2008 Energy Efficiency Program Evaluation Plan

Submitted To:

Plumas Sierra Rural Electric Cooperative

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Submitted to: Plumas Sierra REC

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1 UTILITY OVERVIEW

Two legislative bills (SB1037 and AB2021) were signed into law a year apart. SB1037 requires that the Publically 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 Plumas-Sierra Rural Electric Cooperative (PSREC) to meet these requirements. This plan provides guidance and recommends evaluation, measurement, and verification (E,M&V) activities that will help PSREC 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 staff interviews, a review of existing utility records, databases, and marketing materials. Based on this review, it is recommended that PSREC conduct the following E,M&V activities.

1. A limited process evaluation of all residential energy efficiency programs to ensure consistency in database tracking given the overlap in several programs;
2. Verification of the savings attributable to the GeoExchange systems installed in PSREC's territory via an engineering review; and,
3. Verification of installations through a review of the application and receipt documentation of sampled installations.

1.1 General Utility Background Information

PSREC is located in Plumas, Lassen, and Sierra counties in California and portions of Washoe County in Nevada. The REC was established in 1937 and serves 7,677 member-owners of which 50% are residential, 44% commercial/industrial, 5% irrigation, and 1% other. PSREC has 78 employees, including the telecommunications subsidiaries.

PSREC is a winter peaking utility, with peak hours occurring between 5 and 10 a.m. Its facilities include two 69kV interconnect substations, 150 miles of transmission line, 11 distribution subs and 1200 miles of 12.47/7.2kV distribution line. Annual energy use is 155 GWh of which 50% is from their commercial/industrial members, 43% from their residential members, 6% from their irrigation members, and a 1% from other members. The utility energy use is growing at an estimated rate of 1.7% per year.

PSREC is located in California Title 24 Climate Zone 16. The service territory is characterized by a high, mountainous and semi-arid landscape above 5,000 feet in elevation. The climate is cold for much of the year, but seasonal changes are well defined and summer temperatures can be mild. Temperature varies tremendously with the slope orientation and elevation, but cool temperatures and snow cover predominate for more than half of the year. Summer temperatures are modestly warm with cool nights. Table 1 illustrates both the high number of heating degree days and the variability in those heating degree days for two weather stations within the geographic area. The annual precipitation is between 30-60 inches a year of which 90% falls between November and March.

Table 1: Temperature Reference Points for Plumas Sierra REC

Base Temp: 65F	Portola	Quincy
Heating Degree Days (HDD)	7,303	5,490
Cooling Degree Days (CDD)	106	364

Since this zone experiences the most extreme range of temperatures, the energy consumption per member, especially for heating, is the highest in the state.

1.2 Key Customer Markets

PSREC has been promoting energy efficiency programs to its members since the 1980s. These programs encourage members to be more energy efficient, decrease their energy demand and costs, and conserve resources. PSREC has consistently exceeded its AB 1890 spending requirements.

The residential market is the primary focus for all of PSREC's programs. Most of their efficiency programs are targeted to the existing home market, focusing on retrofits or upgrades to existing home appliances, heating and cooling systems, and water heaters.

1.3 Efficiency Programs Offered

PSREC offers a variety of residential energy efficiency programs to encourage its members to reduce energy consumption. These programs include a combination of rebates, no interest loans, and giveaways as a way to help increase member awareness of energy efficiency and encourage the wise use of electricity.

1.3.1 Program Summaries

- GeoExchange Program: Rebates and 0% interest loans offered for installation of geothermal heat pumps in residences and businesses.
- EnergyStar® Appliance Rebates: Rebates offered for the purchase of an EnergyStar® refrigerator, dishwasher, clothes washer or small appliances.
- Non-essential Freezer/Fridge Retirement: Rebates offered for recycling a non-essential freezer or refrigerator.
- Marathon Water Heater Program: Discounted sales of high-efficiency electric water heaters.
- Compact Fluorescent Light Bulb Program: Discounted sales of CFLs and several events to give members free CFLs.
- Energy Efficient Equipment Discounts: Discounted sales of water heater blankets, low-flow showerheads, and ConvectAir heaters.
- Energy Audits: Free energy audits to assist members with energy conservation or troubleshooting in their home or business.
- Meter Lending Program: Members can borrow from PSREC kWh meters to plug in 120-volt appliances and help them troubleshoot energy usage.
- Green Building Program: Quarterly presentations to introduce contractors on new technologies for building more energy efficient homes.
- Education/Outreach: Provide energy efficiency and conservation information to interested members to help them reduce their bills. This year, we also provided books to local libraries about energy efficiency and conservation.

2007 Program Summary

PSREC spent a total of $666,116 in program costs which led to total demand reductions of 36 net demand kW and total annual energy reductions of 4874554 kWh. Table 2 summarizes the kW, kWh and program costs for PSREC's 2007 programs.

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

1.4 Evaluation Priorities

PSREC's GeoExchange Program constitutes the largest component of its residential DSM activities, and is the top priority for Evaluation, Measurement, and Verification (E,M&V) activities. In 2007, this program accounted for 44% of the net kW reductions; 68% of the annual kWh reductions, and 80% of total program costs.

Other programs that should be considered for evaluations in later years include the CFL light bulb program and the free energy audits. These programs contribute small, but significant, kW and kWh savings to PSREC.

Based on our assessment, it is recommended that PSREC conduct the following E,M&V activities.

1. A limited process evaluation of all residential energy efficiency programs to ensure consistency in database tracking given the overlap in several programs;
2. Verification of the savings attributable to the GeoExchange systems installed in PSREC's territory via an engineering review; and,
3. Verification of installations through a review of the application and receipt documentation of sampled installations.

2 OVERVIEW OF GEOEXCHANGE PROGRAM

The largest component of PSREC's energy efficiency portfolio is its GeoExchange program. PSREC offers its members a GeoExchange program that includes financing and a free water heater. The program is marketed on the website and through several comprehensive (and technical) brochures. The utility also provides a list of certified GeoExchange contractors.

Given the importance of this program in helping PSREC achieve its DSM goals, it is critical to review the engineering calculations and assumptions used to determine program impacts. Moreover, given that this is a technology that is not adequately addressed in the DEER database, using Deemed Savings numbers would be not accurately reflect the savings from these installations.

2.1 Program Goals and Objectives

The goal of this program is to increase the number of GeoExchange installations in PSREC's service territory. This technology both reduces the energy use for space heating and cooling as well as shifts the load from peak hours of demand to less costly off-peak hours. By including an electric water heater with each GeoExchange installation, additional energy savings and load shifting occurs when replacing existing electric water heating systems. In those cases where the new space and water heating system replaces a non-electric system, the new system is more energy efficient, though it does increase electricity load. However, the increase in electricity load from any new water heating system installation is generally to off-peak hours and is beneficial to the utility's overall load factor.

Currently there are approximately 430 GeoExchange systems installed in PSREC's service territory.

2.1.1 Financing

PSREC offers its members a financing program as a way to lower the higher first cost of installing this technology. To defray the cost of the loop, the utility offers a 30 year interest free non transferable loan via a monthly loop lease program. The monthly payments are summarized in Table 3. The monthly loop lease is based upon the size of the GeoExchange system installed. The loan is added to the member's monthly electric bill.

Table 3: 2007 Summary of PSREC's Largest Residential Programs

GeoExchange Monthly Loop Lease Payments*		
Heat Exchanger Size	**Horizontal Loop**	**Vertical Loop**
3 ton	$12.45	$24.95
4 ton	$14.95	$29.95
5 ton	$17.95	$36.95
6 ton	$20.45	$41.65
7 ton	$22.95	Call for pricing
8 ton	$25.95	Call for pricing
9 ton	$28.95	Call for pricing
10 ton	$31.95	Call for pricing

2.1.2 Customer Eligibility

This program is open to all PSREC customers who install a GeoExchange system by a certified contractor.

2.1.3 Marketing Methods

This program is marketed on its website, through brochures sent to customers, and in selected print magazines, and through contractor referrals. The utility also lists certified contractors operating in its territory in its marketing materials. However the utility does provide the following qualifying language regarding contractor referrals:

> *This list has been complied by PSREC for the primary purpose of providing information on qualified geothermal contractors whose services may be available for the planning, design and installation of geothermal systems in its service territory. PSREC does not promote any particular company on the list and assumes no liability and provides no warranty for the work performed or claims made by any of these companies. The list user is responsible for reviewing and verifying the qualifications, references, installation experience, and any other pertinent information of any selected geothermal contractor.*[1]

2.1.4 Program Implementer

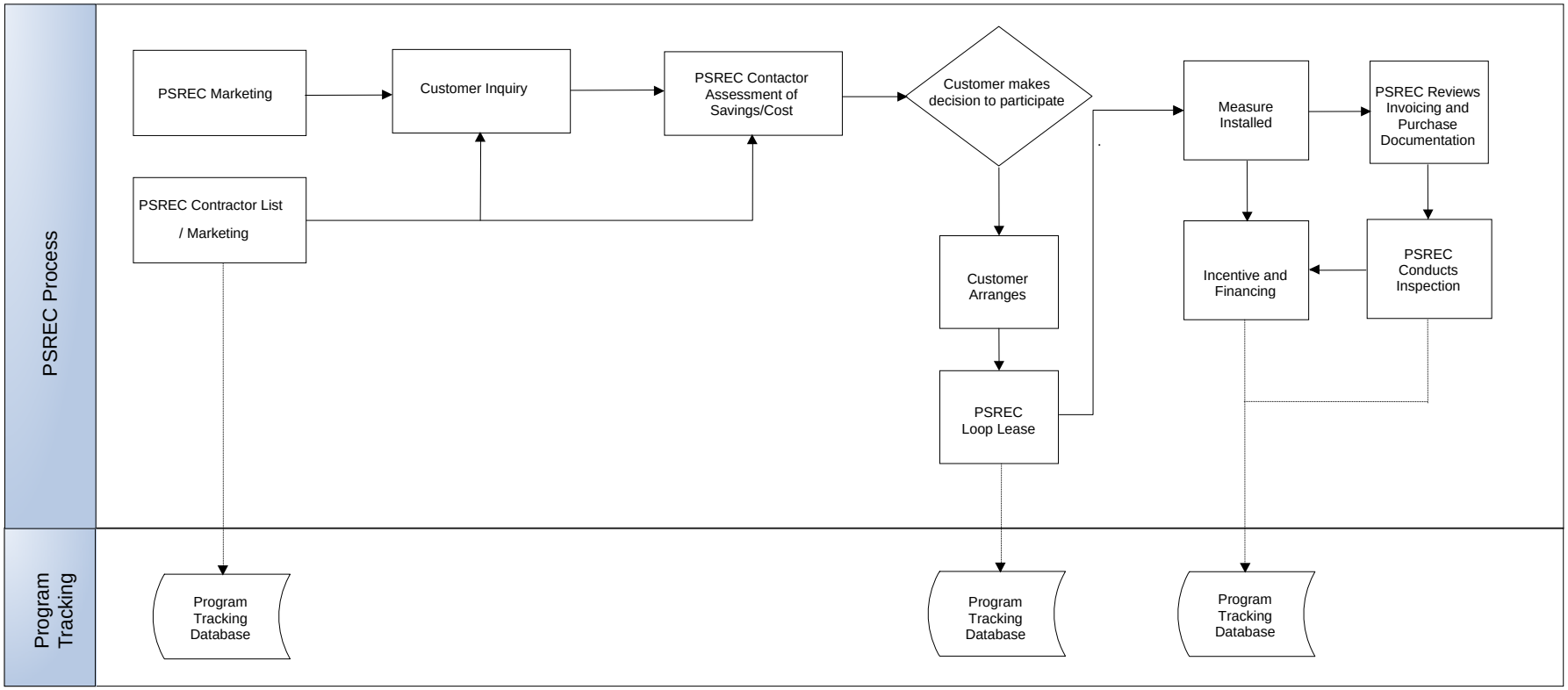
The program is administered in-house.

2.1.5 Program Process Flow

Figure 1 illustrates a simplified process flow of PSREC's GeoExchange program. This process flow diagram will be expanded to include the overlapping program areas after completing the limited process evaluation (see Section 3.0).

[1] http://www.psln.com/downloads/GEO%20info%20kit.pdf

Figure 1: Simplified Process Flow Diagram of the GeoExchange Program



3 PROCESS EVALUATION PLAN FOR RESIDENTIAL APPLIANCE PROGRAMS

Based on a review of the program records and materials provided by PSREC staff, it is recommended that a process evaluation be conducted for all of the PSREC residential programs:

- GeoExchange Program
- EnergyStar® Appliance Rebates
- Non-essential Freezer/Fridge Retirement
- Energy Efficient Lighting Program
- Marathon Water Heater Program

Since part of this work has already been completed, this process evaluation would focus on the ways in which these programs operate together and overlap and what customer information should be included in the tracking database. Moreover, this review would provide the opportunity to standardize and streamline the database tracking procedures.

3.1 Task 1: Review Tracking Systems

Given that these programs are often cross-promoted, the consulting team should review the ways the program data are tracked. Based on our preliminary review of the current tracking, provided by PSREC, 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. Of particular interest will be the review of customer data currently being collected and stored in the tracking system and what, if any, additional data should be collected and tracked.

3.2 Task 2: Review Program Procedures and Inter-Relationships

This process evaluation would include a review of the materials currently used for recruiting customers to the equipment and appliance programs. This review will also identify additional messages that PSREC may want to include in future program updates. This information would be supplemented by interviews with program staff, focusing specifically on the following topics:

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

4 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 GeoExchange 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.

4.1 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 which 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.[2]

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

4.2 Methods and Data Sources

A useful construct for thinking about the range of efficiency measures covered by the GeoExchange Program is the International Performance Measurement and Verification Protocol (IPMVP). Table 4 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 4: 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	• Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	• 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	• 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	• 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

The engineering calculation used to estimate savings per home are currently based on assumed heating and cooling load averages per home that may not necessarily be representative of the PSREC service territory. Therefore, our recommendation is that M&V Option "C" is the most appropriate method for this impact evaluation.

Two methods could be employed under M&V Option "C". One would use pre-and post-installation billing data, along with other data such as system tonnage, the type of system replaced, and heating and cooling degree data as input variables in a multi-variate regression analysis. The other would review any sub-metering data that may be available and extrapolating those results to the full population of participants.

In discussions with PSREC staff, we have learned that there have been a total of 430 Geo systems installed. Of these, 85% were installed as part of new construction. Only 66 systems are retrofits. Further, PSREC up to this point has not been collecting information on what type of heating system was being replaced. (PSREC is now collecting this information. The proposed process evaluation will include a full review of what information is collected for all programs and make recommendations as to what additional information should be collected.) These two limitations make performing the billing analysis difficult for FY 2008. Fortunately, it was also learned that PSREC is conducting sub-metering of one of

the Geo units. Although it is only one system, we believe using the data from this system to help make adjustments to the engineering estimates of savings is the better evaluation option for FY 2008. A billing analysis may be the better approach for FY 2009 as more retrofits occur and additional customer information, such as what is the existing heating being replaced, is available.

4.3 Task 3: Impact Evaluation Energy and Demand Savings

The second evaluation priority, as identified in Section 1.4, is to verify the savings attributable to the GeoExchange program. As discussed in Section 4.2, it is our recommendation that the results from the sub-metered Geo system be reviewed and utilized.

The current estimates of measure impact are based on an engineering calculator available from the Washington State University (WSU) Energy Extension (http://www.energyexperts.org/fuelcalc/default.asp) and local heating and cooling degree day information.

The results from the sub-metered Geo system will be used to calibrate the WSU engineering calculator for the PSREC service territory. The consulting team will discuss with PSREC staff how the characteristics of the sub-metered home vary from the typical new construction and retrofit installations occurring under the program. Based on these discussions and utilizing the calibrated engineering calculator, typical impact estimates will be developed for both new construction and retrofit applications. Demand estimates will be based on the same energy to demand ratio for heat pump systems found in the E^3 calculator.

4.4 Task 4: Installation Verification

GeoExchange systems are unique among energy conservation measures in that they provide large energy impacts and cannot be removed easily. The installation of each system has already been verified by PSREC before the incentive is provided. The evaluation consultant will insure that this verification information is included in the PSREC program tracking database.

4.5 Task 5: 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 PSREC in meeting the requirements with the AB2021 requirements. PSREC will utilize this report for its required submittals 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

5 EVALUATION PLAN TIMING

The 2008 Energy Efficiency Program Evaluation should begin early in 2009 (or earlier if funding is available). Much of the information gathered and assessed by the evaluation team will improve the program offerings, the program tracking systems, and the estimates of energy impacts. It is anticipated that the actual work will take about one month.

6 ESTIMATED BUDGET

It is estimated that the evaluation, as outline in Section 3 and Section 4, should be between $12,400 and $19,900. By task, the costs should be:

- Task 1: Review Tracking System - $2,000 - $3,000
- Task 2: Review Program Procedures and Inter-Relationships (costs depend on who the evaluation team is) - $3,000 - $5,000
- Task 3: Impact Evaluation Energy and Demand Savings - $2,400 - $4,400
- Task 4: Installation Verification (assumed completed in Task 1) - $0
- Task 5: Process and Impact Evaluation Report - $5,000 - $7,500