2008 Energy Efficiency Program Evaluation Plan

Submitted To:

Lodi Electric Utility

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SUMMIT BLUE
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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 Lodi Electric Utility (Lodi) to meet these requirements. This plan provides guidance and recommends evaluation, measurement, and verification (E,M&V) activities that will help Lodi 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, and the Lodi website. Based on this review, it is recommended that Lodi conduct the following E,M&V activities:

1. A process evaluation of Lodi's efficiency programs consisting of the following:
    a. A review of the database tracking system to streamline program reporting and enhance comparison between and among programs.
    b. A free-ridership analysis to determine net to gross impacts and improve overall program cost-effectiveness for its residential programs (to be completed at a later date)
    c. A review of the measures targeted in Lodi's residential portfolio to determine cost-effectiveness and identify potential alternative measures.
2. Verification of the savings for non-residential refrigeration and non-residential lighting measures through a review of the engineering assumptions.
3. Verification of installations through a limited number of on-site visits and through a review of the application and receipt documentation of sampled installations.
4. Possible participation in a larger NCPA-wide residential lighting study in FY 2009.

1.1 General Utility Background Information

Lodi Electric Utility was established in 1910. Currently, this utility serves 23,500 residential customers and 5,000 commercial/industrial customers. This is a summer peaking utility with a peak demand of 138 megawatts. Its annual energy usage in 2007 was 458,749,745 kilowatt hours (kWh).

Lodi is located in Climate Zone 12. This part of the Northern California Central Valley is situated just inland of the Bay Area. This climate zone experiences cool winters and hot summers). Winter rains fall from November to April.

Table 1: Temperature Reference Points for Stockton[1]

Base Temp: 65F	Stockton
Heating Degree Days (HDD)	2,702
Cooling Degree Days (CDD)	1,470

1.2 Key Customer Markets

Lodi offers energy efficiency programs to its residential and commercial/industrial markets. It also has specialized offerings for its low-income population and a school outreach and education campaign.

1.3 Efficiency Programs Offered

Since 1998, Lodi has spent more than $6.5 million on demand-side management rebates and programs designed to increase energy efficiency for the community, resulting in a 14 percent peak demand reduction and a 10 percent energy reduction.

2007 Program Summary

Current Residential Customer Programs:

- *Lodi Appliance Rebate Program:* Provides rebates to all customers who purchase an ENERGY STAR ® refrigerator, dishwasher and or front-loading clothes washer.
- *Lodi Energy Efficient Home Improvement Rebate Program:* Provides rebates to customers who install qualifying measures as described next. Rebates are capped at a per customer amount of either $350 per customer, until funds are exhausted, plus an additional $250 allowance for air

[1] http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zone_11.pdf

duct repairs, OR an additional $700 allowance for air duct replacement, if eligible.

- **HVAC Replacement** - customers that purchase and install new heating, ventilation and air conditioning (HVAC) with a high efficiency seasonal energy efficiency rating (SEER) can receive a rebate: $175 for a 14+ SEER HVAC unit or 13 SEER rooftop unit with variable speed drive or $275 for installation of an ultra-high efficiency of 17+ SEER HVAC unit. (Requires participation in the HVAC System Performance Test.);
- **Attic Insulation**- a rebate of $0.15 per square foot is available if you install attic insulation up to an R-38 (energy efficiency) value;
- **Radiant Barrier/Thermal Shield -** a maximum rebate of $150 for radiant barrier/thermal shield is available;
- **Wall Insulation** - a rebate of $0.15 per square foot is available if you install wall insulation with an R-8 or greater energy efficiency value;
- **Air Duct Repairs** - a maximum rebate of $250 is available if you have leaky or damaged air ducts repaired (Requires participation in the HVAC System Performance Test.);
- **Air Duct Replacement -** a maximum rebate of $700 (Requires participation in the HVAC System Performance Test.);
- **Whole House Fan** - install a whole house fan in your home and receive a rebate of $100; **Attic Fan** - install an attic fan and receive a rebate of $40;
- **Shade Screen/Window Tinting** - install shade screens or window tinting and receive a rebate of $0.50 per square foot. *Note: the shade screen or window tinting must block at least 70% of the solar heat gain or sun's rays and the shade screens or window tinting must cover (at a minimum) the west and south facing windows of the home.*

- *HVAC System Performance Test:* Provides a rebate for customers who utilize a select list of HVAC contractors capable of performing a high-end duct system performance test (the test measures air flow, air return and system balance).

Current School (In-Classroom) Programs:

- *Lodi LivingWise Program:* Provides energy efficiency "kits" and manuals to 425 6th grade students in Lodi schools; the program is designed to teach the students the basics of energy and water conservation.
- *Lodi Solar Schoolhouse Program:* Provides teacher mini-grants and teacher training regarding solar/renewable energy resources; also via this program, we sponsor the annual Lodi Solar Olympics (the event, held each May, features solar-powered model race cars, fountains, ovens, and model homes built by area students).

Current Low-Income Residential Programs:

- *Lodi C.A.R.E. Package Program:* Provides grants to very low-income customers in need of assistance paying their electric utility account; the program coordination/customer screening is performed by the Lodi Salvation Army. In order to secure a grant payment, customers must consent to in an in-home energy audit.

Current Commercial/Industrial Customer Programs:

- *Lodi Energy Audit Program:* Lodi offers on-line and on-site residential energy audits as well as on-site small commercial customer energy audits.
- *Commercial (G-1 & G-2) Rebate Program:* Provides rebates for small and medium-sized commercial customers who install designated energy efficiency measures, such as: attic insulation, window tinting/shade screens, programmable thermostats, ceiling fans, appliances, high efficiency lighting retrofits, and maintenance of refrigeration/HVAC equipment.

- *Lodi Commercial/Industrial (G-3 to I-1) Rebate Program:* Provides rebates of up to $12,500 to large commercial and industrial customers; the rebate is for pumps/motors, process equipment improvements, building envelope improvements, HVAC/chiller replacements, and high efficiency lighting retrofits.

Table 2 summarizes the 2007 results from the largest programs in Lodi's energy efficiency portfolio.

Table 2: 2007 Summary of Lodi's Largest Energy Efficiency Programs

Residential Program	Demand Savings (KW)	Net Peak kW Savings	Net Annual kWh Savings	Incentives	Mtg, E,M&V Costs	Total Program Costs
HVAC- Residential Shell	15	15	13,234	$13,100	$11,741	$24,841
HVAC- Residential Cooling	6	2	7,817	$3,169	$4,191	$7,360
Residential Lighting	43	6	33,843	$2,314	$12,971	$15,285
Commercial Program	**Demand Savings (KW)**	**Net Peak kW Savings**	**Net Annual kWh Savings**	**Incentives**	**Mtg, E,M&V Costs**	**Total Program Costs**
Non-Res Lighting	11	10	54,808	$21,491	$29,358	$50,849
Non-Res Refrigeration	28	19	173,769	$1,557	$36,048	$37,605
Total of all Lodi's EE Programs	112	61	383,317	66,854	$151,262	$218,116

1.4 Evaluation Priorities

In 2007, over 60% of Lodi's net annual energy savings came from non-residential lighting and refrigeration. In 2008, it is projected that about 95% will come from these two programs with about 90% from non-residential lighting.

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. The cost of different evaluation approaches also is a key element in determining priorities. Savings resulting from energy efficient non-residential lighting and refrigeration make up most of the current and projected energy savings for Lodi. Fortunately, the *ex ante* energy savings for these measures come from the relatively simple engineering calculations which are more certain when 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.

The evaluation budget for Lodi is relatively small and limits the extent of evaluation efforts that can be undertaken. It is our recommendation that both a process and impact evaluation be performed.

1. A process evaluation of Lodi's efficiency programs consisting of the following:
    a. A review of the database tracking system to streamline program reporting and enhance comparison between and among programs.
    b. A free-ridership analysis to determine net to gross impacts and improve overall program cost-effectiveness for its residential programs. (to be completed at a later date)

c. A review of the measures targeted in Lodi's residential portfolio to determine cost-effectiveness and identify potential alternative measures.

2. Verification of the savings for non-residential refrigeration and non-residential lighting measures through a review of the engineering assumptions.
3. Verification of installations through a limited number of on-site visits and through a review of the application and receipt documentation of sampled installations.
4. Possible participation in a larger NCPA-wide residential lighting study in FY 2009.

1.5 Program Goals and Objectives

Lodi offers its residential and commercial customers several rebate programs as a way to encourage them to purchase and install energy efficiency measures and make energy efficiency improvements.

1.5.1 Customer Eligibility

The programs are open to Lodi customers who install qualifying equipment and provide the proper documentation. To receive the appliance rebates, the customer must purchase the equipment at one of the participating retailers, who are listed on the program's website.

To receive rebates for the HVAC Performance Systems Test, customers receive an inspection from a participating HVAC contractor which analyze a home's mechanical (heating/air conditioning unit) system and the home's air delivery/duct system. If customers make the recommended improvements based on the test, they are also eligible to receive $100 as a rebate for having pursued the test as step one of the process.

There are varieties of rebates available for customers who participate in Lodi's Energy Efficient Home Improvement Program. However, to qualify for these rebates, the customers have to install the recommended measures and/or participate in the HVAC Performance Systems Test to qualify for HVAC or duct-related repairs/replacements. In all cases, the customers must provide the proper documentation that indicates the measures were installed.

Commercial customers may also participate in rebates to defray the cost of installing energy efficient measures. In all cases, the customer must provide the proper documentation that the measures have been installed and provide an audit of kWh savings.

1.5.2 Marketing Methods

This program is marketed on its website, through customer workshops, and via print materials including brochures, flyers, and the utility newsletter. Participating contractors and retailers are listed on Lodi's website.

1.5.3 Program Implementer

The program is administered in-house.

1.5.4 Program Process Flow

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

Figure 1: Process Flow- Residential Programs

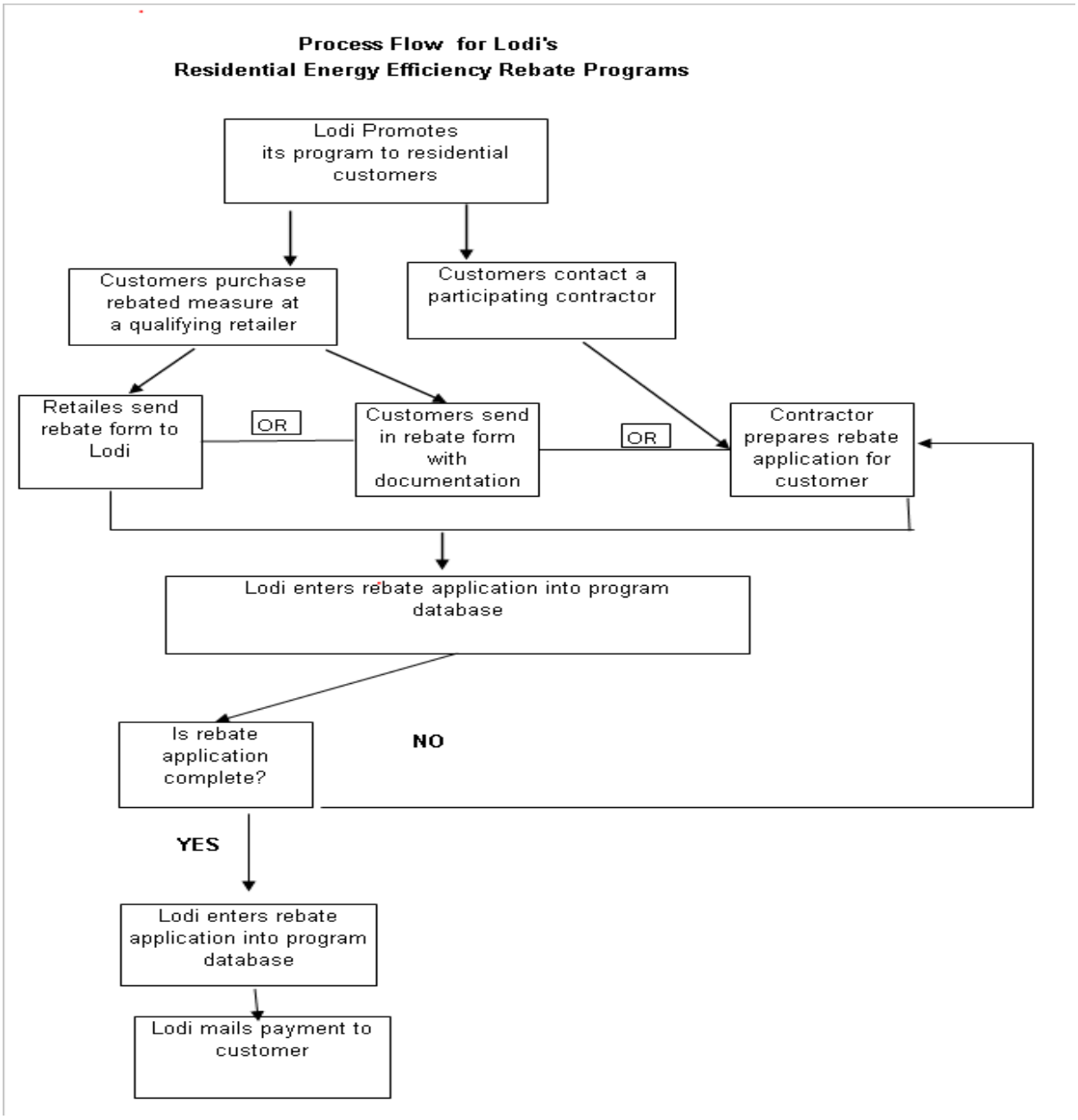
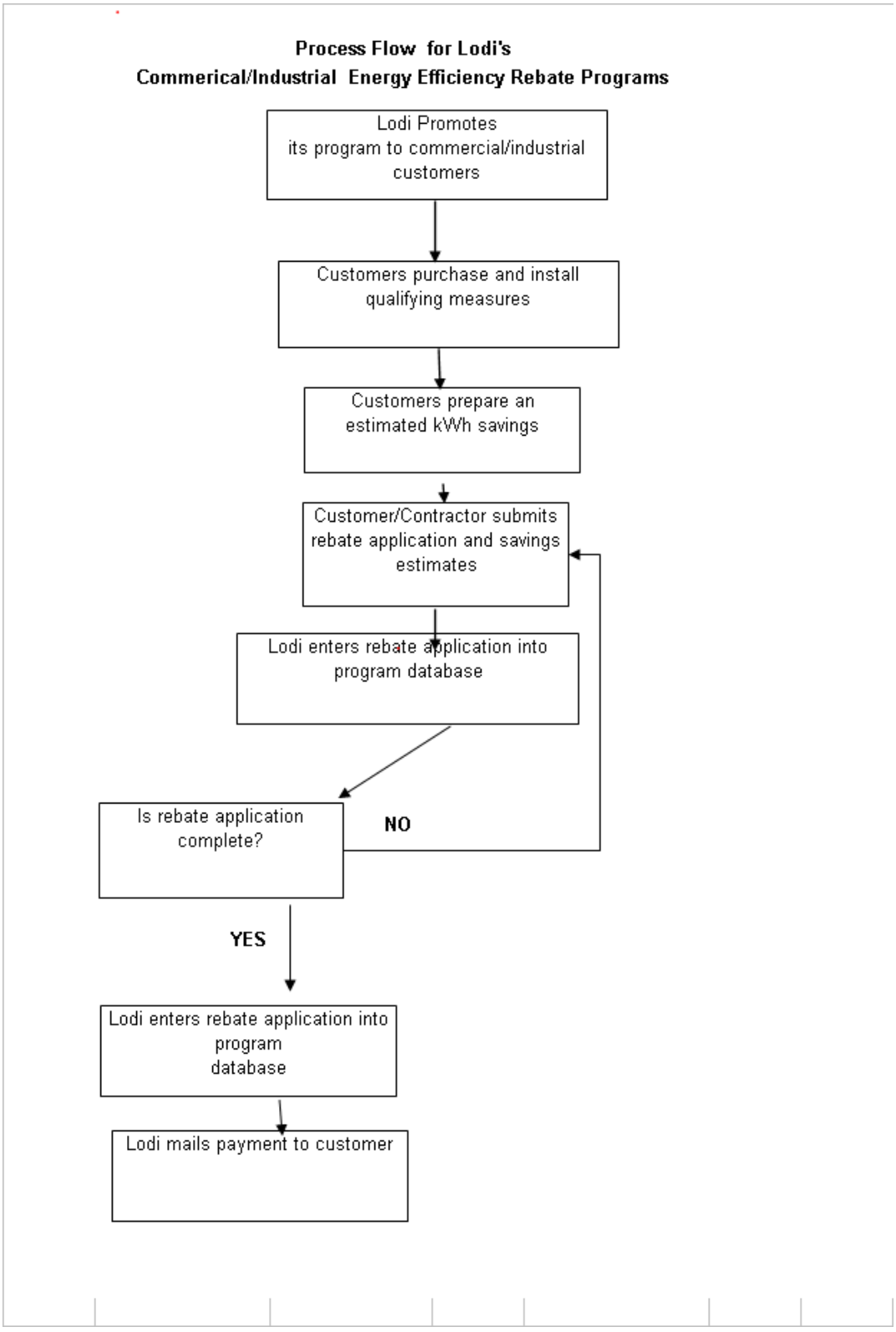


Figure 2: Process Flow- Commercial and Industrial Programs



2 PROCESS EVALUATION PLAN

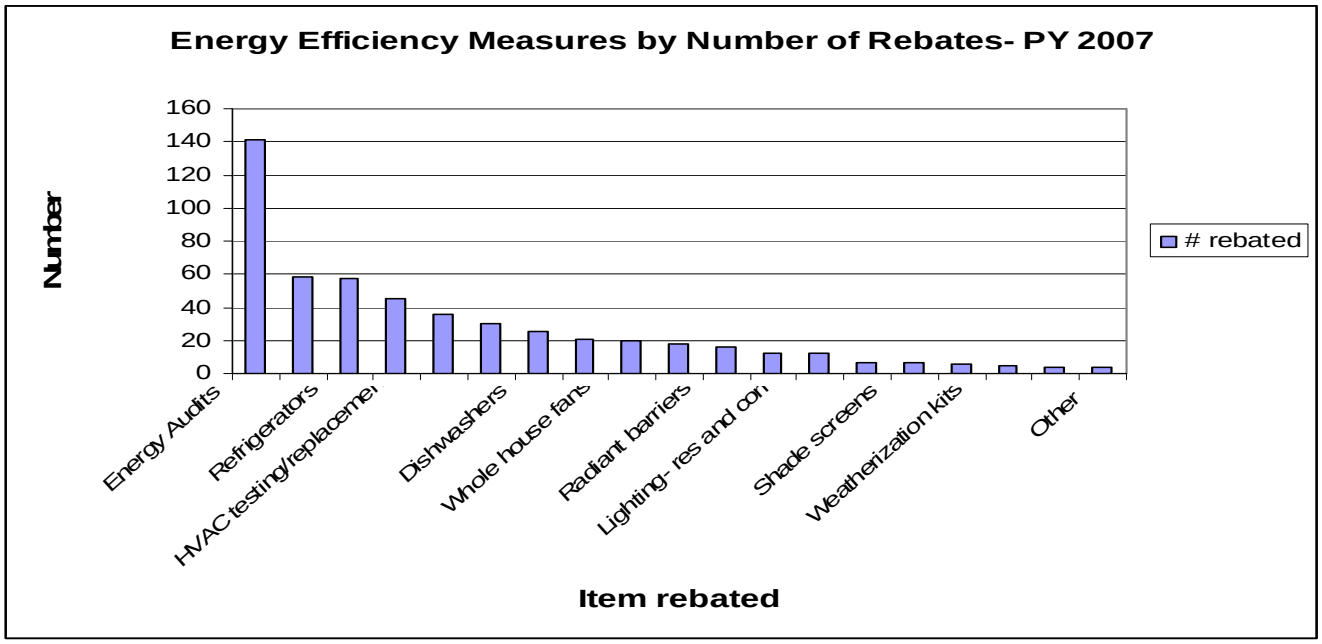
Based on a review of the program records and materials provided by Lodi staff, it is recommended that Lodi conducts a process evaluation all of its energy efficiency programs. Based on this preliminary analysis of its programs, it is most critical for Lodi to review the cost-effectiveness of the measures rebated in this programs. Free ridership is especially a concern for those measures rebated in the ENERGY STAR Appliance and Lodi Home Improvement Rebate Programs. Several rebated measures, such as residential lighting, appliances, insulation, and shell measures are often subject to high free ridership rates and therefore may not be the most cost-effective use of Lodi's efficiency expenditures. There is also some concern that Lodi may be overly-optimistic in accounting savings for those measures that are given away in the school kits. Therefore, the savings attributable to residential lighting should be verified through a customer survey.

2.1 Task 1: Review Tracking Systems

Given that these programs are often cross-promoted, we will review the ways the program data are tracked. Currently, all Lodi programs are tracked within the same database and the records date back to November 2003. Based on our preliminary review of the current tracking, provided by Lodi, the process evaluation could identify ways to simplify and streamline the data tracking process currently used. For example, under the current program is it difficult to identify rebates paid for each type of measure. Moreover, there seems to be a "disconnect" between the various databases in that the customer information is not currently linked to the actual measures received or rebate amounts. While Lodi has done an excellent job of collecting all relevant information, the program information is difficult to extract. Moreover, the program costs are included in the same format as the actual program rebates.

A preliminary review of the program database for PY 2007 revealed that Lodi has spent more than $206,000 in rebates for its residential and commercial programs. The rebates range in amount for $25.00 to $14,840. The program records also revealed that total number of rebates paid by measure category, as displayed in Figure 3.

Figure 3: Summary of Lodi's Energy Efficient Rebates by Measure-PY 2007



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 Inter-Relationships

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

2.3 Task 3: Assess Free Ridership Levels

Lodi should consider conducting a customer survey of 100 participants and 100 non participating residential customers. The goal of these customer surveys would be to measure current program free ridership levels and determine effective strategies. These surveys would also address the following issues:

1. Customer satisfaction with the programs and Lodi;
2. Likely free ridership rates for each targeted measure;
3. Installation rates for its Lodi LivingWise Program;
4. Measure persistence;
5. Spillover- that is the effect of the program had on encouraging other energy efficiency actions;
6. Additional measures to consider in upcoming program years; and
7. Areas for program improvement.

This customer survey would be integral in guiding Lodi's decisions to refine the current program offerings and to offer new types of programs in 2009 and 2010. However, implementation of the survey can wait until a later date.

The participating customer sample would be drawn randomly from Lodi's program tracking database. It would also include an analysis of customers who have participated in more than one Lodi program. The non-participating sample would be based either on Lodi's current residential customer database less the customers identified as program participants in the program tracking database or on random digit dialing of Lodi's customers in its service territory.

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, 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.[2]

[2] 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	• 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

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. The majority of 2007 energy savings came from non-residential lighting and non-residential refrigeration measures. The savings estimates for each of these sets of measures are based on relatively simple engineering calculations. Only a small percentage of energy savings, such as from HVAC measures, accrue from measures with higher levels of uncertainty. Therefore, our recommendation is that M&V Options "A" is the most appropriate method for this impact evaluation.

In order to accurately evaluate a typical lighting installation, all that is needed is a list of fixtures removed, fixtures installed, and operational hours. Standard wattages are available for most fixtures and can be used in a straightforward calculation of savings. Standard hour reductions are also available for occupancy sensors. Daylight sensor savings can be calculated using a combination of operating hours and standard weather data for the installation location.

The majority of refrigeration measure savings come from refrigeration door gaskets. The saving from refrigeration door gaskets are based on a PG&E working paper and is included in the KEMA database, but is a measure not necessarily considered deemed by the state of California since it is not a measure

included in the DEER database. Therefore, it is recommended that the working paper assumptions and methodology be reviewed as part of the impact evaluation.

Once this analysis is completed, Lodi will have defensible impact estimates for its non-residential lighting and refrigeration gasket measures. These results should also help to reduce the need for an impact evaluation for future installations unless equipment characteristics change in the future.

3.3 Task 4: Identify Impact Evaluation Sample

The number of participants in the Lodi non-residential programs is small even though a majority of their program savings comes from them. It is uncertain how many participants there will be in FY 2008 but it will not be very many. 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 15 participants would require 13 in the sample. For a population of 10, 9 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 5: Installation Verification

Verification that measures have actually been installed is an important part of an impact evaluation. Site visits to visually verify installation are a costly means of doing so but considering the small number of projects and the largeness of their impact to the overall savings coming from the Lodi energy efficiency programs, it is recommended that at least some on-site verification take place. It is recommended that the on-site verification be only done for the lighting projects and then at the reduced level of precision and confidence of 90% +/-10%. If the population consisted of 10 projects, this would mean 9 on-site visits. For the remaining lighting and refrigeration sampled sites, 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.

3.5 Task 6: Calculate Gross Energy and Demand Impacts

It is expected that the same methodology used to develop the *ex ante* estimates of savings will be used for the *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 *ex ante* estimates.

3.6 Task 7: 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 Lodi in meeting the requirements with the AB2021 requirements and will be used by Lodi to develop its submittal 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 OTHER POTENTIAL NCPA-WIDE EVALUATION INITIATIVES

Residential CFL Lighting: Lodi may also want to consider participating in a CFL lighting impact study. This study, which would involve members across several NCPA utilities, would document the current CFL installation rates, measure persistence, hours of use, free ridership, and free drivership rates. These findings could then be calibrated for Lodi to use when reporting its savings estimates to the CEC in Program Years 2009 and 2010.

5 EVALUATION PLAN TIMING

The 2008 Energy Efficiency Program Evaluation should begin as soon as Lodi can secure an independent evaluation team. The reason for moving forward quickly in the program year is to be able to provide the Lodi program managers immediate feedback on program operation, efficiency measure assumptions, and program tracking.

The measures that will be evaluated are not dependent on pre and post billing or metering data. The participant population can be segmented into quarterly participation groups with participants from the first quarter of 2008 being evaluated in the third quarter of 2008.

6 ESTIMATED BUDGET

It is estimated that the evaluation, as outline, should cost between $21,000 and $32,000 (not including Task 3. Task three should cost between $10,000 and $15,000)). By task, the cost range should be:

- Task 1: Review Tracking System - $2,500 - $3,000
- Task 2: Review Program Procedures and Inter-Relationships - $2,500 - $3,000
- Task 3: Conduct 200 customer surveys – (to be determined at a later date)
- Task 4: Identify Impact Evaluation Sample – cost included in tracking system review
- Task 5: Installation Verification - $4,000 - $8,000
- Task 6: Calculate Gross Energy and Demand Impacts - $6,000 - $10,000
- Task 7: Process and Impact Evaluation Report - $6,000 - $8,000