Evaluation, Measurement and Verification Report
California Multi Measure Farm Program
1354-04 and 1360-04

prepared for

California Public Utilities Commission
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Table of Contents

1.0 EXECUTIVE SUMMARY

This report summarizes the approach, data collection and results for the Evaluation, Measurement and Verification of EnSave, Inc's *California Multi Measure Farm Program (354-04 and 1360-04)*. All activities, with the exception of the Process Questionnaire and survey, were developed and conducted by kW Engineering, an independent energy engineering firm based in Oakland, CA.

The objective of the program was to promote and provide incentives for the installation of high efficiency options for five measures associated with milking at dairies. The program was implemented in Pacific Gas and Electric and Southern California Edison's service territories, California's two largest Investor Owned Utilities (IOUs). The program targeted small, independent dairies that have typically been underserved by energy efficiency programs in the past.

Evaluation results are based on calculations completed using comprehensive data collected through end-use metering and telephone surveys. A summary of the program results is provided in Exhibit 1 below. This exhibit shows the ex-ante estimate of savings as provided by EnSave, the program implementer. Also provided in the table are the ex-post, evaluation based savings reflecting both gross and net adjustments to the ex-ante values. As discussed in the M&V plan, four of the five energy efficiency measures offered under the program were explicitly evaluated under this study. The fifth measure, variable speed drives for vacuum pumps, is reported using both gross and net adjustments from previous studies.

Exhibit 1: Energy Impacts Reporting Tables for 2004-2005 Programs

Sum Of Energy Impacts for This 2004-2005 Program

2004-2005 form

Program IDs*:	354-04 and 1360-04							
Program Name:	California Multi-Measure Farm Program							
	Year	Calendar Year	Ex-ante Gross Program-Projected Program MWh Savings (1)	Ex-Post Net Evaluation Confirmed Program MWh Savings (2)	Ex-Ante Gross Program-Projected Peak Program MW Savings (1**)	Ex-Post Evaluation Projected Peak MW Savings (2**)	Ex-Ante Gross Program-Projected Program Therm Savings (1)	Ex-Post Net Evaluation Confirmed Program Therm Savings (2)
	1	2004	5,177.07	2,620.90	0.952	0.504	0	0
	2	2005	5,177.07	2,620.90	0.952	0.504	0	0
	3	2006	5,177.07	2,620.90	0.952	0.504	0	0
	4	2007	5,177.07	2,620.90	0.952	0.504	0	0
	5	2008	5,177.07	2,620.90	0.952	0.504	0	0
	6	2009	5,177.07	2,620.90	0.952	0.504	0	0
	7	2010	5,177.07	2,620.90	0.952	0.504	0	0
	8	2011	5,177.07	2,620.90	0.952	0.504	0	0
	9	2012	5,177.07	2,620.90	0.952	0.504	0	0
	10	2013	5,177.07	2,620.90	0.952	0.504	0	0
	11	2014	5,177.07	2,620.90	0.952	0.504	0	0
	12	2015	5,177.07	2,620.90	0.952	0.504	0	0
	13	2016	5,177.07	2,620.90	0.952	0.504	0	0
	14	2017	5,177.07	2,620.90	0.952	0.504	0	0
	15	2018	5,177.07	2,620.90	0.952	0.504	0	0
	16	2019	5,177.07	2,620.90	0.952	0.504	0	0
	17	2020	5,177.07	2,620.90	0.952	0.504	0	0
	18	2021	5,177.07	2,620.90	0.952	0.504	0	0
	19	2022	5,177.07	2,620.90	0.952	0.504	0	0
	20	2023	5,177.07	2,620.90	0.952	0.504	0	0
	TOTAL	**2004-2023**	103,541.48	52,418.03	0.952	0.504	0	0

Exhibit 2 below provides ex-ante, gross and net ex-post estimates of energy and demand savings, and associated realization rates. The ex-ante savings values are estimated savings from EnSave, taken from their final program database of participants. Gross ex-post savings values are the result of savings estimates based on the measured data collected to support this evaluation and associated analysis. The Gross Realization Rate is simply the ratio of the gross ex-post savings estimate to the ex-ante savings estimate. The ex-ante estimate of savings for the compressor heat recovery measure was accepted at 100% because the total savings for the measures was less than 1% of the program total and the sample frame (three participants) did not warrant primary data collection. As mentioned above, the gross realization rate of 100% is used for the Vacuum pump VSD measure per the evaluation plan.

For the four measures evaluated under this study, the net-to-gross analysis resulted in a net realization rate of 42%. This net realization rate was estimated based on telephone survey data and subsequent analysis conducted by Dr. Phil Willems. Please see Section 5, Process Survey, for a complete discussion of how this value was derived. For the last measure, the vacuum pump VSD, the ex-ante net realization rate of 75% applied.

Exhibit 2: Energy and Demand Impacts by Measure

Measure	Ex-Ante Energy Savings (kWh/yr)	Gross Ex-Post Energy Savings (kWh/yr)	Gross Realization Rate	Net Realization Rate	Net Ex-Post Energy Savings (kWh/yr)	Overall Ex-Post Realization Rate
Milk Pump VSD	1,004,682	385,709	38%	42%	161,998.0	16%
Scroll Compressor	631,928	365,634	58%	42%	153,566.1	24%
Plate Cooler	570,773	220,221	39%	42%	92,493.0	16%
Compressor Heat Recovery Unit	43,705	43,705	100%	42%	18,356.0	42%
Vaccum Pump VSD	2,925,985	2,925,985	100%	75%	2,194,488.4	75%
Total	**5,177,073**	**3,941,254**	**76.1%**		**2,620,901.5**	**50.6%**

Measure	Ex-Ante Demand Savings (kW)	Gross EM&V Demand Savings (kW)	Gross Realization Rate	Net Realization Rate	Net Ex-Post Demand Savings (kW)	Overall Ex-Post Realization Rate
Milk Pump VSD	178.41	85.32	48%	42%	35.84	20%
Scroll Compressor	106.72	80.88	76%	42%	33.97	32%
Plate Cooler	112.11	48.72	43%	42%	20.46	18%
Compressor Heat Recovery Unit	7.26	7.26	100%	42%	3.05	42%
Vaccum Pump VSD	547.38	547.38	100%	75%	410.53	75%
Total	**951.88**	**769.56**	**80.8%**		**503.85**	**52.9%**

2.0
PROGRAM DESCRIPTION

2.1. Program Overview

EnSave, Inc.'s (EnSave) California Multi Measure Farm Program (1354-04 and 1360-04) was designed to provide peak demand and energy savings to Agricultural (Dairy) customers in Pacific Gas and Electric's (PG&E) and Southern California Edison's (SCE) service territories. These are the two largest Investor Owned Utilities (IOU's) whose customers contribute the Public Goods Charge (PGC), which provides funding for this program.

Savings were to be achieved through the installation of five measures. Measures include the following:

- The installation of variable speed drives (VSD) for vacuum pumps used for milking
- The installation of plate and frame heat exchangers (plate coolers) used to pre-cool milk using ground water before it enters refrigerated bulk storage tanks
- The installation of VSDs for milk transfer pumps used to transport milk to the storage tanks
- The installation of compressor heat recovery units used to capture heat rejected from refrigeration compressor in order to heat water used in equipment washing
- The installation of scroll compressors which provide more efficient means of cooling milk

2.2 Measure Descriptions

There are five measures included in the program: Variable speed drives (VSD) on milking vacuum pumps; plate coolers; VSDs on milk pumps; compressor heat recovery units; and scroll compressors. Each of these measures provides significant energy (kWh) and demand (kW) savings to participants. The vacuum pump VSD measure was previously offered under the 2002-2003 California Variable Speed Drive Farm Program. The four additional measures that complete the portfolio under this program complement the VSD on the milking vacuum pump measure by saving energy on other aspects of the milk production process.

Standard equipment for milk production in dairy farms typically consists of one or more electrically powered vacuum pumps, one or more refrigeration compressors, and one or more milk transfer pumps per farm. While the loading of refrigeration compressors varies substantially over the process, a standard refrigeration compressor operates primarily to cool milk as it enters a bulk storage tank, and secondarily to maintain a temperature setpoint for stored milk. Vacuum pumps and milk transfer pumps operate during milking hours only. The baseline refrigeration compressor type is an air cooled reciprocating compressor. Both vacuum pump and milk transfer pump baseline equipment consists of constant speed pumps with constant energy consumption. The vacuum pump runs at full speed and a mechanical regulator creates an intentional air leak or "bleed" to regulate the pressure of the system regardless of the amount of milk being pumped. When the system requires a higher level of

vacuum, the regulator closes and the vacuum level increases. Milk transfer pumps are enabled during milking and provide a constant flow of milk to bulk storage tanks.

Of the five energy efficiency measures, it is important to note that energy and demand savings for the plate cooler, milk pump VSD and scroll compressor all come from reduced energy consumption for cooling the milk. This cooling can be accomplished with either refrigeration associated with the bulk tank or a milk chiller. The point is that direct measurement of usage and calculation of savings for all of these measures came from measurement of the refrigeration energy. Following is a more detailed description of each of the measures.

Measure 1: Vacuum Pump VSD

The VSD electronically senses the vacuum need of the system at all times and adjusts the speed at which the pump runs to deliver only that amount of vacuum required. This is accomplished by using a pressure sensor to eliminate the regulator. The baseline for this measure is a constant speed/constant pressure pump. While the baseline pump always provides enough vacuum to satisfy the highest load, the VSD pump only runs at a speed required to meet the current milking load. This reduction in pump motor speed results in electrical energy and demand savings over the constant speed situation. This measure has been evaluated in a previous study. Per the program implementation plan, no M&V was conducted for this measure.

Measure 2: Milk Plate Cooler

The plate cooler consists of a two stream plate and frame heat exchanger that uses cool ground water to reduce the temperature of milk before it enters a bulk tank. The savings resulting from this measure are incurred at the refrigeration compressor in the form of reduced thermal load. Typical dairy refrigeration systems consist of direct exchange compressors used to cool milk in bulk storage tanks. The reduced heat content of milk entering the bulk storage tanks results directly in a reduced refrigeration load. The baseline for the plate cooler measure is a system that does not utilize a plate cooler.

Measure 3: Milk Pump VSD

The milk removed by the vacuum pump system is captured in small tanks before it is transferred to the bulk storage tank by the milk transfer pump. The baseline for the Milk Pump VSD measure is a constant speed milk transfer system including a plate cooler. A variable speed milk pump optimizes milk flow through the plate cooler to regulate the water-to-milk flow ratio and enhance the performance of the milk plate cooler. This optimized flow further reduces the amount of refrigeration needed in the bulk tank. The baseline for this measure is a system that uses a plate cooler without a VSD on the milk pump.

It should be noted that there is a small amount of pumping savings associated with operating the pump at a slower speed. This savings is small relative to a more typical application of a VSD (such as the vacuum pump application or a variable volume chilled water system) where the mass flow is reduced, and was not estimated as part of the evaluation.

Measure 4: Compressor Heat Recovery

The installation of a compressor heat recovery system captures heat rejected from refrigeration compressors to be used for pre-heating of hot water. Hot water is used throughout the milking process for equipment cleaning. The unit is composed of a storage tank lined with heat exchangers through which hot refrigerant gas condenses, giving up heat to the water. The pre-heated water is then introduced to a conventional water heater as needed. As indicated in the program filing, this measure is limited to farms using electric water heating. The baseline for this measure is a conventional electric water heater without heat recovery.

Measure 5: Scroll Compressor

Compared to a conventional reciprocating (positive displacement) compressor, scroll compressors use about 30% less electricity for the same refrigeration effect. Scroll compressors also tend to run more quietly, have fewer breakdowns and last longer. This measure replaces older reciprocating compressors with new scroll compressors. The baseline for a scroll compressor is an existing reciprocating compressor.

3.0
EM&V APPROACH, SAMPLE DESIGN, AND DATA COLLECTION

In this section we provide a discussion of the evaluation approach, the sample design for selecting metered sites, and the process used to collect data. The general approach was founded in the idea that savings are relatively constant day-to-day, but the daily total is difficult to estimate accurately without measurement.

3.1 Approach

Direct measurement was a driving requirement for the evaluation. Based on this approach, kW Engineering developed a data collection and analysis plan consistent with that outlined by the International Performance Measurement and Verification Protocol (IPMVP), Option B, Retrofit Isolation. In the EM&V plan, it was assumed that the sample design would initially be evenly divided between measures with five metered sites for each of the four measures. The approach was to directly measure the energy consumption for a representative sample of participants for each of the measures and estimate site-specific demand and energy savings. These site specific estimates of savings were then to be used to develop savings metrics that could be applied to individual non-metered participants.

3.2 Sample Design and Adjustments to the Analysis Approach

Per the EM&V plan, the sample design began with the assumption that five occurrences of each measure would be metered. This plan was qualified with the idea that as participation in the program advanced, metered sites would be redistributed to reflect participation. One of the difficulties faced in the selection and recruitment of sites, was that the participation process made it impossible to identify participating sites prior to measure installation. Basically the program operated on a first come, first served basis, so there was no guarantee that a potential site would ultimately participate.

Given the understanding that obtaining significant pre-installation data would not be possible, the analysis approach was revisited. The revised approach assumed that the majority of the data collected would come from post-installation monitoring and that secondary data would be used to estimate the pre condition. The plan had already allowed for some level of thermal monitoring, and that data would serve as the means for estimating the pre condition for the sample.

The pre condition for these sites was estimated using the following procedure. In all cases, the compressor cooling electrical usage was monitored. Thermal monitoring was used to track the temperature of the milk entering and leaving the plate coolers. According to the National Dairy Council, milk is required to be cooled to a minimum of 45 °F for storage and transportation. Since the cooling of milk is 100% sensible, the cooling energy required is directly proportional to the temperature change of the milk. Said another way, if the temperature of the milk exiting the plate cooler is halfway between the entering temperature and the storage temperature, then 50% of the energy required to cool the milk can be attributed to the plate cooler and the other 50% to the refrigeration system. Since we know the electrical consumption of the refrigeration system from the monitoring, and can estimate

the percentage of heat that the refrigeration system is removing, we can calculate the electrical consumption that would have been required in the absence of the plate cooler as a ratio of the observed electrical consumption and percentage of heat removed by the refrigeration system. This approach assumes that the refrigeration system consumption is constant over the range of milk temperatures, which isn't a perfect assumption but reasonably close relative to other independent variables such as changes in outdoor temperature.

To calculate the single baseline consumption value to be used in the population estimate of savings, the estimated "pre condition" value discussed above were combined with monitored sites that ultimately did not install measures and the sites which used the plate coolers with chilled water. The chilled water sites could be used since 100% of the cooling effect was provided by the refrigeration system.

3.3 Data Collection

The primary data for the analysis were collected through direct metering of electricity consumption of refrigeration equipment as well as temperature variables associated with the milk production process. There were three main areas of data collection accomplished by kW Engineering: 1) Interval electricity consumption, 2) Baseline equipment and operating data, 3) Temperature data. Electrical consumption data were collected by kW Engineering using ElitePro data loggers temporarily installed at each of the metered sites. Temperature data were collected using Pace Scientific XR440 Pocket Loggers. Each of the selected farms was contacted and arrangements were made to visit the farm and install data loggers. Some baseline data were collected via telephone. The resulting data provides a census of the participant population. Milk production data, in gallons[1] of milk produced per year, were collected. A discussion of data collection and analysis for multiple measures can be found in the next section.

Measure 1: Vacuum Pump VSD

The vacuum pump VSD measure was previously offered under the 2002-2003 California Variable Speed Drive Farm Program. This measure has been evaluated in a previous study. Per the program implementation plan, no M&V was conducted for this measure.

Measure 2: Milk Plate Cooler

Both electric and thermal metering was completed for this measure. Since the savings for this measure are generated through reduced heat load on the refrigeration system, pre- and post-installation electrical consumption of the refrigeration system were monitored. Electrical monitoring was accomplished using a true three-phase interval meter. In addition, thermal monitoring was used to quantify the amount of heat removed from the production cycle. Determining the heat removed was accomplished by using high accuracy (12-bit) data loggers in tandem with high accuracy thermisters.

[1] When the M&V plan was developed, our understanding was that this milk production data would be provided in pounds both for annual and daily data. In actuality it is provided in gallons. From an analysis standpoint, this was easily reconciled with standard unit conversions.

Measure 3: Milk Pump VSD

Because this measure is an enhancement to a Milk Plate Cooler, the savings are also realized through reduced refrigeration. Therefore an identical monitoring approach to the milk plate cooler was used, with the exception that pre-installation thermal monitoring was also accomplished.

Measure 4: Compressor Heat Recovery

kW Engineering was only able to monitor one pre-retrofit water heater. The metering consisted of the total power consumption of the water heater.

Measure 5: Scroll Compressor

Monitoring for this measure involved Post-installation electrical consumption of the refrigeration system. If the system included both a milk chiller and DX refrigeration on the bulk tank, both were metered.

While the requirement for analysis was total daily electricity usage, electrical consumption and temperature data were logged at 15-minute intervals in order to be able to collect operating hours as well as consumption. Based on the recommendations of the IPMVP, Option B, the metering duration was set as a minimum of 14 days. At the end of the monitoring period the loggers were retrieved and the data downloaded. A discussion of data collection and analysis for multiple measures can be found in the next section.

4.0
RESULTS

4.1 Calculation of Savings

The estimates for demand and energy savings for the program were completed in a series of steps working with the metered and participant data. Ex-ante savings estimates for the program participants were developed by EnSave based on experience and data collected from previous programs. As mentioned above, EnSave has developed proprietary software, which estimates energy savings given baseline data. This software was used to develop the ex-ante demand and energy savings estimates for each participant using baseline information provided in the application.

Using the data downloaded from each logger, spreadsheets for each site were developed to compute daily usage, annual usage, and savings. This was accomplished by first screening the raw data so that only full days are included in the analysis.

Next, using a pivot table, average daily kWh, kW, and kWh/100 Gallons of milk were calculated for each full day. In a similar fashion the daily runtime was computed. Daily, total kWh and runtime are averaged over all of the complete days to yield a final estimate of daily electricity usage and runtime.

The metric used for savings is kWh per 100 gallons of milk produced. Using the metered data a baseline energy usage was determined as discussed in Section 3.2. In order to leverage metered sites with the total population, energy usage adjustment factors were calculated for each measure. The adjustment factors were used to predict energy savings for non-metered participants.

The last step in the process was to estimate the annual verified savings values and compare them to the ex-ante estimates. For demand this is simply the baseline demand computed by EnSave and the average daily demand discussed above. The energy savings were estimated by subtracting the average post-installation production specific energy usage (kWh/100 Gal) from the baseline and then multiplying by the average daily milk production and 365 days per year. The result is then compared to the ex-ante estimate generated by EnSave's software.

For both demand and energy impacts, the ratio of the verified savings to the ex-ante estimate is termed the gross realization rate. This realization rate is the percentage of the ex-ante estimate that is realized (or actual) gross savings based on the verified savings values without adjustment for net effects. The following is a description of the Adjustment factors used to calculate participant energy savings**.**

Baseline

Baseline site equipment consists of a constant speed milk transfer pump and bulk tank refrigeration only. Due to the lack of sites in which to meter the baseline equipment, the baseline energy usage, as applied to all participant farms, is based on the kWh /100 gallons for metered sites adjusted to reflect operation without energy efficient equipment. As discussed in Section 3.2, these adjustments were accomplished using thermal data to isolate

the impacts of the plate coolers and milk pump VSD's. The energy use for each measure was determined using the adjustment factors described below.

Chilled Water Plate Cooler System – CW

It was noted that some sites incorporate a mechanically cooled water stream with the installation of plate coolers. The use of chilled water in plate coolers significantly reduces the milk exit temperature. However, because the cooling is provided by the facility's refrigeration system no energy savings result from the addition of a plate cooler or variable speed drive milk pumps. The reduced flow advantage of a variable speed milk pump is unable to produce further heat transfer due to the temperature difference of the chilled water and the milk streams. Monitoring of plate cooler inlet and outlet temperatures show an average of 71% of the heat removed from incoming milk is removed by the plate cooler. Systems using ground water plate cooler systems removed an average of 28% of the milk's heat. Sites with chilled water plate cooler systems will not provide energy savings from either the plate cooler measure or the variable speed milk pump measure.

In the discussion of the Plate Cooler and Milk Transfer VSD measures below we present two realization rates, an overall realization rate for program level delivery of savings and also a realization rate to reflect the removal of the chilled water sites. We include the second realization rate to provide a better technical potential estimate of measure savings given that the program can be modified to eliminate the installation of chilled water with these measures.

Plate Cooler – PC

The plate cooler adjustment factor is based on monitored kWh/100 gallon values from dairy farms with and without the installed equipment and the percent of heat removed from milk by the plate cooler. Temperature data gathered from farms with existing plate cooler systems were used to determine the percent of total heat removed by the plate cooler for both full and reduced milk flow rates. The heat removal was used to determine the plate cooler adjustment factor. The sample used for the plate cooler adjustment factor is provided Exhibit 3, as well as the heat removal data.

Exhibit 3: Summary of Plate Cooler Metered Sites

Sample Sites	Approx. Daily Milk Production (Gal)	kWh/100 Gal	Plate Cooler	Chilled Water	VSD Milk Pump	Scroll Compressor	Plate Cooler Heat Removal	Baseline (kWh/100 Gal)	Post-Retrofit (kWh/100 Gal)	Plate Cooler Savings	PC
Metered Site 3	2,000	2.95	X	0	0	0	21.3%	3.58	2.95	0.63	18%
Metered Site 4	1,000	3.25	X	0	0	0	20.2%	3.91	3.25	0.66	17%
Metered Site 5	5,000	3.55	X	0	0	0	21.3%	4.30	3.55	0.76	18%
Metered Site 6	2,000	1.69	X	0	0	0	ND				
Metered Site 12	1,000	2.51	X	0	0	0	26.6%	3.18	2.51	0.67	21%
Average		2.79						3.74	3.07	0.68	

ND - No Data: Logger Failure

Savings Ratio:	18.1%
Usage Ratio:	81.9%

Only dairy farms using ground water through the plate cooler were included in the sample. The Plate Cooler adjustment factor sample consists of monitored sites having installed only a plate cooler as compared to the baseline sites. The factor is applied as a multiplicative function of baseline energy usage. The average usage factor, 81.9%, was applied to the

baseline kWh/100 gallon for all sites having installed a ground water plate cooler system, to determine the post-retrofit energy usage as follows:

Post Plate Cooler Energy Usage = Baseline Energy Usage * PC Usage Factor (81.9%)

The table below provides realization rates for the Plate Cooler measure with and without the chilled water sites included. The lower realization rate for all sites reflects the fact the chilled water sites did not achieve savings. The higher realization rate reflects a more realistic savings value (relative to the ex ante estimate) for the measure given that the program could be modified to eliminate the installation of chilled water sites.

Exhibit 4: Gross Plate Cooler Savings
All Sites and Non-Chilled Water Sites

Plate Cooler	Ex-Ante Energy Savings (kWh/yr)	Gross Ex-Post Energy Savings (kWh/yr)	Gross Realization Rate
Energy (kWh)			
All Sites	570,773	220,221	39%
Non-Chilled Water Sites	400,596	220,221	55%
Demand (kW)			
All Sites	112.11	48.72	43%
Non-Chilled Water Sites	83.60	48.72	58%

Milk Transfer Pump VSD – MP

The Milk Transfer Pump VSD adjustment factor is based on a sample of monitored sites having installed a variable speed drive on a milk transfer pump with an existing plate cooler as compared to the baseline sites. The sample is provided below. Because the baseline for the installation of a milk transfer pump VSD is a milk cooling system including a plate cooler, the plate cooler heat removal data for systems with reduced milk flow was used to isolate the energy savings due to the installation of a milk transfer pump VSD. The factor is applied as a multiplicative function of baseline energy usage. The post-installation sample includes both pre and post-installation metering and post only metering of farms with variable frequency milk transfer pumps. The usage factor, 88.6%, was applied to the baseline kWh/100 gallon for all sites having installed a variable speed milk transfer pump, to determine the post-retrofit energy usage.

Exhibit 5: Summary of Milk Pump Metered Sites

Sample Sites	Approx.Daily Milk Production (Gal)	kWh/100 Gal	Plate Cooler	Chilled Water	VSD Milk Pump	Plate Cooler Heat Removal	Baseline	Post	Savings Ratio
Metered Site 8	3,000	2.96	X	0	X	33.2%	3.94	3.49	0.11
Metered Site 10	2,000	4.21	X	0	X	34.1%	5.65	4.97	0.12
Metered Site 13	4,000	1.75	X	0	X	36.9%	2.39	2.06	0.14
Metered Site 14	2,000	2.07	X	0	X	43.9%	2.97	2.44	0.18
Metered Site 15	4,000	2.06	X	0	X	17.8%	2.43	2.43	(0.00)

Baseline	3.47
Post Retrofit	3.08
Savings	0.39
Savings Ratio	10.9%
Usage Ratio	88.6%

The Milk Transfer Pump VSD measure had the same issue regarding the chilled water installations as discussed in the Plate Cooler measure above, and similar results are presented below.

Exhibit 6: Gross Milk Pump Savings
All Sites and Non-Chilled Water Sites

Milk Pump	Ex-Ante Energy Savings (kWh/yr)	Gross Ex-Post Energy Savings (kWh/yr)	Gross Realization Rate
Energy (kWh)			
All Sites	1,004,682	385,709	38%
Non-Chilled Water Sites	696,859	385,709	55%
Demand (kW)			
All Sites	178.41	85.32	48%
Non-Chilled Water Sites	129.10	85.32	66%

Compressor Efficiency – CE

Because the Scroll Compressor measure will reduce energy usage over all compressor operating periods, the Compressor Efficiency adjustment factor is applied as a multiplicative function of baseline energy usage. The sample for this measure includes sites with baseline reciprocating compressors as compared to sites using scroll type compressors without chilled water plate cooler systems. The adjustment factor was determined by adjusting the kWh/100 gallon values for each farm to isolate the baseline and post-retrofit compressor specific energy usage without other installed measures. The usage factor, 64.1%, was applied to the baseline kWh/100 gallon for all sites having installed the scroll compressor measure, to determine the post-retrofit energy usage.

4.2 Results for Metered Sample

Using the process described above, metered results of energy usage, operating hours, demand and energy savings were developed for each of the metered sites based on the data collected. A summary of results for all of the metered sites can be found in Table-7, Summary of Site Specific Results, below.

Exhibit 7: Site Specific Measurement Results

Site	Gal/Day	kWh/Day		kWh/ 100 Gal		Milk ΔT (Deg F)		Water ΔT (Deg F)	
	(kGals)	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Metered Site 9	N/A	480.8	441.0	3.9	3.7	37.0	35.8	0.5	0.6
Metered Site 8	4,000	264.0	261.5	6.2	6.1	52.7	51.9	1.4	1.7
Metered Site 1	1,000	44.6	-	5.8	-	-	-	-	-
Metered Site 4	1,000	35.9	-	3.3	-	11.4	-	4.8	-
Metered Site 13	2,000	-	82.0	-	4.2	-	19.2	-	21.5
Metered Site 14	2,000	-	82.7	-	4.4	-	19.9	-	12.6
Metered Site 15	1,000	16.5	10.4	2.5	2.1	15.0	5.1	9.2	11.2
Metered Site 21	1,000	27.7	31.6	4.2	4.9	25.8	25.0	4.8	2.8
Metered Site 23	0	-	19.2	-	5.7	-	1.3	-	3.2
Metered Site 3	2,000	59.3	-	3.0	-	12	-	8.1	-
Metered Site 6	2,000	26.2	-	1.7	-	-	-	-	-
Metered Site 2	2,000	159.6	-	6.4	-	-	-	-	-
Metered Site 18	4,000	-	68.6	-	2.1	-	10	-	1.2
Metered Site 22	1,000	-	35.3	-	3.6	-	-	-	-
Metered Site 19	2,000	-	112.4	-	7.2	-	-	-	-
Metered Site 11	3,000	-	89.4	-	3.0	-	-	-	-
Metered Site 17	2,000	-	112.8	-	2.1	-	24.7	-	3.4
Metered Site 5	5,000	-	79.5	-	3.5	-	12	-	8.8
Metered Site 16	4,000	-	73.0	-	1.7	-	20.8	-	6.8
Metered Site 24	N/A	-	1,058.5	-	0.4	-	47.9	-	40.6

Exhibit 8: Site Summary of Measures Installed at Metered Sites

Sample Sites	Pre-Installation Data Collected	Chilled Water	Plate Cooler	VSD Milk Pump	Scroll Compress-or
Metered Site 1	X				
Metered Site 2	X				
Metered Site 3			X		
Metered Site 4			X		
Metered Site 5			X		
Metered Site 6			X		
Metered Site 7		X	X		
Metered Site 8			X	X	
Metered Site 9	X	X	X		
Metered Site 10			X	X	
Metered Site 11			X	X	
Metered Site 12			X		
Metered Site 13			X	X	X
Metered Site 14			X	X	X
Metered Site 15			X	X	X
Metered Site 16		X	X	X	X
Metered Site 17	X	X	X		
Metered Site 18	X	X	X		
Metered Site 19					X

4.3 Participant Population Results

Total program level results for the participant population were computed by applying the measure-specific savings factors determined in the above mentioned process to the final database of participants. A summary of program level savings by measure is presented in Exhibit 9 below.

Exhibit 9: Energy and Demand Impacts by Measure

Measure	Ex-Ante Energy Savings (kWh/yr)	Gross Ex-Post Energy Savings (kWh/yr)	Gross Realization Rate	Net Realization Rate	Net Ex-Post Energy Savings (kWh/yr)	Overall Ex-Post Realization Rate
Milk Pump VSD	1,004,682	385,709	38%	42%	161,998.0	16%
Scroll Compressor	631,928	365,634	58%	42%	153,566.1	24%
Plate Cooler	570,773	220,221	39%	42%	92,493.0	16%
Compressor Heat Recovery Unit	43,705	43,705	100%	42%	18,356.0	42%
Vaccum Pump VSD	2,925,985	2,925,985	100%	75%	2,194,488.4	75%
Total	**5,177,073**	**3,941,254**	**76.1%**		**2,620,901.5**	**50.6%**

Measure	Ex-Ante Demand Savings (kW)	Gross EM&V Demand Savings (kW)	Gross Realization Rate	Net Realization Rate	Net Ex-Post Demand Savings (kW)	Overall Ex-Post Realization Rate
Milk Pump VSD	178.41	85.32	48%	42%	35.84	20%
Scroll Compressor	106.72	80.88	76%	42%	33.97	32%
Plate Cooler	112.11	48.72	43%	42%	20.46	18%
Compressor Heat Recovery Unit	7.26	7.26	100%	42%	3.05	42%
Vaccum Pump VSD	547.38	547.38	100%	75%	410.53	75%
Total	**951.88**	**769.56**	**80.8%**		**503.85**	**52.9%**

A total of 118 farmers participated in the program. As illustrated in Exhibit 10 below, the majority of the participants and savings were attained in Pacific Gas and Electric Company's service territory.

Exhibit 10: Participants, Energy and Demand Impacts by Utility

Measure	Number of Participants	Ex-Ante Savings	Gross EM&V Savings	Gross Realization Rate	Net Ex-Post Savings	Overall Ex-Post Realization Rate
PG&E						
Energy (kWh)	99	3,966,668	2,968,406	75%	1,958,424	49.4%
Demand (kW)	99	769.96	611.67	79%	399.97	51.9%
SCE						
Energy (kWh)	19	1,210,406	972,848	80%	662,478	54.7%
Demand (kW)	19	181.93	157.89	87%	103.88	57.1%
Total						
Energy (kWh)	118	5,177,074	3,941,254	76%	2,620,901	50.6%
Demand (kW)	118	951.88	769.56	81%	503.85	52.9%

Please note that full versions of the required Energy Impacts Reporting Tables can be found in Appendix A.

5.0
PROCESS SURVEY

The following section contains the process analysis for the program. The process analysis was conducted by Philippus Willems, PhD. Inc, based on telephone survey data collected from participants and non-participants by Quantum Market Research, Inc.

I. Introduction

This report summarizes the results of a process evaluation of EnSave's California Multi Measure Farm Program, which was funded by the California Public Utilities Commission (CPUC) for PY2004-2005. EnSave offered the program to 2,120 dairy producers throughout Pacific Gas and Electric's (PG&E's) and Southern California Edison's (SCE's) service territories, with the objective of achieving energy and demand savings through the installation of five energy efficiency measures at dairy farms. These installations were accomplished by educating farmers on the benefits of the energy efficient measures and offering cash incentives.

The goals of the process evaluation were to:

- identify market barriers to the installation of the program measures
- assess the effectiveness of program outreach and delivery
- estimate a Net-to-Gross ratio for the program

Note that the present evaluation only addresses four of the five measures covered by the program, since the VSD Vacuum Pump measure (previously offered under the 2002-2003 California Variable Speed Drive Farm Program) was addressed in a previous study.

Evaluation Tasks

The evaluation goals were addressed through the following tasks:

- A telephone survey conducted with 51 program participants out of a total of 118.
- A telephone survey conducted with 32 non-participants, defined as farmers who were informed about the program but chose not to participate. The 32 surveys were successfully completed from a sample of 45 non-participants.
- Analysis and reporting.

The phone surveys were conducted by Quantum Market Research from April through June of 2006.

II. Evaluation Findings

Program Awareness

Data on the timing and source of awareness of the program were collected from both participants and non-participants. The year in which survey respondents reported becoming aware of the program is shown in Exhibit 1.

Exhibit 1. Year Respondents Became Aware of the Program

	Parts	Non-Parts
2002	8.0%	9.4%
2003	18.0%	18.8%
2004	42.0%	31.3%
2005	28.0%	25.0%
2006	2.0%	6.3%
DK	2.0%	9.4%
Total	100.0%	100.0%

While 70% of participants and 56% of non-participants said they learned of the program in 2004 or 2005 (the program years), 26% of participants and 28% of non-participants said they learned of the program during 2002 or 2003, when EnSave offered the Vacuum Pump VFD Program.

Sources of program awareness are summarized in Exhibit 2, which shows participant and non-participants responses to the question: "How did you find out about the California Multi Measure Farm Program?"

Exhibit 2. Sources of Program Awareness

	Participants (N=51)	Non-Parts (N=32)
Equipment vendor	72.5%	25.0%
Direct mail	19.6%	34.4%
Newspaper/newsletter	3.9%	9.4%
Utility rep	0.0%	9.4%
Word of mouth	2.0%	6.3%
EnSave program rep	2.0%	0.0%
DK	0.0%	15.6%
Total	100.0%	100.0%

The survey results indicate the importance of vendors and to a lesser extent direct mail in effectively reaching California dairy farmers with this program and encouraging them to participate:

- More than 70% of participants said they learned of the program from equipment vendors, compared to just 25% of non-participants. In contrast, only a single participant and no non-participants became aware of the program through an EnSave Program representative.

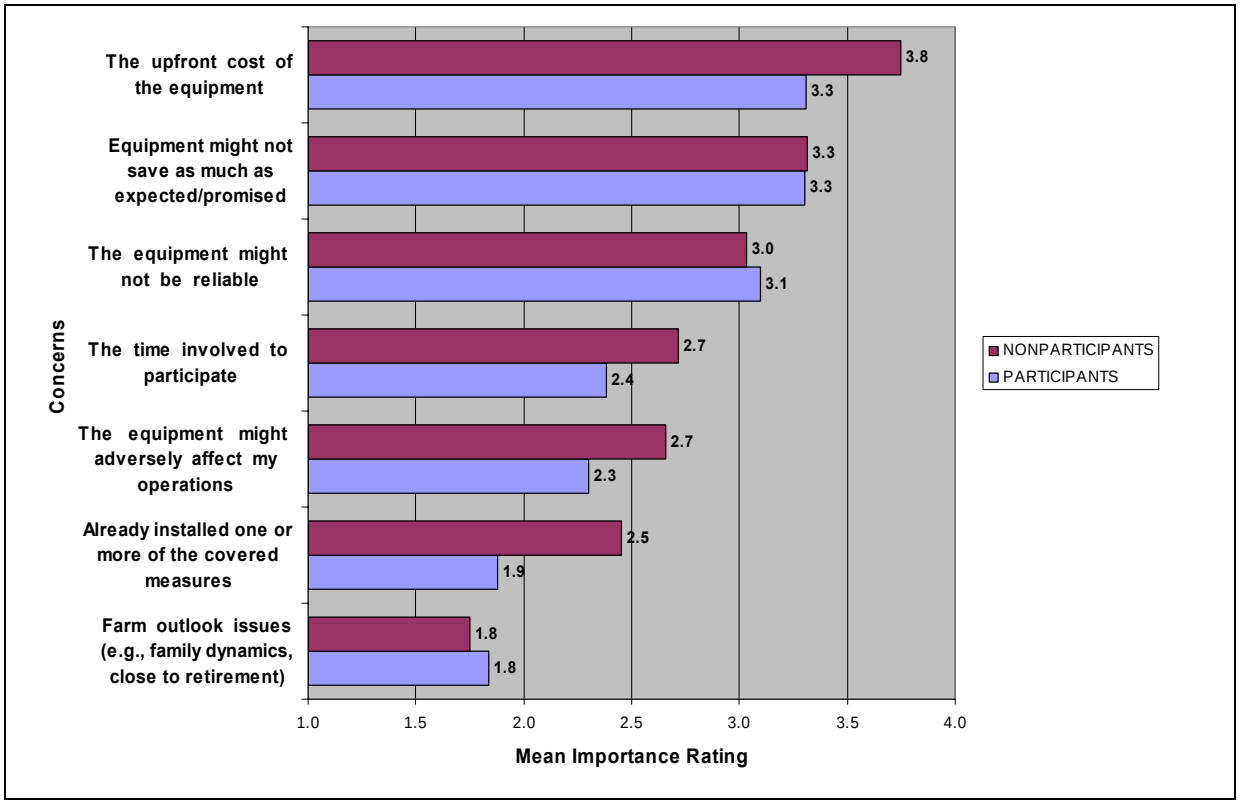
- Direct mail was also a significant source of program awareness, and was cited by more than one-third of non-participants as well as 20% of participants.

While only 4% of participants said they learned of the program through newsletters or newspapers, more than 9% of non-participants became aware through this channel. Moreover, 8% of participants offered the suggestion that the program should have been announced or advertised in dairy magazines when asked what recommendations they had to improve the California Multi Measure program, suggesting that these magazines could have been an effective way to reach the program's targeted audience.

Barriers to Participation

Both participants and non-participants were asked about the importance of various concerns regarding their participation in the program. Results are presented in Exhibit 3.

Exhibit 3. Concerns Regarding Participation



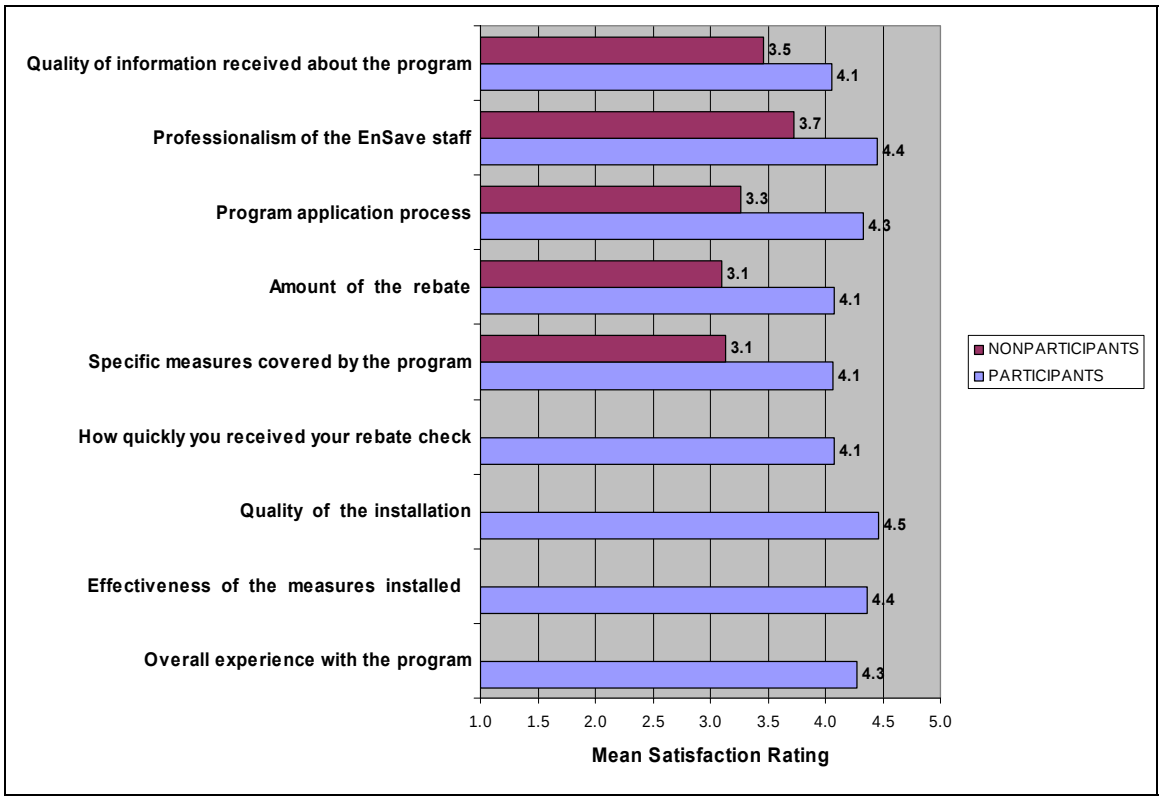
Participants generally assigned somewhat lower levels of importance to concerns they may have had about participating in the program, although none of the differences between the two sets of means were statistically significant. For both groups, the biggest issues were the

upfront cost of the equipment, concerns that the equipment might not save as much as promised, and concerns that it might not be reliable. The biggest difference between participants and non-participants was in whether they already had one or more program measures installed. For both groups, farm outlook issues, such as family dynamics or a farmer nearing retirement, were the least significant concern affecting the decision to participate.

Program Satisfaction

To assess program performance, both participants and non-participants were asked about their satisfaction with those elements of the California Multi Measure Farm program dealing with awareness and enrollment. Program participants were also asked about their satisfaction with various aspects of program participation after they had signed up for the program. Results are summarized in Exhibit 4 and discussed below.

Exhibit 4. Satisfaction with Program Elements



Participants were more satisfied than non-participants with all elements related to learning about and deciding whether to participate in the program, with all of the differences statistically significant at the 95% confidence level. The differences between participants and non-participants were greatest for satisfaction with the program application process, the measures covered by the program, and the amount of the rebate – suggesting that non-participants may have chosen not to participate because of their perception of the steps involved in the process. Farmers who did participate were generally very satisfied with both the application process and their actual participation, assigning all of the program elements a mean rating of greater than 4 on a 1 to 5 scale.

Respondents who assigned a satisfaction rating of 1 or 2 to any element were asked to explain why they did so. The resulting explanations or comments are summarized below, first for participants, then for non-participants.

Participant Explanations for Ratings of 1 or 2

- Information
  - There wasn't very much information; it could have been more detailed
  - I didn't receive any information
- EnSave staff professionalism
  - I had a hard time getting hold of anyone
- Application process
  - Hard to get hold of anyone, and when I did they turned me down
- Rebate
  - Because of how long it took to process everything. I was involved in two programs. It took 6 months until I got the rebate on the fans.
  - I didn't get any rebate.
  - The amount was too low, $2200 on an $8000 unit
  - The cost of the equipment compared to the rebate
  - Because it was too low
- Length of time to receive the rebate
  - My check was delayed by some person's negligence
  - I didn't get a rebate
  - It took too long
- Quality of the installation
  - There were problems with the installation
- Equipment performance
  - We're still having a problem with our milk being too hot
- Program overall
  - It is silly for them to say you have to get it approved before installation. Sometimes you have to get the equipment put in quickly.
  - The installation had problems

Non-participants Explanations for Ratings of 1 or 2

- Information
  - The whole process took too long
  - It didn't accurately reflect what I could get
  - It was unclear the way they put it
- EnSave staff professionalism
  - They were friendly but not expert enough on the technical side of the program.
  - I didn't think I'd get paid. Payback or rebate was promised on original vacuum pump install but never came through. (Someone) at EnSave said they'd be able to pay but after installing the equipment and calling her back she said there was no money left.
  - Because I didn't really get the help I needed to actually get the rebate.
- Application process
  - Took too long
  - Bad past experiences
  - They didn't explain what was covered and what wasn't. I installed the unit and they didn't give me credit for it saying it didn't meet requirements.
  - There was no guarantee that if the equipment was put in the rebate would be paid..
  - They were slow getting back to me; need to get back quicker.
  - Too much paperwork, it became a burden.
  - Too many forms to fill out.
- Rebate
  - Because of maintenance, it would not be worth it.
  - Because of the concern about the vendor raising price in view of the program, so no real savings were available.
  - Amount of the rebate offered was too low for both rebate and payback time.
  - Would like a higher percent offer.
  - Because I never got the rebate.
  - By the time the company that installed finished the paperwork, they had run out of money.
  - Would like a higher rebate offer.
  - They were too low, should have been 20 percent.
  - Wanted more money (rebate).
  - Regardless of what we save we still pay a lot for electricity, so the rebates should be higher.
- Measures covered by the program
  - Somehow I was misled about what equipment I could get.
  - They never got back to me about offering to rebate on any piece of equipment.
  - Lack of information regarding measures and effects of them.
  - Should have been more measures.

One of the underlying factors contributing to the low satisfaction ratings offered by non-

participants appears to be the fact that the program ran out of money before the end of 2005, a point that was raised by six non-participants when they were asked to offer suggestions for program improvement. The following comments were offered:

- If I enroll in the program I'd like to be guaranteed that a rebate will be paid after investing in expensive equipment.
- If the program has an end date for a year then the money should be available for anybody who applies.
- We bought an air compressor, did the paperwork to get a rebate, then got a letter saying that EnSave was out of money. I think that if we agree to take part in the program and purchase equipment then the money for the rebate should be set aside for us.
- Have more funds available, so that those who wish to participate can do so.
- Make more effort to communicate regarding ongoing paperwork needed from the farmer. Should not be a reason to be deprived of rebate when money runs out.
- The application was easy to fill out but as the communication process happened it was not very good. I still have copies of applications and I still haven't received any rebates. One time when I called EnSave they said they had run out of funds.

Other recommendations from non-participants included better program communication (4 respondents), more or higher rebates (3), better technical information/support (3), rebates to manufacturers (1), financing (1), and providing a list of other farmers who have this equipment (1).

Among participants, most said they had no suggestions or offered positive comments, reflecting the high level of satisfaction with program elements and with the program overall. Those comments that were offered focused on better communication, including advertising of the program in dairy magazines and via direct mail (7), higher rebates (4), an improved, shorter application process (4), and a wider range of measures covered by the program (3).

Net-to-Gross Estimates

Several questions were asked of program participants to determine the extent to which measures installed through the program would have been installed anyway. While the intent was to estimate a program-level NTG, the best way to do this would be through the calculation of NTG numbers for each individual measure and the application of these individual numbers to the number of each measure installed through the program. However, because many of the participants surveyed had installed the Vacuum Pump VSD measure that was excluded from this evaluation, the number of respondents having installed each of the other individual measures was relatively small, ranging from 3 for the compressor heat recovery unit to 32 for milk pump VSDs.

For each measure, all survey respondents were asked whether they had installed that measure

through the program (for participants only), through another program, or outside any program. Results are presented in Exhibit 5.

Exhibit 5. Actions Taken by Program Measure

Measure / Action Taken	Milk plate cooler		Milk pump VSD		Scroll compressor		Compressor Heat Recovery Unit	
	N=50 PARTS	N=32 NPs	N=50 PARTS	N=32 NPs	N=50 PARTS	N=32 NPs	N=50 PARTS	N=32 NPs
Installed through the program	14.0%	0.0%	64.0%	0.0%	16.0%	0.0%	6.0%	0
Installed through another program	0.0%	6.3%	2.0%	25.0%	0.0%	3.1%	0.0%	6.3%
Installed, but not through any program	74.0%	78.1%	18.0%	25.0%	20.0%	18.8%	40.0%	40.6%
Have not installed	12.0%	12.5%	14.0%	40.6%	60.0%	56.3%	52.0%	50.0%
Other		3.1%	0.0%	3.1%	0.0%	6.3%	0.0%	0.0%
DK		0.0%	2.0%	6.3%	4.0%	15.6%	2.0%	3.1%

For all measures except milk pump VSDs, more participants had installed the measure outside any program than had installed through the Multi measure Farm program. The percentage installing outside any program was similar for participants and non-participants, while the percentage who had not installed the measure was roughly equal for all measures except milk pump VSDs.

The implication for the program NTG is that at all but the milk pump VSD measure were more likely to have been installed outside the program than through the program. Moreover, milk plate coolers appear to be standard practice, with roughly three-fourths of all respondents having installed them without using any program. While about 20% of milk coolers installed outside the program by both participants and non-participants use cooled water (and therefore do not obtain energy savings,) all seven[2] of the milk plate coolers installed through the program, use ground water.

Both participants and non-participants were also asked why they had not installed the measures targeted by the program. Results are presented in Exhibit 6.

Exhibit 6. Reasons for Not Installing Program Measures

[2] This refers to the sample of program participants that also participated in the telephone survey

Measure / Reason for Not Installing	Milk plate cooler		Milk pump VSD		Scroll compressor		Compressor Heat Recovery Unit	
	N=6	N=4	N=7	N=13	N=30	N=18	N=26	N=16
	PARTS	NPs	PARTS	NPs	PARTS	NPs	PARTS	NPs
Costs too much/payback too long	33.3%	75.0%	28.6%	46.2%	36.7%	38.9%	38.5%	37.5%
Didn't know /wasn't told about it	33.3%		14.3%		40.0%	27.8%	26.9%	18.8%
No need/already have/equipment still good	33.3%	25.0%	14.3%	15.4%	16.7%	11.1%	7.7%	31.3%
Might not save as much as expected			14.3%	15.4%				
Didn't think about it							7.7%	
Might not be reliable							3.8%	
Other			28.6%	15.4%	3.3%		7.7%	
DK				7.7%	3.3%	22.2%	7.7%	12.5%

While the number of respondents who had not installed the measure was low for both milk plate coolers and milk pumps VSDs, more than 40 farmers said they had not installed scroll compressors or compressor heat recovery units. Upfront costs/payback concerns were the main reason these measures had not been installed, followed by lack of information or knowledge about the measures. Fully 40% of participants said they did not know or had not been told about scroll compressors, while 26.9% offered that response for compressor heat recovery units. To the extent that this may have happened because compressors are offered by a different set of vendors, participating suppliers should be encouraged to make farmers aware of other measures offered through the program. They may not have done so because demand for other measures would reduce the availability of program funds for their own product line.

Finally, the extent to which the Multi Measure Farm Program encouraged participants to take actions they would otherwise not have taken was addressed by a survey question asking participants who installed a measure through the program what they would have done if the program had not been available. Results are presented in Exhibit 7.

Exhibit 7. Actions in the Absence of the Program

Measure / Action Without Program	Milk plate cooler	Milk pump VSD	Scroll compressor	Compressor Heat Recovery Unit	All Measures Combined
	N=7	N=32	N=8	N=3	N=50
would not have installed	14.3%	25.0%	12.5%	33.3%	22.0%
would have installed anyway	28.6%	34.4%	62.5%	66.7%	40.0%
would have installed, but not as soon	57.1%	40.6%	25.0%	0.0%	38.0%

Note first that the number of participants who installed each measure was fewer than 10 for all but milk pump VSDs, making the results statistically invalid at the individual measure level. For milk pump VSDs, 32 participants installed the measure, and 34% of those said they would have installed the measure anyway, while 41% said they would have installed,

but not as soon. Combining the percentage who said they would not have installed the measure and the percentage who would not have installed at this time, we calculate the NTG for this measure as .25 plus .41, or .66. More conservatively, if the percentage who would have installed the measure later is weighted at 50% to account for deferred free-ridership, the NTG for this measure would be .25 plus .20, or .45.

Ideally, we would estimate the program NTG by calculating measure-specific NTG values and calculating a weighted program mean based on the number of each measure installed. However, as noted above, there are too few observations for measure-specific calculation. Instead, we combined the observations for all measures, as shown in the last column in Exhibit 7. For the surveyed participants, this yields an aggregate NTG of 0.42 across all 50 measures for which respondents provided data (.22 + 50% of .4).

The high market penetration for most of the measures covered by the program stands in contrast to the results of a 2002 survey conducted by EnSave, which indicated that less than 20 percent of California dairy producers were currently adopting the energy efficiency measures to be offered under the program. It appears that several of the program technologies have gained widespread market acceptance since then, suggesting that there is no strong continuing need for a program targeting the installation of these measures.

At least some of the non-participants who said they installed one of the program measures did so in anticipation of receiving a rebate through the Multi Measure Farm Program but ultimately found that the program had run out of money. Such installation of measures outside a program would normally be considered a spillover effect. However, we did not quantify this effect because there was no statistically sound way to do so. As noted previously, non-participant questions asked about the installation of program measures through other programs or outside any program, but did not explicitly ask whether a measure had been installed in anticipation of a rebate that was never received. Instead, nonparticipants provided this information in comments at the end of the survey. A total of six non-participants both installed one or more measures outside any program and offered comments on the program running out of money, sometimes (but not always) with reference to specific measures. Thus, while it is clear that some non-participants undertook measure installations that were induced by the program, we do not know which measures and how many non-participant installations were affected.

We do know from non-participant comments that the funding shortfall appears to have been perceived as bait and switch by a number of (involuntary) non-participants, that this led to negative perceptions of the program, and that this may make it more difficult to encourage participation targeted to this generally skeptical market segment.

IV. Summary of Key Findings

- More than two thirds of participants and 56% of non-participants said they learned of the program in 2004 or 2005 (the program years), while 26% of participants and 28% of non-participants said they learned of the program during 2002 or 2003, when EnSave offered the Vacuum Pump VSD Program.

- More than 70% of participants learned of the program from equipment vendors, compared to 25% of non-participants. Direct mail was also a significant source of program awareness, cited by more than one-third of non-participants and 20% of participants. While only 4% of participants said they learned of the program through newsletters or newspapers, more than 9% of non-participants became aware through this channel, and 8% of participants offered the suggestion that the program should have been announced or advertised in dairy magazines – a relatively high percentage for an unprompted response.

- Participants generally assigned somewhat lower levels of importance to concerns about participating in the program, although none of the differences between the two sets of means were statistically significant. For both groups, the biggest issues were the upfront cost of the equipment, concerns that the equipment might not save as much as promised, and concerns that it might not be reliable.

- Participants were statistically significantly (at the 95% confidence level) more satisfied than non-participants with all elements related to learning about and deciding whether to participate in the program.
  - The differences between participants and non-participants were greatest for satisfaction with the program application process, the measures covered by the program, and the amount of the rebate – suggesting that non-participants may have chosen not to participate because of their perception of the steps involved in the process.
  - On the other hand, farmers who did participate were generally very satisfied with both the application process and their actual participation, assigning all of the program elements a mean rating of greater than 4 on a 1 to 5 scale.
  - One of the underlying factors contributing to the low satisfaction ratings offered by non-participants appears to be the fact that the program ran out of money before the end of 2005, a point that was raised by six non-participants when they were asked to offer suggestions for program improvement.

- All but the milk pump VSD measure were more likely to have been installed outside the program than through the program. Moreover, milk plate coolers appear to be standard practice, with roughly three-fourths of all respondents having installed them without using any program.
  - While the number of respondents who had not installed the measure was low for both milk plate coolers and milk pumps VSDs, more than 40 farmers said they had not installed scroll compressors or compressor heat recovery units.

  - Upfront costs/payback concerns were the main reason these measures had not been installed, followed by lack of information or knowledge about the measures.

- NTG estimates were calculated based on the percentage of participants who said they would not have installed the program measure without the program in place or would not have installed it until later.
  - Because so few participants installed other measures, milk pump VSDs were the only measure for which an individual NTG value could be calculated: 0.66.
  - Making the same calculation using all 50 measures installed by survey respondents yields an aggregate NTG of 0.6 for the program based on survey results.

- The high market penetration for most program measures stands in contrast to the results of a 2002 survey conducted by EnSave indicating that less than 20 percent of California dairy farms were adopting these measures.
  - It appears that several of the program technologies have gained widespread market acceptance since then, suggesting that there is no strong continuing need for a program targeting the installation of these measures.
  - At least some non-participants installed program measures in anticipation of receiving a rebate through the Multi Measure Farm Program but ultimately found that the program had run out of money. This is perceived as bait-and-switch marketing by the effected farmers, discredits the current program, and will make it more difficult for future programs to succeed with this target market. Ensuring that participants who install program measures in anticipation of incentives do in fact receive those incentives is a fundamental requirement of program implementation. Program managers should avoid these unexpected (but not unpredictable) shortfalls through, suggesting that there is no strong continuing need for a program targeting the installation of these measures better communication and the commitment of funds before a project is initiated.

APPENDIX A
REQUIRED ENERGY IMPACTS REPORTING TABLES

Sum Of Energy Impacts for This 2004-2005 Program

2004-2005 form

Program IDs*:	354-04 and 1360-04							
Program Name:	California Multi-Measure Farm Program							
	Year	Calendar Year	Ex-ante Gross Program-Projected Program MWh Savings (1)	Ex-Post Net Evaluation Confirmed Program MWh Savings (2)	Ex-Ante Gross Program-Projected Peak Program MW Savings (1**)	Ex-Post Evaluation Projected Peak MW Savings (2**)	Ex-Ante Gross Program-Projected Program Therm Savings (1)	Ex-Post Net Evaluation Confirmed Program Therm Savings (2)
	1	2004	5,177.07	2,620.90	0.952	0.504	0	0
	2	2005	5,177.07	2,620.90	0.952	0.504	0	0
	3	2006	5,177.07	2,620.90	0.952	0.504	0	0
	4	2007	5,177.07	2,620.90	0.952	0.504	0	0
	5	2008	5,177.07	2,620.90	0.952	0.504	0	0
	6	2009	5,177.07	2,620.90	0.952	0.504	0	0
	7	2010	5,177.07	2,620.90	0.952	0.504	0	0
	8	2011	5,177.07	2,620.90	0.952	0.504	0	0
	9	2012	5,177.07	2,620.90	0.952	0.504	0	0
	10	2013	5,177.07	2,620.90	0.952	0.504	0	0
	11	2014	5,177.07	2,620.90	0.952	0.504	0	0
	12	2015	5,177.07	2,620.90	0.952	0.504	0	0
	13	2016	5,177.07	2,620.90	0.952	0.504	0	0
	14	2017	5,177.07	2,620.90	0.952	0.504	0	0
	15	2018	5,177.07	2,620.90	0.952	0.504	0	0
	16	2019	5,177.07	2,620.90	0.952	0.504	0	0
	17	2020	5,177.07	2,620.90	0.952	0.504	0	0
	18	2021	5,177.07	2,620.90	0.952	0.504	0	0
	19	2022	5,177.07	2,620.90	0.952	0.504	0	0
	20	2023	5,177.07	2,620.90	0.952	0.504	0	0
	TOTAL	**2004-2023**	103,541.48	52,418.03	0.952	0.504	0	0

*This form is for the total energy impacts for the program across all IOU territories in which the program was implemented.
May be multiple ID numbers if implemented in more than one territory.
**Please include the definition of Peak MW used in the evaluation.

Definition of Peak MW as used in this evaluation: The average demand reduction achieved between 12:00 PM and 6:00 PM when the equipment is operating.

1. Gross Program-Projected savings are those savings projected by the program before NTG adjustments.
2. Net Evaluation Confirmed savings are those documented via the evaluation and include the evaluation contractor's NTG adjustments.

Note:
Peak MW is defined as average annual peak demand reduction.

SCE Program Energy Impact Reporting for 2004-2005 Programs

Program ID*:	1360-04							
Program Name:	California Multi-Measure Farm Program							
	Year	Calendar Year	Ex-ante Gross Program-Projected Program MWh Savings (1)	Ex-Post Net Evaluation Confirmed Program MWh Savings (2)	Ex-Ante Gross Program-Projected Peak Program MW Savings (1**)	Ex-Post Evaluation Projected Peak MW Savings (2**)	Ex-Ante Gross Program-Projected Program Therm Savings (1)	Ex-Post Net Evaluation Confirmed Program Therm Savings (2)
	1	2004	1,210.4	662.5	0.182	0.104	0	0
	2	2005	1,210.4	662.5	0.182	0.104	0	0
	3	2006	1,210.4	662.5	0.182	0.104	0	0
	4	2007	1,210.4	662.5	0.182	0.104	0	0
	5	2008	1,210.4	662.5	0.182	0.104	0	0
	6	2009	1,210.4	662.5	0.182	0.104	0	0
	7	2010	1,210.4	662.5	0.182	0.104	0	0
	8	2011	1,210.4	662.5	0.182	0.104	0	0
	9	2012	1,210.4	662.5	0.182	0.104	0	0
	10	2013	1,210.4	662.5	0.182	0.104	0	0
	11	2014	1,210.4	662.5	0.182	0.104	0	0
	12	2015	1,210.4	662.5	0.182	0.104	0	0
	13	2016	1,210.4	662.5	0.182	0.104	0	0
	14	2017	1,210.4	662.5	0.182	0.104	0	0
	15	2018	1,210.4	662.5	0.182	0.104	0	0
	16	2019	1,210.4	662.5	0.182	0.104	0	0
	17	2020	1,210.4	662.5	0.182	0.104	0	0
	18	2021	1,210.4	662.5	0.182	0.104	0	0
	19	2022	1,210.4	662.5	0.182	0.104	0	0
	20	2023	1,210.4	662.5	0.182	0.104	0	0
	TOTAL	**2004-2023**	24,208.13	13,249.56	0.182	0.104	0	0

*Please complete this form for the SCE program ID included in the evaluation.
**Please include the definition of Peak MW used in the evaluation.
Definition of Peak MW as used in this evaluation: The average demand reduction achieved between 12:00 PM and 6:00 PM when the equipment is operating.

Note, change the Program ID Number on the worksheet tabs (below), so that it matches the Program ID Number of the program being evaluated.

1. Gross Program-Projected savings are those savings projected by the program before NTG adjustments.
2. Net Evaluation Confirmed savings are those documented via the evaluation and include the evaluation contractor's NTG adjustments.

Note:
Peak MW is defined as average annual peak demand reduction.

Program ID*:	354-04							
Program Name:	California Multi-Measure Farm Program							
	Year	Calendar Year	Ex-ante Gross Program-Projected Program MWh Savings (1)	Ex-Post Net Evaluation Confirmed Program MWh Savings (2)	Ex-Ante Gross Program-Projected Peak Program MW Savings (1**)	Ex-Post Evaluation Projected Peak MW Savings (2**)	Ex-Ante Gross Program-Projected Program Therm Savings (1)	Ex-Post Net Evaluation Confirmed Program Therm Savings (2)
	1	2004	3,966.7	1,958.4	0.770	0.400	0	0
	2	2005	3,966.7	1,958.4	0.770	0.400	0	0
	3	2006	3,966.7	1,958.4	0.770	0.400	0	0
	4	2007	3,966.7	1,958.4	0.770	0.400	0	0
	5	2008	3,966.7	1,958.4	0.770	0.400	0	0
	6	2009	3,966.7	1,958.4	0.770	0.400	0	0
	7	2010	3,966.7	1,958.4	0.770	0.400	0	0
	8	2011	3,966.7	1,958.4	0.770	0.400	0	0
	9	2012	3,966.7	1,958.4	0.770	0.400	0	0
	10	2013	3,966.7	1,958.4	0.770	0.400	0	0
	11	2014	3,966.7	1,958.4	0.770	0.400	0	0
	12	2015	3,966.7	1,958.4	0.770	0.400	0	0
	13	2016	3,966.7	1,958.4	0.770	0.400	0	0
	14	2017	3,966.7	1,958.4	0.770	0.400	0	0
	15	2018	3,966.7	1,958.4	0.770	0.400	0	0
	16	2019	3,966.7	1,958.4	0.770	0.400	0	0
	17	2020	3,966.7	1,958.4	0.770	0.400	0	0
	18	2021	3,966.7	1,958.4	0.770	0.400	0	0
	19	2022	3,966.7	1,958.4	0.770	0.400	0	0
	20	2023	3,966.7	1,958.4	0.770	0.400	0	0
	TOTAL	**2004-2023**	79,333.35	39,168.47	0.770	0.400	0	0

*Please complete this form for the PG&E program ID included in the evaluation.
**Please include the definition of Peak MW used in the evaluation.
Definition of Peak MW as used in this evaluation: The average demand reduction achieved between 12:00 PM and 6:00 PM when the equipment is operating.

Note, change the Program ID Number on the worksheet tabs (below), so that it matches the Program ID Number of the program being evaluated.

1. Gross Program-Projected savings are those savings projected by the program before NTG adjustments.
2. Net Evaluation Confirmed savings are those documented via the evaluation and include the evaluation contractor's NTG adjustments.

Note:
Peak MW is defined as average annual peak demand reduction.

APPENDIX B
EM&V PLAN REVIEW COMMENTS & RESPONSES

CPUC/Policy Manual Evaluation Goal		How the plan addresses the Policy Manual or justification for not doing so:	Issues of concern, if any:
Measure energy and peak savings per year over the life of the measures (kWh, kW & therms for each year)	Installation verification	Sample of 10% of sites (20) receive M&V	
	Gross impact analysis	Based off realization rate adjustments to sites from M&V analysis	
	Impact units of measure (program or measure)	Measure and program level savings estimates, with estimates per pound of milk production	
	Measurement and Verification approach	IPMVP Option B, 2 week pre and post metering with 15-minute interval, electric and thermal (logger thermisters and ultrasonic flow meter, measure entering & exiting milk and cooling water temperatures for milk plate cooler & milk pump VSDs	
	Sampling and uncertainty	85% confidence on a measure-basis assuming a 20% standard deviation	
	Peak demand analysis	Pre-Evaluation Comments: Will update EM&V plan in appropriate sections. Not difficult, all data available. Post-Evaluation Comments: Demand impacts for all measures were developed and reported as part of the evaluation.	Need to include in EM&V Plan (should be relatively simple off of 15-minute interval data)
	Net-to-Gross	Pre-Evaluation Comments: The simplest approach will be to	Needs to be added.

		stipulate 75% which is consistent with the PIP and the Policy manual. We will state that a comprehensive Net-to-gross analysis is more suited to the statewide evaluation of the IOU programs that involve the dairy industry. Post-Evaluation Comments: A net to gross analysis was conducted and incorporated in the final report, see Section 5.	
Measure cost-effectiveness		Pre-Evaluation Comments: Cost-effectiveness will be computed using the program workbook with updated savings and costs to reflect the EM&V findings and actual costs. Post-Evaluation Comments: Given the low overall realization rates for the four measures evaluated, a detailed review and analysis does not seem to be useful or warranted.	Needs to be addressed.
Provide upfront market assessment and baseline analysis		Pre-Evaluation Comments: Based on EnSave's experience with the 2002 program, and that small dairies have traditionally been under served, there is a clear need for energy efficiency programs targeted toward the dairy industry. Given the timeframe of the program, the hard to reach aspect, and identified need, an upfront market assessment was not reasonable. With the exception of Vacuum pump VSD's (which are not part of the evaluation), baseline data do not exist for the other measures. As a	Needs to be addressed.

		component of the process survey, participating farmers will be polled regarding the installation of measures outside of the program. Also, all participating farmers will be asked if any of the qualifying measures have already been installed and if any incentive was received. Results will be provided in a tabular format.	
Provide ongoing feedback and guidance		Pre-Evaluation Comments: EnSave will receive quarterly progress reports of the evaluation effort detailing what was found at the site and effectiveness of the measures installed and evaluated to date. EnSave can then incorporate those comments in progress reports to the Commission.	Needs to be addressed.
Measure indicators of effectiveness and testing program theory (PT/LM) and approach		Post-Evaluation Comments Detailed measurement and testing of the program theory was not completed under the evaluation, given the relatively small size of the program and the established need for the program based on results from the 2002-2003 VSD Vacuum pump program.	Needs to be addressed.
Assess the overall levels of performance and success **(Process eval)**	Process evaluation approach	Pre-Evaluation Comments: A process evaluation will be conducted in a similar fashion to the 2002 program.	Needs to be addressed.
	Sampling plan for process evaluation	Since this market sector is hard to reach, the process evaluation will be conducted as a census.	Needs to be addressed.
Inform decisions regarding		Verification on sample of 10%.	

compensation and final payments **(Measure counts)**			
Help assess the continuing need for the program **(Gen assessment)**		Pre-Evaluation Comments: Will update EM&V Plan. We will base this on the response rate to marketing activities and how fast the program becomes subscribed. Post-Evaluation Comments: See Section 5, Process Survey of the final report.	Needs to be addressed.