



# REPORT

## MEASUREMENT AND EVALUATION STUDY

for

**San Francisco Community Power  
Cooperative's 2004-2005 Energy  
Efficiency on Wheels Program  
CPUC Program No. 1083.04  
CALMAC Study ID: SFC0001**

Final Report

Prepared for the

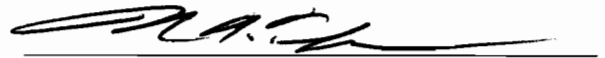
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and the

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## PREFACE

This document is the Measurement and Evaluation Study Report required per the San Francisco Community Power Cooperative's contract with EMCOR Energy & Technologies (EE&T) for Measurement & Evaluation Services for the 2004 - 2005 Energy Efficiency on Wheels Program.

EMCOR Energy & Technologies, of San Francisco, California, prepared this document for the San Francisco Community Power Cooperative. The authors of this report are Marc A. Theobald, Lucien Berger, and Ayad Al-Shaikh, P.E. EE&T's Program Manager for the San Francisco Community Power Cooperative is Marc A. Theobald. This report was reviewed for technical quality by Merlin G. Luedke, P.E., and edited by April Kaden Banerjee, C.E.M.

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## 1. EXECUTIVE SUMMARY

### Introduction

The San Francisco Community Power Cooperative's Energy Efficiency on Wheels Program was an \$800,000, 18-month energy efficiency program serving utility customers in low-income, hard-to-reach areas of San Francisco. This program provided for the distribution and installation of energy saving measures and the education of participants with regards to energy efficiency options for homes and businesses. The program received its funding from the 2004-2005 California Public Utilities Commission (CPUC) Energy Efficiency Program.

EE&T was retained to provide a measurement and evaluation (M&E) study of the Energy Efficiency on Wheels Program (program), in accordance with CPUC M&E requirements. The initial phase of the evaluation was the development of a program M&E research plan, the purpose of which was to outline the methods to be used to evaluate the program. The M&E research plan is attached in its entirety as Appendix A to this Measurement and Evaluation Report, along with the CPUC's review comments, which modify this plan as published.

The M&E research plan outlined the program goals and the CPUC evaluation criteria. The plan offered proposed evaluation methods, including procedures related to sampling, data collection and management, and analysis. This research plan was implemented and this report summarizes the resultant findings.

### Findings

The program's database at the close of the program indicated 66,126 implemented measures for 4,164 participants, generating a gross savings of 3,295,754 kWh annually, a peak reduction of 475.3 kW, and a reduction in annual natural gas use of 99,908 therms per year. A field verification process was applied to a sample of 459 measures to estimate the percentage of measures likely to be remaining in service. The process verified an implementation rate of 87.8% of the indicated quantities.

Table 1.1 summarizes the gross and net program savings. The net verified program savings represent 102% of the original program savings goals for gas use (therms per year), 122% for peak electrical demand reduction (kW), and 83% for reduction of electrical energy use (kWh per year).

According to program administration staff, coordination issues with the IOU Contract Administrator, Pacific Gas and Electric Company (PG&E), have prevented a "closing" database that reflects the program's final documentation of all included measures. The findings reported herein are therefore expected to be conservative with respect to the overall program accomplishments.

The program installed some energy efficiency equipment and distributed others. The distributed equipment was intended for the participants to install. Since only equipment that is installed actually saves energy, there is a good likelihood that some received equipment may not have been installed and thus may not be saving energy. This, combined with the conservatism in the measurement due to lack of final program documentation, indicates that there may be both over- and under-representation biases in the measurement.

**Table 1.1: Program Summary**

Source of Data <sup>(a)</sup>	Measure Quantity	Gross Values			Net Values <sup>(b)</sup>		
		Natural Gas (Therms /yr)	Electric Demand (kW)	Electricity (kWh/yr)	Natural Gas (Therms /yr)	Electric Demand (kW)	Electricity (kWh/yr)
Original Program Goals	68,200	92,500	490.5	3,577,500	74,000	392.4	2,862,000
Revised Program Goals	76,650	110,288	558.9	4,034,156	88,230	447.1	3,227,325
Reported Results-Database	66,126	99,908	475.3	3,295,754	79,927	380.3	2,636,603
Verified Program Savings (Extrapolated)	58,057	94,123	598.0	2,967,708	75,299	478.4	2,374,166

<sup>(a)</sup> Refer to Appendix B, "Energy Impacts and Project Calculations."

<sup>(b)</sup> Reflects application of Net-to-Gross Ratio of 0.8. See Section 2 for more information.

## 2. SUMMARY OF APPROACH

This program was designed to help low-income, hard-to-reach households lower their energy bills through education and access to energy efficiency technologies. This M&E study verifies the delivery of energy efficiency technologies and validates the energy savings through a sampling of the program participants.

The M&E approach relies on previous work done for the CPUC and the utility, PG&E, that established electric demand reduction and energy savings for various energy conservation measures (ECMs). The San Francisco Community Power Cooperative used established criteria from other energy savings monitoring projects [Database for Energy Efficient Resources (DEER) published by the California Energy Commission (CEC) and PG&E survey results] to stipulate values for electric demand reduction and energy savings due to the included measures. Measurements performed in previous programs determined the stipulated savings. This evaluation assessed the savings assumptions provided in San Francisco Power Co-op's "Efficiency on Wheels Proposal for the 2004-2005 CPUC Energy Efficiency Programs" (December 29, 2005 Revision, Section IV). Rather than evaluate the merits of the Program's assumptions, this assessment revised the stipulated savings for each measure based on the current values from the DEER database and from documentation used by the CPUC in support of the DEER values.

It should be noted that the CPUC's Energy Efficiency Policy Manual, which governs this program, indicates the measurement and verification protocols: "For the M&V portion of the plan, implementers should adhere to the guidelines in the International Performance Measurement and Verification Protocol (IPMVP)".<sup>1</sup> IPMVP Option A is prescribed for lighting and similar measures, requiring the partial measurement of at least one parameter while others may be stipulated. The intent of this protocol is that field measurements be conducted of the element or elements with the greatest potential effect on reducing uncertainty in the energy savings estimate. For lighting measures, for example, this could be operating hours, with the remaining parameters (such as the change in wattage) being stipulated from existing studies. Under IPMVP protocol, counting the pieces of equipment installed does not qualify as a field measurement. While the CPUC Energy Efficiency Policy Manual indicates the use of the IPMVP, the scope of this evaluation study did not include field measurements of connected load or operations. Instead, the research plan for this measurement and evaluation study as accepted by the CPUC provided for field verification in conjunction with stipulated savings values.

A statistically valid sample of ECM installations were drawn from the program database and verified. The number of verified ECM installations were compared with the total quantity of installations indicated in the sample to arrive at a savings factor: the ratio of verified to indicated measures, which is calculated to be 87.8%.

This savings factor was applied to the reported quantities of each measure to arrive at a verified number of installations. The number of verified ECM installations was multiplied by the unit stipulated savings for each measure to determine the gross electric demand reduction and annual energy savings achieved by the program. The gross savings values were then de-rated to mitigate the effect of "free-ridership" through the application of a net-to-gross (NTG) ratio. The program used an NTG ratio of 0.80, for residential and non-specific commercial programs, which is supported based on the CPUC Energy Efficiency Policy Manual Version 2, Table 4.2 "Net-to-Gross Ratios".

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<sup>1</sup> California Public Utilities Commission Energy Efficiency Policy Manual Ver. 2, August 2003, pg. 26

The projected lives of the ECMs were used to determine the energy savings for each year of the ECMs for years 2 through the projected lives of the ECMs. The data source for projected lives was drawn from the current DEER database values as indicated at the CPUC website: <http://eega.cpuc.ca.gov/deer/>.

Energy impact results are provided to the CPUC electronically in the required format and are attached to this report as Appendix B, "Energy Impacts and Project Calculations".

### 3. EVALUATION CRITERIA AND BASELINE

The program goals included energy savings impacts, as quantified by electrical energy savings (kWh), electrical load reduction (kW), and natural gas savings (therms). These values were based on stipulated per-unit savings computations that were previously accepted by the CPUC for various efficiency measures. The aggregate program savings goals were based on the projected quantity of installations for each measure multiplied by the stipulated per unit savings.

The program also had “soft goals” related to encouraging participation in other qualifying programs, and whether or not program participants were indeed “hard-to-reach” based on qualifying demographic information. “Hard-to-reach” is defined by whether a participant is “low-income” (per CPUC guidelines), a renter, has a primary language other than English, or lives in a multi-family dwelling. The program goal was that a minimum of 80% of participants fell into one or more of these categories.

As the program implementation took place, program management negotiated changes to the program goals with the CPUC in order to reflect the relative distribution of energy use reduction opportunities in the residential and commercial sectors. The revised program goals resulted in increased goals for energy and electric demand reductions. Tables 3.1 and 3.2 show the original and revised program goals, respectively.

**Table 3.1: Original Program Goals**

Measure <sup>(a)</sup>	Qty	Savings					
		Unit Natural Gas (Therms/yr)	Unit Electric Demand (kW)	Unit Electricity (kWh/yr)	Total Natural Gas (Therms/yr)	Total Electric Demand (kW)	Total Electricity (kWh/yr)
CFLs, 15 W	14,000		0.0081	36.1		113.4	505,400
CFLs, 25 W	14,000		0.0135	89.9		189.0	1,258,600
CFLs, 23 W (Exterior)	9,000		0.0135	89.9		121.5	809,100
Low Flow Showerhead *	5,000	9.3			46,500		
Sink Aerator *	5,000	3.3			16,500		
Weatherstripping *	5,000	0.7	0.0015	3.1	3,500	7.5	15,500
Programmable Thermostat	1,000	26.0		5.0	26,000		5,000
Occupancy Sensors	15,000		0.0035	47.9		52.5	718,500
Vending Misers	200		0.0330	1,327		6.6	265,400
Gross Savings Total	68,200				92,500	490.5	3,577,500
Net-to-gross Ratio:					0.8	0.8	0.8
<b>Program Goals</b>					<b>74,000</b>	<b>392.4</b>	<b>2,862,000</b>

(a) 5,000 each of 15 W & 25 W compact fluorescent lamps (CFLs) were incorporated in distributed energy kits along with items marked by an asterisk (\*). The quantity and savings values for these 5,000 CFLs are reflected in the respective rows for the 15 W and 25 W CFLs.



**Table 3.2: Revised Program Goals**

Measure <sup>(a)</sup>	Qty	Savings					
		Unit Natural Gas (Therms/yr)	Unit Electric Demand (kW)	Unit Electricity (kWh/yr)	Total Natural Gas (Therms/yr)	Total Electric Demand (kW)	Total Electricity (kWh/yr)
CFLs, 15 W	15,927		0.0081	36.1		129.0	574,965
CFLs, 25 W	21,357		0.0135	89.9		288.3	1,919,994
CFLs, 23 W (Exterior)	5,136		0.0135	89.9		69.3	461,726
Low Flow Showerhead *	5,360	9.3			49,848		
Sink Aerator *	5,360	3.3			17,688		
Weatherstripping *	5,360	0.7	0.0015	3.1	3,752	8.0	16,616
Programmable Thermostat	1,500	26.0		5	39,000		7,500
Occupancy Sensors	16,450		0.0035	47.9		57.6	787,955
Vending Misers	200		0.0330	1,327		6.6	265,400
Gross Savings Total	76,650				110,288	558.8	4,034,156
Net-to-gross Ratio:					0.8	0.8	0.8
<b>Program Goals</b>					<b>88,230</b>	<b>447</b>	<b>3,227,325</b>

(a) 5,000 each of 15 W & 25 W compact fluorescent lamps (CFLs) were incorporated in distributed energy kits along with items marked by an asterisk (\*). The quantity and savings values for these 5,000 CFLs are reflected in the respective rows for the 15 W and 25 W CFLs.

#### 4. EVALUATION SUMMARY

The achievement of electrical energy, electrical load reduction, and natural gas savings goals were evaluated on the basis of the validity of the stipulated values, the results of a review of the database, and the inspection process.

##### **Validation of Stipulated Savings**

A key aspect of this evaluation consists of a review of the assumptions employed by the Program to calculate the program savings. This review consists of two components: (1) a review of kW, kWh, and therm reduction values associated with the measures, and (2) a validation of the program assumptions related to the effective useful life (EUL) of each measure.

##### Background

When the CPUC accepted the SF Power Co-op's program proposal, it was with the understanding that the key program savings assumptions would be assessed as part of the M&E study and updated as necessary to conform to the current research findings.

This M&E study assessed the savings assumptions provided in San Francisco Power Co-op's "Efficiency on Wheels Proposal for the 2004-2005 CPUC Energy Efficiency Programs" (December 29, 2005 Revision, Section IV). The Program's stipulated values are presented in Table 4.1 on the following page; the Program's justifications for these assumptions can be found in the referenced text.

##### Assessment

Rather than evaluate the merits of the Program's assumptions, this assessment revises the stipulated savings and EUL values based on the current stipulated values available for each measure from the DEER database and from documentation used by the CPUC in support of the DEER values.

##### Findings and Revisions

The Evaluator found that DEER stipulated values have changed significantly since the Co-op first developed the program savings estimates. These updated DEER values are based on the results of new studies including the source documents, "CFL Metering Study" (KEMA) Feb 25, 2005, and "Revised / Updated EULs Based on Retention and Persistence Studies Results" [Skumatz Economic Research Associates (SERA)] July 8, 2005.

Also, as indicated by the values provided in Table 4.1, the SF Power Co-op did not distinguish between the savings and equipment life expectancy associated with residential and non-residential applications.

The Evaluator obtained available savings and EUL values for residential and non-residential conditions (shown in Table 4.2). These values were applied in accordance with the fixture quantities as indicated in the program database, subject to field verification, to arrive at the verified savings.

**Table 4.1: Program’s Stipulated Savings and EUL Values**

Measure	Program Stipulated Values			
	Effective Useful Life [EUL] (yrs)	Unit Natural Gas Savings (Therms/yr)	Unit Electricity Demand Reduction (kW/yr)	Unit Electricity Savings (kWh/yr)
R-CFL 15W	8		0.0081	36.1
R-CFL 25W	8		0.0135	89.9
R-CFL Outdoor PAR Lamps	8		0.0135	89.9
R-Low Flow Showerhead	10	9.3		
R-Sink Aerator	5	3.3		
R-Weatherstripping	1	0.7	0.0015	3.1
R-Programmable Thermostat	11	26.0		5.0
R-Motion Sensor Indoor	8		0.0035	47.9
R-Motion Sensor Indoor 3-way	8		0.0035	47.9
R-Motion Sensor Outdoor – Retrofit	8		0.0035	47.9
R-Motion Sensor Outdoor w/ Fixture	8		0.0035	47.9
R-Vending Miser	10		0.0330	1,327.0
NR-CFL 15W	8		0.0081	36.1
NR-CFL 25W	8		0.0135	89.9
NR-CFL Outdoor PAR Lamps	8		0.0135	89.9
NR-Low Flow Showerhead	10	9.3		
NR-Sink Aerator	5	3.3		
NR-Weatherstripping	1	0.7	0.0015	3.1
NR-Programmable Thermostat	11	26.0		5.0
NR-Motion Sensor Indoor	8		0.0035	47.9
NR-Motion Sensor Indoor 3-way	8		0.0035	47.9
NR-Motion Sensor Outdoor – Retrofit	8		0.0035	47.9
NR-Motion Sensor Outdoor w/ Fixture	8		0.0035	47.9
NR-Vending Miser	10		0.0330	1,327.0

**Table 4.2: Stipulated Savings and EUL Values Used in M&E Study**

Measure	Revised Stipulated Values			
	Effective Useful Life [EUL] (yrs)	Unit Natural Gas Savings (Therms/yr)	Unit Electricity Demand Reduction (kW/yr)	Unit Electricity Savings (kWh/yr)
R-CFL 15W	9		0.0033	34.591
R-CFL 25W	9		0.0055	57.652
R-CFL Outdoor PAR Lamps	7		0.0000	59.189
R-Low Flow Showerhead	10	7.502		
R-Sink Aerator	9	5.627		
R-Weatherstripping	13	11.0672		
R-Programmable Thermostat	12			
R-Motion Sensor Indoor	8		0.0134	43.207
R-Motion Sensor Indoor 3-way	8		0.0134	43.207
R-Motion Sensor Outdoor – Retrofit	8		0.0000	43.207
R-Motion Sensor Outdoor w/ Fixture	8		0.0000	43.207
R-Vending Miser	10		0.0000	1,612.000
NR-CFL 15W	2		0.0434	171.133
NR-CFL 25W	2		0.0723	285.221
NR-CFL Outdoor PAR Lamps	7		0.0000	292.827
NR-Low Flow Showerhead	10	7.502		
NR-Sink Aerator	9	5.627		
NR-Weatherstripping	13	11.0672		
NR-Programmable Thermostat	11			
NR-Motion Sensor Indoor	8		0.1762	213.759
NR-Motion Sensor Indoor 3-way	8		0.1762	213.759
NR-Motion Sensor Outdoor – Retrofit	8		0.0000	213.759
NR-Motion Sensor Outdoor w/ Fixture	8		0.0000	213.759
NR-Vending Miser	10		0.0000	1,612.000

## **Database Review and Inspection**

The program delivered some measures and installed others. An in-depth evaluation of a sample of the measures was performed to determine whether they had been either delivered or installed and remained in service, according to the service method indicated in the program database. This portion of the evaluation also included a review of findings related to the soft goals. An actual equipment count was conducted for each measure and this count compared with the count indicated in the program database.

The realization of soft goals for the sample was determined from information provided by the participants. Each participant was classified as low income, a renter, has a primary language other than English, or lives in a multi-family dwelling, according to his or her response.

The evaluation was performed on an aggregated basis. For the sample, the ratio of implemented items to reported items generated a percentage, which was applied across the board to the reported savings values to arrive at the verified values for the sample. The results from the sample were then extrapolated to the total results reported in the database to determine the total verified savings for the program.

Table 4.3 shows the CPUC measurement and evaluation goals and how this study met those goals. Please refer to Section 5 for a discussion of the sampling methods, Section 6 for the data collection process, and Section 7 for a discussion of the method of analysis.

**Table 4.3: Achievement of M&E Goals**

CPUC Energy Efficiency Policy Manual Evaluation Goal	Sub-Part	How M&E Plan Addressed Goal	How Evaluation Addressed Goal	Details
Measure energy and peak savings per year over the life of the measures (kWh, kW & therms for each year)				
	Installation verification	On-site verification to be conducted for a sample of sites	Verification was conducted for 53 sites.	Measures were verified by phone interview or on-site inspection in accordance with practices outlined in Section 6, "Data Collection and Management".
	Gross impact analysis	Based upon installation verification rate and deemed values	An installation verification rate of 87.8% was found and used with stipulated values for each measure to determine the gross savings impact.	San Francisco Community Power Cooperative provided stipulated savings for each of the measures in the approved proposal for the 2004-2005 CPUC Energy Efficiency Programs.
	Impact units of measure (program or measure)	Program savings to be reported based on M&E results.	Program savings are reported herein based on M&E results.	Verified savings are tabulated at program level.
	Measurement and Verification approach	Followed IPMPV Option A, with one exception since measurements are stipulated.	Followed IPMPV Option A, with one exception since measurements are stipulated.	Stipulated values were approved in the Efficiency on Wheels Proposal and approved in principle by the CPUC during the review of the M&E plan. These values were from the DEER Database, with additional input from PG&E and CEC studies.
	Sampling and uncertainty	Sampling plan was designed and included in the M&E plan.	Sampling plan was applied to the data using Single-Stage Cluster Sampling technique	The sample was drawn from the measures in accordance with the sampling plan formula. The sampling plan and execution are detailed in Section 5

**Table 4.3: Achievement of M&E Goals**

CPUC Energy Efficiency Policy Manual Evaluation Goal	Sub-Part	How M&E Plan Addressed Goal	How Evaluation Addressed Goal	Details
	Peak demand analysis	Projected from deemed reduction in demand by installation verification and stipulated per measure values.	Projected from deemed reduction in demand by installation verification and stipulated per measure values. Stipulated values were updated in accordance with current research results.	Stipulated values were approved in the Efficiency on Wheels Proposal. These values were from the DEER Database, with additional input from PG&E and CEC studies. Stipulated values are justified in part because there is no accurate record of the "base case" load from which to calculate the demand reduction. This evaluation adjusted the values in accordance with currently accepted DEER values, and assigned non-residential DEER values where available and as applicable. The approved M&E plan did not include ongoing monitoring to determine system runtimes to support operational characteristics.
	Net-to-gross Ratio	Stipulated NTG ratio of 0.8 used	Stipulated NTG ratio of 0.8 used	The Energy Efficiency Policy Manual, Version 2, Table 4.2 lists an NTG of 0.80 for undefined residential and nonresidential programs.
Measure cost-effectiveness		Incremental measure costs to be compared with per-unit energy savings estimates to determine cost-effectiveness.	Program costs were compared with verified energy savings estimates to determine program cost-effectiveness.	Program costs include measure costs (equipment and implementation), as well as administrative costs (program design and management). Administrative costs were not apportioned by measure, therefore the cost-effectiveness of incremental measures could not be calculated. Program cost-effectiveness was verified by using the total resource cost (TRC) calculation in the CPUC workbook.

**Table 4.3: Achievement of M&E Goals**

<b>CPUC Energy Efficiency Policy Manual Evaluation Goal</b>	<b>Sub-Part</b>	<b>How M&amp;E Plan Addressed Goal</b>	<b>How Evaluation Addressed Goal</b>	<b>Details</b>
Provide upfront market assessment and baseline analysis		The baseline analysis and upfront market assessment were provided by the Efficiency on Wheels proposal.	The baseline analysis and upfront market assessment were provided by the Efficiency on Wheels proposal.	The demographics of the target markets were determined from census data and other studies. The baseline information basis was the DEER database.
Provide ongoing feedback and guidance		M&E to be completed near the end of the program. The M&E research plan was designed to ensure that installations were completed and to determine the energy savings.	Ongoing feedback and guidance were provided primarily in the early stages of the evaluation so as to assist the program in delivering verifiable savings.	The attached M&E plan includes appendices outlining some of the feedback and guidance that were provided in the early stages of program implementation.
Measure indicator of effectiveness and testing program theory (PT/LM) and approach		Sampling to be conducted to collect installation data on each measure, to be aggregated for analysis	Sampling and verification were conducted and program effectiveness analyzed on that basis.	Program effectiveness was analyzed on the basis of the findings.
Assess the overall levels of performance and success (process evaluation)		Determine if the measures were implemented and verify that the measures are still in place and saving energy.	Determined if the measures were implemented and still in place to save energy.	Compared the overall measure implementation with the proposal and determined the level of performance and success.
	Process evaluation approach	Customer satisfaction questionnaire	Developed and implemented customer satisfaction questionnaire	Reviewed customer data to determine if the measures went to the target market and if the customers were satisfied.
	Sampling plan for process evaluation	Sampling plan provided	Sampling plan adjusted	Details provided under Sampling Plan, see Section 5



**Table 4.3: Achievement of M&E Goals**

<b>CPUC Energy Efficiency Policy Manual Evaluation Goal</b>	<b>Sub-Part</b>	<b>How M&amp;E Plan Addressed Goal</b>	<b>How Evaluation Addressed Goal</b>	<b>Details</b>
Inform decisions regarding compensation and final payments (measure counts)		Verification with the proper level of confidence that the measures were implemented as specified.	Verified with the proper level of confidence that the measures were implemented as specified.	Evaluation of the sample was used to determine if the measures were implemented as specified.
Help assess the continuing need for the program		Determine if there is a continuing need for the program.	Determined if there is a continuing need for the program.	Assessed whether the measures were installed within budget and within the designated timeframe. Determined if there was a positive, cost-effective community impact.
General assessment		Summary of findings	Summary of findings	The detailed findings were summarized to provide an overall assessment of the program. See Section 8.

## 5. DATA SAMPLING METHODS

### Background

The sampling plan was designed to satisfy three main requirements. First, the objectives of the program, which included both hard and soft goals, were measured. Second, the plan adopted a statistically valid methodology to ensure that results could be quantified with a statistically satisfactory degree of accuracy. Third, the sampling methodology allowed each measure a proportional chance of selection into the sampling pool. The M&E sampling plan and supporting documentation can be referenced in Appendix C for more detailed background information.

### Methodology

Throughout the period of execution for this program, the San Francisco Power Cooperative maintained a Microsoft FrameMaker database to track program status. This database acted as the source of information for periodic progress reports to the CPUC and to EE&T for the M&E review. The database that was closed on 1/30/2006 (emailed to EE&T on 2/3/2006) was used to export information to a Microsoft Excel format, which will be referred to as “the database”; a description of the data included within this file is documented as a list in Appendix D.

The CPUC approved the Specified Precision Method as submitted in the M&E study research plan to be used as the basis for calculating the sample size. With the closing of the program database, reported quantities of implemented measures were used to recalculate the required sample size of measures.

Given the program design and budget limitations, the Single-Stage Cluster Sampling method was approved for use to select which of the participants to include in the sample. (See explanation in the following paragraph.) With this method, the primary sampling unit is called a cluster, which in this case is defined as a participant.

Sequential numbers were assigned to each measure reported in the database. Energy kits, which are composed of several different measures, were broken down into individual measures so that every element would be given an equal chance of selection in this proportional sampling method. Measures were chosen randomly, and the order of selection was maintained. The participant for each chosen measure was extracted from the database and added to a contact list. Participants were removed from the pool for selection once they were added to the contact list. This participant's name was used to identify all other measures that he/she also received; this group of measures defines a cluster. All of these measures were added to the total number of measures to be verified. This selection process continued until the total number of measures exceeded the calculated requirement for the sample size.

With the program closed, the database was used to calculate program accomplishments and parameters that were estimated within the M&E Study proposal. The total number of measures decreased from 68,200 to 66,126, and the total number of participants decreased from 5,000 to 4,164. The average number of measures per participant is 16, which is close to the estimated number of 13.64 measures. In addition, the total quantity for each specific measure was updated from the estimated totals. These totals were used to recalculate the necessary number of measures to be verified for the Specified Precision Method, which

resulted in a sample size of 459 measures. The number of participants needed to fulfill this sample size was 50, which is a 43%  $\{(50 - 35) / 35\}$  increase from the value predicted in the research plan. This occurred because the average number of measures per participant was inflated by the few participants that acted as distribution channels and became large clusters. Because of this observation, an additional strategy was implemented to prevent the results from being skewed by large distribution participants: no single participant could contribute more than the average number of measures to the sample size. For these large distribution participants, a two-stage cluster sampling approach was taken such that no more than 16 measures per participant were investigated. The items to verify were determined by the surveyor during the interview because a detailed breakdown of these distributed measures was not available from the database.

The selection process continued beyond the required number of measures, which produced additional names of participants in an order that was maintained. These names became the alternate list.

## 6. DATA COLLECTION AND MANAGEMENT

### Data Collection Background and Summary

The purpose of the Data Collection and Management Plan was to systematically and accurately document the data collection efforts performed to verify the accomplishment of the hard and soft program goals. A summary of this plan is as follows:

For each participant, implementation measures were either distributed or installed; the program database indicated the service implementation method for each participant. On-site inspections and interviews were the primary methods for data collection, and were performed as a means of assessing the status of the installed measures. Phone surveys were conducted to verify the distributed measures, although receipt of some distributed measures were verified in person.

A survey form was developed for the surveyors to record collected data in a consistent manner. The surveyors recorded the data via hard copy and subsequently transferred the data into electronic format, which was then used for analysis.

The on-site survey team was equipped with a survey script and a generic letter of introduction as issued by the San Francisco Power Co-op as a means of facilitating access to customer premises.

### Pre-Contact Methodology

To aid in the collection of data from on-site inspections, on-site interviews and phone surveys, a Field Data Collection Sheet (FDCS) was developed, a copy of which is provided in Appendix D. This form allowed surveyors to document information related to installed and distributed measures. In addition, it included questions related to other programs to which participants may have been introduced and whether or not they had investigated their use. For on-site inspections and interviews, the form included an opportunity for participants to register their level of satisfaction with the program and any subjective comments.

As described in the previous “Data Sampling Methods” section, the program database was exported into Microsoft Excel and used to develop a random sample of participants to survey. To ensure a large enough sample size, a pool of 101 program participants were selected to contact, yielding a total of 933 possible measures to verify.

A contact list was developed for this participant pool, containing customer and measure information collected by the San Francisco Power Cooperative. For each of these selected participants, a unique FDCS with pre-loaded information was printed and used during the on-site and phone surveys. Participants were sent a letter of introduction, as shown in Appendix D, indicating that they may be contacted as part of the program evaluation.

A scripting plan was developed for phone surveys, pre-field surveys and field surveys; this is also included in Appendix D.

## Contact Methodology

As described above, different processes were developed for use depending on whether a customer received services by means of a distributed kit or had an actual installation performed.

Distribution: For customers who took delivery by distribution, a phone call was placed to the number indicated on the FDCS and the following information was recorded:

- Name of the customer or contact with whom the surveyor was speaking.
- Relationship of the contact to the customer (if other).
- Date of phone interview.
- Name of the surveyor conducting the interview.
- Contact information corrections or notes, if any.
- Personal information as specified in the Data Collection and Management Plan.
- Quantity of measures received.

If no answer was received or the designated contact was not available, a note was made with the date and time of the call so that another attempt could be made later.

Installation: For participants who received on-site program services (installation), a phone call was placed to the number indicated on the FDCS and the following information was recorded:

- The name of the customer or contact with whom the surveyor was speaking.
- The relationship of the contact to the customer (if other).
- The date of phone interview.
- The name of the surveyor conducting the interview.
- Contact information corrections or notes, if any.
- Date and time of scheduled site inspection

If no answer was received or the designated contact was not available, a note was made with the date and time of the call so that another attempt could be made later.

When an on-site inspection was successfully scheduled, the surveyor proceeded to the address indicated on the FDCS. The same information collected during the phone surveys of customers who received program delivery via distribution was collected during the field survey. In addition, the following information was recorded:

- Date of site visit.
- The name of surveyor conducting the site visit (and translator, if applicable)
- Quantity of each measure installed
- Notes indicating which installed items were verified.
- Comments as to the condition, suitability, and functionality of installed items.
- Answers to questions related to the installer, installed items, other programs, and overall satisfaction with the work that was done.
- Other comments, concerns, or suggestions, if any.

In the event a customer was not available at the time the site visit was attempted, a visual inspection was performed to verify any installed measures recognized by the surveyor.

After a participant was successfully contacted and all the required information recorded, the collected data were transferred into electronic format. If two or more attempts to contact a participant were unsuccessful, this failure was indicated on the FDCS and the next unique FDCS was printed from the list of alternate participants. The same procedure indicated above was performed until the required number of measures was verified. Besides customers being unreachable by phone, many were also found to have invalid addresses and names. With no phone number, address, or name, a customer was deemed unreachable and an FDCS for the next alternate customer was printed.

## Results

The Data Collection and Management Plan met the objective of verifying 459 measures. As expected, many customers could not be reached. The survey process required attempted contact with 101 participants in order to reach 53 customers and verify 468 measures, 9 more measures than the 459 required by the sampling methodology.

## Process Adjustments

Several factors affected the data collection process, resulting in a slight adjustment to the Data Collection Methodology than as proposed in the research plan.

As expected, phone numbers for many customers had been disconnected, changed (with no forwarding number), or were no longer in service. For customers with installed measures, this did not hinder the data collection process since a site visit was required for data collection. For customers with distributed measures, however, an invalid phone number meant no phone survey could be conducted and thus no data collected. To avoid these losses to the sample, a site visit was performed for all customers with invalid phone numbers, even those with distributed measures.

It should be noted that site visits for distributed measures were only conducted to verify the receipt of the measures, not the installation, per the approved M&E research plan. The intent of the program was for participants to install the distributed measures. Since only measures that are installed (either by the program or by participants) actually save energy, there is a good likelihood that some received measures may not have been installed and thus are not saving energy.

In some instances, a site visit was performed for a customer with installed measures yet no contact was made directly with the customer. When a customer did not answer the door, a visual verification of measures was made by the surveyor (outdoor fixtures, outdoor motion sensors, lobby light fixtures, etc.), and the program was given credit for the number of measures observed. When an individual other than the customer answered the door, the surveyor verified that he/she was over the age of 18 and that he/she was familiar with the distributed or installed measures. When this was confirmed and a visual verification (or verification of receipt of distributed measures) could be made, the program was given credit for these measures.

## Contact Barriers

A substantial number of program participants in the sample did not consider English as their primary language and some apparently spoke little or no English. The survey process incorporated the services of two translators: one for Mandarin and Cantonese and one for Spanish. With the help of these translators, language was removed as a barrier to verification.

Understandably, many of the participants in the sample were unavailable during certain hours due to work schedules. Our survey process tried to mitigate the impact of varied work schedules by attempting contact at different times of the day, including during evenings and weekends.

On-site surveys were conducted at participants' homes. Some customers surveyed were reluctant to open their homes to inspection or to provide financial or other personal information, even if program-related. These factors placed a limit on the amount of data that could be collected from each participant, although every effort was made to put participants at ease. For these reasons, the data that were collected do not generally represent a complete dataset (all questions answered and verified) for all surveyed participants. It follows that the collected data may not have verified some measures that were actually installed.

#### Affect on Data Analysis

As noted earlier in this section, it is possible that the M&E process over-estimated program savings accomplishments due to the potential lack of installation of distributed equipment. Conversely, collected data may not have verified some measures that were actually installed. This is due to two factors as noted earlier:

- 1) lack of final database of program accomplishments and
- 2) limitations in the amount of data that could be collected from each participant (see "Contact Barriers" above).

The net effect of these factors is unknown, but it should be noted that there may be both over- and under-representation biases in the measurement.

## 7. DATA ANALYSIS METHODS

### 7.1 Evaluation of Quantitative Goals

This evaluation report summarizes the findings with respect to the quantitative goals.

The underlying savings assumptions associated with each measure were reviewed in the development of the Research Plan, and have been accepted as the basis for the underlying assumptions as indicated therein.

As discussed in the Research Plan, an NTG ratio of 0.8 was applied to this program in order to estimate “free-ridership,” therefore, the savings figures reported to the CPUC should represent 80% of the total (gross) reported savings. This study excluded an NTG battery, so it is using a default NTG value as provided by the IOU.

The program cost-effectiveness was determined by comparing the projected program financial benefits with the cost of the program as shown in Table 7.2 below.

The method of this evaluation was as follows: for each customer, the quantities of measures installed or distributed that were reported by the customer as seen by the surveyor were considered verified. Note that installation of distributed items was not physically verified by the surveyors. Table 7.1 indicates typical data for a single participant:

Data for customers were recorded on an on-going basis until the target sample size had been reached. The target sample size was considered to have been reached when the reported quantities reached the target sample size of 459 measures.

**Table 7.1: Typical Participant Data<sup>(a)</sup>**

<b>Measure</b>	<b>Quantity Reported (QRn)</b>	<b>Quantity Verified (QVn)</b>
15 W CFL	1	1
23 W CFL (outdoors)	2	2
25 W CFL	1	1
15 W CFL, (kit)	1	1
25 W CFL, (kit)	1	1
Low Flow Sink Aerator (kit)	1	1
Weatherstripping (kit)	1	1
Showerhead (kit)	1	1
Programmable T-stat	0	0
Occupancy Sensors	3	3
Vending Misers	0	0
Total	12	12

<sup>(a)</sup> In this typical case, it was determined that the customer had received an energy kit and four additional CFLs of varying wattages. Three occupancy sensors were verified to be installed.

### Research Plan Methodology

The quantitative analysis method indicated in the Research Plan was to compare the “target” savings indicated by program records with the savings calculated based on the verification of findings for the surveyed (sample) sites. The plan called for the ratio between



verified savings and target savings of the sample to be multiplied by the stated gross program savings and then by the 0.8 NTG factor in order to approximate the actual total program claimed savings.

### Revised Data Analysis Methodology

During the sampling, data collection, and verification activities, it was noted that there are considerable variances in the stipulated savings among the various measures, and that the sampling method does not provide for distribution between them. To normalize this effect, a streamlined approach was developed for data analysis of the sample based on the ratio of verified quantities to those indicated as installed. Of 468 measures indicated as installed, 411 were verified, providing a verified rate of 87.8%. This multiplier was applied uniformly to all measures in order to reduce the quantities of each category of measure and to therefore derate the savings estimates proportionally. The sample population was too small to provide a reliable adjustment of the verified rate on a per-measure basis. These savings were further derated by the 0.8 NTG factor in order to estimate the total program actual savings.

### Evaluation of Program Cost-effectiveness

Total resource cost (TRC) calculations consider overall program costs, i.e., administrative costs in addition to participant and utility costs, when considering overall program cost-effectiveness.

The calculations include total resource net benefits [(benefits – costs) in net present value], and a benefit-cost ratio, which is equal to the program benefits divided by the costs. The levelized utility costs are the discounted net present value of the average cost of the avoided utilities over the operating life of the equipment. The results are indicated in Table 7.2.

The values shown in the column “CPUC Workbook Projections” are taken directly from the “final” CPUC workbook (reporting through September 2005). Note that the “final” CPUC workbook and corresponding “CPUC Workbook Projections” do not include all program costs. In the column “CPUC Workbook Projections (Revised Cost Basis)”, the cost basis has been adjusted to be equivalent to the total program cost; values have been accordingly recalculated. The column “Values Based on Verified Results” retains the total program cost as the cost basis, and computes the benefits based on the verified program savings.

**Table 7.2: Total Resource Cost Test**

<b>Value</b>	<b>CPUC Workbook Projections</b>	<b>CPUC Workbook Projections (Revised Cost Basis)</b>	<b>Values Based on Verified Results</b>
Levelized Cost of Electricity (\$/kWh)	\$0.0291	\$0.0397	\$0.0628
Levelized Cost of Gas (\$/therm)	\$0.9907	\$1.3513	\$1.3808
Costs	\$584,973	\$797,900	\$797,900
Benefits	\$1,659,895	\$1,659,895	\$1,154,421
Total Resource Net Benefits	\$1,074,922	\$861,995	\$356,521
Benefit-Cost Ratio	2.8376	1.9256	1.4468

## 7.2 Evaluation of Qualitative Goals

The program database records were used to establish whether participants met the “hard-to-reach” criteria associated with this program. For every customer included in the sample, program records were evaluated for conformance with the “hard-to-reach” goals. The percentage of sampled customers verified as meeting these criteria was calculated and reported to be 85%.

It was intended in the Research Plan that the survey process be used to collect data with regard to program referrals, however, this information was not consistently reported by program participants. No evaluation of this aspect is therefore included.

The survey instrument was used to ask the customers about the extent of their satisfaction with the program. For every customer included in the sample, the survey instrument was used to record customer satisfaction with several program attributes on a numerical scale. Individual results were combined and a customer satisfaction quotient was calculated. There were 23 responses regarding customer satisfaction based on a 1 – 5 scale, where 1 was “Best” and 5 was “Lowest”. An average satisfaction rating of 1.13 was calculated from (20) scores of “1” and (3) scores of “2”s.

## 8. RESULTS

### Quantitative Results

The program impacts are summarized in Table 8.1. The reported results very nearly match and in some cases exceed the original program goals.

As discussed in Section 4, the stipulated per unit savings were adjusted from the values designated by the program. These adjustments contribute to the variance between reported savings and the verified results. The revised savings values for residential CFLs, for example, are lower than original program estimates because recent supporting studies point to lower savings estimates for this type of measure than had previously been thought. Also, the program design had not taken into account that a significant number of measures were planned for and ultimately carried out in non-residential settings. This evaluation applied these (typically higher) non-residential stipulated values in accordance with the information in the program database, subject to verification.

The M&E study verifies 87.8% of reported measure quantity. Since the verification process consisted of comparing the quantities indicated in the database with the observed quantities, it is likely that the inspection process tended to undercount the number of items actually installed, as described in Section 6 “Data Collection and Management.” Also, the final program database may report a larger number of measures implemented. For these reasons, we believe that the verified quantities and therefore savings amounts to be somewhat conservative.

The survey responses verify that 85% of respondents meet the “hard-to-reach” criteria, exceeding the program goal of 80%. It is likely that a higher percentage of participants meet these criteria but could not be verified because they were non-responsive to the questions.

**Table 8.1: Program Impacts**

Source of Data	Measure Quantity	Gross Values			Net Values (gross values multiplied by 0.8 NTG)		
		Natural Gas (Therms /yr)	Electric Demand (kW)	Electricity (kWh/yr)	Natural Gas (Therms /yr)	Electric Demand (kW)	Electricity (kWh/yr)
Original Program Goals	68,200	92,500	490.5	3,577,500	74,000	392.4	2,862,000
Revised Program Goals	76,650	110,288	558.9	4,034,156	88,230	447.1	3,227,325
Reported Results-Database	66,126	99,908	475.3	3,295,754	79,927	380.3	2,636,603
Verified Program Savings (Extrapolated)	58,057	94,123	598.0	2,967,708	75,299	478.4	2,374,166

## Qualitative Results

In the interest of providing feedback to the program and the CPUC, highlights of participant reactions are summarized here.

In general, the customers contacted by phone and visited in person were cooperative and appreciative of the items received from the San Francisco Power Cooperative. Many persons asked for additional items, even those – such as building receptionists, neighbors, and bystanders – who had not participated in the program. Most customers that had measures installed indicated they were satisfied with both the installer and items installed. In some cases, the items installed did not work properly for the application and had to be uninstalled by the customer. Nevertheless, it was often reported that these items were given to family or friends for use in other households.

Other cases involved the customer simply being dissatisfied with an installed measure. For instance, one participant removed a programmable thermostat that was installed because, even after being shown how to use it, the user still felt it was too complicated. Another example involved a participant who found the low flow showerhead to be “too low flow”. In this case, she gave the showerhead to her neighbor, who used it happily.

## 9. RECOMMENDATIONS

The main focus of this study was to ascertain the effectiveness of this program in terms of meeting the quantitative and qualitative program goals. An additional goal of this study was to help assess the general effectiveness of this program and the continuing need for this type of program. A brief description of the program structure and highlights are provided; areas of potential improvement and recommendations follow.

### Program Structure

The program was administered by the San Francisco Power Co-op, an established community group involved in raising awareness with respect to energy issues. The Contract Administrator was PG&E, who conducted inspections and provided feedback to the Power Co-op related to quality assurance.

### Program Highlights

The program successfully installed or distributed more than 58,000 items to predominantly low-income households and small businesses. The program exceeded its goals for natural gas savings and electric demand reduction and achieved a high percentage of the electrical energy savings compared with that forecasted in the initial program implementation plan. Additionally, the program exceeded the “hard-to-reach” impact goals.

The program served over 12,000 customers in primarily diverse, low-income communities. By working with established community groups, including the Tenderloin Neighborhood Development Agency and the Charity Cultural Services Center, SF Power Co-op was able to promote energy efficiency awareness within the communities served by these groups. SF Power Co-op prioritized the hiring of individuals from within the served communities and hired and trained installers with specific diverse language skills, including Spanish, Mandarin, and Cantonese.

Program participants indicated a high degree of satisfaction with this program.

The program database was relatively well-managed, in that participant information tended to be accurate and the work as noted in the database generally corresponded to the field conditions to the extent it was within the program administrator’s control<sup>(2)</sup>.

### Areas for Potential Improvement

EE&T did not review PG&E’s inspection reports, however, EE&T conducted independent inspections in mid-2004 (Appendix A) and again in 2006 as part of the program evaluation. EE&T reported its 2004 findings to the program administrator, including the use of interior-rated CFLs in exterior fixtures and misapplication of occupancy sensors. The feedback EE&T provided was incorporated into program operations, and the (more widespread) 2006 inspections noted few of these types of problems.

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<sup>(2)</sup> With a transient, “hard-to-reach” population, it was difficult to schedule and complete surveys, so the M&E study had to exclude some of the initially drawn sampled customers in favor of those that were able to be reached.

The M&E study verification rate was 87.8% of the reported distributed and installed quantities. EE&T has no reason to believe that installers or the program over-reported the quantities distributed or installed. Three plausible reasons for the gap are: (1) program participants have deliberately removed functional items (such as a showerhead that was not perceived to provide adequate flow), (2) a product (such as a CFL) had failed and been replaced by a less expensive product (e.g., an incandescent lamp), or (3) the item was actually installed, but the participant could not remember the location of the item, would not provide the M&E surveyor with information related to it, or was not present at the scheduled site survey to allow verification of particular measures.

### Recommendations

In general, a program of this type is highly recommended for “hard-to-reach” communities that might not otherwise be offered opportunities to improve energy efficiency or who have missed participation in programs that serve the general population. It is recommended that the size of the market, remaining market (based on current market penetration), and the potential savings impact be determined for other programs.

The net-to-gross ratio used for this program was 0.80, based on residential and non-specific commercial programs. It is possible that the hard-to-reach sector has a lower free-ridership than this NTG ratio assumes. It is recommended that research into this dynamic be conducted as it relates to future programs of this type.

This program’s use of established community groups and community-based and diverse personnel afforded opportunities for the program to overcome typical barriers associated with the “hard-to-reach” market segment. This is a well-established practice and continues to be recommended.

In addressing deficiencies related to product function or customer perception, it is recommended that a follow-on program of this type invest sufficient resources in thoroughly training field personnel to properly apply the program offerings and be equipped to set-up, adjust, and troubleshoot the installations.

In addressing the gap between reported and verified savings, program administrators should expect some attrition from the installed base when anticipating the verified net program savings.



## APPENDICES



**APPENDIX A**  
**Research Plan and CPUC Review Comments**





**EMCOR**

*Energy & Technologies*

# REPORT

## RESEARCH PLAN

for

**Measurement and Evaluation Study  
San Francisco Community Power's  
Energy Efficiency On Wheels Program**

Final Report  
Revision 1


Prepared for

**SAN FRANCISCO COMMUNITY POWER  
COOPERATIVE**  
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July 2005



# REPORT

## RESEARCH PLAN

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## PREFACE

This document is the Research Plan required per the San Francisco Community Power Cooperative's contract with EMCOR Energy & Technologies for Measurement & Evaluation Services for the 2004 - 2005 Energy Efficiency on Wheels Program.

EMCOR Energy & Technologies, of San Francisco, California, prepared this document for the San Francisco Community Power Cooperative. The authors of this report are Marc A. Theobald and Merlin Luedtke, P.E. EMCOR Energy & Technologies' Program Manager for the San Francisco Community Power Cooperative is Marc A. Theobald. This report was reviewed for technical quality by Colman M. Snaith, P.E, and edited by April K. Banerjee, C.E.M.

## ACKNOWLEDGEMENTS

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## 1. INTRODUCTION AND KEY ISSUES

### Introduction

The San Francisco Community Power Cooperative's Energy Efficiency on Wheels Program is an \$800,000, 18-month energy efficiency program for low-income, hard-to-reach areas of San Francisco. This program provides for the installation of energy saving measures and the education of participants with regards to energy efficiency options for homes and businesses. The program receives its funding from the 2004-2005 California Public Utilities Commission (CPUC) Energy Efficiency Program.

EMCOR Energy & Technologies (EE&T) has been retained to provide a measurement and evaluation (M&E) study of the Energy Efficiency on Wheels Program, in accordance with CPUC requirements. The initial phase of the evaluation is the development of a program research plan, the purpose of which is to outline the methods that will be used to evaluate the program. This document comprises the research plan.

In order to develop the research plan, EE&T became familiar with the program goals, procedures, and management tools. EE&T attended a project initiation meeting (summarized in Appendix A, "Initiation Meeting Notes") to receive a brief overview of program operation and meet key personnel. EE&T then observed the program's field quality control (QC) process for tracking the installed work, reviewed the program database for form and function, and examined the tool used for reporting program progress to the CPUC (the program workbook).

A preliminary set of observations was recorded and is summarized in Appendix B, "Preliminary Observations". The purpose of recording and presenting these observations are two-fold: 1) an understanding of program practice is fundamental to the development of the research plan and 2) at the time the observations were made, the program was early enough in progress that the observations might be of value to program staff in making modifications to benefit the program.

### CPUC Objectives and Program Goals

This program will help hard-to-reach households lower their energy bills through education and access to energy efficiency technologies. The M&E study will verify the installation of energy efficiency technologies and validate the energy savings through a sampling of the program installations.

The sampling plan relies on previous work done for the CPUC and the utility, Pacific Gas & Electric Company (PG&E), that established electric demand reduction and energy savings for various energy conservation measures (ECMs). The San Francisco Community Power Cooperative used established criteria from other energy savings monitoring projects [Database for Energy Efficient Resources (DEER) published by the California Energy Commission (CEC) and PG&E survey results] to stipulate values for electric demand reduction and energy savings due to the included measures. Measurement was accomplished in the programs that determined the stipulated savings, therefore, monitoring is not required for this project. This program uses previously established stipulated savings and verified ECM installations to determine the impact of the program.

The number of ECM installations will be used with the stipulated savings values to determine the electric demand reduction and the annual energy savings achieved by the program. The projected life of the ECMs will be used to determine the energy savings for each year of the ECMs for years 2 through the projected life of the ECMs.

Net-to-gross (NTG) values are established at 80% based on the California Public Utilities Commission Energy Efficiency Policy Manual Version 2, Table 4.2 “Net-to-Gross Ratios”.

## 2. EVALUATION CRITERIA

The program goals include energy savings impacts, as quantified by electrical energy savings (kWh), electrical load reduction (kW), and natural gas savings (therms). These values are based on stipulated per-unit savings computations that have previously been accepted by the CPUC for various efficiency measures. The aggregate program savings goals were based on the projected quantity of installations for each measure.

The program also has “soft goals” related to participation in other qualifying programs, and whether or not program participants are indeed “hard-to-reach” based on qualifying demographic information. “Hard-to-reach” is defined by whether a participant is “low-income” (per CPUC guidelines), a renter, has a primary language other than English, or lives in a multi-family dwelling. The program goal is that a minimum of 80% of participants fall into one or more of these categories.

**Table 2.1: Program Goals**

Measure <sup>1</sup>	Qty	Savings					
		Unit Natural Gas (Therms/yr)	Unit Electric Demand (kW)	Unit Electricity (kWh/yr)	Total Natural Gas (Therms/yr)	Total Electric Demand (kW)	Total Electricity (kWh/yr)
CFLs, 15 W	14,000		0.0081	36.1		113.4	505,400
CFLs, 23 W	14,000		0.0135	89.9		189.0	1,258,600
CFLs, 25 W	9,000		0.0135	89.9		121.5	809,100
Low Flow Showerhead *	5,000	9.3			46,500		
Sink Aerator *	5,000	3.3			16,500		
Weatherstripping *	5,000	0.7	0.0015	3.1	3,500	7.5	15,500
Programmable Thermostat	1,000	26.0		5	26,000		5,000
Occupancy Sensors	15,000		0.0035	47.9		52.5	718,500
Vending Misers	200		0.0330	1327		6.6	265,400
Gross Savings Total	68,200				92,500	490.5	3,577,500
Net-to-gross Ratio:					0.8	0.8	0.8
<b>Program Goals:</b>					<b>74,000</b>	<b>392.4</b>	<b>2,862,000</b>

<sup>1</sup> 5,000 each of 15 W & 23 W compact fluorescent lamps (CFLs) are incorporated in distributed energy kits along with items marked by an asterisk (\*). The quantity and savings values for these 5,000 CFLs are reflected in the respective rows for the 15 W and 23 W CFLs.

The CPUC Energy Efficiency Policy Manual states objectives for M&E studies. The Energy Efficiency on Wheels Proposal for the 2004-2005 CPUC Energy Efficiency Programs uses established standards developed through previous programs to stipulate the energy savings per installed measure. Since the energy savings per measure have already been established, the goal of this M&E study is to determine that the installations were made as proposed and that the measures are still in place.

This research plan addresses each of the CPUC Energy Efficiency Policy Manual objectives for M&E. Table 2.2 summarizes these objectives and how they are addressed by this research plan.

**Table 2.2: M&E Objectives for Energy Efficiency Programs<sup>1</sup>**

<b>CPUC Energy Efficiency Policy Manual Evaluation Goal</b>	<b>Sub-Part</b>	<b>How This Plan Addresses Goal</b>	<b>Details</b>
Measure energy and peak savings per year over the life of the measures (kWh, kW & therms for each year)			
	Installation verification	On-site verification to be conducted for a sample of sites	The Specified Precision Method was used to determine the proper sample size of a simple random sample.
	Gross impact analysis	Based upon installation verification rate and deemed values	Installation verification will be used with stipulated values for each measure to determine the gross impact. San Francisco Community Power Cooperative provided stipulated savings for each of the measures in the approved proposal for the 2004-2005 CPUC Energy Efficiency Programs.
	Impact units of measure (program or ECM level)	Program savings will be reported based on M&E results.	Savings will be reported by measure and summarized to provide total savings.
	Measurement and verification approach	Does not follow one of the IPMPV options since measurements are stipulated.	Stipulated values were approved in the Energy Efficiency on Wheels Proposal. These values were from the DEER Database, with additional input from PG&E and CEC studies.

<sup>1</sup> Per the CPUC Energy Efficiency Policy Manual, Version 2.



<b>CPUC Energy Efficiency Policy Manual Evaluation Goal</b>	<b>Sub-Part</b>	<b>How This Plan Addresses Goal</b>	<b>Details</b>
	Sampling and uncertainty	Sampling plan completed	The Specified Precision Method was used to determine the proper sample size of a simple random sample.
	Peak demand analysis	Projected from deemed reduction in demand by installation verification only	Stipulated values were approved in the Energy Efficiency on Wheels Proposal. These values were from the DEER Database, with additional input from PG&E and CEC studies.
	Net-to-gross (NTG) ratio	Stipulated NTG of 0.8 used	Energy Efficiency Policy Manual, Version 2, Table 4.2 lists an NTG of 0.80 for undefined residential and nonresidential programs.
Measure cost-effectiveness		Incremental measure costs compared with per-unit energy savings estimates to determine cost effectiveness.	The incremental measure costs will be about the same for 200 or 2,000 installations and will depend primarily on the supplier used. The energy savings for each measure is stipulated. Cost-effectiveness will be verified by confirming the total resource cost (TRC) calculation.
Provide upfront market assessment and baseline analysis		The baseline analysis and upfront market assessment were provided by the Efficiency on Wheels proposal.	The demographics of the target markets were determined from census data and other studies. The baseline information basis was from the DEER database.
Provide ongoing feedback and guidance		The M&E will be completed near the end of the program. This M&E research plan is designed to ensure that installations were completed and to determine the energy savings.	Feedback was provided in the early stages of the program as a result of research conducted for this M&E plan. See Section 1 and Appendix B for more information. Additional feedback will be provided as necessary; the primary purpose of the remaining tasks is to verify the number of installations and determine the energy savings.
Measure indicator of effectiveness and testing program theory and approach		Sampling will provide installation data on each measure	Data will be analyzed by measure and summarized to provide overall program effectiveness.

<b>CPUC Energy Efficiency Policy Manual Evaluation Goal</b>	<b>Sub-Part</b>	<b>How This Plan Addresses Goal</b>	<b>Details</b>
Assess the overall levels of performance and success (process evaluation)		Determine if the measures were installed and verify that the measures are still in place and saving energy.	Compare the overall measure installation with those stated in the proposal to determine the level of performance and success.
	Process evaluation approach	Customer satisfaction questionnaire	Review customer data to determine if the measures served the target market and if the customers are satisfied.
	Sampling plan for process evaluation	Sampling plan provided	Details provided under sampling plan; see Section 4.
Inform decisions regarding compensation and final payments (measure counts)		Verification with the proper level of confidence that the measures were installed as specified.	The Specified Precision Method was used to determine the proper sample size of a simple random sample. Evaluation of the random sample will determine if the measures were installed as specified.
Help assess the continuing need for the program		Determine if there is a continuing need for the program.	Assess whether the measures were installed within budget and within the designated timeframe. Determine if there was a positive community impact.
General assessment		Summary of findings	The detailed findings will be summarized to provide an overall assessment of the program.

### 3. EVALUATION METHODS

The electrical energy, electrical load reduction, and natural gas savings goals will be evaluated in three ways. First, a cursory review of the savings assumptions and computations will be performed. PG&E and the CPUC have already conducted detailed review of these assumptions and calculations, therefore, it is not anticipated that changes to the formulas will be recommended.

The measurement and verification work will follow International Performance Measurement and Verification Protocol (IPMVP) Option A . The electric demand reduction and energy savings are stipulated. The measurement for each site in the sample will include a count of the number of devices installed for the site and apply the count to the stipulated demand reduction and energy savings.

IPMVP Option A states that partial field measurements of energy use will be taken. It also states that partial measurement means that some, but not all, of the parameters may be stipulated. The usual protocol for the measurement would be to measure directly the demand and/or energy use of individual or grouped equipment. For this plan, the demand reduction and energy savings are stipulated. This is a deviation from IPMVP Option A because the measurements were previously made to determine the stipulated values for these ECMs. An actual equipment count will be conducted and this count compared with the count stated by the installer. The energy savings for each ECM has already been established through earlier PG&E and CPUC programs. The purpose of this program is to determine the energy reduction impact and short-term persistence of savings.

The second part of the evaluation will consist of a review of the program database to determine whether the program savings factors are applied appropriately. The installed ECMs will be checked against the stipulated savings for each ECM to ensure that the stipulated values are applied correctly to the ECMs.

The third portion of the evaluation will consist of an in-depth evaluation of a sample of the program installations to determine whether the measures have been installed and remain in service. This portion of the evaluation will also include a review of findings related to the soft goals.

The realization of soft goals for the sample will be determined from information provided by the participants. Each participant will be classified as low income, a renter, has a primary language other than English, or lives in a multi-family dwelling, according to his or her response.

The evaluation will be performed at the ECM level to determine the effectiveness of each ECM. The results of all ECMs will be summarized to provide an overall program evaluation.

Please refer to Section 4 for a discussion of the sampling plan, Section 5 for the data collection plan, and Section 6 for a discussion of the method of analysis.

#### 4. SAMPLING PLAN

The purpose of developing a sampling plan is to devise a statistically valid methodology of determining whether or not program objectives are met by studying a sample of the completed work. For this program, the hard program goals are a function of the savings associated with each measure and the quantity of measures installed. Thus, the pool from which data will be drawn comprises the sum of the installed measures rather than the number of program participants.

A simple random sample was selected as the method to select elements (installed measures) to be included from the survey population. In a simple random sample, every element has the same probability of being selected.

The Specified Precision Method was used to determine the appropriate size of the simple random sample. The Specified Precision Method will result in a sample size that will provide an estimate within a defined accuracy range, e.g., determining the total program savings within 10%.

The sample size calculated from the Specified Precision Method was 472 elements. Please refer to Appendix C, Sampling Plan, for the specific methods by which the plan was developed.

Based on an expected 5,000 program participants and 68,200 measures, an average of 13 to 14 measures per participant are expected. The total number of measures reflects each kit component as a separate item because the program goals for kW, kWh, and therms are calculated that way.

We therefore propose performing field verification or telephone surveys of approximately 35 program participants, which is expected to be as many as is required to reach the calculated sample (472 measures) of the population. It is anticipated that the field surveys will account for the majority of the total elements sampled, with the balance collected through phone interviews.

## 5. DATA COLLECTION AND MANAGEMENT PLAN

The data to be gathered fall into two broad categories, that which support energy savings (hard goals) and that which support soft program goals. San Francisco Power Co-Op can facilitate data collection efforts by advising participants that they may be contacted by EE&T in the future to verify program installations.

On-site inspection and interview will be the primary instrument for data collection, and will be performed as a means of assessing the status of the installed measures. The primary reason for on-site inspection is to provide the San Francisco Power Co-op with additional, robust information related to the quality of the installations and to solicit informal customer feedback for the purposes of future program development.

It is anticipated that phone surveys will be conducted to verify the distribution of energy kits and CFLs as indicated by program records.

An electronic survey instrument (form) will be developed for the surveyors to record the quantity of each measure installed at every sampled site, and whether or not the measures are presently in service. For energy kit components and other items designated in the program plan for distribution, questions will be developed to ascertain whether the items were delivered.

This form will include questions related to other programs to which participants have been introduced, and whether or not they have investigated their use. The form will also include an opportunity for participants to register their level of satisfaction with the program and will record subjective comments the customers make, which may be helpful in making recommendations for future program improvements. The program has recorded demographic data from participants; this information will be transferred directly into the survey instrument for evaluation from the program's records.

A sample of program participants selected for surveys will be randomly drawn from the program database. Participants will be contacted by a telephone scheduler and asked to participate in a program evaluation. The sample group will be asked to participate in a phone survey, and the telephone survey will be administered or scheduled later for willing participants. On-site surveys will be scheduled for willing participants; EE&T may send reminder postcards or make reminder phone calls for the site surveys.

A telephone script that reminds the participant of his or her role in the program and explains the purpose of the evaluation will be developed. A series of questions related to the installation will be asked, and the responses will be recorded on the survey instrument electronically.

For on-site surveys, the on-site survey team will be equipped with a generic letter of introduction as issued by the San Francisco Power Co-op as a means of facilitating access to customer premises. The survey team will review program database records for each participant prior to conducting the on-site survey, and will enter relevant information electronically into the survey instrument if the scheduler has not already done so. The on-site survey team may elect to use a tablet computer to conduct the survey and record field data in accordance with the program evaluation requirements. Alternatively, the field surveyors will record the data via hard copy and subsequently transfer the data into electronic format.

The program database exports data into Microsoft Excel, which is the format used by the program when reporting monthly status to the CPUC. The survey instrument will record data in a Microsoft Excel spreadsheet so as to streamline data transfer from the database and to optimize the analysis. Field data will be backed up on a daily basis to ensure a permanent record.

Customer data will be treated with the utmost confidentiality at all times. Database record information and collected data will be provided only to the program and to the CPUC.

It is anticipated that all data collected on-site will be usable for analysis.

## 6. ANALYSIS PLAN

### 6.1 Evaluation of Quantitative Goals

The evaluation report will summarize the findings with respect to the quantitative goals.

The underlying savings assumptions associated with each measure have been reviewed in the development of this Research Plan. The original development of the program plan included ongoing development, analysis and review of savings assumptions, with final acceptance provided by the CPUC. EE&T's review concurs that the savings values indicated in the program workbook are reasonable on a measure-by-measure basis and recommends no revisions to the underlying assumptions.

An NTG ratio of 0.8 was applied to this program in order to estimate "free-ridership". Free riders are program participants who would have undertaken an activity whether or not there was an energy efficiency program promoting that activity. Thus, the savings figures reported to the CPUC should represent 80% of the total (gross) reported savings.

This NTG ratio is consistent with other programs. With the broad demographics and the relatively small size of the program, it is more reliable to use the results of previous programs than to sample to determine an NTG ratio for this program.

The program cost effectiveness will be determined by comparing the projected energy savings with the cost of the program.

The method of this evaluation will be as follows. For each customer, the reported and verified quantities of measures installed and items distributed will be considered verified. Note: installation of distributed items will not be verified. Table 6.1 indicates hypothetical data for a single participant:

**Table 6.1: Hypothetical Participant Data<sup>1</sup>**

<b>Measure</b>	<b>Quantity Reported (QRn)</b>	<b>Quantity Verified (QVn)</b>
15 W CFL	1	1
23 W CFL (outdoors)	2	2
25 W CFL	1	1
15 W CFL, (kit)	1	1
25 W CFL, (kit)	1	1
Low Flow Sink Aerator (kit)	1	1
Weatherstripping (kit)	1	1
Showerhead (kit)	1	1
Programmable T-stat	0	0
Occupancy Sensors	3	3
Vending Misers	0	0
<b>Total</b>	<b>12</b>	<b>12</b>

<sup>1</sup> In this hypothetical case, it was determined that the customer had received an energy kit and four additional CFLs of varying wattages. Three occupancy sensors were verified to be installed.

Data for customers will be recorded on an on-going basis until the target sample size has been reached. The target sample size will be considered to have been reached when the reported quantities reach the target sample size of 472 measures.

For sampled data, a comparison will be drawn between the total savings indicated by the program records (target savings) for the surveyed sites, and the actual savings for these sites as calculated based on the findings, generating a ratio. This ratio between actual savings and target savings will be multiplied by the gross program stated savings and by the 0.8 NTG factor in order to estimate the total program actual savings.

The energy savings and demand reduction for the sampled measures as recorded in the database will be calculated and aggregated as the target savings for the sample. The following example indicates the proposed equation to calculate the target electricity demand (kW) reduction for the sampled data. A similar method will be applied to calculate target electric energy (kWh) and natural gas savings:

$$\text{Target kW reduction} = \text{Sum (QR kWn * kW saved/measure)}$$

The energy savings and demand reduction for the sampled measures as installed will be calculated and aggregated as the installed savings for the sample. The following example indicates the proposed equation to calculate the installed electric demand reduction for the sampled data. A similar method will be applied to calculate installed electric energy and natural gas savings:

$$\text{Verified kW reduction} = \text{Sum (QV kWn * kW saved/measure)}$$

A comparison will be drawn between the expected findings (targeted) as indicated in the program database and the actual findings (verified). The ratio to be applied to the entire program savings to determine actual program savings is the program savings multiplier (P). The following example indicates the proposed equation to calculate (P) for the electric demand reduction. A similar method will be used to calculate the program savings multiplier for electric energy and natural gas savings.

$$P \text{ kW} = \text{Sum (QVn kW)} / \text{Sum (QRn kW)}$$

The calculated program multiplier and the NTG factor will be applied to the program's reported savings to quantify the actual savings, which will then be compared with program goals.



## 6.2 Evaluation of Qualitative Goals

The program database records will be used to establish whether participants meet the “hard-to-reach” criteria associated with this program. For every customer with a measure included in the sample for quantitative analysis, program records will be evaluated for conformance with the “hard-to-reach” goals. The percentage of sampled customers meeting these criteria will be calculated and reported.

The survey instrument will be used to collect data regarding whether or not a customer has been referred to and/or taken part in another energy efficiency program as a result of contact with the San Francisco Power Co-op Energy Efficiency on Wheels program. For every customer with a measure included in the sample for quantitative analysis, the survey instrument will be used to record whether program referrals and or follow-on participation in related programs has occurred. The percentage of sampled customers will be calculated and reported for each of these attributes.

The survey instrument will be used to collect data regarding to what extent a customer was satisfied with his or her participation in the program. For every customer with a measure included in the sample for quantitative analysis, the survey instrument will be used to record customer satisfaction on a numerical scale for several program attributes. Individual results will be combined and a customer satisfaction quotient will be calculated and reported.

7. STAFFING PLAN, COST SUMMARY, AND TIMELINE BY TASK

**Table 7.1: Staffing Plan and Cost Summary**

Rates:

Officer	\$210		
Program Director	\$175	Staff Engineer	\$105
Senior Energy Engineer	\$145	Technician	\$65

<b>Labor Costs - EMCOR Energy &amp; Technologies</b>							
Task No	Description	Program		Senior		Technician	TOTAL
		Officer	Director	Engineer	Engineer		
1	Conduct Project Initiation Meeting	0	4	8	0	0	\$1,860
2	Develop Research Plan	2	2	40	4	0	\$6,990
3	Develop Survey Instruments	0	2	16	4	4	\$3,350
4	Conduct Data Collection Activities	0	2	16	4	64	\$7,250
5	Prepare Reports and Databases	2	4	30	4	10	\$6,540
6	Provide Project Management and Reporting	2	8	8	0	0	\$2,980
<b>Subtotal</b>		<b>6</b>	<b>22</b>	<b>118</b>	<b>16</b>	<b>78</b>	<b>\$28,970</b>

<b>Travel Expenses/Direct Costs</b>			
Mileage	208 miles	0.36 per mile	75
Lodging	0 days	125 per day	0
Meals	0 days	25 per day	0
Copying, Messenger			100
<b>Subtotal</b>			<b>\$175</b>

<b>T&amp;M, Not to Exceed Total</b>	<b>\$29,145</b>
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<b>Staff</b>			
<b>Officer</b>	<b>Senior Engineers</b>	<b>Staff Engineers</b>	<b>Technicians</b>
Paul M. David, P.E.	April K. Banerjee, C.E.M.	Lance C. Kincaid, P.E.	Joshua S. Babcock
Ann L. McCormick, P.E.	Marc A. Theobald	Matt G. Heling	Rhoda Allen
<b>Program Director</b>	Colman M. Snaith, P.E.	Jonathon W. Stage	
Mary M. Bryan, P.E.	Merlin Luedtke, P.E.		

**Table 7.2: Timeline**

Task		Estimated Week Number
<b>Task 1 – Project Initiation Meeting (July 19, 2004)</b>		1
1.1	Agenda	1
1.2	Meeting Summary Memorandum	2
<b>Task 2 – Study Research Plan</b>		
2.1	Determine information to be collected and data collection methods	2
2.2	Develop and describe analysis techniques and/or sampling method	2
2.3	Develop and describe evaluation methodology to be used to assess program impacts	2
2.4	Prepare and submit Draft Research Plan	3
2.5	SF Power Review Draft Research Plan	4 – 5
2.6	Prepare and Submit Final Research Plan	6
2.7	Final CPUC Approval of Research Plan	53
<b>Task 3 – Develop Survey Instruments</b>		
3.1	Draft survey instruments for site visits and telephone surveys	54
3.2	SF Power review draft survey instruments	55 – 56
3.3	Final survey instruments	57
<b>Task 4 – Data Collection Activities*</b>		
4.1	Select participant sample	54
4.2	Complete site visits and telephone surveys	58 – 60
4.3	Prepare load impact analyses	61 – 62
4.4	Provide memorandum summarizing data collection activities	63
<b>Task 5 – Reports and Databases</b>		
5.1	Issue Draft M&E Report	66
5.2	SF Power review Draft Report	67 – 68
5.3	Issue Final M&E Report	70
5.4	Presentation of Results to SF Power Project Manager and/or CPUC**	TBD **
<b>Task 6 – Project Management and Progress Reporting</b>		On-going

\* The sample that will be used for Task 4 (Data Collection) will be drawn when the program is minimally 90% complete.

\*\* This presentation will be delivered according to the scheduling needs of San Francisco Power and/or the CPUC.



## APPENDICES



**APPENDIX A**  
**Initiation Meeting Notes**

<b>Project Initiation Meeting Notes</b>	
DATE/TIME	July 19, 2004 10:00 a.m.
LOCATION	San Francisco Community Power Cooperative (SF Power Co-op) Offices 2323 3 <sup>rd</sup> St., Suite 244 San Francisco, CA 94107
ATTENDEES	Steve Moss, Executive Director San Francisco Power Co-op Gwendolyn Westbrook, Program Manager, San Francisco Power Co-op Catie Magee, Program Administration, San Francisco Power Co-op Mary Matteson Bryan, P.E., Program Manager, EMCOR Energy & Technologies Marc Theobald, Project Lead, EMCOR Energy & Technologies
WORKING AGENDA	<ol style="list-style-type: none"> <li>1. Clarify team member roles and responsibilities and compile contact information (10 minutes)</li> <li>2. Clarify communication and reporting requirements and preferences (10 minutes)</li> <li>3. Obtain general overview of program in practice, including types of energy efficiency measures and delivery mechanism(s) (20 minutes)</li> <li>4. Discuss program information and records in terms of content, format, and availability (20 minutes)</li> <li>5. Discuss research methodologies and solicit input on various alternatives to refine the study approach (20 minutes)</li> <li>6. Agree on basic content, format, and direction of Research Plan (20 minutes)</li> <li>7. Understand project timeline requirements and agree on dates for major milestones (10 minutes)</li> <li>8. Discuss and clarify content and preferred format of all project deliverables (10 minutes)</li> </ol>
NOTES	<ol style="list-style-type: none"> <li>1. In addition to the team members who attended the meeting, key San Francisco Power Co-op staff include Christopher Nash, who manages the project database; Kaire Poole, who provides field quality control services; one electrician; and approximately 10 field installers.</li> <li>2. Informal communication will be by means of email to the extent possible. Deliverables as outlined in EMCOR's proposal will be submitted electronically as file attachments. Contact in support of day-to-day project work will be between EMCOR and Program staff as required to facilitate the evaluation. Contract negotiations, timelines and deliverable review comments will be between Steve Moss (or designate), and Mary Bryan (or designate) as applicable.</li> </ol>

<p>NOTES (cont'd)</p>	<ol style="list-style-type: none"> <li data-bbox="446 218 1429 661">3. The Program has been underway since February 2004 and about 2,000 households have been served by the program so far. Completion is expected sometime in the middle of 2005. There are approximately 10 field installers, who solicit homeowners to provide residential energy services and to provide outreach for other programs and services. Field staff install up to three occupancy sensors per household to control lighting, and they also provide residential energy kits and up to 10 compact fluorescent lamps. Programmable thermostats will be added to the residential offerings once supply has been procured. A commercial offering for control of vending machines may be included in the future. Direct marketing is supplemented with billboard advertisements, radio interviews, flyers, and events. A program van has been purchased and is readied for promotional use.</li> <li data-bbox="446 693 1429 955">4. Installers obtain signed "Efficiency on Wheels Program Agreements" and supplemental demographic information from customers who participate in the program. This information is used to generate an electronic database, which tracks program installations and follow-up activity. Hard copies of program information will be available for the program review. EMCOR may request electronic information or specific database queries that differ from the standard queries used by San Francisco Power Co-op for CPUC reporting.</li> <li data-bbox="446 987 1429 1228">5. Discussion centered on the following: Consensus is that EMCOR will evaluate the project records and reports and follow-up with field inspections and interviews as outlined in the research plan. It is anticipated that the majority of the field verification and interviews will take place when the program is close to completion. A small, test sample of field verifications and site visits may be conducted at an earlier date to test the survey instruments and provide interim feedback.</li> <li data-bbox="446 1260 1429 1354">6. The Research plan will address sampling, data collection, data screening, analysis, and reporting appropriate to the anticipated research methodologies listed above.</li> <li data-bbox="446 1386 1429 1564">7. The Research plan is due to the CPUC on August 10, 2004. It is proposed that EMCOR provide the draft research plan to the San Francisco Power Co-op no later than July 30 so that the Co-op can review and comment. The proposed schedule for the delivery of other tasks will be incorporated into the Research Plan.</li> <li data-bbox="446 1596 1429 1696">8. It is anticipated that deliverables will be electronic, in .pdf format, however, EMCOR is flexible in terms of use of hard copy or electronic, PC-compatible format.</li> </ol>
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**APPENDIX B**  
**Preliminary Observations**



**SF Power Coop – Energy Efficiency of Wheels Program  
Preliminary Observations: Quality Assurance Inspection Process**

Background:

The quality assurance (QA) component of the Energy Efficiency on Wheels Program has been active since approximately March 2004. The QA process is as follows:

The program database is used to generate a list of customers for follow-up QA. The QA Manager performs “QA Message Call” to between 20 and 25 customers per week, referring to the “free motion sensor program” as a means of triggering the customer’s recollection.

The QA Manager verifies program contact information and asks if they are satisfied, recording the data in the database as a “QC call”. The QA Manager additionally performs approximately 4 field visits per week, physically inspecting the installed work and gathering customer feedback. Information about the installation is recorded and later entered into the program database. Customer complaints are also fielded by the QA Manager, who conducts site visits for resolution of unsolicited customer complaints as applicable.

The QA Manager has indicated that the largest challenge to successfully completing the QA survey is “language barriers”. The QA Manager speaks Spanish and English, however, many program customers have Cantonese or other languages as their first language.

Site Visits

Marc Theobald, of EMCOR Energy & Technologies, accompanied the program QA Manager, Kaire (Poole) Besses, on July 21, 2004 on quality inspections of three customer premises.

Site 1: Robert Williams at 1489 Kirkwood (apartment). Two outdoor sensors had been installed, one in the front and one in the rear. Each was equipped with two compact fluorescent lamps (CFLs) that were apparently not rated for wet locations. A common area electrical meter may supply power for the front fixture. The customer said both sensors were working and that he was generally satisfied. The customer had received additional CFLs that the installer had put in place for him.

Site 2: Yolanda Harris, 1215 Brussels (house / board and care facility). An outdoor sensor was installed in the covered entryway, not a wet location. This fixture was equipped with two indoor-rated CFLs. There was an indoor sensor controlling a 75 W incandescent lamp located in the laundry room. At least one additional incandescent lamp was noted to be in place in the center of the living room ceiling. The customer was very satisfied with the sensors, the four free CFLs that had been received, and the program itself. This customer had requested additional program information at the time of the installation and was planning to promote the program herself. She had initially found out about the program through a billboard.

Site 3: Sabrina Session, 29 Blythdale (apartment / community housing). Three indoor sensors had been installed in three bedrooms upstairs. The fixtures control incandescent lamps. In one of the bedrooms, the switch is inside the entryway but not visible to the entire room, which could cause a problem of premature shut off due to lack of proper sensing. The bathroom might have been a better place for a sensor or possibly the stairwell. (The

**SF Power Coop – Energy Efficiency of Wheels Program**  
**Preliminary Observations: Quality Assurance Inspection Process**

stairwell switch may be too far from the base of the stairs in order to effectively sense movement approaching the base of the stairs, however.) According to the customer, the installer did not leave a program packet or any CFLs. The installer was apparently running late and said that he/she would return.

Process Observations and Recommendations

1. Observation: The QC Manager took notes in a field notebook and did not have detailed information about the installation when she arrived. She was not able to crosscheck the invoice or database in the field.

Recommendation: Take a hard copy of the customer signup form and/or a relevant report from the database to the field for the QA check. The QA Manager will be able to crosscheck the installation from the field with the advantage of having the reported basis of the work as a starting place, rather than only the customer recollection of the install. This is standard procedure for utility residential programs.

2. Observation: All outdoor motion sensor fixtures were observed to have indoor rated CFLs installed. This is a potential liability hazard.

Recommendation: Installer training should be strengthened regarding use of proper lamps. The proper lamps should be procured prior to sensor installation, however, they are not yet available in the program. Incandescent lamps could be installed in the meanwhile. The installer is responsible for following up with the correct lamps once they are available to the program.

3. Observation: An indoor sensor was installed in a location where the occupant will not generally be in view of the sensor. This could well cause a customer complaint.

Recommendation: Installer training should be strengthened regarding sensor coverage and placement.

4. Observation: One customer stated that he/she did not receive a program information packet from the installer. One customer stated she had requested and received additional program information packets. The QA person did not ask the third customer whether or not he had received a packet. The QA Manager did not have additional printed program information readily available for customers.

Recommendations: Every customer contact is a potential for further program success. Installer training should emphasize the responsibility of educating customers about related programs. Equip the field QA personnel with printed program information. Ensure that field QA personnel discuss upcoming offerings, such as programmable thermostats.

5. Observation: Indoor sensors were installed controlling incandescent lamps rather than CFLs. This is evidence of proper training and follow-through because the sensors are not rated to control as small a load as a single CFL.



**APPENDIX C**  
**Sampling Plan**

**San Francisco Community Power Energy Efficiency on Wheels Program Evaluation**  
 Sample Size for CPUC Compliance Assessment

Specified Precision Method

Specified Precision Method is concerned with defining a sample size that will provide an estimate that does not exceed a defined maximum difference, e.g., determining the total program savings within 10%.

The Specified Precision Method was selected to generate a sample for the verification of energy savings associated with this program. It operates on the basis of the equation below:

$$n = 1 / (d^2 / (N^2 * Z^2 * S^2) + 1 / N)$$

The formula provides a sample size (n) that is as small as possible but such that the estimate exceeds the maximum allowable difference (d), between the true value and the estimate with a small probability  $\alpha$ .

In this case, (d) is related to the entire program savings (kBTU), as calculated by the quantities and stipulated savings associated with the program measures. Verified installations will be used to test the program savings estimates.

N = 68,200 Total population of measures  
 315 Average kBTU saved per unit (estimated)  
 d = 2,148,300 Based on 10% error of estimation & average MBtu/unit  
 Z = 1.645 From table below @ 90% confidence level; computed @2 tail limit due to split probability

Measure *	kWh/Unit	therms	kBTU/Unit	# of Units	kBTU	Sum(x^2)	(sum(x))^2
CFLS, 15 W	36.10		123.17	14,000	1,724,425	212,402,921	1,724,425
CFLS, 23 W	89.90		306.74	14,000	4,294,343	1,317,241,680	4,294,343
CFLS, 25 W	89.90		306.74	9,000	2,760,649	846,798,223	2,760,649
Low Flow Showerhead		9.30	930.00	5,000	4,650,000	4,324,500,000	4,650,000
Sink Aerator		3.30	330.00	5,000	1,650,000	544,500,000	1,650,000
Weatherstripping	3.10	0.70	80.58	5,000	402,886	32,463,426	402,886
Programmable Tstat	5.00	26.00	2617.06	1,000	2,617,060	6,849,003,044	2,617,060
Occupancy Sensors	47.90		163.43	15,000	2,451,522	400,664,008	2,451,522
Vending Misers	1327.00		4527.72	200	905,545	4,100,056,924	905,545
<b>Total</b>				<b>68,200</b>	<b>21,456,430</b>		

\* Program goals current from CPUC Workbook; kBTU values include combined electricity and gas savings.

$$S = \sqrt{(\text{Sum}(x^2) - (\text{Sum}(x))^2 / (\text{Measures})) / (\text{Measures} - 1)}$$

S = 417,3191

n = 472 **Sample**, total number of measures, including components of "Energy kits" individually.  
 13.64 estimated number of measures per customer site, based on estimated 5,000 customers.  
 35 estimated # of customer sites to survey

Table: Values for Z for Various Confidence Levels \*

confidence level.	C	one-tail limit z	two-tail limit z
90.00%		1.280	1.645
95.00%		1.645	1.060
97.50%		1.960	2.170
99.00%		2.330	2.575
99.50%		2.575	2.810
97.75%		2.810	3.000

\* from Mechanical Engineering Reference Manual, 1997, Table 11.1

"Lori Megdal, Ph.D." <megdal@verizon.net>  
07/26/2005 05:28 PM  
To  
Marc Theobald <Marc\_Theobald@emcorgroup.com>  
cc

bcc

Subject  
Re: 1683.01 Research Plan SF Power Co-op

I have reviewed the revised EM&V Plan for the San Francisco Community Power Cooperative's Energy Efficiency on Wheels Program. I was out of town one week and then felt I needed time to think and talk to other members of our review team on how to respond.

The revised EM&V Plan does show an attempt to address most of the concerns written in our review of the first version last August/September. The upfront table on the Energy Efficiency Policy Manual (EEPM) requirements and this plan's response to these is most helpful. They are not all met satisfactorily. Nor does the EM&V Plan specifically describe how you prioritized your efforts and justified that it was the best that could be done to meet the requirements of the EEPM given budget limitations and that no further funding from the Program could be allocated to evaluation given other program needs for meeting program required goals. There are also a few errors in the EM&V Plan.

At the same time, the evaluation of only \$31,900 was part of the Program Implementation Plan (PIP) for this program. It is not an adequate budget to meet all the EEPM requirements and is only 2.76% of the program budget. But we can not require the program to spend more on evaluation than was implicitly accepted by the CPUC in their acceptance of the Program's PIP. The revised EM&V Plan does provide its budget and its use. The revised EM&V Plan seems reasonable given the budget presented.

Considering all of the above, I am lead to believe that that the EEPM requirements not being met are due to budget limitations and a prioritization towards the evaluation activities that have already occurred and those planned in the revised EM&V Plan.

If I am correct on this assessment, please let me know. Then I will complete my review of the revised Plan (as provided) sending along my comments and recommendation to move forward to the CPUC staff. There are some issues I do wish you to note below and properly address these in your evaluation report from this effort. Yet, I will not ask you to spend any more time or your limited budget on another revised EM&V Plan.

The issues which I think should be noted and then handled appropriately as analysis is conducted and the evaluation report produced are as follows:  
1. Recognize that IPMVP Option A requires partial field measurement of at least one parameter and the others may be stipulated. The intent is that the one or more field measurement elements are those that have the greatest effect on reducing uncertainty in the energy savings estimate. For lighting measures this would often be operating hours and then the

remaining parameters (such as the change in wattage) would be taken from the database or other stipulated studies. Counting what is installed does not qualify as a field measurement.

The EM&V report should note that while the EEPM requires the use of IPMVP, the budget of the evaluation study did not support field measurement to occur. Instead the EM&V Plan provided for field verification of installation, an important parameter for the estimate of energy savings.

2. As requested in the review, please report in the EM&V report the following:

- a. Provide peak savings.
- b. Provide first year kWh and kW savings along with annual savings for years 1 through x depending upon an assessment of measure lifetimes for this program.
- c. Provide net energy and peak savings.

The EM&V Plan stated that a and c above would be included but failed to mention that b would be reported. It is a fairly simple manner to produce this using stipulated measure lifetimes for the measures as the evaluation estimates are installed.

3. The net-to-gross estimates in the EEPM and the DEER estimates are provided as the best estimates given past evaluations for the purposes of program planning. Provision of these in the EEPM or in DEER does not in any way substitute for the evaluation requirements listed in the EEPM. You may rely upon them as the most reliable stipulated estimates for your evaluation. Again, your use of these is as the most reliable estimates for these inputs and given your evaluation budget limitations.

4. The sampling method provided in your EM&V Plan is not simple random sampling. It is a single-stage cluster sampling approach. (You are random sampling participants and then checking all of the installations at these 35 participants. You think this will yield 472 measures being examined. Each participant is then a cluster. The between cluster error is the reason that cluster sampling is less efficient than random sampling.) Given the program design and your budget limitations, this design is quite reasonable. Yet, we feel that when you write the final EM&V report you need to state that this is cluster sampling and provided the most cost-effective reasonable sampling approach given the program design. Given this type of sampling, your statistics are not accurate and it is quite unlikely that your evaluation will achieve 10% precision at a 90% confidence level. Cluster sampling is much more cost-effective than random sampling but much less efficient statistically. The EEPM does not require a full reporting of precision and its associated statistics. We would like to see it but it is not required. As the statistics might get complicated. The simplest reporting would be to report your findings and the standard deviation across measures for the installation rate and then the standard deviation of installation rates across participants.

Hopefully I have made the correct assumption and this presents a very reasonable compromise to produce the best possible evaluation for this program given its very limited evaluation budget.

Lori Megdal

On Behalf of the TecMarket Works' Master Evaluation Contract Team

Marc Theobald wrote:

All:

Attached please find the revised final submittal for the Research Plan associated with evaluation of the San Francisco Community Power Cooperative's Energy Efficiency on Wheels Program. I apologize for the delay associated with this deliverable. We believe we have addressed all of the Reviewer's outstanding comments. If additional clarifications are required, please let me know and we will work quickly to address them.

(See attached file: SF Power M&E Research Plan Rev.pdf)

Sincerely,

Marc Theobald

EMCOR Energy & Technologies, Consulting Services  
505 Sansome Street Suite 1600  
San Francisco, CA 94111  
Phone: 415.434.2600 x223 / Fax: 415.434.2321

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--

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**APPENDIX B**  
**Energy Impacts and Project Calculations**



## Measure Verification Summary

KEY	
A	= Income
B	= Renter
C	= Language
D	= Multi-Family

	Customer ID	Measures Reported	Measures Verified	Hard To Reach Criteria Reported	Hard To Reach Criteria Verified	Satisfaction Level	Distributed or Installed
1	2756	16	16	None	B	1	Installed
2	4112	3	1	ABC	ABCD	N/A	Distributed
3	9073	7	7	AB	A	1	Distributed
4	9523	2	2	AB	AB	1	Distributed
5	17591	5	5	AB	ABC	N/A	Distributed
6	18452	10	5	A	ABD	N/A	Distributed
7	22103	7	5	None	B	N/A	Distributed
8	24605	16	16	None	B	N/A	Distributed
9	25097	5	5	None	AC	N/A	Distributed
10	25142	3	3	ABCD	ABC	N/A	Distributed
11	<b>25674</b>	<b>1</b>	<b>1</b>	<b>A</b>	<b>None</b>	<b>N/A</b>	<b>Installed</b> *
12	30558	6	6	BD	BD	1	Distributed
13	30733	5	3	A	AC	1	Distributed
14	34035	12	10	AC	AC	N/A	Installed
15	36248	16	16	A	AC	1	Installed
16	36802	16	16	None	None	N/A	Installed
17	40232	13	7	A	A	2	Installed
18	41189	16	16	BD	A	1	Installed
19	<b>43730</b>	<b>4</b>	<b>4</b>	<b>AB</b>	<b>None</b>	<b>N/A</b>	<b>Distributed</b> *
20	44427	16	11	ABC	ABC	2	Installed
21	47451	11	11	None	A	1	Installed
22	49174	5	4	None	ABD	1	Distributed
23	51260	11	6	C	AD	N/A	Distributed
24	52849	5	4	None	AB	N/A	Installed
25	54141	15	11	AB	ABC	2	Installed
26	56670	16	16	None	ABD	1	Installed
27	58359	12	4	A	None	N/A	Installed
28	60618	4	4	ABCD	C	N/A	Distributed
29	62934	16	16	None	A	1	Installed
30	62939	5	4	None	A	N/A	Distributed
31	63274	17	14	AC	AC	N/A	Installed
32	ALT(1)-10402	5	5	A	A	N/A	Installed
33	ALT(2)-17795	10	10	AB	None	1	Installed
34	ALT(3)-14152	15	12	A	ABCD	1	Installed
35	ALT(5)-60904	8	8	A	None	N/A	Installed
36	ALT(6)-57741	5	5	AD	ABD	N/A	Distributed
37	ALT(8)-17944	3	3	None	B	1	Installed
38	ALT(10)-31642	10	10	ABD	BD	N/A	Distributed
39	ALT(11)-1732	4	4	None	None	N/A	Distributed
40	ALT(12)-44720	5	5	None	AB	N/A	Distributed
41	ALT(13)-39654	2	2	ABC	ABC	1	Distributed
42	ALT(15)-41052	5	5	ABCD	C	N/A	Distributed
43	ALT(17)-34333	15	13	C	C	N/A	Distributed
44	ALT(18)-18444	4	4	None	AB	1	Installed
45	ALT(19)-56518	16	16	None	ABD	N/A	Distributed
46	ALT(20)-13848	3	3	ABC	AB	1	Installed
47	ALT(21)-57642	5	5	None	D	N/A	Distributed
48	ALT(23)-35654	13	11	A	AC	1	Installed
49	ALT(25)-53743	6	4	ABD	ABD	N/A	Distributed
50	ALT(30)-14388	15	14	A	None	N/A	Installed
51	ALT(31)-38884	6	6	ABD	AB	N/A	Distributed
52	ALT(32)-40778	11	11	A	A	1	Installed
53	ALT(37)-7446	6	6	AB	AB	1	Distributed
	<b>Total</b>	<b>468</b>	<b>411</b>		<b>HTR % Verified</b>	<b>Satisfaction</b>	<b>I = 47%</b> <b>D = 53%</b>
		<b>Verification Rate</b>	<b>87.8%</b>		<b>85.0%</b>	<b>1.13</b>	

\* These measures were verified by a partial visual inspection with no customer present. Only measures in locations that could be observed were evaluated. The program was given full credit for each measure observed during the inspection and the values for Measures Reported were adjusted to correspond to those measures that could be evaluated.

## Program Summary

Source of Data	Qty of Measures	Gross Values			Net Values		
		Total Natural Gas (Therms/yr)	Total Electric Demand (kW)	Total Electricity (kWh/yr)	Total Natural Gas (Therms/yr)	Total Electric Demand (kW)	Total Electricity (kWh/yr)
Original Program Goals	68,200	92,500	490.5	3,577,500	74,000	392.4	2,862,000
Revised Program Goals	76,650	110,288	558.9	4,034,156	88,230	447.1	3,227,325
Reported Results-Database	66,126	99,908	475.3	3,295,754	79,927	380.3	2,636,603
Verified Program Savings (1)	58,057	87,721	417.3	2,893,201	70,177	333.9	2,314,561
Verified Program Savings, Updated (2)	58,057	94,123	598.0	2,967,708	75,299	478.4	2,374,166

Notes: Values per related tables as documented; "Net" values are 80% of Gross values per program NTG ratio.

- (1) Verified based on program verification rate, based on original stipulated values.
- (2) Verified based on program verification rate, based on revised stipulated and EUL values.

## Program Savings Calculations (Original Program Goals)

Measure	Original Program Goals (1)	Savings (2)					
		Unit Natural Gas (Therms/yr)	Unit Electricity Demand (kW/yr)	Unit Electricity (kWh/yr)	Total Natural Gas (Therms/yr)	Total Electric Demand (kW)	Total Electricity (kWh/yr)
CFLs, 15W	14,000		0.0081	36.1		113.4	505,400
CFLs, 25W	14,000		0.0135	89.9		189.0	1,258,600
CFLs 23W (exterior)	9,000		0.0135	89.9		121.5	809,100
Low Flow Showerhead	5,000	9.3			46,500		0
Sink Aerator	5,000	3.3			16,500		0
Weatherstripping	5,000	0.7	0.0015	3.1	3,500	7.5	15,500
Programmable Thermostat	1,000	26		5	26,000		5,000
Occupancy Sensors	15,000		0.0035	47.9		52.5	718,500
Vending Misers	200		0.033	1327		6.6	265,400
<b>Gross Savings Total</b>	<b>68,200</b>				<b>92,500</b>	<b>490.5</b>	<b>3,577,500</b>
<b>Net-to-gross Ratio</b>					<b>0.8</b>	<b>0.8</b>	<b>0.8</b>
<b>Net Totals:</b>					<b>74,000</b>	<b>392.4</b>	<b>2,862,000</b>

Notes:

(1) As referenced in CPUC reporting workbook, May 2004  
 (2) Projected based on original program goals

## Program Savings Calculations (Revised Program Goals)

Measure	Revised Program Goals (1)	Savings (2)					
		Unit Natural Gas (Therms/yr)	Unit Electricity Demand (kW/yr)	Unit Electricity (kWh/yr)	Total Natural Gas (Therms/yr)	Total Electric Demand (kW)	Total Electricity (kWh/yr)
CFLs, 15W	15,927		0.0081	36.1		129.0	574,965
CFLs, 25W	21,357		0.0135	89.9		288.3	1,919,994
CFLs 23W (exterior)	5,136		0.0135	89.9		69.3	461,726
Low Flow Showerhead	5,360	9.3			49,848		0
Sink Aerator	5,360	3.3			17,688		0
Weatherstripping	5,360	0.7	0.0015	3.1	3,752	8.0	16,616
Programmable Thermostat	1,500	26		5	39,000		7,500
Occupancy Sensors	16,450		0.0035	47.9		57.6	787,955
Vending Misers	200		0.033	1327		6.6	265,400
<b>Gross Savings Total</b>	<b>76,650</b>				<b>110,288</b>	<b>558.9</b>	<b>4,034,156</b>
<b>Net-to-gross Ratio</b>					<b>0.8</b>	<b>0.8</b>	<b>0.8</b>
<b>Net Totals:</b>					<b>88,230</b>	<b>447.1</b>	<b>3,227,325</b>

Notes:

- (1) As referenced in CPUC reporting workbook, September 2005
- (2) Projected based on revised program goals

## Program Savings Calculations (Reported Results)

Measure	Database Results (1)	Savings (2)					
		Unit Natural Gas (Therms/yr)	Unit Electricity Demand (kW/yr)	Unit Electricity (kWh/yr)	Total Natural Gas (Therms/yr)	Total Electric Demand (kW)	Total Electricity (kWh/yr)
R-CFL 15w	11,900		0.0081	36.1	0	96.4	429,590
R-CFL 25w	16,177		0.0135	89.9	0	218.4	1,454,312
R-CFL outdoor par lamps	4,662		0.0135	89.9	0	62.9	419,114
R-Low Flow Showerhead	4,408	9.3			40,994	0.0	0
R-Sink Aerator	4,408	3.3			14,546	0.0	0
R-Weatherstripping	4,408	0.7	0.0015	3.1	3,086	6.6	13,665
R-Programmable Thermostat	1,419	26		5	36,894	0.0	7,095
R-Motion Sensor Indoor	8,156		0.0035	47.9	0	28.5	390,672
R-Motion Sensor Indoor 3-way	125		0.0035	47.9	0	0.4	5,988
R-Motion Sensor Outdoor - Retrofit	664		0.0035	47.9	0	2.3	31,806
R-Motion Sensor Outdoor w/ Fixture	4,402		0.0035	47.9	0	15.4	210,856
R-Vending Miser	3		0.0330	1327	0	0.1	3,981
NR-CFL 15w	1,940		0.0081	36.1	0	15.7	70,034
NR-CFL 25w	1,321		0.0135	89.9	0	17.8	118,758
NR-CFL outdoor par lamps	313		0.0135	89.9	0	4.2	28,139
NR-Low Flow Showerhead	23	9.3			214	0.0	0
NR-Sink Aerator	23	3.3			76	0.0	0
NR-Weatherstripping	23	0.7	0.0015	3.1	16	0.0	71
NR-Programmable Thermostat	157	26		5	4,082	0.0	785
NR-Motion Sensor Indoor	1,482		0.0035	47.9	0	5.2	70,988
NR-Motion Sensor Indoor 3-way	7		0.0035	47.9	0	0.0	335
NR-Motion Sensor Outdoor - Retrofit	19		0.0035	47.9	0	0.1	910
NR-Motion Sensor Outdoor w/ Fixture	59		0.0035	47.9	0	0.2	2,826
NR-Vending Miser	27		0.0330	1327	0	0.9	35,829

Gross Savings Total	66,126		99,908	475.3	3,295,754
Net-to-gross Ratio			0.8	0.8	0.8
<b>Net Totals:</b>			<b>79,927</b>	<b>380.3</b>	<b>2,636,603</b>

Notes:

(1) Per SF Power Co-op database, 1/30/06  
 (2) Recorded results based on original stipulated values

## Program Savings Calculations (Verified Results/Original Stipulations)

Measure	EUL (yrs) (1)	Database Results (2)	Savings (3)					
			Unit Natural Gas (Therms/yr)	Unit Electricity Demand (kW/yr)	Unit Electricity (kWh/yr)	Total Natural Gas (Therms/yr)	Total Electric Demand (kW)	Total Electricity (kWh/yr)
R-CFL 15w	8	10,448		0.0081	36.1	0	84.6	377,173
R-CFL 25w	8	14,203		0.0135	89.9	0	191.7	1,276,850
R-CFL outdoor par lamps	8	4,093		0.0135	89.9	0	55.3	367,961
R-Low Flow Showerhead	10	3,870	9.3			35,991	0.0	0
R-Sink Aerator	5	3,870	3.3			12,771	0.0	0
R-Weatherstripping	1	3,870	0.7	0.0015	3.1	2,709	5.8	11,997
R-Programmable Thermostat	11	1,246	26.0		5.0	32,396	0.0	6,230
R-Motion Sensor Indoor	8	7,161		0.0035	47.9	0	25.1	343,012
R-Motion Sensor Indoor 3-way	8	110		0.0035	47.9	0	0.4	5,269
R-Motion Sensor Outdoor - Retrofit	8	583		0.0035	47.9	0	2.0	27,926
R-Motion Sensor Outdoor w/ Fixture	8	3,865		0.0035	47.9	0	13.5	185,134
R-Vending Miser	10	3		0.0330	1,327.0	0	0.1	3,981
NR-CFL 15w	8	1,703		0.0081	36.1	0	13.8	61,478
NR-CFL 25w	8	1,160		0.0135	89.9	0	15.7	104,284
NR-CFL outdoor par lamps	8	275		0.0135	89.9	0	3.7	24,723
NR-Low Flow Showerhead	10	20	9.3			186	0.0	0
NR-Sink Aerator	5	20	3.3			66	0.0	0
NR-Weatherstripping	1	20	0.7	0.0015	3.1	14	0.0	62
NR-Programmable Thermostat	11	138	26.0		5.0	3,588	0.0	690
NR-Motion Sensor Indoor	8	1,301		0.0035	47.9	0	4.6	62,318
NR-Motion Sensor Indoor 3-way	8	6		0.0035	47.9	0	0.0	287
NR-Motion Sensor Outdoor - Retrofit	8	17		0.0035	47.9	0	0.1	814
NR-Motion Sensor Outdoor w/ Fixture	8	52		0.0035	47.9	0	0.2	2,491
NR-Vending Miser	10	23		0.0330	1,327.0	0	0.8	30,521

Gross Savings Total	58,057		87,721	417.3	2,893,201
Net-to-gross Ratio			0.8	0.8	0.8
<b>Net Totals:</b>			<b>70,177</b>	<b>333.9</b>	<b>2,314,561</b>

Notes:		As originally provided by SF Power Co-op.
	(2)	Per SF Power Co-op database, 1/30/06, derated by average verification rate.
	(3)	Recorded results based on original stipulated values

### Program Savings Calculations (Verified Results/Revised Stipulations)

Measure	Notes	EUL (yrs)	Database Results (1)	Savings (2)					
				Unit Natural Gas (Therms/yr)	Unit Electricity Demand (kW/yr)	Unit Electricity (kWh/yr)	Total Natural Gas (Therms/yr)	Total Electric Demand (kW)	Total Electricity (kWh/yr)
R-CFL 15w	a	9	10,448		0.0033	34.591	0	34.5	361,407
R-CFL 25w	a	9	14,203		0.0055	57.652	0	78.1	818,831
R-CFL outdoor par lamps	a,b	7	4,093			59.189	0	0.0	242,261
R-Low Flow Showerhead	c	10	3,870	7.502			29,033	0.0	0
R-Sink Aerator	c	9	3,870	5.627			21,776	0.0	0
R-Weatherstripping	c	13	3,870	11.0672			42,830	0.0	0
R-Programmable Thermostat	d	12	1,246	-	-	-	0	0.0	0
R-Motion Sensor Indoor	e	8	7,161		0.0134	43.207	0	95.9	309,405
R-Motion Sensor Indoor 3-way	e	8	110		0.0134	43.207	0	1.5	4,753
R-Motion Sensor Outdoor - Retrofit	b,e	8	583			43.207	0	0.0	25,190
R-Motion Sensor Outdoor w/ Fixture	b,e	8	3,865			43.207	0	0.0	166,995
R-Vending Miser	f	10	3		0.0000	1,612.000	0	0.1	4,836
NR-CFL 15w	g	2	1,703		0.0434	171.133	0	73.8	291,439
NR-CFL 25w	g	2	1,160		0.0723	285.221	0	83.9	330,856
NR-CFL outdoor par lamps	b,g	7	275			292.827	0	0.0	80,527
NR-Low Flow Showerhead	c,h	10	20	7.502			150	0.0	0
NR-Sink Aerator	c,h	9	20	5.627			113	0.0	0
NR-Weatherstripping	c,h	13	20	11.0672			221	0.0	0
NR-Programmable Thermostat	d	11	138	-	-	-	0	0.0	0
NR-Motion Sensor Indoor	i	8	1,301		0.1762	213.759	0	229.2	278,100
NR-Motion Sensor Indoor 3-way	i	8	6		0.1762	213.759	0	1.1	1,283
NR-Motion Sensor Outdoor - Retrofit	b,i	8	17			213.759	0	0.0	3,634
NR-Motion Sensor Outdoor w/ Fixture	b,i	8	52			213.759	0	0.0	11,115
NR-Vending Miser	f	10	23		0.0000	1,612.000	0	0.0	37,076

Gross Savings Total	58,057	94,123	598.0	2,967,708
Net-to-gross Ratio		0.8	0.8	0.8
<b>Net Totals:</b>		<b>75,299</b>	<b>478.4</b>	<b>2,374,166</b>

Notes:  
 (1) Per SF Power Co-op database, 1/30/06, derated by average verification rate.  
 (2) Recorded results based on revised stipulated values 9/06. Current EUL data from DEER website, rounded to nearest whole year. Assumptions as noted:  
 a) DEER Res. CFL values are from "KEMA CFL Study"; Note: DEER website derates the values by 10% to account for in-service rate.  
 b) Assume Exterior CFLs and sensor loads not coincident with peak  
 c) gas only savings values per SFPower-Co-op research due to typical hot water source fuel.  
 d) DEER shows no savings for this measure  
 e) DEER does not have sensor data for residential. Assume proportional savings based on metrics for CFL operation as follows:  
 e) res. sensor peak kW = DEER non-residential sensor peak kW \* [(peak kW saved res 25W CFL) / (peak kW saved non-res 25W CFL)]  
 e) res. sensor kWh saved = DEER non-residential sensor kWh saved \* [(kWh saved res 25W CFL) / (kWh saved non-res 25W CFL)]  
 f) res. value not available; non-res value applied to residential case  
 g) Non Res CFL from DEER, assuming "retail-small" category, conservative values when range available  
 h) Non-Res information not available or not applicable; residential values used.  
 i) per DEER database

**PG&E Program Energy Impact Reporting for 2004-2005 Programs**

<b>Program ID*:</b>		PG&E 1083-04						
<b>Program Name:</b>		Efficiency on Wheels PY 2004-2005						
Year	Calendar Year	Gross Program-Projected MWh Savings ***	Net Evaluation Confirmed Program MWh Savings	Gross Program-Projected Peak MW Savings ***	Evaluation Projected Peak MW Savings**	Gross Program-Projected Therm Savings ***	Net Evaluation Confirmed Program Therm Savings	
1	2004	0.0	0.0	0	0	0	0	
2	2005	2636.6	2374.2	0.38	0.48	79,927	75,299	
3	2006	2636.6	2374.2	0.38	0.48	79,927	75,299	
4	2007	2636.6	1876.3	0.38	0.35	79,927	75,299	
5	2008	2636.6	1876.3	0.38	0.35	79,927	75,299	
6	2009	2636.6	1876.3	0.38	0.35	79,927	75,299	
7	2010	2636.6	1876.3	0.38	0.35	79,927	75,299	
8	2011	2636.6	1876.3	0.38	0.35	79,927	75,299	
9	2012	2278.8	1618.1	0.33	0.35	79,927	75,299	
10	2013	1707.3	977.7	0.28	0.09	79,927	75,299	
11	2014	49.1	33.5	0.01	0	68,229	57,787	
12	2015	17.3	0.0	0.01	0	35,262	34,441	
13	2016	17.3	0.0	0.01	0	35,262	34,441	
14	2017	11.0	0.0	0.01	0	2,481	34,441	
15	2018	0.0	0.0	0	0	-	-	
16	2019	0.0	0.0	0	0	-	-	
17	2020	0.0	0.0	0	0	-	-	
18	2021	0.0	0.0	0	0	-	-	
19	2022	0.0	0.0	0	0	-	-	
20	2023	0.0	0.0	0	0	-	-	
<b>TOTAL</b>	<b>2004-2023</b>	<b>22537.0</b>	<b>16759.3</b>	<b>0.38</b>	<b>0.48</b>	<b>860,574</b>	<b>838,798</b>	

\*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: *peak savings values per measure stipulated per DEER database; "total" = max kW reduction over period*

\*\*\* "Gross" Program projected savings reflects application of 0.8 NTG Ratio to raw results so as to be directly comparable to "Confirmed" savings



### San Francisco Community Power - Efficiency on Wheels Program Cost Effectiveness Calculation

Note: The following is based on data available at the time of this analysis as noted below.

Table 1 Results based on calculations as developed by the CPUC with inputs provided by SF Community Power Co-op.

**Table 1:**

Projected Total Resource Costs and Benefits		Net Projected Energy Effects	
TRC Costs	\$584,973	Net Coincident Peak kW	447
TRC Benefits	\$1,659,895	Net Annual kWh	3,227,325
TRC Net Benefits	\$1,074,922	Net Lifecycle kWh	26,168,191
TRC Ratio	2.8376	Net Annual Therms	88,230
TRC Levelized Cost Electric	\$0.0291	Net Lifecycle Therms	815,738
TRC Levelized Cost Gas	\$0.9907		

Table 2, below: Evaluator recalculated Projected TRC and other metrics based on total program cost per standard practices, using total program cost.

**Table 2:**

Adjusted Total Resource Costs and Benefits		Net Projected Energy Effects	
TRC Costs	\$797,900	Net Coincident Peak kW	447
TRC Benefits	\$1,659,895	Net Annual kWh	3,227,325
TRC Net Benefits	\$861,995	Net Lifecycle kWh	26,168,191
TRC Ratio	1.9256	Net Annual Therms	88,230
TRC Levelized Cost Electric	\$0.0397	Net Lifecycle Therms	815,738
TRC Levelized Cost Gas	\$1.3513		

Table 3, below: Evaluator calculated TRC and other metrics based on standard calculation practices, verified results, and the assumption that the entire program budget will be expended. Values based on current DEER values for EUL and estimated savings.

**Table 3:**

Verified Total Resource Costs and Benefits		Net Verified Energy Effects	
TRC Costs	\$797,900	Net Coincident Peak kW	478
TRC Benefits	\$1,154,421	Net Annual kWh	2,374,167
TRC Net Benefits	\$356,521	Net Lifecycle kWh	16,759,338
TRC Ratio	1.4468	Net Annual Therms	75,299
TRC Levelized Cost Electric	\$0.0628	Net Lifecycle Therms	838,798
TRC Levelized Cost Gas	\$1.3808		

Data source: 1083 - San Francisco Community Power - Efficiency on Wheels PY 2004-2005 - PGE service area - IOU Local Program - Sep-05 Report Workbook modified by EMCOR; reported values were replaced by verified values to calculate "Verified Total Resource Cost" indicies.



**APPENDIX C**  
**Revised Sampling Plan**

**San Francisco Community Power Energy Efficiency on Wheels Program Evaluation**  
Sample Size for Compliance Assessment based on 02/06/06 Database

Specified Precision Method

Specified Precision Method is concerned with defining a sample size that will provide an estimate that does not exceed a defined maximum difference, e.g., determining the total program savings within 10%.

The specified precision method was selected to generate a sample for the verification of energy savings associated with this program. It operates on the basis of the equation below:

$$n = 1 / (d^2 / (N^2 * Z^2 * S^2) + 1 / N)$$

The formula provides a sample size (n) that is as small as possible but such that the estimate exceeds the maximum allowable difference (d), between the true value and the estimate with a small probability  $\alpha$ .

In this case, (d) is related to the entire program savings (kBTU), as calculated by the quantities and stipulated savings associated with the program measures. Verified installations will be used to test the program savings estimates.

<b>N =</b>	<b>66126</b>	<b>Total population of measures based on database results</b>
	321.14358	Average kBTU saved per unit (estimated)
<b>d =</b>	2123594.1	Based on 10% error of estimation & average mbtu/unit
<b>Z =</b>	1.645	From table below @ 90% confidence level; computed @2 tail limit due to split probability

Measure *	kWh/Unit	therms	kBTU/Unit	# of Units	kBTU	Sum(x^2)	(sum(x))^2
CFL 15w	36.10		123.17	13840	1704717	209975458.8	1704717.1
CFL 25w	89.90		306.74	17498	5367316	1646363922.6	5367315.5
CFL outdoor par lamps	89.90		306.74	4975	1526026	468091239.8	1526025.5
Low Flow Showerhead		9.30	930.00	4431	4120830	3832371900.0	4120830.0
Sink Aerator		3.30	330.00	4431	1462230	482535900.0	1462230.0
Weatherstripping	3.10	0.70	80.58	4431	357037.6	28769087.9	357037.6
Programmable Thermost:	5.00	26.00	2617.06	1576	4124487	10794028796.7	4124486.6
Motion Sensor Indoor	47.90		163.43	9638	1575185	257439980.5	1575184.6
Motion Sensor Indoor 3-w	47.90		163.43	132	21573.39	3525843.3	21573.4
Motion Sensor Outdoor -	47.90		163.43	683	111626	18243567.8	111626.0
Motion Sensor Outdoor w	47.90		163.43	4461	729082.6	119157475.9	729082.6
Vending Miser	1327.00		4527.72	30	135831.7	615008538.6	135831.7
<b>Total</b>				<b>66126</b>	<b>21235941</b>		

\* Program actuals current from Program Database; kBTU values also includes combined electricity & gas savings

S = Sqrt( (Sum(x^2) - (Sum(x))^2 / (Measures)) / (Measures - 1) )  
S = 419.8429

<b>Estimated</b>	<b>Actual</b>	<b>Sample</b> , total number of measures, including components of "Energy kits" individually.
<b>n =</b>	<b>459</b>	number of measures per customer site, based on estimated 5000 customers.
<b>13.64</b>	<b>9.2</b>	number of customer sites
<b>34</b>	<b>50</b>	

confidence level, C	one-tail limit z	two-tail limit z
90%	1.28	1.645
95%	1.645	1.06
97.5%	1.96	2.17
99%	2.33	2.575
99.5%	2.575	2.81
97.75%	2.81	3

\* from Mechanical Engineering Reference Manual, 1997, Table 11.1

where  $\bar{Y}' = \frac{1}{K} \sum_j \bar{Y}_j$ .<sup>5</sup>

- A **second** method for estimating the mean is to utilize the **cluster sample ratio**. This approach relies on the idea that the population mean can be written as:

$$\bar{Y} = \frac{\sum_j \sum_i Y_{ij}}{\sum_j N_j} = \frac{\sum_j T_j}{\sum_j N_j},$$

where  $T_j = \sum_i Y_{ij}$  is the population total in a cluster. The population mean now is the ratio of the total of the cluster totals over the total of the cluster sizes. This ratio is referred to as the **population ratio**.

By defining the sample equivalent of this ratio we obtain an alternative estimator of the population mean:

$$\bar{y}_{cl}'' = \frac{\sum_j t_j}{\sum_j n_j}.$$

---

<sup>5</sup> With this result it can be shown that  $Bias = \bar{Y}' - \sum_j W_j \bar{Y}_j = \frac{1}{K} \sum_j \bar{Y}_j - \sum_j W_j \bar{Y}_j$ . We can also show that the bias goes to zero when  $W_j$  and  $\bar{Y}_j$  do not covary and  $K$  is large. The covariance is given by  $Cov = \frac{1}{K-1} \left( \sum_j W_j \bar{Y}_j - \bar{W} \bar{Y}' \right)$ . Here  $\bar{W} = \frac{1}{K} \sum_j W_j = \frac{1}{K}$ , since  $\sum_j W_j = 1$ . Thus,  $Cov = \frac{1}{K-1} \left( \sum_j W_j \bar{Y}_j - \frac{1}{K} \bar{Y}' \right)$ . We can also express this as  $\sum_j W_j \bar{Y}_j = (K-1)Cov + \frac{K-1}{K} \bar{Y}'$ . However, we assume  $Cov = 0$ , and thus  $\sum_j W_j \bar{Y}_j = \frac{K-1}{K} \bar{Y}'$ . For large  $K$  this is approximately equal to  $\sum_j W_j \bar{Y}_j = \bar{Y}'$ . The bias is then given by  $Bias = \bar{Y}' - \sum_j W_j \bar{Y}_j = \bar{Y}' - \bar{Y}' = 0$ . Q.E.D.

This estimator is generally **biased** by a factor  $\frac{1}{k}$ . Obviously, when  $k \rightarrow \infty$ , the bias will disappear. When a relatively small number of clusters is selected, however, the bias can be considerable.

On the other hand, the variance of the sampling distribution of means under the cluster sample ratio estimator tends to be small. An approximation of this variance is given by:

$$V[\bar{y}_{cl}'] \cong \frac{(K-k)K}{(K-1)k} \sum_j \left(\frac{N_j}{N}\right)^2 (\bar{Y}_j - \bar{Y})^2 = S_D^2$$

As you can see, this variance can be quite small if the variation between the population cluster means is relatively small.

- A **third** method for estimating the population mean takes advantage of the fact that the population mean can be expressed as:

$$\bar{Y} = \frac{K}{N} \sum_j \frac{T_j}{K}$$

This implies the use of the following estimator:

$$\bar{y}_{cl}''' = \frac{K}{N} \sum_j \frac{t_j}{k} = \frac{K}{Nk} \sum_j t_j$$

This estimator is **unbiased**.

The variance is given by:

$$V[\bar{y}_{cl}'''] = \frac{(K-k)K}{(K-1)kN^2} \sum_j \left(T_j - \frac{N}{K} \bar{Y}\right)^2$$

This tends to be greater than  $V[\bar{y}_{cl}']$ , because  $T_j$  is more likely to be affected by cluster sizes than  $\bar{Y}_j$ . Indeed, when the cluster sizes are large, it is possible for  $T_j$  to be considerably larger than  $\bar{Y}_j$ , in which case  $V[\bar{y}_{cl}'''] > V[\bar{y}_{cl}']$ . Thus, what is gained in unbiasedness may be lost in terms of reduced efficiency.



**APPENDIX D**  
**Data Collection Plan and Activities**

## SAN FRANCISCO POWER CO-OP EFFICIENCY ON WHEELS PROGRAM EM&V FIELD DATA COLLECTION AND MANAGEMENT PROCEDURES

### **Background**

The data to be gathered fall into two broad categories, that which support energy savings (hard goals) and that which support soft program goals, such as whether program peripherals are considered “hard to reach”. A standard “Field Data Collection Sheet” (FDCS) has been developed for recording the data required for the evaluation, and a sample is provided as Attachment 1.

A random sample of program participants has been drawn from the current version of the program database. The participants included in this sample were provided with a letter from the SF Power Co-op indicating our intention to contact them.

Two methods will be used for data collection, on-site surveys and phone surveys. For each participant, the delivery method is indicated as either “Distributed” or “Installed” depending on the information contained in the program database. Phone surveys will be conducted to verify the distribution of energy kits and CFLs, while on-site inspection and interview will be the primary instrument for data collection to assess the status of the installed measures.

### **General**

EMCOR's Survey Team members have been given the names of the participants included in the sample, and have entered key information regarding each participant into a unique FDCS. The Surveyor will review each participant's FDCS and determine whether to initiate a phone survey or a field inspection.

SAN FRANCISCO POWER CO-OP EFFICIENCY ON WHEELS PROGRAM  
EM&V FIELD DATA COLLECTION AND MANAGEMENT PROCEDURES

### Phone Surveys

The process for conducting a phone survey will be as follows:

For customers who took delivery by distribution, place a phone call to the customer at the phone number indicated on the FDCS. Suggested text follows:

*"Hi, my name is \_\_\_\_\_, and I am calling to follow up on the (Efficiency on Wheels) program, where SF Community Power provided energy saving items to members of the community. Is \_\_\_\_\_ there?"*

If this is the right person, continue to complete the survey. If no, first ask if the person on the phone is over the age of 18. If the answer is yes, then ask:

*"Are you aware whether SF Power provided energy saving items for your household, or should I be speaking with \_\_\_\_ (contact name) \_\_\_\_\_ directly about it?"*

Either complete the survey or note when to call back to reach the designated contact. In most cases do not leave a message. If the survey is incomplete after this initial call, enter notes in the notes portion of the "Contact Notes & Corrections" field of the FDCS (BOX 3) to facilitate further contact.

When proceeding to complete the survey, note as follows in BOX 1 of the FDCS:

- The customer or contact with whom the survey is being completed
- The relationship to the indicated contact (if other)
- The date of phone interview
- name/names of person conducting the interview, (include translator if applicable)

The information in Box 2 has been obtained from the program database. As you speak with the participant, note all corrections in the appropriate "Corrections" portion of BOX 3.

Proceed to verify the contact information:

*"I'd like to make sure we have the right information about you. Our notes have you listed as: .. (name) ... at .. (address).*

*"Do you recall whether you received energy saving materials from the Power Co-op?"*

*"Based on your recollection, I'm going to read a list of items and ask you how many of each item you received from the Program."*

Refer to Box 5: Read the list of measures. Ask how many were received of each of the 12 measures and note the results in the Quantity Received column.



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Refer to Box 4 and prepare to verify additional personal and program contact information.  
Record responses in the indicated areas:

*“Just a couple more questions about you and the program and we’ll be finished”.*

- How did they find out about the program
- What is their primary language?
- Do live in a single or multifamily home?
- Do you rent your home?
- How many people are in your household? \*
- Is your household income above or below \_\_\_\_\_ . \*

\* Note: The pre-loaded survey sheet will indicate a specific qualifying income level for the participant based on the number of people in the household which are reported in the database. If a different number of people are reported, the qualifying income level will vary. Refer to the “Income Reference Chart in Box 4 when asking the question related to household income, selecting the amount that corresponds to the number of people in the household.

At the end of the interview, be sure to thank them for participating in the survey.

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**On-site-Surveys**

On-site surveys will be conducted for program participants who received services by means of installation. Survey team members will review the program database records and initiate an FDCS for each participant prior to conducting the on-site survey. For on-site surveys, survey team members will be pre-equipped with the generic letter of introduction issued by the San Francisco Power Co-op.

Pre-Field

For customers who are listed as having had products installed, place a call to the participant. Suggested text follows:

*"Hi, my name is \_\_\_\_\_, and I am calling to follow up on the (Efficiency on Wheels) program, where SF Community Power installed energy savings items for some members of the community. Is \_\_\_\_\_ there?"*

If this is the right person, continue to schedule the site survey. If no, first ask:

*"Are you aware whether SF Power provided energy saving items for your household, or should I be speaking with \_\_\_\_ (contact name) \_\_\_\_\_ directly about it?"*

Either schedule the site survey or note when to call back to reach the designated contact. In most cases do not leave a message. Enter notes in the notes portion of the "Contact Notes & Corrections" field of the FDCS (BOX 3) to facilitate further contact.

\* Note: Someone over the age of 18 must be at home if the surveyor is going inside.

SAN FRANCISCO POWER CO-OP EFFICIENCY ON WHEELS PROGRAM  
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Field

Proceed to customer premises in accordance with schedule. Sample text:

*"Hi, I spoke to \_\_\_\_\_ about coming by today. My name is \_\_\_\_\_, and I am following up on the (Efficiency on Wheels) program, where SF Community Power installed energy savings items for some members of the community. Is \_\_\_\_\_ there?"*

When the customer participant comes to the door:

*Hi, \_\_\_\_\_. I'm \_\_\_\_\_ and I'm here to follow up about the energy saving program that you recently took part in.*

Proceed to verify the contact information: When completing the survey, note as follows in BOX 1 of the FDCS:

- The customer or contact with whom the survey is being completed
- The relationship to the indicated contact (if other)
- The date of phone interview
- Name/names of person conducting the interview (include translator if applicable)

The information in Box 2 has been obtained from the program database. As you speak with the participant, note all corrections in the appropriate "Corrections" portion of BOX 3.

*"I'd like to make sure we have the right information about you. Our notes have you listed as: .. (name) ... at .. (address).*

*"Do you recall whether you received energy saving materials from the Power Co-op?"*

*"Based on your recollection, I'm going to read a list of items and ask you how many of each item you received from the Program."*

Refer to Box 5: Read the list of measures. Ask how many were received and how many have been installed of each of the 12 measures. Note the results in the "Qty Received" column for all items received, and in the "Qty Installed" column for items which were either installed by the Power-Co-op, or have been since been installed.

Verification of measures is an important part of this on-site survey. Ask the customer participant if it would be possible to see the installed items in order to ensure that items were installed correctly and to improve the program overall.

Use BOX 6 to indicate which installed items were verified. Include comments as to the condition, suitability, and functionality of the installed items.

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Refer to BOX 7 for questions related to the installation itself and indicate responses on the appropriate lines of BOX 7.

Refer to Box 4 and prepare to verify additional personal and program contact information. Record responses in the indicated areas:

*“Just a couple more questions about you and the program and we’ll be finished”.*

- How did they find out about the program
- What is their primary language?
- Do live in a single or multifamily home?
- Do you rent your home?
- How many people are in your household? \*
- Is your household income above or below \_\_\_\_\_ . \*

\* Note: The pre-loaded survey sheet will indicate a specific qualifying income level for the participant based on the number of people in the household which are reported in the database. If a different number of people are reported, the qualifying income level will vary. Refer to the “Income Reference Chart in Box 4 when asking the question related to household income, selecting the amount that corresponds to the number of people in the household.

At the end of the interview, be sure to thank them for participating in the survey.

## Field Data Collection Sheet, Energy Efficiency on Wheels

BOX 1	Spoke to _____ Relationship to Database Contact _____ Phone Interview <input type="checkbox"/> (date) -> _____ Site Visit <input type="checkbox"/> (date)-> _____	INTERNAL USE ONLY - DATA VALIDATION <input type="checkbox"/> Data Reviewed <input type="checkbox"/> Data Processed By: _____ By: _____																																																						
BOX 2	<b>Customer Information</b> Customer ID _____ Last Name _____ First Name _____ Company Name _____ Street Address _____ City, State _____ Zip Code _____ Area Code - Phone Number _____ HTR Category _____ Location _____ Installation Date _____ Delivery _____	<b>Database Contact Information:</b> 7888 Bowser, Shinota Bowser Shinota 0 3021 Folsom San Francisco, CA 94110 415 - 2823022 0 0 6/10/2004 Installed	BOX 3 <b>Contact Notes &amp; Corrections:</b> (Corrections) _____ (Notes) _____																																																					
BOX 4	<b>Personal Information (Always Ask)</b> How did you find out about the program? Friends What is your primary language? English Do you live in a (single/multi-family/other) ? Single Family Home Do you rent your home? --- How many people are in your household? 6 Is household annual income above or below (see ranges inc ref. chart) ---																																																							
(friends, church, flier, radio, billboard, other) (from Database): _____ <table border="1" style="margin-left: auto; margin-right: 0;"> <tr> <td style="text-align: center;">income reference chart -&gt;</td> <td style="text-align: center;">1 - \$37,240</td> <td style="text-align: center;">5 - \$88,120</td> </tr> <tr> <td></td> <td style="text-align: center;">2 - \$49,960</td> <td style="text-align: center;">6 - \$100,840</td> </tr> <tr> <td></td> <td style="text-align: center;">3 - \$ 62,680</td> <td style="text-align: center;">7 - \$113,560</td> </tr> <tr> <td></td> <td style="text-align: center;">\$ 100,740</td> <td style="text-align: center;">4 - \$75,400    8 - \$126,280</td> </tr> </table>				income reference chart ->	1 - \$37,240	5 - \$88,120		2 - \$49,960	6 - \$100,840		3 - \$ 62,680	7 - \$113,560		\$ 100,740	4 - \$75,400    8 - \$126,280																																									
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	3 - \$ 62,680	7 - \$113,560																																																						
	\$ 100,740	4 - \$75,400    8 - \$126,280																																																						
BOX 5	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 40%;"></th> <th style="width: 10%;">Qty Reported</th> <th style="width: 10%;">Qty Received</th> <th style="width: 10%;">Qty Installed</th> </tr> </thead> <tbody> <tr><td>CFL 15w</td><td style="text-align: center;">4</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td></tr> <tr><td>CFL 25w</td><td style="text-align: center;">2</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td></tr> <tr><td>CFL outdoor par lamps</td><td style="text-align: center;">0</td><td></td><td></td></tr> <tr><td>Low Flow Showerhead</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td></tr> <tr><td>Sink Aerator</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td></tr> <tr><td>Weatherstripping</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td></tr> <tr><td>Programmable Thermostat</td><td style="text-align: center;">0</td><td></td><td></td></tr> <tr><td>Motion Sensor Indoor</td><td style="text-align: center;">0</td><td></td><td></td></tr> <tr><td>Motion Sensor Indoor 3-way</td><td style="text-align: center;">0</td><td></td><td></td></tr> <tr><td>Motion Sensor Outdoor - Retrofit</td><td style="text-align: center;">0</td><td></td><td></td></tr> <tr><td>Motion Sensor Outdoor w/ Fixture</td><td style="text-align: center;">1</td><td></td><td></td></tr> <tr><td>Vending Miser</td><td style="text-align: center;">0</td><td></td><td></td></tr> </tbody> </table> <p>                     "Reported" is defined as the value taken from the Power Coop Database                      "Received" is defined as verbal acknowledgement from the customer that the measure was delivered                      "Installed" is defined as visual/verbal acknowledgement that measure was installed;                      By definition, "Installed" items have also been "Received" (mark in both columns)                 </p>				Qty Reported	Qty Received	Qty Installed	CFL 15w	4	1	1	CFL 25w	2	1	1	CFL outdoor par lamps	0			Low Flow Showerhead	0	1	1	Sink Aerator	0	1	1	Weatherstripping	0	1	1	Programmable Thermostat	0			Motion Sensor Indoor	0			Motion Sensor Indoor 3-way	0			Motion Sensor Outdoor - Retrofit	0			Motion Sensor Outdoor w/ Fixture	1			Vending Miser	0			BOX 6 <b>Field Verification Notes:</b> _____ _____ _____
	Qty Reported	Qty Received	Qty Installed																																																					
CFL 15w	4	1	1																																																					
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Motion Sensor Outdoor - Retrofit	0																																																							
Motion Sensor Outdoor w/ Fixture	1																																																							
Vending Miser	0																																																							
BOX 7	<b>Survey Questions (For Install Only)</b> What was your installer's name? Larry Chew Did you receive the Energy Kit from SF Power? No Were all of the materials installed? --- If not, which ones were not installed and why? Were you told about other programs? CARE Program / Other <b>Rate Response: 1 = BEST, 5 = LOWEST Rating</b> Did the installer arrive on-time for your appointment? enter #1-5 in box -> Did the installer clean up after the installation? enter #1-5 in box -> If you had a motion sensor installed, were you shown how to adjust it? enter #1-5 in box -> If you had a thermostat installed, were you shown how to adjust it? enter #1-5 in box -> Are you satisfied with the work that was done? enter #1-5 in box -> Do you have other comments, concerns or suggestions? -->																																																							
(As required, correct installer name below) _____ (Provide reason not installed, below) _____ Other Comments: _____ _____																																																								



### Contact List for SF Power Co-op Verification

Distributed item by non-designated "distributor"  
 Distributed item by designated "distributor"

Random Number (frozen)	Contact Attempted	Included in Measure Verification	Qty	Revised No	Name	Date	Company Name	Address	Zip	Area Code	Phone	HTR Category	Language Preference	SF Power Staff	Location	Delivery I = Installed D = Distributed
2936	Yes	No	972	16	Abastu, Willie	7/13/2005	Building Manager	737 Folsom St.	94103	415	243-8140	0	0	Charinetta Hart	5 15 watt per 52 units: 5 per unit for	Installed
14388	Yes	Yes	15	15	Cunguan, Manuel	5/13/2005	0	216 Raymond Ave	94134	415	656-0779	low income	0	Raymond Ng	0	Installed
38884	Yes	No	6	6	McDaniel, Milton	7/22/2005	0	1189 Revere	94124	415	240-8237	renter multi-family low income	0	Happy Torrey	0	Distributed
40778	Yes	No	11	11	Moore, Leola	9/27/2004	0	36 Bertha	94124	415	6416194	low income	0	Charles Conway	0	Installed
32510	Yes	No	308	16	Lecue, Jacque	10/13/2005	Murphy Investment	1355 Valencia	94110	415	648-4000	0	0	Paul Liotsakis	0	Installed
16956	Yes	No	5	5	Ellis, Verna	12/21/2004	0	1439 Shafter Ave	94124	415	621-3841	0	0	Bill Yuen	Safeway kit distribution	Distributed
20725	No	No	13	13	Gee, Vivian	6/15/2004	0	1135 Gilman Ave	94124	415	8221130	language	0	Raymond Ng	0	Distributed
5327	No	No	10	10	Aurar, Sheyla	5/28/2005	0	3415 22nd St. #28	94110	415	285-0186	low income renter multi-family	0	Bill Yuen	w/ Barry Lefsky @ Carnavale	Installed
7446	No	No	4	4	Bloom, Saul	3/12/2005	0	4634 3rd Street	94124	415	495-1786	low income renter	0	Happy Torrey	Super Save bulbDistribution	Installed
52450	No	No	10	10	Sanders, Lera	5/23/2005	0	397 Sweeny St.	94134	415	239-9249	low income	0	Raymond Ng	0	Distributed
47304	No	No	8	8	Poon, Tak	9/24/2005	0	335 Guerrero Street	94103	415	310-8836	low income	0	Elias Stahl	Ross-16th/Potrero Flor and Elias	Installed
118	No	No	0	0	#N/A	#N/A	Heritage Homes	ilding-bathroom,front door	94134	415	3339956	0	0	John Bryant	0	Installed
17316	No	No	12	12	Escobar, Maria	10/13/2005	0	3368 26th Street	94110	415	824-4684	come renter multi-family land	0	Flor Valencia	St. Peters/24th	Distributed
62140	No	No	13	13	Williams, April	12/10/2004	0	50 Reuel #2b	94124	415	468-3352	low income renter	0	Angela Sweets	0	Distributed
56516	No	No	238	16	Tahbazof, Sia	6/27/2005	0	3175 Mission	94110	415	584-0503	0	0	Charinetta Hart	15 bulbs per unit (14 units)	Installed
17874	No	No	5	5	Falley, Lee	4/21/2005	0	221 Rutland Street	94134	415	467-0685	low income renter	0	Happy Torrey	0	Installed
29034	No	No	15	15	Jones, Donald	2/5/2005	0	828 Franklin #504	94102	415	902-1349	low income renter	0	Charinetta Hart	bedroom, hallway	Distributed
50567	No	No	41	16	Rodriguez, Francis	8/10/2005	0	y Area Real Estate Servic	94110	415	642-1911	0	0	Happy Torrey	business outreach valencia	Installed
50334	No	No	5	5	Robison, Pastor Vicki	4/30/2005	ch of God of Prop	6212 35th Street	94124	415	467-7160	low income renter multi-family	0	Happy Torrey	0	Installed
42604	No	No	1450	16	Mullins, Tyron	8/10/2005	Building Manager	1045 Mission St.	94110	415	846-8884	0	0	Charinetta Hart	2 sensors per 150 units	Distributed
25340	No	No	9	9	Hidalgo, Luis	10/5/2005	0	2807 Harrison Street	94110	415	821-6264	come renter multi-family land	0	Flor Valencia	St. Peters School	Distributed
19419	No	No	10	10	Fung, Alan	5/24/2004	0	1974 Quint St	94124	415	4678628	low income language	0	Raymond Ng	0	Installed
16301	No	No	6	6	Douglas, Susan	7/26/2004	0	3336 San Bruno #202	94134	415	9202201	low income	0	Genette Tatum	0	Installed
26610	No	No	3	3	Hudson, Anetta	7/5/2005	0	1569 Hudson Street	94124	415	621-6225	low income renter multi-family	0	Happy Torrey	3rd street	Distributed
11937	No	No	5	5	Cheu, Bee Ngu	2/26/2005	0	61 Gooells St.	94110	415	206-7807	0	0	Charinetta Hart	Trader Joe's Kit Distribution	Installed
<b>TOTAL</b>	<b>Yes = 82</b>			<b>933</b>												

**Contact List (2)**

**Purpose:** This sheet contains the list of participants (clusters) that are used within the survey.

Random Number (frozen)	A	Number of a measure that links to the "Count" of the SFCP_database_020306 worksheet to choose the appropriate measure.
Qty	B	Quantity of measures associated with the participant chosen by the random measure number.
Revised No	C	Quantity of measures associated with the participant chosen by the random measure number that is capped to limit the number of measure from on particular source.
Name	D	Participant's full name.
Date	E	Date that the installation was performed.
Company Name	F	Company name that the participant is associated with, if applicable.
Address	G	Street address of the participant.
Zip	H	Zip code of the participant.
Area Code	I	Area code of the participant.
Phone	J	Phone number of the participant.
HTR Category	K	Description of why this participant falls into the 'hard-to-reach' category.
Language Preference	L	Language preference of the participant.
SF Power Staff	M	Full name of the SF Power Coop staff person responsible for the installation of this measure.
Location	N	Location that this measure was installed, specifically used for distribution sites where measure were given away.
Name (First Last)	P	Participant's full name.
Address	Q	Street address of the participant.
City, zip and state	R	Address used for mailing label creation.
Classification	S	Describes whether the customer is classified as standard or hard-to-reach.

**Sample Plan**

**Purpose:** This sheet contains the details needed to determine the sample size for a given precision level and a simple random sample.

**SFCP\_database\_020306**

**Purpose:** This sheet contains the details needed to determine the sample size for a given precision level and a simple random sample.

This is the database information that was provided original; only Columns A and E were added to support data manipulation

Count	A	This values contains the cumulative count of measures distributed within the entire program. This is used to provide every measure with a number to aid in a proportional sample selection.
No.	B	Used to preserve the original order of the list that was sorted by measure type.
Date	C	Date that the installation was performed.
Quantity	D	Quantity of measure associated with this line item entry into the database.
Adj Qty	E	Quantity of measures that is expanded based on the knowledge that energy kits involve the installation of 5 measures.
Measure	F	Text description of the measure that was installed.
Energy Savings in kWh per year	G	Approved energy savings for this particular measure type.
Demand Reduction in kW	H	Approved demand reduction for this particular measure type.
Therms	I	Approved savings of therms for this particular measure type.
First Name	J	First name of the participant.
Last Name	K	Last name of the participant.
Full Name	L	Participant's full name.
Company Name	M	Company name that the participant is associated with, if applicable.
Address	N	Street address of the participant.
Zip	O	Zip code of the participant.
Area Code	P	Area code of the participant.
Phone	Q	Phone number of the participant.
HTR Category	R	Description of why this participant falls into the 'hard-to-reach' category.
Language Preference	S	Language preference of the participant.
SF Power Staff	T	Full name of the SF Power Coop staff person responsible for the installation of this measure.
Location	U	Location that this measure was installed, specifically used for distribution sites where measure were given away.

**Customer List\_020206**

**Purpose:** Extracted from the SP Power Access database. This is the customer information that was provided original; only Column A was added to support data manipulation

No.	A	Incremental ID that is given to the list of customers provided with the original database.
Customer Classification	B	Describes whether the customer is classified as standard or hard-to-reach.
Company	C	Company name that the participant is associated with, if applicable.
Name	D	Participant's full name.
Address	E	Street address of the participant.
Zip	F	Zip code of the participant.
Area Code	G	Area code of the participant.
Phone Number	H	Phone number of the participant.
Hard to Reach Category	I	Description of why this participant falls into the 'hard-to-reach' category.
Install Date	J	Date that the installation was performed.





TOGETHER, WE'VE GOT THE POWER TO SAVE ENERGY.

February 7, 2006

Dear SF Community Power Customer,

Through the California Public Utilities Commission (CPUC)-funded *Efficiency on Wheels* program, you were provided with one or more free energy saving items sometime during 2004 or 2005. These items included indoor and outdoor motion sensing lights, compact florescent light bulbs, and programmable thermostats.

In order to determine how successful the *Efficiency on Wheels* has been, the CPUC has asked **EMCOR Energy & Technologies (EE&T)** to evaluate the program. In particular, the CPUC has asked EE&T to understand and verify:

- Who benefited most from the program.
- What energy efficiency technologies have been delivered and installed.
- Your level of program satisfaction.

To accomplish this, EE&T will need to collect some information about how energy is used in your home. Someone from EE&T may be contacting you by telephone in the next several days to ask you to participate in the evaluation. If an EE&T representative visits your home, they will carry identification as proof of their affiliation with this evaluation.

All information they collect is *strictly* confidential and will *not* be shared with any organization that is not directly involved in this project. There will be no charge for any visit to your home.

If you have any questions or concerns, please don't hesitate to call our offices.

We greatly appreciate your generous cooperation in this evaluation. Thank you for your help and participation in the *Efficiency on Wheels* program and for your continued support of SF Community Power.

Sincerely,

Katie Magee.  
Finance Manager  
San Francisco Community Power  
415.626.8723 p  
415.626.8746 f  
[www.sfpower.org](http://www.sfpower.org)  
[info@sfpower.org](mailto:info@sfpower.org)