



Evaluation, Measurement & Verification Report for Truckee Donner Public Utility District 2009

Prepared for:

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Introduction

This document contains two distinct reports, presented as two sections. The first section is the full EM&V evaluation of six programs. The second is a calculation only EM&V evaluation of nine additional programs that were evaluated thoroughly in TDPUD's 2008 EM&V Report.

Section I – Full EM&V

Executive Summary

This report provides findings from an independent Evaluation, Measurement, and Verification (EM&V) for the following energy efficiency programs from Truckee Donner Public Utility District's (TDPUD) 2009 fiscal year:

- Commercial Lighting
- Energy Survey Programs
- Keep Your Cool
- Business LED Pilot
- LED Exit Sign
- Residential Green Partners programs

The programs were evaluated using a continuous improvement approach with the goal of identifying and recommending areas where changes can be made to improve data management and ensure data quality. For TDPUD, this involved a review of the overall program, with particular focus on data collection for these programs. Using available data, demand and consumption savings were calculated for each program.

Our analysis of collected data for the EM&V'ed programs showed the following savings figures:

Program	Demand Savings (kW)	Consumption Savings (kWh)
Commercial Lighting	79.15	322,929
Energy Survey	19.00	24,275
Business LED Pilot	4.78	24,152
LED Exit Sign	3.03	26,262
Residential Green Partners	146.60	123,027
Keep Your Cool	77.49	624,861

After a thorough review of TDPUD's energy efficiency programs, we recommend the following actions to improve TDPUD's energy efficiency programs and to more accurately capture and report results:

- Continue to pursue rebate management software
- Plan for regular, periodic installation verification for commercial lighting projects
- Conduct a rigorous study of the Energy Survey Program to determine accurate net to gross ratio and coincident factor. For non-standard measures such as door sweeps, research appropriate deemed energy savings figures.

For more detail on individual recommendations please refer to Findings & Recommendations section.

Introduction & Purpose of Report

EM&V is the documentation of energy savings using direct measurements, engineering calculations, statistical analyses, and/or computer simulation modeling. EM&V is a requirement of two bills adopted during the 2005-2006 California legislative session:

- **SB 1037 (Kehoe):** Requires all publicly-owned utilities to report to the California Energy Commission and their local governing boards about current and projected energy efficiency programs, including expenditures and savings.
- **AB 2021 (Levine):** Reaffirms SB1037 mandates but also requires publicly-owned utilities to develop energy efficiency targets on a triennial basis and provide an independent assessment of measured savings.

This report provides unbiased, independent, third-party auditing of programs selected by TDPUD.

Program Descriptions

Commercial Lighting

TDPUD pays the lesser of a third of project cost or up to \$10,000 for commercial customers upgrading to more efficient lighting.

Energy Survey Program

This program is designed to help low income customers incorporate cost-effective energy and water efficiency measures into their homes. Interested customers are first screened by a local non-profit family advocacy organization called Family Resource Center. The Sierra Green Building Association, a local green building non-profit education and training organization, is then used to conduct a residential energy survey and hand out appropriate energy and water efficiency measures to qualified families.

Business LED Pilot

TDPUD is currently developing a program for light-emitting diode (LED) lighting that can be used to replace MR-16 halogen bulbs, four foot tube lamps, PAR lamps, and other lighting types in local businesses. Businesses were given samples to install, test, and give feedback on desired light output and color and to validate reliability. Once a business selects their preferred LED lamp, TDPUD helps them upgrade the remainder of their MR-16 bulbs to LEDs.

LED Exit Sign Direct Install

TDPUD business customers have the opportunity to upgrade incandescent and CFL exit signs to LED. This program is direct install whereby TDPUD contracts with a vendor to retrofit the less efficient exit signs free of charge.

Residential Green Partners

The Residential Green Partners program provided free energy and water saving measures to residential customers. This program is a combination of customers receiving measures and TDPUD educating their customers about energy and water efficiency. The main focus in 2009 was on the selection of seven different screw-in CFLs.

Keep Your Cool

The *Keep Your Cool* program is a direct install program that focuses on reducing refrigeration equipment electrical consumption within the food and beverage industry through the installation of a variety of cost-effective refrigeration unit retrofit measures.

- Common measures installed in this phase included door gaskets and auto-closers.

Evaluation Standards

The requirement for utilities to provide independent third-party assessments of measured savings is relatively new and subject to some interpretation. There are published references (such as the International Measurement and Verification Protocol and the Technical, Methodological and Reporting Requirements for Evaluation Professionals). It is apparent from the body of previous third-party assessments that there is a range of interpretations and application of these references.

Our stance and approach is to:

- 1) Provide a rigorous review of the utility's programs.
- 2) Meet them where they are at and identify actionable improvements.
- 3) Minimize costs so more public benefits funds can be devoted to energy efficiency programs.

With this approach, our goal is to provide an "optimized" assessment resulting in an actionable review at minimal cost to the utility. This Continuous Improvement approach begins with process evaluation, followed by data analysis and detailed savings verification. If, we discover significant opportunities for improvement in the course of evaluating a process or analyzing the data, we will stop and document the needed improvement actions.

For example, if required program data is incomplete, we will work through our process to gather additional data. If complete data is still unavailable, it will be documented and evaluation will be performed on what data is available.

Evaluation Plans

Using the approach explained above, the specific evaluation plan for TDPUD was as follows:

Process Review

Evaluate the data for overall structure and accuracy. Conduct staff interviews to identify any specific issues with the energy efficiency program and identify improvement opportunities.

Program Evaluation

Review TDPUD's collected data for each program (Commercial Lighting, Energy Survey Program, Business LED Pilot, LED Exit Sign Direct Install, Residential Green Partners and Keep Your Cool) and look for inconsistencies in specific data and identify areas of improvement. Prepare savings estimates based on industry standard deemed figures or calculated energy savings.

Findings & Recommendations

Process Review – Data Collection

TDPUD's rebate tracking system consists of individual spreadsheets and documents. The number and diversity of programs offered by TDPUD is similar to what would be expected from a larger utility, but the staffing and budget are that of a smaller utility. As a result of this, there are some issues with data collection and management.

TDPUD would be well served by a consistent data management method that included pulling all data into a single spreadsheet or database. Such a system should be structured so that prompting is given for what types of data need to be collected for each program. For example, a direct install program does not require data on net to gross ratio but a give away program does. The system should prompt for such data to be collected.

Process Review - Staff Interviews

On January 26, 2010 a meeting was conducted at TDPUD offices in Truckee, CA to review program data and conduct staff interviews. Scott Terrell, Conservation Specialist Administrator, and Steven Poncelet, Public Information and Conservation Manager, were in attendance for TDPUD. Data collection and storage, program tracking, strategy and history were the main points of discussion. TDPUD acknowledged during the meeting that data management is an area that needs improvement. TDPUD was open to suggestions and is currently in the process of pursuing a data management system that will help to remove the burden of manually entering rebate program data into their spreadsheet system.

TDPUD staff has a remarkable desire to implement a wide variety of measures and programs and has been very successful at marketing these programs. They are active in the community, and have established good relationships with many of the local small businesses. Such relationships are essential to gaining acceptance and use of efficiency measures.

While data tracking is essential to ensure transparency of how public goods funds are spent, clearly the goal of public goods funds is to encourage the customer base to embrace energy efficiency. TDPUD is making great strides in that regard.

Program Evaluation - Commercial Lighting

Four (4) projects were installed during the 2009 fiscal year:

- New Moon Natural Foods
- Northwoods Ventures
- TDPUD Community Center
- Tahoe Truckee Unified School District (TTUSD) schools

New Moon Natural Foods and Northwoods Ventures

These businesses retrofitted their lighting from T12 to T8 lighting fixtures. Savings were calculated by taking the difference in existing fixture and new fixture wattage and using an estimated hours of operation, as stated by the business owners.

TDPUD Community Center

This is a brand new facility with new fixtures and occupancy sensors installed within the facility. As this was new construction, the rebate given was based on exceeding Title 24 building efficiency standards. This is a common method of calculating savings for new construction.

TTUSD Schools

This project involved delamping and retrofitting existing T12 lighting with T8 lighting. Pre- and post-retrofit wattages were used to calculate energy savings. Annual hours of operation were stated as somewhere in the range of 2000 – 2500 hours for most classrooms and offices; hallways and storage spaces were stated at 1000 hours. These figures coincide with the deemed hours operation as specified in KEMA’s “Measure Quantification Methodology Statewide Savings and Cost” report (KEMA).

Demand and consumption savings for the commercial lighting projects are summarized in the following table:

Project	Demand Savings (kW)	Consumption Savings (kWh)
New Moon Natural Foods	0.75	2,867
Northwoods Ventures	0.53	2,117
TDRPD (Community Center)	54.99	213,305
TTUSD (schools)	22.88	62,880
TOTAL	79.15	281,168

The commercial lighting program at TDPUD is consistent with programs offered by other utilities. Calculated wattage differences are used to determine savings and estimated or deemed hours of operation used to calculate consumption savings.

Since this type of program is well understood and the engineering qualifications well researched, it should not be necessary to apply more research into energy estimates. However as part of regular EM&V reporting, installation verification should be periodically performed.

Program Evaluation - Energy Survey Program

This is a new program for TDPUD. While it is an innovative program that targets low income customers, it is also somewhat complex to quantify since so many discrete measures are involved. For E3 reporting, deemed savings were used for each measure and industry accepted net to gross ratios applied. For some measures where deemed savings were not available, energy savings were conservatively assumed to be zero.

Using those assumptions, the calculations showed 19 kW of demand savings and 24,275 kWh of consumptions savings from this program

It was beyond the scope of this review to perform a more detailed analysis of these savings, but it could be beneficial to target this program for future study. Such a study should account for program costs associated with the Family Resource Center, the Sierra Green Building Association as well as direct costs. Attention should be paid to determining an accurate net to gross ratio and coincident factor. For most individual measures, it is reasonable to assume that published, deemed standards are sufficient to determine demand savings.

Program Evaluation - Business LED Pilot

For this program, over 200 LED lamps were distributed to local businesses to be used as direct replacements for existing less efficient lamps. Lamps were distributed free of charge with follow up visits made to encourage participation. This type of program is a good way to promote education of business owners and build up the utility's public perception on new lighting technology. A potential drawback is that businesses may be less likely to install lighting that is given to them free of charge. The effort by TDPUD to follow up with businesses and encourage installation is commendable and a helpful way to overcome this drawback.

Hours of operation were estimated using deemed standards based on business type (e.g. Restaurant, Commercial, Retail, etc). A total of 212 lamps were distributed for a calculated demand savings of 4.78 kW and an annual consumption savings of 24,152 kWhs.

As this is a pilot program, it may not be necessary to do a full evaluation of net to gross or coincident factor since estimates could be used to determine the effectiveness. If this is formalized into a standing efficiency program, a study should be performed to determine more accurate figures.

Program Evaluation - LED Exit Sign Direct Install

This was a direct install program where existing incandescent (25W) or fluorescent (15W) exit signs were replaced (for free) with new LED (2.5W) units. The cost of the retrofit kit and installation were entirely covered by TDPUD. Since exit signs are always on, annual hours of operation are known to be 8760 per year. Similarly, the coincident factor can be taken to be exactly 1. For a direct install measure, net to gross is also exactly 1.

In 2009, TDPUD replaced 160 incandescent exit signs and 31 fluorescent exit signs for a total of 191 installations. Based on fixture wattage difference and the above stated hours of operation and reduction factors, the demand reduction from this program was calculated to be 3.03 kW, and the consumption reduction was calculated to be 26,262 kWhs.

No further analysis should be required for this program if it is formalized into a standing program, since savings can be accurately calculated without any assumptions.

Program Evaluation - Residential Green Partners

In 2009, TDPUD distributed (for free) a wide array of light bulbs. Data collected included manufacturer data for new bulbs along with "watts replaced", which were used to calculate savings. The existing fixture wattage is assumed, since it is not practical to gather this information as part of a bulb give-away.

Some inconsistencies were found with the collected data. A number of entries had missing bulb quantities and/or existing watts information. Some rows were blank with only applicant's name listed. For some bulbs it was not clear what the existing bulb wattage was, so assumptions had to be made. This program in particular demonstrates the value that an improved data collection mechanism would provide.

Ideally, all data would be complete, but it is understood that in program such as this, where large quantities of measures are being distributed, some data will be missed. Overall, sufficient data was collected to generate reasonable savings estimates.

Using the data available, a simple demand and consumption calculation was made by taking the difference in wattage between existing bulb and new bulb and multiplying by the quantity distributed. Hours of operation were based on an estimate in KEMA that a typical residential bulb is in use 2.3 hours a day, 265 days a year, which equates to 839 hours.

It is likely that net to gross ratio and coincidence factor play a significant role in the actual savings from this program, but they have not been investigated. Based on the above calculation and ignoring the effects of net to gross and coincidence, the demand savings from this program are 146.60 kW and consumption savings are 123,027 kWhs.

These are significant savings and should be verified more accurately. A study should be done to quantify net to gross and coincidence factor for this program. A more accurate savings figure could be arrived at if a complete inventory of each type of bulb were performed.

Program Evaluation - Keep Your Cool

The demand and consumption savings figures used in the Keep Your Cool program were reasonable and close to those of similar deemed savings programs. The program data was provided in a complete and useable format. We have no recommendations for improvement at this time.

Section II – Calculation Only EM&V

Summary

The purpose of this report is to generate an estimate of annual energy savings of some of the programs offered by Truckee Donner Public Utility District (TDPUD) during the 2009 fiscal year. These programs were evaluated in detail as part of the 2008 EM&V analysis so they were not closely reviewed for 2009. This report provides a baseline analysis of savings using the per unit savings calculated in the 2008 study combined with the quantity of each measure carried out in 2009. In addition, a year over year comparison of program savings is included.

The following table summarizes the year over year differences in quantity of each measure implemented and the resulting total savings for these measures.

Table 1.1 – Year over Year Comparison of Quantities and Savings

Program	2008 Quantity	2009 Quantity
Residential Lighting Rebate	1,282	234
EE Appliance Rebate Program	294	526
Refrigerator & Freezer Recycling	50	25
Building Envelope & Duct Testing	42	25
Thermally-Efficient Windows	0	16
Ground Source Heat Pumps	0	0
Electric Water Heater Rebate	4	2
Million CFLs	55,308	50,869
LED Holiday Lights	1,450	2,459
Total	58,430	54,156

Savings Summary	2008	2009
Net Annual Electricity Savings (kWh/yr)	3,245,225	3,031,669
Net Demand Savings (kW)	2,315	2,255
Net Lifecycle Electricity Savings (kWh)	28,810,154	31,002,018

Most measures had lower participation levels in 2009 as compared to 2008. As a result, the 2009 savings estimate for these measures is lower. Lifecycle savings for 2009 are slightly higher since the deemed savings life for LED holiday lights is very high and this program saw a large increase in participation.

Program Descriptions

The following programs were evaluated as part of this analysis:

- **Residential Lighting Rebate**

The Residential Lighting Rebate Program provides a rebate of up to \$2/bulb for compact

fluorescent lights (CFLs). TDPUD's customers can receive up to \$50 for multifamily and \$100 for single family residences, with a minimum purchase of 5 CFLs for multifamily and 10 CFLs for single family residences.

- **Energy Efficient Appliance Rebate Program**

TDPUD customers purchasing Energy Star® qualified Clothes Washers, Dishwashers, and Refrigerators may receive a \$100 rebate per appliance.

- **Refrigerator & Freezer Recycling**

The Refrigerator & Freezer Recycling program is designed to remove inefficient secondary refrigerators and freezers from homes and businesses. TDPUD provides free refrigerator recycling and a \$30 rebate per unit where evidence can be shown that the unit was recycled.

- **Building Envelope & Duct Testing**

This program is designed to help reduce building infiltration and duct leakage in customer residences. TDPUD offers rebates on envelope leakage tests up to \$75 per dwelling and the lesser of \$250 or 50% of the cost of remediation. In addition, TDPUD offers a \$75 rebate for duct leakage testing and the lesser of \$250 or 50% of the cost of remediation.

- **Thermally-Efficient Windows**

Residents may receive a rebate for replacing their single-pane windows with thermally efficient double- or triple-pane low-emissivity windows with vinyl or wood clad frames (aluminum framed windows do not qualify unless they are designed with a thermal break). To qualify, the dwelling must be using a permanent electric space heating unit as their primary heating system.

- **Ground Source Heat Pumps**

Customers purchasing and installing electric ground source heat pumps can receive a \$200/ton rebate.

- **Electric Water Heater Rebate**

TDPUD customers installing a qualifying high efficiency electric water heater can receive a \$2/gallon rebate. Electric water heaters 59 gallons and less must have an Energy Factor (EF) Rating of .93 or higher to receive a cash rebate. Electric water heaters 60 gallons and greater must have an EF Rating of .91 or higher to receive a cash rebate

- **Million CFL**

The Million CFL program is designed to provide every homeowner and business in the Truckee community with a box of a dozen free CFLs. TDPUD's staff hands out the 12-packs of CFLs at the TDPUD Customer Service and Conservation counters as well as at local events.

- **LED Holiday Lights**

During November and December, TDPUD staff provides walk-in customers with the ability to exchange up to three of their old strands of incandescent holiday lights with up to three new strands of LED holiday lights at no cost; a strand for strand exchange.

Analysis

The 2008 program results are summarized in Table 3.1. These savings were determined as part of the EM&V study for the 2008 fiscal year.

Table 3.1 – 2008 Savings for Selected Programs, from 2008 analysis

Programs	Units Installed	Gross Unit Savings (kWh/yr)	Gross Unit Savings (kW)	Net-to-Gross Ratio	Net Annual Electricity Savings (kWh/yr)	Net Demand Savings (kW)
Residential Lighting Rebate	1,282	59	0.04	0.80	61,023	42.05
Appliance Rebate Program	294	146	0.02	0.80	34,284	4.65
Refrigerator & Freezer Recycling	50	1625	0.37	0.84	68,250	15.33
Building Envelope & Duct Testing	42	60	0.11	0.89	2,261	4.27
Thermally-Efficient Windows	0	0	0.00	0.96	0	0.00
Ground Source Heat Pumps	0	0	0.00	0.80	0	0.00
Electric Water Heater Rebate	4	45	0.01	1.00	178	0.02
Million CFLs	55,308	59	0.04	0.90	2,961,743	2,040.87
LED Holiday Lights	1,450	89	0.16	0.91	117,486	207.48
Totals	58,430				3,245,225	2,315

Note: Gross Unit Savings and Net to Gross Ratio were taken from 2008 Analysis, and lead to apparent rounding discrepancies in Net Annual Electricity Savings. Thermally-Efficient Windows and Ground Source Heat Pumps Gross Unit Savings for kWh/yr and kW values were zero (0) in 2008 EM&V analysis.

The 2009 savings are summarized in Table 3.2. Savings were calculated by applying actual units installed in 2009 to the Gross Unit Savings numbers of 2008.

Table 3.2 – 2009 Calculated Savings for Selected Programs

Program	Units Installed	Gross Unit Savings (kWh/yr)	Gross Unit Savings (kW)	Net-to-Gross Ratio	Net Annual Electricity Savings (kWh/yr)	Net Demand Savings (kW)
Residential Lighting Rebate	234	59	0.04	0.80	11,138	7.68
Appliance Rebate Program	526	146	0.02	0.80	61,338	8.32
Refrigerator & Freezer Recycling	25	1625	0.37	0.84	34,125	7.67
Building Envelope & Duct Testing	25	60	0.11	0.89	1,346	2.54
Thermally-Efficient Windows	16	0	0.00	0.96	0	0.00
Ground Source Heat Pumps	0	775	0.11	0.80	0	0.00
Electric Water Heater Rebate	2	45	0.01	1.00	89	0.01
Million CFLs	50,869	59	0.04	0.90	2,724,035	1,877.07
LED Holiday Lights	2,459	89	0.16	0.91	199,240	351.86
Totals	54,156				3,031,311	2,255

Note: Gross Unit Savings and Net to Gross Ratio were taken from 2008 Analysis, and lead to apparent rounding discrepancies in Net Annual Electricity Savings. Thermally-Efficient Windows and Ground Source Heat Pumps Gross Unit Savings for kWh/yr and kW values were zero (0) in 2008 EM&V analysis.