

2008 Energy Efficiency Program Evaluation Plan

Submitted To:

Ukiah Public Utility

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1 UTILITY OVERVIEW

Two legislative bills (SB1037 and AB2021) were signed into law a year apart. SB1037 requires that the Publicly Owned Utilities (POUs), similar to the Investor Owned Utilities (IOUs), place cost effective, reliable, and feasible energy efficiency and demand reduction resources at the top of the loading order. They must now procure 'negawatts' first. Additionally, SB1037 (signed September 29, 2005) requires an annual report that describes the programs, expenditures, expected energy savings, and actual energy savings.

Assembly Bill 2021, signed by the Governor a year later (September 29, 2006), reiterated the loading order and annual report stated in SB1037 as well as expanding on the annual report requirements. The expanded report must include investment funding, cost-effectiveness methodologies, and an independent evaluation that measures and verifies the energy efficiency savings and reductions in energy demand achieved by the energy efficiency and demand reduction programs. AB2021 additionally requires a report every three years that highlights cost-effective electrical and natural gas potential savings from energy efficiency and established annual targets for energy efficiency and demand reduction over 10 years.

The legislative reports require both an on-going assessment of what is occurring within the programs along with a comparison of how much possible savings are left within the POU service territory. The goal of this 2008 energy efficiency program plan is to assist Ukiah Public Utility (UPU), and its efficiency program implementer, Efficiency Services Group, to meet these requirements. This plan provides guidance and recommends Evaluation, Measurement, and Verification (EM&V) activities that will help UPU standardize and streamline the reporting process in order to meet the legislative requirements.

This plan identifies recommended E, M&V actions based on information gathered from Efficiency Services Group, a review of existing utility records, databases, and marketing materials. Based on this review, it is recommended that UPU conduct the following EM&V activities:

- A limited process evaluation of UPU's efficiency programs to ensure consistency in database tracking given the overlap in several program elements, focusing on the most active programs.
- Review of the measures included in the residential comprehensive program.
- Verification of the savings for non-residential lighting measures through a review of the engineering assumptions;
- Verification of installations through a review of the application and receipt documentation of sampled installations;

1.1 General Utility Background Information

Ukiah is a small agricultural community nestled in the Yokayo valley in southern Mendocino County with a population of about 15,500 residents. Ukiah is nestled in the wine country and is 100 miles north of San Francisco on Hwy. 101.

Ukiah was founded in 1876 and the city's utility department provides electric service to approximately 15,000 customers. Its annual energy use is about 122.9 gigawatt-hours (GWh) and its peak demand is

about 36 megawatts (MW). UPU is a summer peaking utility with the 36 MW peak event occurring on July of 2006.

UPU is located in California Title 24 Climate Zone 2, which is in the north central coastal area of California just north of San Francisco. Here the seasons are relatively mild. Cool in the winter and warm but generally not hot in the summer. Annual precipitation is about 37" per year with the wettest month being January with about 8". The summers are generally dry. Table 1 illustrates the heating and cooling degree-days for Ukiah.

Table 1: Temperature Reference Points for Ukiah Public Utility

	Ukiah
Base Temp: 65F	
Heating Degree Days (HDD)	3,083

Cooling Degree Days (CDD) 843

1.2 Key Customer Markets

UPU serves both residential and commercial customers with the residential HVAC program providing most of the conservation savings in past years. However, non-residential lighting has been becoming more important and after eight months of FY 2008, accounts for over 60% of the energy savings from Ukiah's energy conservation programs.

1.3 Efficiency Programs Offered

UPU offers a variety of energy efficiency programs to encourage its members to reduce energy consumption. These programs include a combination of informational energy audits, rebates, and giveaways as a way to help increase member awareness of energy efficiency and encourage the wise use of electricity.

1.3.1 Residential Program Summaries

There are four residential program initiatives.

- Residential Rebate Programs – UPU offers customers rebates for purchasing and installing:
 - Energy Star Refrigerator
 - Energy Star Room AC
 - Energy Star Clothes Washer
 - Energy Star Dishwasher
- Energy Efficient Air Conditioning and Heat Pump Program - UPU provides rebates for purchasing and installing:
 - Heat Pumps
 - Central Air Conditioning
- CFL Rebate Program - UPU provides a rebate for the purchase and installation of CFLs.
- Weatherization Program – UPU provides financial incentives to homeowners who invest in weatherization measures.

1.3.2 Non-residential Program Summaries

UPU offers the following non-residential program initiatives.

- Lighting Retrofit – Many types of lighting retrofits qualify for a rebate. Most have been for T-8s, T-5s, CFLs and sensors.
- Non-Residential Energy Efficiency Incentives - UPU offers financial incentives along with technical support for all non-residential customers to promote the purchase and installation of energy efficient commercial equipment and systems.

1.3.3 2007 Program Summary

In 2007, UPU spent a total of \$83,405 in program costs, which led to total demand reductions of 36 kW and total annual energy reductions of 29,727 kWh. Table 2 summarizes the kW, kWh and program costs for UPU's programs.

Table 2: 2007 Summary of Ukiah's Energy Efficiency Programs



1.3.4 Customer Incentives

UPU programs offer rebates for a large number of energy efficiency applications. The residential appliance program offers the following incentives:

- Energy Star Refrigerators (\$75)
- Energy Star Clothes Washers (\$100)
- Energy Star Dishwashers (\$50)
- Energy Star Room AC (\$50)
- Electric Water Heaters
 - SF – all sizes w/minimum EF of .93 (\$100)
 - MF – all sizes w/minimum EF of .93 (\$75)

The weatherization program offers these incentives:

- Attic insulation – R-38 minimum (if uninsulated, \$0.35 per square foot. If partially insulated, \$0.20 per square foot)
- Wall insulation – R-13 minimum (\$0.30 per square foot)
- Floor insulation – R-19 minimum (\$0.20 per square foot)
- Window tinting and sunscreens (\$0.75 per square foot)

- Windows – Energy Star replacement (\$2 per square foot up to \$250 per home)
- Duct insulation – R-8 minimum (\$1.00 per linear foot)

The HVAC program offers the following incentives:

- Central A/C with minimum of SEER 14 (SEER 14 or more \$75/ton, SEER 15 or more \$100/ton, SEER 16 or more \$125/ton, SEER 17 or more \$175/ton, SEER 18 or more \$200/ton)
- Heat pump
 - HSPF 8.6, SEER 14 or higher (\$125/ton)
 - HSPF 8.8, SEER 15 or higher (\$150/ton)
 - HSPF 8.4, SEER 16 or higher (\$175/ton)
 - HSPF 8.6, SEER 17 or higher (\$200/ton)
 - HSPF 9.2, SEER 18 or higher (\$225/ton)

The commercial lighting program does not specify specific technologies but is generally for T12 to T-8 or T5 and CFLs. The incentive is based on a fixed rebate schedule and is capped at the percentage of installed cost.

For residential lighting, the incentive is for CFLs at \$2.50/unit with a minimum of four units purchased.

1.4 Evaluation Priorities

As seen in Table 2, in 2007 about 64% of UPU's net annual energy savings and over 90% of net peak demand savings came from its residential HVAC program. However, after reviewing the program participation data for the first eight months of FY 2008 supplied by Efficiency Services Group, the share of savings provided by the residential HVAC program has fallen substantially to only about a 15% share of the utility program's energy savings. Non-residential lighting now provides the largest share with over a 60% share of the utility program's energy savings.

Evaluation priorities should be based on a combination of relative size of the savings achieved as well as the degree of uncertainty with *anticipated* (ex ante) estimates of the savings. The cost of different evaluation approaches also is a key element in determining priorities. For FY 2008, savings resulting from energy efficient non-residential lighting make up the greatest share of the energy savings for UPU. Fortunately, the *anticipated* (ex ante) energy savings for lighting are less uncertain compared to other types of measures, such as HVAC and shell measures where savings estimates are derived from building simulation modeling with the building characteristics being an average across all vintages and home sizes. With lighting, hours of operation is the most critical key variable. The other key variables, such as lamp wattage, are known factors. Weather is not a significant variable with motors and lighting.

The evaluation budget for UPU is small which limits the extent of evaluation efforts that can be undertaken. It is our recommendation that both a limited process evaluation be performed as well as an impact evaluation. Fortunately, for the process evaluation, UPU is one of five utilities that use the services of Energy Efficiency Group to implement their programs and therefore the process evaluation can encompass all five utilities through a cost-sharing arrangement.

Based on the small budget, the large share of savings coming from the non-residential lighting program, and the fact that Efficiency Services Group is used for program implementation; it is recommended that UPU conduct the following E, M&V activities.

1. A limited process evaluation of all energy efficiency programs to ensure consistency in database tracking given the overlap in several programs. This evaluation would be across all five of the utilities whose program implementation is managed by Efficiency Services Group. This evaluation will focus on the most active programs for each utility.
2. Review of the measures included in the residential comprehensive program.
3. Verification of the savings attributable to the non-residential lighting program.

2 PROCESS EVALUATION PLAN

Based on a review of the program records and materials provided by the Efficiency Services Group, the consulting firm that manages the UPU programs, it is recommended that a process evaluation of the UPU programs be performed. This review will insure that the proper data tracked is being collected in Energy Services Group's tracking system and that program promotion is being conducted efficiently. We recommend that a limited process evaluation be performed that:

- reviews the current tracking system and the information gathered and recorded by that system,
- reviews the marketing materials and customer recruitment processes, and
- reviews the measures targeted in Ukiah's residential portfolio to determine cost-effectiveness and identify potential alternatives.

2.1 Task 1: Review Tracking Systems

Given that these programs are generally cross-promoted, the consulting team should review the ways the program data are tracked as well as insure that certain variables, such as lighting measure hours of operation for non-residential lighting, are gathered at the time of implementation.

Based on our preliminary review of the current tracking, provided by the Efficiency Services Group, the process evaluation could identify ways to simplify and streamline the data tracking process currently used. Moreover, this review would also identify more expedient ways to measure program impacts, which will streamline the reporting process to the CEC.

2.2 Task 2: Review Program Procedures and Relationships

This process evaluation would include a review of the materials and events currently used for recruiting customers to the UPU efficiency programs. This review would also identify additional messages that UPU may want to include in future program marketing efforts. This information would be supplemented by interviews with program staff, both at UPU and Efficiency Services Group, focusing specifically on the ways on the following topics:

- Program process flow and relationships.
- Program metrics including current enrollment, customer satisfaction, and savings estimates.
- Marketing and outreach activities.
- Areas for improvement.

3 IMPACT EVALUATION PLAN

The primary objectives of an impact analysis are to assess gross and net demand and energy savings and the cost-effectiveness of the installed systems. An impact evaluation verifies measure installations, identifies key energy assumptions and provides the research necessary to calculate defensible and accurate savings attributable to the program.

3.1 Impact Evaluation Research Issues and Objectives

The primary objectives of an impact analysis are:

1. Conduct a preliminary uncertainty analysis and identify and rank those factors that contribute to overall uncertainty regarding program gross and net kW and kWh savings.
2. Review engineering assumptions.
3. Develop an analysis approach designed to minimize uncertainty of reported savings.
4. Verify measure installations.
5. Calculate verified gross demand and energy savings.
6. Calculate net-to-gross factors and verified net demand and energy savings.
7. Assess program costs, including incremental costs associated with measures installed through the program.
8. Determine the cost-effectiveness of the program based on Total Resource Cost (TRC) test.¹

¹ As defined in the California Standard Practice Manual, Economic Analysis of Demand Side Programs and Projects, October 2001

3.2 Methods and Data Sources

A useful construct for thinking about the range of efficiency measures covered by the Program is the International Performance Measurement and Verification Protocol (IPMVP), Table 3 presents a listing of the IPMVP protocols, the nature of the performance characteristics of the measures to which M&V options typically apply, and an overview of the data requirements to support each option. Our approach to selecting M&V strategies follows these guidelines.

Table 3: Overview of M&V Options

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multi-variate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

As stated earlier, evaluation priorities should be based on a combination of relative size of the savings achieved as well as the degree of uncertainty with *ex ante* estimates of the savings. Based on the *ex ante* estimates of the savings and the level of achieved savings so far seen in FY 2008, the highest evaluation priority is to evaluate the savings from the non-residential lighting measures.

For non-residential lighting measures, it is our recommendation that M&V Option “A” is the most appropriate methodology. The methodology recommended is a review of the engineering estimates used to develop the anticipated (*ex ante*) estimates.

In order to accurately evaluate a typical lighting installation, all that is needed is a list of fixtures/lamps removed, fixtures/lamps installed, and operational hours. Standard wattages are available for most fixtures/lamps and can be used in a straightforward calculation of savings.

3.3 Task 3: Identify Impact Evaluation Sample

So far in FY 2008, the number of participants in the UPU non-residential lighting program is small even though most of their utility program's savings come from non-residential lighting. It is uncertain how many participants there will be in FY 2008 but based on the records provided by Energy Efficiency Group, there have been five participants in the non-residential lighting program during the period of July 2007 through February 2008. With small populations, sample sizes begin to approach the entire population. For example, to achieve a level of precision and confidence of 90% +/-10% from a population of 20 participants would require 16 in the sample. For a population of 15, 13 would be needed in the sample. Essentially, because of the expectation of a small participant population, it is expected that nearly all participants will be in the sample.

3.4 Task 4: Installation Verification

Verification that measures have actually been installed is an important part of an impact evaluation. However, site visits to visually verify installation are a costly means of doing so. In lieu of on-site verification, it is recommended that verification consist of a review of the verification records kept in the program tracking database and a phone call to the participant to verify installation. As part of the process evaluation, the current process of verifying installation and recording that verification did occur will be reviewed and any needed changes identified and made. Minimal cost beyond the process evaluation should be needed.

3.5 Task 5: Calculate Gross Energy and Demand Impacts

It is expected that the same methodology used to develop the anticipated (*ex ante*) estimates of savings will be used for the measured (*ex post*) estimates. What may change are some of the input variables into the methodology, such as hours of operation. If sampling is employed, a weighting factor will be used to normalize the results to the full participant population. Demand impacts will be based on the kW/kWh ratio currently used in the anticipated (*ex ante*) estimates.

3.6 Task 6: Process and Impact Evaluation Report

The evaluation consultant will issue a final report to the utility summarizing the results from the process and impact evaluations and describing any recommendations that come from the evaluations. These recommendations will assist UPU in meeting the requirements with the AB2021 requirements and will be submitted to the California Energy Commission (CEC).

The final report will include:

E: Executive Summary

1. Introduction and Selected Evaluation Issues
 - 1.1. Program Overview
 - 1.2. Program Objectives
2. Process Evaluation Plan
 - 2.1. Research Issues and Objectives
 - 2.2. Description of Evaluation Efforts
3. Impact Evaluation Plan
 - 3.1. Research Issues and Objectives
 - 3.2. Methods & Data Sources
 - 3.3. Sample Design
4. Data Collection Plan
5. Process Evaluation Results
 - 5.1. Findings
 - 5.2. Recommendations
6. Impact Evaluation Results
 - 6.1. Findings
 - 6.2. Recommendations
7. Evaluation Based Recommendations

4 EVALUATION PLAN TIMING

The recommended methodology for the impact evaluation does not require any billing data or on-site metering work. Therefore, the 2008 Energy Efficiency Program Evaluation can begin immediately upon the completion of FY 2008.

5 ESTIMATED BUDGET

Since the program administrator for UPU is Efficiency Services Group, some and possibly much of the work effort could be combined among the five utilities for which Efficiency Services Group is the program administrator. For instance, Task 1 and Task 2 would be about the same cost in total for the entire group of five as it would be for just UPU. With the impact evaluation tasks, it may be possible to also combine some of the evaluation efforts since methodology is likely the same among all five utilities. However, each of the five may have different higher priority programs that they should evaluate first. By task, the cost range should be:

- Task 1: Review Tracking System - \$1,500 - \$3,000
- Task 2: Review Program Procedures and Inter-Relationships (costs depend on the evaluation team selected) - \$1,500 - \$3,000
- Task 3: Identify Impact Evaluation Sample - \$1,000 - \$2,000
- Task 4: Installation Verification - \$400 - \$800
- Task 5: Calculate Gross Energy and Demand Impacts - \$1,500 - \$3,000
- Task 6: Process and Impact Evaluation Report - \$5,000 - \$6,000