedley. During follow up reporting, Nexant determined that the Reedley Phase II measure was never implemented.

Chiller peak demand savings were calculated from the difference between the baseline system efficiency (1.2 kW/ton) and the new chiller system efficiency (0.6 kW/ton). Nexant's verified peak demand savings for the Phase II HVAC measures is calculated at 210 kW.

A thermal energy storage (TES) measure was also included in the original application scope. However, the TES measure was never implemented; no peak demand savings are associated with the TES measure.

The State Center Community College District project resulted in a total verified peak demand savings of 581.9 kW.

Error Analysis

The on-peak use per fixture was determined from monitoring operating hours during a finite period. Fixture wattage error was assumed to be 5.0 percent. In addition, a 5.0 percent assumption error was incurred for extrapolating the logging period to the entire summer school operating schedule. The coincident peak use factor standard error was calculated to be 3.6

percent. Sampling error was calculated to be 9.0 percent. In addition, an extrapolation error of 20.0 percent was attributed to the uncertainty in applying the monitoring/calculation methodology to all line items associated with this project. The total error associated with this project is demonstrated below (the modeling error value of 6.2 percent was calculated from the 5.0 percent logging period error and the 3.6 percent coincident peak use factor error).

Table 1: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	5.0
Modeling Error	6.2
Sampling Error	9.0
Assumptions of Stipulated Factors	20.0
Project Total Error	23.3

Program Effectiveness

Verified savings	=	581.9 kW
Reported savings	=	480.0 kW
Realization Rate	=	121.2 percent

Project Number:	SB5XL039
Project Name:	Smart and Final, Inc.

Project Overview

Project Summary

Smart and Final, Inc. is a foodservice and warehouse grocery company with 230 stores in seven states and northern Mexico. The project submitted to the Energy Commission proposed the installation of a computer process controls (CPC) system at all of the 151 stores in California. The new control system enables the implementation of five different measures to achieve demand reductions during peak period. These measures included:

- Reduction of the total lighting by 50 percent during peak period
- Increase of space temperature set point by 4ºF during peak period
- Increase of refrigeration compressor suction temperature by 3ºF
- Installation of variable speed drives on refrigeration evaporator fans
- Use of a new control system to cycle anti-sweat heaters on freezer doors

The original contract dated March 14, 2001 included a savings goal of 5,050 kW, with an incentive of $250/kW. The contracted incentive budget was $1.26 million. The Energy Commission reviewed the demand savings estimates and found them to be too high. Subsequently the savings goal was reduced to 2,500 kW with $457,171 in incentives.

Key Participants

Don Page – Honeywell H&BC Services, conducted initial store surveys

Bill Jackson – Honeywell Project Manager, was responsible for installing control systems

Rich Rogan – Honeywell T.E.A.M. Services representative for the Pomona store

John Kosinski – Smart and Final corporate VP in charge of construction and purchasing

Ron Felix- Smart and Final maintenance supervisor

Adel Suleiman – Energy Commission

Technology Overview

Honeywell installed a control and monitoring system by Tridium Niagra and Atrium Energy. This system enabled Smart and Final to reduce and monitor their energy use. The control system has three basic parts: (1) lighting, (2) refrigeration, and (3) HVAC.

Honeywell has servers at their corporate headquarters that run the control and monitoring systems and the enterprise-wide system “front-end”, from which users can track energy use and modify system control parameters such as remote lighting and cooling set-point levels.

All control systems at each Smart & Final store were wired to an in-store Tridium/Honeywell Web central hub, which is connected to the front-end LAN (Atrium) and finally to the Internet (via Atrium software). The following is a description of each measure:

Lighting curtailment during peak period

The new Smart and Final control system has been designed to automatically turn off 50 percent of the stores' lights during the summer peak period. Honeywell has installed the required hardware so that pre-determined lighting fixtures can be turned off, for any required period of time, from the control system front-end.

Temperature setback on HVAC by 4º F during peak period

Smart and Final control system has the capability of automatically increasing the space temperature setpoint from 72 ºF to 76 ºF during the summer peak period. Honeywell installed the hardware at each store and programmed the front-end so that this occurs automatically.

Reset suction temperature on refrigeration compressors by 3ºF

Honeywell installed controls to raise the suction temperature on the refrigeration compressors so that the refrigerated-case temperatures can float up a few degrees and rely on thermal mass to save demand.

Installation of VSDs on evaporator fans

The CPC monitors the refrigeration loads and controls VSDs so that fans can modulate below 100 percent during summer peak demand periods.

Reduce anti-sweat heater load

Anti-sweat heater controls are connected to the CPC. The controls allow for cycling of the anti-sweat heaters based on a humidity reading from an installed humidistat.

Evaluation

Monitoring and Evaluation Procedures

Approximately 75 percent of project demand savings resulted from lighting and HVAC measures. The primary evaluation of the project's claimed demand reductions focused on these two measures. Nexant's M&V efforts included pre-and post-installation site inspections to determine the accuracy of the claimed kW reduction. Nexant staff verified the control system installation and constructed an EQUEST model to predict demand reduction from the lighting and HVAC measures at a typical Smart and Final Store.

Pre-installation site inspections: Nexant staff conducted pre-installation site inspections at store #329 and store #449. At the time of the pre-installation inspection, neither store had yet installed the controls described above.

Post-installation site inspections: Nexant conducted post-installation site inspections at stores #325, #301, #389, and #418. At the time of the post-installation inspection, all stores had installed the controls described above.

At store #389, summer peak demand reduction mode was simulated. Approximately 50 percent of the overhead lights, and 100 percent of the refrigerated-case lights, were turned off. In addition, the open-air freezers and coolers were also shut off. A small section of the overhead lights did not go off because of a wiring problem.

Demand Reduction Quantification:

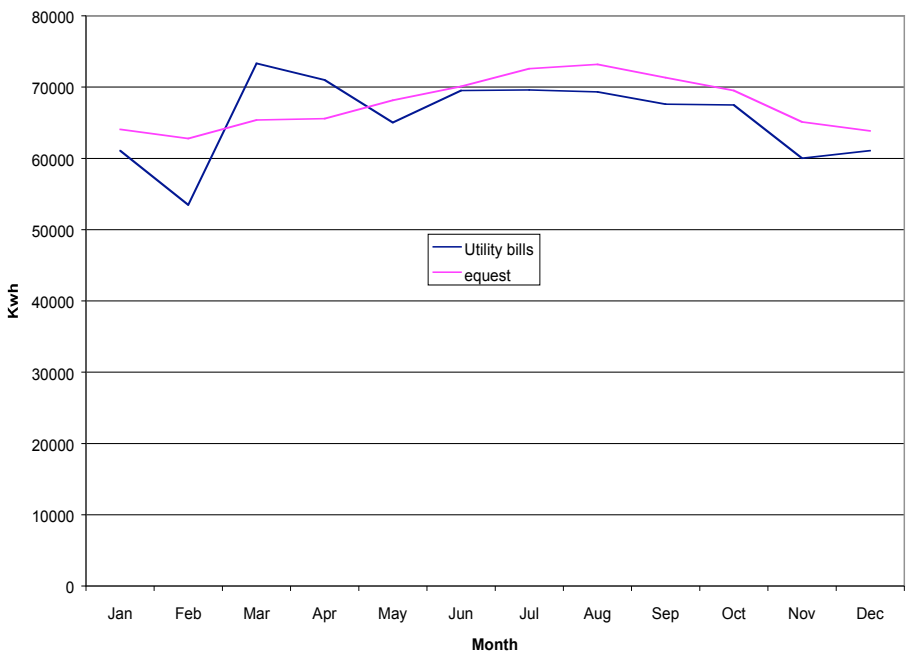
To assess the demand reduction associated with the lighting and HVAC measures, Nexant constructed an EQUEST model to predict pre-and post-retrofit peak-period energy consumption at a typical participating store. The store chosen was Store #308 in

Pomona, California. Smart & Final sent Nexant architectural prints, refrigeration data, electrical plans, and electric utility data for store #308.

EQUEST models energy efficiency measures using a graphic results display module and a simulation engine derived from the latest version of the DOE-2 building energy use simulation program. Information contained in the submitted store plans was used to run the EQUEST model. Nexant also executed a spreadsheet analysis to model energy usage parameters that could not be modeled with EQUEST.

Nexant added the results of the spreadsheet analysis to the EQUEST simulation results to arrive at total energy usage for the store. This total was compared to the store's utility bills. Parameters for both the spreadsheet model and EQUEST model were corrected to match the total energy usage as calculated from utility bills.

Figure 1: Utility Bills versus Energy Savings Simulation



Acceptable limits and criteria were used for judging model calibration, as specified in the 1999 California Non-Residential Performance Contract Program. Store #308 model error figures are in Table 1 below.

Table 1: Equest Model Calibration

	Store #308 Simulation	SPC Program Acceptable Tolerances
ERR_{month}	13.80%	15.00%
ERR_{year}	6.17%	10.00%
C_V(RMSEmonth)	6.85%	10.00%

Additional information about whole building level calibration with monthly data can be found in California's 1999 LNSPC Program Procedures Manual, page 145.

Once Nexant had calibrated the model, the predicted summer peak demands of all electrical loads were summed to arrive at a peak period power demand baseline for Store #308. EQUEST input parameters were changed to simulate the lighting measure, and the model was run to calculate peak-period post-installation electrical power demand. The lighting model input parameters were adjusted to better simulate the energy consumption of both the lighting and HVAC measures. Table 2 shows energy savings and demand savings associated with each measure as predicted by EQUEST.

Table 2: Energy & Demand Savings as Predicted by EQUEST

Arithmetic	Predicted Savings Measure	Peak Period kWh/yr Savings	Hours in Peak Period	Peak Period Reduction (kW) Store #308	Peak Period Reduction (kW) 17,500 ft^2 Store
Baseline run - Lighting measure run	Lighting	3,839	340	11.3	15.9
Lighting measure run - lighting and HVAC measure run	HVAC	4,490	340	13.2	18.6

Store #308 has a floor area of 12,447 ft^2. According to Smart and Final, the average floor area for all Smart and Final Stores is 17,500 ft2. The ratio of (17,500/12,477) was multiplied by the predicted kW reduction of each measure to arrive at a predicted kW reduction for an average size store.

Table 3: Measure Demand Savings

Measure Description	ECM #	kW reduction-proposal	kW Reduction Accepted by CEC	kW reduction Verified	Number of Stores Proposed	Number of Stores Verified	Total kW Reduction Proposed	Total kW Reduction Verified	Measure Realization Rate
50% reduction in peak period lighting	1	13.13	9.14	15.9	151	151	1379.9	2397.1	174%
4 degree set up for space temp	2	4.81	3.35	18.6	151	151	506.0	2803.6	554%
3 deg F suction temperature reset	3	0.67	0.47	0.47	151	151	70.5	70.5	100%
VFDs on evaporator fans*	4	0.67	0.47	0.47	151	151	70.5	70.5	100%
Anti sweat heaters*	5	4.50	3.13	3.13	151	151	473.1	473.1	100%
Totals		**23.8**	**16.6**	**38.5**			**2500.0**	**5814.8**	**233%**

*Not verified

Calculations used to predict demand reduction for the three non-verified measures were checked for accuracy, and information collected from pre- and post-installation site inspections was used to check assumptions in the calculations. Below is a description of calculations used, and Nexant's resulting conclusions.

Measure: 3º F reset of suction temperature on Refrigeration Compressor

Equation used in calculations for this measure:

$$kW\ reduction = \left(\frac{30\,\text{HP of Refrigeration Compressors}}{17{,}500\ ft^2\ store}\right)\cdot\left(\frac{0.746\,kW}{HP}\right)\cdot\left(3\,°F\ \text{Reset}\right)\cdot\left(\frac{1\%\,\text{decrese in Compressor kW}}{1\,°F\ \text{Reset}}\right) = 0.67\,kW\ /\ store$$

The table below compares the assumed refrigeration hp/store area used in the calculation with those stores for which Nexant verified installed refrigeration compressor horsepower.

Refrigerator Compressor hp/ store ft^2			
Metric used in Calculation	Store 308	Store 389	Store 301
0.0017	0.0047	0.0038	0.0027

Verification of percent kW reduction/ºF reset and actual 3ºF reset were not preformed. However, Nexant believes the values are conservative.

Measure: VFDs on evaporator fans

Equation used in calculations for this measure:

$$kW\ reduction = \left(\frac{4.5\ \text{HP of Evaporator Fan}}{17{,}500\ ft^2\ store}\right)\cdot\left(\frac{0.746\,kW}{HP}\right)\cdot\left(20\%\ reduction\ in\ kW\right) = 0.67\,kW\ /\ store$$

The table below compares the assumed evaporator fan hp/store area used in the calculation with those stores for which Nexant verified installed evaporator fan horsepower.

Evaporator Fan hp/ store ft^2			
Metric used in Calculation	Store 308	Store 389	Store 301
0.0003	0.0005	0.0002	0.0004

In order to achieve a 20 percent reduction in fan input power, a VSD must reduce fan airflow by 10 percent of rated maximum airflow[1]. This airflow reduction target is reasonable for refrigeration evaporator fans. During the post-installation site inspection of store #389, the rotation of fan blades were slower for evaporator fans controlled by VFDs.

Measure: Anti sweat heaters

Equation used in calculations for this measure:

$$kW\ reduction = \left(\frac{25\ \text{freezer doors}}{17{,}500\ ft^2\ store}\right)\cdot\left(\frac{3\ amps}{freezer\ door}\right)\cdot(120\ volts)\left(\frac{kW}{1000\ watts}\right)\cdot(50\%\ reduction\ in\ kW) = 4.50\ kW\ /\ store$$

The table below compares the assumed number of freezer doors/store area used in the calculation with those stores for which Nexant verified the quantity of freezer doors. The table shows that the metric used in the calculation is reasonable.

Freezer doors/ store ft^2			
Metric used in Calculation	Store 308	Store 389	Store 301
0.0014	0.0021	0.0013	0.0023

The table below compares the assumed number of amps per freezer door used in the calculation with stores for which Nexant verified the number of installed freezer doors.

Amps / door			
Metric used in Calculation	Store 308	Store 389	Store 301
3.0000	2.3440	2.5000	2.4133

Smart and Final is cycling their anti-sweat heaters. The percent reduction is equal to the duty cycle imposed on the anti-sweat heaters by the new control system.

Error analysis

Nexant performed error analyses for the HVAC and lighting measure demand savings. For each of the two measures, error was introduced into the analysis as follows: Equest error (modeling error), error in normalizing results for store #308 to the average 17,500 square foot store (sampling error), and error associated with extrapolating verified data to the 151 stores involved in the project (assumption of stipulated factors). Table 4 shows the cumulative error results associated with each measure.

1 United States Environmental Protection Agency (EPA), Energy Star Buildings Manual. EPA 430-B-95-007, July 1995, Figure 4.1.3-2, page 4-16.

Table 4: Error Analysis

Source of Uncertainty	Lighting	Non-lighting (HVAC)
Instrumentation Error	0.0	0.0
Modeling Error	13.8	13.8
Sampling Error	3.0	5.0
Assumptions of Stipulated Factors	7.0	10.0
Total Measure Error	15.8	17.8

Program Effectiveness

Verified savings = 5,814.8 kW
Reported savings = 2,188.0 kW
Realization Rate = 265.8 percent

Project Number:	SB5XL044
Project Name:	Johns Manville

Project Overview

Project Summary

Johns Manville specializes in the manufacture of building insulation and roofing materials.

This project consisted of four measures.

1. Motor downsizing. Seventeen 5-hp motors were downsized to ¾-hp.
2. Temperature controls on melter hoods. Temperature sensors that operate in conjunction with variable speed drives were placed on previously manually operated melter hoods.
3. Insulation on melter hoods. Insulation was installed on six melter hoods.
4. Compressed air demand reduction. Multiple measures allowed one 700-hp air compressor to be taken out of service.

1.394 MW in savings was initially contracted. The incentive associated with this project was $230,750.

Key Participants

Johns Manville's Willow Plant Engineering and Maintenance staff was responsible for all aspects of this project, including management, engineering, installation, and maintenance. Mr. Tom Cianelli, Plant Engineer, manages staff. Corporate Engineering and Energy Resources staff supported the group when necessary.

Technology Overview

Motor Downsizing

Seventeen vacuum motors are utilized in the packaging process. Previously, they were grossly oversized at 5 hp each. The motors power vacuums used in the packaging process. These motors were downsized to ¾ hp.

Temperature Controls on Melter Hoods

During the melting process, sand is fed into the melter by a metering auger, which is run by a 5 hp motor equipped with a VSD. The motor's VSD is currently controlled by a hand-tuned potentiometer. Inside the melter, there is a gradient of temperatures, from the bottom which is mostly molten glass to the top, where a layer of un-melted sand shields the melter from the extreme radiant energy losses that occur when the molten glass is left open to the melter's hood. Brian Warthen of Johns Manville reported that approximately five times per day in each of the six melters, the temperature and consistency of the material in the melter become such that the top layer of sand burns off, exposing the hood to the extreme heat of the molten glass. A great deal of energy is lost at these times due to radiant heat losses. If the metering augers were better able to control the amount of sand being fed into the melters at any one time, the problem would be mitigated. Consequently, the project included the installation of temperature sensors in the melter hoods. The amount of sand being fed into the melters is automatically controlled by the

VSDs, which are in turn controlled by the temperature sensors. The Energy Commission funded two melter hoods as part of this retrofit.

Insulation on Melter Hoods

Additional insulation was installed on six melter hoods.

Compressed Air Demand Reduction

This measure involved a number of sub-measures that resulted in a reduced demand for the 90-PSI rated compressed air provided by the air compressors.

The first sub-measure involved the facility's dust filter. Previously, the filter was continuously cleaned by a series of "air bars" (air bars are pipe headers with holes drilled into them where the air escapes) that delivered pulses of air to clear dust from the filter. The project included installation of a differential pressure sensor, which controls the air bars so that they operate only when needed, rather than continuously.

The next four sub-measures involved air bars that were used for some part of the manufacturing process. Previously, the air bars were supplied with air by the central compressed air system; however, they did not need the amount of air pressure provided by the central system. These air bars were converted from the central system compressed air to distributed, low-pressure, high volume compressed air supplied by small motors.

Another sub-measure involved the conveyor belt cleaning system. The system previously used high-pressure air bars to clean and dry a conveyor belt of scrap insulation on the return part of its cycle. The air bar was converted to a low-pressure air knife.

Another sub-measure involved the conversion of an air bar to a low-pressure blower system where it's needed to keep the insulation from sticking to a roller. Another air bar that kept the insulation inside the desired track on the conveyor belt was converted to a low-pressure blower system. A final air bar to blower system conversion was made where compressed air is used to trim the edges from the finished product on the production line.

Lastly, two sub-measures involved the conversion of a high-pressure air/water spray system to a low-pressure water atomizer.

Previously, there were 5 active 700-hp compressors with a 6th serving as backup. With the compressed air reductions that resulted from this project, the facility was able to go down to 4 active compressors with a 5th serving as backup.

Evaluation

Monitoring and Evaluation Procedures

Nexant's M&V efforts included two pre-installation inspections, a post-installation inspection, detailed heat transfer calculations, pre- and post-installation real time power monitoring on all air compressors, and all other measurements and calculations necessary for verifying the summer peak period power reduction for all project measures.

Motor Downsizing--Engineering calculations were employed. Seventeen motors downsized from 5-hp to ¾ hp. It was assumed that the motors operate 8760 hours per year.

Temperature Controls on Melter Hoods--This measure involved the installation of automatic variable-speed drive controllers on feed augers serving two of the facility's

electric melter hoods. Controller data was available, including melter hood temperature and feed auger material flow. Melter hood temperature data was recorded before the installation of the measure, and similar data was recorded after the installation. These two data sets were compared, and a combination of this data and engineering heat transfer calculations were used to determine savings.

Insulation on Melter Hoods—Heat transfer engineering calculations were used to calculate savings for this measure.

Compressed Air Demand Reduction--Previously there were 5 active compressors with a 6th serving as a backup. With the compressed air reductions from this project, the facility was able to go down to 4 active compressors with the 5th serving as a backup. These compressors are controlled by an Ingersoll-Rand motor control system that can be used to monitor and record operational data. The existing control system was used to monitor the compressors so that the facility's processes were not interrupted by the installation of another monitoring system. Data was recorded on a laptop computer at 15-minute intervals for one week prior to the installation of measures, and then again for one week after the installation of measures. The two data sets were compared to determine peak demand savings. Nexant performed regressions of compressor power draw against ambient air temperature and compressor airflow to better estimate savings. There are seven controllers, one for each of the six compressors and one master controller that runs the others. Data was collected from the master controller box. Each of the six compressor-controllers has 8 analog inputs. The DOS program used for monitoring could record a large number of parameters, including kW power draw, flow, temperature and pressure. Final compressed air demand reduction savings were calculated from monitored data for average kW power draw for all active air compressors, including adjustments for additional low-pressure blowers and ambient air temperatures.

Program Savings

Table 1: Contracted and Verified Savings

	Contracted Savings (kW)	Verified Savings (kW)
Motor Downsizing	29.8	53.9
Temp Controls on Melters	22.0	22.0
Insulation on Melters	300.0	300.0
Compressed Air Reduction	1041.5	547.1
Total	**1,394**	**923**

Brian Warthen of Johns Manville originally submitted the savings calculation of 923 kW for the project's peak period demand savings. John Farthing, of Air Solutions Group, assisted Brian Warthen with savings potentials and calculations.

Nexant's engineering staff worked closely with Brian Warthen, performing due diligence review in order to validate and approve all assumptions and calculations used in deriving the final demand savings figure. After careful analysis, and extended correspondence, the demand savings figure was verified and agreed upon by Brian Warthen, Nexant engineering staff and Adel Suleiman of the Energy Commission.

Error Analysis

The total project error is significant because the four main measures involved a total of twelve sub-measures which each contributed its own uncertainty. Each of the four main project measures includes related instrumentation, sampling, modeling, and assumption error.

Table 2: Error Analysis

Source of Uncertainty	Percent Error
Motor Downsizing	0.8
Temp Controls on Melters	16.0
Insulation on Melters	5.3
Compressed Air Reduction	19.1
Project Total Error	25.5

Program Effectiveness

Verified savings	=	923.0 kW
Reported savings	=	923.0 kW
Realization Rate	=	100.0 percent

Project Number:	SB5XL048
Project Name:	USA Waste of California

Project Overview

Project Summary

USA Waste of California (Waste Management (WM)) proposed to install eleven new electrical generation facilities at existing WM-operated landfills. The generators were expected to provide total peak demand reduction impacts of 14.4 MW with an accompanying incentive of $3,607,000.

Key Participants

Kent Stoddard, of Waste Management, is listed as the Authorized Representative on the IPLRP application form.

Technology Overview

The installed generation units use landfill gas (LFG) as a fuel source. The projects were designed to utilize Deutz reciprocating engines with net power capacities of 1.28 MW.

The basic configuration employed at each facility is as follows: gas is extracted from the main header of the LFG collection system and delivered to gas processing equipment. The gas processing equipment consists of a gas booster/compressor, coalescing filter to remove slugs of water, particulate filter, flow metering station, final moisture separator, condensate receiver, and condensate pumping and storage subsystem. After processing, the gas enters the engine generator set, where it is combusted. A high voltage system with transformers and switchgears steps up the 480-volt electrical output to distribution and transmission voltage.

Evaluation

Monitoring and Evaluation Procedures

The original measurement and verification plan consisted of reviewing and analyzing power production data collected via on-site monitoring systems. However, per Nexant's discussions with Frank Mazanec of WM Energy Solutions, Inc., 15-minute data monitoring was not provided because of problems with installed units, problems with the data monitoring system, and issues with well head replacements. As Nexant could not directly monitor the installed units due to their high voltages, and because the data monitoring system was beset with problems, 15-minute real power data was not available to verify demand savings during the summer peak demand period.

Program Savings

Waste Management completed installation of the proposed generation equipment at one site only, the Altamont Landfill. Two Deutz engine generator sets with rated capacities of 1.28 MW each have been installed at the Altamont Landfill site. WM reported that this installation is contributing 2.5 MW of demand reduction impacts.

Error Analysis

Since no monitoring data was available to verify the demand impacts for this project, Nexant assumed an error of 20% for the stipulation that both generation sets are operating at nameplate rated capacities during the summer peak demand period.

Table 1: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	0.0
Modeling Error	0.0
Sampling Error	0.0
Assumptions of Stipulated Factors	20.0
Project Total Error	20.0

Program Effectiveness

Verified savings	=	2,500 kW
Reported savings	=	2,500 kW
Realization Rate	=	100.0 percent

Project Number:	SB5X3002
Project Name:	Pure Power

Project Overview

Project Summary

The goal of this project was to install 3.6 MW (contract incentive = $900,000) of electrical generating capacity through the installation of turbine generators using ethanol as fuel. The turbines were designed to take advantage of a substation interconnect that had previously been used for the now defunct Carver Wind Energy facility. This setup allowed the turbines to share the wind power grid interconnect facilities and infrastructure.

The project was originally submitted under the AB 970 program; however, adequate funding was not available. The Energy Commission allowed the project to be submitted and approved under the SB 5X program. The units were installed in the San Gorgonio Pass near North Palm Springs.

Key Participants

Doug Vind, the Managing Partner of Pure Power Energy Company, LLC was the authorized representative listed on the grant application, and served as the primary contact. Ralph E. Hitchcock, President of Ralph E. Hitchcock & Associates, assisted with implementation of the project, and prepared periodic status reports.

Technology Overview

The project uses turbines to produce electricity using low-grade ethanol as fuel. The turbines are approximately 20-year-old units. Seven of the nine installed generating units were manufactured by Garrett; these units have a rated nominal capacity of 560 kW. The two remaining installed units were manufactured by Solar; these units have a rated nominal capacity of 350 kW.

The low-grade ethanol is manufactured from beverage wastes, which are fermented at a facility in Rancho Cucamonga. Originally, the participant had planned to install some of the units at the fermentation facility. However, city regulatory issues and a lack of a substation infrastructure prevented this.

Evaluation

Monitoring and Evaluation Procedures

The M&V plan consisted of performing pre- and post-installation inspections at Palm Springs wind farm where the turbines were installed, in order to observe the site before and after the installation of the equipment. The nine gas turbine generating units were installed at the site as of June 2002. However, due to interconnection issues raised by Southern California Edison, the project did not come online until December 31, 2002. Test runs of the turbines were conducted in May 2002 to determine the achievable power output. The rated capacity of the units is 4,620 kW. Actual testing showed that the total achievable capacity is equal to 3,460 kW.

Program Savings

The approved savings for the project were originally based on the nameplate generating capacity of twenty-four 150 kW turbines. However, the participant installed seven 560 kW turbine units and two 350 kW units rather than the proposed units. The total tested capacity of the units is equal to 3.46 MW.

The 3.46 MW demand savings figure represents an increase in available generation capacity during summer peak period hours. The units are exposed to the elements and not expected to run on a permanent basis. In addition, for full facility operation at the test-demonstrated 3.46 MW, the facility requires approximately 850 gallons of ethanol per hour. Continuous operation at full load during summer peak demand hours requires at least one truck delivery of ethanol per day.

Error Analysis

Sources of error in the estimation of the demand savings for this project are instrumentation error and assumption error. Revenue electrical meters on the substation serving the generators were used to determine generation capacity. Error inherent in the electric meters is equal to 2 percent.

Assumption error included the consistency of turbine power production over a period of several hours. Nexant assumed that the facility would be able to simultaneously provided power from all nine generators, with rapid start up times, during summer peak periods and without downtime for maintenance. Nexant assumed the aggregate of these errors to be 20 percent. The resulting total error for the project is 20.1 percent.

Table 1: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	2.0
Modeling Error	0.0
Sampling Error	0.0
Assumptions of Stipulated Factors	20.0
Project Total Error	20.1

Program Effectiveness

Verified savings	=	3,460 kW
Reported savings	=	3,600 kW
Realization Rate	=	96.1 percent

Project Number:	Energy Commission 0011
Project Name:	Pilgrim Towers East

Project Overview

Project Summary

Pilgrim Towers East is an 8-story senior citizens apartment complex with meeting rooms and activity areas on the ground floor. This project involved lighting efficiency retrofits in the common areas (hallways and meeting rooms), and application of window tinting film on the west-facing side of the building. Total demand savings for the project were estimated in the application as 34.4 kW with 19.0 kW attributable to the lighting portion, and the remaining 15.4 kW for the window film. The grant was expected to be $9,750.

Key Participants

Pilgrim Towers, as the participant, referred to the LA area BOMA group for technical assistance and proposed vendor selection. Through BOMA, ASW Engineering was consulted in order to determine demand savings calculations for the window tint film. The actual tint vendor was not identified. BOMA also introduced Amtech Lighting Services as the lighting vendor and the source of demand savings calculations for the lighting retrofit portion of the project.

Technology Overview

Pre-existing T-12 fluorescent lamps, operating with conventional electro-magnetic ballasts, were removed and replaced with new high-efficiency electronically ballasted T-8 lamps on a lamp-for-lamp basis. Pre-existing incandescent *Exit* signs were also removed and replaced with LED *Exit* signs. Large sliding glass doors and other windows mounted on each apartment on the west side of the building were coated with a tint film called V-Kool. V-Kool is designed to reduce the effects of solar heat gain and its subsequent demands on centralized HVAC systems.

Evaluation

Monitoring and Evaluation Procedures

The lighting system was evaluated by performing both pre- and post-installation site inspections to verify both fixture quantities and the configurations of lamps and ballasts described in the audit. As the lighting is operated in common area hallways that lack any natural light, the stated 24-hour per day operational schedule was readily endorsed without need of monitoring. Tint film application was verified at the post-installation site inspection, as was the gross square footage of affected windows. These figures were compared with the calculations performed by ASW Engineering for accuracy and engineering precision.

Program Savings

During the course of the post-installation inspection, some inconsistencies were identified in terms of the qualitative aspects of the lighting audit. The input wattage values used for the baseline fixtures were overstated in the final draft submitted for Energy Commission review. An original copy of the lighting audit performed by Amtech's Greg Blair revealed more reasonable input wattage values based on fixture vintages and components

being utilized during the baseline period. Furthermore, the original fixture wattage values reflected current minimum efficiency standards for the relevant components. While this issue affects the baseline claimed for the lighting system's demand, the proposed retrofit configurations were not accurately identified either. While the audit indicates that the predominant fixture type (a 4 foot, 2-lamp unit) is to be retrofitted with single two-lamp ballast, the vendor instead used 4-lamp ballasts that were tandem-wired between two fixtures. This alternate wiring configuration slightly affects the post-installation lighting system demand, but was not accurately identified in the audit submitted to the Energy Commission. The ballast installed was inspected and their input wattage ratings were confirmed from the manufacturer's published specifications.

The following table summarizes the differences between the demand values claimed in the project application and those that represent the accurate values as confirmed by Nexant's M&V efforts. It should be noted that the final demand savings value claimed in the application incorporates a 0.75 coincidence factor that ultimately reduces the verified demand savings to 13.3 kW from the calculated 19.0 kW.

Table 1: Claimed and Verified Demand Savings

		Claimed in Application				As Inspected			
Fixture type	**Total fixtures**	**Watts per fixture**	**Total demand (kW)**	**Retrofit watts per fixture**	**Demand savings (kW)**	**Watts per fixture**	**Total demand (kW)**	**Retrofit watts per fixture**	**Demand savings (kW)**
F41EE	24	55	1.32	32	0.552	43	1.032	35	0.192
F42EE	297	96	28.512	51	13.365	72	21.384	50	6.534
F44EE	95	192	18.24	98	8.93	144	13.68	100	4.18
F82EE	1	172	0.172	98	0.074	123	0.123	100	0.023
IE20/2	65	40	2.6	3	2.405	40	2.6	3	2.405
Totals	**482**		**50.844**		**25.326**		**38.819**		**13.334**

A default HVAC interactive cooling effect of 10 percent was factored into the lighting retrofit demand savings. Verified lighting demand savings were calculated at 14.7 kW.

While some inaccuracies were identified in the lighting scope of the project, the window film application was consistent with the descriptions provided to the Energy Commission, and the calculations performed by ASW Engineering were sound. Subsequently, no modifications to the demand savings attributable to the window film were required; the verified demand savings are equal to 15.4 kW.

Error Analysis

The standard deviations reported for the lighting retrofit were calculated using realization rates for each different fixture configuration for the five different types of affected units. The sampling error of 3.5 percent for the lighting measure was based on a sample size of 55 from a population of 482 fixtures. The modeling error of 17.0 percent was based on the range of discrepancies between actual and claimed lighting wattage ratings for both baseline and post-retrofit fixture types. A stipulated error of 5 percent was applied for use of standard fixture wattages. A stipulated error of 10 percent was applied for use of a default HVAC interactive factor.

The modeling error of 20 percent for the window film measure was based on the operational efficiency range of the HVAC equipment affected by the V-Kool window film. For lighting, 55 of 482 fixtures were sampled. For the V-Kool window film, all 2800 square feet of film surface was verified.

Table 2: Error Analysis

Source of Uncertainty	Windows	Lighting
Instrumentation Error	0.0	5.0
Modeling Error	20.0	17.0
Sampling Error	0.0	3.5
Assumptions of Stipulated Factors	0.0	10.0
Total Measure Error	20.0	20.6

Program Effectiveness

Verified savings = 30.1 kW
Reported savings = 19.0 kW
Realization Rate = 158.4 percent

Project Number:	Energy Commission 0020
Project Name:	City of Lakewood

Project Overview

Project Summary

The City of Lakewood's City Hall facility utilizes a new 80-ton chiller configured to operate as the basis of a TES (Thermal Energy Storage) system. The chiller and its accompanying cooling tower and pumps operate at night to make ice that is stored in two new outdoor tanks. The new chiller was recently installed to replace a pair of older water-cooled condensing units, and the savings identified in the application were a combination of the retrofit of the original cooling system and the conversion to the TES system. During the day (i.e. peak period hours), only the chilled water circulation pumps are operated to distribute cooling water throughout the facility. The total demand savings were estimated at 59.5 kW with an accompanying incentive of $14,875.

Key Participants

The City of Lakewood utilized internal project management resources for project implementation and relied on a consultant, Toft Wolff Farrow, Inc., for design of the construction drawings and specifications for this project. A competitive bid was conducted within the city's list of approved HVAC contractors to determine the installation vendor. The vendor's name was not provided during the inspection; however, Trane was responsible for final commissioning of the chiller after the conversion. The City of Lakewood also contracted with Xenergy, Inc. as a program administrator. Xenergy's responsibilities included estimating peak kW savings for the project.

Technology Overview

The existing water-cooled condensing units were removed, and a new central plant operating an 80-ton chiller was installed along with all auxiliary pumps and a set of ice storage tanks. During the evening hours, the chiller, a cooling tower (with a single 7.5 hp fan motor), and two condenser-water pump motors (rated at 7.5 hp each) are operated. During the day, two new 15-hp chilled water circulation pumps are operated to distribute cooling water from the ice storage tanks throughout the facility. Along with the new central plant, a new DDC control system was installed to regulate the operation of all the affected systems, including the existing air-handlers and some new VAV boxes that were also added inside the main building.

Evaluation

Monitoring and Evaluation Procedures

While the original demand savings calculations made by Toft Wolff Farrow, Inc. indicated an estimated demand reduction of 59.5 kW, a pre-installation review of the project resulted in modifications to the estimated demand reduction based on load factors attributable to the original cooling system. Xenergy was contracted to provide peak demand savings calculations. Xenergy's peak demand savings calculations were modified based on a pre-installation review of the project, and a revised demand savings figure of 48.3 kW was derived. Reports from Xenergy were reviewed, and Nexant's pre- and post-

installation site inspections confirmed the data, assumptions, and calculations used in Xenergy's peak demand savings estimates. A review of operational records and instantaneous measurements of the affected HVAC components formed the basis of Nexant's due diligence review and analysis. During Nexant's post-installation site inspection, the DDC system's terminal was consulted for operational schedules; these parameters were compared with the design submitted with the application. Ultimately, all aspects of the project were consistent with the design description and the demand savings calculations.

Program Savings

Operational parameters maintained by the site's DDC system were reviewed during the site inspections and compared with the design consultant's original study. Subsequently, the original demand reduction estimate of 59.5 kW was recalculated by Xenergy, reviewed by Nexant, and verified at 48.3 kW.

Error Analysis

Pursuant to Nexant's M&V and evaluation efforts, the following sections and accompanying table describe the magnitude and nature of error in the demand savings analysis.

Instrumentation or measurement error: Selected pre- and post-installation demand measurements for the affected pumps were recorded with the use of a Fluke Model 41B true power meter. The manufacturer's specifications identify a potential error of 1 percent for demand measurements within the relevant range.

Modeling error: An assumption regarding the loading characteristics of the baseline cooling units was used to reduce the original demand savings estimate. The loading characteristic of the original cooling units was stipulated at roughly 60 percent of full load, and this assumption is consistent with a 19 percent modeling error in terms of net kW savings attributable to the project.

Sampling error: As all the affected components were reviewed in detail as opposed to a statistical sample, no sampling error is attributed to the project.

Assumptions of stipulated factors: As the stipulated operational parameters of the new TES system were readily confirmed via the EMS program, no error for post-installation stipulated factors is appropriate.

Table 1: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	1.0
Modeling Error	19.0
Sampling Error	0.0
Assumptions of Stipulated Factors	0.0
Project Total Error	19.0

Program Effectiveness

Verified savings	=	48.3 kW
Reported savings	=	48.3 kW
Realization Rate	=	100.0 percent

Project Number:	Energy Commission 0090
Project Name:	St. Jude Medical Center

Project Overview

Project Summary

The St. Jude Medical Center is a hospital and series of accompanying support buildings that have been progressively modified and expanded since the first part of the facility was constructed in 1957. The project involves a comprehensive lighting retrofit of all the fixtures in the hospital and surrounding support structures. The demand savings identified in the application was 101 kW, with approximately 87 kW directly attributable to the lighting retrofit, and the remaining 15 kW claimed for interactive HVAC savings enabled by the lighting load reductions. The grant was expected to be $25,250.

Key Participants

St. Jude relied on Johnson Controls for all of the engineering audits and implementation of the project. Johnson Controls also performed the administration and preparation of all Energy Commission submittals and program participation activities.

Technology Overview

Existing T-12 fluorescent lamps operated with conventional electro-magnetic ballasts were removed and replaced with new high-efficiency electronic ballasts and T-8 lamps on a lamp-for-lamp basis. Existing incandescent *Exit* signs were also removed and replaced with new LED *Exit* signs. In some cases, original HID recessed interior fixtures were removed and replaced with new compact fluorescent units, and a small number of fixtures were de-lamped to operate with half the original quantity of lamps per fixture. Using lighting demand reduction values, Johnson Controls claimed interactive demand savings based on the reduction in cooling tons required from the site's central plant.

Evaluation

Monitoring and Evaluation Procedures

The lighting system was evaluated by performing both pre- and post-installation site inspections to verify both fixture quantities and the configurations of lamps and ballasts described in the audit. As the lighting is operated in common area hallways that lack any natural light, the stated 24-hour per day operational schedule was readily endorsed without need of monitoring. However, lighting operations in the patient rooms were scrutinized as part of the inspection process. Based on inspection results, the lighting inventory was analyzed in detail to segregate the demand savings attributable to the patient rooms from the total demand reduction figure. Inspections revealed that patient room lighting is not operated during the peak periods of 14:00 to 18:00 hours, and demand savings attributable to these areas were deducted from the total claimed for the project.

The interactive HVAC savings calculations were also carefully scrutinized and consistency with demand savings calculations was evaluated. Observations of the areas served by the central plant revealed that the central plant does not serve many areas where lights were retrofitted; the interactive savings allocated for these areas were deducted from the total. Furthermore, the fundamental requirement of the hospital's air distribution system to utilize 100 percent outside air (to mitigate nosocomial infection proliferation) reduces the validity of the interactive savings assumptions. These factors, combined with the lack of patient room lighting during peak periods, led Nexant to conclude that demand savings attributable to the interactive HVAC effects should not be included in the total verified demand savings.

Program Savings

During the course of the post-installation inspection, some inconsistencies were identified relating to lighting project completion. Several of the more significant areas of the hospital were never completed. Fixtures representing approximately 3 percent of the total demand savings for non-patient room areas were never retrofitted, and their accompanying demand savings were deducted from the total. As previously indicated, the lighting audit was analyzed in detail in order to segregate the savings attributable to patient rooms. While a total demand savings potential of 108.75 kW was identified in the audit, 28.22 kW of lighting load is in patient rooms and other areas connected with them that do not operate during the peak demand period.

Due to the fact that three percent of the retrofit to non-patient rooms was not completed, a reduction was made to the non-patient room area demand savings of 80.53 kW, yielding the value of 78.11 kW.

In addition, Johnson Controls acknowledged the use of the Energy Commission's suggested 80 percent coincidence factor in developing its claimed demand savings for the lighting retrofit. The 80 percent coincidence factor was applied to the non-patient room areas' demand savings value of 78.11 kW, in order to derive a more accurate demand savings calculation of 62.49 kW.

As previously stated, the interactive HVAC savings assumptions did not withstand the scrutiny of inspection and were deducted in total. Based on Nexant's pre- and post-installation inspection findings and review, demand savings for the project were revised. The verified demand savings are equal to 62.49 kW.

Error Analysis

Pursuant to the project's M&V and evaluation efforts, the following sections and accompanying table describe the magnitude and nature of error in the energy savings analysis.

Instrumentation or measurement error: Nexant assumed a 5 percent error for fixture wattages from the standard wattage table.

Modeling error: Nexant assumed a 10 percent modeling error for use of the default lighting coincident factor.

Sampling error: The total population of fixtures affected by the retrofit project (the N value in the sampling error calculations) is 3389, and the sample observed during the inspection (the *n* value in the calculations) is 417. Based on the review of the lighting inventories submitted with the project documents, a comparison of estimated savings versus verified lighting savings was completed and a standard deviation value of 12.26

was calculated for the project. Using standard statistical practices, a sampling error of 0.5623 was derived for the project that incorporates a finite population multiplier in observance of the known N value of 3389.

Assumptions of stipulated factors: During the post-installation review, it was determined that the operational schedules originally submitted for the lighting systems were inaccurate. However, this inaccuracy was accounted for in Nexant's calculation of verified demand savings, and is not applicable as error associated with verified demand savings.

Table 1: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	5.0
Modeling Error	10.0
Sampling Error	56.2
Assumptions of Stipulated Factors	0.0
Project Total Error	57.3

Program Effectiveness

Verified savings	=	62.5 kW
Reported savings	=	101.4 kW
Realization Rate	=	61.6 percent

Project Number:	Energy Commission 0118
Project Name:	Southern California Water Company

Project Overview

Project Summary

The Southern California Water Company operates a series of wells throughout the region that collect potable water for sale to municipalities that do not operate internal water accumulation assets. The wells and pumps were aging, and new high-efficiency pump motors and accessory components would enable a more energy-efficient removal of the groundwater. The contracted demand savings for the proposed retrofits at 11 sites was 342.2 kW, with an accompanying incentive of $129,500.

Key Participants

The Southern California Water Co. used a combination of internal resources and a consultant, Rod Larsen, to administer the Energy Commission application process and overall project design and implementation. An independent third-party company, Pump Check, of Riverside California, was retained as a testing and verification agent to assist in the assessment of well and pump motor performance. Pump Check was responsible for pre- and post-retrofit analyses.

Technology Overview

Pre-existing pump motor efficiencies and sequences of operation were inefficient. New high-efficiency motors and VFDs with new controls were added to selected pumping fields in an effort to reduce inefficient or excessive pump operations and accompanying power demand.

Evaluation

Monitoring and Evaluation Procedures

Due to the submersed configuration of many of the affected pumps, conventional M&V activities and measurements were not possible. Nevertheless, Pump Check was retained by the Southern California Water Company as a resource with a unique inventory of measurement and analysis tools that were used to evaluate post-installation pump performance. Based on analyses performed by Pump Check's technicians for all of the affected systems, a comprehensive review was possible which yielded highly accurate results that would not have been attainable with the use of conventional testing and metering equipment. Based on the detailed measurements performed by Pump Check, revised demand savings values were derived.

Program Savings

During the course of the project, several pumping sites proved to be too costly for retrofit with the proposed systems, and the scope was modified in order to exclude these systems. Furthermore, several pumping systems achieved differing levels of demand reductions based on the analyses performed by Pump Check. The original demand reduction was estimated at 342.2 kW; however, the combination of eliminated sites and varying results yielded a total of 216 kW in savings. The following table summarizes the demand reductions for all of the affected sites.

Table 1: Estimated and Verified Pump Demand Savings

Name of Pumping Site	Pump Motor Size (hp)	Estimated Demand Savings (kW)	Verified Demand Savings (kW)	Proposed Savings Realization (%)
Hawaiian	100	96.4	54.9	57
Centralia 3	30	9.6	10	104
Compton	75	65.6	29	44
McKinley	100	18.7	45.5	243
Roseton	100	14	35.7	255
Priory	75	58.6	40.9	70
Miramonte	100	10.9	0	0
Willowbrook	75	7.6	0	0
Centralia 5	75	35.3	0	0
Massinger	75	20.6	0	0
Dace	75	4.9	0	0
Total		**342.2**	**216.0**	**63%**

Based on the detailed site inspections and analyses of the revised pumping efficiency enhancements, demand savings for the project are verified at 216 kW. Only 63 percent of *proposed* savings were realized; however, the project Realization Rate is equal to 100 percent because Nexant verified all demand savings *reported* to the Energy Commission.

Error Analysis

Pursuant to the project's M&V and evaluation efforts, the following sections and accompanying table describe the magnitude and nature of error in the demand savings analysis.

Instrumentation and measurement error: As discussed in prior sections, all measurements for the project were performed by a third-party consultant, Pump Check, using specialized instruments. A review of the testing and measurement equipment used in the analysis of the project yielded a maximum potential error of 1.5 percent for the relevant range of samples recorded.

Modeling error: Calculation methodologies utilized to estimate verified demand savings are assumed to incorporate a modeling error of 15 percent.

Sampling error: As all six of the sites that were retrofitted were analyzed in great detail, no sampling error is assigned to the project.

Assumptions of stipulated factors: Nexant assumed a 10 percent error for these demand savings consistently occurring during summer peak demand hours.

Table 2: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	1.5
Modeling Error	15.0
Sampling Error	0.0
Assumptions of Stipulated Factors	10.0
Project Total Error	18.1

Program Effectiveness

Verified savings = 216.0 kW
Reported savings = 216.0 kW
Realization Rate = 100.0 percent

Project Number:	Energy Commission 0127
Project Name:	City of Burbank

Project Overview

Project Summary

The City of Burbank operates a wastewater treatment facility that used 1986-vintage ceramic cone-type diffusers as the basis of its aeration process. Wastewater is passed through long basins, where pressurized air is injected in order to feed oxygen to microbes that break down the waste for further chemical processing. Older systems using the ceramic cones were prone to clogging and, subsequently, required more air pressure over time in order to deliver sufficient oxygen to the waste being treated. This project involved the removal of the ceramic cones and the installation of more efficient membranous diffusers. Each diffuser is a flat disk, roughly 12 inches in diameter, which is connected to the existing pressurized air-piping network. The diffusers produce more bubbles in the wastewater and do not clog in the same manner as the cones. Subsequently, the air produced by the blowers is more efficiently distributed through the wastewater, and the absence of clogged cones results in less escalation of energy usage between maintenance intervals. The Burbank facility houses four long aeration basins that were served with two 450 hp blowers and a single 300 hp unit. The blowers are driven by multi-stage motors that were previously operated manually in response to demands for oxygen within the waste flow. The new system incorporates new sensors that monitor oxygen levels in the waste, and can activate the blower motors in proportion to airflow requirements. Demand savings were estimated to be 135 kW, with an accompanying incentive of $54,500.

Key Participants

The City of Burbank used a consultant, Kennedy Jenks from Oregon, to analyze the systems and assess the savings attributable to the conversion to the new membrane diffusers. Once the appropriate diffuser supplier was identified, the City handled the procurement of the components and installation with internal personnel. The project manager, Rodney Anderson, handled the Energy Commission application process.

Technology Overview

Existing ceramic cone aeration diffusers were removed, and a new piping network was installed that enabled the new membrane diffusers to receive pressurized air from the existing blower system. The spacing and density of the diffusers was increased toward the influent side of the basins in order to optimize the oxygen transfer process. Controls were installed that regulate the operation of the blower motors, and can provide air pressure that is directly proportional to the demands for oxygen being monitored in the basins.

Evaluation

Monitoring and Evaluation Procedures

The aeration system was evaluated by performing both pre- and post-installation site inspections to verify both blower capacities and sequences of operation as described in

the application. As the blowers are operated on a continuous 24-hour basis, the stated 24-hour per day operational schedule was readily endorsed without need of monitoring. Internal monitoring equipment for the blower motors was cited as the source of demand data during the M&V process and was used to validate the original calculations submitted with the application.

Program Savings

During the course of the post-installation inspection, blower operation was confirmed. Data indicated that the single 300 hp blower was sufficient to serve the entire series of four aeration basins. Previously, one of the 450 hp units was activated during the peak hours of the day (14:00 to 18:00) in addition to one stage of the 300 hp blower motor. Further discussions with plant operations personnel revealed that since the new diffusers were installed, there has not been any need for the 450 hp blowers, and their operations logs reinforced this observation.

Demand savings estimates for the project were submitted at the non-peak level of 135 kW; however, the calculations revealed that peak operations would yield potential demand reductions of 218 kW. Observations of the post-installation operations and the analysis of data from the operable 300 hp blower indicated demand savings of 153 kW for non-peak periods, and 243 kW for peak periods, were more accurate. These demand savings values exceed the submitted calculations by 18 kW for non-peak periods and 25 kW for peak periods. Based on the detailed site inspection and analysis of the revised blower operations, demand savings for the project are verified at 153 kW.

It should be noted that The City of Burbank has contemplated modifications to the treatment standards applied to the wastewater plant. It has been suggested that a more rigorous level of treatment may be demanded of the facility in the future and the escalation of oxygenation levels in the wastewater flow may result in increased blower demands.

Error Analysis

Pursuant to the project's M&V and evaluation efforts, the following sections and accompanying table describe the magnitude and nature of error in the demand savings analysis.

Instrumentation or measurement error: Selected pre- and post-installation demand measurements for the affected blowers were recorded with the use of a Fluke Model 41B true power meter. The manufacturer's specifications identify a potential error of 1 percent for demand measurements within the relevant range.

Modeling error: Calculation methodologies utilized to estimate verified demand savings are assumed to incorporate a modeling error of 15 percent.

Sampling error: All of the affected blowers were reviewed in detail. Subsequently, no sampling error is assigned to the project.

Assumptions of stipulated factors: Nexant assumed a 10 percent error for consistent operating schedules and no use of 450 hp pumps during peak periods.

Table 1: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	1.0
Modeling Error	15.0
Sampling Error	0.0
Assumptions of Stipulated Factors	10.0
Project Total Error	18.1

Program Effectiveness

Verified savings = 153.0 kW
Reported savings = 135.0 kW
Realization Rate = 113.3 percent

Project Number:	Energy Commission 0161
Project Name:	City of Fairfield

Project Overview

Project Summary

This project included the retrofit of pre-existing T-12 magnetically ballasted fluorescent fixtures with T-8 electronically ballasted fluorescent fixtures. Additionally, incandescent lamps were replaced with compact fluorescent lamps. The project also included installation of occupancy sensors in selected spaces. The lighting retrofit was implemented at multiple city-owned facilities.

Contracted demand savings goal = 120.4 kW

Contracted incentive amount = $38,250

Key Participants

City of Fairfield – Jay Trottier, Assistant to the Public Works Director.

Lighting Technology Services, Inc. served as the lighting contractor, and was responsible for installation of all control system components, lighting fixtures, lamps, ballasts and fixture conversions.

Xenergy is listed in the grant agreement as the project administrator; responsibilities included estimating peak demand savings.

Technology Overview

T-12 magnetically ballasted fluorescent fixtures were replaced with T-8 electronically ballasted fluorescent fixtures. Additionally, occupancy sensors were installed in selected spaces. This retrofit was a citywide effort that reduced lighting energy consumption at a number of city-operated buildings. The retrofit encompassed nearly every lighting fixture in each retrofitted building.

Evaluation

Monitoring and Evaluation Procedures

Baseline lighting equipment was established through pre-installation fixture surveys. Pre-installation inspections served to verify room locations and usage area designations, the number of fixtures included in the retrofit, the number of occurrences of burned-out lamps, and the make and model numbers of existing equipment (including fixtures, lamps and ballasts). For a randomly selected sample of sites, post-installation lighting inspections were performed to verify installation of new equipment. The post-retrofit lighting fixtures were verified during the post-installation inspection, which included an equipment survey of the new equipment identical to that of the pre-installation inspection.

Data loggers were installed to determine operating hours and time-of-use during peak demand periods. Operating hours were assumed to be constant for the pre- and post-retrofit cases. Adjustments were made to reflect non-operating fixtures at all monitored

facilities, and to reflect in-session and out-of-session classroom operating hours at school sites. Where applicable, standard wattage lighting tables were used to determine baseline and post-retrofit fixture power demands. Baseline fixture power demands were based on verified equipment from the pre-installation lighting survey; baseline power demands were based on actual equipment and not on any standard performance contracting guidelines for minimum efficiency standards.

Peak demand savings realization rates for the verified lighting fixtures were applied to the participant-supplied inventory of removed and installed equipment.

Program Savings

For the post-installation inspections, Nexant chose to double the sample size while still including the original fixtures sampled in the pre-installation inspections.

Verified savings were determined by first calculating the percent difference between the reported peak power demand reduction and the verified peak power demand reduction in the sample population. The percent difference was then applied to the peak power demand reduction reported for the total population. The difference between baseline and post-installation kW represents peak power demand savings. Peak power demand savings were adjusted by a lighting coincidence factor of 85 percent. Nexant calculated this applied coincidence factor based on monitoring results from Hobo lighting data loggers, based on space types and size. A default adjustment of 10 percent was made to the demand savings figure to account for demand savings resulting from HVAC interactive effects.

Table 1: Time-of-Use Summary

Space Type Code	Percent of Spaces Monitored	Average Peak Period On-Time (from TOU Macro)	Weight
mfg	50%	95%	48%
hall	15%	50%	8%
office	20%	95%	19%
common	10%	80%	8%
restroom	5%	50%	3%
Totals	100%	Weighted Average Coincidence Peak Use Factor	85%

Table 2: City of Fairfield Lighting, Peak Period Demand Savings

Inventory Line Item	Reported Baseline	Verified Baseline	Reported Post	Verified Post
70	122	**103.7**	46	**39.1**
108	144	**122.4**	104	**100.3**
145	288	**489.6**	208	**200.6**
153	804	**683.4**	208	**143.65**
0	216	**183.6**	480	**150.45**
316	1050	**166.6**	280	**178.5**
318	120	**102**	31	**23.8**
320	230	**195.5**	156	**147.9**
478	288	**122.4**	208	**200.6**
485	432	**367.2**	177	**150.45**
497	432	**367.2**	312	**300.9**
528	72	**61.2**	52	**50.15**
538	864	**734.4**	612	**300.9**
590	1728	**979.2**	1224	**752.25**
582	1008	**856.8**	714	**100.3**
623	72	**61.2**	52	**50.15**
712	128	**108.8**	102	**95.2**
791	72	**61.2**	52	**50.15**
Sample Population (Watts)	**8070**	**5766.4**	**5018**	**3035.35**
% diff		*0.7145477*		*0.604892*
Total Population (kW)	**436.4**	**311.8**	**282.4**	**170.8**
Reported savings		***153.9***		
Verified savings		***140.9***		

The peak power demand savings were adjusted based on pre- and post-installation inspections and lighting monitoring results as follows:

Peak power demand savings without 85% coincidence factor adjustment: 165.8 kW.

Peak power demand savings with 85% coincidence factor adjustment: 140.9 kW.

Peak power demand savings with HVAC interactive adjustment: 155.0 kW.

Final Verified Savings (with coincidence factor & interactive effects): = 155.0 kW.

Error Analysis

Nexant applied 5 percent error for use of standard wattage tables. For the calculated lighting coincidence adjustment factor, Nexant assumed an error of 5 percent. Sampling error was calculated at 13.6 percent. A standard error of 10 percent was assumed for the default HVAC interactive factor.

Table 3: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	5.0
Modeling Error	5.0
Sampling Error	13.6
Assumptions of Stipulated Factors	10.0
Project Total Error	18.3

Program Effectiveness

Verified savings = 155.0 kW
Reported savings = 95.5 kW
Realization Rate = 162.3 percent

Project Number:	Energy Commission 0199
Project Name:	City of Fremont

Project Overview

Project Summary

This project consists of several separate measures designed to reduce peak power demand at two City of Fremont buildings by 124.7 kW. The Energy Commission incentive was for $37,574. The demand reduction measures included the following:

1. Utilization of Direct Digital Controls to control the packaged HVAC units and curtail demand of the units.
2. Replacement of existing packaged HVAC units with more efficient units.
3. A comprehensive lighting retrofit at one of the facilities to replace T-12 magnetically ballasted lamps with T-8 electronically ballasted lamps.

Key Participants

Martha Martinez, Project Manager for the City of Fremont, is the primary contact for this project. She replaced Sheela Dasari as the primary contact. Steve Alexander is the facilities manager who was in charge of implementing the DDC control system for the facility.

Technology Overview

The first measure consisted of curtailing the demand of rooftop HVAC units through the use of direct digital controls (DDC). The DDC system allows for the compressors on the units to be locked-out according to a preset schedule.

The second measure consisted of a simple efficiency retrofit, changing out pre-existing HVAC units with similarly sized, more efficient units. In addition, the new HVAC units use gas heating in place of electric resistance heating.

The third measure consisted of a common efficiency retrofit of T-12 magnetically ballasted lighting fixtures with T-8 electronically ballasted lighting fixtures.

Evaluation

Monitoring and Evaluation Procedures

The M&V plan consisted of performing a pre- and post-installation inspection to verify baseline and installed equipment. Short-term monitoring was performed on a sample of the HVAC units to confirm that the DDC system was operating.

During the pre-installation inspection, Nexant recorded nameplate information on the baseline HVAC units. At the time of the pre-installation inspection, the lighting retrofit had already begun and the entire population of baseline lighting fixtures had been removed from the site.

For the post-installation inspection, Nexant inspected the new HVAC equipment at the Liberty Street building. In addition, the installation of the new T-8 lighting fixtures in the

Capitol Avenue building was verified. At the time of the inspection, loggers were installed on a sample of HVAC units to determine the post-retrofit duty cycles for those HVAC units controlled with the DDC. These data loggers were later removed and analyzed to determine applicable AC unit duty cycles.

Program Savings

The HVAC curtailment savings reported to the CEC were calculated at 41.6 kW. These savings were calculated by dividing the affected HVAC units into four curtailment groups. The four groups were alternately curtailed for 15-minutes each hour. Curtailment consisted of sending a compressor disable signal to each of the appropriate HVAC units. The City of Fremont calculated their demand savings by averaging the total demand of the units in each curtailment group, and multiplying by a stipulated 80 percent duty cycle. This initial analysis did not address how the curtailment affected the overall facility-cooling load, nor did it account for fan power used during periods of curtailment.

After careful analysis, Nexant determined that, as implemented, the DDC system curtailment measure does not consistently reduce peak power demand. Although the curtailment controls limit the operation of the HVAC units to a maximum duty cycle of 75 percent, monitoring data indicated that the average peak period duty cycle of the units does not normally exceed this value. In addition, the DDC system does not control temperature set points (it only performs compressor lockout), and as a result, does not reduce the overall cooling load of the facility. Therefore, the effect of the DDC system controls is to shift the load of the individual HVAC units while not effectively reducing the total cooling load of the facility. After careful analysis, Nexant did not approve any peak demand savings for this measure.

Logging data from nine randomly selected HVAC units was recorded over a period of two weeks. The data showed duty cycles ranging from 2 percent to 61 percent. Nexant calculated the HVAC efficiency improvement peak demand savings by multiplying the full load kW reduction (77.88 kW) by the average package unit duty cycle (35.4 percent), for calculated HVAC savings of 27.6 kW.

Due to the fact that air conditioner unit duty cycles were determined from monitoring in the months of September and October, the average duty cycle for calculating peak demand savings has been normalized to summer months. Nexant calculated the average cooling degree-days for the months of June, July and August; Nexant then calculated the average cooling degree-days for the monitored months of September and October. The ratio of peak period cooling degree-days to monitoring period cooling degree-days was equal to 1.79. The average duty cycle as calculated from monitoring data was adjusted by this factor. The applied AC unit duty cycle is equal to 63.3 percent (adjusted from 35.4 percent). Cooling degree-days were based on bin data from World Climate. Data from San Jose, California, was used because it is the closest climate zone to Fremont, California. After normalizing the AC unit duty cycles, total calculated HVAC savings are equal to 49.3 kW.

Table 1: Fremont HVAC Unit Monitored Duty Cycles

Unit	Tons	Start	End	Duty Cycle
4	5	09/25/02	10/10/02	0.020
6	10	09/25/02	10/10/02	0.370
7	7	09/25/02	10/10/02	0.096
8	7	09/05/02	09/20/02	0.200
9	10	09/25/02	10/10/02	0.400
10	10	09/25/02	10/10/02	0.558
18	3	09/05/02	09/20/02	0.351
19	3	09/05/02	09/20/02	0.580
21	4	09/25/02	10/10/02	0.611
Average Duty Cycle from Monitoring				0.354
Cooling Degree-Days Normalizing Factor				1.790
Normalized Average Duty Cycle from Monitoring				0.633

For the lighting measure, because Nexant could not verify the quantity and type of the pre-installation fixtures, those fixtures were accepted as stated in the application. The 20.8 kW demand savings for the lighting project were determined by calculating the difference in the total demand of the pre- and post-installation lighting fixtures. This methodology assumes that all of the fixtures operate during peak demand periods. Based on Nexant's inspections, it was determined that the fixtures in the council chambers were not operating during peak demand periods. According to the applicant's representative, the council chambers are used primarily in the evening. Nexant estimated the peak demand savings by multiplying the calculated demand savings for the project by a default coincidence factor of 80 percent for standard office space. Nexant calculated direct lighting demand savings of 16.6 kW.

In addition to the direct savings, interactive savings resulting from the reduced cooling load from the lighting reduction were also calculated. Nexant calculated the peak demand savings resulting from interactive cooling effects based on an energy efficiency ratio (EER) of 11 and a corresponding coefficient of performance (COP) of 3.22. The interactive cooling savings were calculated at 5.1 kW. The total demand savings from the lighting measures are 21.7 kW.

Error Analysis

The savings for the lighting and HVAC measures were calculated independently, and therefore have their own respective errors.

For the HVAC measures, three sources of error in the demand savings were identified. While there was measurement error associated with instrumentation, the measured data was used only to determine the state of the unit (i.e. compressor ON/OFF); therefore, no significant error is introduced. Nexant monitoring data showed a large variation in the duty cycles of the HVAC units, resulting in a sampling error of 16.7 percent. Nexant assumed a maximum error of 20 percent in extrapolating the monitored duty cycles to all summer peak demand periods. The Air Conditioning and Refrigeration Institute (ARI) efficiency ratings used in the demand calculations were subject to a 5 percent variation error. The total HVAC error was equal to 26.5 percent.

For the lighting measures, four sources of error were identified. The fixture wattages used in the demand calculation were assumed to have a maximum error of 5 percent. Error for the ARI efficiency ratings used to determine interactive HVAC demand savings was equal to 5 percent. The default lighting coincidence factor was assumed to have a maximum error of 10 percent. Sampling error was assumed at 15 percent. The total lighting error was equal to 19.4 percent.

Table 2: Error Analysis

Source of Uncertainty	Lighting	HVAC
Instrumentation Error	5.0	0.0
Modeling Error	5.0	5.0
Sampling Error	15.0	16.7
Assumptions of Stipulated Factors	10.0	20.0
Total Measure Error	19.4	26.5

Program Effectiveness

Verified savings = 71.0 kW
Reported savings = 124.7 kW
Realization Rate = 56.9 percent

Project Number:	Energy Commission 0299
Project Name:	Ecogate

Project Overview

Project Summary

GL Veneer is a woodworking facility located in Huntington Park. As part of their operations, they require a dust-collecting system to remove the wood dust that is produced throughout the day, as residual dust poses a fire hazard at the facility.

In the base case, two100 hp fan motors ran at full capacity to keep the wood working ducts at a negative pressure in order to prevent wood dust from collecting in the ducts. In the post-installation case, a control system was installed to respond to information from sensors placed at the end of each duct that signaled when a woodworking machine was in use. One of the 100 hp motors was switched out for a new 300 hp motor; both the new 300 hp and pre-existing 100 hp motors were equipped with VFDs. With the control system in place, fan speed ramps up or down depending on the number of wood working machines in use. Demand savings result from the reduction in total required fan motor horsepower. The contracted demand savings goal was 205 kW. The incentive amount totaled $51,250.

Key Participants

Ecogate procured the contract with the Energy Commission and installed the control system at GL Veneer. Jack Sloan was the project contact at Ecogate, and Jeff Levin was the project contact at GL Veneer. Xenergy is listed in the grant agreement as the project administrator; responsibilities included estimating peak demand savings.

Technology Overview

Ecogate does not install or repair ducts. They take existing systems with large dust collectors – designed to run 100 percent on, 100 percent open – and install automated blast gates at each of the duct take-offs. A sensor is placed on each woodworking machine so that only when the machine is on and the cutting heads are working will the control system open the gate to that machine's duct. In this way, a constant negative pressure is maintained. Flash-card technology built into the system takes a snapshot of the facility conditions, including which machines are on and how much power the fan motor is using, at a user-specified interval. At each moment, the control system knows what combination of machines is on and how much airflow is being moved.

The control system can be turned off anytime in order to collect data and to simulate conditions before the equipment was in place. Doing so yielded the baseline energy consumption that was the basis for demand savings calculations.

There are 44 blast gates (22 on each duct system), and each workstation is equipped with a sensor. A central control system (the greenBOX MASTER) synthesizes all the information from all of the duct takeoffs. The greenBOX MASTER regulates the speed (power) of the dust collector fan via a PowerMASTER unit.

Evaluation

Monitoring and Evaluation Procedures

The installed system at the GL Veneer facility is an industrial system by EcoGate, which includes fan motor VSDs and controls, in addition to sensors and controls on all of the dust-producing machines in the factory. The VSD and machine-controls are coordinated by a computer that calculates the necessary pressures and CFM in the system based on the machines that are on at the time, and then controls the blast gates and VSD to meet exactly those needs, thereby reducing the overall demand and energy use of the dust-collecting system. The accompanying EcoGate monitoring system allows the user to disable the controls and take data on the system as it was before the installation of EcoGate technology for comparison to post-installation conditions.

Nexant's M&V activities included a pre-installation inspection of the GL Veneer facility on February 12, 2002. During this inspection, it was noted that two 100 hp motors were running at full load, new main ductwork was being installed, the greenBOX MASTER and PowerMASTER control systems were both mounted but not yet connected, and the re-manufactured 300 hp motor which was installed as part of the new system had the following nameplate data: IM TEFC 3-phase motor, serial #100041A, 300 hp, 1787 RPM, 460V, 328 Amp, PF=0.89, 80 F temperature rise, 94.5 percent efficiency at ¾ L/C, and 94.1 percent guaranteed efficiency.

Nexant performed a post-installation inspection on December 19, 2002 in order to verify that the proposed equipment was in place and operational, which it was. Fan energy usage data was downloaded from the greenBOX MASTER and PowerMASTER control boxes and a real power spot measurement was performed on the 300 hp motor. Data from that spot measurement is presented in Table 1 below. Nexant's post-installation inspection served two purposes: to verify that the equipment was installed and to verify the accuracy and validity of the EcoGate power savings as calculated by Xenergy.

Table 1: Post-Installation Real Power Spot Measurements and Calculations

Measured Data		Real Power Calculations		Nameplate/Given Data	
Vab	335.8	I-avg=	126.4	Sqrt 3=	1.732
Vbc	344.3	V-avg=	343.2	PF=	0.89
Vca	349.4	PF=	0.89	Efficiency=	0.94
Ia	128.3	Real kW=	66.8	kW/HP=	0.746
Ib	120.0	Rated kW=	238.0	Motor HP=	300
Ic	130.8	% Load=	28%		

Program Savings

The grant agreement project administrator, Xenergy, Inc., submitted to Nexant a summary of demand savings resulting from the EcoGate project. The data submitted was measured kW following installation. The data showed that greenBOX MASTER and PowerMASTER systems were operational by September 30, 2002. However, demand savings were calculated based on monitoring data from five weekdays during the period of October 16 to October 22, 2002. Due to start up problems, monitoring data previous to

October 16, 2002 was not useful. While this data was not collected during summer months, it was assumed that typical facility operations do not demonstrate any significant seasonal variation. EcoGate's post-installation monitoring results, as submitted by Xenergy are presented below in Table 2.

Table 2: EcoGate Post-Installation Monitoring Data

Date	Hour	300 hp Avg. kW	100 hp Avg. kW	300 hp Savings (kW)	100 hp Savings (kW)
10/16/02	14	95.9	53.7	112.2	36.3
	15	91.9	49.2	98.8	40.8
	16	0.0	0.0	0.0	0.0
	17	0.0	0.0	0.0	0.0
10/17/02	14	103.5	50.2	104.5	32.3
	15	105.5	55.1	102.5	34.9
	16	0.0	0.0	0.0	0.0
	17	0.0	0.0	0.0	0.0
10/18/02	14	8.7	4.9	8.7	10.1
	15	0.0	0.0	0.0	0.0
	16	0.0	0.0	0.0	0.0
	17	0.0	0.0	0.0	0.0
10/21/02	14	106.3	54.9	101.7	35.1
	15	2.3	4.5	15.0	3.1
	16	0.0	0.0	0.0	0.0
	17	0.0	0.0	0.0	0.0
10/22/02	14	104.0	57.7	104.0	32.3
	15	99.2	52.8	108.8	29.7
	16	20.7	14.3	31.3	8.2
	17	0.0	0.0	0.0	0.0
Average		36.9	19.9	39.4	13.1

The savings calculations presented in Table 2 were calculated by EcoGate and Xenergy as the difference between monitored post-installation kW consumption (from the greenBOX MASTER and PowerMASTER systems) and baseline peak power demand as determined by spot measurements. The baseline kW for the 100 hp motor was 90 kW due to low motor efficiency. The baseline kW for the 300 hp motor was 208 kW due to its being re-manufactured. Savings were calculated for the two duct systems separately.

Total peak demand savings for the 300 hp duct and the 100 hp duct totaled 52.5 kW. However, as the project involved an overall increase in duct horsepower from 200 hp to 400 hp, Nexant determined that the submitted peak power demand savings for the 300 hp motor overestimate actual reduction to peak power demand. Therefore, Nexant approves all the reported savings for the 100 hp motor and 1/3 of the reported savings for the 300 hp motor. This adjustment assigns peak power demand savings based on actual, not theoretical, baseline capacity. Total peak power demand savings are approved at 26.2 kW.

Error Analysis

Per Ales Litomisky at Ecogate, instrumentation error in the greenBOX MASTER system is on the order of 3 percent. A modeling error of 20 percent is also assigned, as the peak demand savings were based on only five consecutive weekdays of power monitoring.

Table 3: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	3.0
Modeling Error	20.0
Sampling Error	0.0
Assumptions of Stipulated Factors	0.0
Project Total Error	20.2

Program Effectiveness

Verified savings = 26.2 kW
Reported savings = 52.5 kW
Realization Rate = 49.9 percent

Project Number:	Energy Commission 0301
Project Name:	Fresno Chamber of Commerce

Project Overview

Project Summary

The Fresno Area Chamber of Commerce used small grant monies to run a "mini" third-party-administered program. The Chamber recruited small area businesses to participate in a lighting efficiency retrofit program, whereby the Chamber negotiated bulk rates on lighting equipment and installation for a group of small businesses. The Chamber used grant money to pay for all but a fraction of the retrofit cost. This program was unique in that it aimed to enlist a large number of historically hard-to-reach small business customers who previously did not have the capital or access to the information necessary to implement such a retrofit in their facility.

The City of Fresno originally had two applications with the Energy Commission (301 and 302). The total contracted demand savings goal for both of these applications was 243.3 kW at the Grant Agreement stage. This figure took into account not only lighting savings, but also associated savings in facility cooling loads. The incentive amount totaled $60,825.

Between the execution of the Grant Agreement and completion of the lighting retrofit, a number of project changes occurred. Some of the original program participants dropped out and were substituted with others (at the approval of Wesley Sullens of Xenergy). Also, the Fresno Chamber of Commerce ran out of time to implement both the applications it had with the Energy Commission, and so combined them into one (301). This is one reason why the final kW savings are different from the original estimates. Additionally, Fresno was penalized for completing the project late. The final kW savings figures and incentive approved by Xenergy were 243.3 kW and $68,601, respectively.

Key Participants

Fresno Chamber of Commerce contracted with Xenergy to aggregate a number of small businesses to participate in the Rapid Response program.

Technology Overview

T-12 magnetically ballasted fluorescent lamps were retrofitted with T-8 electronically ballasted fluorescent lamps. In addition to savings associated with the T-12 to T-8 lamp change out, fixtures were also delamped from 4 to 2 lamps, 3 to 2 lamps, and 2 to 1 lamp. No lighting controls were installed under this program.

Evaluation

Monitoring and Evaluation Procedures

As part of Nexant's M&V activities, pre- and post-installation site inspections were performed at a sample of retrofit sites. On February 21, 2002, Nexant staff met with Kevin Fantz, the Chamber's program administrator, and performed inspections at three

project sites. On April 10, 2002, Nexant staff met with Kevin Fantz and performed site inspections at six additional sites.

Lighting inspections were performed to verify installation of new equipment. Baseline equipment performance was established through pre-installation equipment and fixture surveys. During inspections, the following were noted: room location and usage area designation, the number of fixtures that were retrofitted, the number of occurrences of burned-out lamps, and the make and model numbers of existing equipment (including fixtures, lamps and ballasts).

The post-retrofit performance was established through the post-installation fixture surveys, which included an equipment survey of the new equipment identical to that of the pre-installation surveys. Data loggers were installed to determine operating hours during peak demand periods. Operating hours were assumed to be constant for the pre- and post-retrofit cases. Adjustments were made to reflect non-operating fixtures at all monitored facilities, and to reflect in-session and out-of-session classroom operating hours at schools sites. The applied lighting coincidence factors were determined from Nexant's data logger analysis.

Xenergy submitted baseline and post-installation lighting fixture wattages to Nexant. Nexant subsequently performed its own due diligence review for all applied fixture wattages based on Nexant's inspection findings. Nexant found that Xenergy's lighting fixture wattages were accurate. Fixture wattages were based on actual equipment, and were not based on any minimum efficiency codes or standards. Based on information submitted by Xenergy, and inspection findings at sampled sites, including calculated coincidence factors and calculated interactive HVAC demand savings, results were extrapolated to the balance of the sites based on participant-supplied inventories of removed and installed equipment.

Program Savings

Nexant calculated total savings to be 217.7 kW. See Table 1 below.

Table 1: Nexant Verified Savings

Fresno Chamber of Commerce	Pre June 1, 2002	Post June 1, 2002	Total
Lighting kW saved	***129.9***	***25.8***	***155.7***
Hourly Btu's saved	443,091	88,033	531,124
AC tons saved	36.9	7.3	44.3
Cooling savings @ 1.4 kW/ton	***51.7***	***10.3***	***62.0***
Total	***181.6***	***36.1***	***217.7***

Error Analysis

Total project error is calculated below. Standard fixture wattage tables have a stipulated maximum error of 5 percent. Error from the calculated coincidence factors was assumed to be 5 percent. A 10 percent sampling error was assumed. A 5 percent error was assumed for the efficiency ratings used to determine interactive HVAC demand savings. Total lighting error is equal to 13.2 percent.

Table 2: Error Analysis

Source of Uncertainty	Percent Error
Instrumentation Error	5.0
Modeling Error	5.0
Sampling Error	10.0
Assumptions of Stipulated Factors	5.0
Project Total Error	13.2

Program Effectiveness

Verified savings = 217.7 kW
Reported savings = 249.3 kW
Realization Rate = 87.3 percent

Lighting Efficiency Retrofit and HVAC Interactive Savings

Lighting efficiency retrofits result in a reduction to building cooling load during summer peak period hours, and therefore a reduction to chiller compressor kW power demand. Such measures also result in an increased heating load during winter months. However, as the focus of SB5X was demand reduction during summer peak demand periods, Nexant has defined HVAC interactive savings effects as marginal reductions to total cooling load resulting from lighting efficiency retrofits.

There are three main M&V options for capturing the HVAC interactive savings. These options are explained below[1]:

Option A – Stipulating the interactive savings. Calculation can be performed based on standard values of interactive savings for the climate and HVAC equipment type. An ASHRAE Journal article by Rundquist et al. presents an approach for calculating interactive savings. Again, as with all Option A approaches, the results may not be very accurate for the particular facility, and it may be a problem for the facility owner in a shared savings arrangement.

Option B – Meter the HVAC units before and after retrofit and calculate the savings based on the load. While capable of producing very accurate results of the interactive savings, the expense and expertise needed to perform this type of monitoring can get expensive. Monitoring equipment will need to capture a full range of outside air temperature and interior loads to extrapolate the energy use patterns throughout the year, which will require the monitoring equipment to be installed for a significant period of time on each HVAC unit. Determining building load is not a simple task, with tricky airflow measurements needed. The relative expense of this option virtually rules it out.

Option D – Construct a calibrated simulation of the facility to predict the interactive savings. Some expertise in building modeling will be required to produce a calibrated model of the facility. Additionally, lighting loads will have to be converted to watts per square foot, for each zone of the building served by a HVAC unit. This method can get expensive, but given an experienced modeler and calibrating the model to the facility's utility bills, it should produce accurate results.

For all projects, Option D proved to be financially infeasible. Whenever possible, Nexant employed Option B; meaning that metered or nameplate data from HVAC units was used to calculate interactive HVAC savings for summer peak demand periods.

If Option B was not possible, Nexant employed Option A, using a stipulated AC interactive savings default factor of 10 percent. Option A was employed when lighting retrofits involved numerous buildings and numerous HVAC systems. In these cases, Nexant was not able to accurately calculate interactive savings resulting from lighting retrofits. These projects also involved discrepancies between the areas where HVAC systems operated and the areas where retrofitted lighting systems operated. For all of the aforementioned reasons, Nexant chose to stipulate AC interactive effects for lighting efficiency retrofits where Option B was not possible.

To stipulate a parameter is to hold its value constant regardless of what the actual value is during the contract term or the life of the measure. Stipulated values must be based on reliable, traceable, and documented sources of information. Stipulating parameters that represent a small degree of uncertainty and a small part of overall savings will not increase uncertainty significantly.

[1] DETAILED GUIDELINES FOR FEMP M&V OPTION A, May 29, 2002, U.S. Department of Energy, Federal Energy Management Program. Developed for the U.S. DOE Federal Energy Management Program by Nexant and Lawrence Berkeley National Laboratory.

For all projects in which Option A was employed, Nexant applied a 10 percent default interactive HVAC savings factor. In California, typical buildings have interactive factors between 3% and 15%, depending on system type and efficiency. The primary drivers of interactive factor are chiller efficiency, HVAC system type, building size and climate zone.[1] Building cooling loads are typically highest during summer peak demand periods, meaning that associated interactive savings resulting from reduced lighting loads are most important during these peak periods. As interactive cooling factors increase with increasing ambient temperatures, interactive savings are highest during summer peak demand periods. For summer peak demand periods, Nexant concluded that 10 percent was an appropriate, and relatively conservative, default factor.

Default Lighting Coincidence Factors

The amount of demand reduction achieved by a lighting project will depend on how many of the lights are operating when the building peak demand occurs. It is unlikely that all lighting fixtures will be operating when the peak demand is set, so summing the demand reduction from all affected fixtures will overstate the demand reduction seen in the utility bill. The fraction of lights operating when the peak demand is set is known as the *coincidence facto*r, which can range from 0 percent (outside lights that operate only at night) to 100 percent (continuously operating lights). It is difficult to accurately determine coincidence factors without taking time-of-use measurements.[2]

For those lighting retrofits included in the Innovative Program where time-of-use measurements were not possible due to constraints of time, budget, building size, building space, and total number of buildings retrofitted, Nexant applied a stipulated coincidence factor of 80 percent. The stipulated 80 percent coincidence factor is an industry standard default for standard office space. For those lighting retrofits with sufficient time-of-use monitoring data, the applied coincidence factors were calculated using monitored data and Nexant's in-house Time-of-Use MACRO program.

[1] SCE DSM Bidding Program: Program Guidelines and Recommended Procedure, Version 4.1, Appendices Section D, Chapter 18, Default Interactive Factors, 1995.

[2] DETAILED GUIDELINES FOR FEMP M&V OPTION A, May 29, 2002 U.S. Department of Energy, Federal Energy Management Program, Developed for the U.S. DOE Federal Energy Management Program by Nexant and, Lawrence Berkeley National Laboratory.

SB 5X
Agricultural Peak Load Reduction Program
2004 Final Report
Appendices

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Section 1 Agricultural MV&E Plan

1.1 Introduction to the MV&E Plan

Senate Bill 5X (SB 5X) was enacted in April 2001 as urgency legislation in response to an imbalance in electricity supply and demand in the State. The goal of SB 5X is to reduce peak period electricity demand. The California Energy Commission (Energy Commission), acting under authority of Section 5(b) of the legislation, has developed the Agricultural Peak Load Reduction Program.

The Agricultural Peak Load Demand Program provides incentive grant payments to the agriculture industry to install energy efficient hardware or make other conservation efforts in order to reduce peak period electricity demand. Electricity demand will be measured as true kilowatts (kW).

1.2 Program Element Description

There are four categories of projects eligible for grants under this Program.

1. The purchase and installation of high-efficiency electrical equipment and other conservation efforts to achieve peak period electricity reduction for agricultural operations. Projects installed on or after January 1, 2001 can qualify for funding. Eligible projects include, but are not limited to lighting, refrigeration and other cold storage equipment, pumps and premium motors, and automated control systems.
2. The testing of agricultural water pumps and retrofit or replacement of pumps and motors to increase efficiency. Pump test grants simply require that the applicants have the pump test completed by an approved pump tester. Pump repairs may require before and after repair/retrofit pump tests by participating pump test companies to qualify for a grant.
3. The purchase and installation of advanced metering and telemetry equipment for agricultural and water pumping customers to improve load management and use demand responsiveness techniques. Projects include scheduling systems for irrigation and water pumping, and assistance to grantees to participate in other demand reduction programs.
4. The purchase and installation of equipment for the replacement or retrofit of natural gas fired equipment in order to burn an alternative fuel. Alternative fuels include, but are not limited to, in state produced “non spec” or “off spec” natural gas.

Grants in the four project categories will help buy down the capital cost of energy efficient retrofits, advanced metering, telemetry and demand controls, or retrofits of gas powered equipment to alternative fuels and are available to eligible grant recipients statewide. Grant recipients include:

- Water Agencies and Irrigation Districts engaged in the delivery of water to agricultural water users and/or removal of water from agricultural land
- Confined Animal Feeding Operations (e.g., poultry houses, hog farms, feed lots, dairies)

- Greenhouses and Nurseries
- Food processors and others handling or processing agricultural products or commodities
- Cold Storage or refrigerated warehouses used for agricultural commodities
- Agricultural and commodity non-profit organizations serving agricultural customers

The program administrators for this program element are The Center for Irrigation Technology, California State University, Fresno (CIT/CSUS, Fresno) and The Irrigation Training and Research Center, California Polytechnic State University, San Luis Obispo (ITRC/Cal Poly). The administrators are responsible for the grant application procedures for measurement and verification (M&V) as outlined in sections C and D and the program element description, http://www.energy.ca.gov/ag/DESCRIPTION.PDF. A list of grant projects accepted by program administrators is provided in Tables 2 and 3.

1.3 Measurement Verification & Evaluation Objectives

The primary objective of Nexant's MV&E efforts is to quantify a program level seasonal average peak electricity demand reduction resulting from the projects in the Agricultural Peak Load Reduction Categories 1, 2 (pump repair), and 3 (this plan uses demand or load reduction and demand or load savings interchangeably). For the Agricultural Peak Load Reduction Program, the peak period is defined as 12:00 pm to 6:00pm weekdays from June 1 to September 30, excluding holidays. The peak period demand savings identified are relative to a baseline that would have occurred without the implementation of this program element.

Nexant will perform those activities necessary to estimate peak period demand savings based on the existing program M&V requirements and procedures developed by the Energy Commission and program administrators. Nexant will complete an evaluation of the overall effectiveness of the program in achieving peak period kW reductions in categories 1, 2 (pump repair or retrofit) and 3. Nexant will also review administrators' performance in following its M&V requirements and procedures. Most Category 2 pump repair or retrofit projects will be awarded grants based on peak energy reduction. Category 4 projects will include verification that the installed equipment is functional and can be used to offset natural gas consumption. It is expected that installed equipment will be in place for at least 3 years from the date of commissioning.

Nexant will complete the program level evaluation of this element. Time and budget constraints make it impractical to directly monitor and analyze the demand reduction of the entire population of projects in categories 1, 2 (pump repair or retrofit) and 3. Therefore, Nexant will identify statistically valid samples of projects within each Category for inspection and direct monitoring where applicable. Inspection and monitoring results from these samples will allow Nexant to infer the estimated demand reductions at all sites these categories. Demand savings for each project identified through a sampling of projects will be verified through post installation monitoring and/or analysis of available data. The results of our findings will be described in reports to the Commission.

1.4 Program Administrator M&V Procedure and Assumptions

All grant recipients will submit a completed application to the program administrators that details their plan to reduce electrical demand, or in the case of Category 4 projects, lists the specifics of enabling a switch to burn an alternative fuel. The applicant identifies the existing peak period demand, the baseline, and proposes a M&V plan that is both feasible and accurate for identifying the peak period demand savings for equipment affected by the project proposal.

Administrators will complete a technical evaluation of the application to verify the accuracy of assumptions and calculations – There may be requests for more detailed monitoring or utility metering information from applicants. Baseline and post installation demand will be established by the Program Administrators, and will form the basis for the demand savings.

In all projects in Categories 1,2 (pump repair or retrofit) and 3 the baseline demand is a critical component of the eventual savings estimates. With relatively broad guidelines for determining the baseline demand for a project, any MV&E activities performed after the Program Administrators review of pre and post demands must either use a similar methodology, or recognize the differences in approach for estimating any demand savings from a project.

1.5 Summary of Program Administrators' M&V Methodology to Determine Impacts and Grant Payments

Category 1 and 3 Projects

The grant payment for a Category 1 or 3 project is based on reduced peak period electrical demand by comparing the current peak period demand and the after-project peak period demand. The Agricultural PLRP description lists two available methodologies for the applicant to estimate reduced peak period demand for Category 1 and 3 type projects. The current program description states:

Reduced electrical demand this will be determined using one of two methodologies:

Method 1

This is the methodology used in the Energy Commission's AB 970 Peak Demand Reduction Program. The peak load reduction formula is:

$kW_{reduced}$ = (System kWh Usage pre-project – System kWh Usage post-project) / 6 hours
Where:

$kW_{reduced}$ = the Reduced Electrical Demand used for calculating the grant.
System kWh Usage = consumption of kilowatt-hours of affected /system(s) during the peak period with typical or average operating conditions.

Method 2

This is based on instantaneous kW demand either measured directly or as it appears on the applicant's utility bills, and averaged over the six-hour peak period.

The simplest projects will involve situations where only one piece of equipment is connected to the service meter and the service meter is a time-of-use meter (capable of measuring loads and segmenting them by time-of-use costing periods). Thus, verification may be simply a matter of inspecting and analyzing the utility bills demand and/or energy usage before and after the project and developing an average peak kW reduction.

More complex projects can involve several types of equipment, some or all with variable operating schedules and characteristics, connected to one or more service meters. For these projects, often only a potion of the total metered demand is modified. The measurement and verification required by the administrators might include pre-installation monitoring (e.g., with a power meter for spot measurements, data loggers for demand, hours of operation, or both, or sub metering arrangement) to isolate the effects of those modifications. Engineering models that predict demand for pre- and post-project installation cases may also be the basis for demand savings calculations.

Project applicants are responsible for both accurately identifying the existing peak period demand and proposing a feasible and accurate plan for identifying the after-project peak period demand and savings for the equipment or facility affected by the project proposal. This may involve analysis of utility billing records, on-site energy audits by experienced and knowledgeable companies, or installation of specialized instrumentation. The most recent available data should be used for the application. Thus, if peak-period data is available for 2001, do not use peak-period data for 2000 unless there is a compelling reason to do so (i.e. “year 2000 data are more representative of normal operations because..”). Installing time-of-use meters may be required as a condition for project acceptance.

Category 2 Projects

Category 2 projects include grant applications to offset the cost of a pump test to determine the efficiency of the agricultural water pumping plant/s, or for making improvements to the pump and motor system to increase plant efficiency. The M&V component of Category 2 pump repair projects requires accurate measurement or documentation of energy use for the 12 months prior to or after the pump repair or retrofit so that annual energy or peak period operating hours can be determined and applied to the applicable grant methodology. There are currently 4 methods for determining the grant amount for pump repair or retrofit. In most cases M&V for these projects require pre and post-repair pump tests or field measurements to determine peak demand or energy reduction in determining the grant payment. Where an applicant has multiple water pumps on a service meter, they must propose a viable method for determining energy use for the project by providing the future or past energy use of each pump via utility metered or billing data or other verifiable spot or auxiliary metered measurements. Grants are awarded based on the following:

Pump Testing

80 percent of the cost of the test up to a maximum of $200 per standard test and up to a maximum of $250 if the test requires two transects in order to measure velocity.

Pump Repairs

There are currently four methods for calculating the incentive payment for pump repair/retrofit projects. The grant is based on one of the following methods but in no case exceeds 65 percent of the total project cost.

The first method used by CIT/CSUS, Fresno for individual agricultural business applicants involve the ratio of the pumping plant efficiency, OPE, before and after the repair/retrofit. This method requires that pump efficiency tests be performed under similar operating conditions. The grant payment is based on the following:

CATI/CSUS, Fresno Grant = \$0.10 /kWh * (kWh_{annual} – (kWh_{annual} * pre-repair OPE / post-repair OPE))

Where:

KWh_{annual} = 12 months of energy use prior to or after at the discretion of the applicant.
OPE = Operating Plant Efficiency as tested.

A second method used by ITRC/Cal Poly for water and irrigation districts and CIT/CSUS, Fresno for individual agricultural businesses also requires pump efficiency tests before and after the repair/retrofit and these tests are performed under similar operating conditions.

However, the grant calculation uses a variant of the OPE, comparing the repaired pumping plant's kWh/Acre Foot (AF) to kWh/Acre-Foot before the repair. The Cal Poly grant uses pump test information and pre-repair kW test data and prorates the grant based on calculated operating hours during the peak period. The CSUS, Fresno grant relies on an applicant's pre and post-repair pump tests and the total AF pumped over 12 months.

ITRC/Cal Poly Grant = \$0.1025 / kWh * [1 – ((post-repair kWh per AF) / (pre-repair kWh per AF))] * (total operating hours, June 1 – September 30) * (pre-repair kW)

CATI/CSUS, Fresno Grant = \$0.10 / kWh * (AF_{annual} * (pre-repair kWh per AF - post-repair kWh per AF))

Where:

AF_{annual} = acre-feet of water pumped in 12 months
kWh /AF = Kilowatt-hours required to pump an acre-foot of water through the system as determined by a pump efficiency test

Method 3

A third method used by both administrators is based on 25% of 12 months energy (kWh) following the repair/retrofit (.25 is based on a ENERGY COMMISSION assumption that a pump repair will result in increased pump efficiency).

$$\text{Grant} = \$0.10 / \text{kWh} * .25 * \text{kWh}_{annual}$$

Where:

KWh_{annual} = 12 months of energy use prior to or after at the discretion of the applicant

Method 4

The fourth method used by ITRC/Cal Poly for Water and Irrigation District applicants uses pre and post-repair measured kW and billing data to determine the grant.

ITRC/Cal Poly Grant = $300/ kW * [(total operating hours, June 1 – September 30) / 2928 total hours, June 1 – September 30)] * [(Pre-repair kW) - (Post-repair kW)].

Where:

Pre-and post-repair kW must be verified by (a) a pump company representative, (b) an authorized pump tester, (c) a registered engineer, or (d) a union electrician.

Category 4 Projects

Program Administrators, and Nexant, will conduct M&V activities for Category 4 projects that consist of observing the operation of the installed equipment. For projects in this Category the equipment must be capable of burning an alternative fuel, however quantification of actual natural gas savings are not required under the program guidelines.

Program administrators will evaluate all Category 4 project applications and perform any pre-installation verifications of existing equipment if necessary.

The Program Administrators will also evaluate post installation documentation, however any post installation fieldwork on Project 4 applications will be performed on a sampling basis by Nexant personnel. See Category 4 Sampling Plan for details on selection of sites for post installation site verification by Nexant.

1.6 Outline of Administrators M&V Procedures

The M&V activities for the agricultural program element consist of:

1. Analysis - Technical evaluation of the engineering calculations and/or review of utility bills, pre- or post-metering of loads or operational hours to verify the accuracy of assumptions and calculations.
2. Construction and commissioning of the project - Note that recipients may be required to submit monthly progress reports depending on the size of the project.
3. Verification of construction and operation by the Program Administrator.
4. For Category 1 and 3 projects payment of 50 percent of estimated incentive grant payment after completion and verification of construction and operation - Copies of all invoices, service contracts, personnel time records, and other relevant information to document final

installation of the project, will be required. Full grant payments are made for categories 2 and 4 once applicant has completed installation and provides proof of operational capability (Category 4) or required energy and pump test data (Category 2).

5. Final grant payment for Category 1 and 3 projects are made after verification of the project's actual peak period demand reduction. This generally requires one full peak period of operation (June through September) after construction and operation. Note that the total of actual grant payments may be less than the estimated grant. The basic verification process consists of establishing a *baseline,* the existing peak period demand, then verifying a post-project peak period demand.

Establishing the baseline – the existing demand can be established through:

- Historical metering data (i.e. from a Time-of-Use meter).
- An engineering model accepted by the Grant Administrator.
- Direct measurements of demand.
- Field verification of existing equipment

Post-project – post-project demand or peak energy use will be verified through electric billing or monitoring/metering equipment where appropriate. During post installation review, the program element administrators complete one of the following activities:

- Confirmation that the equipment was installed and operable for all project categories.
- Verification through field monitoring, review of utility billing, or other acceptable metering methods to verify the post installation demand or peak energy use of the equipment affected by the project

The estimated baseline or post-installation kW (or kWh for Category 2 pump repair or retrofit) for non-monitored projects may be adjusted by the program administrators as part of their M&V process and for determining the final grant payment. For example, the program administrator may find that the estimated baseline demand for a process pumping plant load assumed it operated noon to six, Mondays through Fridays, all 4 months of the June through September peak season. The administrator reviews the operating data and determines that it operated during those peak hours but only 2 months of the peak season. Based on program guidelines the baseline average demand would be reduced 50 percent. The post-installation demand (kW) may also be adjusted if a review of the post-installation peak operating season load data shows a change in load from that estimated. The verified kW (or kWh) reduction (savings) and the final grant payment would be adjusted accordingly.

1.7 Evaluation Activities

Each grant recipient submits an application from which the program administrators assure data is sent to the database administrator within two (2) weeks of receipt of application. This information will be used to, generate sample populations for the evaluation process, and establish initial demand and energy savings estimates.

Nexant will choose representative samples of projects from each Category and sub-Category usage group to conduct post installation inspections and monitoring. Among the parameters that Nexant will verify during on site post installation inspections are the following:

- Confirmation that the equipment was installed and is operable for all project categories.
- Verification through field monitoring, review of utility billing or other acceptable metering records, or field checks for engineering models to verify the post demand reduction of the installed equipment.
- Review of engineering models, assumptions, and any model calibrations used to estimate demand reductions for complex projects.

Nexant Post-Installation Monitoring

Nexant's post-installation MV&E activities will include use of techniques ranging from desk reviews of utility billing for single load easily verified measures, to short or long-term monitoring at sites with multiple pieces of equipment operating at variable loads or schedules. During any post-installation monitoring, the following parameters may be verified:

- Post installation operating schedules and associated load factors of affected equipment, and instantaneous demand of affected equipment.
- Load profiles for variable load equipment where appropriate for analyzing overall system performance improvements.
- Spot measurements of instantaneous demands for individual pieces of equipment in a project's scope.

Field verification and monitoring will be conducted over the post-installation period, beginning in August 2001 and will continue beyond the end of the installation phase of the program in May 2002. Once the final population of projects is determined, inspection and monitoring samples will be finalized, and the inspection and monitoring activities schedule can be completed. Based on program timelines, the post retrofit monitoring should be completed by the end of the 2002 summer peak season, on or about September 30, 2002. Due to the currently low program subscription rates for Category 1 and 3 projects, and the start of the harvest and food processing activities by the agricultural industry, there may be a significant number of projects that cannot be completed until after the 2001 summer peak season. Post installation MV&E activities through the 2002 summer peak season would allow for these projects to be included in sampling populations for each of the four project categories.

Analysis

The demand from post-installation monitoring, utility billing, or engineering models will be compared against baseline demand established by the program administrators. Validation of baseline demand by Nexant as part of the MV&E efforts will typically be infeasible, however, where possible Nexant will collect information to validate or further refine baseline and savings calculations.

Overall Reporting

Quantitative and qualitative End-of-summer peak period reports will present the average demand savings during the peak period by project category. Reports will be generated in a format consistent with other program element evaluations and submitted for review to the Commission according to the deliverable schedule in Nexant's work authorization.

1.8 Audit of Program Administrator Performance

The purpose of the Program Administrator Audit is to determine the effectiveness of third-party program administration for the Energy Commission's Peak Load Reduction Program. In the Agricultural Peak Load Reduction Program Element, there are two third-party administrators:

- Center for Irrigation Technology, California State University, Fresno
- Irrigation Training and Research Center, California Polytechnic State University, San Luis Obispo.

These program administrators have developed their own plan for processing applications and performing measurement and verification responsibilities as required under their scopes of work with the Commission. Their plan is outlined in the program description, http://www.energy.ca.gov/ag/DESCRIPTION.PDF.

The Commission has a separate contract with Onsite Energy for achieving 8 MW of peak period demand reduction. While Nexant will perform an evaluation of their efforts to achieve the demand reduction they are not considered an administrator for the purposes of this audit.

1.9 Audit Plan

Each administrator will be evaluated using the attached audit checklist. Information for the completion of the checklist will use the following sources: Interviews with the administrators, audits of a sample of administrators' participant files of approved projects. If time and budget allow we may also include several participant interviews of selected approved projects for each of the administrators. These interviews would be a source of information to get an indication of the level of satisfaction with the administrator's application process. A draft participant questionnaire is included.

1.10 Evaluation and Reporting

From the information gathered in the audit checklists, the administrator's performance will be evaluated in the following areas: Part A: Project Information and; Part B: Audit Checklist which consists of:

- Key Milestones (ref. Administrators' Scopes of Work)
- Education, Training & Technical Support (refer to Administrators' Scope of Work)
- Participant Management and Care - Application Process
- Participant Management and Care - At Project Completion
- M&V Requirements (as required by the contract with the participant)

- Reports

1.11 Audit of Program Participants

The purpose of the Program Participant Audit is to check for compliance with program requirements as specified by the program guidelines and agreements between the administrators and participants.

The Commission has a separate contract with Onsite energy for achieving 20 MW of peak period demand reduction. While Nexant will perform an evaluation of their efforts to achieve the demand reduction contracted for, Nexant will not audit this project.

The Onsite Energy project is not addressed in this audit plan.

1.12 Audit Plan

Each participant will be evaluated using the attached audit checklist. Information for the completion of the checklist will audit a sample of approved project files.

1.13 Evaluation and Reporting

From the information gathered in the audit checklists, the administrator's performance will be evaluated in the following areas: Part A: Participant Information and; Part B: Audit Checklist which consists of: Applicant Eligibility.

- Project is Eligibility
- Application Process
- Completed Project
- M&V Requirements
- Miscellaneous

These checklist audits will be completed and the results reported to the Energy Commission during the first quarter of 2002**.**

1.14 Project Sampling for Program Element Evaluation

Nexant will complete the program level evaluation of the Agriculture element. Time and budget constraints make it impractical to directly monitor and analyze the demand reduction (and as necessary energy savings, e.g., Category 2, pump repair projects) of the entire population of projects in categories 1 through 3. Therefore the MV&E plan will rely on statistically valid samples of projects within each Category for inspection and direct monitoring. From these samples we can infer the estimated demand reductions at all sites in categories 1 and 3.

Category 2 projects present difficulties in verification of demand savings. Demand on some pumps will likely increase due to improvements in the pumps flow and pressure relationships. Savings for many of these projects are largely dependent on increased flow rates offering the operator an opportunity to shift pumping to off peak hours. Changes in energy from baseline

conditions to the retrofit case will be examined for a statistical sample; however, assigning demand savings to pump repair projects is somewhat speculative and may not meet the program's statistical precision and confidence goals. Where possible Nexant will verify peak demand reductions through post-installation direct measurement for comparison to baseline peak period demand under similar operational conditions, and for similar crop cycles.

Nexant will work with the program administrators to perform post installation verification of Category 4 projects in order to reduce the time and cost of administration for these projects which provide no electrical demand savings.

Stratified sampling is a technique employed to identify a sample of projects that meet statistical precision and confidence guidelines for the program element. Effective use of stratified sampling depends on defining sub-populations that are relatively homogenous for a given parameter. Random samples can then be drawn from each strata resulting in improved overall variance at lower overall MV&E costs. Each Category of project grants is considered an overall stratum, and within Category 1 and 2, the population of each Category is further segmented into relatively homogenous strata; a random sample of projects is then selected from each stratum for post-installation evaluation.

The final population of projects is undetermined at this time due to extension of the deadlines for project approval. A slight revision to the sampling plan may be required should the proportion of projects in individual strata change significantly. The approach used to generate the list of projects for post-installation evaluation will be repeated in case of shifts in populations.

Category 4 projects are treated as another strata of projects for sample selection. While Category 1 to 3 projects lead to kW demand reductions, Category 4 projects do not. Category 4 project participants are offered incentives for the installation of equipment that allows a facility owner or manager to switch from burning natural gas to an alternative fuel. With no requirement in the program to switch to burning an alternative fuel, only a requirement to enable the switch, these projects are well suited to using the Acceptable Quality Level (AQL) method of sampling on the basis of the attribute sampling for completion of equipment installation.

Meeting the required degree of precision and confidence in the overall demand savings is difficult given the range and diversity of project types received to date, as well as expected portfolio of submittals for the agriculture program element. Based on the most up to date population of project applications received by the program administrators, projects will be placed in several sub-populations within project categories for sampling and MV&E work. Overall levels of sampling within a project Category are to be determined with a stratified approach to program level savings and the contribution from each project Category on an aggregated kW demand reduction basis. Individual projects will be chosen from the sub-populations within each project Category to meet the results of the stratified calculator.

Additional considerations in meeting MV&E goals of precision and accuracy include concerns for adequate baseline analysis and verification. Nexant's MV&E sampling plans are designed to meet the precision and confidence goals of the program, however, the actual statistics achieved

through the MV&E efforts will not be known until the monitoring and analysis of the projects are completed. Note that all verified demand savings are based on the difference between pre- and post-installation demands, and many instances the baseline demands cannot be verifiable by Nexant in their MV&E activities. The following sections describe the proposed approach for defining samples from the sub-populations of Category 1-4 projects. are listed below.

1.15 Subpopulation Designations

Category 1

This group includes the purchase and installation of high-efficiency electrical equipment and other conservation efforts for agricultural operations. The current population of Category 1 projects includes a variety of sub-Category technologies for achieving demand savings. Category 1 projects will be grouped for homogeneity as follows:

- Lighting and lighting controls,
- HVAC, refrigeration measures, and refrigeration controls
- Motors, motor controls including VSDs and non irrigation pump resize/trim projects

Envelope improvement projects may not appear to fit readily into the Category 1 technologies listed above. An example is reflective roof installation for a cold storage warehouse.

The installation of a high albedo roof surface achieves no actual reduction in energy use of the roof (the building envelope does not use energy), but peak demand savings accrue at the chiller plant. Typically, building insulation projects will be grouped in HVAC&R groups. Projects that are not readily grouped within the three main groups will be evaluated and grouped for the best overall fit with a Category 1 technology. Should the need become apparent, additional Category 1 technology groups can be incorporated into the sampling approach as needed.

Where a group makes up only a small portion of the overall demand savings of Category 1 projects, sampling may be deferred for that group until a larger population is defined for the particular technology group. All sampling within Category 1 will be considered as interim samples until the close of project acceptance and final population definition.

Where projects fall into multiple groups for comprehensive retrofits at a facility, all measures for that project will be analyzed, and overall sampling will be revised to reflect the sampling of the additional measures. This approach can help lower overall MV&E costs provided any single measure was selected as part of the Category 1 sample.

A sampling approach for an undefined population requires an approach that is flexible, while achieving the goal of evaluating program wide savings estimates on a statistically valid basis. One approach that minimizes the number of site inspections and costs while preserving statistical validity is to develop a stratified sample of peak kW demand savings across the Category 1 and 3 projects, and develop samples within each category.

The following methodology is proposed for developing MV&E samples in Category 1and 3 projects:

1. Sum all peak kW demand savings from Category 1 and Category 3 projects.
2. Identify a kW amount from all Category 1 and 3 projects to be sampled from to meet the statistical goals of 80/20; i.e., an 80 percent chance that the true kW of the entire population falls within a 20 percent interval around the estimate of kW savings from the project applications.
3. Stratify the kW identified for sampling through proportional weighting of the kW contributions for Category 1 technologies or Category 3.
4. Choose random samples of projects within each Category 1 technology or Category 3 such that the sum of kW from the projects equals the stratified kW for sampling determined in step 3 above.

The following formula is used to calculate the sample size for a hypothetical infinite population of projects:

$$n^i = \frac{\lfloor C_v^{\,2} \times z^2 \rfloor}{p^2}$$

Where:

n^i = sample size for an infinite population
Cv = Coefficient of variation (depends on expected variation of key parameters)
Z = z-statistic (equal to 1.2817 for an 80 percent confidence level)
P = precision level (set at 20 percent for 80/20 reliability)

To determine the sample size for a finite population of projects:

Where:

N = size of the actual population to be measured

As the population of projects grows as a result of additional applications accepted, the process of revised sample selection can be repeated as required. Projects previously selected for MV&E activities are excluded when determining additional randomly selected projects, but the peak kW demand savings contributions are included for the revised stratified sample size calculations.

The initial stratified sampling will be performed with an assumed coefficient of variation (C_v) of 0.5. Experience in many years of utility demand savings programs using an assumed C_v of 0.5 has shown that using a C_v of 0.5 to be reasonable. Possible effects of assuming a conservative C_v include a slightly higher sampling rate, increased precision, and higher confidence in the estimates of program level savings. The trade-off for conservative assumptions in sampling is a higher cost for additional inspections and analysis, however, there is no guarantee that an assumed C_v of 0.5 will be conservative, and the actual C_v will not be known until sampling is completed.

Table App-1 shows an initial sample size determination for Category 1 projects accepted by the program administrators and readily identifiable for technology type.

As none of these projects are reported as installed and verified by the program administrators, the sampling at this time is merely for demonstration of the approach.

Table App-1: Stratified kW Sampling Example for Category 1 and Category 3 Projects

Category Technology	Number of Projects in Group	Estimated kW Savings	Number Projects to sample from Tech. Group
1, HVAC & R	13	802.6	1
1, Lighting	2	68.3	1
1, Motors/Others	15	1,371.8	1
1, Water District pumps	3	7,802	3
3, Water Pumping	8	44,417	8
Totals	41	54,461.7	14

Based on the stratified sample sizes identified above, and considering the large influence of the 8 projects in Category 3, a minimum of 1 project from each technology group is recommended for sampling. The sampling equation for infinite population results in a total of 41 projects. Using the finite population correction factor, a total of 21 projects sites are suggested. By stratifying for kW, the majority of MV&E activities will currently be associated with the Category 3 projects, with a suggested sample size of 17 projects. With a total of only 8 projects received to date, and in excess of 81 percent of total peak demand savings from these 8 projects, Category 3 projects will all be chosen as part of the sample.

Category 2

Category 2 projects include grants for the express purpose of testing the efficiency and flow of pumps, and a second sub Category for repairing or retrofitting of the pumps. Pump repairs approved for a post retrofit must follow grants by or repair test to establish a new efficiency and capacity point for the motor and pump system. Peak demand savings for the pump retrofit or repair projects are assumed to derive from improved load management and by moving pumping energy to off peak hours. This strategy is particularly appealing when combined with telemetry to remotely control pumping equipment while meeting irrigation or other water delivery needs.

Pump test projects will be verified by the program administrators through a desk review of submitted documentation as described on the program administrators web sites. The grants will be paid in full at the completion of the review and approval. For purposes of program evaluation, these projects will be ignored for post installation inspections or monitoring. With no demand savings from testing alone, there is little need to evaluate these projects for savings.

Pump repair or retrofit projects, however, may lead to energy and peak period demand savings provided the peak period operation of these pumps is reduced from increased pumping capacity. The four methods of determining the energy or demand savings are based on utility billing records.

Nexant at the request of the Energy Commission program element manager developed estimates of demand savings for Category 2 pump repair projects. Energy based savings (kWh) determined by point-in-time pump tests along with meter or billing demand data supplied by the participant would be used to provide a desk-based estimate of average seasonal demand (kW) savings. Sampling for this Category will be treated as a separate class of projects apart from demand reduction categories 1 and 3. Using project grant amounts as a measure of project impact, we would perform a similar evaluation of the projected savings from a representative sample of the project applications for pump repair or retrofit.

Category 3

This group includes the installation of advanced metering and telemetry equipment for agricultural and water pumping load reduction strategies. Current projects received include increases in water storage capacity in order to shift load to off peak hours, installation of interval metering for use with the ISO programs, and changes to pipeline system to reduce head loss. The projected kW demand reductions are not expected to be consistent throughout the summer peak season, and the total kW is a maximum estimate if full subscription of an aggregator is achieved. Category 3 projects will be sampled along with Category 1 projects in order to minimize MV&E costs. Details of the sampling for these projects are described in the section for Category 1 projects.

Category 4

This group includes retrofitting existing natural gas powered equipment to burn alternative fuels. For projects in Category 4, there are no kW demand savings from the conversion to alternative fuels, nor are the project applicants required to document the use of the alternative fuel as a condition for the grant. The test for completion of a project is the successful demonstration that the equipment is capable of burning an alternative fuel.

Nexant, in conjunction with the program administrators, will conduct post installation inspections for a representative sample of the completed projects. Pre- and post-installation desk review of each of the projects will continue to be the responsibility of the program administrator at CSU Fresno, however cost savings will be realized by utilizing Nexant personnel for both post installation inspection and MV&E activities for Category 4 projects.

The post installation inspection reporting will be based on whether or not the retrofit equipment can utilize an alternative fuel. The sampling for Category 4 projects can then be based on principles from Acceptable Quality Level (AQL) sampling for attributes (equipment is installed and functional, or not) where the sample size is determined from an AQL table of the specified precision. The sample population to be inspected will then be drawn randomly from the overall population without regard to cost of installation, grant amount, or likely gas savings from the project.

Based on the current population of 35 Category 4 projects either accepted or pending, in the Fresno database report of July 31, 2001, a sample of eight sites would be selected for inspection based on the 10/100 AQL tables, which is appropriate for a 20 percent precision interval.

1.16 Demand Savings Calculations

Secondary Issues

As outlined in the program description estimated demand savings (reduction) are the difference between the baseline and post-installation peak period demands *averaged over the entire season*. Project estimated *average* baseline demand is derived from the desk-based or measured estimates provided by the applicants and verified by the program administrators as part of their M&V responsibilities. The administrators using measured or utility-based meter or billing data verifies post-installation average peak period demands. This verification requires one full peak period of operation (June through September) after construction and operation.

Analysis of the sampled sites will determine the realized demand reduction at each of the sites identified in Table 1. Realized demand saved (reduced) over the entire season will be determined by:

$$kW_{saved} = \frac{\sum_{12pm}^{6pm} kWh_{baseline} - \sum_{12pm}^{6pm} kWh_{post\text{-}installation}}{6}$$

Where:

kWh_{baseline} and $kWh_{\text{post-installation}}$ = The average daily energy usage of the project system(s) from 12pm and 6pm on a non-holiday weekday from June 1 through September 30.

Average daily energy = Daily use is averaged using the total weekdays from June 1 through September 30. There are 84 weekdays in the 2001 season, excluding July 4 and September 3 holidays.

Method I. complies with the program description methodology for establishing baseline and verifying post-installation peak period demand averaged over the entire season. This method will require time of use billing data or seasonal monitoring of peak period usage.

The program description also provides for a second method for determining averaged demand. This method relies on spot-measurements or metered data for energy and demand for before and after project installation to determine demand savings averaged over the entire peak season.

The following equation, as an alternative, can be used to determine the realized demand saved (reduced):

$$kW_{saved} = \frac{\left[kW_{baseline} \times \sum_{12\,p.m.}^{6\,p.m.} \left(Average\ daily\ peak\ hours_{baseline} \right) - kW_{post\text{-}installation} \times \sum_{12\,p.m.}^{6\,p.m.} \left(Average\ daily\ peak\ hours_{post\text{-}installation} \right) \right]}{6}$$

Where:

$kW_{baseline}$ = Instantaneous kW demand either measured directly or as documented by utility metering
billing data for the project system(s) prior to installation.

$kW_{post\text{-}installation}$ = Instantaneous kW demand either measured directly or as documented by utility metering billing data for the project system(s) after installation.

Average daily peak hours = the average daily operating hours of the project system(s) from 12pm to 6pm on a non-holiday weekday from June 1 through September 30 season. In most cases baseline and post-installation hours will remain the same. There are 84 weekdays in the 2001 season, excluding July 4 and September 3 holidays.

This method complies with the program description methodology for establishing baseline and verifying post-installation peak period demand averaged over the entire season.

Where necessary, the demand reduction determined by program administrators for the site will be compared to the sites analyzed by Nexant as part of its sample population and a realization factor will be determined. The realization factors of all monitored sites within a sub-population will be averaged to give a sub-population realization factor, which will then be applied to determine the demand reduction of the entire sub-population. The following calculation will be used to determine the realization factor for a sub-population.

$$RF = \sum_{j=1}^{n} \left[\frac{kW_Sample_j}{kW_Administrator_j} \right]$$

Where:

RF = sub-population realization factor
kW_Sample = demand reduction of site j in Nexant analysis.
kW_administrator = demand reduction for site j verified by program administrator
n = total number of monitored sites in sub-population

Demand reduction for the Agricultural Peak Load Reduction program element will be calculated by the summation of all sub-populations that comprise all completed projects within the program element. The total savings is determined by,

$$kW_\text{Savings} = \sum_k \left[RF_k \times Sub\text{-}Population_kW_k \right]$$

Where:

kW_Savings = the realized total demand reduction for the Agricultural Peak Load Reduction program element
RF = realization factor associated with sub-population k
Sub-Population_kW = total demand reduction verified by administrators for all projects within sub-population *k*

1.17 Definitions

Peak Period

For the Agricultural Peak Load Reduction Program, the peak period is defined as noon to 6:00pm weekdays from June 1 to September 30.

Operating Hours

The hours of operation during the peak period are estimated by the applicant's using operational logs, utility metered or billing data, pump efficiency tests or spot field measurements. The administrators will review the applicant's data to verify these hours. For the purposes of determining peak demand reduction the administrators will estimate the average daily operating hours based on total no-holiday weekdays from June 1 through September 30.

Baseline Demand

For categories 1 and, 3 and the pump repair portion of Category 2 baseline demand (i.e. the existing conditions from which savings are calculated) will be defined as the existing equipment, systems and procedures in place at the time of retrofit. The baseline equipment will not be required to meet state or federal minimum efficiencies to receive incentives for the equipment upgrade. The baseline demand (Kilowatts, kW) can be established by,

- Historical metering data (i.e. from a Time-of-Use meter)
- An engineering model accepted by the Grant Administrator
- Direct measurements of demand including pump tests

Project baseline demand is the average the daily consumption (kWh) of the system(s) between the hours of 12pm and 6pm on a non-holiday, summer weekday from June 1 through September 30 and dividing by the total peak hours in the peak period. There are 84 weekdays in the 2001 season, excluding July 4 and September 3 holidays.

Baseline Energy Use

For categories 1 and 2 Baseline (i.e. the existing conditions from which savings are calculated) will be defined as the existing equipment, systems and procedures in place to be affected by the retrofit. The baseline equipment will not be required to meet state or federal minimum efficiencies to receive incentives for the equipment upgrade. The baseline energy (Kilowatts-hours, kWh) use will be established by:

- Historical metering data (e.g., from a Time-of-Use meter)
- An engineering model accepted by the Grant Administrator
  - Estimates derived from spot measurements, including pump tests, and documentation of project equipment operating hours.

Project baseline kWh is the *average* daily consumption of the system(s) between the hours of 12pm and 6pm on a non-holiday summer weekday from June 1 through September 30. There are 84 weekdays in the 2001 season, excluding July 4 and September 3 holidays.

Adjustments to Baseline Demand or Energy

Program administrators as part of their M&V function may adjust baseline energy or demand if verification of the data submitted by the applicant reveals that project equipment operating hours or loading vary significantly from those reported by the applicant in estimating baseline demand. Nexant may also adjust baseline energy or demand based on administrator changes or monitoring data from a site(s) in our sampling plan.

Completed Demand or Energy

The post-installation energy or demand will be verified by the administrators through post-installation demand engineering calculations, utility billing analysis, pump tests, or spot power (kW) measurements as necessary in determining demand in categories 1, 3 and the pump repair component of Category 2. Nexant will use program administrators' data and its analysis of post-installation sites in its sampling plan to determine this demand.

The Agricultural program element has successfully recruited and approved more than 800 projects that are expected to contribute nearly 80 MW of peak demand savings. Of the expected contributions, more than 48 MW of demand-responsive project contracts were executed within months of the program element kick-off in June 2001. The demand-responsive projects account for a majority of expected program element impacts at a cost of less than $22/kW, among the most cost-effective of the overall PLRP.

Pump testing and pump repair projects account for the majority of projects (590 of 837 approved projects), enabling more efficient delivery of water to the economic benefit of the agricultural sector. It is not clear, however, that the projects reduce peak demand for electricity unless combined with TOU metering or other strategies that would change pumping usage patterns.

The program element has demonstrated success in encouraging the more widespread adoption of advanced energy technologies in California's agricultural industry. Clean technology

applications, for example, include biogas generation, alternative fuels, telemetry equipment and control systems, and thermal storage load shifting.

Section 2 Agricultural Program Sampling Plan

Nexant's general approach to verifying savings involves calculating the difference between equipment energy use during peak operating hours after an energy efficiency retrofit with that equipment's baseline energy use, which is what the load *would have been* had the retrofit not occurred. A representative sample of projects is chosen for analysis, and the findings from that sample are extrapolated to the population as a whole. The sample population must be large and diverse enough to meet the statistical confidence and accuracy levels established as targets by the Energy Commission. The remainder of this Appendix discusses Nexant's sampling methods in detail.

The sampling plan spreadsheets are included on the CD accompanying this Appendix and contain six spreadsheets: two for Category 1, two for Category 2, one for Category 3 and one for Category 4. All sampling plan documentation, calculations, and assumptions by Category are found in these spreadsheets.

Sub-Population Designations and Sampling

Nexant is completing the program level evaluation of the Agriculture element. Time and budget constraints make it impractical to directly monitor and analyze the demand reduction (and as necessary, energy savings, e.g., Category 2 pump repair projects) of the entire population of projects in Categories 1 through 3. Therefore, the measurement, verification, and evaluation (MV&E) plan relies on statistically valid samples of projects within each category for inspection and direct monitoring. From the post-installation evaluations of the samples, Nexant infers the estimated demand reductions at all sites in Categories 1 and 3.

Nexant uses stratified sampling techniques to identify a sample of projects that will meet statistical precision and confidence guidelines for the program element. Effective use of stratified sampling depends on defining sub-populations that are relatively homogenous for a common parameter. Accordingly, Nexant drew random samples from homogenous strata within each project category, resulting in reduced overall variance for category level savings. Each category of project grants was treated separately, and within Category 1, Category 2, and Category 3, each category population is further segmented into relatively homogenous strata. A random sample of projects was selected from each category's strata for post-installation evaluation and verification. The following paragraphs discuss the process and resulting samples, also listed below in Table App-2 through Table App-8.

The final population of approved projects has not been determined, but is anticipated during the next few months. A slight revision to the sampling plan may be required for Category 1 and Category 2 if the representation of projects in individual strata changes significantly from the original sample selection. The approach used to generate the list of projects for post-installation evaluation will be repeated to test whether shifts in populations have changed the sampling stratification.

Nexant's MV&E sampling plans are designed to meet the precision and confidence goals of the program; however, the actual statistics achieved through the MV&E efforts will not be known until post-installation monitoring and analysis of the sample projects are completed.

Equation 1, below is the formula used to calculate the sample size for a hypothetical infinite population of projects that follow criteria for normal distributions:

(1)
$$n^i = \frac{\left\lfloor C_v^{\,2} \times z^2 \right\rfloor}{p^2}$$

Where:
n^i = sample size for an infinite population
C_v = Coefficient of variation (assumed to be 0.50 for sampling purposes)
Z = z-statistic (equal to 1.2817 for an 80% confidence level)
P = precision level (set at 20% for 80/20 reliability)

Previous experience with utility-sponsored DSM programs has shown that a starting value for the coefficient of variation of 0.5 is reasonable and conservative for a large variety of project technologies. With C_v set at 0.5, the sample size for a normally distributed, infinite population was found to be 11 from Equation 1 above.

None of the program categories has an infinite population of projects, of course, which requires compensatory adjustments to the sample size. The formula given in Equation 2 below is used to determine the sample size for a finite population of projects, and is used to adjust the sample sizes:

(2)
$$SampleSize = \frac{n^i}{\left[1 + \left(\frac{n^i}{N}\right)\right]}$$

The sampling formulas in Equation 1 and Equation 2 both apply to normal distributions. Sampling with these formulas assumes the populations are relatively similar in the parameters of interest. Approved projects from the two administrators are not similar in typical savings, technology type, and persistence of peak demand savings for Category 3 demand response projects; Category 4 projects do not have electrical savings.

To accommodate the heterogeneity of projects within program categories, sampling within each category of projects helps to ensure that each sub-population is closer to a normal distribution and results of sampling are statistically valid. This in turn ensures inferred sub-population demand savings are statistically valid within the target confidence level and precision interval. Within each project category there are a wide range of savings and project technologies. A

stratified sampling technique was used to identify the sample sizes for Category 1, Category 2, and Category 3. The technique is designed to improve the overall variance of the sampling efforts while reducing the sample sizes to a minimum. The stratified approach assigns sampling efforts for each of the strata in relation to the proportion of demand savings each individual stratum contributes to the overall category level demand savings.

A stratified sample calculator, developed for other energy savings programs by Nexant, was used to estimate the sample sizes for each project category and stratum. A spreadsheet of each of the Category 1, 2, and 3 sub-populations was characterized and populated for an appropriate number of strata for each project category. The defined stratum within each sub-population was examined for the number of approved projects and contribution to category level demand savings in kW; these were input to the calculator with an annual peak period operating total of 522 hours. The operating hours figure was derived from total number of summer peak period hours for this program element; however, the actual number is relatively unimportant – the number serves to reduce bias in the sampling. The resulting sample size for each category of projects is proportioned for each stratum within a sub-population according to its contribution to the project category's demand savings.

Sampling for Category 4 projects was treated in a slightly different manner—an Acceptable Quality Level (AQL) sampling approach was used to identify a representative sample of projects. The AQL sampling approach (ANSI/ASQC Z1.4) is based on sampling for an attribute, in this case the ability of the facility to switch to burning an alternative fuel, and applying the test results to the sub-population of Category 4 projects. If the number of sites that fail is less than the acceptance limit, the sample is accepted and the lot, or sub-population of Category 4 projects, is accepted as installed and presumed able to switch to alternative fuels.

Tables of AQL sample sizes are published for various precision levels. The 10 percent AQL table corresponds to a 20% precision interval, and for the sub-population of 27 approved projects, the sample size is eight (8)[1].

For all project categories, after the stratified sample sizes were calculated, each project on a sub-population spreadsheet was assigned a random number from the Excel RAND function. All projects within each stratum were then sorted and ranked by their random numbers. The sample size for the corresponding stratum was next applied to identify the projects for post-installation evaluation. Each stratum of projects in Category 1, 2, and 3 was treated in the same manner. Projects for Category 4 were also identified using this approach; however, there was no initial stratification of the population.

The following paragraphs describe the procedures used to identify post-installation samples from the four project categories and individual strata within the project categories. Projects for post-installation evaluation selected with the stratified calculator and random sampling are presented in Table App-2 through Table App-8. The entire list of approved projects from the two administrators and Onsite Energy Corporation can be found in the Appendices.

[1] An online AQL sample size calculator is available at: http://iew3.technion.ac.il/sqconline/milstd105.html

Sub-population—Category 1

Category 1 projects include a wide variety of technologies and range of demand savings estimates. The diversity of technology and demand savings in Category 1 approved projects and the need to keep the number of strata at a reasonably low level require that not all strata adhere to the ideal of homogeneity in either technology type or demand savings. In order to identify samples from strata with similar characteristics, five individual strata were defined and populated with projects approved by the two administrators.

Category 1 projects were allocated to the following strata:

1. Lighting efficiency and lighting controls
2. Motors, VFDs, and motor controls
3. HVAC and refrigeration
4. Reservoir improvements and TOU meters for load shifting
5. Drip irrigation conversions, new irrigation wells and booster pumps

Lighting projects of all types, including lighting efficiency, lighting controls, and skylights, have been grouped into the first Category 1 stratum. The second stratum is a broader grouping of motor efficiency, variable frequency drives (VFDs), automated controls and other measures involving installation of high efficiency electrical equipment. Refrigeration, HVAC, evaporative condensers, or other projects leading to refrigeration savings are grouped into the third stratum. The fourth stratum includes projects related to reservoir expansions, and time-of-use (TOU) meters that encourage facility owners to move operations to off peak hours. The fifth and final stratum for Category 1 projects includes conversion to drip irrigation, and irrigation pump equipment installations to offset peak period demand. Individual projects chosen from the five strata in Category 1 are shown in Table App-2.

Table App-2: Category 1 Stratified Samples

Stratum #	Stratum Name	Population in Stratum	Projects in Sample	Demand Reduction of Sample, kW
1	Lighting Efficiency/Controls	8	1	48
2	Motors/Drives/Controls	80	2	1,159
3	HVAC&R	29	2	683
4	Reservoir Improvement, TOU meters	40	6	386
5	Drip Irrigation, Boosters, Wells	19	1	45
Totals		168	12	2,320

Some of the approved Category 1 projects fall into multiple strata due to comprehensive retrofits at a facility; all measures for such projects are analyzed, and overall sampling will be revised to reflect the evaluation of the additional measures.

The 12 projects selected for post-installation evaluation are listed in Table App-3. Each project is identified by its unique APLRP number and is listed in the order of the strata to which it was assigned.

Table App-3: Category 1 Projects Selected for Post-Installation Evaluation

APLRP	Stratum #	Technology Description	Demand Savings, kW	Applicant
1-0378-A	1	DC Lighting efficiency retrofit	48	Blue Diamond Growers
1-0134-A	2	Comprehensive plant retrofit	1,029	Campbell Soup Company
1-0152-A	2	Power factor correction, lighting voltage reduction	129	Trinchero Family Estates
1-0177-A	3	Add suction line; increase capacity for off peak ops.	654	Puritan Ice Company
1-0404-A	3	Increased refrigeration coil capacity	29	Taylor Farms
1-0100-A	4	Lockouts for nursery circulation fans	9	Rote Greenhouses
1-0101E	4	Water pump time controls	168	Sierra View Farms
1-0351-A	4	Install TOU meters	47	Sandhu Bros. Farm
1-0367-A	4	Install TOU meters	2	Ewy Enterprises
1-0367-A	4	Install TOU meters	2	Ewy Enterprises
02-022-47310	4	Expand existing storage reservoir for off peak pumping	158	Belridge Water Storage District
01-269-A	5	Drip irrigation conversion	45	Silva Vineyards
Totals			2,320	

Sub-population—Category 2

Category 2 project grants help pay for testing the efficiency and flow of pumps, with a second sub-category for repairing or retrofitting of the pumps. Pump repairs must be followed by a post-retrofit or repair test to establish a new efficiency and capacity point for the motor and pump system. Peak demand savings for the pump retrofit or repair projects are assumed to result from improved load management and by moving pumping energy to off peak hours. This strategy is appealing when combined with telemetry to remotely control pumping equipment while meeting irrigation or other water delivery needs.

Pump test projects are verified by the program administrators through a desk review of submitted documentation, as described on the program administrators' web sites. The grants are paid in full at the completion of the review and approval process. For purposes of program evaluation, these projects are ignored for post-installation inspections or monitoring. With no demand savings attributable to testing alone, there is little need to evaluate these projects for savings.

Peak period demand savings are not reported, and choosing a stratified sample of projects for post-installation evaluation requires a slightly modified approach. The two administrators offer incentives for pump repair projects through one of three options for calculating incentives. There

are slight differences in each administrator's documentation and calculation of the project incentives; however, both administrators have comparable grant options, and all pump repair projects are grouped together by grant option.

There is a large sub-population of pump repair projects, with a current total of 590 individual pumps approved by the two administrators. Annual energy use was reported for the majority of the individual project sites for projects approved by the Fresno CIT administrator. CalPoly's ITRC administrator required the submittal of peak period billing from June through September, but has not yet provided energy use data for the projects in their database of approved projects.

Each of the projects was grouped by the grant option number on a spreadsheet for sample selection in four strata that are defined by the three grant options and an additional stratum for the projects paid at 65 percent of repair cost. Projects that had no reported annual energy use were assigned an energy use equal to the average of all other projects in the same grant option, with the exception of the projects that were approved at 65% of cost. The resulting sample sizes are proportioned according to the number of projects approved under each grant option, as well as the relative size of expected energy savings resulting from the pump repairs. Table App-4 lists the four strata and sample sizes from the stratified calculator.

Table App-4: Category 2 Stratified Samples

Stratum #	Stratum Name	Population in Stratum	Projects in Sample	Demand Reduction of Sample, kW*
1	Grant Option 1	80	2	6
2	Grant Option 2	33	1	18
3	Grant Option 3	309	8	77
4	65% of Cost	37	1	6
Total		459	12	107

*kW estimates are for sampling size calculations only. Annual kWh was divided by 2000 operating hours per year; with 8% savings assumed for pump repairs. Operating hours and savings rate suggested in utility study of irrigation pump repairs.

The selected projects in Table App-5 were randomly selected from each of the four strata defined for Category 2 projects.

Table App-5: Category 2 Projects Selected for Post-Installation Evaluation

APLRP*	Stratum #	Grant Option Description	Annual kWh Use	Applicant
02-0280-A	1	Change in plant operating efficiency	92,560	Tracy Ranch, Inc.
02-0369-A	1	Change in plant operating efficiency	63,633	E&M Dairy
02-0183-A	2	Change in kWh/AF from repairs	447,636	JG Boswell Co.
#27-D-10 #5	3	Grant paid at 25% of kWh	161,003	Delano-Earlimart Irrigation District
02-0266-A	3	Grant paid at 25% of kWh	26,736	A-G Sod Farms Inc.
#19-White #1	3	Grant paid at 25% of kWh	161,003	Reclamation District #548

APLRP*	Stratum #	Grant Option Description	Annual kWh Use	Applicant
#32-Area 18-10hp	3	Grant paid at 25% of kWh	161,003	Tulare Irrigation District
#34-C-82	3	Grant paid at 25% of kWh	161,003	James Irrigation District
#31-1R4.OD	3	Grant paid at 25% of kWh	161,003	Westlands Water District
02-0129-A	3	Grant paid at 25% of kWh	870,280	J.G. Boswell Co.
02-0333-A	3	Grant paid at 25% of kWh	217,520	M&C Farms
#13-Station B, Pump 2	4	Grant paid at 65% of cost, kWh use not provided	65% of cost	Cawelo Water District

* APLRP numbers preceded by "#" are from ITRC. The first number corresponds to water district application number for multiple site Category 2 projects.

Sub-population—Category 3

Technologies for Category 3 projects include installation of advanced metering and telemetry equipment for agricultural and water pumping load reduction strategies. Approved projects include increases in water storage capacity for load shifting, installation of interval metering for use with the ISO programs, and changes to pipeline systems to reduce head loss. Eleven of the eighteen approved Category 3 projects took part in the CAISO demand response program, and were required to shed load when an emergency signal was received from the CAISO. Two strata were defined for the sub-population: those projects with and those without a CAISO contract.

Projected kW demand reductions are not persistent throughout the summer peak season for projects with CAISO contracts, and the total kW is an estimate of *potential* demand savings if full subscription of an aggregator is achieved.

Table App-6 lists the strata defined for Category 3 demand responsive projects and calculated sample sizes.

Table App-6: Category 3 Stratified Samples

Stratum #	Stratum Name	Population in Stratum	Projects in Sample	Demand Reduction of Sample, kW
1	ISO Contracts	11	6	4,550
2	Non-ISO Contracts	7	1	425
Totals		18	7	4,975

Table App-7 lists the randomly selected Category 3 project sites for post-installation evaluation.

Table App-7: Category 3 Projects Selected for Post-Installation Evaluation

APLRP*	Stratum #	Project Description	kW Demand Reduction	Applicant
#01-020-47330	1	Interval meters for ISO program	1,000	Solano Irrigation District
03-0064-A	1	Install interval meters and telemetry equipment	1,595	Joseph Gallo Farms

#02-03-47330	1	Install 3 interval meters and telemetry for ISO contract	1,270	Natomas Central Mutual Water District
03-0112-A	1	Artesia Dairy ISO drip irrigation telemetry	450	Artesia Dairy
03-0113-A	1	Triangle-M Dairy ISO drip irrigation telemetry	100	Triangle-M Dairy
03-0118-A	1	Tevelde Dairy ISO drip irrigation telemetry	135	Ralph Tevelde Dairy
03-0095-A	2	Advanced metering/telemetry	425	Diamond D Dairy

*APLRP numbers preceded by "#" are from ITRC. The first number corresponds to the water district application number for multiple site Category 3 projects.

Sub-population—Category 4

Category 4 projects include retrofits to convert existing natural gas-powered equipment to burn alternative fuels. There are no kW demand savings for projects in Category 4, nor are the project applicants required to switch to full-time use of an alternative fuel. The test for completion of a project is the successful demonstration that the equipment is capable of burning an alternative fuel.

The post-installation inspection reporting will be based on whether or not the retrofit equipment can utilize an alternative fuel. The sample size calculation for Category 4 projects was based on principles from Acceptable Quality Level (AQL) sampling for attributes (equipment is installed and functional, or not). At the specified precision, the sample size was determined from an AQL table in correlation to the number of approved projects. The sample population to be inspected was then drawn randomly from the overall population without regard to cost of installation, grant amount, or possible natural gas savings from the project.

Based on the current population of 24 Category 4 projects, a sample of eight sites has been selected for inspection. The sample size was based on the 10 percent AQL table, which is appropriate for a 20 percent precision interval.

Table App-8 lists the randomly selected project sites for Category 4 sub-population post-installation evaluation. All Category 4 projects were submitted to CIT for evaluation and grant funding.

Table App-8: Category 4 Projects Selected for Post-Installation Evaluation

APLRP #	Project Name	Project Description	Applicant
04-0017-A	Fresno poultry plant yellow grease project	Vegetable oil project proposal #2	J.G. Boswell Co.
04-0018-A	Del Mesa Porterville plant propane project	Cotton gins 2&3 – project proposal #3	J.G. Boswell Co.
04-0019-A	Del Mesa Feed Mill yellow grease project	Cotton gin #5 – project proposal #4	J.G. Boswell Co.
04-0022-A	Waste heat boiler oxidizer to burn yellow grease	Waste heat boiler oxidizer to burn yellow grease	Merced Milling Co. LLC
04-0038-A	Dual fuel conversion	Retrofit boiler 1 gas burner to burn yellow grease	Baker Commodities Inc.

04-0041-A	Propane tank and vaporizer conversion	Waste heat boiler oxidizer to burn yellow grease	Baker Commodities Inc.
04-0059-A	Natural gas-powered equipment retrofit	Natural gas to propane conversion	Fowler Dehydrator
04-0065-A	Natural gas powered equipment retrofit	Dual fuel gas conversion	Farmers Cooperatives Gin, Inc.

Section 3 Agricultural Program Project List

Program Administrator	Project Category	Application #/Incentive Agreement Number	Project Description / Address	City/Area	Comments - estimated construction completion dates from application.	Administrator Grant Payments	Anticipated or Contracted Savings, kW	Reported Savings, kW	Simple Cost Effectiveness, $/kW
Category 1 Projects for Cal Poly									
Cal Poly	1	01-018-47310	Add reservoir and modify deep wells to curtail deep well pumping during peak times.	Bakersfield	Project approved; second grant payment on Feb 11, 2002	$ 346,204.90	7,643	5,135	$ 67.42
Cal Poly	1	02-006-47310	Hills Valley Irrigation District is proposing to install a VFD on an existing 60 HP pump, thereby reducing the peak load usge by an average of 16 kW. The district obtains water from the Friant-Kern Canal and currently has a pumping plant that switches pumps on and off depending upon the demand. By installing a VFD, the supply can more closely match the demand.	San Joaquin Valley	Project has been completed October 31, 2001. First grant payment on 8/7/02.	$ 4,800.00	16.0	16	$ 300.00

Program Administrator	Project Category	Application #/Incentive Agreement Number	Project Description / Address	City/Area	Comments - estimated construction completion dates from application.	Administrator Grant Payments	Anticipated or Contracted Savings, kW	Reported Savings, kW	Simple Cost Effectiveness, $/kW
Cal Poly	1	02-009-47310	Berrenda Mesa WD proposes to raise the height of the spillway on the Berrenda Mesa Reservoir. The increased height (15 inches) will allow for additional storage in the reservoir and therefore reduced pumping during the peak periods. The stored water will supply growers during the on-peak times, while filled during the off-peak times.	Bakersfield/Kern	Project completed 5/2/02. First payment on 6/4/02	$ 28,754.00	770.0	4,400	$ 6.54
Cal Poly	1	02-013-47310	North Kern Water Storage District will modify deep wells and regulating reservoirs to reduce the peak load. Telemetry at selected sites will also be installed.	Bakersfield	Signed contract sent to Tranquillity ID. Amendment extends project completion date from April 30, 2002 to May 31, 2003.	$ 813,750.00	3,255	3,331	$ 244.30

Program Administrator	Project Category	Application #/Incentive Agreement Number	Project Description / Address	City/Area	Comments - estimated construction completion dates from application.	Administrator Grant Payments	Anticipated or Contracted Savings, kW	Reported Savings, kW	Simple Cost Effectiveness, $/kW
Cal Poly	1	02-014-47310	Sutter Extension Water District proposes to install a variable frequency drive to reduce the peak load. Flow meters are also part of the application.	Yuba City	Signed contract sent to North Kern WSD. Amendment to contract extends project completion date from April 15, 2002 to December 31, 2002. Sent for signature 4/8/2002.	$ 8,250.00	66.0	23	$ 358.70
Cal Poly	1	02-015-47310	The City of Santa Rosa proposes to replace an existing pump station, which includes 3-40 HP and 1-10 HP motors with 2-60 HP motors and variable frequency drives to operate irrigation systems. This new station will allow the grower to operate almost completely off-peak.	Santa Rosa	Project completed 4/20/02. First payment on6/1/02	$ 8,625.00	35.0	46	$ 187.50
Cal Poly	1	02-020-47310	Orange Cove ID proposes to reduce the peak load by constructing a regulating reservoir, coupled with telemetry equipment. Peak load will further be reduced by the installation of time-of-use meters, flow control valves, and/or clock timers for individual growers.	Fresno County	Project completed 4/1/02 - first payment 6/14/02	$ 44,500.00	178	178	$ 250.00
Cal Poly	1	03-001-43710	Berrenda Mesa WD proposes to remove sediment from their main storage reservoir and use the increased storage to reduce peak load.	Bakersfield	Signed contract sent to Orange Cove ID; project completion predicted for December 2002	$ 61,750.00	250	270	$ 228.70

Program Administrator	Project Category	Application #/Incentive Agreement Number	Project Description / Address	City/Area	Comments - estimated construction completion dates from application.	Administrator Grant Payments	Anticipated or Contracted Savings, kW	Reported Savings, kW	Simple Cost Effectiveness, $/kW
Cal Poly	1	03-009-47310	North Kern Water Storage District will modify deep wells and add a low lift pumping station to a reservoir to reduce peak load. Telemetry at selected sites will also be installed.	Bakersfield	Contract approved, project completion projected for Nov. 2003	$ 375,400.00	1502	1,502	$ 249.93
Cal Poly	1	03-013-47310	Tulare ID proposes to increase their water demand through Kaweah river during the peak period thus increasing the on peak generation. During the off-peak the demand will be reduced and supplied by another source (CVP). SCADA will be used for monitoring and control of remote sites whcih will make this project logistically feasible.	Tulare	Project Pre-approved, contract sent for signature 1/20/03	$ 98,033.00	470	470	$ 208.58
Subtotal projects	10				Subtotal of Grant Payments	**$2,288,132.90**			
					Subtotal of expected savings		**16,458**		
					Subtotal of Verified Savings, kW			**16,824**	
					Average project cost effectiveness (preliminary)				**$123.82**
Category 1 Fuel Switching Projects for Cal Poly									
Cal Poly	1	1	Natural gas engine driven pump conversion	Greenfield	Project pre-approved	$62,000	248.0		
Cal Poly	1	2	Natural gas engine driven pump conversion	Eastern Municipal Water District	Project pre-approved	$62,500	250.0	250	$250.00
Cal Poly	1	3	Natural gas engine driven pump conversion	Eastern Municipal Water District	Project pre-approved	$80,500	322.0	322	$250.00
Subtotal projects	3				Subtotal of Grant Payments	**$205,000**			
					Subtotal of contracted savings		**820.0**		

					Sub total of reported savings			**577.0**	
					Average project cost effectiveness (preliminary)				**$250.00**
Category 1 Electrical Efficiency Projects for California State University, Fresno Foundation									
Program Administrator	***Category***	***Project #***	***Project Name***	***City***	***Grant Payment Date***	***Grant Payment Total***	***Contracted Savings, kW***	***Verified Savings, kW***	***Simple Cost Effectiveness, $/kW***
CSU Fresno	1	01-0008-A	Meridian Facility - Bean Mill	Meridian	12/15/03	$24,600.00	82	82	$300.00
CSU Fresno	1	01-0026-A	VFD Compressor	Finley	01/02/02	$1,096.55	6.06	6.06	$179.76
CSU Fresno	1	01-0026-B	Water recirculation pump	Finley	06/11/03	$7,230.00	24.1	24.1	$301.25
CSU Fresno	1	01-0026-C	Scotts Valley - Condensor Fans VFDs	Finley	01/02/02	$7,448.00	21.28	21.28	$354.67
CSU Fresno	1	01-0027-A	Finley Pre-cooling Fan	Finley	01/02/02	$2,445.30	22.2	22.2	$111.15
CSU Fresno	1	01-0027-B	Finley Evaporative Cooling Tower VFD	Finley	01/02/02	$8,450.00	25.25	25.25	$338.00
CSU Fresno	1	01-0027-C	VFD on Recirculating Pump	Finley	01/02/02	$1,300.00	6.77	6.77	$185.71
CSU Fresno	1	01-0027-D	VFD on Compressor	Finley	01/02/02	$6,912.00	19.75	19.75	$345.60
CSU Fresno	1	01-0029-A	Insulate Tanks 7001 and 7003	Ripon	11/26/02	$17,745.00	50.7	50.7	$350.00
CSU Fresno	1	01-0035-A	Dyer Creek	Bakersfield	05/21/03	$564.46	45	45	$12.54
CSU Fresno	1	01-0042-A	Insulate Tanks 2019 & 2021	Ripon	11/26/02	$6,360.00	25.44	25.44	$250.39
CSU Fresno	1	01-0053-A	Alternate Sequence Gin Processing	Firebaugh	07/24/02	$10,954.42	219.09	219.09	$50.02

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-0054-A	Time Management Load Control Device	Hanford	10/07/03	$3,282.83	37	37	$88.73
CSU Fresno	1	01-0054-B	Time Management Load Control Device	Hanford	11/05/01	$820.71	44	44	$18.65
CSU Fresno	1	01-0054-C	Time Management Load Control Device	Hanford	11/05/01	$820.70	130	130	$6.31
CSU Fresno	1	01-0060-A	Alternate Sequence Gin Processing	Mendota	03/05/03	$7,800.00	156	156	$50.00
CSU Fresno	1	01-0067-A	Lighting Office & Cooler	Encinitas		$595.00	1.7	1.7	$350.00
CSU Fresno	1	01-0067-B	Roof Vent	Encinitas	10/29/04	$12,336.39	25.3	36.48	$337.98
CSU Fresno	1	01-0067-C	Water Storage Tank	Encinitas		$910.00	8.3	8.3	$0.00
CSU Fresno	1	01-0068-A		Stocton	10/06/04	$19,627.91	98.4	119	$164.94
CSU Fresno	1	01-0076-A	Evaporative Condenser Replacement	Arvin	06/02/03	$16,555.00	47.3	47.3	$350.00
CSU Fresno	1	01-0078-A	Golden Valley Grape Juice Tanks	Madera	02/08/02	$4,410.00	14.7	14.7	$300.00
CSU Fresno	1	01-0080-A	Turlock Turkey Plant #1 Air Compressor	Livingston		$33,950.00	97	0	$0.00
CSU Fresno	1	01-0082-A	Pressure System Re-Configuration	Fillmore	04/30/03	$9,543.00	31.81	31.81	$300.00
CSU Fresno	1	01-0084-A	Flash Cooler/T-60 Installation Project	Colusa	11/04/02	$53,200.00	152	152	$350.00
CSU Fresno	1	01-0086-A	Variable Speed Vacum Pump For Dairy	Riverdale	04/11/02	$1,812.50	7.25	7.25	$258.93

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-0088-A	South Avenue	Delhi	10/28/02	$17,636.50	50.89	50.89	$345.81
CSU Fresno	1	01-0091-A	Lighting System Upgrade	Fresno	11/06/01	$8,799.70	25.142	25.142	$350.00
CSU Fresno	1	01-0100-A	Rote Greenhouses	San Marcos	06/02/04	$471.90	8.95	8.95	$52.43
CSU Fresno	1	01-0100-B	Rote Greenhouses	San Marcos	06/02/04	$468.00	2.24	2.24	$234.00
CSU Fresno	1	01-0100-C	Rote Greenhouses	San Marcos	06/02/04	$165.10	2.21	2.21	$82.55
CSU Fresno	1	01-0101-A	Time Management Load Control Device	Hanford	11/02/04	$208.36	56	56	$3.72
CSU Fresno	1	01-0101-B	Surface Drip System/Time Management	Hanford	11/02/04	$31,006.50	88.59	88.59	$350.00
CSU Fresno	1	01-0101-D	Time Management Load Control Device	Hanford	11/02/04	$304.36	84	84	$3.62
CSU Fresno	1	01-0101-E	Time Management Load Control Device	Hanford	11/02/04	$305.06	158	158	$1.93
CSU Fresno	1	01-0106-A	Efficient Electrical Equipment	Carlsbad	01/10/02	$8,238.13	49.5	49.5	$164.76
CSU Fresno	1	01-0108-A	Energy reduction I	Sacramento	11/01/04	$33,728.15	104	104	$324.31
CSU Fresno	1	01-0108-B	Energy reduction I	Sacramento	11/22/02	$3,731.00	10.66	10.66	$373.10
CSU Fresno	1	01-0109-A	Indianola Drip System Retrofit	Kingsburg	11/12/02	$5,621.00	16.06	16.06	$351.31
CSU Fresno	1	01-0119-A		Escalon	11/08/01	$8,354.50	23.87	23.87	$348.10

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-0120-A	Variable Speed Pump For Dairy	Fresno	11/05/01	$5,700.00	19	19	$300.00
CSU Fresno	1	01-0122-A		Santa Paula	06/05/02	$2,550.00	17	17	$150.00
CSU Fresno	1	01-0126-A		Linden	06/02/03	$1,197.86	9.05	9.05	$133.10
CSU Fresno	1	01-0128-A	Energy Reduction	Sacramento	06/10/03	$9,100.00	89	89	$102.25
CSU Fresno	1	01-0128-B	Energy Reduction	Sacramento	06/10/03	$10,209.00	72.2	72.2	$141.79
CSU Fresno	1	01-0128-C	Energy Reduction	Sacramento	06/10/03	$3,250.00	14	14	$232.14
CSU Fresno	1	01-0133-A	Hormel Foods Corporation	Stockton	06/17/03	$253,300.00	1029.75	1013.2	$250.00
CSU Fresno	1	01-0134-A	Dixon Plant Electrical Load Reduction Project	Dixon	11/22/02	$2,947.50	15	15	$196.50
CSU Fresno	1	01-0135-A	60hp VSD system	Grimes	11/06/01	$27,061.00	101.46	101.46	$266.72
CSU Fresno	1	01-0136-A		Stockton	11/18/02	$4,907.50	30	30	$163.58
CSU Fresno	1	01-0142-A	Efficienct Electrical Equipment	Ventura		$2,730.00	9.1	9.1	$300.00
CSU Fresno	1	01-0144-A	Replace Vacuum Pump with Variable Speed drive	Riverdale	11/01/04	$38,745.37	74.8	342.9	$112.99
CSU Fresno	1	01-0146-A	Efficient Regenerative Cooling	Delano	02/05/03	$3,292.70	34.7	16.45	$348.94
CSU Fresno	1	01-0151-A	Coil Replacement	Watsonville	03/20/02	$2,464.80	0	0	$0.00

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-152-A	Power factor correction and lighting power controls	St. Helena		$32,302.00	128.81	0	$350.00
CSU Fresno	1	01-0157-A	Replacing a water tower	Salinas	11/01/04	$68,705.00	104.07	196.3	$298.72
CSU Fresno	1	01-0158-A	Frito-Lay Modesto	Modesto	12/14/01	$29,245.00	97.9	97.9	$492.21
CSU Fresno	1	01-0159-A	Frito-Lay Bakersfield	Bakersfield	12/12/02	$69,845.00	149.9	141.89	$250.00
CSU Fresno	1	01-0160-A	Variable speed vacuum pump for dairy	Fresno	03/26/03	$4,825.00	19.3	19.3	$292.34
CSU Fresno	1	01-0161-A	AC Drive	Reedley	11/01/04	$10,302.00	24.2	35.24	$299.70
CSU Fresno	1	01-0162-A	AC Drive	Reedley	11/01/04	$3,027.00	5.68	10.09	$250.33
CSU Fresno	1	01-0172-A	Jongsma Dairy	Pixley	07/09/02	$5,632.50	22.53	22.53	$250.00
CSU Fresno	1	01-0182-A	Lighting Retrofit	Sonoma	11/18/02	$8,250.00	33	33	$9.37
CSU Fresno	1	01-0185-A	GlenEagles Agricultural Water Pump Timer Addition	Solvang	10/09/02	$655.79	70	70	$15.78
CSU Fresno	1	01-0186-A	Ake Boosters	Hanford	12/03/02	$1,641.42	104	104	$301.15
CSU Fresno	1	01-0189-A	VSD for vacuum pump	Laton	06/01/04	$2,349.00	7.83	7.83	$249.96
CSU Fresno	1	01-0191-A	Natural gas engine-driven chiller	Chico	11/01/04	$55,715.00	154	222.86	$249.00

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-0195-A	McCall Pump	Fowler	12/13/02	$1,867.50	7.47	7.47	$250.92
CSU Fresno	1	01-0200-A	Drip irrigation retrofit	Hanford	01/13/04	$27,350.00	109.4	109.4	$251.18
CSU Fresno	1	01-0204-A	S&S Farms	Bakersfield	11/18/02	$4,270.00	17.08	17.08	$355.46
CSU Fresno	1	01-0207-A	Sprinkler System Conversion	Corning	09/04/03	$1,208.55	3.453	3.453	$350.00
CSU Fresno	1	01-0209-A	B67386	Lodi	01/24/02	$2,905.00	8.3	8.3	$0.00
CSU Fresno	1	01-0217-A	Livingston Processing Plant Air Compressors	Livingston		$9,720.00	38.8	0	$373.39
CSU Fresno	1	01-0218-A	James Murphy	Fallbrook	05/15/02	$4,107.25	11.375	11.375	$350.00
CSU Fresno	1	01-0219-A	Room #'s 1-4 Ammonia Pump Replacement	Reedley	06/01/02	$15,750.00	45	45	$250.08
CSU Fresno	1	01-0223-A	Schechert Ranches	Susanville	02/06/03	$15,330.00	61.32	61.32	$250.00
CSU Fresno	1	01-0225-A	Schechert Ranches	Terrebonne	02/06/03	$1,825.00	7.3	7.3	$125.96
CSU Fresno	1	01-0232-A	Del Puerto Farms	Patterson	02/11/03	$11,437.50	90.77	90.77	$248.96
CSU Fresno	1	01-0241-A	H.D. Plocher Partnership	Woodland	03/30/04	$1,170.13	4.68	4.68	$247.86
CSU Fresno	1	01-0244-A	Pine Crest Farms Dairy	Fresno	03/01/02	$1,735.00	6.94	6.94	$250.00

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-0245-A	Rocking S Dairy	Fresno	02/28/02	$3,500.00	14	14	$247.83
CSU Fresno	1	01-0246-A	Louie Durrer & Sons Dairy	Fresno	02/22/02	$2,280.00	9.18	9.18	$350.00
CSU Fresno	1	01-0249-A	Marugliano Farms	Linden	05/01/02	$4,760.00	13.6	13.6	$349.69
CSU Fresno	1	01-0251-A	Wolff Vineyards	San Luis Obispo	10/21/02	$3,916.50	11.19	11.19	$175.60
CSU Fresno	1	01-0269-A	6179R2- project was Category 2, but switch to Cat 1 for conversion to 40hp pump from 125hp.	Soledad	06/03/04	$7,902.17	44.98	45	$250.00
CSU Fresno	1	01-0287-A	Ray Avansino	Linden	11/15/02	$7,500.00	30	30	$0.00
CSU Fresno	1	01-0312-A	Delano Farms Reservoir 18	Delano		$12,500.00	50	0	$0.00
CSU Fresno	1	01-0312-B	Delano Farms Reservoir 25	Delano		$7,250.00	29	0	$0.00
CSU Fresno	1	01-0312-C	Delano Farms Reservoir 23	Delano		$10,250.00	41	0	$300.00
CSU Fresno	1	01-0315-A	Boiler Plant Modification	Fresno	05/06/02	$19,986.00	66.62	66.62	$250.04
CSU Fresno	1	01-0318-A		Tulare	12/02/02	$34,706.00	140	138.8	$250.53
CSU Fresno	1	01-0328-A	Scully Packing Company LLC	Finley	04/17/03	$2,380.00	17.81	9.52	$269.06
CSU Fresno	1	01-330-A	Replace cooling Tower	Fresno	11/25/03	$28,250.83	104.8	104.8	$250.00

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-0345-A	Horseradish Refrigeration	Tulelake	02/05/03	$4,250.00	30.5	17	$249.74
CSU Fresno	1	01-0348-A	Enology Wine Chiller Replacement & Tank Insulation	Fresno	09/25/03	$9,540.00	50.7	38.16	$250.00
CSU Fresno	1	01-350-A	Talley Farms Reservoir	Arroyo Grande	06/02/04	$7,150.00	41.03	28.6	$14.64
CSU Fresno	1	01-351-A	TOU Meter	Tracy	05/05/03	$683.80	46.7	46.7	$250.64
CSU Fresno	1	01-0353-A	Freemark Abbey Winery	Saint Helena	05/21/03	$1,955.00	7.82	7.82	$252.78
CSU Fresno	1	01-0355-A	Quest Dairy	Chino	04/05/02	$910.00	3.64	3.64	$250.00
CSU Fresno	1	01-357-A		Chandler	12/03/02	$2,950.00	11.8	11.8	$249.99
CSU Fresno	1	01-0358-A	E & J Gallo Winery	Fresno	11/02/04	$87,447.50	174.08	349.79	$247.50
CSU Fresno	1	01-0359-A	Tony Machado Dairy	Merced	09/06/02	$3,465.00	13.86	13.86	$143.33
CSU Fresno	1	01-0367-A	Time of Use Meter	Parlier	01/27/03	$286.66	2.24	2.24	$143.33
CSU Fresno	1	01-0367-B	Time of Use Meter	Parlier	01/27/03	$286.66	1.86	1.86	$143.33
CSU Fresno	1	01-0367-C	Time of Use Meter	Parlier	01/27/03	$286.66	2.24	2.24	$286.66
CSU Fresno	1	01-0367-D	Time of Use Meter	Parlier	01/27/03	$286.66	1.49	1.49	$71.67

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-0367-E	Time of Use Meter	Parlier	01/27/03	$286.66	3.7	3.7	$286.66
CSU Fresno	1	01-0367-F	Time of Use Meter	Parlier	01/27/03	$286.66	1.2	1.2	$57.33
CSU Fresno	1	01-0367-G	Time of Use Meter	Parlier	01/27/03	$286.66	4.92	4.92	$143.33
CSU Fresno	1	01-0367-H	Time of Use Meter	Parlier	01/27/03	$286.66	2.24	2.24	$286.66
CSU Fresno	1	01-0367-I	Time of Use Meter	Parlier	01/27/03	$286.66	1.87	1.87	$249.85
CSU Fresno	1	01-0368-A	Packinghouse Remodel	Lindsay	07/19/02	$16,790.00	67.16	67.16	$250.00
CSU Fresno	1	01-0376-A	Valley Fig Growers	Fresno	06/02/03	$12,100.00		48.4	$248.44
CSU Fresno	1	01-0378-A	DC Lighting	Sacramento	11/18/02	$11,925.00	47.7	47.7	$240.83
CSU Fresno	1	01-0380-A	Vacuum pump VSD	Fresno	04/24/02	$2,890.00	11.56	11.56	$358.75
CSU Fresno	1	01-0391-A	MRD Dairy	Chino	02/22/02	$2,152.50	6.15	6.15	$253.89
CSU Fresno	1	01-0392-A	L&M Dairy	Merced	05/16/02	$2,285.00	9.14	9.14	$256.25
CSU Fresno	1	01-0402-A	Ronnie Ray Dairy	Fresno	08/19/02	$1,537.50	6.15	6.15	$350.00
CSU Fresno	1	01-0404-A	Replacing Water Tower	Salinas	06/25/02	$10,115.00	28.9	28.9	$249.77

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-0405-A	Sun Maid Growers	Kingsburg	09/20/02	$32,470.00	144.28	129.88	$251.88
CSU Fresno	1	01-0412-A	Clos Pegase	Calistoga	12/06/02	$3,022.50	12.09	12.09	$386.71
CSU Fresno	1	01-0415-A	Ed Brower dairy	Exeter	08/12/02	$6,690.00	17.34	17.34	$249.14
CSU Fresno	1	01-0416-A	Toledo Dairy	Kingburg	05/31/02	$2,890.00	11.56	11.56	$249.49
CSU Fresno	1	01-0417-A	M.F. Gomes & Sons Dairy	Tulare	11/26/03	$2,470.00	9.88	9.88	$250.02
CSU Fresno	1	01-0422-A	Ice Production	Santa Maria	05/25/04	$53,705.00	220.35	214.82	$260.00
CSU Fresno	1	01-0428-A	Vacuum pump VSD	San Jacinto	10/01/02	$2,340.00	9.36	9.36	$250.37
CSU Fresno	1	01-0433-A	Franciscan Vineyards - Solar Bees	St. Helena	11/18/03	$6,735.00	26.93	26.93	$248.19
CSU Fresno	1	01-0436-A	2Vel Dairy Dairy	Winton	09/03/02	$4,467.50	17.87	17.87	$342.31
CSU Fresno	1	01-0449-A	Vacuum pump VSD	Tulare	08/19/02	$5,477.00	15.67	15.67	$293.81
CSU Fresno	1	01-0449-B	Vacuum pump VSD	Tulare	08/19/02	$4,701.00	15.67	15.67	$249.80
CSU Fresno	1	01-0453-A	JP Farms	Tulare	01/16/03	$39,892.50	159.57	159.57	$350.00
CSU Fresno	1	01-0465-A	Frank Guidera Co.	Tulare	09/11/02	$18,445.00	52.7	52.7	$250.00

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-0468-A	Lee Cardoza Dairy	Hanford	09/03/02	$1,025.00	4.1	4.1	$250.96
CSU Fresno	1	01-0469-A	Vacuum pump VSD	Tulare	11/20/02	$1,957.50	7.83	7.83	$250.00
CSU Fresno	1	01-0471-A	Tony Souza Dairy	Selma	11/27/02	$3,825.00	15.3	15.3	$247.98
CSU Fresno	1	01-0474-A	Vacuum pump VSD	Hanford	08/06/02	$1,537.50	6.15	6.15	$250.00
CSU Fresno	1	01-0477-A	James Brower	Modesto	11/12/02	$1,000.00	4	4	$235.76
CSU Fresno	1	01-0479-A	David Allan H.P. Reduction	Cedarville	11/15/02	$8,487.36	36.09	36.09	$250.05
CSU Fresno	1	01-0480-A	Lance Mouw Dairy	Bakersfield	02/27/03	$24,805.00	99.22	99.22	$0.00
CSU Fresno	1	01-0488-A	Vander Schaaf Dairy	Chino		$2,025.00	8.1	0	$256.67
CSU Fresno	1	01-0489-A	VSD for vacuum pump	Newman	10/07/02	$1,540.00	6.16	6.19	$53.62
CSU Fresno	1	01-0493-A	Chandlers 60 HP	Stockton	06/16/03	$2,000.00	26.4	37.3	
CSU Fresno	1	01-0493-B	Tulare 50hp	Stockton		$0.00	0	0	$0.00
CSU Fresno	1	01-0500-A	If2 Drip Station	Madera		$1,991.50	5.69	0	$244.95
CSU Fresno	1	01-0503-A	Don Cardey Pump	Turlock	10/27/03	$25,720.00	105	105	$249.21
CSU Fresno	1	01-0513-A	Golden Valley Grape Juice and Wine	Madera	12/05/02	$3,937.50	15.75	15.75	$249.49

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-0514-A	J. Wine Company	Healdsburg	05/22/03	$4,940.00	19.76	19.76	$302.67
CSU Fresno	1	01-0519-A	A&T Dairy	Chowchilla	03/05/03	$2,270.00	9.08	7.45	$256.25
CSU Fresno	1	01-0521-A	S & S Dairy	Visalia	10/03/02	$2,050.00	8.2	8.2	$256.25
CSU Fresno	1	01-0522-A	Harry Miersma Dairy	Chino	11/29/02	$2,050.00	8.2	8.2	$250.00
CSU Fresno	1	01-0525-A	Palla Rosa #3 Dairy	Bakersfield	06/02/03	$3,075.00	12.3	12.3	$249.49
CSU Fresno	1	01-0526-A	Jack Mendonsa Dairy	Tipton	04/30/03	$2,470.00	9.88	9.88	$250.00
CSU Fresno	1	01-0533-A	J&L Dairy	Tulare	11/27/02	$2,875.00	11.5	11.5	$247.00
CSU Fresno	1	01-0538-A	Three Palms Dairy/Antonio Rodriguez	Chino	11/27/02	$2,470.00	9.88	9.88	$15.94
CSU Fresno	1	01-583-A	Family Limited Partnership 2 and 3	Delano	03/05/03	$6,565.65	412	412	$250.00
CSU Fresno	1	01-0592-A	Red Diamond Cooling, Inc.	Santa Maria	05/17/04	$33,475.00	133.9	133.9	$250.00
CSU Fresno	1	01-0595-A	Rio Pluma Company	Gridley	10/20/03	$5,150.00	0	0	$250.00
CSU Fresno	1	01-0616-A	Cordeniz & Gomes Dairy	Tulare	10/23/03	$2,875.00	11.5	11.5	$250.00
CSU Fresno	1	01-0618-A	Tony Mendonca #2	Tulare	12/16/03	$2,470.00	9.88	9.88	$250.00

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-0621-A	Harry Hoffman Dairy	Tulare	10/27/03	$1,950.00	7.8	7.8	$227.53
CSU Fresno	1	01-0628-A	Puritan Ice Co.	Guadalupe	02/25/03	$139,705.54	614	614	$250.00
CSU Fresno	1	01-0637-A	Manual Rosa Dairy	Bakersfield	06/30/03	$4,860.00	19.44	19.44	$251.70
CSU Fresno	1	01-652-A	James R. Samuel	Stockton	08/18/03	$3,642.14	14.57	14.47	$250.00
CSU Fresno	1	01-0724-A	Scott Mather	Morro Bay	10/28/03	$932.50	0	3.73	$250.00
CSU Fresno	1	01-0725-A	Puritan Ice Company		06/23/04	$105,950.00	423.8	423.8	$250.00
CSU Fresno	1	01-0727-A	El Solyo Water District	Vernalis	12/09/03	$1,762.50	30	7.05	$250.00
CSU Fresno	1	01-0728-A	El Solyo Water District	Vernalis	12/09/03	$620.00	27.45	2.48	$250.00
CSU Fresno	1	01-0734-A	Rockview Dairies Inc	Downey	10/10/04	$60,342.50	199.45	241.37	$250.00
CSU Fresno	1	01-0737-A	Rosemary Farms	Santa Maria	12/16/03	$4,275.00	17.1	17.1	
CSU Fresno	1	01-0747-A	Walsh Vineyard Management	Napa		$0.00	0	0	$0.00
CSU Fresno	1	01-0754-A	Enns Packing	Dinuba		$12,675.00	50.7	0	$250.00
CSU Fresno	1	01-0765-A	Central California Almond Growers Assoc.	Sanger	06/02/04	$6,075.00	33.57	24.3	$0.00

Program Administrator	Category	Project #	Project Name	City	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU Fresno	1	01-0766-A	Lindauer River Ranch	Red Bluff		$3,370.00	13.48	0	$250.02
CSU Fresno	1	01-0771-A	Ag Foundation CSU, Fresno	Fresno	10/10/03	$15,628.50	62.51	62.51	$0.00
CSU Fresno	1	01-0778-A	Fox Point Farms	Encinitas		$4,070.00	16.28	0	$250.00
CSU Fresno	1	01-0780-A	Selma Cold & Dry Storage, LLC	Selma	12/08/03	$20,272.50	81.09	81.09	$0.00
CSU Fresno	1	01-0781-A	Netle USA Carnation Products	Mendota		$256,030.00	1024.12	0	$0.00
CSU Fresno	1	01-0794-A	Whitehouse Rd Irrigation System	Linden		$5,000.00	23.4	0	$250.94
CSU Fresno	1	01-0795-A	Keithly-Williams Seeds	Holtville	11/04/04	$2,662.50	11.1	10.61	$243.72
CSU Fresno	1	01-0799-A	Paul Masson	Madera	11/10/04	$38,787.50	175	159.15	$300.00
Subtotal projects	179				Subtotal of Grant Payments	**$2,094,337**			
					Subtotal of contracted savings, kW		**10,632**		
					Subtotal of verified savings			**9,676**	
					Average simple cost effectiveness				**$216.44**

Cal Poly Category 2 Pump Repair Projects

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	1	Chamberlain Water Company (M-141)	(M-141)	Pre-Approved 7/127/01	$16,802.25		Option 3	
Cal Poly	2	1	Chamberlain Water Company (M-142)	(M-142)	Pre-Approved 7/127/01	$15,332.75		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	1	Chamberlain Water Company (M_147)	(M_147)	Pre-Approved 7/127/01	$28,340.00		Option 1; 65% of Cost	
Cal Poly	2	2	Westlands WD - Vasto Valle Farms (#108)	(#108)	07/02/02	$40,235.33		Option 3	
Cal Poly	2	3	Lloyd-Butler Mutual Water Company		12/06/01	$ 2,548.20		Option 3	
Cal Poly	2	4	Patterson Irrigation District- Station 4, Pump 4	Station 4, Pump 4	Pre-Approved 8/31/01	$ 4,002.65		Option 2: Pre vs Post kW/AF	
Cal Poly	2	5	Westlands Water District - Vasto Valle Farms	#109	07/02/02	$40,570.95		Option 1; 65% of Cost	
Cal Poly	2	5	Westlands Water District - Vasto Valle Farms	#1	07/02/02	$37,622.08		Option 3	
Cal Poly	2	5	Westlands Water District - Vasto Valle Farms	#3	07/02/02	$46,764.17		Option 3	
Cal Poly	2	6	Patterson Irrigation District	Station 1, Pump 7	04/26/02	$ 7,529.62		Option 2	
Cal Poly	2	6	Patterson Irrigation District	Station 2, Pump 4	Pre-Approved 9/10/01	$ 5,678.75		Option 2	
Cal Poly	2	6	Patterson Irrigation District	Station 4, Pump 1	Pre-Approved 9/10/01	$ 6,271.13		Option 2	
Cal Poly	2	7	Wheeler Ridge - Maricopa Water Storage District	5PP4, Unit 2	Pre-Approved 11/7/01	$ 4,550.00		Option 2	
Cal Poly	2	7	Wheeler Ridge - Maricopa Water Storage District	PC-1, Unit 1	08/08/03	$ 3,256.00		Option 2	
Cal Poly	2	7	Wheeler Ridge - Maricopa Water Storage District	WRM4, Unit 4	Pre-Approved 11/7/01	$ 4,448.00		Option 3	
Cal Poly	2	7	Wheeler Ridge - Maricopa Water Storage District	WRM4, Unit 5	08/08/03	$ 1,352.00		Option 3	
Cal Poly	2	7	Wheeler Ridge - Maricopa Water Storage District	WRM7, Unit 4	08/08/03	$ 4,109.00		Option 3	
Cal Poly	2	7	Wheeler Ridge - Maricopa Water Storage District	WRM7, Unit 5	Pre-Approved 11/7/01	$ 4,550.00		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	7	Wheeler Ridge - Maricopa Water Storage District	WRM9, Unit 1	08/08/03	$ 2,222.00		Option 3	
Cal Poly	2	7	Wheeler Ridge - Maricopa Water Storage District	WRM9, Unit 3	08/08/03	$ 1,899.00		Option 3	
Cal Poly	2	8	Westside WD	Lateral 5, Pump 3	05/16/03	$ 2,363.16		Option 2	
Cal Poly	2	8	Westside WD	Lateral 5, Pump 4	09/18/02	$ 1,128.73		Option 2	
Cal Poly	2	8	Westside WD	Lateral 5, Pump 5	09/18/02	$ 1,116.77		Option 2	
Cal Poly	2	8	Westside WD	Lateral 7, Pump 4	09/18/02	$ 1,098.75		Option 2	
Cal Poly	2	9	Westlands WD	6-1, Unit 1	12/13/01	$ 6,063.50		Option 3	
Cal Poly	2	9	Westlands WD	6-1, Unit 7	12/13/01	$ 1,732.43		Option 3	
Cal Poly	2	9	Westlands WD	7RA, Unit 3	12/13/01	$ 8,001.20		Option 3	
Cal Poly	2	9	Westlands WD	23R, Unit 5	12/13/01	$ 523.03		Option 3	
Cal Poly	2	10	Central California ID	5A	05/09/03	$ 3,950.50		Option 3	
Cal Poly	2	10	Central California ID	6A	05/09/03	$ 3,219.10		Option 2	
Cal Poly	2	10	Central California ID	9A	05/09/03	$ 3,402.68		Option 3	
Cal Poly	2	10	Central California ID	12C	05/09/03	$ 4,228.75		Option 3	
Cal Poly	2	10	Central California ID	13	05/09/03	$ 2,852.10		Option 3	
Cal Poly	2	10	Central California ID	15B	05/09/03	$ 2,483.58		Option 3	
Cal Poly	2	10	Central California ID	18B	05/09/03	$ 3,724.70		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	10	Central California ID	19B	05/09/03	$ 2,363.00		Option 3	
Cal Poly	2	10	Central California ID	21A	05/09/03	$ 3,742.75		Option 3	
Cal Poly	2	10	Central California ID	23B	05/09/03	$ 4,007.05		Option 3	
Cal Poly	2	10	Central California ID	29	05/09/03	$ 4,063.03		Option 3	
Cal Poly	2	10	Central California ID	30	05/09/03	$ 1,390.68		Option 3	
Cal Poly	2	10	Central California ID	32B	05/09/03	$ 4,405.00		Option 3	
Cal Poly	2	10	Central California ID	35A	05/09/03	$ 3,954.03		Option 3	
Cal Poly	2	10	Central California ID	36	05/09/03	$ 3,560.48		Option 2	
Cal Poly	2	10	Central California ID	37A	05/09/03	$ 4,099.30		Option 3	
Cal Poly	2	10	Central California ID	41	05/09/03	$ 5,140.00		Option 3	
Cal Poly	2	10	Central California ID	42	05/09/03	$ 2,949.05		Option 3	
Cal Poly	2	10	Central California ID	45A	05/09/03	$ 1,787.18		Option 3	
Cal Poly	2	10	Central California ID	46	05/09/03	$ 3,416.73		Option 3	
Cal Poly	2	10	Central California ID	48A	05/09/03	$ 3,646.05		Option 3	
Cal Poly	2	10	Central California ID	49A	05/09/03	$ 4,063.63		Option 3	
Cal Poly	2	10	Central California ID	51	05/09/03	$ 3,653.00		Option 2	
Cal Poly	2	10	Central California ID	53	05/09/03	$ 2,107.63		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	10	Central California ID	54A	05/09/03	$ 2,267.65		Option 3	
Cal Poly	2	10	Central California ID	55	05/09/03	$ 3,007.73		Option 3	
Cal Poly	2	11	Westlands WD	3R, Unit 1	12/02/01	$ 3,658.92		Option 3	
Cal Poly	2	11	Westlands WD	24R, Unit 3	12/02/01	$ 2,945.32		Option 3	
Cal Poly	2	11	Westlands WD	2RB, Unit 3	12/02/01	$10,694.81		Option 3	
Cal Poly	2	11	Westlands WD	2RA, Unit 2	12/02/01	$ 8,169.12		Option 3	
Cal Poly	2	12	Lost Hills WD	Station 1, Pump 1	09/23/03	$ 6,712.42		Option 1; 65% of Cost	
Cal Poly	2	12	Lost Hills WD	Station 1, Pump 2	Accpeted 1/16/02	$13,000.00		Option 1; 65% of Cost	
Cal Poly	2	12	Lost Hills WD	Station 1, Pump 3	09/23/03	$33,562.09		Option 1; 65% of Cost	
Cal Poly	2	12	Lost Hills WD	Station 1, Pump 4	09/23/03	$33,562.09		Option 1; 65% of Cost	
Cal Poly	2	12	Lost Hills WD	Station 1, Pump 5	Accpeted 1/16/02	$12,052.00		Option 1; 65% of Cost	
Cal Poly	2	12	Lost Hills WD	Station 1, Pump 6	Accpeted 1/16/02	$ 5,529.00		Option 3	
Cal Poly	2	12	Lost Hills WD	Station 1, Pump 7	Accpeted 1/16/02	$14,300.00		Option 1; 65% of Cost	
Cal Poly	2	12	Lost Hills WD	Station 1R, Pump 1	09/23/03	$ 5,889.99		Option 3	
Cal Poly	2	12	Lost Hills WD	Station 1R, Pump 2	Accpeted 1/16/02	$11,375.00		Option 1; 65% of Cost	
Cal Poly	2	12	Lost Hills WD	Station 1R, Pump 3	Accpeted 1/16/02	$11,375.00		Option 1; 65% of Cost	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	12	Lost Hills WD	Station 1R, Pump 4	Accpeted 1/16/02	$11,375.00		Option 1; 65% of Cost	
Cal Poly	2	12	Lost Hills WD	Station 1R, Pump 5	09/23/03	$ 5,889.99		Option 3	
Cal Poly	2	12	Lost Hills WD	Station 5, Pump 1	09/23/03	$ 1,550.50		Option 2	
Cal Poly	2	12	Lost Hills WD	Station 5, Pump 2	Accpeted 1/16/02	$ 2,455.00		Option 3	
Cal Poly	2	12	Lost Hills WD	Station 7, Pump 1	09/23/03	$ 2,913.78		Option 2	
Cal Poly	2	12	Lost Hills WD	Station 7, Pump 2	09/23/03	$ 3,642.22		Option 2	
Cal Poly	2	13	Cawelo WD	Station B, Pump 1	Accpeted 1/16/02	$12,350.00		Option 1; 65% of Cost	
Cal Poly	2	13	Cawelo WD	Station B, Pump 2	Accpeted 1/16/02	$14,625.00		Option 1; 65% of Cost	
Cal Poly	2	13	Cawelo WD	Station B, Pump 3	Accpeted 1/16/02	$14,625.00		Option 1; 65% of Cost	
Cal Poly	2	13	Cawelo WD	Station B, Pump 4	Accpeted 1/16/02	$14,625.00		Option 1; 65% of Cost	
Cal Poly	2	13	Cawelo WD	Station B, Pump 6	Accpeted 1/16/02	$14,950.00		Option 1; 65% of Cost	
Cal Poly	2	13	Cawelo WD	Station B, Pump 7	Accpeted 1/16/02	$14,950.00		Option 1; 65% of Cost	
Cal Poly	2	13	Cawelo WD	Station C, Pump 1	Accpeted 1/16/02	$11,700.00		Option 1; 65% of Cost	
Cal Poly	2	13	Cawelo WD	Station C, Pump 2	Accpeted 1/16/02	$14,300.00		Option 1; 65% of Cost	
Cal Poly	2	13	Cawelo WD	Station C, Pump 3	Accpeted 1/16/02	$14,300.00		Option 1; 65% of Cost	
Cal Poly	2	13	Cawelo WD	Station C, Pump 5	Accpeted 1/16/02	$14,300.00		Option 1; 65% of Cost	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	14	James ID	C - 59	03/10/03	$ 3,588.00		Option 3	
Cal Poly	2	14	James ID	D - 36	03/10/03	$ 7,543.00		Option 3	
Cal Poly	2	14	James ID	D - 39	03/10/03	$ 2,770.00		Option 3	
Cal Poly	2	14	James ID	D - 47	03/10/03	$ 4,282.00		Option 3	
Cal Poly	2	15	Kern County Water Agency	KCWA 1	08/29/03	$17,439.00		Option 3	
Cal Poly	2	15	Kern County Water Agency	KCWA 2	08/29/03	$16,707.45		Option 3	
Cal Poly	2	15	Kern County Water Agency	KCWA 3	06/20/03	$18,793.00		Option 3	
Cal Poly	2	15	Kern County Water Agency	KCWA 4	Accpeted 3/4/02	$11,912.95		Option 3	
Cal Poly	2	15	Kern County Water Agency	KCWA 5	08/29/03	$17,655.00		Option 3	
Cal Poly	2	15	Kern County Water Agency	KCWA 6	Accpeted 3/4/02	$13,583.67		Option 3	
Cal Poly	2	15	Kern County Water Agency	KCWA 10	Accpeted 3/4/02	$13,077.20		Option 3	
Cal Poly	2	15	Kern County Water Agency	KCWA 12	Accpeted 3/4/02	$11,041.27		Option 3	
Cal Poly	2	15	Kern County Water Agency	KCWA 13	Accpeted 3/4/02	$10,242.22		Option 3	
Cal Poly	2	15	Kern County Water Agency	BK 4	Accpeted 3/4/02	$13,566.32		Option 3	
Cal Poly	2	16	Kern Water Bank Authority	30S/25E-5K1	03/06/03	$24,981.97		Option 3	
Cal Poly	2	16	Kern Water Bank Authority	30S/25E-6K1	03/06/03	$23,660.00		Option 3	
Cal Poly	2	16	Kern Water Bank Authority	30S/25E-18P1	07/08/03	$10,047.81		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	16	Kern Water Bank Authority	30S/25E-4L1	03/06/03	$21,101.84		Option 3	
Cal Poly	2	16	Kern Water Bank Authority	30S/25E-20C1	07/08/03	$13,965.50		Option 3	
Cal Poly	2	16	Kern Water Bank Authority	30S/25E-15C1	07/08/03	$15,503.18		Option 3	
Cal Poly	2	16	Kern Water Bank Authority	30S/25E-15O1	07/08/03	$25,791.54		Option 3	
Cal Poly	2	16	Kern Water Bank Authority	30S/25E-15B1	07/08/03	$30,012.70		Option 3	
Cal Poly	2	17	Westlands WD	2RB, Unit 1	03/22/02	$10,694.81		Option 3	
Cal Poly	2	17	Westlands WD	4R, Unit 2	03/22/02	$ 3,881.49		Option 3	
Cal Poly	2	17	Westlands WD	6-1, Unit 2	03/22/02	$ 6,063.50		Option 3	
Cal Poly	2	17	Westlands WD	9L, Unit 1	03/22/02	$ 959.68		Option 3	
Cal Poly	2	17	Westlands WD	9L, Unit 2	03/22/02	$ 959.68		Option 3	
Cal Poly	2	17	Westlands WD	11R, Unit 1	03/22/02	$ 8,706.98		Option 3	
Cal Poly	2	17	Westlands WD	18L, Unit 1	03/22/02	$ 1,053.87		Option 3	
Cal Poly	2	17	Westlands WD	21L, Unit 1	03/22/02	$ 495.79		Option 3	
Cal Poly	2	17	Westlands WD	21R, Unit 4	03/22/02	$ 2,817.02		Option 3	
Cal Poly	2	17	Westlands WD	21R, Unit 5	03/22/02	$ 1,355.33		Option 3	
Cal Poly	2	17	Westlands WD	29L, Unit 4	03/22/02	$ 3,808.40		Option 3	
Cal Poly	2	17	Westlands WD	32L, Unit 4	03/22/02	$ 1,538.30		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	18	RD 2068	PS4, #1	Approved 3/21/02	$ 2,159.00		Option 3	
Cal Poly	2	19	RD 548	#5	09/18/02	$ 5,035.50		Option 3	
Cal Poly	2	19	RD 548	White #1	09/18/02	$ 3,827.00		Option 3	
Cal Poly	2	20	RD 2028	#3 - North	Pre-Approved 3/21/02	$ 1,650.00		Option 3	
Cal Poly	2	20	RD 2028	#2 - West	04/12/02	$ 3,166.33		Option 3	
Cal Poly	2	21	RD 830	Jersey Island	04/08/02	$ 5,592.50		Option 3	
Cal Poly	2	22	Patterson Irrigation District	Sta 4 VFD+Pump Repair	Approved 4/4/02	$10,000.00		Option 2	
Cal Poly	2	22	Patterson Irrigation District	Station 5 VFD	Approved 4/4/02	$ 8,000.00		Option 2	
Cal Poly	2	23	Westlands WD	14RA, Unit 3	04/08/02	$17,034.01		Option 3	
Cal Poly	2	23	Westlands WD	3L, Unit 4	04/08/02	$ 5,842.16		Option 3	
Cal Poly	2	23	Westlands WD	32L, Unit 2	04/08/02	$ 769.15		Option 3	
Cal Poly	2	24	RD 2058	R37463	04/24/02	$ 3,431.43		Option 3	
Cal Poly	2	25	Westlands WD	26R, Unit 1	04/25/02	$ 2,334.80		Option 3	
Cal Poly	2	25	Westlands WD	11R, Unit 2	04/25/02	$ 4,568.77		Option 1; 65% of Cost	
Cal Poly	2	25	Westlands WD	16RB, Unit 2	04/25/02	$ 6,164.55		Option 1; 65% of Cost	
Cal Poly	2	25	Westlands WD	3R, Unit 3	04/25/02	$ 6,237.73		Option 3	
Cal Poly	2	26	James Irrigation District	C - 67	03/10/03	$ 3,914.00		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	26	James Irrigation District	C - 70	03/10/03	$ 5,085.00		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-17 #1	08/06/02	$ 345.13		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-12 #2	08/06/02	$ 472.29		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-1 #3	08/06/02	$ 802.20		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-18 #5	08/06/02	$ 641.76		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-12 #1	08/06/02	$ 472.29		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-10 #5	08/06/02	$ 2,951.28		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-2 #3	08/06/02	$ 187.06		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-17 #2	08/06/02	$ 443.74		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-10 #2	08/06/02	$ 1,475.64		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-10 #4	08/06/02	$ 2,951.28		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-10 #1	08/06/02	$ 1,475.64		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-11 #3	08/06/02	$ 393.86		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-2 #1	08/06/02	$ 187.06		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-10 #3	08/06/02	$ 2,951.28		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-17 #3	08/06/02	$ 887.47		Option 3	
Cal Poly	2	27	Delano-Earlimart Irrigation District	D-12 #3	08/06/02	$ 787.16			

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	28	Maxwell Irrigation District	West PS #4	05/22/02	$ 1,643.25		Option 3	
Cal Poly	2	29	Reclamation District #2033	North Pump of South Plant	Approved 5/23/02	$ 1,115.45		Option 3	
Cal Poly	2	29	Reclamation District #2033	South Pump of South Plant	Approved 5/23/02	$ 3,135.28		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	WRM-10,4	08/08/03	$ 4,532.00		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	WRM-10,7	08/08/03	$ 8,970.00		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	WRM-3,4	08/08/03	$ 521.00		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	WRM4,3	Approved 6/4/02	$ 256.50		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	WRM-6,1	Approved 6/4/02	$ 3,575.00		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	5P-P2,5	Approved 6/4/02	$ 2,219.75		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	5P-P3,3	Approved 6/4/02	$ 2,219.75		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	6P-P2,2	Approved 6/4/02	$ 2,567.50		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	6P-P2,3	Approved 6/4/02	$ 2,278.69		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	7P-P2,1	Approved 6/4/02	$ 2,414.75		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	PA-2,3	Approved 6/4/02	$ 2,827.50		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	PB-1,5	Approved 6/4/02	$ 3,575.00		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	PB-2,1	Approved 6/4/02	$ 2,219.75		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	PB-2,2	Approved 6/4/02	$ 2,219.75		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	PB-2,3	Approved 6/4/02	$ 690.75		Option 3	
Cal Poly	2	30	Wheeler Ridge-Maricopa Water Storage District	PD-1,3	Approved 6/4/02	$ 2,567.50		Option 3	
Cal Poly	2	31	Westlands Water District	26R, Unit 4	06/19/02	$ 2,523.18		Option 1; 65% of Cost	
Cal Poly	2	31	Westlands Water District	1R2.0 B, Unit 1	06/19/02	$ 2,728.34		Option 1; 65% of Cost	
Cal Poly	2	31	Westlands Water District	12R, Unit 6	06/19/02	$ 3,312.91		Option 1; 65% of Cost	
Cal Poly	2	31	Westlands Water District	7RC, Unit 5	06/19/02	$ 1,859.30		Option 1; 65% of Cost	
Cal Poly	2	31	Westlands Water District	24L, Unit 2	06/19/02	$ 779.90		Option 3	
Cal Poly	2	31	Westlands Water District	DU#4, Unit 3	06/19/02	$ 2,641.51		Option 1; 65% of Cost	
Cal Poly	2	31	Westlands Water District	PV6, Unit 3	06/19/02	$ 1,054.95		Option 3	
Cal Poly	2	31	Westlands Water District	38RA, Unit 4	06/19/02	$ 3,929.61		Option 1; 65% of Cost	
Cal Poly	2	31	Westlands Water District	1R4.0D	06/19/02	$ 2,614.63		Option 3	
Cal Poly	2	31	Westlands Water District	32L, Unit 1	06/19/02	$ 549.98		Option 3	
Cal Poly	2	31	Westlands Water District	22R, Unit 2	06/19/02	$ 7,520.88		Option 3	
Cal Poly	2	31	Westlands Water District	24L, Unit 3	06/19/02	$ 1,559.83		Option 3	
Cal Poly	2	31	Westlands Water District	14RA, Unit 5	06/19/02	$ 4,004.15		Option 1; 65% of Cost	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	31	Westlands Water District	17L, Unit 1	06/19/02	$ 842.93		Option 1; 65% of Cost	
Cal Poly	2	31	Westlands Water District	6-1, Unit 4	06/19/02	$ 6,063.50		Option 3	
Cal Poly	2	31	Westlands Water District	16L, Unit 1	06/19/02	$ 2,617.38		Option 3	
Cal Poly	2	31	Westlands Water District	11R, Unit 4	06/19/02	$ 4,594.67		Option 1; 65% of Cost	
Cal Poly	2	31	Westlands Water District	6L, Unit 2	06/19/02	$ 2,768.15		Option 1; 65% of Cost	
Cal Poly	2	31	Westlands Water District	7RC, Unit 2	06/19/02	$10,371.28		Option 1; 65% of Cost	
Cal Poly	2	32	Tulare Irrigation District	Area 7	Pre-Approved 7/16/02	$ 76.50		Option 3	
Cal Poly	2	32	Tulare Irrigation District	Area 12	Pre-Approved 7/16/02	$ 258.00		Option 3	
Cal Poly	2	32	Tulare Irrigation District	Area 18-10HP	Pre-Approved 7/16/02	$ 214.80		Option 3	
Cal Poly	2	32	Tulare Irrigation District	Area 18-20HP	Pre-Approved 7/16/02	$ 564.50		Option 3	
Cal Poly	2	32	Tulare Irrigation District	City	Pre-Approved 7/16/02	$ 561.00		Option 3	
Cal Poly	2	33	Jackson Valley Irrigation District	1	09/18/02	$ 3,625.00		Option 3	
Cal Poly	2	34	James Irrigation District	D-35	03/10/03	$ 7,718.00		Option 1; 65% of Cost	
Cal Poly	2	34	James Irrigation District	C-82	03/10/03	$ 8,298.00		Option 1; 65% of Cost	
Cal Poly	2	34	James Irrigation District	C-75	03/10/03	$ 3,989.00		Option 3	
Cal Poly	2	35	Garden Hwy. Mutual Water Company	1	03/26/03	$ 8,017.75		Option 1; 65% of Cost	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	36	South San Joaquin Irrigation District	92	Pre-Approved 9/18/02	$ 270.65		Option 3	
Cal Poly	2	36	South San Joaquin Irrigation District	72	02/18/03	$ 732.95		Option 3	
Cal Poly	2	36	South San Joaquin Irrigation District	39	02/18/03	$ 955.31		Option 3	
Cal Poly	2	38	Westlands Water District	Unit 2@PV6	09/20/02	$ 1,054.95		Option 3	
Cal Poly	2	38	Westlands Water District	Unit 4@7RC	09/20/02	$ 3,241.03		Option 3	
Cal Poly	2	38	Westlands Water District	Unit 2@25L	09/20/02	$ 1,518.35		Option 3	
Cal Poly	2	38	Westlands Water District	Unit 3@16RB	09/20/02	$11,372.48		Option 3	
Cal Poly	2	38	Westlands Water District	Unit 5@1R4.0.B	09/20/02	$ 4,493.95		Option 3	
Cal Poly	2	38	Westlands Water District	Unit 5@13RA	09/20/02	$ 2,364.25		Option 3	
Cal Poly	2	38	Westlands Water District	Unit 5@22R	09/20/02	$ 1,764.50		Option 1; 65% of Cost	
Cal Poly	2	38	Westlands Water District	Unit 3@7L	09/20/02	$ 1,377.58		Option 1; 65% of Cost	
Cal Poly	2	38	Westlands Water District	Unit 5@6-2	09/20/02	$ 1,036.98		Option 1; 65% of Cost	
Cal Poly	2	38	Westlands Water District	Unit 1@28R1.0W	09/20/02	$ 1,915.64		Option 1; 65% of Cost	
Cal Poly	2	38	Westlands Water District	Unit 6@6-2PP	09/20/02	$ 472.97		Option 1; 65% of Cost	
Cal Poly	2	40	Madera Water District	Well 1	11/01/02	$ 7,033.00		Option 3	
Cal Poly	2	40	Madera Water District	Well 16	11/01/02	$10,677.00		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	40	Madera Water District	Well 6	11/01/02	$ 8,277.00		Option 3	
		41		Well 32-1	03/06/03	$17,550.98		Option 1; 65% of Cost	
Cal Poly	2	41	Westlands WD - Borba Farms	Well 32-2	Pre-Approved 11/4/02	$22,500.00		Option 3	
Cal Poly	2	41	Westlands WD - Borba Farms	Well 33-5	02/19/03	$13,675.91		Option 3	
Cal Poly	2	42	Corcoran Irrigation District	Well 2	11/01/02	$10,366.33		Option 3	
Cal Poly	2	42	Corcoran Irrigation District	Well 35	11/01/02	$12,367.01		Option 1; 65% of Cost	
Cal Poly	2	42	Corcoran Irrigation District	Well 34	12/09/02	$13,701.00		Option 1; 65% of Cost	
Cal Poly	2	42	Corcoran Irrigation District	Well 54	11/01/02	$ 8,278.80		Option 3	
Cal Poly	2	42	Corcoran Irrigation District	Well 16	11/01/02	$ 3,730.00		Option 1; 65% of Cost	
Cal Poly	2	42	Corcoran Irrigation District	Well 69	11/01/02	$14,909.54		Option 1; 65% of Cost	
Cal Poly	2	42	Corcoran Irrigation District	Well 51	11/01/02	$14,180.00		Option 1; 65% of Cost	
Cal Poly	2	43	Westlands Water District	Unit 1@16RA	11/25/02	$16,168.10		Option 1; 65% of Cost	
Cal Poly	2	43	Westlands Water District	Unit 1@4R	11/25/02	$ 8,893.53		Option 3	
Cal Poly	2	43	Westlands Water District	Unit 2@3R	11/25/02	$ 4,929.00		Option 1; 65% of Cost	
Cal Poly	2	43	Westlands Water District	Unit 5@28RA	11/25/02	$ 4,203.20		Option 3	
Cal Poly	2	43	Westlands Water District	Unit 3@25R	11/25/02	$ 2,978.85		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	43	Westlands Water District	Unit 8@6-1	11/25/02	$ 1,732.43		Option 3	
Cal Poly	2	43	Westlands Water District	Unit 4@25R	11/25/02	$ 1,489.43		Option 3	
Cal Poly	2	43	Westlands Water District	Unit 5@25R	11/25/02	$ 1,489.43		Option 3	
Cal Poly	2	43	Westlands Water District	Unit 5@28RB	11/25/02	$ 1,297.19		Option 1; 65% of Cost	
Cal Poly	2	43	Westlands Water District	Unit 3@26L	11/25/02	$ 664.63		Option 1; 65% of Cost	
Cal Poly	2	44	Browns Valley Irrigation District	50	10/27/03	$ 3,640.12		Option 3	
Cal Poly	2	44	Browns Valley Irrigation District	100	10/27/03	$ 6,667.21		Option 3	
Cal Poly	2	44	Browns Valley Irrigation District	125	10/27/03	$ 9,749.50		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-1	01/07/03	$ 5,700.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-2	01/07/03	$12,800.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-3	01/07/03	$ 7,600.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-4	01/07/03	$ 8,360.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-5	01/07/03	$10,660.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-6	01/07/03	$10,400.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-7	01/07/03	$ 8,200.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-9	01/07/03	$11,200.00		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	45	City of Fresno Waste Water Management	R-12	01/07/03	$ 6,875.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-13	01/07/03	$ 8,480.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-15	01/07/03	$ 8,820.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-16	01/07/03	$ 4,160.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-17	01/07/03	$ 6,980.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-20	01/07/03	$10,400.00		Option 3	
Cal Poly	2	45	City of Fresno Waste Water Management	R-21		$10,000.00	01/07/03	Option 3	
Cal Poly	2	46	Corcoran Irrigation District	Well 44	01/17/03	$17,031.00		Option 3	
Cal Poly	2	47	Westlands Water District	Unit 4@30R	02/19/03	$ 1,617.28		Option 3	
Cal Poly	2	47	Westlands Water District	Unit 2@21R	02/19/03	$ 9,279.48		Option 1; 65% of Cost	
Cal Poly	2	47	Westlands Water District	Unit 1@29L	02/19/03	$ 1,904.20		Option 3	
Cal Poly	2	47	Westlands Water District	Unit 2@33L	02/19/03	$ 1,164.05		Option 3	
Cal Poly	2	47	Westlands Water District	Unit 1@20R	02/19/03	$ 6,564.55		Option 3	
Cal Poly	2	47	Westlands Water District	Unit 3@1R4.0D	02/19/03	$ 1,307.31		Option 3	
Cal Poly	2	47	Westlands Water District	Unit 1@21R	02/19/03	$ 9,758.99		Option 3	
Cal Poly	2	47	Westlands Water District	Unit 2@30R	02/19/03	$ 2,425.91		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	47	Westlands Water District	Unit 2@30L	02/19/03	$ 1,738.71		Option 3	
Cal Poly	2	47	Westlands Water District	Unit 1@27R	02/19/03	$15,245.84		Option 1; 65% of Cost	
Cal Poly	2	48	James Irrigation District	D-15	03/10/03	$ 5,017.00		Option 3	
Cal Poly	2	49	Corcoran Irrigation District	Well 52	04/07/03	$15,948.00		Option 3	
Cal Poly	2	49	Corcoran Irrigation District	Well 53	04/07/03	$15,846.64		Option 1; 65% of Cost	
Cal Poly	2	50	Westlands WD	Unit 2@25R	04/17/03	$ 4,964.76		Option 3	
Cal Poly	2	50	Westlands WD	Unit 5@13RB	04/17/03	$ 3,921.42		Option 1; 65% of Cost	
Cal Poly	2	50	Westlands WD	Unit 3@17RC	04/17/03	$ 2,721.61		Option 3	
Cal Poly	2	50	Westlands WD	Unit 1@28RA	04/17/03	$16,812.80		Option 3	
Cal Poly	2	50	Westlands WD	Unit 5@30L	04/17/03	$ 6,518.14		Option 3	
Cal Poly	2	50	Westlands WD	Unit 3@16L	04/17/03	$ 1,570.43		Option 3	
Cal Poly	2	50	Westlands WD	Unit 2@27R	04/17/03	$16,967.80		Option 1; 65% of Cost	
Cal Poly	2	50	Westlands WD	Unit 1@22R	04/17/03	$ 7,520.87		Option 3	
Cal Poly	2	50	Westlands WD	Unit 2@1R4.01.0C	04/17/03	$ 6,564.19		Option 1; 65% of Cost	
Cal Poly	2	50	Westlands WD	Unit 2@20R	04/17/03	$ 3,282.28		Option 3	
Cal Poly	2	50	Westlands WD	Unit 5@26L	04/17/03	$ 6,378.45		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	51	Corcoran Irrigation District	Well 5	04/21/03	$13,207.00		Option 3	
Cal Poly	2	51	Corcoran Irrigation District	Well 62	04/21/03	$ 6,778.00		Option 3	
Cal Poly	2	52	James Irrigation District	C-79	04/24/03	$ 6,391.00		Option 1; 65% of Cost	
Cal Poly	2	52	James Irrigation District	C-86	10/23/03	$ 7,567.00		Option 3	
Cal Poly	2	53	Corcoran Irrigation District	Well 75	06/10/03	$12,821.48		Option 1; 65% of Cost	
Cal Poly	2	54	Westlands WD - Vasto Valle Farms	#107	Pre-Approved 8/4/03	$41,316.25		Option 3	
Cal Poly	2	55	Corcoran Irrigation District	Well 25	10/08/03	$20,960.00		Option 3	
Cal Poly	2	55	Corcoran Irrigation District	Well 41	10/08/03	$ 6,152.50		Option 3	
Cal Poly	2	56	RD 2037	Pump 1 South	Pre-Approved 10/20/03	$ 3,674.63		Option 3	
Cal Poly	2	56	RD 2037	Pump 4 West	Pre-Approved 10/20/03	$10,022.13		Option 3	
Cal Poly	2	56	RD 2037	Pump 2 West	Pre-Approved 10/20/03	$ 6,013.28		Option 3	
Cal Poly	2	57	RD 2040, Victoria Island Farms	Pump A	11/29/03	$ 7,924.44		Option 3	
Cal Poly	2	58	Corcoran Irrigation District	Well 12	11/13/03	$ 2,268.49		Option 1; 65% of Cost	
Cal Poly	2	58	Corcoran Irrigation District	Well 45	11/13/03	$12,267.03		Option 1; 65% of Cost	
Cal Poly	2	59	Corcoran Irrigation District	Well 44	11/21/03	$11,654.96		Option 1; 65% of Cost	
Cal Poly	2	59	Corcoran Irrigation District	Well 46	11/21/03	$10,153.12		Option 1; 65% of Cost	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	60	Natomas Central WC	Pump 2, Plant 8	11/21/03	$ 7,823.72		Option 3	
Cal Poly	2	60	Natomas Central WC	Pump 1, E Drain	11/21/03	$ 1,206.60		Option 3	
Cal Poly	2	60	Natomas Central WC	Pump 1, Plant 30	11/21/03	$ 2,282.09		Option 3	
Cal Poly	2	60	Natomas Central WC	Pump 4, Plant 30	11/21/03	$ 1,040.65		Option 1; 65% of Cost	
Cal Poly	2	61	Corcoran Irrigation District	Well 43	12/30/03	$10,937.00		Option 3	
Cal Poly	2	62	Santa Ynez WCD	Alamo Pintado	12/31/03	$ 9,126.00		Option 3	
Cal Poly	2	62	Santa Ynez WCD	Refugio 3	12/31/03	$ 1,934.00		Option 3	
Cal Poly	2	62	Santa Ynez WCD	Well 18	12/31/03	$ 1,639.00		Option 3	
Cal Poly	2	62	Santa Ynez WCD	Well 9	12/31/03	$ 3,012.00		Option 3	
Cal Poly	2	62	Santa Ynez WCD	Mesa Verde #1	12/31/03	$ 4,720.00		Option 3	
Cal Poly	2	62	Santa Ynez WCD	Mesa Verde #2	12/31/03	$ 3,071.00		Option 3	
Cal Poly	2	62	Santa Ynez WCD	Mesa Verde #3	12/31/03	$ 3,463.00		Option 3	
Cal Poly	2	62	Santa Ynez WCD	Mesa Verde #4	12/31/03	$ 2,695.00		Option 3	
Cal Poly	2	63	City of Fresno Water Division	1	Pre-Approved 12/31/03	$ 9,750.00		Option 1; 65% of Cost	
Cal Poly	2	63	City of Fresno Water Division	2	Pre-Approved 12/31/03	$29,250.00		Option 1; 65% of Cost	
Cal Poly	2	63	City of Fresno Water Division	3	Pre-Approved 12/31/03	$16,910.00		Option 3	

Administrator	Cat.	Project #	Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
Cal Poly	2	63	City of Fresno Water Division	4	Pre-Approved 12/31/03	$ 9,750.00		Option 1; 65% of Cost	
Cal Poly	2	63	City of Fresno Water Division	5	Pre-Approved 12/31/03	$ 1,193.40		Option 3	
Cal Poly	2	63	City of Fresno Water Division	6	Pre-Approved 12/31/03	$ 9,375.00		Option 3	
Cal Poly	2	63	City of Fresno Water Division	7	Pre-Approved 12/31/03	$ 3,955.98		Option 3	
Cal Poly	2	63	City of Fresno Water Division	8	Pre-Approved 12/31/03	$ 8,061.50		Option 3	
Cal Poly	2	63	City of Fresno Water Division	9	Pre-Approved 12/31/03	$ 4,084.75		Option 3	
Cal Poly	2	63	City of Fresno Water Division	10	Pre-Approved 12/31/03	$19,500.00		Option 1; 65% of Cost	
Subotal of Cal Poly Cat. 2	319				Subtotal of grant payments	**$2,266,399.89**			
		Category 2 Pump Repair Projects from California State University, Fresno Foundation							
Administrator	**Cat.**	**Project #**	**Applicant or Irrigation District**	**Pump ID**	**Grant Status or Payment Date**	**Grant Payment**		**Grant Option**	
CSU, Fresno	2	02-0079-A	Darrell & Norma Cordova	E057394	11/08/01	$ 441.50		Option 3	
CSU, Fresno	2	02-0093-A	Robert & Violet McCorkle	R44532	11/05/01	$ 1,220.00		Option 3	
CSU, Fresno	2	02-0093-B	Robert & Violet McCorkle	R28003	11/05/01	$ 1,410.00		Option 3	
CSU, Fresno	2	02-0093-C	Robert & Violet McCorkle	R51257	11/05/01	$ 1,657.00		Option 3	
CSU, Fresno	2	02-0094-A	Ekizian Farms	732K-1870	10/30/01	$ 1,847.42		Option 3	
CSU, Fresno	2	02-0115-A	Shenandoah Vineyards	789R30	11/15/01	$ 375.00		Option 3	
CSU, Fresno	2	02-0117-A	J.G. Boswell	732-11180	06/06/02	$ 7,762.80		Option 3	
CSU, Fresno	2	02-0117-B	J.G. Boswell	8416-1846	06/06/02	$ 5,393.00		Option 3	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0117-C	J.G. Boswell	645R57	06/06/02	$ 7,049.70		Option 3	
CSU, Fresno	2	02-0117-F	J.G. Boswell	84161791	02/06/02	$ 7,104.90		Option 3	
CSU, Fresno	2	02-0117-G	J.G. Boswell	Y7282590	02/12/03	$ 12,467.00		Option 3	
CSU, Fresno	2	02-0125-A	La Verne Nursery, Inc.	Y728-2153	12/06/02	$ 5,045.58		Option 3	
CSU, Fresno	2	02-0129-B	J.G. Boswell Company	8412-443		$ -		Option 3	
CSU, Fresno	2	02-0129-F	J.G. Boswell Company	91363T	07/31/02	$ 9,785.29		Option 3	
CSU, Fresno	2	02-0141-A	Gary Howard	51833R	05/09/02	$ 1,216.94		Option 1: 65% of Cost	
CSU, Fresno	2	02-0143-A	Paramount Farming Company	426-2R	10/08/04	$ 14,391.00		Option 3	
CSU, Fresno	2	02-0145-A	Cal- Clark Farms	7008R6	11/29/01	$ 4,971.00		Option 3	
CSU, Fresno	2	02-0147-A	Watson Ranch	490-76R	05/29/03	$ 9,840.83		Option 1: 65% of Cost	
CSU, Fresno	2	02-0150-A	Five Dot Land & Cattle Co.	55251092	07/22/02	$ 2,573.27		Option 2	
CSU, Fresno	2	02-0154-A	Den Dulk Farming Companies	318R43	09/18/02	$ 1,781.52		Option 1: 65% of Cost	
CSU, Fresno	2	02-163-A	Cal- Clark Farms	14R303	12/12/01	$ 452.18			
CSU, Fresno	2	02-0164-A	Five Dot Land & Cattle Co.	64753425	07/22/02	$ 5,038.22		Option 1: 65% of Cost	
CSU, Fresno	2	02-0165-A	Five Dot Land & Cattle Co.	19908160	07/22/02	$ 3,153.48		Option 1: 65% of Cost	
CSU, Fresno	2	02-0166-A	Five Dot Land & Cattle Co.	19908173	07/22/02	$ 3,352.25		Option 3	
CSU, Fresno	2	02-0168-A	Bob Ennen	R97642	11/26/02	$ 873.80		Option 3	
CSU, Fresno	2	02-0169-A	Don Pedro Pump		11/20/01	$ 2,443.00		Option 3	
CSU, Fresno	2	02-0170-A	Al Sebasto - 4712T3	4712T3	06/16/03	$ 272.63		Option 3	
CSU, Fresno	2	02-0174-A	Braden Farms Inc.	E0502278		$ 2,472.00		Option 3	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0175-A	Braden Farms Inc.	R12090	02/06/02	$ 8,029.96		Option 3	
CSU, Fresno	2	02-0176-A	Brian's Ranch	2T1921	11/04/02	$ 2,344.50		Option 1: 65% of Cost	
CSU, Fresno	2	02-0178-A	South Valley Farms	R28-588	03/20/02	$ 10,402.00		Option 3	
CSU, Fresno	2	02-0179-A	Kirschenmann Farms	0568R2	01/18/02	$ 6,127.00		Option 3	
CSU, Fresno	2	02-0180-A	Mr. R.J. Christensen	EO53738	10/28/02	$ 638.07		Option 3	
CSU, Fresno	2	02-0184-A	Gallo Vinyards Inc.	2587R0	06/25/02	$ 5,722.00		Option 3	
CSU, Fresno	2	02-0187-A	D.W. KETCHER TRUST	R51630	12/21/01	$ 526.00		Option 3	
CSU, Fresno	2	02-0190-A	Duinkerken Farms	627R98	05/27/03	$ 667.08		Option 2	
CSU, Fresno	2	02-0192-A	Spomer & Sons Turkeys	8057T4	01/18/02	$ 2,352.00		Option 2	
CSU, Fresno	2	02-0193-A	Sierra Vista Ranches	6963R8	02/06/02	$ 765.85		Option 3	
CSU, Fresno	2	02-0199-A	Stone Fruit Farming	R31189	04/02/02	$ 1,086.00		Option 1: 65% of Cost	
CSU, Fresno	2	02-0202-A	Joseph Fontes	R42163	01/10/01	$ 432.88		Option 3	
CSU, Fresno	2	02-0203-A	MARTHEDAL FARMS	R09519	05/10/02	$ 1,323.08			
CSU, Fresno	2	02-0205-A	Cedric Kleinhans	Y278-3727	01/18/02	$ 1,042.70		Option 3	
CSU, Fresno	2	02-0206-A	Self-Realization Fellowship	1661088	01/03/02	$ 632.26		Option 3	
CSU, Fresno	2	02-0210-A	Double "G" Farms	7401R0	05/29/03	$ 3,493.80		Option 3	
CSU, Fresno	2	02-0211-A	Castle Farms Inc.	4894R4	01/14/02	$ 9,074.82		Option 3	
CSU, Fresno	2	02-0212-A	A&R Farms	03560R	01/02/02	$ 1,849.27		Option 3	
CSU, Fresno	2	02-0213-A	DeJager Farms North	59R518	01/18/02	$ 8,122.00		Option 3	
CSU, Fresno	2	02-0214-A	D&T Farms	25305R	01/02/02	$ 5,644.00		Option 3	
CSU, Fresno	2	02-0215-A	DeJager Farms North	40926R	01/02/02	$ 4,422.80		Option 3	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0216-A	Robert E. Saak	33-4597	04/02/02	$ 992.25		Option 3	
CSU, Fresno	2	02-0220-A	Alamo West	R08400	06/12/03	$ 6,996.54			
CSU, Fresno	2	02-0221-A	Silver Creek Ranch	626R16	01/31/02	$ 7,096.00		Option 3	
CSU, Fresno	2	02-0222-A	Marvin Vespermann	27292-R	02/22/02	$ 1,228.40		Option 3	
CSU, Fresno	2	02-0224-A	Schechert Ranches	551-79-653	03/18/02	$ 133.12		Option 3	
CSU, Fresno	2	02-0229-A	Double Diamond Dairy	223R30	04/02/02	$ 3,408.50		Option 3	
CSU, Fresno	2	02-0231-A	Santa Maria Berry Farms	51857R	06/04/02	$ 7,690.58		Option 1: 65% of Cost	
CSU, Fresno	2	02-0233-A	JC Adams Ranch 1	94T951	01/07/02	$ 212.10		Option 3	
CSU, Fresno	2	02-0236-A	Harley Handel	215R11	03/08/02	$ 775.70		Option 1: 65% of Cost	
CSU, Fresno	2	02-0238-A	De Jager Farms North	6856R0	04/02/02	$ 2,835.50		Option 3	
CSU, Fresno	2	02-0240-A	Ben Nydam	R93528	11/14/03	$ 232.65		Option 2	
CSU, Fresno	2	02-0242-A	Laguna Farm	47495T	01/21/02	$ 2,002.43		Option 1: 65% of Cost	
CSU, Fresno	2	02-0243-A	Citrus Ranch	815-3039	06/06/02	$ 899.00		Option 3	
CSU, Fresno	2	02-0247-A	Rancho Alexander	R37327	04/05/02	$ 5,188.00		Option 3	
CSU, Fresno	2	02-0248-A	Douglas McRee	58R907	04/02/02	$ 1,215.50		Option 3	
CSU, Fresno	2	02-0252-A	John P. Satragni	R97722	01/18/02	$ 2,036.53		Option 3	
CSU, Fresno	2	02-0253-A	Double Diamond Dairy	067R96	04/17/03	$ 2,497.00		Option 3	
CSU, Fresno	2	02-0254-A	Tracy Ranch, Inc.	7122R0	09/11/02	$ 9,301.29		Option 3	
CSU, Fresno	2	02-0256-A	Gian S Bhangu	402R19	03/25/02	$ 1,423.45		Option 3	
CSU, Fresno	2	02-0257-A	Vlot Brothers	84R126	01/31/02	$ 7,752.92		Option 3	
CSU, Fresno	2	02-0258-A	Fawcett Farms Inc	99R517	02/20/02	$ 999.27		Option 3	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0259-A	Red Top Jersey's LLC	R42751	04/05/02	$ 4,273.25		Option 3	
CSU, Fresno	2	02-0260-A	AG SOD FARMS	732-3850	05/06/02	$ 3,274.24		Option 1: 65% of Cost	
CSU, Fresno	2	02-0261-A	A-G Sod Farms Inc.	732-6416	05/06/02	$ 3,489.56		Option 1: 65% of Cost	
CSU, Fresno	2	02-0262-A	A-G SOD FARMS INC.	732K-1857	04/19/02	$ 2,925.36		Option 1: 65% of Cost	
CSU, Fresno	2	02-0263-A	A-G SOD FARMS INC.	732-5927	04/19/02	$ 3,547.87		Option 1: 65% of Cost	
CSU, Fresno	2	02-0264-A	A-G SOD FARMS INC.		04/19/02	$ 2,894.45		Option 1: 65% of Cost	
CSU, Fresno	2	02-0265-A	A-G SOD FARMS INC.	732-08313	04/19/02	$ 2,827.08		Option 1: 65% of Cost	
CSU, Fresno	2	02-0266-A	A-G SOD FARMS INC.	732-6166	04/19/02	$ 996.74		Option 3	
CSU, Fresno	2	02-0267-A	A-G SOD FARMS INC.	732-10178	04/19/02	$ 791.20		Option 1: 65% of Cost	
CSU, Fresno	2	02-0268-A	A-G SOD FARMS INC.	732-10490	04/19/02	$ 984.60		Option 3	
CSU, Fresno	2	02-0271-A	Seasholtz Farms	R37314	08/25/04	$ 2,389.00		Option 3	
CSU, Fresno	2	02-0272-A	DeJager Farms North	5060R2	04/15/02	$ 2,767.25		Option 3	
CSU, Fresno	2	02-0273-A	DeJager Farms North	43325R	04/05/02	$ 2,935.12		Option 3	
CSU, Fresno	2	02-0274-A	DeJager Farms North	43384R	02/20/02	$ 1,514.82		Option 3	
CSU, Fresno	2	02-0275-A	DeJager Farms North	R39509	04/02/02	$ 4,177.15		Option 3	
CSU, Fresno	2	02-0276-A	James C. Roberts, Inc.	1572607	02/12/02	$ 2,421.48		Option 3	
CSU, Fresno	2	02-0278-A	DeJager Farms North	99R662	03/19/02	$ 1,324.52		Option 3	
CSU, Fresno	2	02-0279-A	Coburn Ranch	151431001	01/24/03	$ 28,493.96		Option 1: 65% of Cost	
CSU, Fresno	2	02-0280-A	Tracy Ranch Inc.	065939	03/20/02	$ 3,807.48		Option 1: 65% of Cost	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0281-A	Tracy Ranch Inc.	6899R0	03/20/02	$ 4,559.46		Option 1: 65% of Cost	
CSU, Fresno	2	02-0282-A	Tracy Ranch	R71984	03/20/02	$ 3,269.99		Option 1: 65% of Cost	
CSU, Fresno	2	02-0283-A	Riverview Ranches	40802R	10/21/02	$ 3,231.02		Option 3	
CSU, Fresno	2	02-0284-A	A&P Growers	44205R	01/31/02	$ 2,383.40		Option 2	
CSU, Fresno	2	02-0285-A	Zanker Brothers	33347	04/05/02	$ 1,263.78		Option 1: 65% of Cost	
CSU, Fresno	2	02-0286-A	Zanker Brothers	71980	04/05/02	$ 850.67		Option 1: 65% of Cost	
CSU, Fresno	2	02-0288-A	D&T Farms	92915R	04/02/02	$ 3,250.30		Option 3	
CSU, Fresno	2	02-0290-A	Castle Farms Inc.	621R44	04/05/02	$ 4,498.79		Option 3	
CSU, Fresno	2	02-0291-A	DeJager Farms North	R04262	04/18/02	$ 3,538.00		Option 3	
CSU, Fresno	2	02-0292-A	DeJager Farms North	R40347	04/16/03	$ 2,949.88		Option 3	
CSU, Fresno	2	02-0293-A	DeJager Farms North	9534R2	04/05/02	$ 3,756.75		Option 3	
CSU, Fresno	2	02-0294-A	De Jager Farms North	43360R	04/16/02	$ 2,128.22		Option 3	
CSU, Fresno	2	02-0295-A	DeJager Farms North	43318R	04/15/02	$ 2,368.00		Option 3	
CSU, Fresno	2	02-0296-A	DeJager Farms North	32483R	09/02/03	$ 1,162.48		Option 3	
CSU, Fresno	2	02-0297-A	Four Star Fruit, Inc.	92312R	08/13/03	$ 947.93		Option 3	
CSU, Fresno	2	02-0298-A	Four Star Fruit, Inc.	X18438	09/02/03	$ 61.73		Option 1: 65% of Cost	
CSU, Fresno	2	02-0299-A	Riverview Ranches	R69951	10/23/02	$ 4,942.13		Option 1: 65% of Cost	
CSU, Fresno	2	02-0301-A	Riverview Ranches	36993R	10/21/02	$ 708.25		Option 3	
CSU, Fresno	2	02-0303-A	Albert Rossini LTD	1038R6	06/05/02	$ 1,634.76		Option 3	
CSU, Fresno	2	02-0305-A	Linda G. Young	49351R	07/31/02	$ 113.33		Option 3	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0306-A	Cauzza Brothers Farms	R29245	04/18/02	$ 13,127.29		Option 1: 65% of Cost	
CSU, Fresno	2	02-0307-A	Odie Huckabay	641R41	09/02/03	$ 1,784.99		Option 2	
CSU, Fresno	2	02-0308-A	Dimare Company	AQ523-104DKS	10/30/02	$ 4,012.50		Option 3	
CSU, Fresno	2	02-310-A	Ron Samuelson	657R12	07/28/03	$ 1,548.75		Option 3	
CSU, Fresno	2	02-311-A	James Ranch	R42639	05/06/02	$ 1,621.03		Option 3	
CSU, Fresno	2	02-0314-A	Kenneth Hajek	8252R8	03/28/02	$ 650.50		Option 1: 65% of Cost	
CSU, Fresno	2	02-0316-A	DeWitt Senter	17R897	03/07/03	$ 228.23		Option 2	
CSU, Fresno	2	02-0319-A	Riverview Ranches	R40100	10/23/02	$ 3,170.92		Option 1: 65% of Cost	
CSU, Fresno	2	02-0320-A	A & P Growers	646R14	04/02/02	$ 1,864.72		Option 3	
CSU, Fresno	2	02-0321-A	A & P Growers	82R026	04/02/02	$ 1,665.59		Option 3	
CSU, Fresno	2	02-0322-A	Kehar Grill	R39648	04/05/02	$ 718.20		Option 3	
CSU, Fresno	2	02-0323-A	San Felipe Ranch	60R827	05/24/02	$ 3,956.03		Option 3	
CSU, Fresno	2	02-0324-A	San Felipe Ranch	59R176	05/17/02	$ 4,376.79		Option 3	
CSU, Fresno	2	02-0325-A	San Felipe Ranch	5479R2	05/17/02	$ 5,080.75		Option 3	
CSU, Fresno	2	02-0326-A	Oliras & Stewart	5064R4	04/02/02	$ 5,667.13		Option 1: 65% of Cost	
CSU, Fresno	2	02-0327-A	Crooked Creek Ranch	E732M-000074	05/13/03	$ 4,520.00		Option 1: 65% of Cost	
CSU, Fresno	2	02-0329-A	B & H Farms	6514R8	05/22/02	$ 994.68		Option 3	
CSU, Fresno	2	02-0331-A	DeJager Farms	43315R	10/20/04	$ 5,120.43		Option 3	
CSU, Fresno	2	02-0332-A	DeJager Farms	99R402	05/24/02	$ 2,108.65		Option 3	
CSU, Fresno	2	02-0333-A	M&C Farms	R72029	05/09/02	$ 5,438.00		Option 3	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0334-A	Dennis Elam	10R657	05/31/02	$ 3,859.70		Option 1: 65% of Cost	
CSU, Fresno	2	02-0334-B	Dennis Elam	10R657	05/31/02	$ 3,859.70		Option 1: 65% of Cost	
CSU, Fresno	2	02-0335-A	Bernett/Wagner Farming	36608	04/05/02	$ 2,708.00		Option 3	
CSU, Fresno	2	02-0336-A	Jimi Valov	R97-456	05/27/03	$ 4,250.00		Option 1: 65% of Cost	
CSU, Fresno	2	02-337-A	Adam Blas	767T37	03/06/03	$ 428.95		Option 3	
CSU, Fresno	2	02-338-A	Douglas H. King/KMG & King Ranch	332-006430	03/22/03	$ 1,177.00		Option 3	
CSU, Fresno	2	02-0339-A	Riverview Ranches	7404R6	10/24/02	$ 2,440.23		Option 3	
CSU, Fresno	2	02-0341-A	Golden State Vintners	R28377	05/24/02	$ 8,135.00		Option 3	
CSU, Fresno	2	02-0342-A	TJM Thomsen Farms	171615N01	04/05/02	$ 8,522.48		Option 3	
CSU, Fresno	2	02-0343-A	Double Diamnond Dairy	223R3	03/01/02	$ 3,408.50		Option 3	
CSU, Fresno	2	02-0344-A	WP Roduner Cattle	6843R8	03/01/02	$ 3,788.75		Option 3	
CSU, Fresno	2	02-0347-A	Slenders Dairy	R37908	04/29/02	$ 6,770.07		Option 1: 65% of Cost	
CSU, Fresno	2	02-0354-A	Section 32 Partnership	732K001849	03/15/02	$ 301.80		Option 1: 65% of Cost	
CSU, Fresno	2	02-0356-A	Robert H. Astone	100R80	01/07/04	$ 791.58		Option 1: 65% of Cost	
CSU, Fresno	2	02-0360-A	WM Brad McCord	057R23	03/25/02	$ 250.63		Option 3	
CSU, Fresno	2	02-0361-A	Kendall Farms	01029551	04/24/02	$ 3,775.19		Option 1: 65% of Cost	
CSU, Fresno	2	02-0363-A	Valov & Sons Farming	04R506	10/04/04	$ 4,462.26		Option 1: 65% of Cost	
CSU, Fresno	2	02-0364-A	Valov & Sons Farming	229R40	10/04/04	$ 6,064.61		Option 1: 65% of Cost	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0365-A	B & H Farms	0464R0	08/20/03	$ 695.27		Option 1: 65% of Cost	
CSU, Fresno	2	02-0366-A	Philip Verwey Farms	R55256	08/19/02	$ 4,890.00		Option 3	
CSU, Fresno	2	02-0369-A	Mateus M. Evangelho	724M-14	06/17/02	$ 4,264.92		Option 1: 65% of Cost	
CSU, Fresno	2	02-0370-A	Mateus M. Evengelho	23-13626	06/17/02	$ 1,681.25		Option 3	
CSU, Fresno	2	02-0371-A	South Valley Famrs	52018R	05/28/02	$ 2,099.65		Option 3	
CSU, Fresno	2	02-0373-A	Ritter & Goode	P729-8107	05/29/03	$ 13,098.67		Option 3	
CSU, Fresno	2	02-0374-A	Clark Brothers # 16	R55245	06/30/03	$ 2,547.75		Option 3	
CSU, Fresno	2	02-0375-A	Ron Rink	118-2924	12/22/03	$ 2,444.68		Option 3	
CSU, Fresno	2	02-0377-A	Tiera Rejada Ranch LLC	32-9134	05/20/02	$ 2,250.00		Option 3	
CSU, Fresno	2	02-0381-A	Coalinga Pistacchio LLC	4810T7	05/29/03	$ 1,648.53		Option 1: 65% of Cost	
CSU, Fresno	2	02-0384-A	Errotabere Ranches	1819R2	06/11/03	$ 4,159.95		Option 3	
CSU, Fresno	2	02-0385-A	Oasis Ranch Management	01464360	09/02/03	$ 6,754.15		Option 3	
CSU, Fresno	2	02-387-A	Venida Packing Co.	SY28-676	04/17/02	$ 866.00		Option 3	
CSU, Fresno	2	02-0388-A	Pacific Earth Resources	41060R	07/28/03	$ 994.58		Option 2	
CSU, Fresno	2	02-0389-A	Pacific Earth Resources	51707R	04/08/02	$ 7,387.36		Option 1: 65% of Cost	
CSU, Fresno	2	02-0394-A	Mary Gomes Dairy	36266R	05/27/03	$ 3,457.60		Option 3	
CSU, Fresno	2	02-0395-A	Mary Gomes Dairy	5469R6	05/27/03	$ 6,710.26		Option 3	
CSU, Fresno	2	02-0398-A	Hidden Valley Dairy	E034643	04/12/02	$ 1,567.75		Option 3	
CSU, Fresno	2	02-0399-A	Ebi Fiorini	54R993	08/20/03	$ 1,022.05		Option 3	
CSU, Fresno	2	02-0400-A	Dewit Dairy	R07720	04/29/02	$ 1,404.58		Option 3	

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CSU, Fresno	2	02-0401-A	Farmland Management Services	84R120	08/27/02	$ 2,208.80		Option 1: 65% of Cost	
CSU, Fresno	2	02-0403-A	John Totoian	T23362	04/17/02	$ 312.25		Option 3	
CSU, Fresno	2	02-0406-A	Nakayama Farms	R93498	06/23/03	$ 365.18		Option 3	
CSU, Fresno	2	02-0407-A	Grimway Enterprises Inc.	52305T	05/02/02	$ 3,116.00		Option 3	
CSU, Fresno	2	02-0408-A	Chapman Farms III	40992R	07/02/02	$ 2,359.15		Option 3	
CSU, Fresno	2	02-0408-B	Chapman Farms III	0050R9	09/04/02	$ 5,120.31		Option 1: 65% of Cost	
CSU, Fresno	2	02-0408-C	Chapman Farms III	R71144	07/02/02	$ 2,115.22		Option 1: 65% of Cost	
CSU, Fresno	2	02-0410-A	Harmon & Sons	43178R	05/17/02	$ 2,637.63		Option 3	
CSU, Fresno	2	02-0411-A	California Valley Land Co.	X20602	05/14/02	$ 7,850.00		Option 3	
CSU, Fresno	2	02-0413-A	McDevitt Ranch	60R644	07/02/02	$ 2,438.00		Option 3	
CSU, Fresno	2	02-0414-A	D. Podesta Ranch	58R099	07/02/02	$ 904.20		Option 3	
CSU, Fresno	2	02-0418-A	Coastal Valley Management	3516R9	05/01/02	$ 3,899.87		Option 2	
CSU, Fresno	2	02-0419-A	Coastal Valley Management	2930R3	05/01/02	$ 1,120.40		Option 2	
CSU, Fresno	2	02-0420-A	Coastal Valley Management	3515R6	05/01/02	$ 2,246.09		Option 2	
CSU, Fresno	2	02-0423-A	Thoring and Williams	R12152	09/02/03	$ 2,761.88		Option 3	
CSU, Fresno	2	02-0424-A	Dotta Farms	R98971	05/30/03	$ 1,225.08		Option 3	
CSU, Fresno	2	02-0426-A	Tri-Boro Fruit Co. Inc.	R51224	05/06/02	$ 312.10		Option 3	
CSU, Fresno	2	02-0427-A	David Torigiani Farms	43602R	06/07/02	$ 2,153.18		Option 3	
CSU, Fresno	2	02-0429-A	Ken Lam	81546T	05/16/02	$ 200.00		Option 3	
CSU, Fresno	2	02-0430-A	Delta Pump	14R111	05/22/02	$ 1,180.00		Option 3	
CSU, Fresno	2	02-0431-A	Simpson Farm Co.	58R926	07/03/02	$ 3,557.92		Option 1: 65% of Cost	

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CSU, Fresno	2	02-0432-A	Griffen Ranch	9988R0	12/22/03	$ 9,040.43		Option 3	
CSU, Fresno	2	02-0434-A	Rynsburger Dairy	382-000617	07/11/03	$ 1,286.43		Option 1: 65% of Cost	
CSU, Fresno	2	02-0437-A	F & B Ranches	R05496	05/09/02	$ 3,403.19		Option 3	
CSU, Fresno	2	02-0438-A	LV Ranch	732K-2077	07/03/02	$ 6,304.40		Option 1: 65% of Cost	
CSU, Fresno	2	02-0439-A	Hillview Dairy	R04793	05/15/02	$ 3,931.00		Option 3	
CSU, Fresno	2	02-0440-A	John W. Jost	9253	11/18/02	$ 5,039.24		Option 1: 65% of Cost	
CSU, Fresno	2	02-0441-A	John Jost	6620	10/09/02	$ 2,019.92		Option 1: 65% of Cost	
CSU, Fresno	2	02-0442-A	Dennis Pecarovich	R40520	07/03/02	$ 1,121.40		Option 1: 65% of Cost	
CSU, Fresno	2	02-0443-A	California Valley Land Co.	R93037	08/27/03	$ 8,517.49		Option 3	
CSU, Fresno	2	02-0444-A	H.B. Orchard Co., Inc.	33602R	07/19/02	$ 2,030.85		Option 3	
CSU, Fresno	2	02-0447-A	Singh Malhi Sukhminder	0935802-5	07/02/02	$ 108.55		Option 1: 65% of Cost	
CSU, Fresno	2	02-0448-A	David Allan (Ranches)	2835	05/30/02	$ 3,579.55		Option 3	
CSU, Fresno	2	02-0450-A	Larry Shehady Farms Ltd.	650R23	10/02/02	$ 7,079.70		Option 3	
CSU, Fresno	2	02-0451-A	Bar 20 Partners Ltd.	R06337	10/03/02	$ 4,408.69		Option 1: 65% of Cost	
CSU, Fresno	2	02-0452-A	Bar 20 Partner Ltd.	42831T	10/03/02	$ 3,131.20		Option 3	
CSU, Fresno	2	02-0454-A	Diepersloot Ranch	R28350	05/30/02	$ 4,252.00		Option 3	
CSU, Fresno	2	02-0455-A	Diepersloot Ranch	R27146	05/30/02	$ 2,665.08		Option 3	
CSU, Fresno	2	02-0456-A	Diepersloot Ranch	R27090	05/30/02	$ 3,060.83		Option 3	
CSU, Fresno	2	02-0457-A	Diepersloot Ranch	R28458	05/30/02	$ 3,223.00		Option 3	

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CSU, Fresno	2	02-0458-A	Diepersloot Ranch	R28363	05/30/02	$ 4,869.00		Option 3	
CSU, Fresno	2	02-0459-A	Diepersloot Ranch	R53070	05/30/02	$ 972.33		Option 3	
CSU, Fresno	2	02-0462-A	DeBenedetto Ag	0610R1	02/19/03	$ 4,241.48		Option 3	
CSU, Fresno	2	02-0464-A	Mendrin Trust Agreement	202T21	09/02/03	$ 1,163.94		Option 2	
CSU, Fresno	2	02-0466-A	Oakdale Farms	25581R	07/08/03	$ 2,992.83		Option 3	
CSU, Fresno	2	02-0467-A	Dan Dentoni	R54067	07/28/03	$ 1,331.88		Option 1: 65% of Cost	
CSU, Fresno	2	02-0472-A	David Kendall	1161062	07/28/03	$ 2,310.14		Option 2	
CSU, Fresno	2	02-0475-A	JP Farms	8412-252	09/25/02	$ 5,806.98		Option 1: 65% of Cost	
CSU, Fresno	2	02-0476-A	Arvance Turkey Ranch Inc.	28222T	06/26/02	$ 1,337.00		Option 3	
CSU, Fresno	2	02-0478-A	R & B Enterprises	07R501	08/01/02	$ 823.80		Option 1: 65% of Cost	
CSU, Fresno	2	02-0482-A	Batth & Mahil Farms	69122T	07/19/02	$ 3,903.00		Option 3	
CSU, Fresno	2	02-0483-A	Paramount Citrus	R99699	07/02/02	$ 4,379.08		Option 1: 65% of Cost	
CSU, Fresno	2	02-0485-A	Guthrie Farming Co.	113-7693		$ 2,339.33		Option 1: 65% of Cost	
CSU, Fresno	2	02-0486-A	Mike Hospenthal	317324	09/09/04	$ 712.24		Option 1: 65% of Cost	
CSU, Fresno	2	02-0487-A	South Valley Farms	628R13	07/28/03	$ 3,565.79		Option 3	
CSU, Fresno	2	02-0490-A	Carleton Properties	7146R2	09/23/02	$ 4,132.06		Option 1: 65% of Cost	
CSU, Fresno	2	02-0492-A	Sumner Peck Ranch, Inc.	3242R6	01/22/03	$ 4,298.00		Option 1: 65% of Cost	
CSU, Fresno	2	02-0495-A	Kenneth Lasiter	4673R9	09/03/02	$ 1,360.82		Option 3	
CSU, Fresno	2	02-0496-A	Garden Grove Ranch Trust	732-10824	12/22/03	$ 1,450.40		Option 1: 65% of Cost	

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CSU, Fresno	2	02-0497-A	Garden Grove Ranch Trust	724-16316	09/02/03	$ 270.40		Option 3	
CSU, Fresno	2	02-0501-A	Santa Barbara Farms LLC	R97523	07/24/02	$ 5,590.00		Option 1: 65% of Cost	
CSU, Fresno	2	02-0502-A	Santa Barbara Farms LLC	33180R	07/24/02	$ 3,555.19		Option 1: 65% of Cost	
CSU, Fresno	2	02-0505-A	Four Star Dairy	6962R1	08/01/02	$ 4,299.97		Option 1: 65% of Cost	
CSU, Fresno	2	02-0506-A	Charlotte Saroyan	17R879	08/07/02	$ 284.98		Option 1: 65% of Cost	
CSU, Fresno	2	02-0507-A	Joe Lewis		07/28/03	$ 703.79		Option 1: 65% of Cost	
CSU, Fresno	2	02-0509-A	Jon Caywood, Jerrold Olivera	5254R9	08/27/02	$ 8,583.63		Option 3	
CSU, Fresno	2	02-0510-A	M. Curti and Sons	R06777	08/09/02	$ 7,174.23		Option 3	
CSU, Fresno	2	02-0511-A	Brooks Farms IV	X46113	01/22/03	$ 24,990.11		Option 1: 65% of Cost	
CSU, Fresno	2	02-0515-A	Ron Rink	0378-002253	09/25/02	$ 715.95		Option 3	
CSU, Fresno	2	02-0517-A	42836R	Grimmway Enterprises Inc.	09/20/02	$ 6,897.98		Option 3	
CSU, Fresno	2	02-0518-A	Braden Farms	3606R7	09/17/02	$ 3,936.00		Option 3	
CSU, Fresno	2	02-0520-A	CJ & T ITO Farms	0171R9	10/24/02	$ 14,986.00		Option 3	
CSU, Fresno	2	02-0523-A	Betteravia Farms	9913R2	10/30/02	$ 4,404.62		Option 3	
CSU, Fresno	2	02-0524-A	Betteravia Farms	86R182	10/28/02	$ 3,454.29		Option 1: 65% of Cost	
CSU, Fresno	2	02-0528-A	Errotabere Ranches	R37502	09/25/02	$ 10,405.43		Option 3	
CSU, Fresno	2	02-0529-A	Watson Ag Chemicals	61529T	09/11/02	$ 1,497.73		Option 3	
CSU, Fresno	2	02-0531-A	Nishihara Farms	E029388	09/23/02	$ 1,434.75		Option 3	
CSU, Fresno	2	02-0534-A	Espinola Family Trust of 1990	32844R	10/16/02	$ 2,293.00		Option 3	

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CSU, Fresno	2	02-0535-A	Vlot Brothers	0086R5	12/09/02	$ 2,644.00		Option 3	
CSU, Fresno	2	02-0536-A	Wagner Dairy	R29377	09/17/02	$ 3,142.32		Option 3	
CSU, Fresno	2	02-0537-A	Lyons Investments	1398	02/19/03	$ 1,866.83		Option 3	
CSU, Fresno	2	02-0540-A	Viking Ranches	1353442	10/16/02	$ 2,823.00		Option 3	
CSU, Fresno	2	02-0541-A	Grimmway Enterprises, Inc.	57R698	11/08/02	$ 3,502.00		Option 3	
CSU, Fresno	2	02-0542-A	Johnny Romeri	R97960	05/27/03	$ 6,931.61		Option 1: 65% of Cost	
CSU, Fresno	2	02-0543-A	Alamo Farming Co	89R239	11/22/02	$ 8,026.61		Option 3	
CSU, Fresno	2	02-0544-A	Kevin Herman	3645R7	02/05/03	$ 5,420.75		Option 3	
CSU, Fresno	2	02-0545-A	William Bristow	PL13649	11/18/02	$ 3,185.94		Option 3	
CSU, Fresno	2	02-0546-A	Setter Farms	03R645	11/19/02	$ 6,546.99		Option 3	
CSU, Fresno	2	02-0547	Hadley Farms	055R13	08/13/03	$ 3,467.18		Option 1: 65% of Cost	
CSU, Fresno	2	02-0548-A	Setter Farms	R94897	02/24/03	$ 8,265.00		Option 3	
CSU, Fresno	2	02-0550-A	Costamagna Farms 4	X06730	10/18/03	$ 13,256.76		Option 3	
CSU, Fresno	2	02-0551-A	Palms Ranch	1031330	12/22/03	$ 690.17		Option 3	
CSU, Fresno	2	02-0552-A	Costamagna Farms 4	R52344	09/19/03	$ 449.06		Option 3	
CSU, Fresno	2	02-0554-A	Flint Dairy	59R155	03/06/03	$ 6,165.53		Option 1: 65% of Cost	
CSU, Fresno	2	02-0555-A	Mike L. Rego	93636R	10/24/02	$ 1,120.65		Option 3	
CSU, Fresno	2	02-0556-A	Mike L. Rego	21508T	10/24/02	$ 1,255.50		Option 3	
CSU, Fresno	2	02-0558-A	Gretta Vallerga	R09220	11/18/02	$ 1,293.85		Option 3	
CSU, Fresno	2	02-0559-A	Premier Ag Products and Services	21508T	07/09/03	$ 2,458.18		Option 3	
CSU, Fresno	2	02-0560-A	P-R Farms	5876R4	12/11/02	$ 5,556.00		Option 3	

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CSU, Fresno	2	02-0561-A	P-R Farms	9904R6	12/11/02	$ 5,941.00		Option 3	
CSU, Fresno	2	02-0563-A	Bright's Nursery	55R021	11/01/02	$ 1,713.86		Option 1: 65% of Cost	
CSU, Fresno	2	02-0564-A	Roberti Ranch	22793379	01/24/03	$ 4,002.93		Option 3	
CSU, Fresno	2	02-0565-A	Roberti Ranch	22793376	02/19/03	$ 3,800.68		Option 3	
CSU, Fresno	2	02-0566-A	Fortune Farms #6	625R72	04/16/03	$ 11,982.00		Option 3	
CSU, Fresno	2	02-0567-A	P-R Farms, Inc.	4323R4	12/11/02	$ 6,513.00		Option 3	
CSU, Fresno	2	02-0568-A	Deiner Water Company, LLC	R36849	07/29/03	$ 7,813.53		Option 3	
CSU, Fresno	2	02-0569-A	Deiner Water Company, LLC	87290T	07/29/03	$ 5,736.00		Option 3	
CSU, Fresno	2	02-0570-A	Bill Strohm	4180178	04/21/03	$ 6,528.00		Option 3	
CSU, Fresno	2	02-0571-A	G. Oberti & Sons	26R084	11/27/02	$ 4,785.12		Option 3	
CSU, Fresno	2	02-0572-A	Vista Avenue Pistacchio Orchards	094R46	02/28/03	$ 6,031.07		Option 3	
CSU, Fresno	2	02-0573-A	Diamond Farming Company	93121T	01/21/03	$ 4,404.00		Option 3	
CSU, Fresno	2	02-0574-A	Diamond Farming Company	5138R0	02/19/03	$ 10,004.15		Option 3	
CSU, Fresno	2	02-0575-A	Gerawan Farming Partners	R40384	11/19/02	$ 3,823.30		Option 3	
CSU, Fresno	2	02-0576-A	Gerewan Farming Partners, Inc.	R39848	11/19/02	$ 2,172.75		Option 3	
CSU, Fresno	2	02-0577-A	Gerawan Farming Partners, Inc.	04R526	11/19/02	$ 1,267.75		Option 3	
CSU, Fresno	2	02-0578-A	San Felipe Ranch	53R835	02/28/03	$ 3,500.15		Option 3	
CSU, Fresno	2	02-0581-A	Castle Farms Inc.	02336R	02/19/03	$ 6,196.58		Option 3	
CSU, Fresno	2	02-582-A	South Valley Farms	R04-185	07/13/04	$ 9,488.00		Option 3	
CSU, Fresno	2	02-585-A	Cagliero Ranches, Inc.	R79351	12/20/02	$ 343.00		Option 3	
CSU, Fresno	2	02-586-A	Cagliero Ranches, Inc.	58777T	12/20/02	$ 1,913.03		Option 3	
CSU, Fresno	2	02-589-A	Cagliero Ranches, Inc.	R08316	01/06/03	$ 416.77		Option 3	

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CSU, Fresno	2	02-590-A	Cagliero Ranches, Inc.		01/13/03	$ 1,934.13		Option 3	
CSU, Fresno	2	02-591-A	Cagliero Ranches, Inc.	33065R	12/20/02	$ 456.85		Option 3	
CSU, Fresno	2	02-0593-A	Richard Allen	R45063	07/30/03	$ 1,013.55		Option 3	
CSU, Fresno	2	02-594-A	Cory Vineyards	0T0905	01/13/03	$ 135.40		Option 3	
CSU, Fresno	2	02-596-A	3-Way Vineyard	89R037	01/13/03	$ 2,126.25		Option 3	
CSU, Fresno	2	02-0597-A	Harris Farms, Inc.	616R44	01/13/03	$ 24,583.91		Option 1: 65% of Cost	
CSU, Fresno	2	02-598-A	John D. Coelho	9251R6	02/07/03	$ 22,278.20		Option 3	
CSU, Fresno	2	02-0599-A	Simonian Farming Co.	1852R0	02/19/03	$ 593.04		Option 1: 65% of Cost	
CSU, Fresno	2	02-0602-A	Simonian Farming Co.	100R83	02/20/03	$ 564.53		Option 3	
CSU, Fresno	2	02-0603-A	Handel + Wilson Farms	94185T	01/15/03	$ 6,537.00		Option 3	
CSU, Fresno	2	02-0604-A	Junction Farms	32-007438	01/28/03	$ 2,706.57		Option 1: 65% of Cost	
CSU, Fresno	2	02-0605-A	Worth Farms	60R346	01/16/03	$ 6,988.00		Option 3	
CSU, Fresno	2	02-0606-A	De Jager Farms North	6454R7	04/16/03	$ 2,999.65		Option 3	
CSU, Fresno	2	02-0607-A	De Jager Farms North	2114R9	06/20/03	$ 3,488.50		Option 3	
CSU, Fresno	2	02-0608-A	De Jager Farms North	01357R	04/16/03	$ 3,469.95		Option 3	
CSU, Fresno	2	02-0609-A	De Jager Farms North	40796R	02/28/03	$ 3,007.20		Option 3	
CSU, Fresno	2	02-610-A	Chester Tortia	R38227	02/07/03	$ 29.18		Option 1: 65% of Cost	
CSU, Fresno	2	02-0611-A	A + R Farms	R28299	04/16/03	$ 6,746.86		Option 3	
CSU, Fresno	2	02-0612-A	Couchman Farms	8753		$ -		Option 3	
CSU, Fresno	2	02-0613-A	Edgemar Farms	6906R6	04/24/03	$ 9,910.25		Option 3	
CSU, Fresno	2	02-0614-A	Gary B. & Mitch Bagdasarian	51822R	06/19/03	$ 1,548.76		Option 3	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0615-A	Newman Land Company	R71000	02/28/03	$ 1,191.23		Option 3	
CSU, Fresno	2	02-0617-A	Jasvir S. khosa Farm	58R813	04/16/03	$ 2,352.78		Option 1: 65% of Cost	
CSU, Fresno	2	02-0619-A	M & C Farms	57R801	04/16/03	$ 2,810.00		Option 3	
CSU, Fresno	2	02-0620-A	Kevin Herman	4872R6	03/26/03	$ 10,391.00		Option 3	
CSU, Fresno	2	02-0622-A	Samarin Citrus	352227	02/25/03	$ 2,606.33		Option 3	
CSU, Fresno	2	02-0623-A	S & S Farms	573R74	02/21/03	$ 1,457.57		Option 1: 65% of Cost	
CSU, Fresno	2	02-0624-A	Errotabere Ranches	239R32	03/26/03	$ 7,211.75		Option 3	
CSU, Fresno	2	02-0625-A	Mt Whitney Farms, LLC	R36912	05/29/03	$ 17,372.00		Option 3	
CSU, Fresno	2	02-0626-A	Mendota Land Company	9898R2	07/21/04	$ 3,172.00		Option 3	
CSU, Fresno	2	06-0627-A	Helmut Klauer	88197R	04/15/04	$ 659.20		Option 3	
CSU, Fresno	2	06-0629-A	Errotabere Ranches	25788R	06/16/03	$ 3,907.75		Option 3	
CSU, Fresno	2	06-0631-A	Farm of the Future, West Hills College	5543R6	03/05/04	$ 4,308.57		Option 1: 65% of Cost	
CSU, Fresno	2	02-0634-A	Lee Farms	4208R8	06/20/03	$ 4,488.00		Option 3	
CSU, Fresno	2	02-0635-A	Couchman Farms	8753	03/27/03	$ 1,255.52		Option 3	
CSU, Fresno	2	02-0638-A	Mark McKean Farms	065R40	12/22/03	$ 10,761.89		Option 1: 65% of Cost	
CSU, Fresno	2	02-0641-A	MBK Engineers	185-968	12/02/03	$ 4,368.17		Option 1: 65% of Cost	
CSU, Fresno	2	02-0643-A	MKB Engineers	2632R8	12/03/03	$ 23,367.54		Option 1: 65% of Cost	
CSU, Fresno	2	02-0646-A	MBK Engineers	620R64	12/03/03	$ 3,628.78		Option 1: 65% of Cost	
CSU, Fresno	2	02-0647-A	MBK Engineers	620R64	12/03/03	$ 2,941.95		Option 1: 65% of Cost	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0648-A	Ibara Farms	81523T	05/28/03	$ 405.65		Option 3	
CSU, Fresno	2	02-0649-A	Ballantine Produce	21R681	07/28/03	$ 782.60		Option 1: 65% of Cost	
CSU, Fresno	2	02-0650-A	Ballentine Produce	R97501	05/29/03	$ 3,561.33		Option 3	
CSU, Fresno	2	02-0651-A	Pioneer Nursery	57580R	10/20/04	$ 9,361.77		Option 3	
CSU, Fresno	2	02-0653-A	Kamangar Ranches	33641R	06/06/03	$ 3,783.90		Option 3	
CSU, Fresno	2	02-0655-A	California Valley Land Company	04R154	06/12/03	$ 8,954.39		Option 3	
CSU, Fresno	2	02-0656-A	Rosedale Ranch	9992R6	02/17/04	$ 4,875.27		Option 3	
CSU, Fresno	2	02-0657-A	Double Diamond Dairy & Ranch	99R399		$ 1,855.38		Option 3	
CSU, Fresno	2	02-0658-A	J. Oberti Vineyards II	09426R	04/17/03	$ 7,385.89		Option 3	
CSU, Fresno	2	02-0659-A	Matthew P. McGuire	AS5A8-314DKS	09/02/03	$ 1,528.00		Option 3	
CSU, Fresno	2	02-0660-A	Richard De Bendedtto	99R029	07/02/03	$ 7,156.75		Option 3	
CSU, Fresno	2	02-0661-A	Westlands Water District	1R-40B unit 1	09/15/03	$ 15,214.03		Option 3	
CSU, Fresno	2	02-0662-A	Westlands Water District	28RA	04/15/04	$ 14,004.02		Option 3	
CSU, Fresno	2	02-0664-A	Westlands Water District	4R	05/10/04	$ 4,775.85		Option 3	
CSU, Fresno	2	02-0665-A	Westlands Water District	18R	03/16/04	$ 14,795.95		Option 3	
CSU, Fresno	2	02-0666-A	Westlands Water District	17RB pump 2	05/24/04	$ 8,605.51		Option 3	
CSU, Fresno	2	02-0667-A	Westlands Water District	17RB pump 1	03/16/04	$ 10,096.03		Option 3	
CSU, Fresno	2	02-0668-A	Westlands Water District	17RA pump 2	06/02/04	$ 8,667.02		Option 3	
CSU, Fresno	2	02-0669-A	Westlands Water District	17RA pump1	03/16/04	$ 5,144.97		Option 3	
CSU, Fresno	2	02-0670-A	Westlands Water District	15R pump 2	03/16/04	$ 14,457.30		Option 3	
CSU, Fresno	2	02-0672-A	Westlands Water District	14RB #2	08/18/03	$ 5,179.95		Option 3	
CSU, Fresno	2	02-0673-A	Westlands Water District	13RBpump #3	11/11/03	$ 13,165.05		Option 3	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0674-A	Westlands Water District	13RBpump2	04/15/04	$ 13,165.04		Option 3	
CSU, Fresno	2	02-0675-A	Westlands Water District	13RA pump1	03/16/04	$ 13,165.04		Option 3	
CSU, Fresno	2	02-0676-A	Westlands Water District	13 RA pump 4	02/12/04	$ 4,729.05		Option 3	
CSU, Fresno	2	02-0677-A	Westlands Water District	13RA pump 1	01/27/04	$ 9,458.10		Option 3	
CSU, Fresno	2	02-0678-A	Westlands Water District	12R pump 3	01/27/04	$ 10,369.91		Option 3	
CSU, Fresno	2	02-0679-A	Westlands Water District	12Rpump2	05/24/04	$ 10,641.85		Option 3	
CSU, Fresno	2	02-0680-A	Westlands Water District	12R pump 1	06/08/04	$ 10,381.78		Option 3	
CSU, Fresno	2	02-0681-A	Westlands Water District	11R	06/08/04	$ 5,283.20		Option 3	
CSU, Fresno	2	02-0682-A	Westlands Water District	7RD	05/24/04	$ 1,674.93		Option 3	
CSU, Fresno	2	02-0683-A	Westlands Water District	7RB	01/27/04	$ 7,019.44		Option 3	
CSU, Fresno	2	02-0684-A	Westlands Water District	7RA pump 5	06/08/04	$ 2,720.32		Option 3	
CSU, Fresno	2	02-0685-A	Westlands Water District	7RA pump 1	04/15/04	$ 9,067.72		Option 3	
CSU, Fresno	2	02-0686-A	Westlands Water District	2RA pump 6	05/10/04	$ 3,153.48		Option 3	
CSU, Fresno	2	02-0688-A	Westlands Water District	2RA pump 3	06/02/04	$ 9,460.40		Option 3	
CSU, Fresno	2	02-0689-A	Westlands Water District	1RA pump 7	01/27/04	$ 6,351.93		Option 3	
CSU, Fresno	2	02-0690-A	Westlands Water District	1RA pump 6	06/02/04	$ 11,115.87		Option 3	
CSU, Fresno	2	02-0691-A	Westlands Water District	1R-4.0C	09/15/03	$ 4,853.63		Option 3	
CSU, Fresno	2	02-0694-A	Westlands Water District	PV2	03/16/04	$ 1,660.75		Option 3	
CSU, Fresno	2	02-0695-A.	Westlands Water District	29RA	09/15/03	$ 9,313.25		Option 3	
CSU, Fresno	2	02-0696-A	Westlands Water District	18R	09/02/03	$ 3,370.90		Option 3	
CSU, Fresno	2	02-0698-A	Westlands Water District	15R	09/15/03	$ 5,865.20		Option 3	
CSU, Fresno	2	02-0700-A	Westlands Water District	16RC	03/16/04	$ 1,458.69		Option 3	
CSU, Fresno	2	02-0702-A	Westlands Water District	30L pump 4	09/02/03	$ 5,903.29		Option 3	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0703-A	Westlands Water District	11L	09/15/03	$ 2,046.51		Option 3	
CSU, Fresno	2	02-0706-A	Westlands Water District	24R pump 1	08/27/03	$ 9,139.19		Option 3	
CSU, Fresno	2	02-0707-A	Westlands Water District	16RB	09/15/03	$ 4,847.70		Option 3	
CSU, Fresno	2	02-0711-A	Westlands Water District	1R4.0-1.0 C	08/27/03	$ 5,030.36		Option 3	
CSU, Fresno	2	02-0712-A	Westlands Water District	1R-4.0 B	11/11/03	$ 15,214.03		Option 3	
CSU, Fresno	2	02-0713-A	Doug and Julie Freitas Farms	47T322	07/30/04	$ 882.68		Option 3	
CSU, Fresno	2	02-0714-A	Mark McKean Farms	STLSB 12541	09/02/03	$ 796.73		Option 3	
CSU, Fresno	2	02-0715-A	California Valley Land Co.	7559R6	06/05/03	$ 19,254.50		Option 3	
CSU, Fresno	2	02-0716-A	R & J Dondero, Inc.	193R05	05/27/03	$ 651.20		Option 3	
CSU, Fresno	2	02-0717-A	P-R Farms, Inc.	44490R	06/30/03	$ 5,552.00		Option 3	
CSU, Fresno	2	02-0718-A	Power Hydrodynamics			$ -		Option 3	
CSU, Fresno	2	02-0719-A	Double D Farms	6916R4	06/16/03	$ 3,336.75		Option 3	
CSU, Fresno	2	02-0720-A	Polder Bros. Ranch, Inc.	30148T	06/30/03	$ 8,544.48		Option 3	
CSU, Fresno	2	02-0721-A	Danieli Ranch	8004R8	06/23/03	$ 437.50		Option 3	
CSU, Fresno	2	02-0722-A	Sierra View Dairy	113-01063	06/05/03	$ 1,969.25		Option 3	
CSU, Fresno	2	02-0723-A	Sierra View Dairy	3412-001000	06/05/03	$ 4,860.47		Option 3	
CSU, Fresno	2	02-0726-A	Edgemar Farms	67R476	09/02/03	$ 6,057.29		Option 3	
CSU, Fresno	2	02-0729-A	Don Schnoor Farms	59R409	06/30/03	$ 2,566.59		Option 3	
CSU, Fresno	2	02-0730A	Eastman Bros.	R53122	06/30/03	$ 1,718.27		Option 3	
CSU, Fresno	2	02-0732-A	Ruby Lin Farms	R53122	06/23/03	$ 2,174.00		Option 3	
CSU, Fresno	2	02-0735-A	Castoro Cellars	32481R	09/09/03	$ 803.98		Option 3	
CSU, Fresno	2	02-0736-A	De Groot Dairy Farms	R36756	06/11/03	$ 9,203.70		Option 1: 65% of Cost	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0738-A	Batth & Mahil Farms	066R62	06/16/03	$ 11,796.00		Option 3	
CSU, Fresno	2	02-0739-A	DeGroot Dairy Farms	732K002016	06/18/03	$ 7,457.58		Option 1: 65% of Cost	
CSU, Fresno	2	02-0740-A	DeGroot Dairy Farms	0828960	06/18/03	$ 2,587.05		Option 3	
CSU, Fresno	2	02-0741	R & J Dondero, Inc	R54990	06/19/03	$ 2,139.55		Option 3	
CSU, Fresno	2	02-0743-A	Woods Irrigation Company	502R06	06/30/03	$ 3,198.00		Option 3	
CSU, Fresno	2	02-0744-A	Jagtar S. Gill	43110R	06/30/03	$ 1,080.79		Option 1: 65% of Cost	
CSU, Fresno	2	02-0745-A	Jagtar S. Gill	5824R9	06/30/03	$ 1,466.72		Option 1: 65% of Cost	
CSU, Fresno	2	02-0746-A	Satragni Bros. Ranch	32918R	07/01/03	$ 2,806.37		Option 3	
CSU, Fresno	2	02-0749-A	Dennis A. Quashnick	R43711	07/28/03	$ 57.98		Option 3	
CSU, Fresno	2	02-0750-A	Porto Bros	276R51	09/09/03	$ 2,384.18		Option 1: 65% of Cost	
CSU, Fresno	2	02-0751-A	Anthony T Oliverira	R92142	09/02/03	$ 5,578.14		Option 2	
CSU, Fresno	2	02-0752-A	Anthony T Oliveira	7023R1	09/09/03	$ 9,547.51		Option 1: 65% of Cost	
CSU, Fresno	2	02-0753-A	David C Sani	210R78	09/02/03	$ 155.08		Option 3	
CSU, Fresno	2	02-0755-A	Don Gragnani	1514R8	11/10/03	$ 7,678.36		Option 3	
CSU, Fresno	2	02-0757-A	Arnold Dadian	62330T	09/02/03	$ 14,099.07		Option 1: 65% of Cost	
CSU, Fresno	2	02-0758-A	Duane Martin Jr.	61994	10/10/03	$ 654.14		Option 3	
CSU, Fresno	2	02-0759-A	Duane Martin Jr	316351	09/22/03	$ 838.05		Option 3	
CSU, Fresno	2	02-0760-A	William Powers III			$ -		Option 3	
CSU, Fresno	2	02-0761-A	H20 Pump Testing Services			$ -		Option 3	
CSU, Fresno	2	02-0762-A	Wayne Cooper Ag. Services			$ -		Option 3	

Administrator	Cat.	Project #	Applicant or Irrigation District	Pump ID	Grant Status or Payment Date	Grant Payment		Grant Option	
CSU, Fresno	2	02-0763-A	Pump Efficiency Testing Services			$ -		Option 3	
CSU, Fresno	2	02-0764-A	John G. Oliveira	59R591	10/20/03	$ 1,762.67		Option 3	
CSU, Fresno	2	02-0770-A	Pump Check Pumping Systems Analysts			$ -		Option 3	
CSU, Fresno	2	02-0772-A	Rincon Farms Inc.	3689R4	01/05/04	$ 3,720.30		Option 2	
CSU, Fresno	2	02-0773-A	Power Services, Inc.	Pump Tests per Contract 02-0773-A		$ -		Option 3	
CSU, Fresno	2	02-0774-A	Irrigation Pump Testing Service	Pump Tests per Contract 02-0774-A		$ -		Option 3	
CSU, Fresno	2	02-0775-A	Energy & Water Management	Pump Tests per Contract 02-0775-A		$ -		Option 3	
CSU, Fresno	2	02-0776-A	Britz Colusa - TIC	0M5057	12/22/03	$ 8,767.86		Option 3	
CSU, Fresno	2	02-0779-A	Douglas Mederos	Y728-006216	12/22/03	$ 731.25		Option 3	
CSU, Fresno	2	02-0789-A	H2O Pump Testing Services	Pump Tests per Contract 02-0789-A		$ -		Option 3	
CSU, Fresno	2	02-0790-A	Wayne Cooper Ag Services	Pump Tests per Contract 02-0790-A		$ -		Option 3	
CSU, Fresno	2	02-0791-A	Pump Efficiency Testing	Pump Tests per Contract 02-0791-A		$ -		Option 3	
CSU, Fresno	2	02-0792-A	Irrigation Pump Testing Services	Pump Tests per Contract 02-0792-A		$ -		Option 3	
CSU, Fresno	2	02-0793-A	Energy and Water Management	Pump Tests per Contract 02-0793-A		$ -		Option 3	
Subototal of CIT Category 2 projects	429				Subotal of Grant Payments (includes first of two payments)	**$1,783,157.72**			
Category 3 Advanced Telemetry Projects, Cal Poly San Luis Obispo									
Program Administrator	**Category**	**Project #**	**Project Name**	**Description**	**Grant Payment Date**	**Grant Payment Total**	**Contracted Savings, kW**	**Verified Savings, kW**	**Simple Cost Effectiveness, $/kW**
Cal Poly	3	01-020-47730	Solano Irrigation District (ISO contract)	Interval Meters used for demand relief program for an ISO program	10/29/01	$ 5,371.37	1,000	1,000	

Program Administrator	Category	Project #	Project Name	Description	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
Cal Poly	3	01-021-47730	City of Bakersfield Agricultural & Domestic Water Resources Division (ISO contract)	Interval Meters used for demand relief program for an ISO program	10/1/01	$ 26,058.00	1,737	1,737	
Cal Poly	3	01-022-47730	Westlands Water District (ISO contract)	Interval Meters used for demand relief program on district owned farmer operated wells within the district. The actual amount of kW reduction may vary between 0-37,800 kW depending on how many farmers sign up for the program.	12/6/01	$266,373.12	37,800	17,703	
Cal Poly	3	02-002-47330	Orange Cove Irrigation District	Telemetry and interval meters to assist in load reduction for a particular section of their system. Amended contract includes increased peak kW reduction and potential grant payment in response to the installation of additional SCADA equipment as well as the compilation of grower peak load reductions.	12/16/02	$180,000.00	600	637	
Cal Poly	3	02-003-47330	Natomas Central Mutual Water District	Natomas Central Mutual Water Company is committing to the ISO program. Greg Allen of Energy Solutions (800-270-7007) has prepared the application for the proposed installation of 3 meters and the required communication equipment to participate in the ISO program.	4/22/02	$ 7,976.99	1,270	1,270	
Cal Poly	3	02-004-47330	Westlands Water District -- Woolf Telemetry (ISO contract)	Under a Westlands Water District program, Woolf Farms is committing average reduction of 534 kW during the four peak period months for the ISO program. The project application is for communication equipment for 3 existing meters. Each site will require a cellular phone link that will be installed by PG&E.	12/6/01	$ 4,657.56	534	534	

Program Administrator	Category	Project #	Project Name	Description	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
Cal Poly	3	02-005-47330	Westlands Water District -- Vasto Valle Telemetry (ISO contract)	Under a Westlands Water District program, Vasto Valle Farms is committing an average reduction of 725 kW during the four peak period months for the ISO program. The project application is for communication equipment for 5 existing meters. Each site will require a cellular phone link that will be installed by PG&E.	12/6/01	$ 7,762.59	725	725	
Cal Poly	3	03-013-47330	Tulare ID	Tulare ID proposes to increase their water demand through Kaweah river during the peak period thus increasing the on peak generation. During the off-peak the demand will be reduced and supplied by another source (CVP). SCADA will be used for monitoring and control of remote sites which will make this project logistically feasible.	Contract signed 4/18/03; payments for category 3 portion of project pending completion.	$401,167.00	1,923		
subtotal (cal poly)	8				Subtotal of Grant Payments (includes first of two payments)	**$899,366.63**			
					Subtotal of Contracted Savings, kW		**45,589**		
					Subtotal of Verified Savings, kW			**25,529**	
					Simple Cost Effectiveness, $/kW				**$35.23**

Category 3 Advanced Telemetry Projects, California State University, Fresno, Fresno Foundation									
Program Administrator	***Category***	***Project #***	***Project Name***	***Description***	***Grant Payment Date***	***Grant Payment Total***	***Contracted Savings, kW***	***Verified Savings, kW***	***Simple Cost Effectiveness, $/kW***
CSU, Fresno	3	03-0061-A	Naumes Inc.	Marysville	2/19/04	$1,493.38	90	90	$ 16.59
CSU, Fresno	3	03-0064-A	Joseph Gallo Farms (ISO contract)	Atwater	9/18/01	$8,100.60	1595	1595	$ 5.08
CSU, Fresno	3	03-0072-A	Sloughouse Operating LLC	Farmington	4/29/03	$8,748.76	46	46	$ 190.19
CSU, Fresno	3	03-0075-A	Paramount Farming Company	Bakersfield	11/27/02	$69,115.24	1306	1306	$ 52.92
CSU, Fresno	3	03-0095-A	Diamond D Dairy (Danell Bros.)	Hanford	11/1/02	$2,005.84	425	425	$ 4.72
CSU, Fresno	3	03-0102-A	Farmington Capital Group	Farmington	4/30/03	$7,440.00	56	56	$ 132.86
CSU, Fresno	3	03-0111-A	M. Curti & Sons Dairy (Ancillary Services contract)	Tulare	2/23/04	$1,810.84	425	198	$ 9.15
CSU, Fresno	3	03-0112-A	Artesia Dairy (Ancillary Services contract)	Corcoran	10/30/02	$1,810.84	450	450	$ 4.02
CSU, Fresno	3	03-0113-A	Triangle M Dairy (Ancillary Services contract)	Chowchilla	11/18/02	$1,810.84	100	100	$ 18.11
CSU, Fresno	3	03-0118-A	Ralph B. Tevelde Dairy (Ancillary Services contract)	Bakersfield	11/6/01	$1,810.84	135	135	$ 13.41
CSU Fresno Subtotal	10				Subtotal of Grant Payments	**$104,147.18**			
					Subtotal of Contracted Savings, kW		**4,628**		
					Subtotal of Verified Savings, kW			**4,401**	
					Average Simple Cost Effectiveness, $/kW				**$23.66**

Category 4 Fuel Switching Projects, California State University, Fresno, Fresno Foundation									
Program Administrator	***Category***	***Project #***	***Project Name***	***Description***	***Grant Payment Date***	***Grant Payment Total***	***Contracted Savings, kW***	***Verified Savings, kW***	***Simple Cost Effectiveness, $/kW***
CSU, Fresno	4	04-0001-A	J.G. Boswell Company	Cotton Gins 2&3 - Project Proposal #3	4/15/02	$36,574.18			
CSU, Fresno	4	04-0001-D	J.G. Boswell Company	Cotton Gin #5 - Project Proposal #4	4/15/02	$23,857.81			
CSU, Fresno	4	04-0003-A	Central Valley Coop.	Conversion to Propane for Dual Fuel	9/10/01	$37,510.91			
CSU, Fresno	4	04-0004-A	Panoche Ginning Company	Propane Conversion	10/18/01	$73,430.84			
CSU, Fresno	4	04-0005-A	Merced Milling Co. LLC		1/2/02	$14,608.91			
CSU, Fresno	4	04-0006-A	Cantua Cooperative Gin	Dual Fuel Conversion	12/18/01	$38,337.85			
CSU, Fresno	4	04-0007-A	Rio Bravo Tomato Company,LLC	Alternative Propane Fuel Sstem-Buttonwillow Fac.	9/10/01	$300,000.00			
CSU, Fresno	4	04-0011-A	Tenicom Ranch	Tenincom Ranch	7/26/01	$52,734.46			
CSU, Fresno	4	04-0012-A	Lone Star Dehydrator	Propane- Alternative Fuel	9/18/01	$37,675.58			
CSU, Fresno	4	04-0015-A	Darling International Inc	Natural gas boiler retrofit to burn alternative fu	7/6/03	$130,000.00			
CSU, Fresno	4	04-0020-A	Foster Poultry Farms	Kingsburg Plant Yellow Grease Project	11/24/03	$66,856.41			
CSU, Fresno	4	04-0034-A	Six Jewels	Ag. Fruit Dehydrator Retrofitted from Natural Gas	9/10/01	$38,830.64			
CSU, Fresno	4	04-0041-A	A&C Dryers Inc.	Propane Tank & Vaporizer Conversion	7/9/02	$62,458.25			
CSU, Fresno	4	04-0056-A	Rosendahl Farms, Inc.	Rosendahl Farms, Inc.	9/18/01	$89,501.10			

Program Administrator	Category	Project #	Project Name	Description	Grant Payment Date	Grant Payment Total	Contracted Savings, kW	Verified Savings, kW	Simple Cost Effectiveness, $/kW
CSU, Fresno	4	04-0062-A	Central Avenue Dry Yard	Propane Tank & Vaporizer Conversion	9/11/01	$19,157.88			
CSU, Fresno	4	04-0073-A	Foster Farms Dairy	(Modesto) Kansas Ave Plant Propane Project	10/20/03	$202,995.00			
CSU, Fresno	4	04-0085-A	Fowler Dehydrator	Natural Gas to Propane Conversion	5/17/02	$52,073.07			
CSU, Fresno	4	04-0110-A	Tri-Counties Walnut Co.	Tri-Counties Walnut Co.	11/29/01	$62,644.80			
CSU, Fresno	4	04-0255-A	Farmers	Dual Fuel Gas Conversion	11/12/02	$89,050.00			
CSU, Fresno	4	04-0270A	Foster Poultry Farms	Livingston Poultry Plant Alternative Fuel	2/5/04	$204,750.00			
CSU, Fresno	4	04-0001-A	J.G. Boswell Company	Cotton Gins 2&3 - Project Proposal #3	4/15/02	$36,574.18			
Subtotal	**24**				Subtotal of Grant Payments	**$1,633,047.68**			
Total of All Projects from CSU, Fresno and Cal Poly	**976**				**Total Grant Payments for CSU, Fresno and Cal Poly**	**$11,068,589.55**			
					Total Contracted savings, Category 1 & 3, kW	**78,126**			
					Total Verified Savings, Category 1 & 3, kW	**57,250**			

Onsite Energy Corporation Projects									
Contractor	***Category***	***Project #***	***Project Site***	***Project Description***	***Installation notes***	***Grant Payments***	***Demand Savings Filed, kW***	***Verified Demand Savings, kW***	
Onsite Energy	1	1	Gatorade	VSD air compressor and plant air mods	Project completed.	$ 15,255.00	83	61	
Onsite Energy	1	2	Frito Lay, Visalia	VFDs for boiler feedwater pump (100 hp), and FD fan for boiler (75hp)	System complete and operating.	$ 19,075.00	117.0	76.3	
Onsite Energy	1	2	Frito Lay, Visalia	Install 20 SR controllers for dynamic power factor and harmonics control	System complete and operating.	$ 1,300.00	65.5	5.2	
Onsite Energy	1	2	Frito Lay, Visalia	Replace 16 1.5hp vacuum caser motors with central system	System complete and operating.	$ 7,150.00	12.3	28.6	
Onsite Energy	1	2	Frito Lay, Visalia	Expander controls on existing plant air system to eliminate one of electric air compressors	System complete and operating.	$ 35,100.00	123.5	140.4	
Onsite Energy	1	2	Frito Lay, Visalia	Replace remaining electric driven air compressor for plant air with nat. gas driven Kaeser compressor	System complete and operating.	$ 28,750.00	117.0	115.0	
Onsite Energy	1	2	Frito Lay, Visalia	Install Solatube sky lighting for manufacturing floor and office areas	Installation complete - lighting levels too low for company spec in some places; circuit revisions in Phase II.	$ 31,800.00	100	127.2	
Onsite Energy	1	2	Frito Lay, Visalia	Install PowerIT Demand limiting system for plant loads	System installed and undergoing tuneup	$ 40,000.00	250.0	160.0	
Onsite Energy	1	3	Frito Lay, Modesto	Installation of 100 Hp VFD compressor will allow shut down of one 250 Hp unit.	System complete.	$ 36,575.00	120.0	146.3	
Onsite Energy	1	3	Frito Lay, Modesto	Install VFDs on Boiler Pumps.	System complete.	$ 8,425.00	32.0	33.7	
Onsite Energy	1	3	Frito Lay, Modesto	Install PowerIT Demand limiting system for plant loads	System Complete, ongoing tuning of setpoint	$ 87,500	200.0	350.0	
Onsite Energy	1	3	Frito Lay, Modesto	Mytech bi-level HID controls for warehouse lighting (includes Phase II)	System is complete.	$ 7,200	26.5	28.8	
Onsite Energy	1	3	Frito Lay, Modesto	Daylighting Controls for expansion warehouse	System is Complete	$ 50,175.00			

Contractor	Category	Project #	Project Site	Project Description	Installation notes	Grant Payments	Demand Savings Filed, kW	Verified Demand Savings, kW	
Onsite Energy	1	4	Leprino Foods, Tracy	Reduce condenser head pressure from 180 to 155 psig	System is complete and running, SPC baseline data from previous SPC project.	$ 122,525.00	300	490.1	
Onsite Energy	1	4	Leprino Foods, Tracy	Install new heat exchangers, split brine system	System is complete and running, SPC baseline data from previous SPC project.		400		
Onsite Energy	1	5	Del Monte Foods, Hanford	Reconfiguration of the flume piping and pump locations resulted in the removal of 4 each 40 Hp water pumps used for many years	Plant retrofits complete	$ 22,375.00	89.5	89.5	
Onsite Energy	1	5	Del Monte Foods, Hanford	Replace tomato flumes with conveyer belts and eliminate match motor size to loads	Plant retrofits complete	$ 44,750.00	179.0	179.0	
Onsite Energy	1	5	Del Monte Foods, Hanford	Replace current hydraulically driven equipment with properly sized electric motor/gearboxes and VFD.	Plant retrofits complete.	$ 53,650.00	212.7	214.6	
Onsite Energy	1	5	Del Monte Foods, Hanford	Replace 5 each Manzini pulpers with 3 each Fenco pulpers Fenco pulpers are more energy efficient and have higher capacity	Plant retrofits complete.	$ 27,975.00	111.9	111.9	
Onsite Energy	1	5	Del Monte Foods, Hanford	Install cooling water control valves so that pumps may be shut down if one evaporator is turned off (Evaps 1,2 & 8). Estimated to be approximately 900 hours/summer.	Plant retrofits complete.	$ 9,625.00	37.3	38.5	
Onsite Energy	1	6	Dreisbach, Richmond	Install motion detectors and bi-level lighting on existing HID fixtures	No post inspection - equipment verified during installation phase. Project complete.	$ 7,200.00	300.0	25.7	
Onsite Energy	1	6	Dreisbach, Oakland	Install motion detectors and bi-level lighting on existing HID fixtures	No post inspection - equipment verified during installation phase. Project complete.	$ 6,325.00		25.3	
Onsite Energy	1	6	Dreisbach, Moss Landing	Install motion detectors and bi-level lighting on existing HID fixtures	No post inspection - equipment verified during installation phase. Project complete.	$ 6,425.00		28.8	

Contractor	Category	Project #	Project Site	Project Description	Installation notes	Grant Payments	Demand Savings Filed, kW	Verified Demand Savings, kW	
Onsite Energy	1	7	Pacific Coast Producers	Comprehensive plant retrofit	Plant retrofits complete, M&V report reviewed from R. Mowris and Associates, amended, and approved	$ 366,000.00	1464	1,464.0	
Onsite Energy	1	8	Frito Lay Rancho Cucamunga	Install demand limiting system	Project Installed; tuning setpoint	$ 92,000.00	300	368.0	
Onsite Energy	1	9	Dreisbach Demand Limiting System - Richmond	Install demand limiting system	Project Installed, Final report reviewed		75	-	
Onsite Energy	1	10	Dreisbach Demand Limiting System - Oakland	Install demand limiting system	Project Installed, Final report reviewed	$ 84,750.00	110	339	
Onsite Energy		11	Dreisbach Demand Limiting System – Moss Landing	Install demand limiting system	Project Installed, Final report reviewed	$ 28,000.00	190	112	
Onsite Energy		12	Del Mar Foods, Watsonville, Plant Side	Install demand limiting system	Project Installed	$ 99,750.00	500	399	
Onsite Energy		12	Del Mar Foods, Watsonville, Cold Storage Rooms	Install demand limiting system	Project Installed	$ 35,750.00		143	
Onsite Energy		13	Bonita Pak Foods	Install demand limiting system	Project Installed; tuning setpoint	$ 208,500.00	583	834	
Onsite Energy		14	Cool Pacific Foods	Install demand limiting system	Project Installed	$ 52,000.00	300	208	
Onsite Energy		15	Richmond Wholesale Meats	Install demand limiting system	Project Installed	$ 102,900.00	300	412	
Onsite Energy		16	P&O Cold Logistics -Vernon #1	Install demand limiting system	Project Installed	$ 110,300.00	1,500	441	
Onsite Energy		16	P&O Cold Logistics -Vernon #2	Install demand limiting system	Project Installed	$ 39,325.00		157	
Onsite Energy		16	P&O Cold Logistics -City of Industry #4	Install demand limiting system	Project Installed	$ 110,325.00		441	
Onsite Energy		16	P&O Cold Logistics - Dominquez Hills #6	Install demand limiting system	Project Installed	$ 10,900.00		44	

Contractor	Category	Project #	Project Site	Project Description	Installation notes	Grant Payments	Demand Savings Filed, kW	Verified Demand Savings, kW	
Onsite Energy		16	P&O Cold Logistics - Carson #10	Install demand limiting system	Project Installed	$ 48,975.00		196	
Onsite Energy		16	P&O Cold Logistics - Anaheim#11	Install demand limiting system	Project Installed	$ 25,425.00		102	
Onsite Energy		16	P&O Cold Logistics - La Habra #13	Install demand limiting system	Project Installed	$ 28,400.00		114	
Onsite Energy		16	P&O Cold Logistics - Brea #14	Install demand limiting system	Project Installed	$ 24,150.00		97	
Onsite Energy		16	P&O Cold Logistics - Salinas #18	Install demand limiting system	Project Installed	$ 15,600.00		62.0	
Onsite Energy		17	P&O Cold Logistics - Modesto #15	Install demand limiting system	Project Installed	$ 49,525.00	450.0	198.0	
Subtotals for Onsite contract		**17**				**$2,201,730**	**8,884.5**	**8,807.3**	

Section 4 Agricultural Program Cost Effectiveness

Cat 1 = High Efficiency; Cat 3 = Advanced metering & Telemetry												
Cal Poly Category 1 Projects												
Cat	*Administrator*	*Project*	*Project Number*	*Administrator M&V verified Demand Reduction, kW*	*Demand Reduction, per ISO contract, kW*	*Verified Total Reduction, kW*	*Revised CEC Allocation*	*Projected Lifetime, Years*	*NPV factor at 4.1%*	*NPV of kW-Yr*	*Levelized $/kW*	*Simple $/kW*
1	Cal Poly	North Kern Water	01-018-47310	5,135	0	5,135	$ 346,204.90	5	4.62	23,731	$15	$67.42
1	Cal Poly	Hills Valley Irrigation	02-006-47310	16	0	16	$ 4,800.00	10	8.40	134	$36	$300.00
1	Cal Poly	Berrenda Mesa Water	02-009-47310	770	0	4,400	$ 28,754.00	15	11.49	50,572	$1	$6.54
1	Cal Poly	North Kern Water	02-013-47310	3,331	0	3,331	$ 813,750.00	9	7.71	25,665	$32	$244.30
1	Cal Poly	Sutter Extension	02-014-47310	23	0	23	$ 8,250.00	10	8.40	193	$43	$358.70
1	Cal Poly	City of Santa Rosa	02-015-47310	46	0	46	$ 8,625.00	10	8.40	386	$22	$187.50
1	Cal Poly	Orange Cove Irrigation	02-020-47310	178	0	178	$ 44,500.00	10	8.40	1,495	$30	$250.00
1	Cal Poly	Berrenda Mesa Water	03-001-43710	270	0	270	$61,750	5	4.62	1,248	$49	$228.70
1	Cal Poly	North Kern Water	03-009-47310	1,502		1,502	$375,400	10	8.40	12,619	$30	$249.93
1	Cal Poly	North Kern Water Storage	03-009-47310	1,502	0	1,502	$375,400.00	6	5.44	8,170	$46	$249.93
Subtotals				**16,458**		**16,824**	**$ 2,083,132.90**			**132,201**		**$123.82**
Category 1 Natural Gas Engine Projects												
2	Cal Poly	City of Greenfield		248	0	248	$62,000.00	15	11.49	2,850	$22	$250.00
3	Cal Poly	Eastern Municipal Water District		250	0	250	$62,500.00	15	11.49	2,873	$22	$250.00
4	Cal Poly	Eastern Municipal Water District		322	0	322	$80,500.00	15	11.49	3,701	$22	$250.00
Subtotals				**820**	**0**	**820**	**$ 205,000.00**			**6,889**		**$ 250.00**

CSU, Fresno Category 1 Projects												
Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Levelized $/kW	Simple $/kW
1	CSU, Fresno	VFD on Recirculating	01-0027-C	6.77		6.77	$24,600.00	5	4.62	379	$65	$300.00
1	CSU, Fresno	VFD on Compressor	01-0027-D	19.75		19.75	$1,096.55	14	10.92	66	$17	$180.95
1	CSU, Fresno	Insulate Tanks 7001	01-0029-A	50.7		50.7	$7,230.00	14	10.92	263	$27	$300.00
1	CSU, Fresno	Dyer Creek	01-0035-A	45		45	$7,448.00	14	10.92	232	$32	$350.00
1	CSU, Fresno	Insulate Tanks 2019 &	01-0042-A	25.44		25.44	$2,445.30	10	8.40	187	$13	$110.15
1	CSU, Fresno	Alternate Sequence	01-0053-A	219.09		219.09	$8,450.00	20	14.02	354	$24	$334.65
1	CSU, Fresno	Time Management	01-0054-A	37		37	$1,300.00	14	10.92	74	$18	$192.02
1	CSU, Fresno	Time Management	01-0054-B	44		44	$6,912.00	14	10.92	216	$32	$349.97
1	CSU, Fresno	Time Management	01-0054-C	130		130	$17,745.00	15	11.49	583	$30	$350.00
1	CSU, Fresno	Alternate Sequence	01-0060-A	156		156	$564.46	5	4.62	208	$3	$12.54
1	CSU, Fresno	Lighting Office &	01-0067-A	1.7		1.7	$6,360.00	15	11.49	292	$22	$250.00
1	CSU, Fresno	Roof Vent	01-0067-B	25.3		36.48	$10,954.42	5	4.62	1,012	$11	$50.00
1	CSU, Fresno	Water Storage Tank	01-0067-C	8.3		8.3	$3,282.83	5	4.62	171	$19	$88.73
1	CSU, Fresno		01-0068-A	98.4		119	$820.71	5	4.62	203	$4	$18.65
1	CSU, Fresno	Evaporative Condenser	01-0076-A	47.3		47.3	$820.70	5	4.62	601	$1	$6.31
1	CSU, Fresno	Golden Valley Grape Juice	01-0078-A	14.7		14.7	$7,800.00	5	4.62	721	$11	$50.00
1	CSU, Fresno	Turlock Turkey Plant	01-0080-A	97		0	$595.00	15	11.49	20	$30	$350.00
1	CSU, Fresno	Pressure System Re-	01-0082-A	31.81		31.81	$12,336.39	25	16.09	587	$21	$338.17

Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Leveliz ed $/kW	Simple $/kW
1	CSU, Fresno	Flash Cooler/T-60	01-0084-A	152		152	$0.00	5	4.62	38	$0	$0.00
1	CSU, Fresno	Variable Speed Vacum	01-0086-A	7.25		7.25	$19,627.91	5	4.62	550	$36	$164.94
1	CSU, Fresno	South Avenue	01-0088-A	50.89		50.89	$16,555.00	20	14.02	663	$25	$350.00
1	CSU, Fresno	Lighting System	01-0091-A	25.142		25.142	$4,410.00	15	11.49	169	$26	$300.00
1	CSU, Fresno	Rote Greenhouses	01-0100-A	8.95		8.95	$0.00	5	4.62	0		N/a
1	CSU, Fresno	Rote Greenhouses	01-0100-B	2.24		2.24	$9,543.00	5	4.62	147	$65	$300.00
1	CSU, Fresno	Rote Greenhouses	01-0100-C	2.21		2.21	$53,200.00	5	4.62	702	$76	$350.00
1	CSU, Fresno	Time Management	01-0101-A	56		56	$1,812.50	14	10.92	79	$23	$250.00
1	CSU, Fresno	Surface Drip System/Time	01-0101-B	88.59		88.59	$17,636.50	8	6.98	355	$50	$346.56
1	CSU, Fresno	Time Management	01-0101-D	84		84	$8,799.70	15	11.49	289	$30	$350.00
1	CSU, Fresno	Time Management	01-0101-E	158		158	$471.90	5	4.62	41	$11	$52.73
1	CSU, Fresno	Efficient Electrical	01-0106-A	49.5		49.5	$468.00	5	4.62	10	$45	$208.93
1	CSU, Fresno	Energy reduction I	01-0108-A	104		104	$165.10	5	4.62	10	$16	$74.71
1	CSU, Fresno	Energy reduction I	01-0108-B	10.66		10.66	$208.36	5	4.62	259	$1	$3.72
1	CSU, Fresno	Indianola Drip System	01-0109-A	16.06		16.06	$31,006.50	8	6.98	618	$50	$350.00
1	CSU, Fresno		01-0119-A	23.87		23.87	$304.36	5	4.62	388	$1	$3.62
1	CSU, Fresno	Variable Speed Pump	01-0120-A	19		19	$305.06	5	4.62	730	$0	$1.93
1	CSU, Fresno		01-0122-A	17		17	$8,238.13	5	4.62	229	$36	$166.43
1	CSU, Fresno		01-0126-A	9.05		9.05	$33,728.15	5	4.62	481	$70	$324.31

Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Leveliz ed $/kW	Simple $/kW
1	CSU, Fresno	Energy Reduction	01-0128-A	89		89	$3,731.00	5	4.62	49	$76	$350.00
1	CSU, Fresno	Energy Reduction	01-0128-B	72.2		72.2	$5,621.00	8	6.98	112	$50	$350.00
1	CSU, Fresno	Energy Reduction	01-0128-C	14		14	$8,354.50	5	4.62	110	$76	$350.00
1	CSU, Fresno	Dixon Plant Electrical	01-0134-A	1029.75		1013.2	$5,700.00	14	10.92	208	$27	$300.00
1	CSU, Fresno	Poundstone Bros., Inc.	01-0135-A	15		15	$2,550.00	5	4.62	79	$32	$150.00
1	CSU, Fresno	Unilever Best Foods NA	01-0136-A	101.46		101.46	$1,197.86	5	4.62	42	$29	$132.36
1	CSU, Fresno	Efficienct Electrical	01-0142-A	30		30	$9,100.00	5	4.62	411	$35	$22
1	CSU, Fresno	Replace Vacuum	01-0144-A	9.1		9.1	$10,209.00	5	4.62	334	$27	$31
1	CSU, Fresno	Efficient Regenerative	01-0146-A	74.8		342.9	$3,250.00	5	4.62	65	$24	$232.14
1	CSU, Fresno	Coil Replacement	01-0151-A	34.7		16.45	$253,300.00	5	4.62	4,682	$17	$54
1	CSU, Fresno	Power factor correction and	01-152-A	128.81		0	$2,947.50	5	4.62	69		$43
1	CSU, Fresno	Replacing a water tower	01-0157-A	104.07		196.3	$27,061.00	5	4.62	469	$25	$266.72
1	CSU, Fresno	Frito-Lay Modesto	01-0158-A	97.9		97.9	$4,907.50	5	4.62	139	$35	$163.58
1	CSU, Fresno	Frito-Lay Bakersfield	01-0159-A	149.9		141.89	$2,730.00	14	10.92	99	$27	$300.00
1	CSU, Fresno	Variable speed	01-0160-A	19.3		19.3	$38,745.37	5	4.62	1,585	$24	$112.99
1	CSU, Fresno	AC Drive	01-0161-A	24.2		35.24	$3,292.70	15	11.49	189	$17	$200.16
1	CSU, Fresno	AC Drive	01-0162-A	5.68		10.09	$0.00	5	4.62	0		#DIV/0!
1	CSU, Fresno	Jongsma Dairy	01-0172-A	22.53		22.53	$68,705.00	20	14.02	2,753	$25	$350.00
1	CSU, Fresno	Lighting Retrofit	01-0182-A	33		33	$29,245.00	15	11.49	1,125	$26	$298.72

Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Leveliz ed $/kW	Simple $/kW
1	CSU, Fresno	GlenEagles Agricultural	01-0185-A	70		70	$69,845.00	10	8.40	1,192	$59	$492.25
1	CSU, Fresno	Ake Boosters	01-0186-A	104		104	$4,825.00	14	10.92	211	$23	$250.00
1	CSU, Fresno	VSD for vacuum pump	01-0189-A	7.83		7.83	$10,302.00	14	10.92	385	$27	$292.34
1	CSU, Fresno	Natural gas engine-driven	01-0191-A	154		222.86	$3,027.00	14	10.92	110	$27	$300.00
1	CSU, Fresno	McCall Pump	01-0195-A	7.47		7.47	$5,632.50	14	10.92	246	$23	$250.00
1	CSU, Fresno	Drip irrigation retrofit	01-0200-A	109.4		109.4	$8,250.00	15	11.49	379	$22	$250.00
1	CSU, Fresno	S&S Farms	01-0204-A	17.08		17.08	$655.79	5	4.62	323	$2	$9.37
1	CSU, Fresno	Sprinkler System	01-0207-A	3.453		3.453	$1,641.42	5	4.62	481	$3	$15.78
1	CSU, Fresno	B67386	01-0209-A	8.3		8.3	$2,349.00	14	10.92	86	$27	$300.00
1	CSU, Fresno	Livingston Processing	01-0217-A	38.8		0	$55,715.00	20	14.02	3,125	$18	$250.00
1	CSU, Fresno	James Murphy	01-0218-A	11.375		11.375	$1,867.50	5	4.62	35	$54	$250.00
1	CSU, Fresno	Room #'s 1-4 Ammonia	01-0219-A	45		45	$27,350.00	8	6.98	764	$36	$250.00
1	CSU, Fresno	Schechert Ranches	01-0223-A	61.32		61.32	$4,270.00	5	4.62	79	$54	$250.00
1	CSU, Fresno	Schechert Ranches	01-0225-A	7.3		7.3	$1,208.55	8	6.98	24	$50	$350.00
1	CSU, Fresno	Del Puerto Farms	01-0232-A	90.77		90.77	$2,905.00	5	4.62	38	$76	$350.00
1	CSU, Fresno	H.D. Plocher Partnership	01-0241-A	4.68		4.68	$0.00	5	4.62	0		N/a
1	CSU, Fresno	Pine Crest Farms Dairy	01-0244-A	6.94		6.94	$4,107.25	5	4.62	53	$78	$361.08
1	CSU, Fresno	Rocking S Dairy	01-0245-A	14		14	$15,750.00	20	14.02	631	$25	$350.00
1	CSU, Fresno	Louie Durrer & Sons Dairy	01-0246-A	9.18		9.18	$15,330.00	9	7.71	472	$32	$250.00

Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Leveliz ed $/kW	Simple $/kW
1	CSU, Fresno	Marugliano Farms	01-0249-A	13.6		13.6	$1,825.00	9	7.71	56	$32	$250.00
1	CSU, Fresno	Wolff Vineyards	01-0251-A	11.19		11.19	$11,437.50	5	4.62	419	$27	$126.01
1	CSU, Fresno	6179R2-project was	01-0269-A	44.98		45	$1,170.13	5	4.62	22	$54	$250.03
1	CSU, Fresno	Ray Avansino	01-0287-A	30		30	$1,735.00	14	10.92	76	$23	$250.00
1	CSU, Fresno	Delano Farms Reservoir 18	01-0312-A	50		0	$3,500.00	14	10.92	153	$23	$250.00
1	CSU, Fresno	Delano Farms Reservoir 25	01-0312-B	29		0	$2,280.00	14	10.92	100	$23	$248.37
1	CSU, Fresno	Delano Farms Reservoir 23	01-0312-C	41		0	$4,760.00	14	10.92	149	$32	$350.00
1	CSU, Fresno	Boiler Plant Modification	01-0315-A	66.62		66.62	$3,916.50	14	10.92	122	$32	$350.00
1	CSU, Fresno		01-0318-A	140		138.8	$7,902.17	9	7.71	347	$23	$175.60
1	CSU, Fresno	Scully Packing	01-0328-A	17.81		9.52	$7,500.00	5	4.62	139	$54	$250.00
1	CSU, Fresno	Replace cooling Tower	01-330-A	104.8		104.8	$0.00	5	4.62	0		#DIV/0!
1	CSU, Fresno	Horseradish Refrigeration	01-0345-A	30.5		17	$0.00	5	4.62	0		#DIV/0!
1	CSU, Fresno	Enology Wine Chiller	01-0348-A	50.7		38.16	$0.00	5	4.62	0		#DIV/0!
1	CSU, Fresno	Talley Farms Reservoir	01-350-A	41.03		28.6	$19,986.00	15	11.49	766	$26	$300.00
1	CSU, Fresno	TOU Meter	01-351-A	46.7		46.7	$34,706.00	5	4.62	641	$54	$250.04
1	CSU, Fresno	Freemark Abbey Winery	01-0353-A	7.82		7.82	$2,380.00	14	10.92	104	$23	$250.00
1	CSU, Fresno	Quest Dairy	01-0355-A	3.64		3.64	$28,250.83	20	14.02	1,470	$19	$269.57
1	CSU, Fresno		01-357-A	11.8		11.8	$4,250.00	5	4.62	79	$54	$250.00
1	CSU, Fresno	E & J Gallo Winery	01-0358-A	174.08		349.79	$9,540.00	20	14.02	535	$18	$250.00

Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Leveliz ed $/kW	Simple $/kW
1	CSU, Fresno	Tony Machado	01-0359-A	13.86		13.86	$7,150.00	5	4.62	132	$54	$250.00
1	CSU, Fresno	Time of Use Meter	01-0367-A	2.24		2.24	$683.80	5	4.62	216	$3	$14.64
1	CSU, Fresno	Time of Use Meter	01-0367-B	1.86		1.86	$1,955.00	5	4.62	36	$54	$250.00
1	CSU, Fresno	Time of Use Meter	01-0367-C	2.24		2.24	$910.00	14	10.92	40	$23	$250.00
1	CSU, Fresno	Time of Use Meter	01-0367-D	1.49		1.49	$2,950.00	5	4.62	55	$54	$250.00
1	CSU, Fresno	Time of Use Meter	01-0367-E	3.7		3.7	$87,447.50	15	11.49	4,020	$22	$250.00
1	CSU, Fresno	Time of Use Meter	01-0367-F	1.2		1.2	$3,465.00	14	10.92	151	$23	$250.00
1	CSU, Fresno	Time of Use Meter	01-0367-G	4.92		4.92	$286.66	5	4.62	10	$28	$127.97
1	CSU, Fresno	Time of Use Meter	01-0367-H	2.24		2.24	$286.66	5	4.62	9	$33	$154.12
1	CSU, Fresno	Time of Use Meter	01-0367-I	1.87		1.87	$286.66	5	4.62	10	$28	$127.97
1	CSU, Fresno	Packinghouse Remodel	01-0368-A	67.16		67.16	$286.66	5	4.62	7	$42	$192.39
1	CSU, Fresno	Valley Fig Growers	01-376-A			48.4	$286.66	5	4.62	17	$17	$77.48
1	CSU, Fresno	DC Lighting	01-0378-A	47.7		47.7	$286.66	5	4.62	6	$52	$238.88
1	CSU, Fresno	Vacuum pump VSD	01-0380-A	11.56		11.56	$286.66	5	4.62	23	$13	$58.26
1	CSU, Fresno	MRD Dairy	01-0391-A	6.15		6.15	$286.66	5	4.62	10	$28	$127.97
1	CSU, Fresno	L&M Dairy	01-0392-A	9.14		9.14	$286.66	5	4.62	9	$33	$153.29
1	CSU, Fresno	Ronnie Ray Dairy	01-0402-A	6.15		6.15	$16,790.00	5	4.62	310	$54	$250.00
1	CSU, Fresno	Replacing Water Tower	01-0404-A	28.9		28.9	$12,100.00	5	4.62	224	$54	$250.00
1	CSU, Fresno	Sun Maid Growers	01-0405-A	144.28		129.88	$11,925.00	15	11.49	548	$22	$250.00

Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Leveliz ed $/kW	Simple $/kW
1	CSU, Fresno	Clos Pegase	01-0412-A	12.09		12.09	$2,890.00	14	10.92	126	$23	$250.00
1	CSU, Fresno	Ed Brower dairy	01-0415-A	17.34		17.34	$2,152.50	14	10.92	67	$32	$350.00
1	CSU, Fresno	Toledo Dairy	01-0416-A	11.56		11.56	$2,285.00	14	10.92	100	$23	$250.00
1	CSU, Fresno	M.F. Gomes & Sons Dairy	01-0417-A	9.88		9.88	$1,537.50	14	10.92	67	$23	$250.00
1	CSU, Fresno	Ice Production	01-0422-A	220.35		214.82	$10,115.00	20	14.02	405	$25	$350.00
1	CSU, Fresno	Vacuum pump VSD	01-0428-A	9.36		9.36	$32,470.00	5	4.62	600	$54	$250.00
1	CSU, Fresno	Franciscan Vineyards -	01-0433-A	26.93		26.93	$3,022.50	5	4.62	56	$54	$250.00
1	CSU, Fresno	2Vel Dairy Dairy	01-0436-A	17.87		17.87	$6,690.00	14	10.92	189	$35	$385.81
1	CSU, Fresno	Vacuum pump VSD	01-0449-A	15.67		15.67	$2,890.00	14	10.92	126	$23	$250.00
1	CSU, Fresno	Vacuum pump VSD	01-0449-B	15.67		15.67	$2,470.00	14	10.92	108	$23	$250.00
1	CSU, Fresno	JP Farms	01-0453-A	159.57		159.57	$53,705.00	20	14.02	3,012	$18	$250.00
1	CSU, Fresno	Frank Guidera Co.	01-0465-A	52.7		52.7	$2,340.00	14	10.92	102	$23	$250.00
1	CSU, Fresno	Lee Cardoza Dairy	01-0468-A	4.1		4.1	$6,735.00	20	14.02	378	$18	$250.09
1	CSU, Fresno	Vacuum pump VSD	01-0469-A	7.83		7.83	$4,467.50	14	10.92	195	$23	$250.00
1	CSU, Fresno	Tony Souza Dairy	01-0471-A	15.3		15.3	$5,477.00	14	10.92	171	$32	$349.52
1	CSU, Fresno	Vacuum pump VSD	01-0474-A	6.15		6.15	$4,701.00	14	10.92	171	$27	$300.00
1	CSU, Fresno	James Brower	01-0477-A	4		4	$39,892.50	5	4.62	737	$54	$250.00
1	CSU, Fresno	David Allan H.P.	01-0479-A	36.09		36.09	$18,445.00	5	4.62	244	$76	$350.00
1	CSU, Fresno	Lance Mouw Dairy	01-0480-A	99.22		99.22	$1,025.00	14	10.92	45	$23	$250.00

Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Levelized $/kW	Simple $/kW
1	CSU, Fresno	Vander Schaaf Dairy	01-0488-A	8.1		0	$1,957.50	14	10.92	86	$23	$250.00
1	CSU, Fresno	VSD for vacuum pump	01-0489-A	6.16		6.19	$3,825.00	14	10.92	167	$23	$250.00
1	CSU, Fresno	Chandlers 60 HP	01-0493-A	26.4		37.3	$1,537.50	14	10.92	67	$23	$250.00
1	CSU, Fresno	Tulare 50hp	01-0493-B	0		0	$1,000.00	9	7.71	31	$32	$250.00
1	CSU, Fresno	If2 Drip Station	01-0500-A	5.69		0	$8,487.36	9	7.71	278	$31	$235.17
1	CSU, Fresno	Don Cardey Pump	01-0503-A	105		105	$24,805.00	5	4.62	459	$54	$250.00
1	CSU, Fresno	Golden Valley Grape Juice	01-513-A	15.75		15.75	$0.00	14	10.92	0		#DIV/0!
1	CSU, Fresno	J. Wine Company	01-0514-A	19.76		19.76	$1,540.00	14	10.92	68	$23	$248.79
1	CSU, Fresno	A&T Dairy	01-0519-A	9.08		7.45	$2,000.00	5	4.62	172	$12	$53.62
1	CSU, Fresno	S & S Dairy	01-0521-A	8.2		8.2	$0.00	5	4.62	0		#DIV/0!
1	CSU, Fresno	Harry Miersma	01-0522-A	8.2		8.2	$0.00	8	6.98	0		#DIV/0!
1	CSU, Fresno	Palla Rosa #3 Dairy	01-0525-A	12.3		12.3	$25,720.00	5	4.62	485	$53	$244.95
1	CSU, Fresno	Jack Mendonsa	01-0526-A	9.88		9.88	$3,937.50	15	11.49	181	$22	$250.00
1	CSU, Fresno	J&L Dairy	01-0533-A	11.5		11.5	$4,940.00	5	4.62	91	$54	$250.00
1	CSU, Fresno	Three Palms Dairy/Antonio	01-0538-A	9.88		9.88	$2,270.00	14	10.92	81	$28	$304.70
1	CSU, Fresno	Family Limited	01-0583-A	412		412	$2,050.00	14	10.92	90	$23	$250.00
1	CSU, Fresno	Red Diamond Cooling, Inc.	01-0592-A	133.9		133.9	$2,050.00	14	10.92	90	$23	$250.00
1	CSU, Fresno	Rio Pluma Company	01-0595-A	0		0	$3,075.00	14	10.92	134	$23	$250.00
1	CSU, Fresno	Cordeniz & Gomes Dairy	01-0616-A	11.5		11.5	$2,470.00	14	10.92	108	$23	$250.00

Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Leveliz ed $/kW	Simple $/kW
1	CSU, Fresno	Tony Mendonca #2	01-0618-A	9.88		9.88	$2,875.00	14	10.92	126	$23	$250.00
1	CSU, Fresno	Harry Hoffman	01-0621-A	7.8		7.8	$2,470.00	14	10.92	108	$23	$250.00
1	CSU, Fresno	Puritan Ice Co.	01-0628-A	614		614	$6,565.65	5	4.62	1,904	$3	$15.94
1	CSU, Fresno	Manual Rosa Dairy	01-0637-A	19.44		19.44	$33,475.00	5	4.62	619	$54	$250.00
1	CSU, Fresno	James R. Samuel	01-0652-A	14.57		14.47	$5,150.00	5	4.62	0		#DIV/0!
1	CSU, Fresno	Scott Mather	01-0724-A	0		3.73	$2,875.00	5	4.62	53	$54	$250.00
1	CSU, Fresno	Puritan Ice Company	01-0725-A	423.8		423.8	$2,470.00	5	4.62	46	$54	$250.00
1	CSU, Fresno	El Solyo Water District	01-0727-A	30		7.05	$1,950.00	5	4.62	36	$54	$250.00
1	CSU, Fresno	El Solyo Water District	01-0728-A	27.45		2.48	$139,705.54	5	4.62	2,838	$49	$227.53
1	CSU, Fresno	Rockview Dairies Inc	01-0734-A	199.45		241.37	$4,860.00	5	4.62	90	$54	$250.00
1	CSU, Fresno	Rosemary Farms	01-0737-A	17.1		17.1	$3,642.14	5	4.62	67	$54	$251.70
1	CSU, Fresno	Walsh Vineyard	01-0747-A	0		0	$932.50	5	4.62	17	$54	$250.00
1	CSU, Fresno	Enns Packing	01-0754-A	50.7		0	$105,950.00	5	4.62	1,959	$54	$250.00
1	CSU, Fresno	Central California	01-0765-A	33.57		24.3	$1,762.50	5	4.62	33	$54	$250.00
1	CSU, Fresno	Lindauer River Ranch	01-0766-A	13.48		0	$620.00	5	4.62	11	$54	$250.00
1	CSU, Fresno	Ag Foundation	01-0771-A	62.51		62.51	$60,342.50	5	4.62	1,115	$54	$250.00
1	CSU, Fresno	Fox Point Farms	01-0778-A	16.28		0	$4,275.00	5	4.62	79	$54	$250.00
1	CSU, Fresno	Selma Cold & Dry Storage,	01-0780-A	81.09		81.09	$0.00	5	4.62	0		N/a
1	CSU, Fresno	S & S Produce	01-0781-A	1024.12		0	$0.00	5	4.62	0		N/a

Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Levelized $/kW	Simple $/kW
1	*CSU, Fresno*	Whitehouse Rd Irrigation	01-0794-A	23.4		0	$6,075.00	5	4.62	112	$54	$250.00
1	*CSU, Fresno*	Keithly-Williams	01-0795-A	11.1		10.61	$0.00	5	4.62	0		N/a
1	*CSU, Fresno*	Paul Masson	01-0799-A	175		159.15	$15,628.50	5	4.62	289	$54	$250.02
1	**CSU, Fresno subtotals**			**10,632**		**9,676**	**$2,094,337.53**			**169,256**	**$ 24.02**	**$ 182.66**

Cal Poly Category 3 projects												
Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Levelized Cost Effectiveness, $/kW-Yr	Simple cost effectiveness, $/kW
3	Cal Poly	Solano Irrigation District (ISO contract)	01-020-47730	1,000	1,000	$ 5,371.37	3	1	1.00	1,000	$5	$ 5.37
3	Cal Poly	City of Bakersfield Agricultural & Domestic Water Resources Division (ISO contract)	01-021-47730	1737	1,737	$ 26,058.00	3	1	1.00	1,737	$15	$ 15.00
3	Cal Poly	Westlands Water District (ISO contract)	01-022-47730	37800	17,703	$ 266,373.12	3	1	1.00	17,703	$15	$ 15.05
3	Cal Poly	Orange Cove Irrigation District	02-002-47330	600	637	$ 180,000.00	3	5	4.62	2,944	$61	$ 282.57
3	Cal Poly	Natomas Central Mutual Water District	02-003-47330	1270	1,270	$ 7,976.99	3	1	1.00	1,270	$6	$ 6.28
3	Cal Poly	Westlands Water District -- Woolf Telemetry (ISO contract)	02-004-47330	534	534	$ 4,657.56	3	1	1.00	534	$9	$ 8.72

Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Levelized Cost Effectiveness, $/kW-Yr	Simple cost effectiveness, $/kW
3	Cal Poly	Westlands Water District -- Vasto Valle Telemetry (ISO contract)	02-005-47330	725	725	$ 7,762.59	3	1	1.00	725	$11	$ 10.71
3	Cal Poly	Tulare ID	03-013-47330	1923	1,923	$ 401,167.00	3	10	8.40	16,156	$25	$ 208.62
3		**Totals**		**45,589.0**	**25,529.0**	**$899,366.63**				**112,263**	**$ 8.01**	**$ 35.23**

Onsite Energy Company Project Cost Effectiveness												
Cat	Administrator	Project	Project Number	Estimated Demand Reduction Filed	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Levelized Cost Effectiveness, $/kW-Yr	Simple cost effectiveness, $/kW
1	Onsite Energy Corporation	Gatorade	1	83		61	$15,255.00	5	4.62	282	$54	$250.08
1	Onsite Energy Corporation	Pacific Coast Producers	2	1,464		1,464	366,000.00	5	4.62	6,766	$54	$ 250.00
1	Onsite Energy Corporation	Del Monte Hanford	3	89.5		89.5	$22,375.00	5	4.62	414	$54	$ 35.32
1	Onsite Energy Corporation	Del Monte Hanford	3	179		179	$44,750.00	5	4.62	827	$54	$ 250.00
1	Onsite Energy Corporation	Del Monte Hanford	3	212.7		214.6	$53,650.00	5	4.62	992	$54	$ 250.00
1	Onsite Energy Corporation	Del Monte Hanford	3	111.9		111.9	$27,975.00	5	4.62	517	$54	$ 250.00

Cat	Administrator	Project	Project Number	Administrator M&V verified Demand Reduction, kW	Demand Reduction, per ISO contract, kW	Verified Total Reduction, kW	Revised CEC Allocation	Projected Lifetime, Years	NPV factor at 4.1%	NPV of kW-Yr	Levelized Cost Effectiveness, $/kW-Yr	Simple cost effectiveness, $/kW
1	Onsite Energy Corporation	Del Monte Hanford	3	37.3		38.5	$ 9,625.00	5	4.62	178	$54	$250.00
1	Onsite Energy Corporation	Frito Lay, Visalia	4	117		76.3	$ 19,075.00	5	4.62	353	$54	$29.22
1	Onsite Energy Corporation	Frito Lay, Visalia	4	65.5		5.2	$ 1,300.00	5	4.62	24	$54	$250.00
1	Onsite Energy Corporation	Frito Lay, Visalia	4	12.3		28.6	$ 7,150.00	5	4.62	132	$54	$250.00
1	Onsite Energy Corporation	Frito Lay, Visalia	4	123.5		140.4	$ 35,100.00	5	4.62	649	$54	$250.00
1	Onsite Energy Corporation	Frito Lay, Visalia	4	117		115	$ 28,750.00	5	4.62	531	$54	$250.00
1	Onsite Energy Corporation	Frito Lay, Visalia	4	100		127.2	$ 31,800.00	5	4.62	588	$54	$250.00
1	Onsite Energy Corporation	Frito Lay, Visalia	4	250		160	$ 40,000.00	5	4.62	739	$54	$250.00
1	Onsite Energy Corporation	Frito Lay, Modesto	5	120		146.3	$ 36,575.00	5	4.62	676	$54	$40.77
1	Onsite Energy Corporation	Frito Lay, Modesto	5	32		33.7	$ 8,425.00	5	4.62	156	$54	$250.00
1	Onsite Energy Corporation	Frito Lay, Modesto	5	200		350	$ 87,500.00	5	4.62	1,617	$54	$250.00
1	Onsite Energy Corporation	Frito Lay, Modesto	5	26.5		17.2	$ 4,300.00	5	4.62	79	$54	$250.00
1	Onsite Energy Corporation	Frito Lay, Modesto	5			11.6	$2,900.00	5	4.62	54	$54	$250.00

1	Onsite Energy Corporation	Frito Lay, Modesto	5	175.9		200.7	$50,175.00	5	4.62	928	$54	$250.00
Cat	**Administrator**	**Project**	**Project Number**	**Administrator M&V verified Demand Reduction, kW**	**Demand Reduction, per ISO contract, kW**	**Verified Total Reduction, kW**	**Revised CEC Allocation**	**Projected Lifetime, Years**	**NPV factor at 4.1%**	**NPV of kW-Yr**	**Levelized Cost Effectiveness, $/kW-Yr**	**Simple cost effectiveness, $/kW**
1	Onsite Energy Corporation	Frito Lay Rancho Cucamunga	6	300		368	$ 92,000.00	5	4.62	1,701	$54	$ 250.00
1	Onsite Energy Corporation	Leprino Foods	7	700		490.1	$125,000.00	5	4.62	2,265	$54	$ 250.00
1	Onsite Energy Corporation	Dreisbach Lighting Controls	6	300		28.8	$7,200.00	5	4.62	133	$54	$ 250.00
1	Onsite Energy Corporation	Dreisbach Lighting Controls	7			25.3	$6,325.00	5	4.62	117	$54	$ 250.00
1	Onsite Energy Corporation	Dreisbach Lighting Controls	8			25.7	$6,425.00	5	4.62	119	$54	$ 250.00
1	Onsite Energy Corporation	Dreisbach Demand Limiting System	9	75		0	$	5	4.62	0		N/A
1	Onsite Energy Corporation	Dreisbach Demand Limiting System	10	110		339	$84,750.00	5	4.62	1,567	$54	$ 250.00
1	Onsite Energy Corporation	Dreisbach Demand Limiting System	11	190		112	$28,000.00	5	4.62	518	$54	$ 250.00
1	Onsite Energy Corporation	Del Mar Foods, Watsonville, Plant Side	12	300		398.8	$99,695.00	5	4.62	1,844	$54	$ 250.00
1	Onsite Energy Corporation	Del Mar Foods, Watsonville, Cold Storage Rooms	12	200		142.8	$35,692.50	5	4.62	661	$54	$ 250.00
1	Onsite Energy Corporation	Bonita Pak Foods	13	583		834	$208,500.00	5	4.62	3,854	$54	$ 250.00

1	Onsite Energy Corporation	Cool Pacific Foods	14	300		208	$52,000.00	5	4.62	961	$54	$ 250.00
Cat	**Administrator**	**Project**	**Project Number**	**Administrator M&V verified Demand Reduction, kW**	**Demand Reduction, per ISO contract, kW**	**Verified Total Reduction, kW**	**Revised CEC Allocation**	**Projected Lifetime, Years**	**NPV factor at 4.1%**	**NPV of kW-Yr**	**Levelized Cost Effectiveness, $/kW-Yr**	**Simple cost effectiveness, $/kW**
1	Onsite Energy Corporation	Richmond Wholesale	15	300		411.6	$ 102,900.00	5	4.62	1,902	$54	$250.00
1	Onsite Energy Corporation	P&O Cold Logistics - Vernon #1	16	1,500		441.2	$ 110,300.00	5	4.62	2,039	$54	$250.00
1	Onsite Energy Corporation	P&O Cold Logistics - Vernon #2	16			157.3	$39,325.00	5	4.62	727	$54	$250.00
1	Onsite Energy Corporation	P&O Cold Logistics - City of Industry #4	16			441.5	$ 110,375.00	5	4.62	2,039	$54	$250.11
1	Onsite Energy Corporation	P&O Cold Logistics - Dominquez Hills #6	16			43.6	$ 10,901.20	5	4.62	201	$54	$250.03
1	Onsite Energy Corporation	P&O Cold Logistics - Carson #10	16			195.9	$ 48,976.73	5	4.62	905	$54	$250.01
1	Onsite Energy Corporation	P&O Cold Logistics - Anaheim#11	16			101.7	$ 25,433.43	5	4.62	470	$54	$250.08
1	Onsite Energy Corporation	P&O Cold Logistics - La Habra #13	16			113.6	$ 28,400.00	5	4.62	525	$54	$250.00
1	Onsite Energy Corporation	P&O Cold Logistics - Brea #14	16			96.6	$ 24,159.48	5	4.62	446	$54	$250.10
1	Onsite Energy Corporation	P&O Cold Logistics - Modesto #15	16	450		198.1	$ 49,525.00	5	4.62	915	$54	$250.00
1	Onsite Energy Corporation	P&O Cold Logistics - Salinas #18	16			62.4	$ 15,607.50	5	4.62	288	$54	$250.12
1		**Totals**		**8,884.5**		**8,807.3**	***$2,000,000**			**40,699.8**	**$54.00**	**$ 250.00**

*Note: The Onsite Contract was limited to 8MW for a total of $2,000,000 in incentives. Projects shown resulted in 8,807.3 kW in demand savings; projects above the limit may be moved to the CIT program.

Cost Effectiveness Summary of Category 1, Category 3, and Onsite Category 1 Projects												
Cat	*Project*	*Administrator Reported Demand Reduction, kW*	*Demand Reduction, per ISO contract, kW*	*Administrator Reported Total Reduction, kW*	*Revised CEC Allocation*	*NPV factor at 4.1%*	*NPV of kW-Yr*	*Levelized Cost Effectiveness $/kW-Yr*	*Total # projects in data*	*Average project savings, kW*	*Average Grant, $*	*Simple Cost Effectiveness*
1		27,910	0	27,320	$ 4,382,470.43	varies	203,333	$ 21.55	191	146.1	$22,944.87	$ 157.02
3		50,217		29,930	$ 1,003,513.81	varies	56,632	$ 17.72	18	2,789.8	$55,750.77	$ 19.98
Onsite (1)		8,884.5		*8,807.3	*$ 2,000,000	varies	40,700	$ 54.00	43	204.8	$46,511.63	$ 250.00
subtotals		**86,952**		**66,057**	**$ 7,385,984.24**		**300,664**	**$ 24.57**	**252**	**262.13**	**$36,029.19**	**$ 111.81**
Cost Effectiveness of all projects based on demand savings for Category 1, Category 3, and Onsite projects												
Cat					**Paid CEC Grants**							
2					$4,049,557.62		N/A	N/A	747		$5,421.09	
4					$1,633,047.69		N/A	N/A	20		$81,652.35	
	All project category totals			**66,057**	**$13,068,589.55**		**297,785**	**$ 43.89**	**1337**		**$ 9,774.56**	**$ 200.28**

*Note: Onsite Energy Corporation contract limited payment to $2,000,000.00 for 8MW of savings; additional savings may be moved to CIT program

Section 5 Agricultural Program Administrator Audits

The following is a discussion of the responses to the 13 questions used as part of the administrative audits. The first seven questions are qualitative in nature; the latter six are quantitative, with an associated rating of 1 to 5, with five being the highest. Most of the responses are from an interview with the Fresno administrator, the Center for Irrigation Technology (CIT). A more limited interview was also conducted with the Irrigation Training and Research Center (ITRC) at the California Polytechnic Institute in San Luis Obispo.

Question 1: How were participants recruited?

A combination of activities was used to recruit participants. One method was a bill stuffer, which was included in the June 2001 PG&E bill another was a dedicated web page set up and linked to the CEC. In addition, informational seminars were held for farm groups, by farm bureaus, and during the Fresno County Fair with an agricultural technician. Finally, State Senator Sarah Reyes used additional industry contacts to recruit participants.

Question 2: What marketing material was used to attract participants?

A bill stuffer was included in the June 2001, PG&E bill and several seminars were held throughout the Central Valley. Web-based information on the program was made available at the CIT site. County Fair exhibits and a booth for CIT were also set up.

Question 3: (a) How many participants are participating as of December 31, 2002, and
(b) How many participants dropped out since the program's inception?

Table 1-1 gives a breakdown of the program participants by category.

Table 1-1: Reported Number of Participants and Dropouts

Category	Participants	Number Dropped Out	Percent Dropped Out
1: Efficiency	190	Small number	<10%
2: Pump Repair	568	Small number	<10%
3: Adv. Telemetry	18	Small number	
4: Fuel Switching	27	14	37%

Question 4: Were participants offered training or any other instructional help during any time of their participation?

No technical training was offered. A limited number of seminars to farmers, industry groups, and other interested parties were held in the Central Valley. An example of training included breakfast at Brooks Ranch with application assistance, marketing of program, slide show of program highlights, and technical support by CIT staff. Administrators offered rebates,

assistance with calculating savings, assistance in development of M&V strategies, and referral lists of certified pump repair firms.

Question 5: How did you evaluate your projects?

All applications were reviewed and compared to a list of eligible projects. Engineers used a "calculated savings" approach to test applications, and the more complicated projects were monitored. Some projects were forwarded to outside consultants for specialized review. Baseline demand was not measured in most applications, but was established through billing data. Post-installation demand was verified through billing data review for many Category 1 projects.

Question 6: a) How did you verify installations?
b) How many participants or sites were verified, and
c) Was a sampling plan used for this?

a) Project installations for the Fresno administrator were first verified through a notice from the participant. Final verification was through submittal of utility bills, monitoring data for the few projects that required actual M&V with metering equipment, and invoices for installed equipment. All projects were required to submit invoices and utility billing to CIT for final payment of incentives.

b) CIT staff visited an unknown number of project sites for either pre-installation or post-installation inspections. Projects with complicated project measures, or projects where conflicting information was discovered, were visited (i.e. Frito Lay Bakersfield, Puritan Ice, several dairy VSD projects).

c) It is unknown if site visits were in response to sampling plan or conducted when required for problem resolution. Database records from CIT do not indicate significant numbers of visual or on-site project verifications.

Question 7: What method was used to track and report project progress to the Energy Commission and/or the M&V contractor?

Monthly status reports were sent to the Energy Commission. The Fresno administrator used an Access database for tracking purposes, while the IRTC used an Excel spreadsheet. Reports derived from the databases were sent to Nexant for project progress tracking. Early in the program frequent errors were uncovered in the Fresno administrator database entries.

Questions 8-13 are about record keeping, and are answered with ratings based on a 5-point scale, with five being highest. Nexant gave the Fresno administrator a rating of 5 for each of the questions in Table 1-1. The IRTC administrator was not rated.

Table 1-1: Questions 8-13

Question Number	Question	Rating
8	Are documents available for the sampled projects in question?	5
9	Were invoices valid with proper documentation and consistent with the initial between parties involved and the program requirements?	5
10	Was the verification process noted above followed?	5
11	Did the installed equipment agree with the invoice?	5
12	Were participants paid according to the customer agreement?	5
13	Was the tracking/reporting method noted above maintained?	5

Section 6 Agricultural Sampled Projects

This section of the Agricultural program appendices includes information related to evaluation of peak period demand savings, or verification of project installation for projects selected in the sampling plans. The attached documents are organized by project category, and by project number within each of the four project categories. All of the Onsite Energy Corporation projects are organized by project name within the Category 1 group of project evaluations.

Project 01-0100A: Rote Greenhouses

Variances from CEC Approved Savings
Project 01-0100A: Rote Greenhouses

Project Description

This project involves the installation of electrical relays to reduce the hours of operation for convection tube fans at three plant nurseries. The facilities use the fans to circulate air and distribute the heat from overhead heaters at night. Previously the fans were in operation 24 hours/day, 7 days/week. The proposed measure involves installing relays for the fans to connect them to the 4-stage thermostat used in the nursery during the day. This will result in the fans being off during peak hours.

Nexant Calculations

Baseline

Currently the fans are in use 24 hours/day, 7 days/week. Table A lists the calculated baseline demand, based on nameplate information:

Table 1: Baseline Demand

	No. of Motors	Size (hp)*	Total (kW)**
A	16	0.75	8.95
B	4	0.75	2.24
C	9	0.33	2.24
	1	0.50	0.37
		Total:	13.8

*from nameplate information

**based on 0.746 kW/hp

Utility billing data did not include dedicated sub-metering for the motors. However, savings may still be observed in the data based on the difference between baseline and post-installation peak energy use. Using 2000 and 2001 time of use billing data, the peak energy use (kW) for the summer on-peak period for each facility was calculated. It should be noted that the available billing used was for July 2000 through September 2000 and June 2001. The assumption was made that the June 2001 data was similar to June 2000. The total peak energy use (kWh) was divided by the number of peak hours to determine the average peak demand, listed in Table 2:

Table 2: Baseline Demand from Billing Data

	Peak Energy Use (kWh)	Avg Peak Demand (kW)
A	4,040	31.3
B	1,460	11.3
C	2,171	16.8

Demand Savings

The relays installed on the circulation fans will result in a reduction in hours. The fans will be off during peak hours. Therefore, post-installation demand is expected to be 0 kW.

Billing data was included with the project application. Post-installation billing data will verify that the motors are not in operation during peak hours and verify the demand (kW) savings. Based on baseline billing data and motor nameplate data, Table 3 lists the expected demand that will be observed in the post-installation billing data.

Table 3: Expected Demand in Post-Installation Billing Data

	Baseline Peak Demand (kW)	Demand Savings (kW)	Expected Post-Install Billing Demand (kW)
A	31.3	8.95	22.4
B	11.3	2.24	9.1
C	16.8	2.61	14.2

The incentive for this project is $1,105 and was based on 65% of the project costs.

Conclusions

The demand savings for this project were based on nameplate data. Baseline utility billing data did not sub-meter, therefore post-installation billing data may not truly reflect these savings. However, if the facility does operate the motors off-peak, the demand savings should be fairly accurate.

Differences from Approved Savings and Incentive

Demand Savings Discrepancies

The approved demand savings for this project were based on nameplate data. Based on the available information, Nexant's calculations agreed with the approved calculations.

Incentive Discrepancies

The incentive paid for this project was based on the project costs. Based on the total project costs of $1,700, this project was granted $1,105. Nexant's calculations agreed with this incentive.

Project 01-0134A: Campbell Soup Supply Co.

Variances from CEC Approved Savings
Project 01-0134A: Campbell Soup Supply Co.

Project Description

This project involves modifications to the facility's operations that result in the removal of two electric motors totaling 1,850 hp. The modifications include utilizing higher-pressure steam in the tomato evaporation process and using new steam turbines as the evaporation source, replacing the two existing electric motors. Three small (3 hp) condensate pumps will be also be installed as part of the modification. The changes will not affect the facility's production. The facility evaporates tomatoes 24 hours per day, 7 days per week during the tomato season, which typically runs during the months of July, August, and September.

Nexant Calculations

Baseline and Demand Savings

The baseline demand from the two electric motors to be removed and the three condensate pumps to be installed was calculated from nameplate data:

(1,500 hp + 350 hp – (3 hp * 3 pumps) x (0.746 kW/hp) = 1,373 kW

The baseline calculation assumed that the motors and pumps are operating at full load during peak hours for the entire tomato season. However, the tomato season only occurs in July, August, and September. For the CEC Peak Load Reduction program, the summer peak period also includes June. Therefore, the average demand was adjusted based on the ratio of peak hours in July, August, and September (390 hrs) to the total peak hours from June through September (522 hrs) for an average demand savings of 1,026 kW during the summer peak period.

The application included monthly utility billing for the last 5 years, as well as summer peak load data for 2000. The billing data does not include dedicated sub-metering for the motors. However, savings may still be observed in the data based on the difference between baseline and post-installation peak energy use. As shown in Table 1 below, the average maximum demand during the entire 2000 summer peak period (June-Sep) was 3,673 kW. The average peak period demand, based on total energy use during the summer peak period (June-Sep), was 2,493 kW.

Table 1: 2000 Peak Period Utility Billing Data

Month	On-Peak Energy Use (kWh)	Max On-Peak Demand (kW)
June	19,031	270
July	224,621	4,704
August	531,354	4,893
September	526,341	4,824

Month	On-Peak Energy Use (kWh)	Max On-Peak Demand (kW)
Total:	1,301,347	
Peak Hours:	522	
Avg Demand (kW):	2,493	3,673

Using the 2000 billing data and calculated demand savings, the expected post-installation average peak demand is 1,686 kW, based on total peak energy use.

Conclusions

The demand savings for this project were based on nameplate information. According to Joe Halligan of Bellato Engineers, no spot measurements were taken of the motors prior to their removal to verify the nameplate data. The savings might be slightly high because they did not account for motor power factor or efficiency, but the figure should be fairly accurate.

Differences from Approved Savings and Incentive

Demand Savings Discrepancies

Demand savings submitted for the project were based on nameplate data. This methodology appeared accurate and Nexant agrees with the calculations. However, the approved savings did not account for the entire summer peak season. June is also included as a summer peak month for this program. Therefore the demand savings must be averaged over 4 months rather than the 3 months of the tomato season. By using the ratio of hours, the savings are reduced by approximately 25%.

In addition, the application states that the 2000 utility billing data shows the average demand to be 4600 kW. Based on Nexant's analysis, the maximum monthly demand average was 4,807 kW for July through September, and the average demand, based on total peak energy use divided by total hours was 3,288 kW for July through September. Including the energy use from June, the average peak demand for the entire summer was 2,493 kW. The expected demand savings were subtracted from this to estimate the post-installation demand on the utility's electric meter. These savings will be verified through 2002 utility billing data.

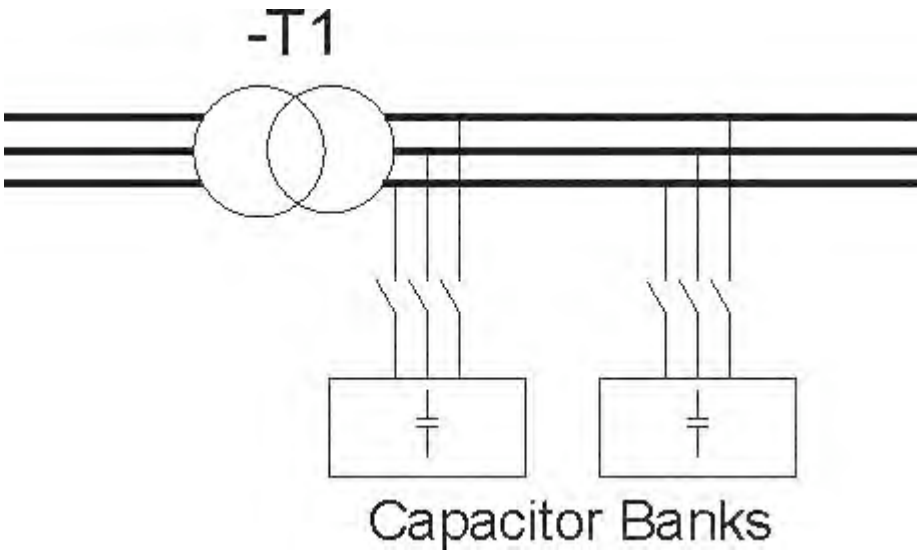
Incentive Discrepancies

The incentive paid for this project was based on the demand savings. Based on the approved savings of 1,373 kW, this project was granted $343,250. However, Nexant's savings of 1,026 result in an incentive of $256,523.

Project 01-0152A: Trinchero Winery

Bulk Correction.

The Power factor of the total current supplied to the distribution board is monitored by a controller which then switches capacitor banks In a fashion to maintain a power factor better than a preset limit. (Typically 0.95) Ideally, the power factor should be as close to unity as possible. There is no problem with bulk correction operating at unity.



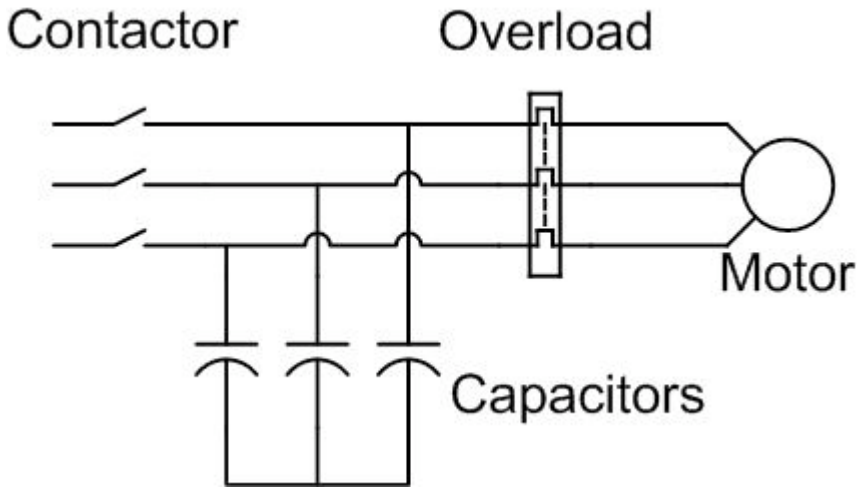
Static Correction.

As a large proportion of the inductive or lagging current on the supply is due to the magnetising current of induction motors, it is easy to correct each individual motor by connecting the correction capacitors to the motor starters. With static correction, it is important that the capacitive current is less than the inductive magnetising current of the induction motor. In many installations employing static power factor correction, the correction capacitors are connected directly in parallel with the motor windings. When the motor is Off Line, the capacitors are also Off Line. When the motor is connected to the supply, the capacitors are also connected providing correction at all times that the motor is connected to the supply. This removes the requirement for any expensive power factor monitoring and control equipment. In this situation, the capacitors remain connected to the motor terminals as the motor slows down. An induction motor, while connected to the supply, is driven by a rotating magnetic field in the stator which induces current into the rotor. When the motor is disconnected from the supply, there is for a period of time, a magnetic field associated with the rotor. As the motor decelerates, it generates voltage out its terminals at a frequency which is related to it's speed. The capacitors connected across the motor terminals, form a resonant circuit with the motor inductance. If the motor is critically corrected, (corrected to a power factor of 1.0) the inductive reactance equals the capacitive reactance at the line frequency and therefore the resonant frequency is equal to the line frequency. If the motor is over corrected, the resonant frequency will be below the line frequency. If the frequency of the voltage generated by the decelerating motor passes through the resonant frequency of the corrected motor, there will be high currents and voltages around the motor/capacitor circuit. This can result in sever damage to the capacitors and motor. It is

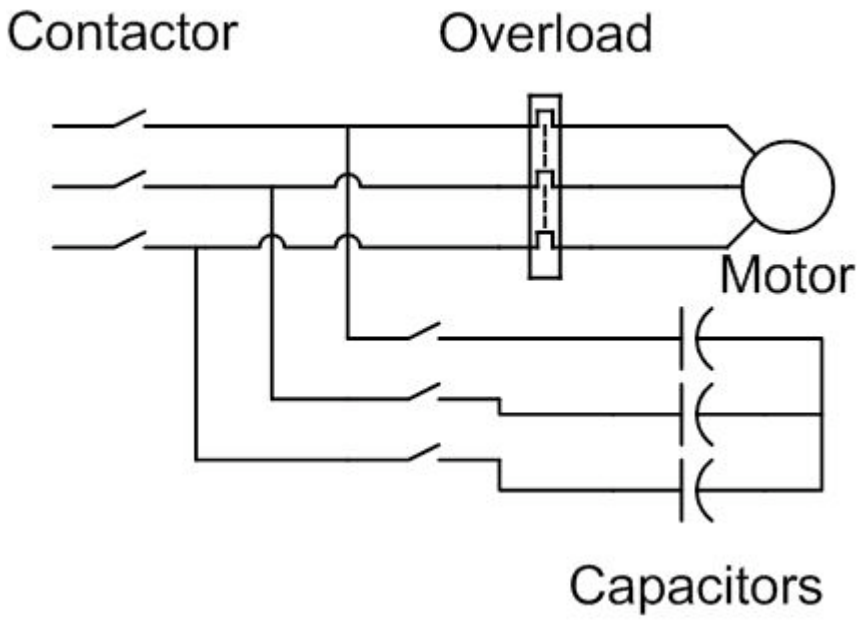
imperative that motors are never over corrected or critically corrected when static correction is employed.

Static power factor correction should provide capacitive current equal to 80% of the magnetising current, which is essentially the open shaft current of the motor.

The magnetising current for induction motors can vary considerably. Typically, magnetising currents for large two pole machines can be as low as 20% of the rated current of the motor while smaller low speed motors can have a magnetising current as high as 60% of the rated full load current of the motor. It is not practical to use a "Standard table" for the correction of induction motors giving optimum correction on all motors. Tables result in undercorrection on most motors but can result in over correction in some cases. Where the open shaft current can not be measured, and the magnetising current is not quoted, an approximate level for the maximum correction that can be applied can be calculated from the half load characteristics of the motor. It is dangerous to base correction on the full load characteristics of the motor as in some cases, motors can exhibit a high leakage reactance and correction to 0.95 at full load will result in overcorrection under no load, or disconnected conditions.



Static correction is commonly applied by using on e contactor to control both the motor and the capacitors. It is better practice to use two contactors, one for the motor and one for the capacitors. Where one contactor is employed, it should be upsized for the capacitive load. The use of a second contactor eliminates the problems of resonance between the motor and the capacitors.


Contactor
Overload
Motor
Capacitors

Projects 01-0159A, 0226A, 0227A, 0445A: Frito Lay

Randy McCall, Project Manger
Energy Delivery and Management Business Unit

February 10, 2003

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RE: APLRP project #'s 01-0159-A, 01-226-A, 01-227-A, 01-0445-A; Frito Lay, Bakersfield category 1 high-efficiency electrical-equipment project measurement and verification review.

Dear Bob and Pete,

I am writing you in response to your request to review and comment on the Measurement and Verification (M&V) plan and demand savings resulting from the four projects approved by CIT for the Frito Lay at their Bakersfield plant. As you are aware, Nexant, Inc. was retained by the CEC to provide M&V services for projects approved by the independent administrators and other contractors to the CEC. In that role, Nexant has identified a sample of projects we are conducting evaluation on to determine program level peak period demand savings. None of the four projects that are the subject of this letter are part of Nexant's random sample; therefore, our evaluation of these projects is not a full evaluation of all project documentation, nor is our investigation to be construed as a rigorous investigation of actual demand savings from the project activities for the four projects in question.

My conclusions regarding the four projects and demand savings from the four are that billing data supplied with the other documentation do not support the full savings claims for the aggregated savings from the three completed projects for which the billing data is applicable. The billing data supplied covers three summer peak period billing periods, and depending on which year is used as to establish a facility baseline average peak period demand, the peak period demand savings can be evaluated as a range from negative savings (ie increased average peak period demand) to approximately 129 kW of average peak period savings.

Based on database reports provided to Nexant, the four projects were submitted to CIT at different dates, with the first submittal for project 01-0159-A received on October 26, 2001. Project #'s 01-226-A, and 01-227-A were submitted on January 2, 2002, and the last project, # 01-445-A was received by CIT on May 16, 2002. Each of the four projects was projected for completion on different dates ranging from August 30, 2001, through November 11, 2002.

Nexant is not aware of the actual completion dates for the four projects, but the projected dates of completion include construction of the first project (01-0159-A) during the summer peak period season of 2001, and completion of the last project after the summer peak season of 2002. The M&V for each of the four projects is detailed in an attachment to each projects grant contract, titled Attachment C Protocol for Measurement and Verification. In each case the appendix is laid out with sections consisting of the following:

- Verification of Project Commissioning
- Verification of Peak Period Load Reduction (where applicable)
- Calculation of Actual Incentive Grant Payment\
- Schedule of Incentive Grant Payments
- Forfeiture of Grant Payment

Section 2.0 of each appendix, Verification of Peak Period Load Reduction, lists the CIT approved estimate of demand savings, the method of initial verification of the actual peak period load reduction, and the final verification of the actual peak period load reduction. Each Appendix has a relatively short section that details the methods of initial and final verification.

Project 01-0159-A is a lighting efficiency installation. The verification of initial savings is indicated to be through physical inspection of the facility and paid invoices. Final verification is to be accomplished through comparison of utility billing "…indicating that facility was in full operation June through September, 2002, to be submitted when that billing becomes available."

Nexant is in agreement with CIT regarding the initial verification methodology, however, the final verification is not specific regarding the billing comparison. While the post-installation billing year is specified in this appendix, the pre-installation baseline is not. Comparing the billing data from the summer of 2000 to the summer of 2002, there are no average peak period demand savings. Comparing the billing data from the summer of 2001 to the summer of 2002 results in an average on peak demand savings of approximately 129 kW.

Project 01-0226-A is a plant wide retrofit of the compressed air system to reduce capacity requirements. The initial verification for this project is accomplished through utility billing comparisons for the summer peak periods of 2001 and 2002 "…showing that peak load was reduced by at least the amount accepted for participation for each of the Applications for this facility and the facility was in full operation for the entire peak period." Although the text is not specific, Nexant believes this includes savings from project 01-0159-A, and possibly projects 01-227-A, and 01-445-A. Project 01-445-A was not submitted to CIT until May 16, 2002; the database records appear to indicate this contract appendix was not meant to include the fourth project by virtue of contract mailing and completion prior to CIT receipt of the last project.

Final verification of the project is to be accomplished through logging of compressor run times showing a net 250hp reduction in compressor usage. Nexant's review of the summer peak billing data between 2001 and 2002 shows an average of 129 kW in average peak reduction, however, if this level of savings are attributed to the lighting project, 01-0159-A on the basis of

the comparison between 2001 and 2002 summer peak period billing data, then there is no additional capacity savings possible for this project.

Because of the lack of baseline year specified year for the billing data comparison in the Appendix for project 01-0159-A, a more complicated picture emerges where peak period demand savings for 01-0159-A are not approved based on comparisons between the summer peak period billing of 2000 and 2002, yet 129kW in peak period savings might be initially verified for project 01-0226-A due to the specified comparison between summer peak period billing between 2001 and 2002. The situation is further complicated by the requirement in the initial verification for 01-0226-A that the reduction is for at least the amount accepted "…for participation for each of the Applications for this facility…"

The third project received by CIT, 01-0227-A, is a refrigeration management system for air conditioning systems projected to deliver 135 kW of peak period demand savings. The Appendix includes identical language for the initial verification of peak period demand savings contained in the Appendix for project 01-226-A. Final verification of savings is to be accomplished by a combination of techniques including a sampling inspection of pre-installation and post-installation power monitoring logs for one-week intervals. In addition, the maximum outdoor air temperatures are to be supplied for use in the analysis.

Issues identified above for initial verification of the peak period demand savings for project 01-0226-A are similar to the problems in initial verification of demand savings for project 01-0227-A, except in magnitude of the expected project savings. In both Appendices, initial verification of the peak period demand savings is contingent on a demonstration that peak period demand "…was reduced by at least the amount accepted for participation for each of the Applications…"

The fourth and final project received by CIT for the Bakersfield plant is for another lighting efficiency project. Similar to project 01-0159-A, the initial verification is accomplished through physical inspection of the facility and paid invoices. Final verification is also similar, "…by utility billing indicating that facility was in full operation June through September, 2002, to be submitted when that billing becomes available."

Due to the projected completion date for this project of November 11, 2002, as reported in the CIT database, Nexant does not agree that the billing data comparison for a non-specific summer peak period baseline year and summer of 2002 peak period billing data will be useful. The project was not delivering savings during the summer peak period of 2002 according the CIT records. PG&E does report partial peak period loads and energy use during the spring and fall time periods, however this is not specified as an option in the Appendix for conducting final savings verification.

Nexant agrees with the initial demand savings estimates for each of the four projects approved for the program, and on an individual basis the peak period demand savings can be verified except as noted above. Billing data comparisons for summer peak periods as specified for each project for either initial or final verification cannot support the savings claimed for the four projects as a group.

In summary, my evaluation of the documentation provide for these four projects reveals that final verification for the two lighting projects includes use of an unspecified baseline peak period year resulting in a range of savings from negative to 129 kW. Furthermore, initial verification of the peak period demand savings for the refrigeration and air compressor projects are complicated by the requirement of demonstrated demand savings for an unspecified number of the four projects through billing data comparisons for summer of 2001 and 2002.

Notes on Frito Lay projects:

Project 01-0159-A Received at CIT on October 26, 2001. M&V protocol contained in Appendix C of the project application requires billing history to show the reduction in peak period demand savings according to the contract appendix C at 149.9kW. Peak period demand savings are to be verified using billing from the peak season for 2002 when the billing statements are available. Grant calculation is $44,970.00 payable on completion of the project, submittal of invoices, and verification of the billing.

Project 01-0226-A Received on January 2, 2002 at CIT.
The M&V protocols specify run time meters for compressor run hours. 250 hp of compressor capacity must by taken off line as shown by the recording devices. Initial verification of the project is through comparison of 2001 and 2002 billing statements. (This does not reflect the reduction for the earlier project for lighting – ie does it really deliver the stated savings)

Project 01-0227-A received on January 2, 2002
Project 01-0445-A Received on May 16, 2002
Eligibility for the APLRP is evaluated on the basis of potential demand savings that can accrue to the California grid. The plant at Bakersfield has a site-located co-generation plant capable of meeting internal loads at the plant during some or all operations. Utility billing information shows purchased summer peak period energy during the 2000, 2001, and 2003 summer peak periods. Additionally the utility billing statements indicate that for some periods of time, the plant called on PG&E to deliver a significant amount of power to meet the internal demands of the plant during the summer peak periods, in excess of 3MW for the summer peak periods for each of the summer peak periods. Nexant has not received nor reviewed any 15-minute interval data that would show the history of the load purchases from PG&E, therefore Nexant cannot comment on how the energy was used during the summer peak periods. Based on the billed on peak energy delivered to the plant, and on peak demand recorded by PG&E, a calculation of the duration of peak period energy use implies very few hours of on peak energy delivery by the utility. Using the CIT methods for calculating average on peak energy during the summer months, the Frito lay plant had an average demand of approximately 129 kW during the entire summer peak. This calculation does not take into consideration the duration of any peak period energy purchases, on the average load for the 504 hours of the summer peak period.

Nexant's role in administration of the APLRP is to evaluate the M&V of project savings and report the information to the CEC. The M&V for the four projects pre-approved for the program by CIT is based solely on utility billing showing a reduction in summer peak period energy purchases. The approved levels of savings for each project were based on Frito Lay's engineering estimates for each technology and seem reasonable for the type of projects approved. Our review of the billing from PG&E for the plant shows a less clear picture for demand savings achieved through the projects. On peak energy purchases for the 2000 summer peak period are in fact, less than on peak energy purchases during either of the next two summer periods. The first of the four projects, 01-0159-A was submitted to CIT on October 26 2001, and was under construction prior to availability of summer 2001 peak period energy billing statements (construction completion was reported to be 8/30/2001). The second and third projects were

received at CIT on January 2, 2002 for evaluation. Construction completion for the two projects was reported to be on December 10, 2001, and May 31, 2002. The fourth project, submitted on May 16, 2002 was projected to be complete by November 11, 2002.

While it is unclear when the actual construction of the four projects was taking place, billing data from both 2001 and 2002 may not have shown the reductions for the one or more of these projects. Using as a baseline the summer of 2000 billing information, the summer of 2002 billing information actually shows a significant increase in peak period energy purchases.

Appendix C: Project 01-0159A

Protocol for Measurement and Verification

This Appendix is the controlling authority for the means and methods of:

a) Verification of Project Commissioning,

b) Verification of Peak Period Load Reduction (where applicable),

c) Calculation of the Actual Incentive Grant Payment,

d) Schedule of Incentive Grant Payments,

for the Project titled "Frito Lay Bakersfield" of Application # 01-0159 titled "Frito Lay Bakersfield".

1.0 Verification of Project Commissioning

This section shall define the Project that will be Commissioned and when it is considered Commissioned.

1.1 This Project is located at the Frito Lay facility at 22801 Highway 58, Bakersfield, CA. It consists of installing high efficiency lighting.

1.2 This Project will be considered Commissioned when it is verified that the following equipment has been purchased, installed, and is operating legally and as intended:

a) Lighting replacements as per Audit sheet supplied in the Application #01-0159 (estimated Project cost = $202,922.54).

2.0 Verification of Peak Period Load Reduction

This section shall define how Peak Period Load Reduction will be verified.

2.1 The estimated Peak Period Load Reduction as a result of this Project is One Hundred, Forty-nine and nine-tenths kiloWatts (149.9 kW).

2.2 Initial verification of the actual Peak Period Load Reduction will be by physical inspection of the facility and paid invoices.

2.3 Final verification of the actual Peak Load Reduction will be by utility billing indicating that facility was in full operation June through September 2002, to be submitted when that billing becomes available.

3.0 Calculation of the Actual Incentive Grant Payment

This section defines how the Actual Incentive Grant Payment will be calculated.

3.1 The Estimated Incentive Grant Payment for this project is Forty-four thousand, nine hundred, seventy dollars ($44,970.00) and is based on the estimated reduction in peak period load at a rate of $300/kW.

3.2 The Actual Incentive Grant Payment will be calculated after verification of actual Peak Period Load Reduction. It will be the lesser of:

a) Sixty-Five percent (65%) of the "Total Cost of the Project", or

b) A sum calculated under the following rules:

- Projects Commissioned by July 31, 2001 shall be awarded $350 per kiloWatt for the verified Peak Period Load Reduction achieved.
- Projects Commissioned after July 31, 2001 and before September 30, 2001 shall be awarded $300 per kiloWatt for the verified Peak Period Load Reduction achieved.
- Projects Commissioned after September 30, 2001 and before May 31, 2002 shall be awarded $250 per kiloWatt for the verified Peak Period Load Reduction achieved.

3.3 The "Total Cost of the Project" is defined as the total cost of the project submitted by the Applicant in his completed Application and approved by The Foundation. The "Total Cost of the Project" is the sum of any costs directly associated with the project including:

a) Design, Planning, and Engineering,

b) Equipment purchase,

c) Site preparation if it is required for the Project,

d) Equipment installation/Facility construction and testing, and

e) Local, State, and Federal sales taxes.

3.4 All Project costs will be verified by presentation of invoices reflecting that the amount due was originally billed on or after January 1, 2001, and then paid in full. The Applicant will gather all such invoices, calculate the "Total Cost of the Project", certify that the dates and amounts involved were timely incurred and paid, and such invoices, calculations and certification will be presented to the Foundation no later than sixty (60) days after the Commission Date. The certification of authenticity and accuracy of submitted invoices form is set forth below.

3.5 Notwithstanding section 3.2, the following will apply:

a) The Actual Incentive Grant Payment may be less than the Estimated Incentive Grant Payment.

b) The Actual Incentive Grant Payment cannot be more than Forty-four thousand, nine hundred, seventy dollars ($44,970.00).

3.6 Notwithstanding sections 3.1 and 3.2, no individual or corporate/business entity will be entitled to more than two million dollars ($2,000,000.00) of incentive payments.

4.0 Schedule of Grant Payments

This section defines when actual payments will be made.

4.1 The Actual Incentive Grant Payment will be calculated as per section 3.0 of this Appendix within ten (10) days after the later of either the date of initial verification of Peak Period Load Reduction (as per section 2.2 of this Appendix) or the date of certification of the "Total Cost of the Project". Payment will be within thirty (30) days of the calculation of the Actual Incentive Grant Payment.

4.2 All payments will be by check made payable to "Frito Lay" and delivered by United States mail to:

Mr. James Preston
22801 Highway 58
Bakersfield, CA 93312

5.0 Forfeiture of Grant Payment

In the event that the final verification of Peak Period Load Reduction as per section 2.3 of this Appendix cannot be established, the Applicant is required to promptly reimburse the Foundation the Actual Incentive Grant Payment. The reimbursement shall by check made payable to "California State University, Fresno Foundation" and delivered by United States mail to:

Mr. Randy Larson
California State University Fresno
Auxiliary Corporations
4910 North Chestnut, OF 123
Fresno, CA 93726-1852

CERTIFICATION OF AUTHENTICITY AND ACCURACY OF SUBMITTED INVOICES

The Applicant hereby certifies that all invoices submitted for Grant Payments are original invoices (or copies of original invoices) that are authentic and accurately reflect costs that were incurred by the Applicant on or after January 1, 2001, solely in connection with the Applicant's submitted project. The Applicant further certifies that all invoices submitted for Grant Payments do not overstate the costs incurred by the Applicant or reflect costs incurred not in direct connection with the Applicant's project.

Signed by:

_____ _____

APPLICANT DATE

Appendix C: Project 01-0226A

Protocol for Measurement and Verification

This Appendix is the controlling authority for the means and methods of:

e) Verification of Project Commissioning,

f) Verification of Peak Period Load Reduction (where applicable),

g) Calculation of the Actual Incentive Grant Payment,

h) Schedule of Incentive Grant Payments,

for the Project titled "Compressed Air Upgrade" of Application # 01-0226-A titled "Recot, Inc."

1.0 Verification of Project Commissioning

This section shall define the Project that will be Commissioned and when it is considered Commissioned.

1.1 This Project is located at the Frito Lay facility located at 4585 22801 Highway 58 in Bakersfield, CA. It consists of installing new equipment and reconfiguring the plant-wide compressed air system to reduce capacity requirements and thus become more efficient.

1.2 This Project will be considered Commissioned when it is verified that the following equipment has been purchased, installed, and is operating legally and as intended:

c) One DMX 1300 Demand Expander
d) One 1550 gallon air receiver
e) Modify existing piping and relocate existing 1830 receiver tank
f) Repair identified leaks in compressed air system as identified in the application
g) Lower plant air system to 75 psi

2.0 Verification of Peak Period Load Reduction

This section shall define how Peak Period Load Reduction will be verified.

2.1 The estimated Peak Period Load Reduction as a result of this Project is 199 kiloWatts (199 kW).

2.2 Initial verification of the actual Peak Period Load Reduction will be by comparison of utility statements for June through September 2001 to June through September 2002 showing that peak load was reduced by at least the amount accepted for participation for each of the Applications for this facility and that the facility was in full operation for the entire peak period.

2.3 Final verification of the actual Peak Period Load Reduction will be by comparison of logging of air compressors 1, 2, 3, 4, and 6 to show that at least a 250 HP reduction in net load was achieved by allowing Compressor #2 to remain off. A simple digital log of run hours by week may be utilized for each compressor, if the controls have digital logging capabilities. If not, an electromechanical run hours meter may be installed for each compressor, and a log generated by weekly readings of these meters.

3.0 Calculation of the Actual Incentive Grant Payment

This section defines how the Actual Incentive Grant Payment will be calculated.

3.1 The Estimated Incentive Grant Payment for this project is Forty nine thousand, seven hundred and fifty dollars ($49,750.00) and is based on the estimated reduction in peak period load.

3.2 The Actual Incentive Grant Payment will be calculated after verification of actual Peak Period Load Reduction. It will be the lesser of:

a) Sixty-Five percent (65%) of the "Total Cost of the Project", or

b) A sum calculated under the following rules:

- Projects Commissioned by July 31, 2001 shall be awarded $350 per kilowatt for the verified Peak Period Load Reduction achieved.
- Projects Commissioned after July 31, 2001 and before September 30, 2001 shall be awarded $300 per kilowatt for the verified Peak Period Load Reduction achieved.
- Projects Commissioned after September 30, 2001 and before May 31, 2002 shall be awarded $250 per kilowatt for the verified Peak Period Load Reduction achieved.

3.3 The "Total Cost of the Project" is defined as the total cost of the project submitted by the Applicant in his completed Application and approved by The Foundation. The "Total Cost of the Project" is the sum of any costs directly associated with the project including:

f) Design, Planning, and Engineering,

g) Equipment purchase,

h) Site preparation if it is required for the Project,

i) Equipment installation/Facility construction and testing, and

j) Local, State, and Federal sales taxes.

3.4 All Project costs will be verified by presentation of invoices reflecting that the amount due was originally billed on or after January 1, 2001, and then paid in full. The Applicant will gather all such invoices, calculate the "Total Cost of the Project", certify that the dates and amounts involved were timely incurred and paid, and such invoices, calculations and certification will be presented to the Foundation no later than sixty (60) days after the Commission Date. The certification of authenticity and accuracy of submitted invoices form is set forth below.

3.5 Notwithstanding section 3.2, the following will apply:

a) The Actual Incentive Grant Payment may be less than the Estimated Incentive Grant Payment.

b) The Actual Incentive Grant Payment cannot be more than Forty nine thousand, seven hundred and fifty dollars ($49,750.00) without prior written approval from the Foundation.

3.6 Notwithstanding sections 3.1 and 3.2, no individual or corporate/business entity will be entitled to more than two million dollars ($2,000,000.00) of incentive payments.

4.0 Schedule of Grant Payments

This section defines when actual payments will be made.

4.1 An initial payment of one half of the recalculated Estimated Incentive Grant Payment will be paid within thirty (30) days after the later of either the date of Project Commissioning or presentation of the "Total Cost of the Project" to the Foundation by the Applicant.

4.2 The Actual Incentive Grant Payment will be calculated as per section 3.0 of this Appendix within ten (10) days after the later of either the date of verification of Peak Period Load Reduction or the date of certification of the "Total Cost of the Project".

4.3 The difference between the Actual Incentive Grant Payment and the payment made under section 4.1 will be paid within thirty (30) days of the calculation of the Actual Incentive Grant Payment.

4.4 All payments will be by check made payable to "Recot, Inc." and delivered by United States mail to:

Mr. James Preston
22081 Highway 58
Bakersfield, CA 93312

5.0 Forfeiture of Grant Payment

In the event that the Actual Incentive Grant Payment is less than the initial payment made under section 4.1 of this Appendix, the Applicant is required to promptly reimburse the Foundation the difference between the Actual Incentive Grant Payment and the initial payment. The reimbursement shall by check made payable to "California State University, Fresno Foundation" and delivered by United States mail to:

Mr. Randy Larson
California State University Fresno
Auxiliary Corporations
4910 North Chestnut, OF 123
Fresno, CA 93726-1852

CERTIFICATION OF AUTHENTICITY AND ACCURACY OF SUBMITTED INVOICES

The Applicant hereby certifies that all invoices submitted for Grant Payments are original invoices (or copies of original invoices) that are authentic and accurately reflect costs that were incurred by the Applicant on or after January 1, 2001, solely in connection with the Applicant's submitted project. The Applicant further certifies that all invoices submitted for Grant Payments do not overstate the costs incurred by the Applicant or reflect costs incurred not in direct connection with the Applicant's project.

Signed by:

_____ _____
APPLICANT DATE

Appendix C: Project 01-0227A

Protocol for Measurement and Verification

This Appendix is the controlling authority for the means and methods of:

i) Verification of Project Commissioning,

j) Verification of Peak Period Load Reduction (where applicable),

k) Calculation of the Actual Incentive Grant Payment,

l) Schedule of Incentive Grant Payments,

for the Project titled "HVAC – Artic Master Refrigerant Management System" of Application # 01-0227-A titled "Frito-Lay, Inc."

1.0 Verification of Project Commissioning

This section shall define the Project that will be commissioned and when it is considered Commissioned.

1.1 This Project is located at the Frito Lay facility located at 4585 22801 Highway 58 in Bakersfield, CA. It consists of installing refrigerant management systems on air conditioning systems throughout the facility, which will achieve energy reduction by more efficient circulation of refrigerants in each unit.

1.2 This Project will be considered Commissioned when it is verified that the following equipment has been purchased, installed, and is operating legally and as intended:

h) Twenty-one (21) ArticMaster Refrigerant Management Systems (RMS) on each of the air conditioning units listed in the Peak Demand Reduction Calculations worksheet included with the Application.

2.0 Verification of Peak Period Load Reduction

This section shall define how Peak Period Load Reduction will be verified.

2.1 The estimated Peak Period Load Reduction as a result of this Project is 135 kilowatts (135 kW).

2.2 Initial verification of the actual Peak Period Load Reduction will be by comparison of utility statements for June through September 2001 to June through September 2002 showing that peak load was reduced by at least the amount accepted for participation for each of the Applications for this facility and that the facility was in full operation for the entire peak period.

2.3 Final verification of the actual Peak Period Load Reduction will be by inspection of power monitoring logs for each unit for one week immediately prior to modification and one week immediately following modification. This analysis will provide the basis for developing a net percentage kW reduction for each unit. The percentages will be applied to a sampling of actual summer loads for the units to be recorded during peak periods in the summer 2002 in order to determine actual peak load kW reduction. Each sample should be recorded for one (1) week during peak hours, with separate weeks utilized for each unit. The sampling will include Units #3, 7, 12, 42, 52, and 56. Outside maximum temperatures for each day of the recording will be provided.

3.0 Calculation of the Actual Incentive Grant Payment

This section defines how the Actual Incentive Grant Payment will be calculated.

3.1 The Estimated Incentive Grant Payment for this project is Thirty three thousand, seven hundred and fifty dollars ($33,750.00) and is based on the estimated reduction in peak period load.

3.2 The Actual Incentive Grant Payment will be calculated after verification of actual Peak Period Load Reduction. It will be the lesser of:

a) Sixty-Five percent (65%) of the "Total Cost of the Project", or

b) A sum calculated under the following rules:

- Projects Commissioned by July 31, 2001 shall be awarded $350 per kiloWatt for the verified Peak Period Load Reduction achieved.
- Projects Commissioned after July 31, 2001 and before September 30, 2001 shall be awarded $300 per kilowatt for the verified Peak Period Load Reduction achieved.
- Projects Commissioned after September 30, 2001 and before May 31, 2002 shall be awarded $250 per kilowatt for the verified Peak Period Load Reduction achieved.

3.3 The "Total Cost of the Project" is defined as the total cost of the project submitted by the Applicant in his completed Application and approved by The Foundation. The "Total Cost of the Project" is the sum of any costs directly associated with the project including:

k) Design, Planning, and Engineering,

l) Equipment purchase,

m) Site preparation if it is required for the Project,

n) Equipment installation/Facility construction and testing, and

o) Local, State, and Federal sales taxes.

3.4 All Project costs will be verified by presentation of invoices reflecting that the amount due was originally billed on or after January 1, 2001, and then paid in full. The Applicant will gather all such invoices, calculate the "Total Cost of the Project", certify that the dates and amounts involved were timely incurred and paid, and such invoices, calculations and certification will be presented to the Foundation no later than sixty (60) days after the Commission Date. The certification of authenticity and accuracy of submitted invoices form is set forth below.

3.5 Notwithstanding section 3.2, the following will apply:

a) The Actual Incentive Grant Payment may be less than the Estimated Incentive Grant Payment.

b) The Actual Incentive Grant Payment cannot be more than Thirty three thousand, seven hundred and fifty dollars ($33,750.00) without prior written approval from the Foundation.

3.6 Notwithstanding sections 3.1 and 3.2, no individual or corporate/business entity will be entitled to more than two million dollars ($2,000,000.00) of incentive payments.

4.0 Schedule of Grant Payments

This section defines when actual payments will be made.

4.1 An initial payment of one half of the recalculated Estimated Incentive Grant Payment will be paid within thirty (30) days after the later of either the date of Project Commissioning or presentation of the "Total Cost of the Project" to the Foundation by the Applicant.

4.2 The Actual Incentive Grant Payment will be calculated as per section 3.0 of this Appendix within ten (10) days after the later of either the date of verification of Peak Period Load Reduction or the date of certification of the "Total Cost of the Project".

4.3 The difference between the Actual Incentive Grant Payment and the payment made under section 4.1 will be paid within thirty (30) days of the calculation of the Actual Incentive Grant Payment.

4.4 All payments will be by check made payable to "Frito-Lay, Inc." and delivered by United States mail to:

Mr. James Preston
22081 Highway 58
Bakersfield, CA 93312

5.0 Forfeiture of Grant Payment

In the event that the Actual Incentive Grant Payment is less than the initial payment made under section 4.1 of this Appendix, the Applicant is required to promptly reimburse the Foundation the difference between the Actual Incentive Grant Payment and the initial payment. The reimbursement shall by check made payable to "California State University, Fresno Foundation" and delivered by United States mail to:

Mr. Randy Larson
California State University Fresno
Auxiliary Corporations
4910 North Chestnut, OF 123
Fresno, CA 93726-1852

CERTIFICATION OF AUTHENTICITY AND ACCURACY OF SUBMITTED INVOICES

The Applicant hereby certifies that all invoices submitted for Grant Payments are original invoices (or copies of original invoices) that are authentic and accurately reflect costs that were incurred by the Applicant on or after January 1, 2001, solely in connection with the Applicant's submitted project. The Applicant further certifies that all invoices submitted for Grant Payments do not overstate the costs incurred by the Applicant or reflect costs incurred not in direct connection with the Applicant's project.

Signed by:

_____ _____
APPLICANT DATE

Appendix C: Project 01-0445A

Protocol for Measurement and Verification

This Appendix is the controlling authority for the means and methods of:

m) Verification of Project Commissioning,

n) Verification of Peak Period Load Reduction (where applicable),

o) Calculation of the Actual Incentive Grant Payment,

p) Schedule of Incentive Grant Payments,

for the Project titled "Frito Lay Bakersfield" of Application # 01-0445 titled "Frito Lay Bakersfield".

1.0 Verification of Project Commissioning

This section shall define the Project that will be Commissioned and when it is considered Commissioned.

1.1 This Project is located at the Frito Lay facility at 22801 Highway 58, Bakersfield, CA. It consists of installing high efficiency lighting.

1.2 This Project will be considered Commissioned when it is verified that the following equipment has been purchased, installed, and is operating legally and as intended:

i) 343 Lighting replacements (400 W standard HID to 320 W pulse) as per Audit sheet supplied in the Application #01-01445 (estimated Project cost = $52,379.50).

2.0 Verification of Peak Period Load Reduction

This section shall define how Peak Period Load Reduction will be verified.

2.1 The estimated Peak Period Load Reduction as a result of this Project is Thirty and eight-tenths kilowatts (30.8 kW).

2.2 Initial verification of the actual Peak Period Load Reduction will be by physical inspection of the facility and paid invoices.

2.3 Final verification of the actual Peak Load Reduction will be by utility billing indicating that facility was in full operation June through September, 2002, to be submitted when that billing becomes available.

3.0 Calculation of the Actual Incentive Grant Payment

This section defines how the Actual Incentive Grant Payment will be calculated.

3.1 The Estimated Incentive Grant Payment for this project is Seven thousand, seven hundred dollars ($7,700.00) and is based on the estimated reduction in peak period load at a rate of $250/kW.

3.2 The Actual Incentive Grant Payment will be calculated after verification of actual Peak Period Load Reduction. It will be the lesser of:

a) Sixty-Five percent (65%) of the "Total Cost of the Project", or

b) A sum calculated under the following rules:

- Projects Commissioned by July 31, 2001 shall be awarded $350 per kilowatt for the verified Peak Period Load Reduction achieved.
- Projects Commissioned after July 31, 2001 and before September 30, 2001 shall be awarded $300 per kiloWatt for the verified Peak Period Load Reduction achieved.
- Projects Commissioned after September 30, 2001 and before May 31, 2002 shall be awarded $250 per kiloWatt for the verified Peak Period Load Reduction achieved.

3.3 The "Total Cost of the Project" is defined as the total cost of the project submitted by the Applicant in his completed Application and approved by The Foundation. The "Total Cost of the Project" is the sum of any costs directly associated with the project including:

p) Design, Planning, and Engineering,

q) Equipment purchase,

r) Site preparation if it is required for the Project,

s) Equipment installation/Facility construction and testing, and

t) Local, State, and Federal sales taxes.

3.4 All Project costs will be verified by presentation of invoices reflecting that the amount due was originally billed on or after January 1, 2001, and then paid in full. The Applicant will gather all such invoices, calculate the "Total Cost of the Project", certify that the dates and amounts involved were timely incurred and paid, and such invoices, calculations and certification will be presented to the Foundation no later than sixty (60) days after the Commission Date. The certification of authenticity and accuracy of submitted invoices form is set forth below.

3.5 Notwithstanding section 3.2, the following will apply:

a) The Actual Incentive Grant Payment may be less than the Estimated Incentive Grant Payment.

b) The Actual Incentive Grant Payment cannot be more than Seven thousand, seven hundred dollars ($7,700.00) without prior written approval from the Foundation.

3.6 Notwithstanding sections 3.1 and 3.2, no individual or corporate/business entity will be entitled to more than two million dollars ($2,000,000.00) of incentive payments.

4.0 Schedule of Grant Payments

This section defines when actual payments will be made.

4.1 The Actual Incentive Grant Payment will be calculated as per section 3.0 of this Appendix within ten (10) days after the later of either the date of initial verification of Peak Period Load Reduction (as per section 2.2 of this Appendix) or the date of certification of the "Total Cost of the Project". Payment will be within thirty-(30)days of the calculation of the Actual Incentive Grant Payment.

4.2 All payments will be by check made payable to "Frito Lay" and delivered by United States mail to:

Mr. James Preston
22801 Highway 58
Bakersfield, CA 93312

5.0 Forfeiture of Grant Payment

In the event that the final verification of Peak Period Load Reduction as per section 2.3 of this Appendix cannot be established, the Applicant is required to promptly reimburse the Foundation the Actual Incentive Grant Payment. The reimbursement shall by check made payable to "California State University, Fresno Foundation" and delivered by United States mail to:

Mr. Randy Larson
California State University Fresno
Auxiliary Corporations
4910 North Chestnut, OF 123
Fresno, CA 93726-1852

CERTIFICATION OF AUTHENTICITY AND ACCURACY OF SUBMITTED INVOICES

The Applicant hereby certifies that all invoices submitted for Grant Payments are original invoices (or copies of original invoices) that are authentic and accurately reflect costs that were incurred by the Applicant on or after January 1, 2001, solely in connection with the Applicant's submitted project. The Applicant further certifies that all invoices submitted for Grant Payments do not overstate the costs incurred by the Applicant or reflect costs incurred not in direct connection with the Applicant's project.

Signed by:

_____ _____
APPLICANT DATE

Pacific Gas and Electric Company

DATE: 11/27/2002

PG&E Bill Usage History

Customer Name: FRITO LAY INC
Account Number: YTXT265001
Service Address: NW 20-29-25 WASCO
Meter Number(s) Electric 2078R6
Supply CO GENERATION-FOOD PLT
Rate Schedule(s) Electric STOUT

BILLING HISTORY

From	To	Days	Electric Charges	Electric Usage	Maximum Demand	On Demand	Part Demand	Off Demand	On kWh	Part kWh	Off kWh
09/26/02	10/27/02	31	$15,747.80	137,532	4,023	3,066	4,023	4,362	5,144	4,271	128,117
08/27/02	09/26/02	30	$11,115.73	104,778	4,941	60	4,941	4,791	300	6,230	98,248
07/29/02	08/27/02	29	$15,093.74	50,849	4,632	4,632	4,329	4,077	20,459	4,745	25,645
06/27/02	07/29/02	32	$20,157.55	137,280	4,920	3,903	4,920	4,479	15,546	7,284	114,450
05/29/02	06/27/02	29	$28,358.18	151,654	5,142	5,130	5,142	5,052	30,421	35,216	86,017
04/29/02	05/29/02	30	$23,981.06	141,720	4,695	4,695	4,425	4,167	23,262	15,476	102,982
03/28/02	04/29/02	32	$23,416.82	214,898	3,768	0	3,768	4,059	0	48,828	166,070
02/27/02	03/28/02	29	$5,690.52	34,350	798	0	798	2,367	0	9,003	25,347
01/28/02	02/27/02	30	$72,283.01	685,872	4,032	0	4,032	3,918	0	236,282	449,590
12/27/01	01/28/02	32	$3,020.03	6,890	222	0	222	75	0	3,759	3,131
11/27/01	12/27/01	30	$15,067.81	131,420	3,903	0	3,903	3,894	0	25,542	105,878
10/25/01	11/27/01	33	$16,464.80	150,581	3,099	36	3,099	3,456	401	9,644	140,536
09/26/01	10/25/01	29	$65,472.31	407,450	4,284	4,284	4,266	4,323	66,303	79,527	261,620
08/27/01	09/26/01	30	$37,926.79	180,195	4,851	4,851	4,701	4,293	46,769	49,517	83,909
07/29/01	08/27/01	29	$10,351.97	79,427	2,112	1,188	2,112	3,744	3,138	10,193	66,096
06/27/01	07/29/01	32	$13,358.24	120,912	2,787	1,152	2,787	2,952	2,091	12,381	106,440
05/30/01	06/27/01	28	$57,565.06	261,084	5,238	5,238	4,770	4,356	78,471	68,943	113,670
04/27/01	05/30/01	33	$5,840.53	23,906	3,294	3,294	351	4,764	9,174	3,551	11,181
03/29/01	04/27/01	29	$9,826.27	113,831	3,387	0	3,387	3,426	0	39,246	74,585

BILLING HISTORY (Continued)

From	To	Days	Electric Charges	Electric Usage	Maximum Demand	On Demand	Part Demand	Off Demand	On kWh	Part kWh	Off kWh
02/28/01	03/29/01	29	$7,094.06	74,306	240	0	240	780	0	22,295	52,011
01/29/01	02/28/01	30	$9,926.15	120,909	627	0	627	1,584	0	24,102	96,807
01/04/01	01/29/01	25	$4,984.48	48,396	138	0	138	174	0	19,534	28,862
11/29/00	12/28/00	29	$4,879.67	47,774	3,828	0	3,828	3,087	0	15,464	32,310
10/27/00	11/29/00	33	$3,112.80	20,340	24	0	24	2,415	0	878	19,462
09/28/00	10/27/00	29	$23,367.61	318,482	4,761	4,020	4,761	4,587	28,080	55,521	234,881
08/29/00	09/28/00	30	$7,601.80	133,557	3,114	0	3,114	3,633	0	4,032	129,525
07/31/00	08/29/00	29	$3,960.26	31,824	3,453	3,453	642	4,083	1,914	1,013	28,897
06/29/00	07/31/00	32	$6,575.67	107,243	4,413	6	4,413	3,474	5	5,517	101,721
05/31/00	06/29/00	29	$5,101.66	34,637	4,866	4,539	4,866	4,284	4,590	17,952	12,095
04/28/00	05/31/00	33	$5,843.10	84,431	4,401	36	4,401	4,284	21	19,329	65,081
03/30/00	04/28/00	29	$15,004.48	245,018	4,212	0	4,212	4,239	0	32,574	212,444
03/01/00	03/30/00	29	$4,259.79	37,782	4,029	0	4,029	2,970	0	14,118	23,664
01/31/00	03/01/00	30	$30,536.33	490,350	3,966	0	3,966	3,879	0	185,700	304,650
12/29/99	01/31/00	33	$5,392.09	65,754	75	0	75	3,096	0	1,764	63,990
11/30/99	12/29/99	29	$8,617.01	128,208	4,035	0	4,035	3,216	0	6,711	121,497
10/28/99	11/30/99	33	$4,386.91	45,561	3,153	0	3,153	2,856	0	9,620	35,941
09/28/99	10/28/99	30	$4,443.09	19,209	4,557	4,557	942	2,991	6,009	1,541	11,659

PLEASE READ THIS IMPORTANT INFORMATION ABOUT THE USAGE HISTORY

This information is provided to help you understand your energy usage patterns. If one of your monthly bills reflects a shorter or longer than normal billing period, your billing data displayed here may differ slightly from the monthly Energy Statement you receive in the mail.

If you purchase your electricity from an energy service provider (ESP), the charges in this report will not include the energy component charges from your ESP unless Pacific Gas and Electric Company is the bill consolidator. For more information about your “direct access” electric energy charges and credits, contact your ESP.

The mailed Energy Statement reflects your actual billing period, billed usage and amounts due.

Project 01-0269A: Silva Vineyards

Variances from CEC Approved Savings
Project 01-0269A: Silva Vineyards

Project Description

This project involves the removal of a 125 hp irrigation pump and the installation of a 40 hp pump and time of use meter. The time of use meter will allow the facility to eliminate on-peak pumping. The facility operates during the entire summer peak season from 6am to 5pm.

Nexant Calculations

Baseline

The baseline demand was calculated from 2000 utility billing data. The application included monthly billing data for the last five years of operation. No time of use information was available; therefore the baseline demand was calculated based on the facility's hours of operation. The facility operates 11 hours/day for the 122 days of the summer peak season. The total energy consumption (kWh) for the summer peak season, June through September, was collected from the utility billing data for each pump. It should be noted that for the beginning of June and the end of September, the billing data was pro-rated based on the number of days in each month compared to the total number of days in each billing period. The total kWh was divided by the total number of operating hours to calculate the average demand. For the summer peak demand, the average demand was multiplied by 5/6 because the facility only operated 5 out of the 6 daily peak hours. The average peak baseline demand is 30.0 kW.

Average Overall Summer Demand: (48,303 kWh) / (1,342 hrs) = 36.0 kW
Average Peak Summer Demand: (36 kW demand) * (5 hrs / 6 hrs) = 30.0 kW

Demand Savings

The time of use meter was intended to eliminate on-peak pumping, therefore the post-installation demand is expected to be 0 kW.

The incentive for this project is $7,902 and was based on 65% of the project costs.

Conclusions

The demand savings for this project were based on utility billing information. Baseline utility billing data did not include time of use data, and the pump hours of operation were not available. Therefore, a method had to be developed to estimate the average peak demand. By using the facility's hours of operation, an estimate of the average peak demand was calculated.

Differences from Approved Savings and Incentive

Demand Savings Discrepancies

The methodology used to calculate the approved demand savings and Nexant's calculated demand savings were similar. The monthly utility billing data and the facility's hours of operation as provided in the application were used to determine the baseline peak demand. However, there were several minor differences in the calculations. The approved demand savings were based on billing data from 5/19/00 through 9/20/00. Nexant used the billing data provided and pro-rated the billing periods at the beginning and end of the summer peak period based on the number of days. Therefore, Nexant's total kWh usage attempted to estimate the energy use from 6/1/00 through 9/30/00 more closely, resulting in a slight difference in the overall kWh. In addition, the approved savings were divided by a 75% seasonal usage figure, to account for variations in irrigation needs from year to year. However, based on the five years of utility billing data provided, 2000 summer energy use was significantly higher than any of the other years. Therefore, Nexant believes that 2000 does not need an adjustment factor based on the assumption that 2000 may have been a down year. The other step that Nexant takes in calculating the average peak demand is to multiply the average summer demand by 5/6. The stated hours of operation are 6am to 5pm. However, the summer peak period is from 12pm to 6pm. Therefore, the pump is only operating 5 out of the 6 peak hours and an adjustment must be made when calculating the average peak demand. Based on these differences, Nexant's calculated demand savings were approximately 33% lower than the approved savings.

Incentive Discrepancies

The incentive paid for this project was based on the project costs. Based on the total project costs of $12,157, this project was granted $7,902. Nexant's calculations agreed with this incentive.

SB5X Agriculture Inspection Form

Project Name 01-0101-A Time Management Load Control Device

Date 11/12/04

Address 13762 1st Avenue

City Hanford, CA

Zip 93230

Contact Johnny Starling (559) 588-9463

Inspected by Mark Galicia

Equipment

Component	Status	Meter	Nameplate data and notes
TOU Meter and Time Management Load Control Device	■ completed installed ❑ being ❑ not installed	■ yes ❑ no	A TOU meter and Sprinkler type timer were found installed on the irrigation pump.
	❑ completed installed ❑ being ❑ not installed	❑ yes ❑ no	
	❑ completed installed ❑ being ❑ not installed	❑ yes ❑ no	

Meter data

Component(s) is metered separately ■ yes ❑ no **If yes, by:** ■ utility ❑ participant ❑ other _____

Data available ❑ yes ■ no

Type of data ❑ TOU ❑ 15min ❑ run time ❑ other _____

Source of data ❑ utility ❑ participant ❑ other _____

Contact for data _____ **Ph#** _____ **Email address**

Mark Galicia of Nexant, Inc. met with Johnny Starling at the Sierra View Farms in Corcoran, CA to conduct a site inspection of the irrigation pump controls. Nexant's inspector observed that an Irritrol timer was installed on the pump to regulate pump operating hours to off peak times. The pump was not running at the time of the inspection and had not been running recently as the growing season was already over for the year. Nameplate data on the pump and motor were not legible.

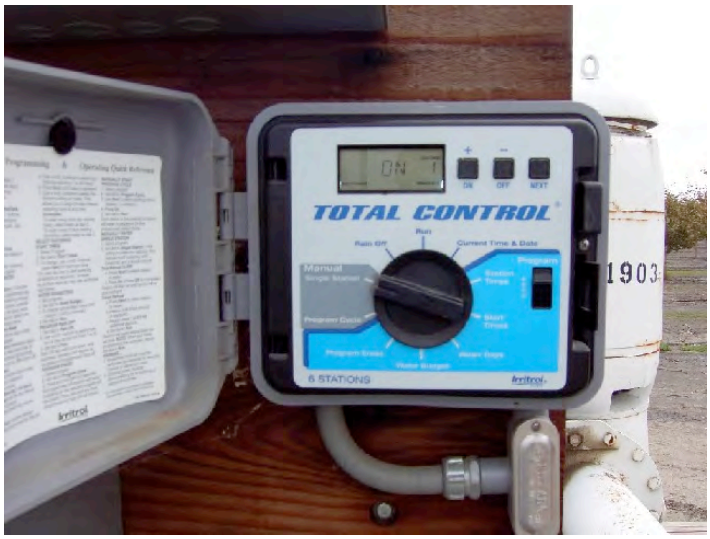

Figure 1 Timer installed on irrigation pump used to schedule pump operation for off peak times.

Figure 2 Irrigation pump at Sierra View Farms

Project 01-0351A: Sandhill Bros. Farm

Variances from CEC Approved Savings
Project 01-0351A: Sandhill Bros. Farm

Project Description

This project involves installation of time of use meters on two irrigation pumps, 75 hp and 40 hp. The time of use meters will allow the facility to eliminate on-peak pumping.

Nexant Calculations

Baseline

The baseline demand from the pumps was calculated from the available 2001 utility billing data (data provided for June 1 through September 11, 2001). No time of use information was available; therefore the total energy consumption (kWh) for summer peak season was collected from the available utility billing data for each pump. It should also be noted that for the beginning of June, the billing data was pro-rated based on the number of days in June compared to the total number of days in the billing period. The estimated on-peak energy use was 50% of the total energy use, based on information provided in the application. Two separate methods were used to calculate the average peak demand. Each method produced the same results.

The first method used the total peak energy use (50% of the total energy use) and divided this energy use by the total peak hours from 6/1/01 to 9/11/01, as shown in Table 1:

Table 1: Baseline Demand Calculations (Method 1)

	Total Summer Energy Use* (kWh)	Peak Energy Use** (kWh)	Total Peak Hours*	Avg. Demand (kW)
40 hp	7,018	3,509	438	8.01
75 hp	21,820	10,910	438	24.91
			Total:	**32.92**

*6/1 – 9/11

**based on assumption of 50% on-peak usage

The second method was to determine the equivalent hours of operation the pump would have operated at full capacity during the peak period. The peak kWh (50% of the total kWh) was divided by the created demand (kW) from the utility billing data. The operating hours were then divided by the total number of peak hours to calculate the percent on time. This percentage was multiplied with the nameplate demand rating to determine the average peak baseline demand. Table 1 lists the calculations for each pump.

Table 1: Baseline Demand Calculations

	Peak Energy Use* (kWh)	On Time (Hrs)	% On Time	Avg. Demand (kW)
75 hp	3,509	125	29%	8.01
40 hp	10,910	261	60%	24.91

	Peak Energy Use* (kWh)	On Time (Hrs)	% On Time	Avg. Demand (kW)
			Total:	**32.92**

*based on assumption of 50% on-peak usage

Demand Savings

The time of use meters were intended to eliminate on-peak pumping, therefore the post-installation demand is expected to be 0 kW. Overall, the total energy use should be ½ of the baseline energy use, based on the assumption that the facility operated 50% on peak.

The incentive paid for this project was $684 and was based on 65% of the project costs.

Conclusions

The demand savings for this project were based on utility billing information. Baseline utility billing data did not include time of use data. Therefore, a method had to be developed to estimate the average peak demand. By estimating the percent on-time, estimate of the peak hours and peak demand was calculated. The assumption of 50% on peak energy use came from the application. This estimate may be high, based on other projects, however, it was based on the application supplied by the customer, therefore was considered accurate. This estimate may be validated if post-installation energy use is 50% of baseline.

Differences from Approved Savings and Incentive

Demand Savings Discrepancies

The methodology used to calculate the approved demand savings and Nexant's calculated demand savings were similar. The monthly utility billing data was used to determine the baseline peak demand by calculating the overall on time percentage. However, the billing data used in the approved calculations covered the entire billing periods from 5/10/01 to 9/11/01. Nexant's calculations pro-rated the June billing period, so that the data was only for 6/1 – 9/11. The number of peak hours used in Nexant's calculations also covered this time period, which should provide a more exact estimate of peak period energy use.

In addition, the approved calculations also use a 75% seasonal load factor to account for year to year variations in energy use. This factor increases the average baseline demand under the assumption that the energy use in 2001 may have been lower than average. This may be true for the 40 hp pump, which did not have any recorded energy use after 8/9/01. However, the 50% on peak energy assumption may be slightly high.
Based on these differences, Nexant's calculated demand savings were approximately 27% lower than the approved savings.

Incentive Discrepancies

The incentive paid for this project was based on the project costs. Based on the total project costs of $1,052, this project was granted $683.80. Nexant's calculations agreed with this incentive.

Project 01-0367A-I: Ewy Enterprises

Variances from CEC Approved Savings
Project 01-0367A-I: Ewy Enterprises

Project Description

This project involves installation of time of use meters on nine irrigation pumps. The time of use meters will allow the facility to eliminate on-peak pumping. The pumps range in size from 7.5 hp to 20 hp.

Nexant Calculations

Baseline

The baseline demand from the pumps was calculated from 2001 utility billing data. No time of use information was available; therefore the baseline energy use was calculated based on the calculated percentage of time that the pumps operated at their nameplate capacity. The total energy consumption (kWh) for the summer peak season, June through September, was collected from the utility billing data for each pump. It should be noted that for the beginning of June and the end of September, the billing data was pro-rated based on the number of days in each month compared to the total number of days in each billing period. To determine the equivalent hours of operation the pump would have operated at full capacity during the summer, the total kWh was divided by the nameplate kW rating. The operating hours were then divided by the total number of hours during the summer months to calculate the percent on time. As a conservative assumption, the percent on time for the peak period was assumed to be the same as the overall percent on time. This percentage was multiplied with the nameplate demand rating to determine the average peak baseline demand. Table 1 lists the calculations for each pump.

Table 1: Baseline Demand Calculations

	Nameplate kW	Total Summer Energy Use* (kWh)	On Time (Hrs)	% On Time**	Avg. Demand (kW)
A: 15 hp	11.19	7,077	632	22%	2.44
B: 7.5 hp	5.60	4,954	885	30%	1.71
C: 15 hp	11.19	5,991	535	18%	2.06
D: 10 hp	7.46	4,340	582	20%	1.49
E: 15 hp	11.19	5,982	535	18%	2.06
F: 16 hp	11.94	3,489	292	10%	1.20
G: 20 hp	14.92	9,355	627	22%	3.22
H: 17 hp	12.68	7,050	556	19%	2.43
I: 10 hp	7.46	4,091	548	19%	1.41
				Total:	**18.02**

*Energy use 6/1 – 9/30

**Based on 2,904 total hours (6/1 – 9/30)

Demand Savings

The time of use meters were intended to eliminate on-peak pumping, therefore the post-installation demand was expected to be 0 kW. The 2002 utility billing data was used to verify the post-installation energy usage. The billing data showed that there was very minimal peak period energy consumption for each of the pumps. Table 2 lists the post-installation peak demand and the demand savings for each pump.

Table 2: Demand Savings

	Nameplate kW	Baseline Demand (kW)	Post-Install Peak Energy Use (kWh)	Post-Install Avg Peak Demand (kW)	Demand Savings (kW)
A: 15 hp	11.19	2.44	11	0.02	2.41
B: 7.5 hp	5.60	1.71	162	0.31	1.39
C: 15 hp	11.19	2.06	24	0.05	2.02
D: 10 hp	7.46	1.49	46	0.09	1.41
E: 15 hp	11.19	2.06	113	0.22	1.84
F: 16 hp	11.94	1.20	155	0.30	0.90
G: 20 hp	14.92	3.22	66	0.13	3.09
H: 17 hp	12.68	2.43	41	0.08	2.35
I: 10 hp	7.46	1.41	12	0.02	1.39
				Total:	**16.8**

The incentive paid for this project was $2,579.85 and was based on 65% of the project costs.

Conclusions

The demand savings for this project were based on utility billing information. Baseline utility billing data did not include time of use data, and the pump hours of operation were not available. Therefore, a method had to be developed to estimate the average peak demand. By estimating the percent on-time, a conservative estimate of the peak hours and peak demand was calculated.

Differences from Approved Savings and Incentive

Demand Savings Discrepancies

The methodology used to calculate the approved demand savings and Nexant's calculated demand savings were similar. The monthly utility billing data was used to determine the baseline peak demand by calculating the overall on time percentage. However, the calculations for several of the pumps were slightly different. The difference may have been due to the partially illegible billing data that was used and from differences in significant figures used. In addition, Nexant's final demand savings number was based on post-installation data, which indicated a small amount of post-installation peak period energy use, reducing the demand savings. Based on these differences, Nexant's calculated demand savings were approximately 24% lower than the approved savings.

Incentive Discrepancies

The incentive paid for this project was based on the project costs. Based on the total project costs of $3969, this project was granted $2,579.85. Nexant's calculations agreed with this incentive.

SB5X Agriculture Inspection Form

Project Name: 01-0367-A Ewy Enterprise Inc.
Date: 11/10/04
Address: 6002 Jac Lac Ave.
City: Parlier, CA
Zip: 93648
Contact: Donald Ewy
Inspected by: Mark Galicia

Equipment

Component	Status	Meter	Nameplate data and notes
TOU Meter on Pump	■ completed installed ❑ being installed ❑ not installed	■ yes ❑ no	AH Reliance Motor Model P21J3335A 15 HP 230/460V S.F 1.0 36.4/18.2 Amps Pump has its own TOU meter
TOU Meter on Pump	■ completed installed ❑ being installed ❑ not installed	■ yes ❑ no	AH Marathon Electric Motor 10 HP Pump has its own TOU meter
	❑ completed installed ❑ being installed ❑ not installed	❑ yes ❑ no	

Meter data

Component(s) is metered separately ■ yes o no **If yes, by:** ■ utility ❑ participant ❑ other _____

Data available ❑ yes ■ no

Type of data ❑ TOU ❑ 15min ❑ run time ❑ other _____

Source of data ❑ utility ❑ participant ❑ other _____

Contact for data _____ **Ph#** _____ **Email address**

Mark Galicia of Nexant, Inc. met with Donald Ewy at the Ewy Enterprise Farm in Parlier, CA. and verified that TOU Meters were installed on two pumps at the farm. Photographs of both pumps are shown below.

Figure 1 Reliance Pump and TOU Meter

Figure 2 TOU Meter for Marathon Electric Motor of Pump 2

Project 01-0378A: Blue Diamond Growers

Variances from CEC Approved Savings
Project 01-0378A: Blue Diamond Growers

Project Description

This project involves the replacement of (300) 400-watt mercury vapor high bay fixtures with 250-watt metal halide fixtures. The proposed measure will reduce the kW load at the facility due to the reduction in fixture wattage.

Nexant Calculations

Baseline

The existing mercury vapor fixtures are rated at 455 watts each in the central standard wattage table. Therefore, the calculated baseline peak period demand, based on nameplate information, is:

(455 watts/fixture) x (300 fixtures) x (1 kW/1,000 watts) = 136.5 kW

Utility billing data does not include dedicated sub-metering for the motors. However, savings may still be observed in the data based on the difference between baseline and post-installation peak energy use.

Demand Savings

The proposed metal halide fixtures are rated at 295 watts each. The calculated post-installation demand, based on nameplate information, is:

(295 watts/fixture) x (300 fixtures) x (1 kW/1,000 watts) = 88.5 kW

Based on nameplate data, the expected demand savings are 48 kW.

The incentive for this project, based on the demand savings, is $12,000.

Conclusions

The demand savings for this project were based on nameplate data. The calculated savings should be fairly accurate.

Differences from Approved Savings and Incentive

Demand Savings Discrepancies

The approved demand savings for this project were based on fixture specifications. The only minor discrepancy was that the application listed the baseline wattage as 454 watts/fixture, and Nexant's central standard wattage table listed the 400 watt mercury vapor fixtures as 455 watts. The difference is relatively insignificant in terms of overall savings (47.7 kW approved versus 48 kW in Nexant's calculations).

Incentive Discrepancies

The incentive paid for this project was based on the demand savings. Based on the total savings of 47.7 kW, this project was granted $11,925. Nexant's calculations resulted in an incentive of $12,000.

SB5X Agriculture Inspection Form

Project Name: 01-0378-A Blue Diamond Growers
Date: 11/22/04

Address: 1802 C Street
City: Sacramento, CA
Zip: 95814
Contact: Dan Ford (916) 446-8482
Inspected by: Mark Galicia

Equipment

Component	Status	Meter	Nameplate data and notes
HID Metal Halide Lighting Fixtures	■ completed installed ❑ being installed ❑ not installed	❑ yes ■ no	All lighting fixtures in the Distribution Center building were verified to be 250 Watt Metal Halide fixtures.

Meter data

Component(s) is metered separately ❑ yes ■ no **If yes, by:** ❑ utility ❑ participant ❑ other _____

Data available ❑ yes ■ no

Type of data ❑ TOU ❑ 15min ❑ run time ❑ other _____

Source of data ❑ utility ❑ participant ❑ other _____

Contact for data _____ **Ph#** _____ **Email address**

Mark Galicia of Nexant, Inc. met with Ben Viones at the Blue Diamond Growers facility in Sacramento, CA to conduct a lighting inspection of the Distribution Center building. Nexant's inspector walked through the entire warehouse and verified that all fixtures were 250 Watt Metal Halide fixtures. None of the previous Mercury Vapor fixtures were found anywhere throughout the building.

Figure 1 250 Watt Metal Halide Fixtures found throughout entire Distribution Center building.

Project 01-0453-A: JP Farms

SB5X Agriculture Inspection Form

Project Name 01-0453-A JP Farms Date 11/12/04

Address 658 N. Cherry Ave.

City Tulare, CA Zip 93274

Contact Jatinder Chopra

Inspected by Mark Galicia

Equipment

Component	Status	Meter	Nameplate data and notes
Drip Irrigation System	■ completed installed ❑ being installed ❑ not installed	■ yes ❑ no	All fields were verified to use the drip irrigation system in place of the flood irrigation system
	❑ completed installed ❑ being installed ❑ not installed	❑ yes ❑ no	
	❑ completed installed ❑ being installed ❑ not installed	❑ yes ❑ no	

Meter data

Component(s) is metered separately ■ yes ❑ no **If yes, by:** ■ utility ❑ participant ❑ other _____

Data available ❑ yes ■ no

Type of data ❑ TOU ❑ 15min ❑ run time ❑ other _____

Source of data ❑ utility ❑ participant ❑ other _____

Contact for data _____ **Ph#** _____ **Email address**

Mark Galicia of Nexant, Inc. conducted a site visit at JP Farms in Alpaugh, CA. Nexant's inspector verified that all fields had the drip irrigation system installed in place of the flood irrigation system as the drip system tubing was visible along the rows of crops. The irrigation pump was identified, however the nameplate data was inaccessible.

Figure 1 Close up of crops showing tubing for drip irrigation system

Figure 2 Pump and filtration system for the fields at JP Farms

Onsite Projects: Frito Lay Visalia and Modesto; Del Monte Hanford

On August 29, 2002 Randy McCall from Nexant and I visited Frito Lay Visalia and Del Monte Hanford to do post installation inspections of Peakload projects that have been completed to date. The efficiency measures outlined below and on the attached sheets are complete and should be filed for the first payments for these measures. In addition there are several measures that are complete at Frito Lay in Modesto and have already been seen by Randy.

Frito Lay Visalia

These projects have been installed and are in use, additional measures shown on the attached sheet are in various stages of completion.

- VFDs and the associated controls have been installed on the boiler feedwater pumps (100 Hp) and on the boiler FD fan motor (125 Hp). Both feedwater pumps have VFDs installed, however only one pump runs at any given time. Peak load savings are based on load studies and engineering evaluation by CPL Systems. Onsite Energy Corporation has taken pre-installation readings and is currently taking post installation load data.
  Estimated Peak load savings: 117.0 kW
- Install Power planners on 20 of the plant's larger motor loads. The 20 units are installed and in operation, these units will adjust the power wave to reduce kW demand. Onsite is currently testing representative units for actual demand savings.
  Estimated Peak load savings from the manufacturer: 65.5 kW
- Replace existing caser mounted vacuum pumps with a central vacuum pump system. This project eliminated 16 each 1.5 Hp vacuum pumps and substituted one 7.5 Hp operating pump. This system is in operation.
  Estimated Peak load savings: 12.3.0 kW
- Air compressor capacity tank and demand expander system. Additional compressed air surge tanks were added, a new air header to key users and a demand expander air system was added to reduce system demand surges and to reduce necessary system pressure. All phases are installed and operational. System pressure has been dropped to 75 psi and the back up air compressors are no longer in regular operation. System savings are based on an engineering study of the plant air system.
  Estimated Peak load savings: 123.5 kW
- Plant lighting. The company has installed 33 each 4'x 8' skylights in the production and warehouse areas of the plant. In addition, they have installed 140 "Solatube" type skylights in areas of the plant and offices. Unneeded lights are manually turned off during daylight hours. Based on site visits (see attached summary), the original site lighting has been reduced by 87.4 kW. Automatic controls and additional lighting changes are being considered.
  Estimated Peak load savings: 100 kW
  Current savings being realized: 87.4 kW
- **Total Frito Lay Visalia Peak load savings installed to date: 405.7 kW**

Del Monte Hanford

These projects have been installed and are in use, a lighting measure shown on the attached sheet is still being considered.

- Flume pump reconfiguration. The pump and piping configuration of the plant tomato unloading system was reconfigured to eliminate 4 each 40 Hp circulating pumps. Load savings based on nameplate motor loads. Normal seasonal operation is 24 hours/day, 7 days per week from the beginning of July until the early part of October
  Peak load savings: 89.5 kW
- Tomato handling systems. Existing water flumes used to distribute tomatos to the various processing lines were rebuilt to use low horsepower conveyors instead of circulating water pumps. Elimination of over 300 Hp in circulating pumps. Net horsepower savings of 240 horsepower based on nameplate capacities.
  Peak load savings: 179.0 kW
- Hydraulic driven conveyors. In 2001 the plant averaged 301 kW of load from electrically driven hydraulic pumps used to power hydraulic motors used throughout the plant. Reconfiguration of the systems and better matching of motor horsepower using electric motors has reduced the necessary hydraulic system needs.
  Estimated Peak load savings: 212.7 kW
- Manzini Pulpers. The pulping process removes skins and seeds from tomato pulp prior to making finished products. Replacement of 5 each 60 Hp units with 3 each 50 Hp units of a newer design reduce the system load by 150 horsepower.
  Estimated Peak load savings: 111.9 kW
- Control valve installations. Installation of a series of control valves and system controls will allow the operators to shut down cooling tower-circulating pumps when one or more of the plant (#1, #2, or #8) evaporators are not in service due to production requirements. Prior to the changes additional volumes of water were circulated to maintain operation of the remaining unit(s). This will allow the elimination of one 100 Hp pump for approximately 900 hours per season.
  Estimated average Peak load savings: 74.6 kW x ½ season = 37.3 kW average
- **Total Del Monte Hanford Peak load savings installed to date: 630.4 kW**

Frito Lay Modesto

Based on prior visits and the completion of their air compressor installation the following projects are being submitted for this plant. Additional measures are being installed and/or evaluated, but are not complete at this time.

- Installed SR controllers on the primary electrical service for the plant system. These units modify the electrical sequencing and power wave to minimize upset and to reduce power consumption and demand. On line load data is being taken and analyzed by the Plant's Utility, Modesto Irrigation District, preliminary data has shown a 6% reduction in demand.
  Estimated Peak load savings: 236.0 kW
- Installation of VFD based compressor. Installation of a 100 Hp VFD compressor allows the shut down of one 250 Hp compressor and still maintain the system pressure requirements.

Savings based on an engineering study of the plant air systems.
Estimated Peak load savings: 120 kW

- Install VFDs and controls on boiler feed water and transfer pumps. Savings based on CPL System engineering study of the boiler system.
  Estimated Peak load savings: 32.6 kW
- **Total Frito Lay Modesto Peak load savings installed to date: 388.6 kW**

SB5X Agriculture Inspection Form

Project Name: Onsite Energy projects, APLRP
Date: 8/30/02
Address: Frito Lay, Visalia
City: 2000 N. Plaza Drive
Contact: Visalia, CA
Zip:
Inspected by: Ron Allen, Onsite Energy
Randy McCall

Equipment

Component	Status	Meter	Nameplate data and notes
VFDs on 100hp Feedwater pump and 125hp Fan Motor	■ completed installed ❑ being ❑ not installed	❑ yes ■ no	Onsite has installed VFDs to control a 100hp feedwater pump for the boiler, as well as a VFD to control the 125hp forced draft fan for the boiler.
Install Power Planners and SR Controllers to modify Power Factor	■ completed installed ❑ being ❑ not installed	❑ yes ■ no	Install wave form modification equipment for plant; SR controllers add capacitors to motor circuits to adjust displacement power factor – debatable savings potential.
Replace individual 1.5hp vacuum pumps with central system	■ completed installed ❑ being ❑ not installed	❑ yes ■ no	Replace 16 1.5hp powered vacuum pumps for caser with central 7.5hp system with 7.5hp backup.
Install Compressed Air system improvments	■ completed installed ❑ being ❑ not installed	❑ yes ■ no	Replace existing Kaiser compressor with gas driven compressor; install air expander controls to lower system pressure (pressure/flow controller), additional storage.
Install efficient lighting; install solatube skylighting, install mfgr floor skylighting	■ completed installed ❑ being ❑ not installed	❑ yes ■ no	Retrofit T-12 lighting, install solatube skylighting in office areas, install 33 large skylights in mfgr floor and warehouse area, integrate lighting system with daylighting to shut down when possible.

Meter data

Component(s) is metered separately ❑ yes ■ no **If yes, by:** ❑ utility ❑ participant ❑ other _____

Data available ■ yes ❑ no

Type of data ■ TOU ❑ 15min ❑ run time ❑ other
Source of data ■ utility ❑ participant ❑ other
Contact for data __Ron Allen, Onsite Energy__ Ph# (925) 358-4264_ Email address Rallenonsite@aol.com

Randy McCall, of Nexant, Inc., conducted a post-installation site inspection at Frito Lay, Visalia in Visalia, CA on August 30, 2002 in order to verify the installation of several measures related to the compressed air system, the lighting system, a central vacuum system used to complete packaging on the manufacturing floor, and power factor control equipment for the facility.. In attendance for the inspection was Mr. McCall, Ron Allen from Onsite energy, and facility engineering staff from Frito Lay, Visalia.

A walk through of the facility was conducted to verify the installation of the lighting equipment; solatubes had been installed throughout the office areas with the electric lighting turned off at the time of the inspection. In addition, the skylights installed on the manufacturing floor were also evident, however, the HID lighting system was still operating as a result of problems with the circuit controls. According to Ron Allen, some of the HID circuits are wired such that they cannot easily be controlled as originally intended. A second phase project at Frito Lay, Visalia is expected to address these issues and allow for emergency egress lighting.

All air compressor projects were installed during the inspection including the reduced head pressure from the installation of the pressure/flow controller, as well as installation of a natural gas powered air compressor.

The last measure, installation of SR Controllers to modify the overall power factor of the facility is also installed, however, Nexant is not convinced of the value of the installation for actual demand savings. While transformer capacity may be freed up from the power factor correction, initial results for another similar project predict little in the way of true kW savings from these projects, unless the overall Power Factor is extremely poor. Even in such cases, it appears that the overall savings from reduction in VA may be slight. Demand savings potential from the Power Planners installed throughout the facility are unknown at this time, but are predicted to be on the order of 65 kW.

Figure 1: Alternate feedwater pump VFDs.

Figure 2: Main Feedwater pumps VFDs

Figure 3: Power Planners for Cooling Tower and HVAC

Figure 4: Power Planner for Additional equipment

Figure 5: Controls for compressed air expander

Figure 6: Existing compressors to be removed after Completion of natural gas engine driven compressor.

Figure 7: Lighting controls for existing HID system.

Figure 7: Solatube installed on manf. floor.

SB5X Agriculture Inspection Form

		Grand Total Controllable Load kW	>>>>>>>>	1265

Project Name: Onsite Energy projects, APLRP
Date: 6/30/03
Address: Frito Lay, Visalia (Second Post – Inspection for add. Measures)
2000 N. Plaza Drive
City: Visalia, CA
Zip: _____
Contact: Ron Allen, Onsite Energy;
Inspected by: Randy McCall

Equipment

Component	Status	Meter	Nameplate data and notes
Powerit load controls	■ completed installed ❑ being ❑ not installed	■ yes ❑ no	Load control hardware and software to limit peak demands of facility through unloading or turning off selected equipment in response to predicted 5 minute average peak loads from monitoring of utility meters.
Additional Lighting Controls	■ completed installed ❑ being ❑ not installed	■ yes ❑ no	Lighting controls were improved for some of the HID lighting at the plant through rewiring of lighting circuits to allow for individual fixture control independent of emergency lighting.
	❑ completed installed ❑ being ❑ not installed	❑ yes ❑ no	

Meter data

Component(s) is metered separately ■ yes ❑ no **If yes, by:** ■ utility ■ participant ❑ other _____

Data available ■ yes ❑ no

Type of data ❑ TOU ❑ 15min ❑ run time ■ other **__5minute interval data for facility peak loads and control actions through Powerit software.**
Source of data ❑ utility ❑ participant ■ other **_Powerit software records reports of load control actions, and the user defined threshold level for control action.**

Contact for data __Ron Allen, Onsite Energy__ Ph# (925) 358-4264_ Email address Rallenonsite@aol.com

Spot meter readings taken ❑ yes ■ no

Component #1 readings _____ _____ _____ Notes__Equipment control actions were observed by Nexant on a PC equipped with a the Powerit software and graphical user interface

Component #2 readings _____ _____ _____ Notes__Lighting controls were verified during normal operations for areas that could not be controlled during a previous post-installation inspection at Frito Lay, Visalia.

Component #3 readings _____ _____ _____ Notes_____

Randy McCall, of Nexant, Inc., conducted a post-installation site inspection at Frito Lay, Visalia in Visalia, CA on June 30, 2003 in order to verify the installation of the Powerit load control equipment for the facility. In attendance for the inspection was Mr. McCall, Ron Allen from Onsite energy, and Mark facility engineering staff from Frito Lay, Visalia.

A stand along PC was set up in the engineering office with the Powerit software system. The software program is provided with pulse signals from the facility utility meter that are used to predict an average five-minute demand for the facility. If the predicted interval is likely to exceed the user-defined threshold for control action, the software sends signals to controllable loads to either turn off select motors, or reduce operations and run at part loads. The equipment to be controlled was previously identified during the pre-installation phase by Mathias Christelius, Powerit's field engineer for implementation, and includes loads that will not adversely affect the production at the food processing plant. Once the Powerit software decides it needs to take action to control a five minute average window for loads, it will send signals to individual pieces of equipment that have been equipped with communications gear and actuators that allow for the remote control. Equipment is listed by priority in the software, on a custom basis for each facility and customer.

At Frito Lay, Visalia, Onsite Energy and Powerit are expecting to control approximately 200 to 250 kW of peak load out of a total estimated 1265 kW of potential load from the controllable equipment. A list of the controllable equipment and their estimated loads are presented below in Table 1.

6.1 Table 1. List of Controllable Loads for Frito Lay, Visalia

Object Name	Quantity	Equipment Description	Unit kW	Total kW
Well Pump	1	Motor	20	20
Waste House HVAC	1	HVAC	5	5
Waste Press	1	Waste Press	20	20
Nitrogen	1	Nitrogen Generation	100	100
Unloading System	1	Truck unloading (incl. Manual override)	75	75
Chillers	3	with temperature constraints*	250	750
Cooling Tower Fans	3	with temperature constraints (20/5hp)	15	45
Oil Tank heaters	6	Current use uncertain	15	90
RTU X1-X16	16	The 16 largest & least sensitive RTU:s	10	160
Lighting	8	*I/O Capability for future lighting control*		0
				0
				0
				0
				0
				0
		Grand Total Controllable Load kW	>>>>>>>>	1265

In addition to the list of controllable equipment in Table 1 above, Onsite Energy forwarded a set of drawings for the Energy Director 3100 that includes an overview of the installation at the plant, and the specific connections to the Energy Director 3100. The installation overview is attached as a screen capture at the end of this report. The full set of drawings and connections for the

equipment is a separate electronic file attachment that cannot be inserted into this document, but will be included along with this report as an addendum.

Demand savings resulting from the Powerit control actions are not expected to be of long duration. The equipment is designed to analyze a short time window for the average peak, and reduce loads when the expected average for the 5minute window will exceed the user-defined threshold. Typical efficiency type projects in the APLRP create load reductions that are continuous throughout the peak period, however, demand savings resulting from the Powerit load controls should not be calculated on the same basis (i.e., total kWh saved during the summer peak period divided by the total number of hours in the summer peak period). With the short duration Powerit load management control actions, the overall savings level from a typical calculation of efficiency based load savings results in relatively small average demand savings that do not reflect the true value of the load management.

Onsite has proposed, and Nexant agrees with the approach, that load control actions will be evaluated as the difference documented by the Powerit data collection system, between the threshold for load control action, and the predicted interval peak demands resulting in equipment load control. While the calculation of peak period demand savings typically recognizes only sustained savings, the intermittent nature of the Powerit load control frees up grid capacity in that control actions guarantee that excursions above the user-defined threshold for peak load are avoided. The result is local and regional grid capacity that is freed up due to control of power spikes.

Onsite will provide electronic copies of the tracking data from the Powerit system that document facility meter loads, and control actions that have taken place to reduce the interval average loads. The documentation will cover both summer peak periods, as well as off peak periods. Final demand savings will be based on the monitored data recorded by the Powerit system.

In addition to the completion of the Powerit load control system, Onsite has completed work on rewiring of selected lighting circuits for a more aggressive lighting controls system. The additional work to provide more aggressive control of lighting circuits includes fluorescent and HID fixtures. Table 2 below shows the additional lighting control savings estimated from the new circuits.

6.2 **Table 2: Lighting circuit review for Frito lay Visalia**

Lighting Review

	HID	Total kW		Turned off			Total kW	
Plant Area	**Lights**	**Original**	**Turned Off**	**HID**	**T-12**	**T-8**	**Turned Off**	**Additional control change**
Warehouse	92	33.6	15.7	78			28.5	12.8
KD	105	38.3	32.9	96			35.0	2.2
Film Storage	77	31.6	0.0	60	72		24.8	24.8
Old Isida	40	26.8	0.0	0	0		0.0	0.0
Old 32	20	7.3	2.9	8			2.9	0.0
Old Tort	60	22.3	18.3	50	0		18.3	0.0
Old pretzel	28	10.2	7.7	21			7.7	0.0
Old S Dock	23	9.2	6.6	16	8		6.6	0.0
Tubar	11	4.0	0.4	1			0.4	0.0
Season Storage	6	2.2	0.7	2			0.7	0.0
Salting room	16	6.5	0.0	0	0	0	0.0	0.0
Season Hallway	16	5.8	0.0	0			0.0	0.0
Maint Hallway	7	3.9	0.0	0	0	0	0.0	0.0
Maintenance		1.5	0.0			0	0.0	0.0
QC Hallway	5	2.5	0.0	0	0		0.0	0.0
Battery Room	3	1.1	0.0	0			0.0	0.0
Front Office		3.8	2.3		0	72	2.3	0.0
Totals:	509	210.7	87.4	332	80	72	127.2	39.7

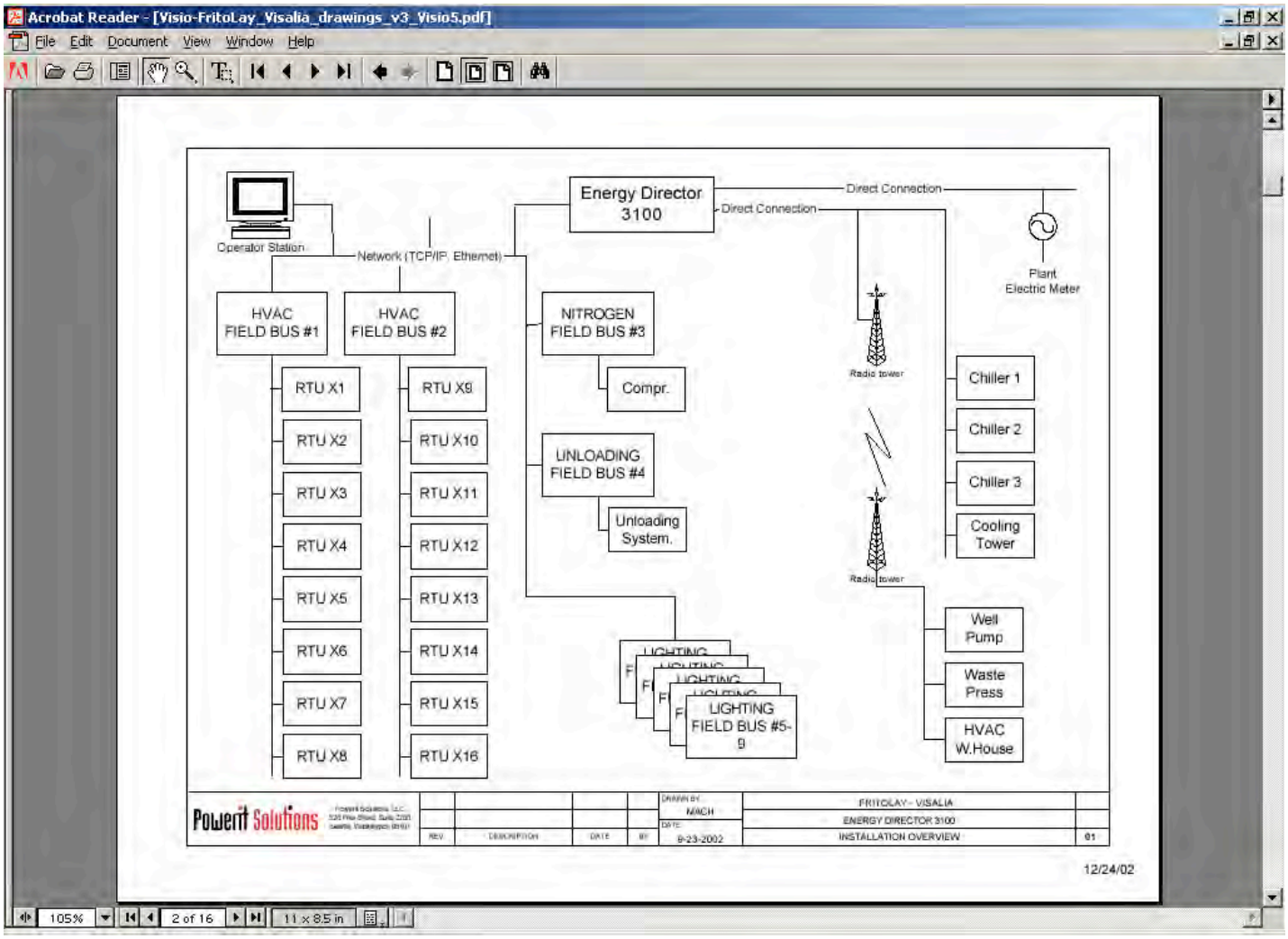

Figure 1: Installation overview of Powerit Energy Director 3100 and control points for Frito Lay, Visalia

SB5X Agriculture Inspection Form

Project Name: Onsite Energy projects, APLRP
Date: 9/24/03
Address: Frito Lay, Modesto
City: 600 Garner Road
Contact: Modesto, CA 95357
Zip:
Inspected by: Ron Allen, Onsite Energy; Dave Cox, Frito Lay Modesto
Randy McCall

Equipment

Component	Status	Meter	Nameplate data and notes
Powerit load controls	■ completed installed ❑ being ❑ not installed	■ yes ❑ no	Load control hardware and software to limit peak demands of facility through unloading or turning off selected equipment in response to predicted 15 minute average peak loads from monitoring of utility meters.
Additional Lighting Controls, Skylight installations	❑ completed installed ❑ being ■ not installed	❑ yes ■ no	Installation of additional skylighting for production areas and some office areas. Addition of lighting controls to function with skylights.
VFD's for Boiler Feedwater and DeAeartor Pumps	■ completed installed ❑ being ❑ not installed	❑ yes ■ no	Installation of Allen Bradley VFDs for 50hp primary feedwater pump and backup, as well as 10hp Deaerator pumps and backup.
SR Power correction Controls	■ completed installed ❑ being ❑ not installed	■ yes ❑ no	Power factor correction equipment on three feeder lines for plant power – little demand savings expected beyond I2R savings for reduced reactive power from power factor correction.
Mytec bilevel HID controls	■ completed installed ❑ being ❑ not installed	❑ yes ■ no	Installation of motion sensor based Bi-level lighting controls for production floor HID lighting. Installation complete.
100 hp VFD Air Compressor for trim unit	■ completed installed ❑ being ❑ not installed	❑ yes ■ no	Compressor is installed and operating,

Meter data

Component(s) is metered separately ❑ yes ■ no **If yes, by:** ■ utility ■ participant ❑ other **_Powerit System____**

Data available ❑ yes ■ no

Type of data ❑ TOU ❑ 15min ❑ run time ■ other **__15minute interval data for facility peak loads and control actions through Powerit software.**
Source of data ❑ utility ❑ participant ■ other **_Powerit software records reports of load control actions, and the user defined threshold level for control action.**

Contact for data __Ron Allen, Onsite Energy__ Ph# (925) 358-4264_ Email address Rallenonsite@aol.com

Section 7 Spot meter

Spot meter readings taken ❑ yes ■ no

Component #1 readings _____ _____ _____ Notes__Equipment control actions were observed by Nexant on a PC equipped with a the Powerit software and graphical user interface . Control points and magnitude of controls action faxed to Nexant at later date.

Component #2 readings _____ _____ _____ Notes__Lighting controls were verified during normal operations; warehouse lighting controls associated with skylights have not been completed and are just getting started for installation.

Component #3 readings _____ _____ _____ Notes__VFD operations were observed from digital displays at each VFD. 50hp VFD was operating in expected range at approximately 40hz; Deaerator VFD was operating at a similar frequency.

Component # readings _____ _____ _____ Notes__SR controllers are providing power factor correction for facility, with near unity Power Factor for plant. Based on other similar project monitoring, little demand savings are expected from this measure. Plant Engineering to investigate with internal monitoring.

A post-installation site inspection was conducted on September 24, 2003 along with Ron Allen of Onsite Energy Corporation, at the Frito Lay, Modesto facility. Randy McCall, of Nexant, Inc. verified that the Powerit Solutions load control system had been installed, and was in the process of calibration to develop a satisfactory load control set point. The system operations were observed in the control room on one of the computer monitors. The equipment that is under control by the Powerit system was shown to be primarily Roof Top Unit (RTU's) air conditioning systems and evaporative cooler units. Mr. Allen explained that there were difficulties in controlling some central chiller equipment at the plant, and other equipment that had been proposed for control had been removed from the list.

Other equipment that are part of the project were previously verified for installation, including the first and second phase of the bi-level HID lighting controls. A new project to install skylights in the warehouse and some office areas has not started as of yet. No skylights were observed for the proposed areas.

The SR controllers are installed and operating, however, based on other studies conducted by Nexant, the savings estimate of 350kW for the three sets of controllers is not approved. To date no monitoring of the equipment has been completed that shows savings for the SR controllers. Plant personnel may conduct some monitoring of power correction and possible demand savings as per conversation with engineering dept. No follow up to date.

The boiler feedwater pump VFDs are installed and operating as proposed. Spot measurements were not recorded, however, the digital displays for the Allen Bradley drives indicated that both the feedwater pump and the de-aerator pumps were operating in the expected frequency ranges.

Onsite Project: Dreisbach Cold Storage Facilities

Site Specific M&V Plan
for
Driesbach Cold Storage Facilities
HID Lighting Controls Retrofit

Project Description:
This project involves converting 400W Metal Halide and High Pressure Sodium lighting fixtures in -10°F storage freezers to tri-level control with occupancy control on each fixture. This is to be accomplished at three facilities owned by Driesbach Enterprises.

The table below summarizes the three facilities and the scope of the retrofit at each facility.

Facility	Address	Warehouse Size	# 400W Fixtures
Oakland	2530 East Eleventh Street, Oakland, CA 94601	150,000	132
Richmond	900 Marina Bay Parkway, Richmond, CA 94804	250,000	133
Hilltop/Moss Landing /Watsonville	1276 Highway 1 Moss Landing, CA 95039	157,000	166

In this project, energy use and summer peak demands are reduced as a portion of the fixtures in the -10°F freezers are operated at either a low power setting due to a short period of inactivity or turned off due to an extended period of inactivity. At full power each 400 W fixture consumes 460 Watts of electric energy. At the reduced power setting, this drops to 255 Watts.

Interactive Effect on Demand Reduction:
All electric energy for lighting produces sensible heat load in the freezer, which must be removed by the refrigeration system to maintain freezer temperatures. Reducing the amount of heat added to the freezers during summer on-peak periods will reduce refrigeration loads in these periods. This effect was studied and results were published as an abstract "Calculating lighting and HVAC interactions" in ASHRAE Journal November 1993 for lighting and HVAC interactions. Cooling savings average impact has been given as 0.23 in this abstract. Therefore interactive demand savings for this project will be calculated using the formula:

Interactive Savings (kW) = [0.23 x **Cooling System Efficiency** (kW/TR)] x **Direct Lighting Savings** (kW)

In this equation interactive effect has a dimension of (TR/kW). By multiplying interactive effect ratio and cooling system efficiency we get a dimensionless factor, which gives the interactive cooling system savings per direct lighting savings. Since cooling efficiency of the refrigeration systems in Driesbach facilities is estimated to be 3-bhp/TR (3 x 0.746 "conversion factor" / 0.94 "electric motor efficiency" = 2.38 kW/TR), we can calculate that interactive savings will be 0.23 x 2.38 = 0.547 kW. This means it will be possible to get 0.547 kW refrigeration system demand savings per 1 kW lighting savings.

This interactive effect is a significant savings due to the energy intensive nature of supplying this refrigeration. Since the lighting equipment is directly in contact with the air inside the warehouse, cooling load coming from the lighting is directly transferred to the evaporators. Therefore the savings coming from the lighting load will affect the amount of evaporation and working conditions of refrigeration compressors, causing demand reduction in the refrigeration system.

Dimming System:
The following excerpt is taken from the manufacturer's (Controlled Lighting Corporation) web page to describe the dimming system. It summarizes functional and energy benefits of the dimming system.

When the H.I.D. lamp is illuminated:

- Power is reduced 50% to 60% when area is unoccupied
- Lamp switches to full power when motion is detected
- Lamp returns to reduced power when no motion has been detected for a selectable period of time. You can select an additional amount of time after which the lamp will be switched off completely, and will restart when motion is detected.
- Smart, Durable, User-Friendly, Customizable

Proven smart chip technology for the most control

- Ballast/igniter protection that switches off lamp and igniter if the lamp continuously cycles on and off
- Enclosures made of lightweight, high-impact plastic
- Unique free-hanging design to help avoid collision damage
- Self-leveling control that restores accurate sensing even when bumped
- Ability to link lights to respond as a group or lighting zone, create a Tri-Level™ lighting schedule, and add daylight detection
- Additional Features of the Ultimate Series High or Low Bay Fixtures:

Options

- Optional Quartz Halogen lamp for instant, temporary light when motion is detected and HID lamp is powering up
- Available in High Pressure Sodium, standard Metal Halide, and Pulse-Start Metal Halide

- Lamp shade assemblies available with acrylic prismatic or spun aluminum reflectors

Verification Approach

Demand savings during summer peak periods will be verified for this project through post-retrofit short term monitoring of amperage to selected lighting circuits at each of the three Driesbach facilities.

Duration of Metering

Post-retrofit metering will be completed for a period of at least three weeks (21 days).

Determination of Baseline Demand.
To determine the baseline kW at each facility, it will be assumed that in the pre-retrofit case, all fixtures will be on during the summer peak hours. Therefore, the baseline kW demand for each facility is equal to the sum of the fixture wattages for all fixtures retrofit with the dimming and occupancy control. Assuming all retrofitted fixtures are 400W metal halide fixtures, the baseline demand is calculated as:

Baseline Facility Lighting Demand = # Fixtures x 460 W/Fixture

Onsite will seek to obtain from the lighting contractor or from Dreisbach, if available, a reflected ceiling plan which describes the lighting circuits for each of the three facilities. This plan will be used to identify for each circuit to be monitored, the number of fixtures located on the circuit.

Determination of Post-Retrofit Demand
It is recognized that different functional areas of the cold storage warehouses experience different activity levels. The population of lighting circuits will therefore be broken into usage groups based on the functional area each serves. The expected functional areas in each warehouse may include:

- Warehouse – All freezer, cooler, and ice cream and dry storage areas.
- Dock – Shipping and receiving docks.
- Maintenance – Include all maintenance, storage, and battery charging areas.
- Production – Would include any space dedicated to processing or mixing frozen items for repackaging and distribution.

If other special types of areas are identified for these facilities, these will be addressed on a case-by-case basis.

For each usage group, Onsite will install portable amperage recording devices at each facility to verify the average post-retrofit demand at each facility. Selected lighting circuits for each usage group will be identified for monitoring. Onsite will seek to capture through measurement as much of the total lighting load in each usage group as is practical given the nature and configuration of the lighting circuits.

For each lighting circuit, or group of circuits, identified for monitoring, Onsite will determine the total number of fixtures located on each circuit and the fixture wattage associated with each fixture. The sum of the fixture wattages is the pre-retrofit or baseline kW for each circuit. The post-retrofit measured demand will be determined by measurement of the amperage for each circuit or group of circuits and converting this amperage to a kW through a calculation of amps multiplied by the appropriate voltage assuming a unity power factor.

The baseline kW for each measured lighting circuit and the verified post-retrofit average demand during summer peak hours will be used to calculate a weighted average facility demand reduction as a percentage. This percentage will then be multiplied times the total lighting demand of the retrofitted fixtures to determine the summer peak demand savings for each of the three facilities.

The equations to be used for each usage group at each facility are as follows:

For each measured lighting circuit(s):

$$Circuit_i \ Baseline\ Demand = \sum Fixture\ Wattages$$

$$Circuit_i \ Post-retrofitDemand = AVG(Circuit_i kW)_{Noon-6\,pm}$$

$$Circuit_i \ \%Demand\ \mathrm{Re}duction = \left(\frac{Baseline\ Demand}{Post-retrofit\ Demand}\right)_{Circuit_i}$$

$$Weighted\ Average\%\ Demand\ \mathrm{Re}duction = \frac{\sum (BaselineDemand * \%Dmd\ \mathrm{Re}duction)_{Circuit_i}}{\sum (BaselineDemand)_{Circuit_i}}$$

Using the above calculations, a table of results similar to that given below will be completed for each facility.

Usage Group	Group Baseline KW	Group Measured Average Post-Retrofit Demand	Demand Savings	Interactive Savings (IF*Demand Savings)	Total Demand Savings
Warehouse					
Dock					
Maintenance					
Production					

Note: IF stands for Interactive factor. This factor will be determined for each usage group and will depend on the temperatures normally maintained for the specific functional area. These will be calculated by Onsite and submitted for review by the CEC and its technical review contractor.

Onsite Final Report, Dreisbach Lighting Controls

SB5X Agriculture Inspection Form

Project Name	Onsite Energy – Dreisbach Cold Storage Facilities	Date	7/26/02
Address	Dreisbach : Richmond, Oakland, Moss Landing.		
City	Meeker Ave, Richmond, 2530 E. 11th, Oakland, Hwy 1, M.L.		various
Contact	Richmond, Oakland, Moss Landing		
Inspected by	Don Hladun, Onsite Energy, Randy Ivie – Driesbach Rich. John Haas – Moss Landing, not recorded - Oakland	Zip	
	Randy McCall		

Equipment

Component	Status	Meter	Nameplate data and notes
Installation of Controlled Lighting HID lighting controls at Richmond	❑ completed installed ■ being ❑ not installed	❑ yes ■ no	Lighting fixtures were found to be a mix of 400W MH and 400 W HPS fixtures. Significant number of non-op fixtures. – 132 fixtures proposed for retrofit.
Installation of Controlled Lighting HID lighting controls at Oakland	❑ completed installed ■ being ❑ not installed	❑ yes ■ no	Lighting fixtures were found to be predominantly 400W MH fixtures except annex building with 400W HPS. 133 fixtures proposed for retrofit.
Installation of Controlled Lighting HID lighting controls at Moss Landing	❑ completed installed ■ being ❑ not installed	❑ yes ■ no	Lighting fixtures were found to be 400W HPS. 166 fixtures proposed for retrofit.

Meter data

Component(s) is metered separately ❑ yes ■ no **If yes, by:** ❑ utility ❑ participant ❑ other **_Post installation monitoring of circuit demand proposed in M&V plan: Baseline usage for Peak Period is full usage.**

Data available ❑ yes ■ no

Type of data ❑ TOU ■ 15min ❑ run time ❑ other **Post installation monitoring to be provided by Onsite.**

Source of data ❑ utility ❑ participant ❑ other **Monitoring data to be provided for sample of circuits after installation**

Contact for data: Eric Nyenhuis, Onsite Energy **Ph#** (760) 931-2400 **Email address** enyenhuis@onsitenergy.com

Notes:

Three Dreisbach Cold Storage Facilities were visited to verify the existing condition of the lighting fixtures and lighting controls. Each facility is discussed individually below.

Dreisbach Cold Storage – Richmond; 900 Marina Bay Parkway, Richmond, CA 94804

The Richmond facility has 12 rooms for cold storage, however only two of the rooms and Loading Dock #1 in the back of the building are proposed for the retrofit. According to Randy Ivie of Dreisbach, Room #1 is approximately 41,000 ft2, and Room 2 is approximately 59,000 ft2. The facility operates on a single shift basis, typically from 6am – 8 pm with some weekend shifts depending on product delivery schedules during the year. Much of the facility contains frozen turkeys, with approximately 21 million pounds of turkey shipped during the year. No estimate of current product on hand was provided, however the stacking rows appeared to be relatively full. Temperatures of Room 1 were set at –10 degF, with Room #2 set slightly higher at 0 deg F. During the inspection we attempted to verify the lighting circuit panels to determine the feasibility of monitoring a sample or all lighting circuits if applicable. Additional work will be required to identify dedicated lighting circuit panels and fixture counts for sampled circuits. Fixture counts were not recorded as the temperatures in the two cold storage rooms prevented us from staying inside for a sufficient amount of time to identify all fixtures. Of note, there were a mix of both 400W MH and 400W HPS fixtures in the two cold storage rooms and loading dock, as well as a significant number of inoperative fixtures. Onsite will need to account for any fixtures not operating for analysis of demand savings from the post-installation monitoring proposed in the M&V plan. Onsite Energy has proposed to include interactive savings from reduced internal heat loads in each of the facilities. The ammonia based refrigeration system included several individual compressors in the engine room at the front of the complex, however nameplate information was not recorded for the compressors. Of note, at each of the facilities visited, the retrofit of the lighting controls had been started. None of the installations inspected were complete, but equipment at Richmond was hung next to each fixture throughout the facility. One section of Room #2 is leased to an outside vendor and fenced off from the Dreisbach portion of the room. The retrofit is proposed for the entire room, however, monitoring of the fixture circuits should provide information on the operations and lighting hours for the outside vendor as well as Dreisbach.
Representative photographs of the Richmond warehouse are attached below.

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Figure 1: Loading dock area at Richmond – 400W MH fixtures with individual controls at each fixture.

Figure 2: Stacking rows and mixture of fixture types in cold storage room.

Dreisbach Cold Storage – Oakland; 2530 E. 11th, Oakland, CA 94601

The Oakland facility includes cold storage rooms, cooler rooms, and unconditioned rooms in the proposal for lighting controls retrofits. The 133 fixtures proposed for retrofit at the facility were not individually counted due to extremely cold conditions and the number of rooms to verify. Similar to the Richmond facility, many of the lighting controls were hung in place next to the fixtures, but not activated

or completed. Fixtures at Oakland included 400W HPS in Room 12, and 400W MH fixtures for the rest of the facility. Total area covered by the retrofit for the Oakland facility was reported to be approximately 110,000 ft2 including the loading docks. Temperatures of the various rooms ranged from ambient in the loading dock area, 34 deg F in the cooler, and 0 deg F, or –10 deg F in individual cold storage rooms. A total of 12 rooms were inspected, with Room 12 across the street from the main facility in an annex building. Lighting hours for the facility were reported by the staff to include the entire summer peak period. The typical single shift operation runs 5 days per week from 7:00am to 6:00pm. All lights are turned off at the lighting contractors after the shift ends. Representative pictures of the Oakland facility are attached below.

Figure 3: 400W MH fixtures in stacking rows.

Figure 4: 400W MH fixture with inactive Controlled Lighting Corporation equipment to right of fixture (typical installation).

Figure 5: Lighting circuit panel for post installation mon-Itoring at right of picture.

Figure 6: -10 deg F cold storage room with 400W MH fixture Note lighting control equipment (inactive) near fixture.

Dreisbach Cold Storage – Moss Landing; 1276 Highway 1, Moss Landing, CA 95039

The Moss Landing facility is equipped entirely with 400W HPS fixtures, and the retrofit is proposed for all cold storage areas, the packing area, and the IQF freezer room. The packing area is at ambient temperatures, with other areas at either 0 deg F, or –10 deg F. The overall size of the cold storage rooms was reported to be approximately 120,000 ft2, according to John Haas, the facility representative. As found at both the Richmond and Oakland facilities, lighting control equipment was hung next to fixtures in some of

the areas to be retrofit. Hours of operation for the facility are reported to be 6 days per week, approximately 16 hours pre day during the summer peak period. All fixtures are therefore assumed to be in operation during the entire summer peak period. None of the lighting controls were active at the time of the inspection, and Mr. Haas reported that the retrofit was held up pending the results of the pre-installation inspection. Completion for the project is projected for the first week in August, 2002. Pictures of the cold storage areas at the Moss Landing facility are attached below.

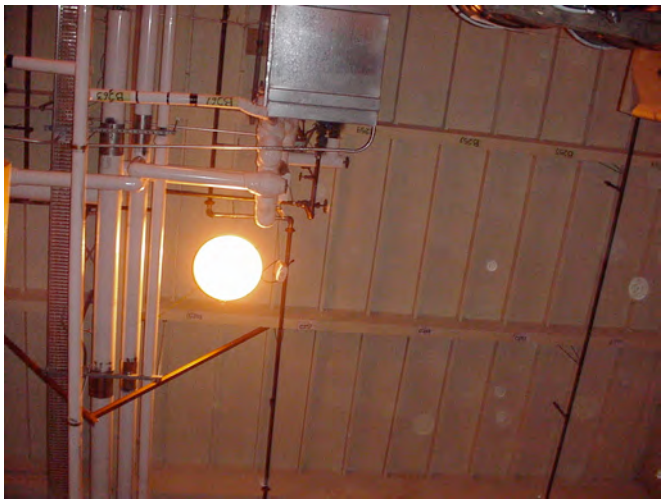

Figure 7: 400W HPS fixture inside cold storage room at Moss Landing. Note controls equipment near fixture.

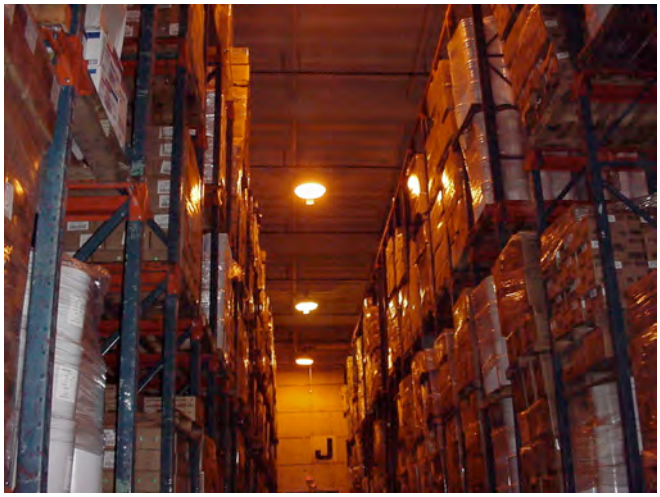

Figure 8: Stacking rows of frozen berries in 0 deg F room. Note lighting controls illuminated by fixtures (inactive).

Summary of inspections: At each of the three facilities inspected, lighting controls had been physically installed, but not activated. Fixture counts were not verified due to extreme cold conditions preventing the inspector from spending an adequate time to count all fixtures. The lighting fixtures observed were all of either 400W MH or 400W HPS type, with little difference between baseline fixture wattage (HPS400/1 = 465W, MH400/1 = 458 W according to Table of Standard Fixture Wattages from Nexant).

Inoperative fixtures noted at the Richmond facility must be accounted for in a detailed inventory of fixtures and fixture types. Post-installation monitoring of circuit demand will include all fixtures on a sampled circuit, and inoperative fixtures can range from 0 Watts demand for fully failed fixtures to slightly less than full power for fixtures near failure by still providing light. Calculating an average demand of all fixtures including any inoperative fixtures will result in artificially high demand savings per fixture from the retrofit project. Baseline monitoring was waived for the project due to short installation deadlines, and fixtures are assumed to be operating at full power during the entire peak demand period. Additional comments on the post-installation monitoring approach, and determination of any interactive effects on demand will be forwarded to Onsite.

Savings estimates for this project have not been provided to date. With the variable nature of the lighting levels throughout each facility solely dependent on the traffic patterns, an accurate assessment of the demand savings is difficult to predict with any accuracy. A similar project for a large distribution warehouse has resulted in measured demand savings of 55% of baseline demand. A second grocery distribution warehouse reviewed by Nexant resulted in measured savings of roughly 38% of connected load. Based on Onsite Energy's proposed M&V plan, and from observations during the pre-inspections, Nexant believes the peak demand savings should meet or exceed the demand savings as a percentage of connected load listed above. On that basis, the demand savings should be in excess of 80kW. Onsite Energy has also proposed to track interactive savings from reduced refrigeration loads and has proposed that for every kW of reduced lighting, 0.85kW of refrigeration compressor savings can be achieved. The total savings then may exceed approximately 150kW for the three facilities.

Onsite Project: Gatorade

SB5X Agriculture Inspection Form

Project Name: Onsite Energy – Gatorade Demand Reduction Project — Date: 3/18/02

Address: Gatorade

City: Oakland, CA — Zip: _____

Contact: Ron Allen

Inspected by: Randy McCall

Equipment

Component	Status	Meter	Nameplate data and notes
Air Compressor Replacement	❑ completed ■ being installed ❑ not installed	❑ yes ❑ no	Removed Atlas CopCo CAU 807 compressor, install new Variable speed Atlas Copco GA-90 rotary screw compressor.
Air Compressor Optimization	❑ completed ■ being installed ❑ not installed	❑ yes ❑ no	Reconfigure piping loop for compressed air header, install low pressure blower with air knives for blow off of bottles on lines, add controls and photo eye sensors for time-out of air nozzles.
Condenser Fan VFDs	❑ completed ❑ being installed ■ not installed	❑ yes ❑ no	Install 4 VFD's to control 25 hp condenser fans in three existing cooling towers along with sump temperature controls loop.
Boiler combustion air fan VFD	❑ completed ❑ being installed ■ not installed	❑ yes ❑ no	Install VFD to control 50 hp boiler combustion air fan.

Meter data

Component(s) is metered separately ❑ yes ❑ no **If yes, by:** ❑ utility ❑ participant ❑ other **_Unknown_____**

Data available ■ yes ❑ no Note: Some pre-installation monitoring data provided in air compressor study. Other info unavailable.

Type of data ❑ TOU ❑ 15min ❑ run time ❑ other **Monitored power data in air compressor study**

Source of data ❑ utility ❑ participant ■ other **Previous study conducted by ESCO_____**

Contact for data __Onsite Representative Is Ron Allen **Ph#** (925) 358-4264 **Email address rallenonsite@aol.com**

Notes on Gatorade:

The air compressor project is nearing completion with installation of the new Copco variable speed screw compressor close to complete. The existing constant speed Copco compressor will be retained as a backup compressor in case of primary screw compressor failure according to Ron Allen, Onsite's representative for the project. A previously completed air compressor study of the plant (according to Ron) has listed savings of approximately 400,000kWh, and approximately 83kW of demand reduction. Additional documentation from Onsite lists air compressor savings at 67kW.

The compressed air optimization program has been largely completed, with the compressed air header loop to be completed along with the new compressor installation. The air knives and dedicated low pressure blower have been installed and were functioning during the inspection. The 10 @ 30CFM air nozzles have been replaced, and the photo sensor controls have been installed.

The VFD installation for the condensers has not been started, and all condenser fans for the three cooling towers were operating at full speed during our inspection (morning hours, mid to low 70's temperature). The documentation lists 4 VFDs to be installed for the three cooling towers, however Ron Allen indicated that all four fan motors on the West Tower would receive VFD's, with the East tower receiving two VFD's for the four fan motors. The total 6 VFD's indicated by Ron Allen is not consistent with the documentation. Follow up on actual planned number of VFD's is needed.

The boiler combustion air retrofit had not been started prior to the inspection. Ron Allen's spreadsheet for the plant improvements indicates that pre-installation monitoring and post-retrofit monitoring would be used to establish the actual load reductions for peak period usage. The savings would typically only occur during low fire rate operations.

In addition to the other items listed above, a minor lighting retrofit is contemplated for office areas and some work floor areas. The listed peak load reduction for the lighting retrofit is 20kW from the spreadsheet dated 3/11 (17kW from the lighting inventory sheets). Nexant believes some of the lighting savings will not be coincident with the peak period. Lighting usage hours must be specified for various locations listed on the inventory sheets.

Based on the visual inspection of project status, documentation of measure baselines, and savings analysis, Nexant recommends approval of the project. Additional documentation is required to approve final savings estimates as shown in Onsite's savings spreadsheets of 165kW peak demand reduction.

Photographs of select equipment below:

Figure 1: Existing Copco compressor – will become backup compressor for plant.

Figure 2. New VSD screw type rotary compressor - not currently operational.

Figure 3: New air knives for blow off of bottles on line.

Figure 4: Blow-off for bottles and new blower.

Figure 5: East cooling tower with four 25hp constant speed fans.

Figure 6: West cooling tower with two 25hp constant speed fans.

Figure 7: Existing boiler with 50hp FD fan.

Figure 8: 50hp FD fan motor for boiler.

Onsite Project: Leprino Foods

SB5X Agriculture Inspection Form

Project Name: Onsite Energy – Leprino Foods
Date: 5/9/02
Address: Leprino Foods Refrigeration and Freezer Improvements
City: Leprino Foods
Zip: _____
Contact: Tracy
Inspected by: Ron Allen, Onsite Energy, Reed Azevedo, Leprino Foods
Randy McCall, Nexant, Inc.

Equipment

Component	Status	Meter	Nameplate data and notes
Mozzarella Cheese brine bath cooling system improvements –split system, new extrusion equipment, belt conveyer, air spray system for cooling cheese.	❑ completed installed ❑ being ■ not installed	❑ yes ■ no	Process change for cooling extruded cheese with brine bath system; move brine cooling to high side of ammonia compressors at 22psig suction, rest of system allowed to float resulting in lower suction pressures and discharge pressures. Redesign and retrofit allow for overall reduction in BHP/ton for brine system. Baseline data from SPC project previously incented by PG&E.
Install 2 new condensers for refrigeration system. 5 existing condensers.	❑ completed installed ■ being ❑ not installed	❑ yes ■ no	System improvements include increase to design capacity by removing bottleneck in cooling cheese. 2 additional Evapco condensers for higher efficiency on refrigeration system BHP/ton and process rate increase.
Install 4 HCR doors for freezer and 2 Rytec doors	❑ completed installed ❑ being ■ not installed	❑ yes ■ no	Improvements to freezer envelope by reducing infiltration, and managing door defrost cycles in more efficient manner. HCR doors are double-envelope, Rytec's are high speed roll up doors.
Refrigeration controls for Freezer flywheeling	❑ completed installed ❑ being ■ not installed	❑ yes ■ no	Improvements to control of ammonia compressors, addition of infiltration doors result in ability to flywheel freezers during peak hours.

Meter data

Component(s) is metered separately ■ yes ❑ no **If yes, by:** ❑ utility ❑ participant ■ other **Onsite has monitored compressors for previous SPC project with PG&E.**

Data available ■ yes ❑ no Baseline data is reportedly available from previous SPC project for refrigeration compressors.

Type of data ❑ TOU ■ 15min ❑ run time ❑ other _____

Source of data ❑ utility ❑ participant ■ other **SPC monitoring data**

Contact for data **Eric Nyenhuis** **Ph#** 760) 931-2400 **Email address** **ENyenhuis@Onsitenergy.com**

Notes:

Ron Allen of Onsite Energy and Reed Azevedo of Leprino Foods were in attendance for the pre-installation inspection on May 9, 2002 at Leprino Foods in Tracy, CA.

The inspection was visual in nature, and no spot measurements of compressor power or condenser demand were recorded during the inspection. According to Ron Allen, Onsite Energy has access to two years of continuous monitoring data for the ammonia refrigeration system collected for a previous PG&E incented SPC project. As the demand savings for the project are all related to improvements to the refrigeration system, or envelope of the freezer, demand reductions will be evident at the ammonia compressors and condenser systems.

The measures proposed for the project include a redesign of the brine cooling system and move from the suction side of the ammonia compressor system to the high side, installation of fast roll-up doors for the freezer to control infiltration and reduce defrost heating of the doors, installation of two additional evaporative condensers to the condenser loop, and installation of controls to allow flywheeling of the freezer for additional compressor savings.

The Leprino plant was under construction at the time of the site inspection, and some of the measures were already underway. The two new Frigid Coil evaporative condensers were installed on the rooftop, however, they were not functioning. According to Mr. Azevedo, all construction for the process change will be completed including the installation of the new cheese cooling system before the actual changeover to the new system occurs. The actual switch of the brine cooling system will take place over a one day interval. The completion of the project was predicted for the end of July, and possibly later.

Photographs of the brine tank and heat exchangers are attached below.

Figure 1: New heat exchangers on roof for brine system. Note construction equipment in foreground–construction area was not accessible for inspection.

Figure 2: Existing immersion type brine bath system. Brine Existing brine bath measures approximately 120' long, and Is maintained at approximately 4 deg F for rapid cheese chilling.

SB5X Agriculture Inspection Form

Project Name: Leprino Foods — Date: 10/2/02

Address: Leprino Foods Refrigeration and Freezer Improvements

City: Macarthur Boulevard

Contact: Tracy, CA — Zip: _____

Inspected by: Don Hladun, Onsite Energy

Randy McCall, Nexant, Inc.

Equipment

Component	Status	Meter	Nameplate data and notes
Install 2 new evaporative condensers for ammonia refrigeration system.	■ completed installed ❑ being ❑ not installed	❑ yes ■ no	Evapco, Model # ATC 755B and Evapco, Model # ATC 473B. Additional existing condensers for ammonia plant not documented for nameplates. Two existing condensers planned for replacement due to failing condition. Existing condenser fans are monitored for power consumption, new condensers are planned for monitoring installation by Onsite-Energy in coming weeks.
Install heat exchangers for new cheese cooling line using brine spray at increased temperature.	■ completed installed ❑ being ❑ not installed	❑ yes ■ no	Installed two new heat exchangers between ammonia refrigeration system and brine cooling system for cheese manufacturing. Brine cooling system has been moved from the low temp ammonia system at –8 deg F to medium temp side at approx. 16 deg F. Refrigeration system reset to 0 deg F on low side when system split completed for freezer operations.
Install new brine bath cheese cooling system. Existing immersion bath system replaced with spray type allowing for warmer brine temperature and move of brine chilling to high side of ammonia refrigeration system.	■ completed installed ❑ being ❑ not installed	❑ yes ■ no	Install brine cooling system to cool extruded mozzarella cheese and provide for salt uptake. New cooling tank uses spray system for brine instead of bath system of existing tank. Combined motor power of new system is not determined, but thought to be less for lower brine pumping requirements, and similar belt power requirements. New brine system allows for higher brine temps, therefore the brine system moved to medium side ammonia compressors at higher temperatures.

Meter data

Component(s) is metered separately ■ yes ❑ no **If yes, by:** ❑ utility ❑ participant ■ other **Onsite Energy_**

Data available ■ yes ❑ no Pre-installation data available for low side compressors and existing condenser fans. Additional monitoring to be installed for new condenser fans and high side compressors.

Type of data ❑ TOU ■ 15min ❑ run time ❑ other _____

Source of data ❑ utility ❑ participant ❑ other **_Onsite Energy monitoring**

Contact for data __Eric Nyenhuis, Onsite Energy Ph# 760-931-2400 Email address: ENyenhuis@Onsitenergy.com

A post installation inspection was conducted at Leprino Foods plant in Tracy on October 2, 2002. In attendance were Don Hladun, Onsite Energy, Steve Azevedo, Leprino Foods, and Randy McCall, Nexant, Inc. The full scope of the project with Leprino Foods includes refrigeration measures related to the cheese cooling, increases in condenser capacity for the ammonia refrigeration system, installation of heat exchangers for the brine cooling system, and installation of infiltration reduction measures for the freezer doors to improve flywheeling potential of the freezer refrigeration system. The measures completed at this time include all but the freezer infiltration measures. Installation of the infiltration measures is anticipated for 2003.

Changes to the refrigeration system revolve around the installation of the new brine spray based cheese cooling system installed as part of the retrofit. Photographs of the new equipment were not permitted, however a brief description of the new system follows. Warm mozzarella cheese is extruded in a wide continuous band approximately 8-feet by 1-inch thickness. The continuous cheese band is fed by conveyor belt through a stainless steel vessel roughly 100' long, equipped with rows of spray nozzles that spray the cheese from top and bottom with a chilled brine solution. The brine, at 18 deg F temperature, serves to both cool the cheese prior to processing and storage, and provide salt for uptake by the cheese. After traveling through the brine spray vessel, the continuous belt of cheese is sliced into smaller slabs of roughly 1-foot by 2-foot dimensions, and moved into processing or freezer storage lines. Further processing includes grating and packaging in bulk for use by Pizza restaurants, or slicing into smaller sizes. After the minimal processing, the cheese is either moved into the freezer storage area or direct shipped to customers.

The existing brine bath system is still on the site, however, has been disconnected and appears to be abandoned in place. All lighting for the previous brine bath is still in place and operating, and new lighting was installed in the area holding the new brine-spray tank. Lighting power was not included in Onsite's previous estimates of demand savings, and must be accounted for in the final analysis of savings.

Refrigeration system improvements included increased condensing capacity through installation two additional Evapco cooling towers. The approximately 225 Tr capacity towers were installed alongside the existing 5 evaporative condensers. Combined with the changeover from brine bath cooling supplied by the low side compressors (previous tank temperature was approx. 4 deg F) to a higher temperature brine spray system (new system is at approx. 18 deg F) supplied by the high side ammonia compressors, the discharge pressures have decreased significantly for the entire system. Reed Azevedo, of Leprino Foods, estimated maximum discharge pressures will consistently average approximately 125-135 psig vs. the previous 160 psig or greater. For the baseline configuration, the condenser capacity was insufficient and the lower temperatures required by the brine bath system (-8 deg F suction temperatures) resulted in excessive discharge pressures and higher compressor power demands. The addition of additional condenser capacity, raising of the low side suction temperature to 0 deg F from –8 deg F for freezer only operations, and moving the brine cooling to the medium side at 18 deg F brine has dramatically lowered the compressor power requirements.

An additional component of the retrofit is the installation of two high efficiency heat exchangers for the new brine cooling system. The heat exchangers were both operating during the inspection, and temperature drop between the brine cooling tank and the compressor was only approximately 2 deg F.

At the conclusion of the inspection, a conference call was originated that included Don Hladun and Eric Nyenhuis of Onsite Energy, and Randy McCall of Nexant, Inc. to discuss M&V methods and monitoring equipment. A previous refrigeration project at Leprino by Onsite required extensive monitoring of the refrigeration system on a continuous basis. The monitoring equipment installed to measure post-installation energy use in the previous project serve to establish baseline conditions for the latest project. Changes to the refrigeration system, installation of the two condensers, and the switch in brine cooling necessitate additional monitoring of the two Frick ammonia compressors, and the new condenser fans and pumps. Onsite anticipates installation of the new monitoring equipment in the next two weeks.

Photographs of the some of the new equipment installations at Leprino Foods are attached below.

Figure 1. One of two Evapco condensers,

Figure 2. Evapco condenser nameplate, Model ATC755B

Figure 3. Brine bath cheese cooling system now disabled – photographs of new system not permitted. Note brine spray on top of extruded cheese belt; replacement equipment includes top and bottom spray

Figure 4. Frick ammonia compressor for new brine cooling system.

in enclosed tank.

Figure 5. Low temperature ammonia compressors – new cooling system moved to medium temp compressors in Figure 4.

Figure 6. Brine system heat exchangers mounted on roof; heat exchangers now supplied by medium temp ammonia compressors at 16 deg F. Leprino plans to insulate lines At left edge of photograph.

Onsite Project: Pacific Coast Producers

Pre-M&V Evaluation REPORT

Prepared for Pacific Coast Producers, Onsite Energy Corporation, and the California Energy Commission

Prepared by Robert Mowris & Associates

SITE SUMMARY INFORMATION

Company Name:	**Pacific Coast Producers**		
Site Name:	**Pacific Coast Producers**		
Site Address:	**1376 Lemen Avenue, Woodland, CA 95776**		
Principal Site Contact:	**Rich Freitas**	**Telephone:**	**(530) 661-7611**
Plant Engineer:	**Robin Dodson**	**Telephone:**	**(530) 661-7634**
OnSite Energy Contact:	**Ron Allen**	**Telephone:**	**(925) 358-4264**
Assigned Lead Engineer:	**Robert Mowris, P.E.**	**Telephone:**	**(800) 786-4130**

Site: Pacific Coast Producers, Woodland, CA

PROJECTS AS PROPOSED

Project	Account Number	End Use	Utility	Program	Project Type
PCP Project	CPYT219203	Tomato Processing	PG&E	Ag. Peak kW Reduction	Custom

MEASURES FOR EACH PROJECT

		Ex Ante Savings Estimate			
Item No.	Efficiency Measure	(kW)	(kWh/yr)	(therms)	Rebate ($)
1	Process Efficiency Upgrade	1,085	1,953,362	n/a	$217,000

PROGRAM MEASUREMENT AND VERIFICATION SAVINGS ESTIMATE

		M&V Evaluation Savings		
Item No.	Efficiency Measure	(kW)	(kWh/yr)	(therms)
1	Process Efficiency Upgrade			n/a

Introduction

The PCP tomato processing facility was previously located in the City of Lodi. It has been moved to Woodland and upgraded to increase production, improve efficiency, and be closer to where the tomatoes are grown. PCP is upgrading the production and efficiency of their tomato processing facility including new equipment and controls as part of the move. They applied for a grant to defer part of the cost of the efficiency upgrades through the CEC-Sponsored Onsite Energy Corporation Agricultural Peak kW Reduction Program. Based on our analysis the grant application will be $217,000 (i.e., 1,085 kW times $200/kw). The old site received electricity from the City of Lodi Electric Utility and historical electrical billing data for the old facility was obtained from the City of Lodi. PG&E will be providing electricity and natural gas to the new site. PCP is preparing an equipment list of motors, VFD drives, helical drives, and controls to assist with the M&V effort. Preliminary information is provided in this report and will be updated later. Historical billing data for PCP is provided in **Attachment 1**.

Business Description

The PCP has been located in Lodi for 31 years and is a grower-owned cooperative founded in 1971. Today, PCP is the largest grower-owned tomato and fruit canning operation in the United States. Pacific Coast Produces employs over 1,000 people at peak season and is one of the City of Lodi Electric Utility's largest energy users. PCP decided to relocate their tomato processing facility in 2000 to be closer to where the tomatoes are grown in order to improve processing quality and reduce transportation costs. PCP purchased the Woodland facility in 2001 and started relocating their tomato facility from Lodi to Woodland in late 2001. The PCP tomato processing facility is used during the tomato harvest season that runs from June through September. The plant will process approximately 525,000 tons of tomatoes per season or 5,850 tons per day during the harvest season. Tomatoes arrive on trucks carrying approximately 20 tons of tomatoes per truck. The Woodland facility will eventually include 24 production lines. Only 18 production lines are considered in this report in order to compare to the Lodi facility that previously included 18 production lines.

Scope of Project and Efficiency Improvements

The old Lodi facility consisted of 4 evaporators and 18 production lines with over-sized standard inefficient constant-speed motors, manual controls, 50% efficient "right-angle" gear drives; and inefficient lighting. Once completed in June, PCP Woodland will have a "state-of-the-art" tomato processing facility. The Woodland facility includes the following efficiency improvements:

1. Computer controls to increase production and improve processing efficiency;
2. Eliminating unnecessary motors;
3. High-efficiency motors (approximately one hundred 1/2 hp to 20 hp motors);
4. Properly-sized motors (the old motors were often oversized);
5. Variable frequency drives (VFDs);
6. High efficiency helical drives (96% efficient); and
7. Reduced lighting levels and Day Lighting.

The move to Woodland will also save transportation fuel since most of the tomatoes processed by PCP are grown in the Woodland area. The most important efficiency upgrade is the drastic

improvement in product throughput. Lodi had annual production of 325,000 tons of tomatoes per year. The Woodland facility will have annual production of 525,000 tons of tomatoes per year (i.e., 62% increase). The net peak load reduction savings of 1,085 kW are based on the overall efficiency upgrade in equipment and throughput. This report provides both a "bottom up" and "top down" analysis of the savings.[2] In addition, transportation fuel and highway congestion savings will be realized. A summary of kW savings based on the two approaches is shown in **Table 1**.

Table 1. Summary of kW Savings

Section	Description	Quantity of Motors	kW Savings
1	Bulk Dump	7	22
2	Caustic Applicator	14	137
3	Cord Peeler	7	31
4a	Product Staging	41	64
4b	Reduced Lighting & Day Lighting		51
5a	Manual Sorter and Hot Break	16	107
5b	Automatic Sorter	7	5
6a	Evaporator/PFT	52	198
6b	Kitchen Mixing Tank	17	23
6c	Kitchen Pump	17	22
7	De-Palletizing	45	16
8a	Product Fill and Close	21	TBD
8b	Paste Fill and Close	21	22
8c	Rotel	18	11
9	Cooker	21	43
10	Cooler	19	38
11	Palletizing and Warehouse	28	26
	"Bottom Up" kW Savings	**351**	**1,085**
	Lodi kW = 6,634 kW		
	Lodi Facility at Woodland Efficiency = 5,549 kW		
	"Top Down" kW Savings		**1,085**

[2] The "bottom up" analysis of savings is in progress and is based on analysis of each section of the facility in terms of reducing the number of unnecessary motors, properly sized high efficiency motors, VFDs, lighting level reduction, and new computer controls that increase production and improve efficiency.

Overview of Woodland Tomato Processing Facility and Energy Efficiency Improvements
The PCP Woodland Tomato Processing Facility consists of eleven (11) processing sections. Each section is described below with an indication of the number of energy efficiency measures installed and estimated savings.

1) Bulk Dump Section. Trucks carry tomatoes into the processing facility where they are bulk dumped from the trucks and then lifted up to the peeler and sorter sections. **Figure 1** shows one of five lifts being retrofitted with a properly sized high efficiency 5-hp VFD motor with helical drive. Previously the lift had an inefficient 20-hp hydraulic motor. **Figure 2** shows new computer (PLC) controls to allow motors to operate at increased speed to maintain optimum product throughput and efficiency. Product throughput has been increased by 60% compared to Lodi with new computer (PLC) controls. Overall peak demand and energy savings are 16.4% compared to Lodi due to computer PLC controls, high efficiency VFD motors, properly sized motors, improved design to eliminate unnecessary motors and other improvements.

Measure Description	Qty.	KW Savings
Efficient Motors w/VFD	1	13
Computer VFD Controls	1	4
Computer Controls	7	5
Subtotal Savings		22

Figure 1. Tomato Lift

Figure 2. Computer (PLC) Controls

2) Caustic Applicator Section. Tomatoes first go through the caustic peelers to loosen the skin (**Figure 3**). There are seven state-of-the-art caustic peelers with one per production line. Each caustic peeler includes properly sized high efficiency 3-hp motors with 96% efficient helical gear drives to replace old right angle gear drives that were 50% efficient. The old motors were 5-hp. The new motors also have computer controlled VFDs to ensure that they operate at optimal speed/efficiency. Seven caustic recirculating pumps have been changed from 30-hp to high efficiency 20-hp motors.

Measure Description	Qty.	KW Savings
Efficient 3-hp Motors w/VFD	7	21
Efficient 20-hp Motors w/VFD	7	114
Computer VFD Controls	14	2
Subtotal Savings		137

Figure 3. Caustic Peeler

3) Cord Peeler Section. Tomatoes go through the cord peelers where the skin is removed (**Figure 4**). There are 7 state-of-the-art cord peelers with one per production line. Each cord peeler includes properly sized high efficiency motors and computer controlled VFDs. The cord peelers have 96% efficient helical gear drives to replace old right angle gear drives that were 50% efficient. Computer controls maintain optimal production speed and efficiency.

Measure Description	Qty.	KW Savings
Efficient Motors w/VFD	7	5
Helical Drives	7	19
Computer VFD Controls	7	7
Subtotal Savings		31

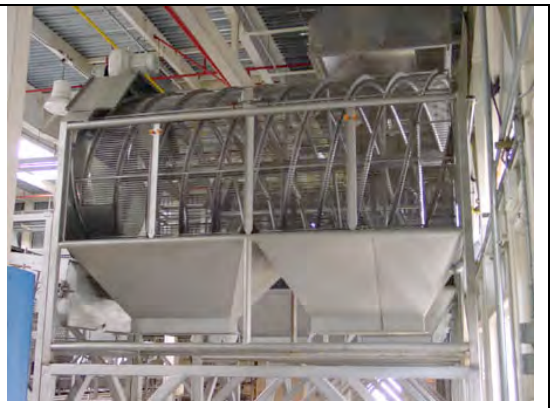
Figure 4. Cord Peeler

4a) Product Staging Section. Tomatoes are routed to product staging conveyor belts prior to sorting. This section includes properly sized energy efficient motors with helical gear drives and computer controls as shown in **Figure 5** (motors and drives are painted white). Helical gear drives are 96% efficient and replace old right angle gear drives that were 50% efficient. Computer controls maintain optimal production speed and efficiency.

Measure Description	Qty.	KW Savings
Efficient Motors w/VFD	16	4
Helical Drives	41	42
Computer VFD Controls	41	18
Subtotal Savings		64

Figure 5. Product Staging Section

4b) Reduced Lighting Levels and Day Lighting. Reduced lighting levels along with skylights are installed throughout the facility. The installed lighting intensity is approximately 1.1 W/sf. The old facility lighting intensity was 1.71 W/sf. With approximately 85,500 square feet of production area the total savings from lighting are estimated at 51 kW.

Measure Description	Qty.	KW Savings
Energy Efficient Lighting		51
Subtotal Savings		51

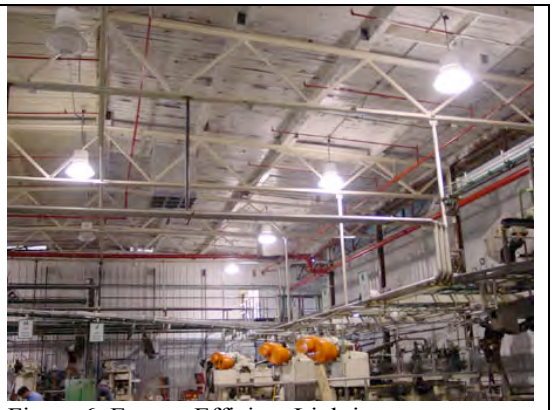

Figure 6. Energy Efficient Lighting

5a) Manual Sorter and Hot Break Section. There are eight manual sorters that that receive tomatoes from the bulk dump section and send tomatoes to the hot breaks (which have six new 25-hp motors at 93.6% efficiency replacing six old 30-hp motors). There are a total of eight 25-hp and eight 15-hp motors in the hot break section. Figure 7 shows the manual sorter which bypass sections 2 through. Computer controlled flow of the tomatoes reduces energy use and increases efficiency and throughput.

Measure Description	Qty.	KW Savings
Efficient Motors w/VFD	6	70
Computer Controls	16	37
Subtotal Savings		107

Figure 7. Manual Sorters

5b) Automatic Sorter Section. From the product staging section tomatoes go to the automatic sorter section that sorts tomatoes by color and size. (Figure 8). There are seven state-of-the-art automatic sorters. Each automatic sorter includes properly sized high efficiency motors and computer controlled VFDs. Computer controlled flow of the tomatoes reduces energy use and increases efficiency and throughput.

Measure Description	Qty.	KW Savings
Efficient Motors w/VFD	7	3
Computer VFD Controls	7	2
Subtotal Savings		5

Figure 8. Automatic Sorter

6a) Evaporator/PFT Section. Tomatoes go from the sorters to the hot breaks, to the pulper feed tanks (PFT), to the pulp/finishers, to the evaporator feed tanks, and then to evaporators (**Figure 9**). From the evaporators the tomato paste goes to either the kitchen mixing tanks or the flash cooler-paste box fill section. There are 7 PFTs, 6 evaporators and 14 pulper systems. **Figure 10** shows four PFTs and 8 pumping motors. High efficiency motors are used to move tomato products through this section and back to the kitchen section. The boiler was moved from Lodi, but the old 300-hp 88% efficient supply air motor was replaced with a 250-hp 96.2% efficient motor and the old 50-hp 84% efficient exhaust air motor was replaced with a 30-hp 90.2% efficient motor.

Measure Description	Qty.	KW Savings
Efficient Motors w/VFD	50	48
Computer VFD Controls	50	43
Boiler Motor Upgrade	2	107
Subtotal Savings		198

Figure 9. Evaporator Section

Figure 10. PFT Section

6b) Kitchen Mixing Tank Section. Tomato product goes from the evaporator section to one of fourteen kitchen mix systems where it is combined with herbs and spices and mixed into sauce, paste, and juice. (**Figure 11**). There are 32 tanks and 15 mixing tanks in the kitchen. Four 4 motors were upgraded to high efficiency motors used to mix tomato products in the kitchen (i.e., 2 10-hp and 2 15-hp motors). All seventeen motors in the kitchen are computer controlled to increase production and efficiency.

Measure Description	Qty.	KW Savings
Efficient Motors w/VFD	4	7
Computer Controls	17	15
Subtotal Savings		23

Figure 11. Kitchen Mixing Tanks

6c) Kitchen Pump Section. There are 32 tanks and 17 are supply tanks as shown in **Figure 12**. There are 17 pumps (15 are VFD motors). This section was upgraded to computer controls and VFD motors used to pump processed tomato product from the kitchen to the production lines. Computer controlled flow of the tomatoes reduces energy use and increases efficiency and throughput.

Measure Description	Qty.	KW Savings
Computer VFD Controls	17	22
Subtotal Savings		22

Figure 12. Kitchen Pumps

7) De-palletizer Section. Tin cans are supplied to the facility in the de-palletizer section. The de-palletizer section sends cans to the product fill bowl sections. There are 12 de-palletizers as shown in **Figure 13**. This section has fifteen 1-hp and thirty 1.5-hp conveying motors. High efficiency motors and controls are installed on each de-palletizer. Savings are based on new design/layout and computer controlled flow of cans that reduces energy use and increases efficiency and throughput.

Measure Description	Qty.	KW Savings
Efficient Motors w/VFD	45	9
Computer Controls	45	7
Subtotal Savings		16

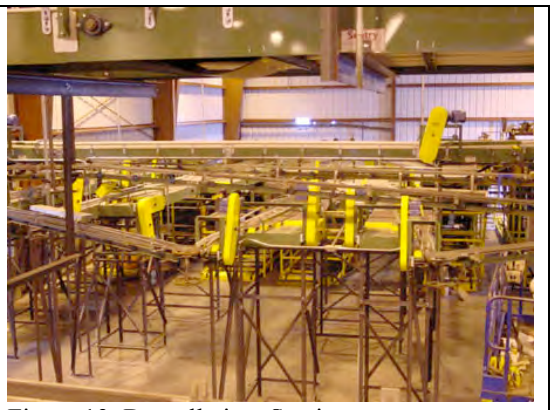

Figure 13. De-palletizer Section

8a) Product Fill and Close Section. Tomatoes go from the automatic sorter section to the product fill and close section. There are seven product fill and close production lines in this section. Six of them have been improved from 250 cans/minute to 400 cans/minute. The seventh is a high-speed canning line that has been improved to 1,000 cans per minute (see **Figure 14**). Computer controlled flow of the tomatoes reduces energy use and increases efficiency and throughput.

Measure Description	Qty.	KW Savings
Efficient Motors w/VFD	21	TBD
Computer Controls	21	TBD
Subtotal Savings		TBD

Figure 14. High Speed Canning Line.

8b) Paste Fill and Closed Section. Tomato product (i.e., sauce, paste, juice) goes from the kitchen to the paste fill and closed section as shown in **Figure 15**. There are 12 product lines. Efficiency has been increased from 250 cans/minute to 400 cans/minute. Savings are based on the new computer controls, shorter conveyor sections (reducing installed hp by 16%), and new high efficiency motors.

Measure Description	Qty.	KW Savings
Efficient Motors	21	6
Computer Controls	21	16
Subtotal Savings		22

Figure 15. Product Fill and Close Section

8c) Rotel Section. Tomatoes or tomato products enter the Rotel section from either the automatic sorter or the kitchen. There are two Rotel lines. Two feed elevators were upgraded to high-efficiency The Rotel section was redesigned to reduce the number and size of motors. New efficient heaters were installed and new computer controls allow increased production and improved efficiency.

Measure Description	Qty.	KW Savings
Efficient Motors w/VFD	2	3
Computer Controls	18	8
Subtotal Savings		11

Figure 16. Rotel Section

9) Cooker Section. Processed or canned tomatoes finally enter the cooker section where they are cooked. There are 21 cookers and properly sized high efficiency VFD motors and controls are installed on each cooker. Computer controlled flow of the tomatoes reduces energy use and increases efficiency and throughput.

Measure Description	Qty.	KW Savings
Efficient Motors w/VFD	21	39
Computer Controls	21	4
Subtotal Savings		43

Figure 17. Cooker Section

10) Cooler Section. Once cooked the canned tomatoes enter the cooler section. There are 19 coolers and properly sized high efficiency VFD motors and controls are installed on each cooler. Computer controlled flow of the tomatoes reduces energy use and increases efficiency and throughput.

Measure Description	Qty.	KW Savings
Efficient Motors w/VFD	19	35
Computer Controls	19	3
Subtotal Savings		38

Figure 19. Cooler Section

11) Palletizing and Warehouse Section. Once cool canned tomatoes are palletized and then sent to warehouse storage. Efficiency and design improvements at Woodland allowed the removal of five 1-hp motors and five 1.5-hp motors. Computer controlled flow of the tomatoes reduces energy use and increases efficiency and throughput.

Measure Description	Qty.	KW Savings
Removed Motors	10	16
Computer Controls	28	10
Subtotal Savings		26

Figure 20. Palletizing and Warehouse Section

Schedule of Key Dates
Full implementation of the project will be completed by July 2002.

Variability in Schedule and Production: The facility operates four months per year during the tomato harvest season with maintenance operations during the remainder of the year.

Square Footage of Affected Area: The affected production area is 85,500 square feet.

Historical Energy Use and Savings
In 2001, Pacific Coast Producers processed 29,320,474 cases of tomatoes with 18 production lines and electrical consumption was 6,634 kW and 11,944,410 kWh (see **Table 2**, 2001 Lodi kWh and kW).

Table 2. Historical Billing Data for Lodi in 2001[3]

Month	Account 16488-9 kWh	Account 16487 kWh	Account 32243-8 kWh	Account 16488-9 kW	Account 16487 kW	Account 32243-8 kW	2001 Lodi kWh	2001 Lodi kW
June	638,400	91,920	17,520	1,579	482	50	747,840	2,111
July	1,368,000	253,530	220,080	3,934	1,698	752	1,841,610	6,384
August	2,800,800	1,154,640	542,640	4,097	1,738	799	4,498,080	6,634
September	2,071,200	1,100,160	545,520	3,972	1,725	807	3,716,880	6,504
October	760,800	258,480	120,720	2,287	1,613	782	1,140,000	4,682
Total							**11,944,410**	**6,634**

Estimated Savings ("Bottom Up" Engineering Analysis)

"Bottom Up" Savings are based on comparing each section of the old Lodi facility to the new Woodland facility in terms of number of measures installed at each section (i.e., motors, motor efficiencies, motor drives, controls, and other measures). An overview of the "bottom up" analysis is described above. A detailed spreadsheet is being developed and will be provided at a later date.

Estimated Savings ("Top Down" Engineering Analysis)

In 2002, Pacific Coast Producers plans to process 41,200,00 cases of tomatoes at Woodland using 21 production lines. PCP Plant Engineer, Robin Dodson, has estimated that the Woodland facility will use 0.34075 kWh/case compared to 0.40737 kWh/case at Lodi in 2001.[4] This represents a 16.4 percent efficiency improvement that is also applied to peak demand based on the measures that are being installed (i.e., high efficiency VFD motors, helical gear drives, computer controls, and efficient lighting. Assuming the Woodland production efficiency for the 18 lines at Lodi provides the estimated 2002 usage of 5,549 kW and 9,991,048 kWh (see **Table 3**, column E and F). Estimated savings are 1,085 kW and 1,953,362 kWh (see **Table 3**, column G and H).

[3] Historical electricity use is based on actual 2001 billing data from City of Lodi Electric Utility, revised 5-20-02, Bill Schmer, Lodi Electric.

[4] Mr. Dodson's estimated energy intensity for Woodland of 0.34075 kWh/case is based on engineering estimates of the annual energy use of 14,039,036 kWh/yr for the as-built production equipment and product throughput of 41,200,000 cases/yr.

Table 3. Estimated kWh and kW Savings in 2002[5]

	A	B	C	D	E	F	G = E - A	H = F - B
Month	**Lodi kWh**	**Lodi kW**	**2001 Lodi Cases**	**2002 Woodland Cases**	**2002 Lodi Assuming Woodland Efficiency kWh**	**2002 Lodi Assuming Woodland Efficiency kW**	**2002 Savings kWh**	**2002 Savings kW**
June	747,840	2,111	1,835,756	0	0	0	1,835,756	2,111
July	1,841,610	6,384	4,520,682	8,931,822	2,165,977	5,340	-324,367	1,044
August	4,498,080	6,634	11,041,637	15,515,283	3,762,474	5,549	735,606	1,085
September	3,716,880	6,504	9,123,991	12,820,680	3,109,030	5,440	607,850	1,064
October	1,140,000	4,682	2,798,409	3,932,216	953,567	3,916	186,433	766
Total	**11,944,410**	**6,634**	**29,320,474**	**41,200,000**	**9,991,048**	**5,549**	**1,953,362**	**1,085**

"Top Down" Algorithms for Estimating Energy Savings for Paid Measure

Estimated savings are based on the overall electricity use per case (EUPC) of 0.34075 kWh/case at Woodland compared to 0.40737 kWh/case at Lodi in 2001. This represents a 16.4 percent efficiency improvement that is also applied to peak demand based on the measures that are being installed (i.e., high efficiency VFD motors, helical gear drives, computer controls, and efficient lighting). The EUPC of each facility is calculated as follows.

$$\text{EUPC}_{\text{Lodi}} = \frac{11{,}944{,}410\ \text{kWh}}{29{,}320{,}474\ \text{cases}} = 0.40737\ \text{kWh/case}$$

$$\text{EUPC}_{\text{Woodland}} = \frac{14{,}039{,}036\ \text{kWh}}{41{,}200{,}000\ \text{cases}} = 0.34075\ \text{kWh/case}$$

The ratio of these energy use indices provides the efficiency improvement of 16.4 percent.

$$\text{Efficiency Improvement} = 1 - \left[\frac{0.34075\ \text{kWh/case}}{0.40737\ \text{kWh/case}}\right] = 16.3537\ \text{percent}$$

The efficiency improvement of 16.4 percent at Woodland is applied to the historical billing data for Lodi in year 2001 to estimate the normalized kWh and kW savings as follows.

$$\text{kWh Savings} = 11{,}944{,}410\ \text{kWh/yr} \times 0.163537 = 1{,}953{,}362\ \text{kWh/yr}$$

$$\text{kW Savings} = 6{,}634\ \text{kW} \times 0.163537 = 1{,}085\ \text{kW}$$

[5] Estimated savings are based on actual 2001 billing and production data and estimated 2002 billing and production data for Woodland assuming 18 production lines (same as Lodi). Woodland is installing 21 production lines. The estimated production is 41.2 million cases of tomatoes at Woodland in 2002.

M&V Plan

The proposed M&V plan includes two options as per the International Performance Measurement & Verification (IPMVP) Protocols.[6]

1. "Bottom up" M&V Plan

The "bottom up" M&V plan will be based on IPMVP Option A. Savings will be determined by short-term or continuous field measurements of measure-specific energy use, separate from facility energy use. Partial measurement means that some parameters will be stipulated (i.e., hours of operation). Measurement and verification of the design and installation of the measures will ensure that stipulated values fairly represent probable actual values. Savings will be based on comparing the old Lodi facility to the new Woodland facility in terms of number of motors, motor efficiencies, motor drives, controls, and other measures installed at each section of both facilities.

2. "Top Down" M&V Plan

The "top down" M&V plan will be based on IPMVP Option C – Whole Facility analysis will be used to determine savings by measuring production and energy use at the whole facility level. Short-term or continuous measurements will be taken throughout the post-retrofit period and savings will be based on total production (i.e., cases of tomatoes) and total electricity use and peak demand for the 2002 harvest and canning season (i.e., months of July through September).

Savings Persistence

The expected lifetime for the new production facility is 20 years.

[6] See *International Performance Measurement & Verification Protocols*, DOE/GO-102000-1132, October 2000.

ATTACHMENTS

1. City of Lodi Electric Utility Department 2001 Historical Billing Data for PCP

CITY COUNCIL

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Mayor

PHILLIP A. PENNINO,
Mayor Pro Tempore

SUSAN HITCHCOCK

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ELECTRIC UTILITY DEPARTMENT

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City Manager

RANDALL A. HAYS
City Attorney

SUSAN J. BLACKSTON,
City Clerk

2001 Historical Billing Data for Pacific Coast Producers Lodi Tomato Processing Facility

Month	Account 16488-9 kWh	Account 16487 kWh	Account 32243-8 kWh	Account 16488-9 kW	Account 16487 kW	Account 32243-8 kW	2001 Lodi kWh	2001 Lodi kW
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October	760,800	258,480	120,720	2,287	1,613	782	1,140,000	4,682
Total							**11,944,410**	**6,634**

SB5X Agriculture Inspection Form

Project Name: Onsite Energy – Pacific Coast Producers (PCP)
Date: 5/10/02
Address: Pacific Coast Producers
City: 1376 Lemen Ave.
Zip: 95776
Contact: Woodland, CA
Inspected by: Ron Allen, Onsite Energy, Robert Mowris, Robert Mowris Ass.
Randy McCall, Nexant, Inc.

Equipment

Component	Status	Meter	Nameplate data and notes
Complete overhaul of existing, but shut - down tomato processing plant. High efficiency equipment, controls, VFDs, right sized motors, new more efficient motors, elimination of hydraulic drive systems, daylighting, and daylighting controls. See Pre-M&V Evaluation Report from Robert Mowris and Associates for details of specific measures.	■ completed ■ being installed ■ not installed	❑ yes ■ no	This project is a comprehensive retrofit of an existing tomato processing plant in Woodland that has been shut down for a number of years. Pacific Coast Producers is shutting down their facility in Lodi and refurbishing the Woodland facility for various reasons. Demand savings for this project are the result of more efficient electrical equipment, right sizing of equipment motors, reductions in hydraulically powered equipment, increased use of daylighting for the production floor along with daylight controls, and installation of VFDs for various process loads where appropriate. The Woodland plant will have a higher capacity for tomato processing, with a reported increase of approximately 62%. The case for demand savings at the newly refurbished Woodland plant is based on the energy use and demand required for production of a unit of product. Overall demand savings are calculated on the basis of the Lodi plant's historical production rate.

Meter data

Component(s) is metered separately ❑ yes ■ no **If yes, by:** ❑ utility ❑ participant ❑ other _____

Data available ■ yes ❑ no

Type of data ■ TOU ❑ 15min ❑ run time ■ other **Utility billing data from Lodi Electric (three accounts)**

Source of data ■ utility ❑ participant ❑ other _____

Contact for data: Rich Freitas, PCP Woodland Ph# 530-661-7611 Email address n/a

Notes:

A site inspection for the new PCP Woodland facility was conducted on May 10, 2002 along with Robert Mowris, PE of Robert Mowris & Associates, and Ron Allen, representative for Onsite Energy. The plant engineer, Robin Dodson accompanied the group through the plant for much of the inspection. The inspection included visual inspections of all affected parts of the plant, however much of the plant was still under construction, and spot measurements of new equipment was not possible.

The inspection was conducted in the order of the Pre-M&V Evaluation report prepared by Robert Mowris for PCP. At each portion of the process, the various components to be installed were discussed along with the current status of the construction. Various pictures of the facility and current status of the project are attached below.

Figure 1: Control room and computers for optimization of plant processes.

Figure 2: Worker installing Toshiba VFD for kitchen Section process motor.

Figure 3: Kitchen tank and new high Efficiency motor for mixers

Figure 4: Todd Boiler – VFD control for FD fan.

Figure 5: Palletizing section will have lighting controls/high efficiency motors.

Figure 6: Kitchen pumps with VFD controls.

Figure 7: High-speed product close and fill section.

Figure 8: High speed canning machine.

Figure 9: Computer controls for kitchen section drives, motors, and tanks.

Figure 10: Can cooker – VFD controlled.

Figure 11: Can Cooler – VFD controlled.

Onsite Project: Bonita Packing Company

SB5X Agriculture Inspection Form

Project Name: Onsite Energy projects, APLRP — Date: 5/22/03
Address: Bonita Pak Foods
City: Santa Maria, CA — Zip: _____
Contact: Don Hladun
Inspected by: Randy McCall

Equipment

Component	Status	Meter	Nameplate data and notes
Powerit load controls	❑ completed installed ❑ being installed ■ not installed	■ yes ❑ no	Load control hardware and software to limit peak demands of facility through unloading or turning off selected equipment in response to predicted 5 minute average peak loads from monitoring of facility meters.
Cooling tunnel fan VFDs	❑ completed installed ❑ being installed ■ not installed	❑ yes ■ no	There are 16 separate cooling tunnel fans for cooling produce with air. Fresh vegetables are lined up on pallets in the cooling tunnel area, tented over the top with a fabric, after which cool air from the evaporators are drawn through the built up stack of produce. The proposed measure is to install VFDs on each of the 16 cooling tunnel fan motors to lower the air velocity as the cooling process is completed. Eight of the existing ducted fans has a 20 hp motor, and the second set are equipped with 25 hp motors, however none could be verified due to lack of operations during the morning inspection, and need to dismantle shrouds to examine the nameplate data for the motors.

Meter data

Component(s) is metered separately ❑ yes ■ no **If yes, by:** ❑ utility ❑ participant ❑ other _____

Data available ■ yes ❑ no

Type of data ❑ TOU ■ 15min ❑ run time ❑ other __**15minute interval data from utility meters**

Source of data ■ utility ❑ participant ❑ other _

Contact for data __Don Hladun, Onsite Energy__ Ph# 925 - 358 - 4270_ **Email address dgHladun@aol.com**

Spot meter readings taken ❑ yes ■ no

Component #1 readings _____ _____ _____ Notes__ Potentially controllable loads were verified during inspection for nameplate information. Load data will be gathered from post-installation Powerit reports.

Component #2 readings _____ _____ _____ Notes_ Cooling tunnels could not be dismantled for visual verification, and all tunnels were idle during inspection.

Component #3 readings _____ _____ _____ Notes_____

Randy McCall, of Nexant, Inc., conducted a post-installation site inspection at Bonita Pak Foods in Santa Maria, CA on May 22, 2003 in order to verify the baseline conditions for installation of the Powerit load control equipment at the facility. In attendance for the inspection were Mr. McCall, Don Hladun from Onsite energy, Mathias Christelius from Powerit, and facility engineering staff from Del Mar Foods.

A stand along PC will be set up in the engineering office to control the Powerit software system. The software program is provided with pulse signals from the facility utility meter that are used to predict an average five-minute demand for the facility. If the predicted interval is likely to exceed the user-defined threshold for control action, the software sends signals to controllable loads to either turn off select motors, run at part loads. The equipment to be controlled was previously identified during the pre-installation phase by Mathias Christelius, Powerit's field engineer for implementation, and includes loads that will not adversely affect the production at the food processing plant. Once the Powerit software decides it needs to take action to control a five minute average window for loads, it will send signals to individual pieces of equipment that have been equipped with communications gear and actuators that allow for the remote control. Equipment is listed by priority in the software, on a custom basis for each facility and customer.

At Bonita Packing, Inc., Onsite Energy and Powerit are expecting to control approximately 150 to 200 kW of peak load out of a total estimated 989 kW of potential load from the controllable equipment in the cold storage side of the facility. Similarly, approximately 200 kW of load control savings are expected from the 1234 kW of controllable loads on the processing side of the plant. Photographs of the facility are shown below.

Figure 1: Typical pressure cooling tunnel proposed for VFDs

Figure 2: Engine room and ammonia compressors

Figure 3: Evaporative towers at Bonita Pack.

Figure 4: Pressure Cooling Tunnels.

SB5X Agriculture Inspection Form

Project Name: Onsite Energy projects, APLRP — Date: 3/3/04
Address: Bonita Pak Foods
City: Santa Maria, CA — Zip: _____
Contact: Don Hladun
Inspected by: Randy McCall

Equipment

Component	Status	Meter	Nameplate data and notes
Powerit load controls	■ completed installed ❑ being installed ❑ not installed	■ yes ❑ no	Load control hardware and software to limit peak demands of facility through unloading or turning off selected equipment in response to predicted 5 minute average peak loads from monitoring of facility meters. Loads under control include refrigeration compressors, ice making equipment, VSD controlled pressure cooling tunnels, vacuum tube cooler
Bi-level and Tri-level HID lighting Controls	■ completed installed ❑ being installed ❑ not installed	❑ yes ■ no	Occupancy lighting controls have been installed for HID lighting throughout the cold storage areas and the loading dock. Baseline equipment consisted of a combination of 400W and 350W Metal Halide fixtures; a total of 152 fixtures were either replaced (48 350W MH fixtures were retrofit, 104 400W MH fixtures were replaced with 320W Pulse Start MH), or equipped with capacitors and bi- or tri- level lighting controls. In addition to the lighting controls savings, the new fixtures have been changed to use 320W pulse start lamps that are more compatible with the lighting controls, and provide efficiency savings .

Meter data

Component(s) is metered separately ❑ yes ■ no **If yes, by:** ❑ utility ❑ participant ❑ other _____

Data available ■ yes ❑ no

Type of data ❑ TOU ❑ 15min ❑ run time ■ other **__30minute interval data from utility meters, Powerit reports of control actions.**

Source of data ■ utility ❑ participant ❑ other _

Contact for data __Don Hladun, Onsite Energy__ Ph# 925 - 358 - 4270_ **Email address dgHladun@aol.com**

Spot meter readings taken ❑ yes ■ no

Component #1 readings _____ _____ _____ Notes__ Powerit load control equipment was verified during inspection. Load savings will be determined from Powerit load control reports, and historical utility billing data.

Component #2 readings _____ _____ _____ Notes_ HID lighting controls were verified as complete. Circuit monitoring data will be basis for demand savings from controls; lighting efficiency demand savings approved for 400W to 320W fixture replacement.
Component #3 readings _____ _____ _____ Notes_____

Randy McCall, of Nexant, Inc., conducted a post-installation site inspection at Bonita Packing Company in Santa Maria, CA on March 3, 2004. The inspector verified the installation of the Powerit load control equipment at the facility, and bi- or tri-level HID lighting controls. In attendance for the inspection were Mr. McCall, Don Hladun from Onsite Energy Corporation, and facility engineering staff from Bonita Packing Company.

A stand along PC has been set up in the engineering office to control the Powerit software system. The software program is provided with pulse signals from the facility utility meter that are used to predict an average five-minute demand for the facility. If the predicted interval load is likely to exceed the user-defined threshold for control action, the software sends signals to either turn off select motors, or run equipment at part loads. The equipment to be controlled was previously identified during the pre-installation phase by Mathias Christelius, Powerit's field engineer for implementation, and includes loads that should not adversely affect the production at the produce processing facility. Once the Powerit software decides it needs to take action, it will send signals to individual pieces of equipment that have been equipped with communications gear and actuators that allow for the automated remote control. Equipment is listed by priority in the software, on a custom basis for each facility and customer.

During the inspection, various relay boxes to control the refrigeration and motor loads were noted as installed and functioning. The facility was operating at a very low level of activity during the inspection, therefore, no control actions were observed outside of facility staff driven tests of system response that were demonstrated for the inspector on the Powerit graphical user interface.

The lighting controls were also observed to be complete, with new fixture installations in the loading dock area, and retrofits of the existing fixtures throughout the remaining cold storage areas. No details were provided on the locations of bi-level vs. tri-level lighting controls (bi-level refers to half power and full power, tri- level refers to off, half power, and full power to an individual fixture). Two types of fixture retrofits were completed for the project. In the loading dock area, all 48 of the existing 350W fixtures were equipped with only the lighting controls. Throughout the cool storage and pressure tunnel areas, the 104 existing 400 W MH fixtures were replaced with 320 W Pulse Start Metal Halide fixtures equipped with lighting controls.

Photographs of the lighting fixtures, and Powerit controls equipment are attached below:

Figure 1: Loading dock area with new 350W pulse start Metal Halide fixtures and bi-level controls.

Figure 2: Powerit load control box located in trailer next to vacuum tube cooler (voluntary permissive control).

Figure 3: Powerit Controls for icemaking Equipment.

Onsite Project: P&O Cold Storage

Nexant

POST INSTALLATION INSPECTION

101 Second Street, 11th Floor. • San Francisco, CA 94105-3672

To: Randy McCall
From: Joseph Lee Ong
Date: April 9, 2004
Re: 2004 CEC Peak Load Demand Reduction Program: P&O Cold Logistics

The purpose of the inspection conducted April 8, 2004 at the P&O Cold Logistics facilities in Anaheim and Brea was to verify the operational conditions and equipment status of the newly installed *Powerit Solutions*™ Energy Director processor/controller used to supervise site power demand levels and execute load reduction actions during peak utility intervals to ensure peaks are managed within user defined limits.

Present during the inspection process were:

Ron Allen	Onsite Energy
Mattias Christelius	Powerit Solutions
Joseph Lee Ong	Nexant, Inc.

During the inspection, the inspector was shown the Energy Director unit at each site, as well as the PLC panel which controls the refrigeration compressors and evaporators. In addition, banks of battery chargers were hooked up to the system as well. The current kWh set points at Anaheim and Brea at the time were 580 kWh per 30 minutes and 120 kWh per 15 minutes intervals, respectively. However, the final set point for both sites are still being fine tuned since those points are apparently still too high and further reduction is possible without disruption of plant operation. Each control point can be remotely monitored in real-time, on site through a laptop or a PC hooked up to the internal network, or directly interfaced with the Energy Director in the panel. Test action was initiated at both sites and the resulting drop in demand can be clearly observed (see Figure 5 below) as the system compensates for the drop in kWh set point and a number of control points were turned off until the calculated average kW in that 30 or 15 minute interval drops below the defined limit.

Pictures

Figure 1 - Field bus unit (Energy Director and relay switches) at Anaheim.

Figure 2 - PLC which controls various refrigeration components at Anaheim.

Figure 3 - Battery charger relays (top) and PLC panel at Anaheim.

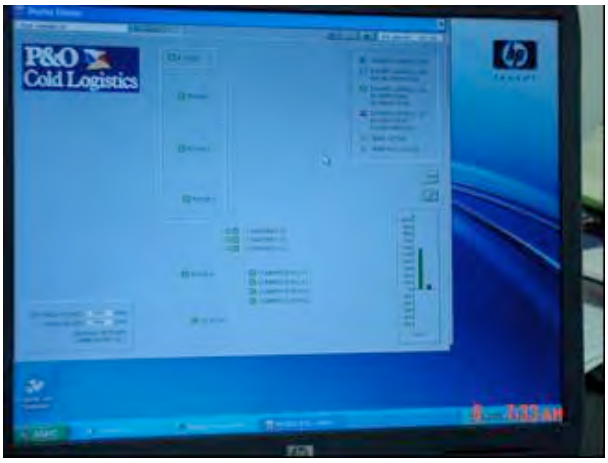


Figure 4 - Screen shot of the control points and the demand control status of each at Anaheim.

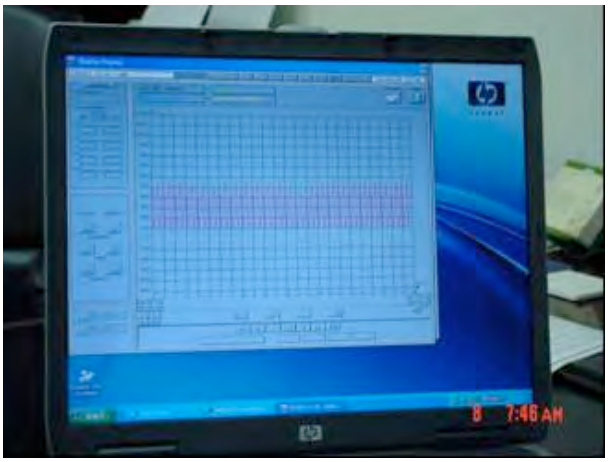


Figure 5 - 24-hour snapshot of the kW demand profile and set point at the Anaheim site.

Figure 6 - Field bus unit controlling the high and low stages of each compressors at Brea.

Figure 7 - Brea site relays and communication port for the evaporator air units at 4 zones.

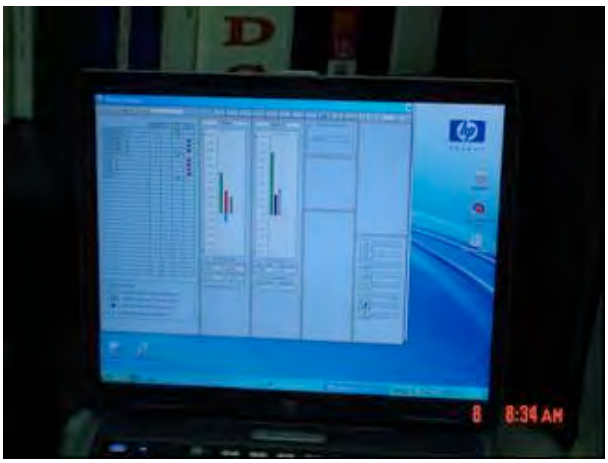


Figure 8 - Screen shot of the status screen for the entire P&O facility at Brea.

Nexant

POST INSTALLATION INSPECTION

101 Second Street, 11th Floor. • San Francisco, CA 94105-3672

To: Randy McCall
From: Joseph Lee Ong
Date: May 19, 2004
Re: 2004 CEC Peak Load Demand Reduction Program: P&O Cold Logistics - La Habra

The purpose of the inspection conducted May 19, 2004 at the P&O Cold Logistics in La Habra was to verify the operational conditions and equipment status of the newly installed *Powerit Solutions*™ Energy Director processor/controller used to supervise site power demand levels and execute load reduction actions during peak utility intervals to ensure peaks are managed within user defined limits.

Present during the inspection process were:

Ron Allen	Onsite Energy
Joseph Lee Ong	Nexant, Inc.

During the inspection, the inspector was shown the Energy Director unit as well as the relay panel from which all the controlled equipments are hardwired into. There were a total of 10 control points for this site which includes three (3) boosters, two (2) air compressors, three (3) freezer zones, cooler and the front dock. Each control point can be remotely monitored in real-time, on site through a laptop or a PC hooked up to the internal network, or directly interfaced with the Energy Director in the panel. All points were active at the time of the inspection.

The current set point was 65 kWh per 15 minute interval. No test actions to determine the system response to changes in the setpoint have been initiated to date.

Pictures

Figure 9 - Refrigeration compressor (engine) room.

Figure 10 - Powerrit Energy Director and communication ports.

Figure 11 - Relay box where all equipment controlled zre hardwired into.

Figure 12 - Screen shot of the active control points and the current set point.

Nexant

POST INSTALLATION INSPECTION

101 Second Street, 11th Floor • San Francisco, CA

Onsite Energy – P & O Cold Logistics

Date: 5-20-04
To: Shawn Espinoza
From: Ken Gonzales
Re: Post Installation Inspection of Vernon Facilities

The purpose of the inspections conducted on May 19, 2004 was to verify the installation of the PowerIt Energy Director load management systems at two of P & O Cold Logistics Southern California sites. The P & O Cold Logistics sites were both within in the City of Vernon. The addresses for the two facilities were 2851 44th St. (Plant #1) and 3420 East Vernon (Plant #2).

2851 44th St.: Present for the inspection was Ron Allen of Onsite Energy, Elizabeth Lowe of Onsite Energy, Robert Bogataj of PowerIt Solutions, Bob Johnson of P & O Cold Logistics and Ken Gonzales of Nexant. The load management system has been installed and the computer interface is active. Mr. Bogataj gave a quick presentation of how the system is designed and showed that it is operating. Mr. Bogataj stated that the load management system has been operating for approximately two weeks. Based on the dates shown on the 'history' screen of the system, the system has been operating at for at least two weeks.

3420 East Vernon St.: Present for the inspection was Ron Allen of Onsite Energy, Elizabeth Lowe of Onsite Energy, Robert Bogataj of PowerIt Solutions, Bob Johnson of P & O Cold Logistics and Ken Gonzales of Nexant. The load management system has been installed and the computer interface is active. Mr. Bogataj gave a quick presentation of how the system is designed and showed that it is operating. Mr. Bogataj stated that the load management system has been operating for approximately three (3) days.

Please refer to the attached photos for supporting evidence of the installation.

Based on the results of the inspection, the project passed the post installation inspection.

2851 44th St. (West Bldg.)

2851 44th St. (West Bldg.)

2851 44th St. (East Bldg.)

3420 East Vernon

Nexant

POST-INSTALLATION INSPECTION

101 Second Street, 11th Floor • San Francisco, CA

Southern California Edison NSPC 2004

Onsite Energy – P & O Cold Logistics

Date: 4-8-04
To: Shawn Espinoza
From: Ken Gonzales
Re: Post Installation Inspection of Dominguez Hills and Carson sites

The purpose of the inspection conducted on April 8, 2004 was to verify the installation of the Poweritt Energy Director load management systems at two of P & O Cold Logistics Southern California sites. The P & O Cold Logistics sites that were visited for these inspections were: 19840 Rancho Way, Compton (Dominguez Hills) and 1610 E. Sepulveda Blvd., Carson.

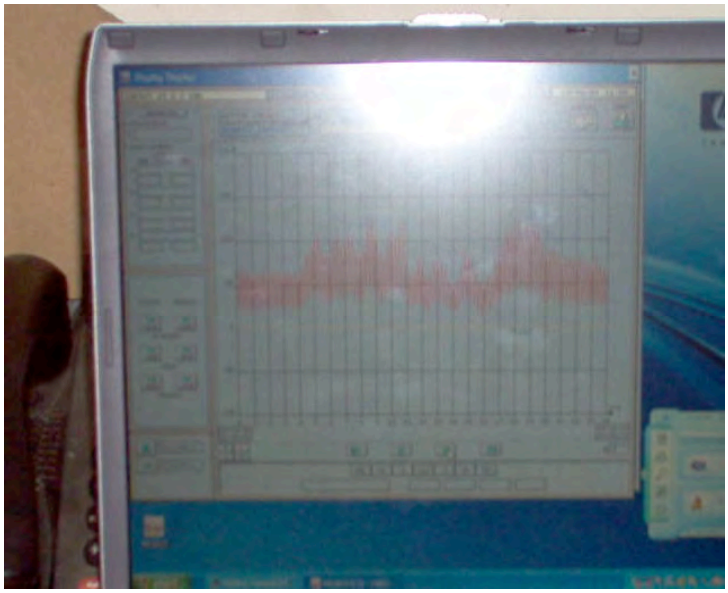
19840 Rancho Way: Present for the inspection was Ron Allen of Onsite Energy, Mattias Christelius of Powerit Solutions and Ken Gonzales of Nexant. The load management system has been installed and the computer interface is active. Mr. Christelius gave a quick presentation of how the system is designed and showed that it is operating. Mr. Christelius had two computers operating at the time of inspection. One computer was designated for the Dominguez Hills site, while the other was designated for the Carson site. Mr. Christelius was able to control/make changes for the Carson site from this computer.

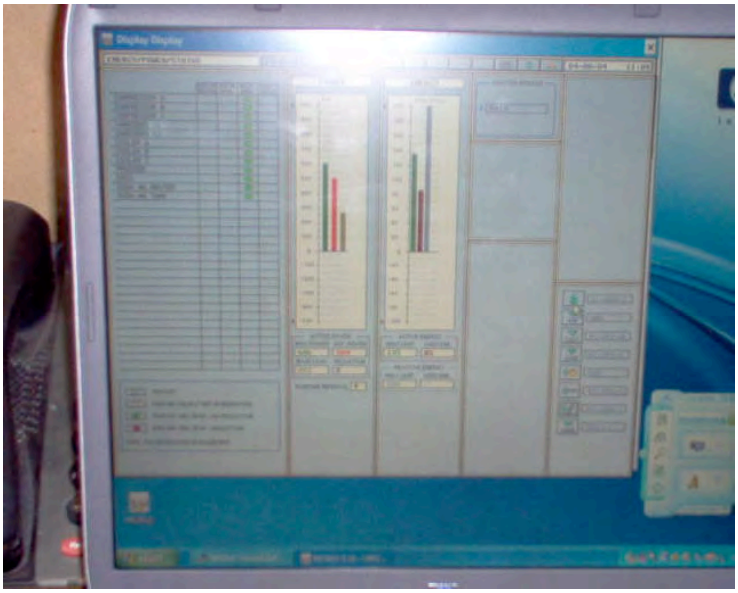
1610 E. Sepulveda Blvd.: Present for the inspection was Ron Allen of Onsite Energy and Ken Gonzales of Nexant. The load management system has been installed and the computer interface is active.

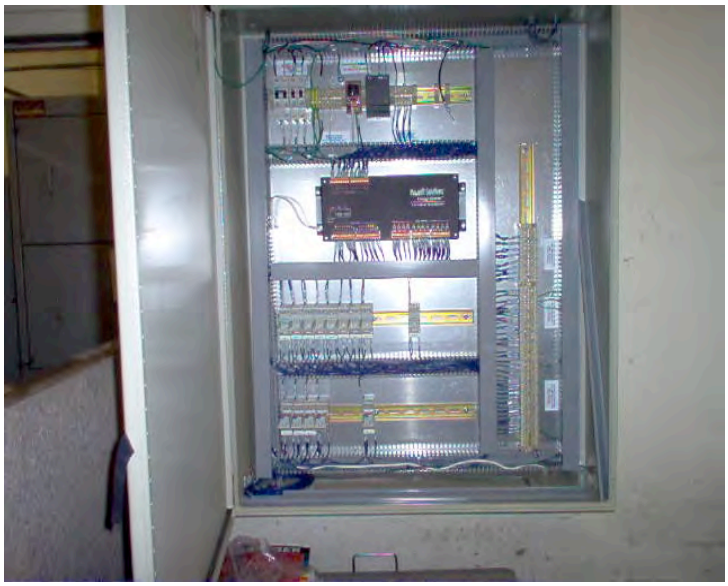
Please refer to the attached photos for supporting evidence of the installation.

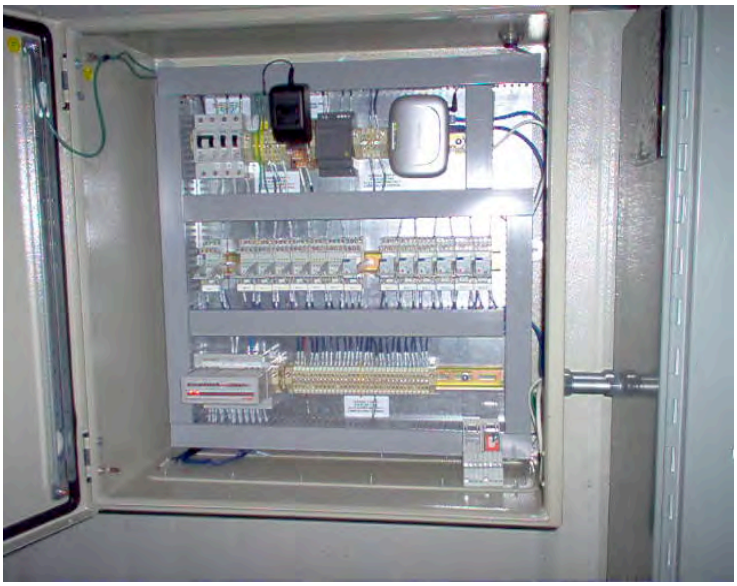
Based on the results of the inspection, the project passed the post installation inspection.

Dominguez Hills Facility

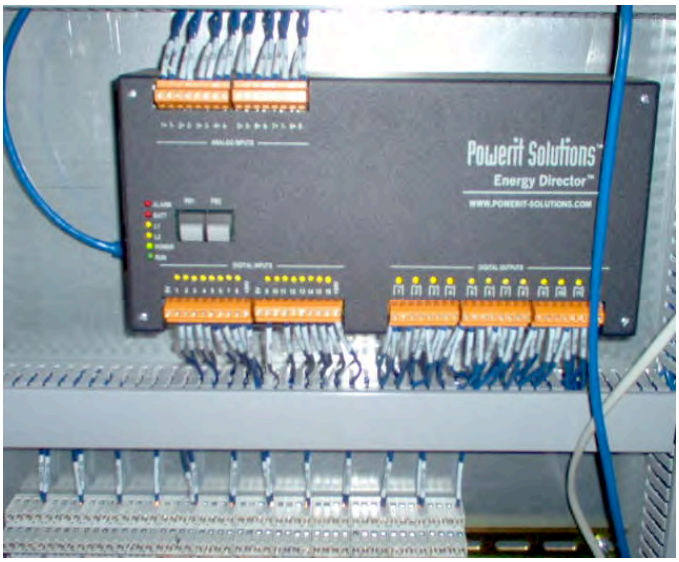


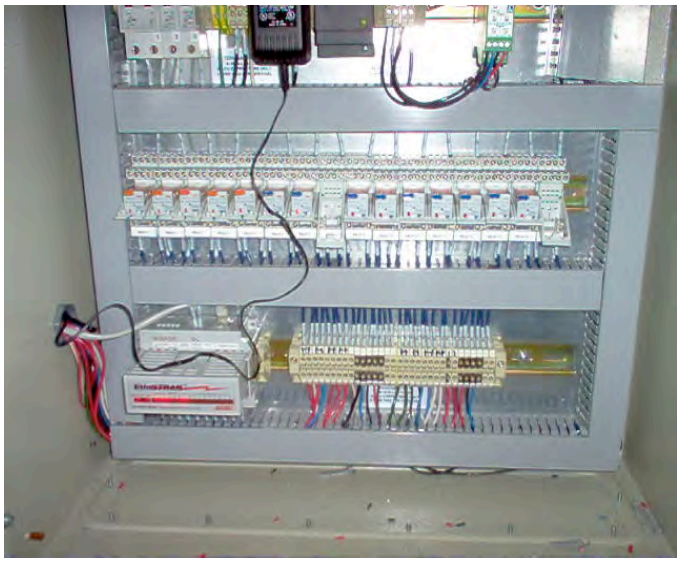






Carson Facility





Onsite Project: Del Monte, Hanford

Nexant

POST INSTALLATION INSPECTION

101 Second Street, 11th Floor. • San Francisco, CA 94105-3672

To: Randy McCall
From: Joseph Lee Ong
Date: April 28, 2004
Re: 2004 CEC Peak Load Demand Reduction Program: P&O Cold Logistics & Frito-Lay - Rancho Cucamonga

The purpose of the inspection conducted April 28, 2004 at the P&O Cold Logistics facilities (Buildings 14840 and 14890 Procter) in City of Industry and Frito-Lay in Rancho Cucamonga was to verify the operational conditions and equipment status of the newly installed *Powerit Solutions*™ Energy Director processor/controller used to supervise site power demand levels and execute load reduction actions during peak utility intervals to ensure peaks are managed within user defined limits.

Present during the inspection process were:

Ron Allen	Onsite Energy
Mattias Christelius	Powerit Solutions
Joseph Lee Ong	Nexant, Inc.

P&O Cold Logistics - Industry

During the inspection, the inspector was shown the Energy Director unit at each site, as well as the PLC panel which controls the refrigeration compressors and evaporative coolers at the P&O Industry sites. There are four (4) compressors, 1 dock and 1 room with 4 zones controlled at the 14890 Proctor, while there are nine (9) compressors, four (4) freezers, and three (3) cooler rooms controlled at 14840 Proctor. In addition, four (4) groups of battery chargers consisting of about 30 to 40 stations were hooked up to the system at the P&O 14840 Proctor as well. Each control point can be remotely monitored in real-time, on site through a laptop or a PC hooked up to the internal network, or directly interfaced with the Energy Director in the panel.

The kWh set points at the P&O sites have not yet been set at the time of the inspection and the systems were still undergoing testing and tune ups. The peak demand at the 14890 and 14840 Proctor for the past 24 hours have been 75 kWh and 200 kWh per 15 minute interval, respectively. No test actions have been initiated at both sites to date.

Frito Lay - Rancho Cucamonga

The inspector was shown the Energy Director unit, remote I/O panels, and the motor control centers that control various rooftop units and evaporative coolers at Frito-Lay. Demand setpoint is currently set at 475 kWh per 15 minute interval. There are a total of about 13 roof top package units and 24 evaporative coolers that are being controlled in the facility.

P&O Pictures

Figure 13 - Field bus unit (Energy Director and relay switches) at P&O Cold Logistics - 14890 Proctor.

Figure 14 - Screen shot of kW demand profile at P&O - 14890 Proctor.

Figure 15 - Screen shot of the control points and the demand control status of each at 14890 Proctor.

Figure 16 - Remote I/O unit and relays at 14840 Proctor.

Figure 17 - Ethernet hub, wireless link, remote I/O unit and relays at 14840 Proctor compressor room.

Figure 18 - Compressor room at 14840 Proctor.

Figure 19 - New high frequency battery chargers at 14840 Proctor.

Figure 20 - Old battery charging stations at 14840 Proctor.

Figure 21 - Field bus unit (Energy Director and relay switches) at P&O Cold Logistics - 14840 Proctor.

Figure 22 - Screen shot of kW demand profile at P&O - 14840 Proctor.

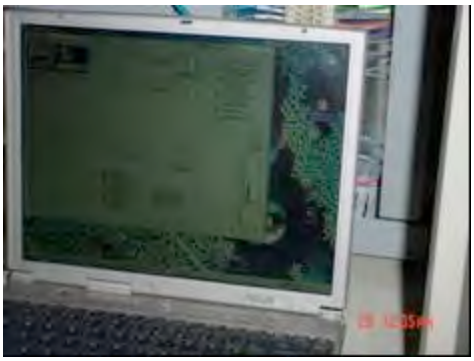


Figure 23 - Screen shot of the control points and the demand control status of each at 14840 Proctor.

Frito Lay Pictures

Figure 24 - Field bus unit (Energy Director and relay switches) at Frito lay

Figure 25 - Motor control center at Frito Lay.

Figure 26 - Screen shot of kW demand profile and kWh set point at Frito Lay.

Figure 27 - Screen shot of the control points and the demand control status of each at Frito Lay.

Nexant

POST-INSTALLATION INSPECTION

101 Second Street, 11th Floor • San Francisco, CA

Onsite Energy – P&O Cold Logistics, Modesto and Salinas

Date: June 1, 2004
To: Onsite Energy Corporation
From: Randy McCall
Re: Post Installation Inspection of P&O Cold Logistics Powerit Installations at Modesto and Salinas facilities

The purpose of the inspections conducted on May 24 and May 27, 2004 was to verify the installation of the Powerit Energy Director load management systems at the three Dreisbach facilities located in Richmond, Oakland, and Watsonville. Present for the inspections were Don Hladun from Onsite Energy Corporation. At all three facilities, the computer interfaces were installed on a local computer, and were active. At each facility the computer interface was accessed to demonstrate its functionality, and relay and control equipment were verified as installed.

P&O Cold Logistics - Salinas: The load management system has been installed and the computer interface is active. The load control objects shown on the computer interface include compressor controls for Fuller #1, Fuller #2, FES Low, FES High, York 1 and York 2, evaporator fans for cold rooms 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and Rooms F, 1, and 2. In addition, the Freon refrigeration systems #1 and 2 are also control load objects on the Powerit interface. At this time all but the FES High stage, York 1 and York 2 are active control points.

The Energy Director had been adjusted to a maximum load of 2000kW for Active Power during off peak hours, and 1350 kW during on peak hours. There are two utility meters that are interfaced with the Powerit equipment, both of which provide a signal in 30-minute windows.

A recorded set of kWh data from May 24 shows that the energy use per 30-minute window. No load control actions were evident as the overall kWh per 30-minute interval was significantly below the initial set point for load control action. Note that the facility was undergoing some maintenance activities in the yard and very low activity was observed at the facility during the inspection.

P&O Cold Logistics - Modesto The load management system was installed and the computer interface is active, however, training for the staff at the facility had not been completed, and Bob Zack from Powerit was configuring the system during the inspection. Load control set points at this time were 3600kW; Mr. Zack anticipated that the limit would drop as the more experience was gained for the system operations. The control system for P&O Cold Logistics, Modesto, is set up to control a number of control points spread out over a large area with seven separate warehouses. The facility has been converted to its current configuration from a previous plant that also supplied ice to another co-located facility. That facility was physically removed, consequently, there is a significantly oversized chilling

plant for the existing warehouse operations. The facility was originally built in the 1940's, and much of the equipment still in place dates from the early part of the facility operations.

The load points shown on the computer interface are not present in this report as the digital photographs of the facility and interface screens have been corrupted. There are seven separate rooms at the facility, some of which are controlled by the Powerit Energy Director through a combination of engine room compressor controls and evaporator fan controls; other areas are reportedly controlled only through evaporator fan controls as the facility staff are not sure that compressors can be brought back on line if the Powerit system puts them offline. Engine Room A has a Powerit Energy Director 4100 installed that controls engine rooms for 4 other rooms. The Evaporator fan controls were active during the inspection, however compressor loads controls were not turned on.

The Energy Director had been adjusted to a maximum load of 3600 kW for Active Power currently, however Mr. Zack indicated that the limits would be lowered as the facility became familiar with the limitations of the system and how it interacts with the different engine rooms.

The site inspection passed for both the Modesto and Salinas P&O Cold Logistics facilities. The digital photographs for Modesto and Salinas were corrupted and cannot be furnished in this report.

Onsite Project: Cool Pacific

SB5X Agriculture Inspection Form

Project Name: Onsite Energy projects, APLRP — Date: 7/24/03

Address: Cool Pacific Packing

City: 1160 Terven

Contact: Salinas, CA — Zip: 93901

Inspected by: Don Hladun

Randy McCall

Equipment

Component	Status	Meter	Nameplate data and notes
Powerit load controls	■ completed installed ❑ being installed ❑ not installed	■ yes ❑ no	Load control hardware and software to limit peak demands of facility through unloading or turning off selected equipment in response to predicted 5 minute average peak loads from monitoring of facility meters.

Meter data

Component(s) is metered separately ■ yes ❑ no **If yes, by:** ■ utility ■ participant ❑ other _____

Data available ■ yes ❑ no

Type of data ❑ TOU ❑ 15min ❑ run time ■ other **__5minute interval data for facility peak loads and control actions_____**

Source of data ❑ utility ❑ participant ■ other **_Andover software reports of load control actions**

Contact for data __Don Hladun, Onsite Energy__ Ph# 925 - 358 - 4270_ **Email address dgHladun@aol.com**

Spot meter readings taken ❑ yes ■ no

Component #1 readings _____ _____ _____ **Notes__Equipment control actions observed on graphical user interface for dedicated PC.**

Component #2 readings _____ _____ _____ **Notes**_____

Component #3 readings _____ _____ _____ **Notes**_____

Randy McCall, of Nexant, Inc., conducted a pre-installation site inspection at Cool Pacific Foods in Salinas, CA on July 24, 2003 in order to verify the baseline conditions for installation of an Andover EMS system that will provide load controls for flexible loads at the fruit and produce packing facility. In attendance for the inspection were Mr. McCall, Don Hladun from Onsite energy, and Chris Stubblefield from Cool Pacific.

None of the controls equipment had been installed prior to the inspection, and the purpose of the inspection was to verify nameplate information and loads likely to be included in the list of control points. Total load of the facility is reported to be approximately 1400 kW, with a peak billing of 1460 kW during summer peak period. Onsite Energy Corporation has indicated they are applying for approximately 300kW of load reduction through the project installations. No measurements of existing equipment were recorded during the inspection, as the Andover EMS system will be capable of providing reports on total load and controlled load once installation is complete.

While the final list of controllable loads has not yet been determined, the preliminary list of loads proposed for the Andover control system include evaporators and fans for seven cold storage rooms and the refrigeration compressors that serve them, a 200 ton capacity ice-making system and the associated 700 hp of reciprocating ammonia compressors, 11 battery chargers in a charging room, pressure cooling tunnels and their evaporator fans and coils, and a vacuum tube cooler. All load controls discussed with Chris Stubblefield and Don Hladun involve reductions in refrigeration system compressor use through relaxation of temperature controls for cold rooms, unloading of ice-making during peak periods, or shutting down of evaporators and evaporator fans for the cold rooms. While reductions in fan motors for evaporators will result in small savings, the majority of the savings for the project will result from unloading of ammonia system compressors, condensers, and associated pumps.

Figure 1: Trailer mounted engine room with 4 Mycom 150 Hp recips and one Vilters 100hp compressor.

Figure 2: Second trailer with Mycom and Vilters refrigeration compressors. Note cooling tower on rear of trailers.

SB5X Agriculture Inspection Form

Project Name: Onsite Energy projects, APLRP
Date: 1/13/04
Address: Cool Pacific Packing
City: 1160 Terven
Zip: 93901
Contact: Salinas, CA
Inspected by: Don Hladun, Onsite Energy
Randy McCall

Equipment

Component	Status	Meter	Nameplate data and notes
Andover; Infinity CMX240 EMS system for load controls	■ completed installed ❑ being ❑ not installed	■ yes ❑ no	Load control hardware and software to limit peak demands of facility through unloading or turning off selected equipment in response to predicted 3-minute average peak loads from monitoring of facility utility meters.

Meter data

Component(s) is metered separately ■ yes ❑ no **If yes, by:** ■ utility ■ participant ❑ other **Andover system uses utility meter data to predict peak kW for the facility.**

Data available ■ yes ❑ no

Type of data ❑ TOU ❑ 15min ❑ run time ■ other **__1 minute interval data for facility peak loads and control actions_____**

Source of data ■ utility ❑ participant ■ other **_Andover software reports of load control actions in response to Utility meter monitoring; Andover reports of peak demands on 3-minute and 15-minute average intervals.**

Contact for data __Don Hladun, Onsite Energy__ Ph# 925 - 358 - 4270_ **Email address dgHladun@aol.com**

Spot meter readings taken ❑ yes ■ no

Component #1 readings _____ _____ _____ **Notes__Andover EMS system equipment control actions observed on graphical user interface for dedicated PC. Current operations are too low to show control of peak loads.**

Component #2 readings _____ _____ _____ **Notes**_____

Component #3 readings _____ _____ _____ **Notes**_____

Randy McCall, of Nexant, Inc., conducted a post-installation site inspection at Cool Pacific Foods in Salinas, CA on January 13, 2004. In attendance for the inspection in addition to Mr. McCall, was Don Hladun from Onsite Energy Corporation, and Chris Stubblefield from Cool Pacific. The purpose for the inspection was to verify installation of the Andover load management system for the Cool Pacific facility.

The Infinity, CMX240 control module, manufactured by Andover Controls, was installed and functioning in the engineering office of the Cool Pacific facility. A software program, including a graphical user interface, has been installed on a PC that allows the facility personnel to assess the plant load conditions, change set points and control strategies, and record the facility load data for equipment throughout the plant.

The inspector was shown a page of control points for the system, the equipment set points and current conditions at the time of the inspection, as well as a report on kW demand for the plant on a 3-minute and 15-minute interval compared with the target demand. A copy of the overview screen is attached at the end of this report (a hard copy screen print was scanned for this report; data on the hard copy report is legible and consistent with expected results).

Equipment that is indicated on the overview screen includes the following:

Ice Machine: Screw Compressor 1, Screw Compressor 2, Condenser Fan 1 and Condenser Fan 2, Auger 1 & 2, Auger 3 and Auger 4; The Andover system is designed to unload the two 350 hp screw compressors for approximately 300kW in potential load control for the ice making system at Cool Pacific. The two screw compressors are currently dedicated to the ice making system, with the other compressor systems (listed below) providing liquid ammonia to the cold rooms and other process loads.

Cold Rooms: Trailer mounted Compressors R1-C1, R1-C2, R2-C1, R2-C2, R2-C3, and Compressor 1 and Compressor 2 (DX units); Evap fans for R-1 through R5, Evap fans for Zone 1 and Zone 2 in Room 6, and Evap fans for Room 7; Condenser fans R1-1, R1-2, R1-3, R2-1, R2-2, R2-3; Ammonia pump 1, Ammonia pump 2: Seven cold rooms are controlled by the Andover system. When called for, the temperature set points are raised, shutting down the evaporators and fans for approximately 100kW of potential load control action. Included in the calculation for cold rooms is the installation of VFDs for pressure cooling tunnels. The demand savings for the VFD's will be recognized under the PG&E Standard Performance Program, and will be subtracted from incentives paid under the CEC APLRP.

Hydrocooler: Controls for the two hydrocoolers are projected to provide approximately 50kW of potential load control. Compressors for the hydrocooler are described above.

Vacuum Tube: Vacuum pump 1 and Vacuum pump 2; Scheduling of the vacuum tube cooler is projected to provide up to 500kW of potential load control, although once the system is started, no control actions are anticipated until completion of a cycle.

Satellite Freon based refrigeration system: A small DX refrigeration system will be unloaded through temperature setpoint increases to provide a small potential when required. This system serves Cold Room 6 described above.

Battery Chargers: The controls are not implemented at this time to control battery-charging operations, but are planned for a future expansion of the Andover system.

An evaluation of the potentially controllable loads now connected to and controlled by the Andover system shows that there are in excess of 1MW of load that could potentially be controlled. The goal set by Cool Pacific for load control during the summer peak period is currently approximately 300kW. Cool Pacific does not anticipate an aggressive program that cuts into production at the plant, but feels that the 300 kW is achievable in comparison to previous peak period billing periods through use of the Andover system.

Nexant was unable to verify any recent load control actions at the plant as the overall plant activity level is low compared to the summer agricultural season. A photograph of the computer report for the previous day's (January 12, 2004) ice making is attached below. Note that the 1-minute interval average peak demand during the time period was approximately 650kW, below the target for the plant for load control actions.

Figure 1: Photograph of the facility demand on January 12, 2004 as reported by the Andover EMS system.

Onsite Project: Del Mar Foods

SB5X Agriculture Inspection Form

Project Name: Onsite Energy projects, APLRP — Date: 7/1/03

Address: Del Mar Foods

City: 1720 Beach Road — Zip: 95076

Contact: Watsonville, CA

Inspected by: Don Hladun

Randy McCall

Equipment

Component	Status	Meter	Nameplate data and notes
Powerit load controls	■ completed ❑ being installed ❑ not installed	■ yes ❑ no	Energy Director 3100; Load control hardware and software to limit peak demands of facility through unloading or turning off selected equipment in response to predicted 5 minute average peak loads derived through monitoring of facility electric meters.

Meter data

Component(s) is metered separately ■ yes ❑ no **If yes, by:** ■ utility ■ participant ❑ other _____

Data available ■ yes ❑ no

Type of data ❑ TOU ❑ 15min ❑ run time ■ other **__5minute interval data for facility peak loads and control actions_____**

Source of data ❑ utility ❑ participant ■ other **_Powerit reports of load control actions, and threshold levels**

Contact for data __Don Hladun, Onsite Energy__ Ph# 925 - 358 - 4270_ **Email address dgHladun@aol.com**

Spot meter readings taken ❑ yes ■ no

Component #1 readings _____ _____ _____ **Notes__Equipment control actions observed on graphical user interface for dedicated PC.**

Component #2 readings _____ _____ _____ **Notes**_____

Component #3 readings _____ _____ _____ **Notes**_____

Randy McCall, of Nexant, Inc., conducted a post-installation site inspection at Del Mar Foods in Watsonville, CA on July 1, 2003 in order to verify the installation of the Powerit load control equipment for the facility. In attendance for the inspection were Mr. McCall, Don Hladun from Onsite energy, Mathias Christelius from Powerit, and facility engineering staff from Del Mar Foods.

A PC was set up in the engineering office with the Powerit software system installed. The software program is provided with pulse signals from the facility utility meter(s) that are used to predict an average five-minute demand for each of the two sides of the facility. If a predicted average peak for a 5minute interval is likely to exceed the user-defined threshold for control action, the software sends signals to controllable loads to either turn off select motors, or run at reduced loads. The equipment to be controlled was previously identified during the pre-installation phase through consultations between Mathias Christelius, Powerit's field engineer for implementation, and plant engineering staff. The list of equipment includes flexible loads that will not adversely affect the production at the food processing plant. Once the Powerit software evaluates a five minute average window that is predicted to exceed the threshold, the software sends signals to individual pieces of equipment that have been equipped with communications equipment that allows for remote control for unloading or shutting down. Equipment is listed by priority in the software, on a custom basis for each facility and customer.

At Del Mar Foods, Onsite Energy and Powerit are expecting to control approximately 150 to 200 kW of peak load out of a total estimated 989 kW of potential load from the controllable equipment in the cold storage side of the facility. Similarly, approximately 200 kW of load control savings are expected from the 1234 kW of controllable loads on the processing side of the plant. A list of the controllable equipment and their estimated loads are presented below in Tables 1 and Table 2.

7.1 Table 1: Del Mar Foods, Cold Storage Controllable Loads

Estimated peakload savings: 150-200 kW

Object Name	Quantity	Equipment Description	Unit kW	Total kW
Compressor V1/V2/V7	3		150	450
Compressor V3/V6	2		56	112
Compressor V4/V5	2		38	76
Compressor F1/F3	2		75	150
Compressor F2	1		56	56
Cold Storage 1	1	3*3hp Fans, Offloads ammonia loop	7	7
Cold Storage 2	1	1*3hp Fans, Offloads ammonia loop	3	3
Cold Storage 3	1	2*3hp Fans, Offloads ammonia loop	5	5
Cold Storage 4	1	2*3hp Fans, Offloads ammonia loop	5	5
Cold Storage 5	1	2*3hp Fans, Offloads ammonia loop	5	5
Tunnel 1	1	Offloads ammonia loop, max 1/2 fans off	15	15
Tunnel 2	1	Offloads ammonia loop, max 1/2 fans	15	15
Tunnel 3	1	Offloads ammonia loop, max 1/2 fans	15	15
Tunnel 4	1	Offloads ammonia loop, max 1/2 fans	15	15
Tunnel 5	1	Offloads ammonia loop, max 1/2 fans	15	15
Tunnel 6	1	Offloads ammonia loop, max 1/2 fans	15	15
Tunnel 7	1	Offloads ammonia loop, max 1/2 fans	15	15
Tunnel 8	1	Offloads ammonia loop, max 1/2 fans	15	15
		Grand Total Controllable Load kW	>>>>>>>>	989

7.2

7.3 Table 2: Del Mar Foods, Food Processing Controllable Loads

Estimated Savings 150-200 kW

Onsite Project: Richmond Wholesale Meats

Nexant

POST-INSTALLATION INSPECTION

101 Second Street, 11th Floor • San Francisco, CA

Onsite Energy – Richmond Wholesale

Date: May 8, 2004
To: Onsite Energy Corporation
From: Randy McCall
Re: Post Installation Inspection of Richmond Wholesale Powerit Installation

The purpose of the inspection conducted on May 7, 2004 was to verify the installation of the Powerit Energy Director load management systems at the Richmond Wholesale facility. Present for the inspection was Don Hladun and Eric Nyenhuis from Onsite Energy Corporation. The Richmond Wholesale refrigerated warehouse facility where the Powerit equipment was installed is located at 2401 Factory Street, Richmond.

The load management system has been installed and the computer interface is active. The load points shown on the computer interface included evaporator fans, truck cooling plugs, two sets of truck battery charging stations, and a separate satellite package unit cooled freezer for ice cream storage. Load control of the refrigeration compressors at the facility is accomplished through the evaporator fan controls. Mr. Hladun described the system setup as safer for the compressors as the compressors will unload quickly when the evaporator fans are shut down.

The Energy Director uses the existing internal Ethernet to communicate with the various control points. The existing Ethernet was previously used with the freezer unit fork lifts, and eliminated the need to hard wire controls to each control point. The PG&E 15-minute interval meter data from the meter on the northeast corner of the building is used by the Energy Director to determine the correct load management strategy if required. System tests of the load controls have begun, however, to date no significant load management activity has been implemented. Onsite Energy Corporation estimates 400 kW of potential load management from the facility.

Based on the results of the inspection, the project passed the post installation inspection. Digital photographs of the Powerit computer interface, and other control equipment and relay are attached below.

Figure 1: Energy Director Control Module.

Figure 2: Refrigeration control system.

Figure 3: Engine room refrigeration compressors.

Figure 4: Satellite Freezer equipment.

Figure 5: Utility meter equipment and tie-in for Powerit energy usage signal.

Figure 6: Battery charger station control cabinet.

Project 04-0003A: Central Valley Cooperative

Inspection Report

SB 5X Agricultural Program Element

Category 4 – Central Valley Cooperative

Date of Inspection: August 31, 2001
Inspection Conducted By: Richard Green, Nexant
Grantee Representatives: Pat Noland
The purpose of this report is to verify completion of the participants alternative fuel system and witness actual use of system on alternative fuel or collect data to assure that the system is capable of burning an accepted alternate fuel. The following are field notes taken for field verification (page 2).

This project retrofitted an existing natural gas system to burn propane as an alternate fuel. Propane is an acceptable alternate fuel under the program guidelines.

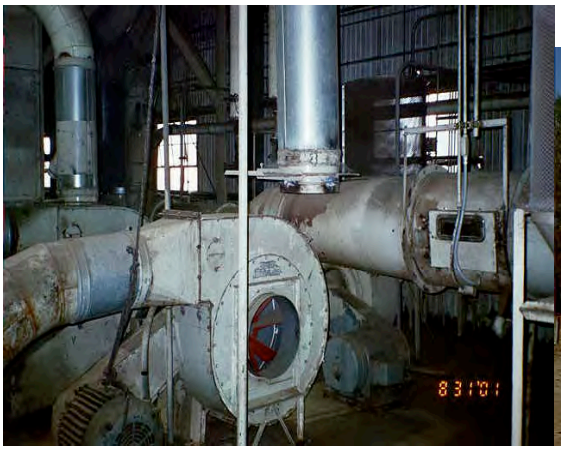


Figure-1 Gin Dryer (Burners)

Figure-2 Propane Tank

Figure-3 System propane vaproizer

Agricultural Peak Load Reduction Program

Category 4 - Natural Gas-powered Equipment Retrofit using a qualified alternate fuel

Inspection / Verification of Installation

Application name/Designation: Central Valley Coop		Number of Individual Projects in this Application: 1
Individual/Organization/Company: Central Valley Coop		
Business Type: Cotton Ginning	Phone: 559.582.0321	
Business Address: 9845 Hanford-Armona Rd.		
City: Hanford	State: CA	Zip Code: 93230
Contact Name: Leroy Gobel		
Street Address: Same as business		
City:	State:	Zip Code:

Contact Phone: 559.582.0321	Alt. Contact: Alt. Phone:	Inspection Date: 08/ 31/ 01 Time: 08:45 am
Alternate fuel used: PROPANE	Photos taken of equipment (yes/no): Yes- Tank, vaporizer, burners	
Project equipment description (e.g. alternative propane system consists of storage tank, vaporizer, pipelines, burners.). Plant will start ginning operation in late September, early October. Have purchased propane (approximately a 26,000 gallon tank).		

I certify all information provided and in any attachments is true and correct to the best of my knowledge and that this system has operated or is capable of operating on a qualified alternate fuel.

Inspected by (print name): Richard Green Phone: 916.397.2202	Signature of Responsible Party : Original signed Title: Office Mgr. Printed name: Pat Noland
Date: 08/31/01	Date: 08/31/01

For Grant Administrator Use :

APLRP Application #: 04-0003-A Administrator: Fresno

Project Verification by: Date:

Project Accepted: YES

Actual Payment: $ Date: **Pending Verification**

Project 04-0012A: Lone Star Dehydrator

Inspection Report

SB 5X Agricultural Program Element

Category 4 – Lone Star Dehydrator

Date of Inspection: August 31, 2001
Inspection Conducted By: Richard Green, Nexant
Grantee Representatives: Douglas Malkonian, V.P.
The purpose of this report is to verify completion of the participants alternative fuel system and witness actual use of system on alternative fuel or collect data to assure that the system is capable of burning an accepted alternate fuel. The following are field notes taken for field verification (page 2).

This project retrofitted an existing natural gas system to burn propane as an alternate fuel. Propane is an acceptable alternate fuel under the program guidelines.

Figure-1 Gin Dryer (Burners)

Figure-2 Propane Tank

Figure-3 System propane vaporizer

- **Agricultural Peak Load Reduction Program**

Category 4 - Natural Gas-powered Equipment Retrofit using a qualified alternate fuel
Inspection / Verification of Installation

Application name/Designation: Lone Star Dehydrator	Number of Individual Projects in this Application: 1	
Individual/Organization/Company/: Lone Star Dehydrator		
Business Type: Fruit and Nut Dehydrator	Phone: 559.582.0321	
Business Address: 2730 S. De Wolf		
City: Sanger	State: CA	Zip Code: 93630
Contact Name: Doug or Mark Melkonian		
Street Address: Same as business		
City:	State:	Zip Code:

Contact Phone: 559.485.6191	Alt. Contact: Walter King Alt. Phone: 559.250.2881	Inspection Date: 08/ 31/ 01 Time: 10:00 am

Alternate fuel used: PROPANE	Photos taken of equipment (yes/no): Yes; Vaporizer, burner, tank
Project equipment description (e.g. alternative propane system consists of storage tank, vaporizer, pipelines, burners.) : Approximately a 26,000 gallon propane tank. Witnessed system operating on propane.	

I certify all information provided and in any attachments is true and correct to the best of my knowledge and that this system has operated or is capable of operating on a qualified alternate fuel.

Inspected by (print name): Richard Green Phone: 916.397.2202	Signature of Responsible Party : Signature on original Title: Vice President Printed name: Douglas Melkonian
Date: 08/31/01	Date: 08/31/01
For Grant Administrator Use : APLRP Application #: 04-0012-A Administrator: Fresno	
Project Verification by Richard Green Date: 08/31/01	
Project Accepted: Yes	
Actual Payment: $ Payment made. Date: 09/18/01	

Project 04-034-A: Six Jewels Ag Fruit Dehydrator Converted from Natural Gas

SB5X Agriculture Inspection Form

Project Name 04-0034 –A Ag. Fruit Dehydrator Retrofitted from Natural Gas

Date 11/12/04

Address 6692 S. Peach Ave.

City Fresno, CA

Zip 93725

Contact Jeff Jue (559) 456-4900

Inspected by Mark Galicia

Equipment

Component	Status	Meter	Nameplate data and notes
Propane Tanks	■ completed installed ❑ being ❑ not installed	❑ yes ■ no	Two large propane tanks were located at the facility
Vaporizer	■ completed installed ❑ being ❑ not installed	■ yes ❑ no	One vaporizer was identified at the facility. The vaporizer has its own designated meter for Natural Gas use.

Meter data

Component(s) is metered separately ■ yes ❑ no **If yes, by:** ■ utility ❑ participant ❑ other _____

Data available ❑ yes ❷ no

Type of data ❑ TOU ❑ 15min ❑ run time ❑ other _____

Source of data ❑ utility ❑ participant ❑ other _____

Contact for data _____ **Ph#** _____ **Email address**

Mark Galicia of Nexant, Inc. met with Jeff Jue at the Six Jewels facility were he verified the two propane tanks and vaporizer were still installed. The piping for the vaporizer is designed so that the vaporizer could run on either propane of Natural Gas, however the propane system is used only as a back up.

Figure 1 Two Propane storage tanks at the Six Jewels facility.

Figure 2 Vaporizer at the Six Jewels facility.