Best practices for developing cost-effective evaluation, measurement, and verification plans: lessons learned from 12 Northern California municipal utilities

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Keywords

program evaluation, measurement and verification, energy efficiency, municipal utilities

Abstract

Evaluation, measurement, and verification studies are vital to the success of any energy efficiency program. However, it is often so costly to undertake these studies, that they are rarely completed by those utility organizations that could benefit the most. This was the challenge facing 12 Northern California municipal and rural electric utilities. Under a new law, they were required to conduct evaluation, measurement, and verification (E,M&V) studies for programs in their energy efficiency portfolios. This has been a requirement for California investor-owned utilities; however, it was a new requirement for the municipally-owned and rural electric cooperative utilities in the state. Most of these utilities had small staffs, limited resources, and little experience in managing these types of evaluation activities.

This paper describes the solution developed by the Northern California Power Agency (NCPA) which helped to ease the financial and administrative burden facing its members. NCPA developed a cost-effective collaborative framework that would meet the necessary regulatory requirements. In this approach, the utilities could pool funds and combine resources to complete comprehensive E,M&V studies across multiple service territories. This paper will describe the approaches used by these organizations to complete E,M&V studies for residential, commercial, and industrial programs.

The utility members participating in this process were diverse: some only had 500 customers, while others served communities of 300,000. However, this framework was flexible enough to meet the diverse needs of these utilities without causing undue financial hardships.

Introduction

Public power utilities are not-for-profit electric systems owned and operated by the people they serve through a local or state government. Across the United States, 1,843 of the 2,010 are operated by cities and towns; 109 are operated by political subdivisions, such as public utility districts; 43 are joint action agencies (a consortium of public power systems, usually located within a single state); and 15 are utilities established by states. Public power systems are public service institutions owned by their consumers and governed locally by elected or appointed citizen boards. The community authorizes these boards to make decisions in open public meetings with consumer input.[1]

The Northern California Power Agency (NCPA) is a joint powers agency that provides support for the electric utility operations of 17 publicly-owned utilities (member communities and districts) in Northern and Central California. Two legislative bills (SB1037 and AB2021) were signed into law a year apart. SB1037 requires that the Publicly-Owned Utilities (POUs) to place cost-effective, reliable, and feasible energy efficiency and demand reduction resources as the top priority. 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.

1. American Public Power website: http://www.appanet.org/

These new laws reinforced the need for California utilities to put energy efficiency first and also broadened the scope of the annual reporting requirements for POUs. 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.

This paper summarizes the ways in which 10 NCPA member utilities (and two non-NCPA utilities) responded to these new legislative requirements in a cost-effective manner. It also describes how these utilities used these new legislative requirements to enhance and strengthen current Demand Side Management (DSM) program by incorporating evaluation, measurement, and verification activities

Evaluation, measurement, and verification (E,M&V) activities incorporate a number of ways to document energy savings achieved through DSM programs. The types of these activities (which will be discussed more fully in the paper) involve some type of savings estimates either through on-site verification or estimates based on data gathered from customers, program records, trade allies, and secondary sources.

The utilities participating in the E,M&V approaches described in this paper are:

Alameda Power & Telecom

City of Gridley

City of Lompoc

Lodi Electric Utility

Redding Electric Utility

City of Shasta Lake (Non-NCPA member)

City of Biggs

City of Healdsburg

City of Ukiah

Plumas-Sierra Rural Electric Cooperative

Turlock Irrigation District

Lassen (Non-NCPA member)

To comply with this new legislation, the California public municipal utilities were required to identify all potentially achievable cost-effective electricity efficiency savings and to establish realistic annual savings targets. The reporting requirements were as follows:

- Annual reporting of energy and demand reduction targets to all stakeholders, including customers and the California Energy Commission, the state's primary energy policy and planning agency.
- Cost effectiveness reporting using standard tests defined in the California Standard Practice Model, such as the Participant Test, the Utility Test, and the Total Resource Cost Test.

Overview of energy efficiency: A public power perspective

Publicly-owned utilities (POU) have had a long-standing commitment to energy efficiency that is an extension of fundamental principles dedicated to social and environmental responsibility, ensuring reliability, and keeping rates low for the communities they serve. Energy efficiency is a critical element of the resource planning process, generation, transmission and distribution. Public power commitments to energy efficiency are guided by four important concepts, as articulated on NCPA's website[2]:

- **Social and environmental responsibility.** POUs place a high priority on energy efficiency, investments in renewable power supplies, low-income programs and economic development. Local elected officials govern and regulate public power to ensure direct accountability on these important issues to customers.
- **Operational energy efficiency.** Public power has important energy efficiency programs that optimize power generation, transmission, and ensure optimal operation of the grid.
- **Demand-side energy efficiency**. This is a major focus of POUs. It includes, but is not limited to, lighting, appliances, air-conditioners, building codes and standards, education, electricity management, and residential housing improvements in shell measures, such as insulation, caulking, and related improvements (weatherization), all coordinated with customer-specific programs.
- **Cost-effective energy efficiency.** Cost-effective energy efficiency lowers the cost of providing electricity to our communities. POU customers are "shareholders" and benefits related to energy efficiency are realized by all customer-owners.

The 15 NPCA members' 2006-2007 demand side management programs[3] are varied in funding, from slightly under $50,000 (39,400 Euro) in funding for the City of Lompoc, to approximately $3.7 million (2.9 million Euro) in Silicon Valley Power (SVP), with the average funding level of $249,000 (196,400 Euro) annually. Some NCPA utilities have maintained energy efficiency programs for years with both residential and commercial components while others are just starting new services. The overriding goal of this project was to develop an E,M&V framework to properly document the results achieved through these programs. This framework focused on developing plans that include process and impact evaluations, and properly documenting the results through careful measurement and verification activities.

E,M&V studies rely on a variety of tools, which are discussed more fully in the subsequent sections. These tools include gathering data from questionnaires, in-depth interviews, and on-site inspections. One tool that has been especially important for this E,M&V work has been to rely on the Database for Energy Efficient Resources (DEER)[4]. This is a California Energy Com-

2. http://www.ncpa.com/energy-efficiency.html

3. While there are 17 NCPA members, two members are not retail electric energy providers and thus do not have DSM programs.

4. http://www.energy.ca.gov/deer/

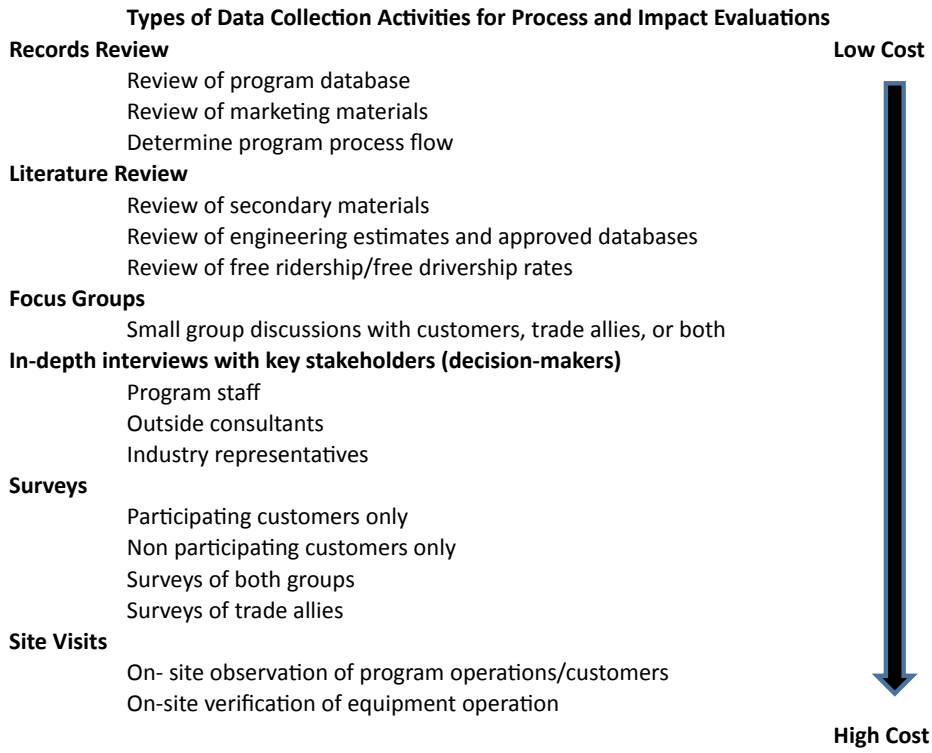

Figure 1: Summary of data collection activities

mission and California Public Utilities Commission (CPUC) sponsored database designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life (EUL) all with one data source. The users of the data are intended to be program planners, regulatory reviewers and planners, utility and regulatory forecasters, and consultants supporting utility and regulatory research and evaluation efforts. DEER has been has been designated by the CPUC as its source for deemed and impact costs for program planning.

Successful and cost-effective elements of a process evaluation

The American Evaluation Association[5] defines evaluation as "assessing the strengths and weaknesses of programs, polices, personnel, products and organisations to improve their effectiveness". Most evaluations of energy efficiency programs include conducting a process and an impact evaluation.

Process evaluation describes and assesses program materials and activities. Examination of materials is likely to occur while programs are being developed, as a check on the appropriateness of the approach and procedures that will be used in the program. Examining the implementation of program activities is an important form of process evaluation. Implementation Analysis documents what actually transpires in a program and how closely it resembles the program's goals. Process evaluations rely on both qualitative and quantitative data research methodologies including literature reviews and reviews of program materials as well as quantitative methods such as customer surveys and on-site field observations.

5. http://www.eval.org/

An impact evaluation examines the long-term effects from a program, including those unintended effects. For energy efficiency programs, impact evaluations seek to quantify the nature and scope of energy savings in terms of reductions in both kilowatt (kW) and kilowatt hour (kWh) savings for electric utilities. All of the utilities participating in the impact evaluations focused on reducing electric usage. Impact evaluations also incorporate both qualitative and quantitative data collection activities from reviewing literature and other engineering estimates to on-site metering of specific equipment for a period of time to determine actual energy reductions.

FAVOURING CONTINUOUS IMPROVEMENTS THROUGH A PROGRESSIVE APPROACH

The first step in conducting these process evaluations was to prioritize the types of data collection activities that would be conducted based on the utility's specific needs and objectives. Since process evaluation was a new activity to many of these utilities, the team began by first conducting a process evaluation that gathered data in a low-cost manner, before moving on to higher cost activities such as surveys and site-visits. Figure 1 displays the data collection activities associated with process and impact evaluations ranging from "low cost" to "high cost".

Figure 1 also shows logical stages of data collection activities. The first step, which is relatively low-cost as it involves readily available data, is to review all the existing program records. This includes reviewing the ways in which the data for the program are collected and tracked; reviewing the marketing materials used to recruit customers and contractors to participate in the program including the website; and developing a flow diagram of the program. This is an especially important component of a process evaluation as it identifies in graphic form the ways in

Measure	Measure Group	Number of Participants by Measure	Units per Installation	Units	Measure Fuel	Savings - Gas (Therms)	Savings - Electricity (kWh)
Custom	Custom	2	1,153,936	kWh	Electric	0	1,153,936
Heat Pump, Water Source < 11.2	HVAC	1	0	ton	Electric	0	0
Exit Sign New Exit Sign	Lighting	1	34	fixture	Electric	0	11,696
Hard-Wired Flourescent > 27 watts	Lighting	1	554	fixture	Electric	0	368,410
Hard-Wired Flourescent 5-26 watts	Lighting	1	154	fixture	Electric	0	43,120
Int. HID 0-35 watts	Lighting	1	81	fixture	Electric	0	20,817
Int. HID 36-70 watts	Lighting	1	24	fixture	Electric	0	12,360
Occupancy Sensor Wall or ceiling-mount lighting	Lighting	2	34	sensor	Electric	0	26,350
Occupancy Sensor Wall-box lighting sensor	Lighting	2	117	sensor	Electric	0	30,537
Pre.T5 or T8 w/ Elect. Ballast 4 ft.	Lighting	3	5,532	lamp	Electric	0	309,792
Reflec. w/Lamp Removal 4 ft.	Lighting	1	482	lamp removed	Electric	0	76,638
Motor 1 hp	Motor	1	1	motor	Electric	0	112
Motor 100	Motor	1	6	motor	Electric	0	91,476
Motor 5 hp	Motor	1	1	motor	Electric	0	336
Motor 50 hp	Motor	1	2	motor	Electric	0	19,876
Motor 60 hp	Motor	1	1	motor	Electric	0	10,009
Var. Freq. Drives Var. Freq. Drives	Motor	5	250	horsepower	Electric	0	188,250
Comm. Boiler Dom. Hot Water Heat (<300k Btuh, T1)	Hot Water	1	250	1k Btuh	Gas	17	0
Comm. Boiler Dom. Hot Water Heat (>=300k Btuh, T2)	Hot Water	1	1,500	1k Btuh	Gas	1,476	0
Comm. Boiler Hot Water Space Heat (>=300k Btuh, T2)	HVAC	1	500	1k Btuh	Gas	360	0
TOTAL		**29**				**1,853**	**2,366,262**

Figure 2: Database Review Summary for City of Palo Alto Utilities

which a customer can flow through the program, and identify any roadblocks or impediments.

The other types of data collection activities are grouped according to the level of effort and expertise required. For example, it is much cheaper to rely on information from secondary sources, such as engineering estimates or free ridership, than it is to gather the data through primary collection methods such as surveys. It is also less expensive to conduct a few in-depth, open-ended surveys with a few respondents, compared to a large-scale survey of many respondents across multiple jurisdictions. The driving factor in determining the costs of surveys is the length of the survey and the desired number of completed surveys. The most expensive component of data gathering is to gather detailed information on-site. This is a highly labour-intensive process that involves specialized professionals such as engineers or professional researchers, and therefore is reserved for the most important or complicated evaluations.

The NCPA evaluations involved a mix of these data collection activities. The goal was to match the data collection activities best to the E,M&V requirements, which allowed a better targeting of available funds.

RECORDS REVIEW

As a first step, the Summit Blue consultancy completed a thorough records review in the first stage of these E,M&V activities for all 12 participating utilities. This review included the following activities:

REVIEW OF PROGRAM DATABASE

- **A review of the database tracking system:** This review examined the types of data that are collected during program operations. These data may include customer information, the types of energy efficiency measures installed, the types of measures replaced, the amount of the rebates, and other demographic variables such as housing type and number of household occupants. The data are collected from rebate forms completed by the customer and mailed to the utility.

The NCPA evaluations revealed great disparities in the quality of the information collected and stored in these databases. Some of the databases tracked the entire program history, which was beyond the specific evaluation period for this work. Many of the databases also tracked the information inconsistently, using a mix of letters and numbers that made it difficult to easily count the number of applications for a specific measure, identify duplicates, or quickly summarize the information. Figure 2 illustrates the types of information captured in the program database review.

As a result of these database reviews, the NCPA organizations were given advice on the best ways in which to track information, as illustrated in the types of recommendations in the text box 1.

- **A review of the targeted measures**: This review included examining all the types of measures that are currently receiving rebates. This approach was used for residential, commercial, and industrial programs. The main goal was

Key recommendations to improve the tracking database

The utility should track its residential and commercial programs in separate databases.

The databases should be separated out by Program as a way to facilitate tracking and reporting rather than creating one comprehensive central database.

The utility should track program costs for meetings, lunches, and events separately from the actual program rebates.

The utility should create a numerical legend to track its measure installations by category.

The utility should consider separating out vendors by category and by program as way to improve overall targeting and outreach. For example, all residential vendors should be listed in the residential database, group by the corresponding measures they install. A similar approach should be used for the commercial vendors.

Text box 1

Table 1: Net to Gross (Free-ridership) Evaluation Based Estimates

Measure	2004/2005 California Statewide Evaluation	PG&E 2004-05 Local Government Partnership Program	Yolo Energy Efficiency Project CFL Giveaway	2003 California Statewide Evaluation	Energy Vermont	Energy Trust of Oregon	DEER 2006-2007 Update Values
Dishwashers	41%						41%
Clothes Washers	81%				17% to 38%		81%
Water Heaters	58%						58%
Screw-In CFLs	62%	70% to 84%	53%			85%	60%
Windows	47%			9% to 28%			55%

to make sure that the equipment that qualified for the rebates were still cost-effective, in terms of offering the highest energy savings for the rebate provided, based on the cost-effectiveness tests in Table 1. Another critical component of this review was to identify if the utilities should replace some of the current measures with other measures that may achieve higher energy savings.

The reviews for the NCPA utilities did reveal that some utilities were continuing to offer rebates for equipment that had already achieved high market penetration rates. This was especially true for utilities still offering rebates for compact fluorescent lamps (CFLs) and some home appliances.

For the City of Redding, this review also included an analysis of current free ridership rates among the rebated measures. The purpose of this review was to identify if the some of the measures currently receiving rebates should be eliminated based on high free ridership rates. The measures in question were: dishwashers, clothes washers, water heaters, screw in CFLs, and windows. This review was especially important because the literature showed that a DSM measure at the beginning of a program period may have had no free-riders. However, after a period of availability, the measure is commonplace, free-ridership has shifted to where now, many people would purchase the DSM measure even if the program incentive faded away. This review compared the results from several studies

Table 1 provides the values estimated from some evaluation efforts reviewed. The last column represents the latest net to gross values include in the most recent update of DEER. The DEER values indicate very high free-ridership for each of these measures, except for clothes washers. The highest free-ridership is with dish washers at 59% followed by Windows at 45%. Water heaters were also had high free-ridership at 42% and screw-in CFLs at 40%.

The findings from this review led to Summit Blue recommending that REU continue discontinuing rebates for dishwashers, windows, and CFLs while keeping rebates for clothes washers and water heaters. These recommendations were based on assessing the current free ridership levels from both a state and national perspective.

Types of Recommendations Based on Process Evaluation and Reviews

The utility may want to bundle program measures, especially weatherization and HVAC measures. Bundling would streamline operations and likely achieve higher levels of energy savings. This change should appeal to a larger group of contractors who could sell and install multiple energy efficiency measures at one site. This approach would also provide a much clearer message to home owners about the benefits of installing measure combinations, such as duct sealing with insulation, as way to improve the whole house.

The utility should incorporate more "non-energy" benefits into its messaging for its residential programs, especially its home improvement program. These non-energy benefits include focusing on increased home comfort, safety, and environmentally-friendly activities. These messages should be included on the website and could be incorporated into future marketing pieces.

Text box 2

REVIEW PROGRAM PROCEDURES AND INTER-RELATIONSHIPS

A second part of this review was to document the program flow and to identify the ways in which information is processed in the utility. This flow diagram helps to identify potential bottlenecks or areas in which information could be misplace or misfiled. It also identifies ways in which the program could be streamlined – both essential elements of a process evaluation.

The NCPA process evaluations also included a review of the materials and events currently used for recruiting customers to participate in the energy efficiency programs. This information was also supplemented by interviews with program staff, focusing on the following topics: program process flow and inter-relationships; program metrics including current enrolment, customer satisfaction, and savings estimates; marketing and outreach activities; and areas for improvement. The types of recommendations are illustrated in the text box 2.

Several NCPA utilities also engaged in more expensive process evaluation activities including conducting surveys with participating and non participating customers, and participating and non participating contractors. These surveys, however, focused only customers in commercial and industrial programs, which offer the highest opportunities for energy savings. These surveys were also limited to those utilities that had more robust budgets and could afford to spend several additional thousand dollars in completing a more comprehensive process evaluation.

In contrast, the methods described in this section focused on the most low-cost strategies that provided the utilities with valuable information at a more manageable cost.

Successful and cost-effective elements of an impact evaluation

Just as there are many approaches to conducting a process evaluation, there are also many approaches to an impact evaluation. To develop both cost-effective and reliable impact evaluation efforts, the project team implemented the following strategies.

ESTABLISH GOOD QUALITY PARTICIPATION DATA

The evaluation consultants worked closely with the NCPA participating utilities to assess the quality of the data that was available though a coordinated review of the program files and databases. The review would identify the type (deemed or custom calculated) and source (DEER, utility work papers, and/or engineering calculations) of the energy savings of the claimed energy savings. These data provided the estimates of impacts by site and also identified the contact information at each site. Assessment of this information is also in helpful in determining the appropriate evaluation methodology to be employed and provided the population for sample draws.

MATCH THE DATA COLLECTION STRATEGY TO THE DATA NEEDS OF THE PROJECT OR MEASURE

On-site data collection is expensive and time consuming, and not everything can or should be measured or monitored. Most of the energy saving estimates used by the NCPA members for their planning and reporting are derived from the deemed saving values of the DEER database. These savings are used by the members in the NCPA to develop appropriate savings estimate for each measure type installed. The savings estimates have been verified and approved for use in reporting to the California Energy Commission (CEC). The primary advantage of using the DEER database is that it simplifies the verification process by confirming the installation of the installed measures either through a records review or a telephone or mail survey. But this does not require the more costly step of actual in-field verification of the installed measures.

For most of the participating NCPA utilities, a simple review of program records and invoices was sufficient to ensure that the measures were actually installed. These reviews were relatively straightforward, especially for the residential programs, and did not require much time or effort.

However, verification becomes more critical when the installations are for multiple measures, such as lighting, motors, and variable frequency drives (VFDs), or at installations in which a large quantity of measures have been installed, such as lighting change-outs. In these programs, which usually involve a customized installation, it is important to also customize the E,M&V approach. This is done by either reviewing the engineering estimates, conducting short term metering, or perhaps a billing analysis. The rigor of these approaches depends upon the scale of the efficiency program and the magnitude of energy efficiency savings. Most of the participating NCPA utilities focused on residential programs that did not require these types

Table 2: Overview of IPMVP 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 or agreed upon assumptions such as deemed savings.	Constant performance	Verified installation Nameplate or stipulated performance parameters Spot measurements Run-time hour measurements
Option B: Engineering calculations using metered data. This includes a mix of both deemed and custom 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. Usually savings should be higher than 10% of the metered energy consumption so that results can be considered significant	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

of analysis. However, there were a few NCPA utilities, such as the City of Palo Alto, Silicon Valley Power, and Alameda Power & Telecom, which focused heavily on commercial and industrial energy efficiency programs and therefore wanted to be sure that they were able to fully and accurately document the savings attributed to these activities.

APPLY THE APPROPRIATE ANALYTIC APPROACH TO THE MEASURE BEING ANALYZED

There are a variety of analytic methods including but not limited to engineering analysis algorithm-based models (e.g. hourly building energy simulation models), and regression modelling tools. In conjunction with the chosen data collection strategy, it is important to apply the appropriate tool to the analysis at hand, recognizing that this method must also fall into budget constraints.

When approaching a multiple program evaluation with a wide range of efficiency measures and diverse set of applications of those measures it is helpful to have a systematic context in which to make decisions about the selection of measurement and verification methods. Table 2 presents a listing of the four International Performance Measurement and Verification Protocols (IPMVP)[6] 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.

The selection of specific option is balanced between the need for reporting accuracy and precision with the amount of money expended in terms of energy savings and reductions. Therefore, for the NCPA evaluations, most of these methods focused on the lower-cost strategies given the relatively small overall budgets for these organizations, the limited resources, and the narrow focus of the programs.

The consultants selected the appropriate E,M&V by collaborating with each NCPA member and then identified the appropriate E,M&V option that best matched the level of rigor required for each project verified and each program's budget constraints. Table 3 provides an example of how these E,M&V options map to the measures that are typically found in many of in the NCPA member programs.

For example, in assessing a lighting program impacts, it may be sufficient to just use Option A – which relies on deemed savings estimates for these measures. In more complex installations involving multiple measures such as HVAC and lighting controls, the most effective approach to document energy savings is through billing analysis and simulation modelling. In general, the deemed savings estimates were used to document impact evaluation savings unless the measures installed were so inter-twined that they required on site metering and billing analysis. This was most common for programs that involve rebating a variety of energy efficiency measures, such as lighting, refrigeration, building shell measures, and combinations thereof.

6. International Performance Measurement and Verification Protocol, US DOE, Revised March 2002.

Table 3: Assignment of IPMVP EMV& Protocols to a Sample of Program Measures

Measure Category	IPMVP Option				Comments
	A	B	C	D	
High-Efficiency lighting equipment	✓				Constant performance, low uncertainty in performance parameters
Lighting controls (occupancy sensors)	✓				
Lighting controls / daylighting		✓		✓	Can be analyzed with either end-use metered data set or simulation model
High-Efficiency HVAC equipment		✓		✓	Pre-/post-installation metering can be used alone or to prepare inputs to simulation models
HVAC Diagnostics		✓		✓	Datasets such as outputs from diagnostic tools may be used as analysis inputs
HVAC Quality Installation		✓		✓	Datasets such as outputs from diagnostic tools may be used as analysis inputs
High-efficiency motors	✓				
Variable speed drives		✓			
Building envelope measures				✓	
Weatherization			✓	✓	Billing record analysis is often used; since measures are envelope, simulation modeling is also effective
New construction whole house performance			✓		
Refrigeration measures		✓	✓		
Process measures			✓		
Appliances	✓	✓			
Water heaters and hot water measures	✓				

Key lessons learned and best practices

The result of this team effort provides several key lessons and highlights best practices that other utilities can use to cost-effectively implement E,M&V:

USE ESTABLISHED INDUSTRY PROTOCOLS

The resurgence of interest in the development, deployment, and evaluation of DSM programs has led to a greater standardization of industry requirements. This has also led to development of accepted practices and guidelines such as the National Action Plan for Energy Efficiency[7] Guidelines and the IMPVP E,M&V protocols as well as California Energy Efficiency Evaluation Protocols[8]. The evaluation team consulted and incorporated these guidelines in developing both the process and impact evaluation plans for the NCPA participating members.

7. http://www.epa.gov/cleanenergy/energy-programs/napee/index.html
8. http://www.cpuc.ca.gov/PUC/energy/electric/Energy+Efficiency/EM+and+V/

TARGET THE MOST IMPORTANT PROGRAMS

The evaluation team also recognized that, given the limited staff and funding, none of the smaller utilities would be able to complete comprehensive program evaluations in time to meet the reporting guidelines. Therefore, the team reviewed each NCPA member's current level of activity for each DSM program and targeted those energy efficiency programs that represented the largest budget expenditures and/or energy savings. For some utilities, such as the City of Roseville and Redding Electric Utility, the largest emphasis was placed on residential programs, specifically focusing on residential lighting and heating and cooling systems. However, other utilities, such as Turlock Irrigation District, the emphasis was on commercial and industrial energy programs, since they represented the largest component of the energy efficiency costs and savings benefits.

ALLOW TIME IN THE PROCESS FOR MUTUAL EDUCATION AND TO BUILD TRUST

Small utilities face a steep learning curve when tackling program evaluation for the first time. If possible, the evaluation team needs to allow time to work with the utilities in order provide education on the benefits of evaluation and to build trust. The importance of establishing this time for trust has been documented by Broc et al (2007).

To help utilities overcome this steep learning curve, NCPA and the Summit Blue consultants developed a series of workshops and planning meetings. This allowed the utilities to learn about evaluation concepts while helping the evaluation team to understand the unique aspects of each individual utility. The result was mutual education and a better understanding by all on how to develop effective evaluation plans.

REVIEW, STREAMLINE, AND INTEGRATE DATA COLLECTION AND DATA TRACKING SYSTEMS.

Utility data collection and data tracking systems are typically set up to meet program administrator needs for internal reporting. Therefore, an essential first step in any evaluation effort is to review and make recommendations for integrating evaluation-specific data collection into the program implementation process. Not only will this streamline and reduce the costs of future program evaluations, it is also very likely to streamline and reduce costs of program implementation.

In fact, several of the utilities were so pleased by the recommendations they received from these reports that they have already implemented the suggested changes in advance of the next program evaluation. Therefore, these E,M&V activities provided an excellent learning opportunity for program staff and will result in better managed programs moving forward.

BEING SMALL DOES NOT REQUIRE SACRIFICING QUALITY

Small utilities with resource and staffing constraints can effectively work together to collaboratively implement E,M&V for their energy efficiency programs. NCPA and it members pursue joint action when it produces consistency, provides for economies of scale, and allows enough flexibility to tailor solutions to meet individual utility needs. Following these principles for effective collaboration allowed NCPA members to implement E,M&V in a cost-effective manner without sacrificing quality.

A common misconception in developing E,M&V programs is that the process has to be expensive. For this collaborative effort, the evaluation team was able to identify cost-effective alternatives for several utilities that would best meet their needs without sacrificing the overall quality of the work completed or the validity of the results.

Another approach was to compare the current program requirements with the ENERGY STAR® standards and qualifications. Since these standards have recently changed, this provided the evaluation team with recommended program improvements based on current market conditions. Moreover, this approach ensured that the NCPA member utilities would be targeting the equipment and appliances that would help them achieve the most energy savings impacts. This approach was incorporated in the E,M&V plans for all of the participating NCPA utilities.

The development of the DEER database NCPA created a standard set of savings estimates that would meet about 80% of the utility's needs. This pooling of resources provided a higher degree of accuracy in preparing program impacts and also effectively leveraged the combined strength and resources of all California publicly-owned utilities. Therefore, all the NCPA utilities were able to rely on the deemed savings approach because they had jointly funded the development of this database, rather than having to provide specific savings estimates for each measure in each territory. So instead of requiring an evaluation that would cost more than $20,000 per utility, most of these evaluations were completed for less than $10,000.

The NCPA utilities are continuing to look for ways to collaborate and cost-share on future E,M&V tasks. Several utilities will use a multi-year approach in implementing their evaluation plans. Each year, one or more elements of the evaluation plan will be implemented until the all of the plan's recommendations have been completed. The initial efforts consist of a strategic evaluation plan, including a timeline for implementing the various recommendations from the E,M&V activities. This helps the utilities to keep their annual evaluation budget within reason while still comprehensively evaluating their programs.

CONDUCT EVALUATIONS ACROSS MULTIPLE UTILITY TERRITORIES

NCPA utilities will consider pursuing a collaborative effort across their entire service territories as a way to cost effectively evaluate the following energy efficiency program measures that are not large enough to warrant separate E,M&V efforts. This collaboration will help to standardize the estimated impacts that each NCPA utility reports and will provide a way to identify savings that may otherwise not be possible to attribute to each program. Measures under consideration for this effort are residential CFLs and audits.

- **Residential CFL Lighting:** many NCPA member utilities currently provide CFLs through give-aways or discounts. In both cases, the savings attributed to these activities are not verifiable since there is no information available regarding how and where the bulbs were installed. These utilities plan to conduct a joint CFL lighting impact evaluation study to better assess current CFL installation rates, measure persistence, hours of use, free ridership, and free drivership rates. These findings will then be calibrated based on number of customers, number of light bulbs, and other demographic variables, so each NCPA member can report its savings es-

timates in a similar manner. This approach is similar to the DEER database strategy, however will only focus on CFLs.

- **Residential Audits**: several NCPA utilities also offer free home energy audits. However, savings from some of these audits do not get reported because they are not verifiable. Thus, some NCPA utilities may be under-reporting program-induced savings. As a way to better determine program savings, several NCPA member utilities are considering participating in a larger impact evaluation. This impact evaluation across several NCPA members will determine reasonable savings estimates for each NCPA member to use in Program Years 2009 and 2010.

REPORT FINDINGS CONSISTENTLY TO FACILITATE INFORMATION SHARING

These E,M&V reports needed to offer reporting consistency for NCPA as a whole, while also allowing for some customization to reflect the specific programs that were the subject of each E,M&V report. Since some program evaluations focused only on one market segment, such as residential, commercial, or industrial markets, and given the disparity of the spending levels for these member utilities, the consulting team developed a consistent outline that was then modified for each utility report based on the specific focus of each E,M&V project.

Conclusion

This paper illustrates how small utilities can effectively implement program evaluation that is both cost-effective and comprehensive. NCPA and the Summit Blue consultancy worked together to develop an evaluation, measurement, and verification framework to properly document the results achieved through their energy efficiency programs. The key lessons learned and best practices developed from this effort include:

- Utilize readily available and industry-accepted resources to optimize evaluation efforts
- Prioritize and target programs for evaluation
- Allow time to educate and build trust
- Review, streamline, and integrate data collection and data tracking systems
- By working together to collectively implement E,M&V utilities can produce consistent results and achieve economies of scale, while still allowing for tailored solutions to meet individual utility needs.
- Report findings in a consistent manner to facilitate information sharing

Comprehensive program evaluation is no longer just for large utilities. Creative solutions for assisting small utilities through evaluation efforts are needed and will continue to evolve in the near future as the demand for this service grows nationally.

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Acknowledgements

We would also like to thank the 12 utilities that are participating in these E,M&V studies for allowing us to share their lessons learned with the European energy efficiency community.