SURVEY OF ENERGY EFFICIENCY EVALUATION MEASUREMENT AND VERIFICATION (EM&V) GUIDELINES AND PROTOCOLS

An INITIAL REVIEW OF PRACTICES AND GAPS AND NEEDS

Submitted to:

Pacific Gas and Electric Company

Prepared for:

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Disclaimer

The opinions expressed in this survey report are not necessarily those of the authors, individual survey participants, the Pacific Gas and Electric Company, the California Public Utilities Commission, or members of the EM&V Outreach Initiative Advisory Committee.

Executive Summary

This report documents a survey of energy-efficiency program evaluation, measurement and verification (EM&V) practices, primarily in the United States. As the level of energy-efficiency activity continues to rise, so does the importance of conducting evaluations in order to document the benefits of energy efficiency. However, as important, if not more so, is using evaluation to learn what works, and does not work, in order to maximize energy-efficiency benefits and justify further investments. Thus, the survey was intended as a heuristic exercise to identify the evaluation resource documents that are utilized and identify gaps and needs associated with program evaluation.

In addition to surveying energy-efficiency programs that are focused on saving energy, the survey also reviewed some programs in which efficiency is used as an emissions, including greenhouse gases (GHG), avoidance mechanism. This report includes chapters that summarize (1) guidelines and approaches that are used for energy-efficiency and climate mitigation evaluation, (2) gaps and needs, and (3) recommendations. There are several appendices, including ones that summarize California evaluation activities and list commonly used evaluation resources. The survey instruments and a list of the survey respondents are also included in appendices.

There were 20 survey respondents (about a 40% response rate) from outside of California as well as several utility and state program representatives from within the state. Survey respondents implement, administer and/or evaluate a wide range of energy-efficiency program types. These include energy-efficiency resource and/or market transformation programs, outreach and training, and emerging technology programs. A few respondents also reported involvement with climate mitigation programs, with or without an energy-efficiency element, and codes and standards programs. The respondents also conduct a wide range of impact, cost-effectiveness, process, and market evaluation activities. It should be noted that the survey sample was not scientifically drawn and cannot be considered to be a statistically valid representation of evaluation practices or opinions. In particular, since many of the survey participants were very experienced evaluation professionals, the opinions of those with limited experience are not well represented.

A list of the evaluation resources used by survey respondents is included in Chapter 2 of this report. Some of the most commonly referenced resources are the 2002 *International Performance Measurement and Verification Protocol (IPMVP)* and the 2006 *California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals*. The most commonly cited climate related protocols are the 2003 World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* and the 2005 WRI and WBCSD *GHG Protocol For Project Accounting*. Several databases are also well utilized by those active in the evaluation community. These are the *California Measurement Advisory Council (CALMAC)* publication database, the California Public Utilities Commission *Database for Energy Efficiency Resources (DEER)* and the Consortium for Energy Efficiency's *Market Assessment and Program Evaluation (MAPE) Clearinghouse*.

The following general categories of EM&V gaps and needs were identified:

- Access to transparent, well-documented, and accurate databases with energy and peak savings data; savings persistence data; and market data, such as penetration rates, behavioral response/market effects, and market potential data
- Training resources for current and new program evaluators, implementers and administrators
- Consistent evaluation guidelines with a common set of evaluation definitions
- Guidance information and tools for:
    - Setting criteria for defining analysis rigor and calculating uncertainty
    - Calculating avoided emissions, particularly greenhouse gases
    - Defining consistent, cross-jurisdictional, definitions of cost-effectiveness and non-energy co-benefits
    - Calculating peak demand reductions
- Adequate funding for evaluations and evaluation databases, such as those listed above

Recommendations are described in the last chapter of the report. The recommendations reference the need for additional resources for the evaluation of energy-efficiency programs. Three categories of resources are identified: guidance documents, databases of evaluation related information, and training. To fulfill these resource requirements, collaborative efforts with state, regional and national organizations, including regulatory bodies, throughout the US and internationally, are recommended. Such collaboration should include developing improved tools for sharing information and promotion of their use. This can facilitate improved and cost-effective evaluation, which in turn should promote energy-efficiency activity.

1. Introduction and Survey Methodology

1.1 Background

Energy efficiency is a critical resource for sustaining economic growth in California, the US and internationally, particularly in developing countries. Energy efficiency is also a key mitigation strategy for addressing climate change. California's energy-efficiency programs are expected to represent a significant percentage of the emission reductions required to meet California's Global Warming Solutions Act of 2006 (AB32) year 2020 greenhouse gas emission goals. With the urgency of climate change requiring both immediate and long-term actions and the volatility of energy markets, the importance of efficiently using energy in California and throughout the world is clear.

There are several technical and policy issues associated with the full use of cost-effective energy efficiency and incorporating efficiency into energy resource programs. Having consistent, complete, accurate and transparent evaluation, measurement and verification (EM&V) mechanisms for documenting energy savings and emission reductions is one such issue. Indeed, having effective EM&V infrastructures that document the energy and environmental benefits of stationary electricity and natural gas end-use energy-efficiency projects and programs is critical to the success of energy-efficiency and climate mitigation programs.

In response to this critical need, in 2006, California public agencies, utilities, environmental and other groups initiated a project to support energy-efficiency EM&V best practices in California, nationally and internationally. The California Evaluation Outreach Initiative is aimed at addressing EM&V issues in order to accelerate the implementation of energy efficiency. While the focus is on energy efficiency as a resource, the Initiative also addresses emission reductions associated with energy efficiency and demand response to the extent the EM&V issues are closely related. This survey project is an activity of the Initiative.

1.2 Survey Scope

This report documents the findings and related recommendations of a small-scale survey of energy-efficiency and climate mitigation program EM&V activities. The survey is intended as a heuristic study to direct attention, help define evaluation guideline needs and, as appropriate, stimulate further investigation. As such, this survey report is an initial review of evaluation activities throughout California, the US and to some degree internationally. The focus is on what guidelines and protocols are being used, what general approaches are being used, and what gaps and needs exist with respect to energy-efficiency resource and climate mitigation program EM&V.

The following two chapters summarize (1) guidelines and approaches that are used for energy-efficiency and climate mitigation evaluation, and (2) gaps and needs. The last chapter provides a brief list of recommendations. In addition, there are five appendices. Since this report was sponsored by a California group, the first appendix summarizes California investor-owned utility (IOU) and municipal utility program evaluation activities, the California Energy Commission's

related programs, including the State's codes and standards programs, and, briefly, California climate change mitigation programs. The second appendix lists people and organizations that participated in the survey. The third appendix lists references and resources, including a sample of Web sites for evaluation documents and resources, and the final two appendices offer the data collection survey instruments used.

1.3 Survey Methodology and Participants

In order to meet the survey's above-listed primary objective, data were collected through telephone interviews with industry experts, written surveys of energy-efficiency and evaluation and program professionals (both consultants and project managers), and secondary research using industry Web sites, EM&V protocol/guideline documents and prior studies. Two of these studies are the very valuable national energy efficiency best practices study conducted by Quantum Consulting for the CPUC (Quantum 2004) and the Northeast Energy Efficiency Partnership's evaluation protocol survey report (NEEP 2006).

Two survey instruments were designed to solicit and capture information on the use, and gaps and needs of industry EM&V guidelines and protocols. One was for evaluation consultants and another for program administrators or individuals representing industry organizations such as the American Council for an Energy-Efficient Economy (ACEEE). The survey instruments collected information on three main areas: program or portfolio type, EM&V information, and EM&V needs and gaps. The survey instruments are found in Appendices D and E. Input on these instruments and suggestions for additional survey participants were garnered in telephone interviews with a select group of experts with considerable experience as evaluators, developers of EM&V guidelines and/or authors of other reports on protocol use. These same interviewees provided responses to survey questions, as well.

Final survey instruments were e-mailed to 24 evaluation consultants and 22 program and organizational representatives (for programs outside of California). These potential survey participants were selected because of either their expertise or experience as an evaluation professional and/or because they were energy-efficiency or program managers in the US or Canada. Completed surveys were received from 16 of the consultants and four program/organizational representatives. A list of respondents and interviewees is found in Appendix B. The Appendix B list includes California survey respondents who were contacted directly.

It is important to understand that this survey was not based on any form of statistical sampling of participants or attempt to segment the participants by type of programs, experience, evaluation philosophies or the like. Almost all of the survey respondents are experienced evaluation consultants or program managers/evaluators. Most of the less experienced people who were sent surveys declined to participate. Thus, over-generalizing the results is not recommended. Instead, the survey provides information on trends and issues and provides a sense, but not a full picture, of how energy-efficiency evaluation is conducted. The gaps and needs, in particular, are from the perspective of very experienced energy-efficiency evaluation professionals – although, they were asked to consider their needs as well as those with less or no EM&V experience.

2. Energy-Efficiency and Emissions Avoidance Program Evaluation Guidelines And Approaches

2.1 Energy-Efficiency Program Evaluation

Surveys of over 20 energy-efficiency professionals, representing efforts across many US states and Canada, led to the discernment of the following patterns.

2.1.1 Program/Portfolio Summary

The vast majority of respondents implement, administer and/or evaluate energy-efficiency resource and/or market transformation programs. Energy-efficiency outreach and training, and emerging technology programs were also well represented in the survey. Only a few respondents reported involvement with climate mitigation programs,[1] with or without an energy-efficiency element, and codes and standards programs. Limited numbers of "other" program types were also listed, including renewables acquisition programs and those used to document climate impacts to justify emission avoidance credits.

There was an even distribution of responses across program administrator/implementer types of "utility," "not-for-profit" and "other," including teams of state government and private firms, and state government and not-for-profit organizations.

Most respondents' programs or programs evaluated targeted "all" primary market events (new construction, retrofit, and customer education and outreach), and "all" end-users markets (residential, residential low income, commercial, industrial, agricultural and public facilities). When "all" was not selected, residential low income tended to be the end-user market excluded. Some also reported targeting "other" primary market events including operations and maintenance, and equipment replacement.

Program objectives varied somewhat, but all included specified energy-savings goals (kW, kWh and therms), most with a longer-term goal of meeting future energy needs and improving system reliability. Several also specified goals to improve the environment and local economies, as well as the health and well-being of local communities.

2.1.2 Evaluation Summary

When reviewing this portion of the report it is important to remember that the survey is not a "scientific survey" but more of a semi-random sampling of mostly experienced evaluation consultants and managers.

- **Evaluation "Philosophies"**

Only program and organizational representatives were asked questions specifically on evaluation "philosophy," including queries on evaluation frequency, requirements, budgets and implementers.

[1] Although anecdotal information indicates a great deal of interest in greenhouse gas (GHG) mitigation programs involving energy efficiency.

All these respondents reported that evaluations were conducted on an on-going and/or annual basis and were required by external bodies (e.g., regulators) and/or internally by the program implementer/administrator. In 75 percent of cases, evaluation results had to be approved by external parties.

Outside of California, EM&V budgets ranged from 1.62 percent - 3.1 percent of overall program/portfolio budget, and from $1.3 M - $3.6 M. However, the largest non-California EM&V budget ($3.6M) did not correspond to the largest percentage of overall budget, but only about 2.1 percent of budget. In California, the evaluation budget for the 2006-2008 IOU programs is $163 M or about 7.6 percent of authorized program funding.

All respondents reported that third parties were used to evaluate their programs/portfolios. Generally, these third parties were managed by the program implementer/administrator who had chosen the third parties through a competitive bid process. In a few cases, internal resources were also used for M&V and market research. Although third parties were used for program evaluation, all respondents also used EM&V information resources themselves, including internal staff and government agencies.

- **Evaluation Objectives & Approaches**

The majority of respondents conducted process, impact and market evaluations. Some indicated that other types of studies were also performed, including technology evaluations, demand response and renewable program evaluations, product and service development evaluations, management audits and assessments, net-to-gross ratio and spillover studies, economic benefit analyses, emission reduction analyses and program theory and logic studies.

All respondents had evaluation objectives of documenting energy savings, verifying cost-effectiveness and improving program performance. Half of those surveyed also aimed to document emission reductions. None reported using evaluations specifically to confirm performance for approval of payments or assessing of penalties. However, for some performance contracting programs this is clearly a function of the measurement and verification activities.

In addition to energy benefits, respondents reported that they are now measuring such non-energy benefits as job creation, net economic benefits, environmental benefits (including GHG emission reductions), health and safety, water savings, community nuisance (e.g., reduced dust), market transformation and product improvement. The approaches being used for these evaluations are likely worthy of further investigation to inform other potential similar evaluations.

When evaluating savings from projects, most respondents use a combination of sample and census. All make adjustments to calculate net (versus gross) savings – although it is known that in some states, only gross savings are calculated. A variety of net-to-gross considerations and factors were reported such as adjustments for switch reception and signal transmission (for residential direct load control), free-ridership (naturally-occurring adoption), and market effects such as spillover.

One respondent stated that net impacts are calculated for all programs on an annual basis, using a screening process that allows evaluators to sort programs into a continuum ranging from participant-based to market-based analysis. This screening and sorting is based on how programs are designed and delivered and what data are available. Full attribution (net-to-gross ratio, NTGR) consists of measurement of free-ridership, and participant and non-participant spillover. For this respondent, market-based analysis occurs only when there is evidence that the program is likely to have influenced the broader market in measurable ways.

Most respondents felt that their EM&V objectives were generally being met in many, if not all, ways and that EM&V activities provide (at a minimum) insights into or (in best case) a solid, defensible basis for assigning full or partial credit to program achievement. The evaluation results are also used for program improvement. Respondents indicated that when EM&V activities did not meet their objectives it was usually because the evaluation objectives were not clearly stated from the beginning at the highest levels and evaluators are not given clear guidance from regulators and political leaders. Budget concerns, most usually perceived insufficient evaluation funding, were also very common.

- **Evaluation Guidelines**

All respondents reported using at least one EM&V protocol or guideline document, and many reported using several, although some are not required to do so. The requirement of EM&V protocol or guideline documents did not appear to correspond to the type of program/portfolio evaluated, but rather more to the general evaluation philosophy, available funding and region's overall level of commitment to energy efficiency as indicated by the history of, scope of and funding provided for programs and related legislative activity. Most respondents indicated a belief in the need to accurately measure, verify and evaluate program results, but many felt limited by the amount of resources available to conduct EM&V.

Almost 60 percent of respondents use the *International Performance and Verification Protocol* (IPMVP) (EVO 2002), which is required by two and referred to by four of the US states from which responses were received, and is required by the Ontario (Canada) Emission Trading Code for energy-efficiency set aside credits. It should also be noted that some other guideline documents (e.g., the FEMP M&V Guidelines V 2.2 (US FEMP 2000), ASHRAE Guideline 14 (ASHRAE 2002) and the 2006 California Energy Efficiency Evaluation Protocols (CPUC 2006)) are based on and/or intended to be compatible with the IPMVP. Users feel the IPMVP to be a citable source to support decisions on M&V, providing a useful general framework of options and definition of terms. The IPMVP is the leading international standard in energy-efficiency M&V protocols. It has been translated into 10 languages and is used in more than 40 countries.

Half of respondents use the 2006 *California Energy Efficiency Evaluation Protocols* (California Protocols) (CPUC 2006) which is required for evaluations of post-2005 California IOU energy-efficiency activities. Comments on the most useful aspects of the 2006 California Protocols, which one respondent called "state of the art protocols" for resource acquisition programs, tended to center on its intentional flexibility married with its detailed "spelling out" of such things as the required level of rigor for project types, reporting requirements and reporting table formats. This combination makes it useful for comparing and contrasting methods and analysis to better defend results and establish relevancy and credibility. This same detailed and yet flexible approach led some to feel that the 2006 California Protocols are also important as a

resource for attempts towards consistency on a national and international basis for program impacts that are going to be used to justify public and private funding for issues such as climate change. The 2006 California Protocols reference to required resource documents and data sources was also found useful. However, some respondents also felt that adherence to the 2006 California Protocols increased scope and costs to the point of being prohibitive. Some users find the 2006 California Protocols wanting in the areas of showing a path from program evaluation to GHG credits or certification, and its discussions of skills required and indirect impacts.

The 2004 *California Evaluation Framework* (CPUC 2004), from which the 2006 California Protocols grew, is also used by close to half the respondents. One respondent called it an overall "great" reference document, and the most comprehensive evaluation framework yet developed. Respondents commented on its strong impact evaluation, sampling, error ratio and cost-effectiveness sections, appendices and bibliography. Others reported it as a good "primer" and training tool for new analysts. However, at least one respondent didn't feel it was "up to the GHG task."

The 2001 *Framework for Planning and Assessing Publicly Funded Energy Efficiency* (Sebold 2001), prepared for California IOU Pacific Gas and Electric Company (PG&E) and used by over a quarter of respondents, was similarly praised as a strong reference document and training tool, and as a citable source for support decisions on M&V.

Twenty-five percent of respondents refer to the California Demand Side Management Advisory Committee (CADMAC) *Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs* (initially adopted by the CPUC in 1993 for use in California and with subsequent revisions until 1999), including its Appendix J: "Quality Assurance Guidelines for Statistical, Engineering, and Self-Report Methods for Estimating DSM Program Impacts Models" (CPUC 1998).

The *Technical Reference Manual* (TRM), prepared by Vermont Energy Investment Corporation (VEIC) and required in Vermont, and *Northwest Regional Technical Forum* (RTF) documents were each used by about a fifth of respondents. While no specific comments were submitted on the TRM, the RTF was lauded as having valuable savings models, deemed savings values (primarily for the northwest US), good detailed documentation and numerous evaluated technologies. However, some felt it was only a good starting point and reference, which can be difficult to use to get to regional consensus among parties, and one respondent found its up-keep and organization to be "suspect."

The 1999 *Guidelines for the Monitoring, Evaluation, Reporting, Verification, and Certification of Energy-Efficiency Projects for Climate Change Mitigation* (LBNL 1999) was reported used by 13 percent of respondents, but no comments were offered on it specifically.

The remaining documents either asked about in the survey, or specified as an "other" protocol/guideline document by respondents, were each referred to by four to eight percent of respondents. Of these, the ASHRAE Guideline 14 (ASHRAE 2002) was noted as providing a good definition of uncertainty calculations, and the 2000 FEMP M&V Guidelines (US FEMP 2000) as having useful specific ECM guidance. The 2004 *New Jersey Clean Energy Program*

Protocols to Measure Resource Savings, which is required in New Jersey, was described as a document that clearly defines the assumptions, inputs and algorithms used to calculate energy savings. The 2006 *Protocols for Estimating the Load Impacts from DR Program* (CPUC, Protocols for Estimating, 2006) proved helpful to one respondent in determining appropriate protocols for demand response, as they differ from energy-efficiency evaluation. EPRI's 1991 *Impact Evaluation of Demand-Side Management Programs, Volume 1: A Guide to Current Practice* (EPRI 1991) was noted as useful for statistics and adjusting engineering models for impact evaluations.

Table 2.1: EM&V Protocol/Guideline Documents Used and Required*

Protocol/Guideline Document	Percent of Respondents Reporting Use	States Requiring Use
2002 International Performance Measurement and Verification Protocol (IPMVP)	58%	New York (for commercial performance program), Texas (note: the following states refer to IPMVP, but do not require it: Idaho, Montana, Oregon, Washington) Also required by the Ontario Emission Trading Code for EE set aside credits
2006 California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals	50%	California (IOUs for post-2005 energy-efficiency activities)
2004 California Evaluation Framework	46%	
2001 [California] Framework for Planning and Assessing Publicly Funded Energy Efficiency Programs	29%	
CADMAC Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs, including its Appendix J: Quality Assurance Guidelines for Statistical, Engineering, and Self-Report Methods for Estimating DSM Program Impacts Models (last revised in 1998)	25%	California (IOUs) – initially adopted by CPUC Decision 93-05-063, with subsequent revisions pursuant to Decisions 94-05-063, 94-10-059, 94-12-021, 95-12-054, 96-12-079, 98-03-063 and 99-06-052

Protocol/Guideline Document	Percent of Respondents Reporting Use	States Requiring Use
Northwest Regional Technical Forum (RTF) documents	17%	
Technical Reference Manual (TRM) (prepared by Vermont Energy Investment Corporation)	17%	Vermont
1999 Guidelines for the Monitoring, Evaluation, Reporting, Verification, and Certification of Energy-Efficiency Projects for Climate Change Mitigation (prepared by LBNL for US EPA)	13%	
2004 Protocols to Measure Resource Savings (New Jersey Clean Energy Program)	8%	New Jersey
ASHRAE Guideline 14	8%	
US DOE FEMP Guide V 2.2	8%	
WRI/WBCSD GHG Protocol for Project Accounting	8%	
2005 Program Savings Documentation (PSD) (prepared as part of C&LM plan filing)	4%	Connecticut
2006 US Dept of Energy EERE Guide for Managing General Program Evaluation Studies	4%	
2006 Protocols for Estimating the Load Impacts from DR Program	4%	
1991 Impact Evaluation of Demand-Side Management Programs; Volume 1: A Guide to Current Practice	4%	

*Table based on survey responses and secondary source documents including the above-mentioned NEEP report on EM&V protocols in the Northeast US (NEEP 2006) and the 2006 National Action Plan for Energy Efficiency (US EPA 2006).

Other resources reported as being used to prepare program EM&V requirements include databases (e.g., utility savings databases, California's DEER database), codes and regulatory documents (e.g., 2002 Energy Conservation Construction Code of New York State and EPAct), previous evaluations and related annual reports, software, primary statistical reference books (particularly those cited in protocol and guideline documents), and qualitative choice analysis training documents.

Since the focus of this survey was the United States and Canadian activities there was not much

awareness of other international activities associated with evaluation. For example, in Europe, one notable document is the evaluation guidebook prepared by the International Energy Agency, *Evaluating Energy Efficiency Policy Measures & DSM Programmes* (IEA 2005). Another European activity is the ongoing effort associated with Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on Energy End-Use Efficiency And Energy Services. This Directive sets savings goals for member countries and there has been a subsequent evaluation effort established. More information can be found on the European Union portal site, "EUROPA" at http://ec.europa.eu/energy/demand/index_en.htm.

2.2 Climate and Emission Program Evaluation of Energy Efficiency

Energy efficiency avoids emissions by lowering the demand for fossil fuels used in the production of electricity and/or thermal energy. Historically, emissions avoidance from efficiency projects have been described only subjectively, not systematically, as a non-quantified benefit. However, with the development of emission trading programs and other environmental market mechanisms, there is now an opportunity to (a) utilize efficiency projects as part of effective emission control strategies, and (b) monetize the emission reduction benefits associated with energy efficiency (Schiller 2006). While criteria pollutants such as Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), and Sulfur Dioxide (SO_2), as well as toxic pollutants such as Mercury (Hg) can also be avoided by energy efficiency, recently there has been a increasing focus on greenhouse gas emissions, principally Carbon Dioxide (CO_2). Energy efficiency is particularly important for the energy industry because approximately 61 percent of all human induced (anthropogenic) GHG emissions (and about 75 percent of all CO_2 emissions) come from energy-related activities (the breakout of energy related GHG emissions is estimated at: electricity and heat 40 percent, transport 22 percent, industry 17 percent, other fuel combustion 15 percent and fugitive emissions 6 percent) (Baumert 2005).

Several existing emission control programs that address the stationary energy production industry have long recognized the value of energy efficiency. The US Acid Rain Program and the US NO_X SIP Call Program include specific mechanisms for including efficiency as a pollution recognition mechanism. Each also has evaluation guidance tools for calculating reductions (US EPA 1995, 2007). However, there has been limited guidance specifically available for calculating avoided GHG emissions. This is starting to change with some activities at the state and national levels, and internationally.

These greenhouse gas/energy-efficiency *evaluation* activities revolve around what are generally known as *project protocols* – guidance or requirements for how to calculate emission reductions from specific GHG mitigation activities. Simply speaking, the process for calculating emission reductions follows this format:

1. A baseline is defined that takes into account considerations of what would have occurred in the absence of the energy-efficiency activity;
2. With the project or program implemented, a project level of energy consumption is defined;
3. Energy savings are determined by comparing baseline and project energy

consumption; and

4. Emission factors are applied to energy savings in order to determine avoided emissions.

Table 2.2 below lists some of the climate-related programs and activities for which project protocols have been developed or are under consideration.

Table 2.2 – Emissions-Related Program & Activity EM&V Protocols: A Selection of Those Existing & Under Consideration

Program or Entity	Program/Entity Description	Protocol Title/Status/ Description
U.S. Acid Rain Program	Created by Congress in Title IV of the 1990 Clean Air Act Amendments. The overall goal of the program is to achieve significant environmental and public health benefits through reductions in emissions of SO_2 and NO_x, the primary causes of acid rain. Specifically, the program seeks to limit, or "cap," SO_2 emissions from power plants at 8.95 million tons annually starting in 2010, authorizes those plants to trade SO_2 allowances, and reduces NO_x emission rates. In addition, the program encourages energy efficiency and pollution prevention.	*Conservation Verification Protocols: A Guidance Document for Electric Utilities Affected by the Acid Rain Program of the Clean Air Act Amendments of 1990.* Prepared in 1995.
U.S. EPA NO_x State Implementation Plan (SIP) Call	A multi-state program to reduce NO_x that includes a voluntary provision for states to set aside emission allowances for renewable energy and efficiency projects and programs.	*"Evaluation, Measurement and Verification of Electricity Savings for Determining Emission Reductions."* Prepared by Schiller Consulting and to be published by EPA in 2007
U.S. EPA ENERGY STAR® Programs	The U.S. EPA has a variety of ENERGY STAR programs, such as labeling and housing.	A summary of EPA/DOE ENERGY STAR program evaluation is in this report: http://www.epa.gov/appdstar/pdf/CPPD2005complete.pdf.
The Climate Trust	An Oregon entity that provides greenhouse gas offset projects for industry, utilities, and individuals.	The Climate Trust is establishing some project protocols, they expect to include some for efficiency.

Program or Entity	Program/Entity Description	Protocol Title/Status/ Description
Texas SIP	This plan includes a credit of 0.5 tons/day NO_x emissions reductions for enacting a building code that includes specific energy-efficiency requirements for new construction.	This program is in place.
UNFCCC Clean Development Mechanism (CDM)	For signers of the Kyoto Treaty, this is a program that allows GHG emitters in developed countries to "take credit" for GHG reduction projects (or programs) they implement in developing countries. This provides dual benefits of low-cost emission reduction programs and expertise and technology export opportunities for developed countries and sustainable development, infrastructure improvements for developing countries.	There are a few methodologies that have been developed for CDM energy-efficiency projects. See *Arquit 2006* for summary of CDM energy efficiency activities.
Wisconsin Focus on Energy Program	The State of Wisconsin has reported estimated emissions savings NOx, SOx, CO_2 and Hg from its Focus on Energy efficiency efforts. The State's work includes estimates of the potential value of tradable emission credits produced by Focus on Energy programs.	This work is now being updated.
World Resources Institute (WRI) Greenhouse Gas Protocol Initiative	A multi-stakeholder partnership of businesses, NGOs, governments and others convened by the WRI and the World Business Council for Sustainable Development (WBCSD). Its mission is to develop internationally accepted accounting and reporting protocols for corporate emissions inventories and greenhouse gas mitigation projects and to promote their use by businesses, policy makers, NGOs and other organizations.	The WRI Initiative's *Corporate Accounting and Reporting Standard*, and *Project Protocol* are the most well known of the number of protocol efforts specifically associated with documenting GHG baselines, and to a lesser degree reductions. An electricity sector protocol is being prepared by WRI.
Lawrence Berkeley National Laboratory (LBNL)	LBNL developed a guide for the US EPA that describes a general process for defining and validating emission reductions fro energy efficiency programs	1999 *Guidelines for the Monitoring, Evaluation and Reporting, Verification, and Certification of Energy-Efficiency Projects for Climate Change Mitigation*

Program or Entity	Program/Entity Description	Protocol Title/Status/ Description
California Public Utilities Commission (CPUC) Initiatives	These initiatives include the addition of CO_2 costs and risk to energy procurement decisions and a carbon cap for investor-owned utilities.	The CPUC is investigating developing emission reduction estimates from its portfolios of energy-efficiency programs by applying emission factors to energy savings.
PG&E Voluntary Climate Protection Program (ClimateSmart)	In the spring of 2007, PG&E will launch ClimateSmart, a voluntary program that will allow its customers to take action to reduce greenhouse gas emissions and make their home or office energy use "climate neutral."	There will be project protocols for this program prepared by the California Climate Action Registry.
State GHG Registries	A few climate (GHG) registries have been established by US States. The most prominent is the California Climate Action Registry.	The California Registry has prepared project protocols, but none on energy efficiency to date. There will likely be protocols developed by the California Registry or others, including the new Multi-State Climate Registry.
National Action Plan for Energy Efficiency	The Action Plan was established to support energy-efficiency activities in the United States.	An Energy Efficiency Program Evaluation Guide is being prepared for publication in 2007.

3. EM&V Gaps And Needs

Gaps and needs were identified from survey responses and through conversations with evaluation experts across the United States. These are summarized in Table 3.1 and discussed below.

Table 3.1: EM&V Gaps and Needs Summary

Consistent evaluation guidelines with common set of evaluation definitions and references to other evaluation resources
Access to transparent and accurate databases of energy savings and savings persistence data for various project and technology types
Market data, such as penetration rates, behavioral research/market effects, and potential data for determining baselines and market net-to-gross ratios
Guidance information and tools for: ▪ Setting criteria for analysis rigor and calculating uncertainty ▪ Calculating avoided emissions, particularly greenhouse gases ▪ Calculating cost-effectiveness ▪ Calculating non-energy, co-benefits ▪ Calculating peak demand reductions
Training of current and new program evaluators
Adequate funding for actual evaluations and evaluation databases

3.1 Guideline Consistency

Respondents were divided in their opinions on the need for cross-jurisdictional guideline consistency. While a majority did feel that consistency was important, a fair number had either mixed feelings or disagreed altogether. Not unexpectedly, those working in roles that call for inter-regional/international interactions and transactions felt more strongly about a consistent or harmonized set of evaluation guidelines. This became particularly evident for those working in the area of GHG emissions. As one respondent put it, "energy is pretty much a global commodity, at least in its waste (CO_2)." The ability to effectively compare, aggregate and communicate program results was a common theme among proponents of consistency. Other arguments for consistency included the avoidance of what some felt was time wasted in debating which of "dueling approaches" best suits a given application.

Some respondents felt that consistency was appropriate and important for national legislative and policymaking purposes, but that state (or regional) policy decision-making only called for statewide guidelines, as determined by each given state. Others believe consistency is valuable in theory but impossible or meaningless in practice, noting that local data, needs, scale, budgets, market conditions and other factors make only the broadest and most principle-focused (as opposed to formulaic) guidelines meaningful and broadly applicable.

Those that stated that consistency was not appropriate argued that different states/regions have very different funding levels and somewhat different information needs, making it wrong-headed to impose uniform evaluation guidelines across all states. Further, those in opposition felt that the technical appropriateness of evaluation guidelines is more important than their consistency.

Lastly, given the wide variety of energy-efficiency resources and program types, as well as the range of evaluation budgets, having a single document that is both sufficiently detailed and applicable to all program types is not practical. Thus, any form of a evaluation protocol would still be open to interpretation by users, as is true with the IPMVP. Nevertheless, the value of a program evaluation guide as a central resource and educational resource is generally accepted.

3.2 Information and Processes

3.2.1 Data Tracking and Databases, Tracking of Evaluation Results

While opinions on the value of guideline consistency proved to be mixed, there was a consistent call for improved information sharing as well as tools to facilitate this information sharing. In order to make cost-effective use of the typically limited planning and evaluation resources, evaluators expressed a need for well maintained energy-savings data and databases, for as many efficiency measures as possible, at a level of quality that ensures confidence in the data, and which eliminates the need to "reinvent the wheel" with each evaluation effort. Additionally, respondents felt that database products should conform to a universal standard for data entry and compatibility with any other databases.

A common refrain was on the importance of transparency in data assumptions. In the words of one respondent, there are "too many black boxes" related to assumptions made for calculations and estimates of savings. To make the information shared have meaningful value, transparency in how results are reached and clear definitions of terms used is essential. Of particular interest are deemed or stipulated savings values and savings persistence data for common energy-efficiency measures.

California's Database for Energy Efficiency Resources (DEER) was mentioned by several respondents as an example of such an information source – albeit an incomplete resource. Those working with energy-efficiency efforts outside California, and without such a tool at their disposal, pointed to it as the type of instrument that would make their EM&V activities more meaningful and effective. Those working within California noted that the DEER database has issues that need to be resolved soon, as regulations are making prescriptive and calculated savings of increased importance.

3.2.2 Billing Data

Some respondents expressed a need for expanded access to and use of billing data to evaluate program impacts. While billing data can be used to support large statistical models of program impacts, for many it has proven time-consuming and laborious to access and integrate it.

3.2.3 Defining Market Penetration of Efficient Equipment/Measures

Almost forty percent of the respondents indicated a need for resources to help define market penetration of efficient equipment and measures. Some expressed interest in an expansion of related market tracking studies to establish a baseline for specific programs as well as to evaluate the effectiveness of market transformation efforts. However, many noted the need for improved cooperation among market players (including retailers and manufacturers) to gain access to

market data. National appliance tracking data and market penetration data on a variety of end-use products were noted as being of particular interest and value. Strategies for measurement when data availability poses challenges were also called for.

3.3 Calculations & Assumptions

3.3.1 Defining and/or Adjusting Baselines:

Over half of respondents expressed concern about issues related to the identification and quantification of appropriate baselines. Respondents pointed to the difficulty of isolating impacts of individual programs and measures in the current environment, where there is such a wide range of initiatives affecting product availability and consumer response.

Some felt that the real need was not for analytical work in this area, but for investment, stating that under-funding of on-site data collection is a considerable problem. One evaluator stated that there is a particular need for such data collection to meet the increasing demand for potential studies.

It should be noted that defining the appropriate baseline for an energy-efficiency program may be different that the definition for an emission reduction program. This would be primarily due to the question of whether avoided emissions are truly additional, given the number of energy-efficiency incentive programs required by states and regulatory commissions.

3.3.2 Calculating Net-to-Gross (NTG) Ratios & Issues of Free-Ridership:

Almost half of respondents claimed a need for additional information or support in these areas. Some pointed to the need for improved methods of estimating true net impact, including market effects, claiming that old models of NTG and free-ridership no longer apply in many states with advanced energy-efficiency programs. Some respondents felt that rather than simply increasing the effort to develop estimates of NTG and free-ridership, a new, consistent and effective framework for assessing program and market impacts should be developed. Others felt that the root of the problem was the data and how they are collected, rather than the calculation tools.

A number of respondents felt that the many of terms themselves (e.g., free-rider, net-to-gross and spillover) and the way they were discussed were the problem in this area. These respondents suggested better definitions would be useful and that a re-framing of the evaluation structure is needed.

3.4 Definitions

Similarly, over a third of respondents felt that a clear, consistent set of EM&V terms and definitions needs to be developed for national, if not global, use. Many pointed out that inconsistent use of terms made it difficult to share information in a meaningful way or, in some cases, to follow guidelines.

3.5 Program Cost-Effectiveness Analysis

Forty-five percent of respondents reported a need for additional information or support related to program cost-effectiveness analyses. Some felt that new industry software would be valuable, as would cost-effectiveness tests that value all key effects, and not merely "dollars in and energy saved." Others suggested that there is inconsistent use of the Total Resource Cost (TRC) test

across the US, and felt that standard tests were needed, particularly to take into account GHG values.

3.6 Uncertainty Analysis

Approximately forty percent of respondents see uncertainty analysis as an area needing information support for both energy-efficiency and climate mitigation program evaluation, feeling that it is difficult to do in a meaningful way. Some called for the establishment of national standards for the level of reliability and persistence that is acceptable to utilities and utility commissions, and the development of guidelines to teach analysts how to perform uncertainty analysis correctly. Many felt it a crucial area that every jurisdiction needs to consider. One respondent also felt that supply-side analysis for avoided costs should use similar methods for calculating uncertainty in future power/fuel costs, claiming that while all resources have uncertainty, demand-side resources seem to be held to a higher standard.

3.7 Measuring Non-Energy Benefits/Factors

As energy-efficiency programs and projects continue to increase in scope and political importance, so too does the scope of related benefits being measured and promoted. The public and policy makers are increasingly recognizing that saving energy is not the sole benefit of energy efficiency. Many respondents reported that they are now measuring such non-energy benefits as job creation, net economic benefits, environmental benefits (including GHG emission reductions), health and safety, water savings, community nuisance (e.g., reduced dust), market transformation and product improvement. Other studies report on considerations of such factors as employee and student performance, and occupant comfort levels and general well-being.

3.7.1 Emissions Factors

While few respondents reported evaluating GHG emissions factors, many indicated a need for such work, and an increase in industry conference sessions and papers would also seem to indicate this. Clearly there is a need to bridge energy-efficiency and GHG emission reduction evaluation. California, which is expecting a significant percentage of its target reductions in GHG to come from energy-efficiency program impacts, provides a good example of why. Respondents specified a desire for evaluation protocols that define a path to reliably credit avoided GHG emissions at the program (versus project) level.

3.7.2 Social Behavior

While a minority (approximately a third) of respondents felt this was an issue that needed attention, those who did felt passionately that this is a very big – perhaps the biggest - gap that needs to be filled. Respondents identified a need for increased evaluation activities that focus on assessments of both the broader market impacts of programs and the consumer perceptions and behavioral responses to those programs. For example, utilities in California would like energy savings credits for their educational efforts. Understanding behavioral effects becomes increasingly important with the realization that there is a need to conserve as well as to be energy efficient as aggregate use keeps growing. Some suggested there was much to be learned in this area from other social marketing efforts.

3.8 Measuring Long-Term Program Effects, Persistence

Approximately half of respondents indicated that this was an important area that called for additional support for both energy-efficiency and climate mitigation program efforts. Indeed, in

order to assure long-term change, long-term effects must be understood. In some regions, measuring persistence and long-term effects has received less attention than others areas to date and it would be valuable to provide examples of best practices or results from other regions for comparative purposes. It was suggested that pooling data and resources nationally or regionally would prove useful.

In California, there has been relatively little effort invested in evaluating the persistence of efficiency measures since the completion of the persistence studies associated with the 1994-97 IOU programs. Some respondents expressed a need for additional evaluation studies to supplement these earlier efforts.

3.9 Training

The issue raised most consistently by California program respondents was the shortage of qualified staff and consultants. The increase in evaluation activities both within California and in other states has resulted in a shortage of qualified professionals. A variety of initiatives could help address this issue including collaboration with academic institutions, development of educational materials, and financial support of academic programs.

Other respondents felt that training regulators on EM&V issues was of especial importance.

3.10 Budgeting & Costs

Budgeting and managing resources was an issue raised for energy-efficiency EM&V. While most respondents agreed that controlling costs was always important, concerns about overall lack of budget proved to be more of an issue. Funding levels proved a common source of frustration for respondents. Many felt that EM&V efforts have been consistently (and grossly) under-funded for the level of reliability requested or required. Some suggested that evaluation funding should be based on developing a multi-year strategic plan to meet overall and program specific goals, objectives and metrics at an acceptable level of rigor, stating that funding is too often a victim of an arbitrary percentage of total funding. This common concern should be somewhat balanced by the realization that the survey respondents were primarily evaluation professionals and advocates and that one respondent felt that efficiency evaluation was overemphasized compared to supply-side resource evaluations.

3.11 Miscellaneous EM&V Issues

3.11.1 Preparing EM&V Guideline/Requirements for Programs/Portfolios

Some respondents felt that, in general, regulators and/or policy makers should establish statewide evaluation requirements. A need for boilerplate guidelines/protocols that can be easily adapted to specific programs and policies was also identified.

3.11.2 Guidance on M&V for Individual Projects

While the IPMVP was noted as a good resource for guidance of M&V for projects, some felt additional training was needed to help understand the IPMVP and how it can be applied.

3.11.3 Demand Response EM&V

Several respondents identified a need for more support on and improved methods for measuring (and defining) demand or peak impacts, and demand response benefit/cost test guidelines. A recent ACEEE report highlights this concern (ACEEE 2007).

3.11.4 Balancing Demand-Side and Supply-Side Evaluations

One of the respondents wrote about a concern that many in the energy-efficiency field have discussed – inconsistent levels of evaluation for supply-side versus demand-side investments. This respondent felt troubled by the sense that energy efficiency has consistently been held to much more stringent independent monitoring and evaluation scrutiny than almost anything else utility companies do in the course of their operations. Specifically, the respondent felt that this "reflects the fact that energy efficiency has been something that utilities have generally not wanted to do, so [regulators] have demanded levels of proof not applied to any other area of their activity….including most recently, demand response programs, renewable energy programs, etc." This respondent would like to see the evaluation industry seek to address this double standard.

Table 3.2 below lists the above the issues and the percentage of respondents that marked them in their surveys as important and requiring additional information or support.

Table 3.2 – EM&V Gaps and Needs

Topic	Require More Info or Support*
Defining and/or adjusting baselines	55%
Defining appropriate level of rigor (accuracy, precision)	50%
Measuring long-term program effects, persistence	50%
Calculating Net to Gross (NTG) ratios	46%
Issues of free-ridership	46%
Data tracking and databases, tracking of evaluation results	46%
Program Cost-effectiveness analysis	45%
Uncertainty analysis	40%
Documented data for assumptions used in developing savings estimates	40%
Having adequate funding for EM&V	40%
Defining market penetration of efficient equipment/measures	38%
Consistent definition of EM&V terms	35%
Preparing EM&V guideline/requirements for your program/portfolio	35%
Sampling guidance	35%
Emission factors	35%
Training on EM&V issues	35%
Guidance on measurement and/or analysis of social behavioral factors	34%
Defining additionality	34%
Examples of Program Evaluation Protocols that can be used as a guide for your programs	30%
Examples of Project M&V plans that can be used as a guide for your programs	30%
Stipulated savings values data	25%
Program Evaluation Guidelines from which to prepare your Program Evaluation Protocols that are consistent with other jurisdictions' protocols	25%
Controlling costs of EM&V	20%
Finding trained EM&V professionals to conduct or review evaluations	17%
Guidance on M&V for individual projects	15%
Measurements guidance	5%

* For Program Administrators/ Implementers/ Regulators

4. Recommendations

The Consortium for Energy Efficiency (CEE) reports that in 2006, US state demand-side management budgets totaled an estimated $2.6 billion, an increase of 13 percent from 2005[2] (CEE 2006, 1). As energy-efficiency programming budgets continue to rise, so does the importance of conducting evaluations in order to ensure that the funds are properly spent. However, as important, if not more so, is using evaluation to learn what works, and does not work, so that funds are wisely spent and increased levels of energy-efficiency investment can be justified. To improve the efficiency and value of EM&V activities, we make the following recommendations based on the gaps and needs identified in the survey and the experience of the authors.

The recommendations all involve providing additional resources for the evaluation of energy-efficiency programs. Three categories of recommendations are identified: guidance documents, databases of evaluation results, and training. To fulfill these recommendations, collaborative efforts with state, regional and national organizations, including regulatory bodies, throughout the US, and internationally, are recommended. Such collaboration should include developing improved tools for sharing information and promotion of their use. This can facilitate improved and cost-effective evaluation which, in turn, should promote energy-efficiency activity.

4.1 Guidance Documents

As noted above there was a mixed level of support for developing generic evaluation guidelines. This is not unexpected given the high level of evaluation experience that the respondents possess. However, there was acknowledgement that guidance is needed in some specific areas and that general guidance is needed by those with less experience and expertise. Thus, the following recommendations are made with respect to guidance documents.

- Prepare a national model program evaluation guideline that can encourage consistent evaluations of energy-efficiency programs. Such an effort is underway as a project of the National Action Plan for Energy Efficiency. The objectives of that effort are to (a) prepare a guide that provides basic process and technical guidance, in a policy neutral manner, on evaluation issues and requirements for efficiency resource programs, (b) provide a model that can be used by individual jurisdictions (e.g., states and utilities) to establish their own evaluation requirements that are consistent in approach to other jurisdictions, (c) provide common definitions and (d) provide a listing of evaluation resources. The guide will not provide enough details to be sufficient on its own to conduct evaluations of programs. Rather, it will provide high-level guidance, identify

[2] In 2006, US energy-efficiency budgets totaled $2.6 billion. Electric programs represent 90 percent of this total, while gas programs represent 10 percent. This total includes low income and load management/control programs. Energy-efficiency budgets in the US have increased 13 percent since 2005. Looking strictly at budgets for energy-efficiency programs, totals have rise from $1.64 billion in 2005 to $1.86 billion in 2006 (CEE 2006, 1).

issues and direct users to resources for defining policy and program--specific requirements and details.

- Prepare guidance information on mechanisms for calculating, and standards for achieving, acceptable levels of rigor and accuracy in the calculation of energy savings. Critical to such guidance would be consideration of trade-offs between uncertainty, value of information gathered from the evaluation process and budgeting. Limited budgets can be a barrier to increased levels of rigor and accuracy and thus a related recommendation is listed below – increasing the availability, breadth and accuracy of evaluation results for the purposes of reducing the costs of subsequent evaluations. This recommendation includes a suggestion for the development of publicly available and transparent tools that can be used for calculating uncertainty and analyzing trade-offs between rigor and budget.

- Develop guidance, resources and tools to address the following additional evaluation topics:

    - Calculating avoided emissions that result from energy-efficiency activities, particularly avoidance of greenhouse gas emissions
    - Calculating other co-benefits associated with energy-efficiency activities, such as water savings, job creation and productivity
    - Defining and calculating peak demand reductions associated with energy-efficiency activities
    - Defining and calculating baselines
    - Defining and calculating net savings and specific considerations such as free-riders, spillover and snap back
    - Evaluating marketing approaches and behavioral responses to the "selling" of energy efficiency
    - Analyzing energy-efficiency evaluation requirements in the context of efficiency as an energy resource and in comparison with other energy (e.g., supply-side) resources

4.2 Databases of Evaluation Results

One of the common themes of the gaps and needs input from survey participants was the need for having access to reliable, accurate and transparent data from prior evaluation efforts. Furthermore, and in particular for stipulated or deemed savings values, the need for rigorous research on defining accurate savings values for particular measures under particular operating conditions. Some areas for which publicly available data for common energy-efficiency measures would be most beneficial are:

- Standard energy and demand savings estimates
- Persistence of savings data
- Market data such as baseline adaptation rates, penetration rates and spillover data

In addition, while not exactly considered an evaluation issue, having publicly available and consistently prepared potential studies would also be of benefit to the energy-efficiency industry as a whole.

4.3 Training

One of the limitations to increased energy-efficiency activity is a shortage of human resources, people trained in the various aspects of energy-efficiency engineering, construction, maintenance, program design and implementation, and evaluation. To address this shortage, the final recommendations relate to increased training activities and resources for evaluation professionals. A variety of initiatives could help address this issue including collaboration with academic institutions, development of educational materials and financial support of academic programs. Specific recommended training tools include the guidance documents discussed above, with the inclusion of EM&V primers and training courses.

Appendices

Appendix A: California Energy-Efficiency Programs and EM&V Activities

California Investor-Owned Utility Energy Efficiency Programs - For the period 2006-2008, the four largest investor-owned utilities (IOU) in California – Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric (SDG&E), Southern California Edison (SCE) and Southern California Gas Company (SoCalGas) – have $1.97 billion in authorized funding for energy-efficiency programs. (D.05-09-043) The program portfolio is composed of close to 200 programs covering all sectors of the economy. Approximately one quarter of program funds will be put out to bid over the three-year program cycle. (D.05-09-043)

PG&E Climate Protection Tariff (CPT) – In December 2006, the CPUC granted PG&E's application to establish a voluntary tariff, allowing customers to offset their greenhouse gas emissions by subscribing to a monthly supplement to their PG&E bill (D.06-12-032). The funding is aggregated by PG&E and used to pay for California Climate Action Registry (CCAR)-certified emissions reductions projects. PG&E is directed to start with forestry projects, but is allowed to fund other projects so long as they have been CCAR-certified. PG&E expects the CPT to produce cumulative reductions of two million tons of CO_2 by the end of the three-year pilot program.

California Publicly-Owned Utility (POU) Energy-Efficiency Programs – According to a recent summary report, mandated by SB 1037, POUs spent $54 million on energy-efficiency programs and reduced peak demand by 53 megawatts during Fiscal Year 05/06 (CMUA 2006). A substantial increase to $77 million in program expenditures is expected for FY06/07. The majority of these savings were provided by LADWP and SMUD, California's two largest POUs. Additional provisions of SB1037 include a statewide commitment to cost-effective and feasible energy efficiency, with the expectation that all utilities consider energy efficiency before investing in any other resources to meet growing demand.

Western Renewable Energy Generation Information System (WREGIS) – The WREGIS is a voluntary independent accounting system covering the WECC Region. WREGIS has four primary functions: (1) to verify renewable energy generation, (2) to issue renewable energy certificates, (3) to account for certificate transactions, and (4) to support voluntary and regulatory markets for certificates. WREGIS is intended to support implementation of the California renewable portfolio standard (RPS) and regional initiatives like the Western Governors' Association Energy Policy Roadmap and the Western Regional Air Partnership. This system can be used for energy-efficiency projects, if tradable energy-efficiency certificates are established in California.

Green Building Initiative (GBI) – Executive Order S-20-04 established the GBI, set a goal of reducing energy use in state-owned buildings by 20 percent by 2015 (from a 2003 baseline), and encouraging private sector compliance with the same goal. As part of the GBI, the CEC was directed to develop a building efficiency benchmarking system and commissioning guidelines and to adopt changes to the Title 24 building code that result in 20 percent savings by 2015 (from a 2003 baseline).

Title 24 Building Codes – California's Title 24 Energy Efficiency Standards for Residential and Nonresidential Buildings were established in 1978. Together with the Title 20 appliance standards, the Title 24 standards have saved more than $56 billion in electricity and natural gas costs since 1978 and are estimated to save an additional $23 billion by 2013. (http://www.energy.ca.gov/title24/index.html) Title 24 standards are updated periodically to allow consideration and possible incorporation of new energy-efficiency technologies and methods. The revised 2005 Title 24 standards went into effect on October 1, 2005. The proceeding to develop the 2008 update has already begun at the time of this report. (http://www.energy.ca.gov/title24/2008standards/index.html)

Title 20 Appliance Standards – California's Title 20 Appliance Efficiency Regulations were initially established in 1976 and have been regularly updated for 30 years. These regulations apply to appliances that are sold or offered for sale in California and cover 21 major categories of appliances. The most recent amendments to the standards were adopted in late 2006.

Other California Energy Commission (CEC) Efficiency Programs – Additional CEC efficiency programs include:

- Technical Assistance for agriculture, industrial process energy, and waste/wastewater (http://www.energy.ca.gov/process/)
- Outdoor Lighting (http://www.energy.ca.gov/efficiency/lighting/index.html)
- Schools (http://www.energy.ca.gov/efficiency/brightschools/index.html)
- Technical Assistance for schools, colleges, and hospitals (http://www.energy.ca.gov/efficiency/financing/index.html
- Financing for schools, colleges, and hospitals http://www.energy.ca.gov/efficiency/partnership/index.html).

Demand Response – In 2002, the CEC and CPUC initiated a joint effort to develop policies and practices for advanced metering, demand response (DR) and dynamic pricing. (R.02-06-001) The two principal elements of the DR program are the Statewide Pricing Pilot, an experiment that began in summer 2003 to measure price elasticities of small customers (< 200 kW), and the development of a portfolio of demand response tariffs and programs for large customers (> 200 kW).

A.2. EM&V Activities

IOU Programs – The CPUC authorized an overall EM&V funding level of $163 million for the 2006-08 program cycle, equal to approximately 7.6 percent of the authorized program funding. (D.05-11-011)

Total EM&V funding was allocated as follows: $118 million (54 percent) to Program and Portfolio Evaluation Studies; $45 million (27 percent) to program design evaluation and market assessment studies; $20 million (12 percent) to EM&V Management, Quality Assurance and Implementation Support; and $11 million (7 percent) to Overarching and Policy Support Studies. (D.05-11-011)

The CPUC assigned Energy Division management and contracting responsibilities for all EM&V

studies that will be used to (1) measure and verify energy and peak load savings for individual programs, groups of programs and at the portfolio level (including load impacts, useful measure life, savings retention and persistence studies), (2) generate the data for savings estimates and cost-effectiveness inputs, (3) measure and evaluate the achievements of energy-efficiency programs, groups of programs and/or the portfolio in terms of the "performance basis" established under Commission-adopted EM&V protocols and (4) evaluate whether program or portfolio goals are met. (D.05-01-055)

For the 2006-08 programs, the IOUs were assigned responsibility for program design evaluation and market assessment studies (D. 05-01-055). This effort includes studies focused on program design and implementation that are intended to provide real-time feedback to program managers. Additional studies being conducted by the IOUs include market research and initial assessments of program process and impacts.

Climate Protection Tariff -- PG&E is required to prepare annual reports to the CPUC. The CPUC Energy Division is directed to review the reports in order to determine (1) whether the program meets the requirements of this decision, (2) whether projected program participation levels are being achieved, and (3) the degree of success in GHG contracting and amount of GHG reductions. PG&E is also required to make annual reports to participating customers summarizing program results.

Publicly-Owned Utilities – The California Municipal Utilities Association (CMUA) in partnership with the Northern California Power Agency and the Southern California Public Power Authority, began a collaborative effort in October 2005 to develop an evaluation tool to measure energy-efficiency programs effectiveness and report program savings in a consistent and comprehensive manner (CMUA 2006).

Title 20 Codes & Title 24 Standards – An evaluation of expected savings from the 2008 update, focusing on the IOUs contribution to impacts, is underway as part of the CPUC's assessment of the impacts of the 2006-08 efficiency programs. An additional study assessing noncompliance rates is also underway.

Demand Response – The DR tariffs and pilot programs are evaluated to determine program impacts and effectiveness. A number of reports have been completed including an impact evaluation of the Statewide Pricing Pilot (Charles River Associates 2005), an evaluation of the Automated Demand Response System Pilot (Rocky Mountain Institute 2006), and an evaluation of the statewide large nonresidential Day-Ahead and Reliability Programs (Quantum Consulting 2006).

Green Building Initiative – In addition to implementation activities, the CEC is initiating additional research to improve the existing benchmarking tools. The additional research will be conducted through contracts with the Oak Ridge National Laboratory (ORNL) and LBNL, and funded by the CEC's Public Interest Energy Research (PIER) program (CEC 2005).

A.5. California Gaps and Needs

A small group of California EM&V managers and consultants were surveyed in order to identify stakeholders perceptions of gaps and needs with current EM&V activities. As with the other participants in the survey effort, the survey data collection instruments included in the last two Appendices were used to guide the interviews. The following themes and issues emerged from those conversations.

Training and Education of Evaluation Professionals – The issue raised most consistently by respondents was the shortage of qualified staff and consultants. The increase in evaluation activities both within California and in other states has resulted in a shortage of qualified professionals. A variety of initiatives could help address this issue including collaboration with academic institutions, development of educational materials, and financial support of academic programs.

Baselines/Additionality/Net-to-Gross/Free-riders – Most respondents expressed concern about issue related to identification and quantification of appropriate baselines. Respondents pointed to the difficulty of isolating impacts of individual programs and measures in the current environment, where there is such a wide range of initiatives affecting product availability and consumer response. Rather than simply increase the effort to develop estimates of net-to-gross and free-ridership, respondents identified a need to develop a new, consistent and effective framework for taking assessing program and market impacts.

Behavioral Research/Market Effects – Respondents identified a need for increased evaluation activities that focus on assessments of both the broader market impacts of programs and the consumer perceptions and responses to those programs. These evaluations offer a more holistic method to measuring program impacts and transforming those markets.

Persistence/Lifetime Studies – There has been relatively little effort invested in evaluating the persistence of efficiency measures since the completion of the persistence studies associated with the 1994-97 IOU programs. Some respondents expressed a need for additional evaluation studies to supplement these earlier efforts.

Billing Data – Some respondents expressed a need for expanded access to and use of billing data to evaluate program impacts. Billing data can be used to support large statistical models of program impacts.

Market Penetration/Tracking Studies – Some respondents expressed an interest in an expansion of market tracking studies that monitor penetration of energy-efficiency technologies. Market tracking studies can be used to establish a baseline for specific programs as well as evaluate the effectiveness of market transformation efforts.

Appendix B: Survey Respondents

Name		Organization	Location
Mike	Ambrosio	Ambrosio Associates	Multiple US
Sylvia	Bender	California Energy Commission	California
Oscar	Bloch	Wisconsin Dept. of Administration / Public Service Commission of Wisconsin	Wisconsin
Kevin	Cooney	Summit Blue Consulting, LLC	Multiple US, Canada
John	Cowan	Environmental Interface Limited	Canada
Fred	Gordon	Energy Trust. Of Oregon, Inc. (ETO)	Oregon
Cherie	Gregorie	New York State Energy Research and Development Authority (NYSERDA)	New York
Nick	Hall	TecMarket Works	Multiple US, Canada
Bob	Holmes	Alliant Energy	Iowa
Ken	Keating	Bonneville Power Authority (BPA)	Pacific Northwest US
Sami	Khawaja	Quantec, LLC	Multiple US, Canada
Marty	Kushler	American Council for an Energy-Efficient Economy (ACEEE)	US
Doug	Mahone	Heschong Mahone Group (HMG)	California
Julie	Michals	Northeast Energy Efficiency Partnerships (NEEP)	Northeast US (6 New England states, New York, New Jersey and Maryland)
Monica	Nevius	Consortium for Energy Efficiency (CEE)	North America
Valerie	Richardson	Pacific Gas and Electric Company (PG&E)	California
Ralph	Prahl	Prahl & Associates	Multiple US
Mike	Rufo	Itron, Inc.	Multiple US
Chris	Schroeder	Nexant, Inc.	Minnesota and Colorado
David	Sumi	PA Consulting Group	Multiple US
Elizabeth	Titus	Northeast Energy Efficiency Partnerships (NEEP)	Northeast US (6 New England states, New York, New Jersey and Maryland)
Edward	Vine	International Energy Program Evaluation Conference (IEPEC)	Multiple International
Roger	Wright	RLW Analytics, Inc.	Multiple US

Appendix C: References & Resources

C.1 Guidelines & Protocols

C.1.1 Energy Efficiency Resource Evaluation Guidelines & Protocols

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C.1.3 Guides Under Development

Evaluation, Measurement and Verification of Electricity Savings for Determining Emission Reductions. Prepared by Schiller Consulting, to be published by US EPA in 2007

GHG Protocol Guidelines for Grid-Connected Electricity Projects. Being prepared by World Resources Institute for publication in 2007.

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C.3 Resource Databases of Evaluation Studies

California Measurement Advisory Council (CALMAC) Publication Database. www.calmac.org

Consortium for Energy Efficiency (CEE) Market Assessment and Program Evaluation (MAPE) Clearinghouse. www.cee1.org/eval/clearinghouse.php3

C.4 Program and Organization Web Sites

California's Appliance Efficiency Program (including California Title 20 Appliance Standards). www.energy.ca.gov/appliances/index.html

California Climate Action Registry. www.climateregistry.org

California Demand Response Programs. www.energy.ca.gov/demandresponse/index.html

California's Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24, Part 6, of the California Code of Regulations). http://www.energy.ca.gov/title24/index.html

California Energy Commission Efficiency Programs. http://www.energy.ca.gov/efficiency/

California Green Building Initiative. www.energy.ca.gov/greenbuilding/index.html

California Investor-Owned Utility Energy-Efficiency Programs. www.californiaenergyefficiency.com/

California Municipal Utilities Association (CMUA). www.cmua.org

California Solar Initiative. www.cpuc.ca.gov/static/energy/solar/index.htm

Climate Trust, The. www.climatetrust.org

Efficiency Vermont. www.efficiencyvermont.com/pages/

Efficiency Valuation Organization (EVO). www.evo-world.org

International Energy Program Evaluation Conference (IEPEC). http://www.iepec.org/

Maine State Energy Program. www.state.me.us/msep/

Northeast Energy Efficiency Council (NEEC). http://www.neec.org

Northeast Energy Efficiency Partnerships (NEEP). www.neep.org

Northwest Energy Efficiency Alliance (NEEA). http://www.nwalliance.org/

New York State Energy Research and Development Authority (NYSERDA). www.nyserda.org

Western Renewable Energy Generation Information System (WREGIS). www.westgov.org/wieb/wregis/

U.S. Department of Energy - http://www.eere.energy.gov/

U.S. Environmental Protection Agency:

- Clean Energy Programs - http://www.epa.gov/cleanenergy/
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World Business Council for Sustainable Development (WBCSD). www.wbcsd.org

World Resources Institute (WRI). www.wri.org

Appendix D: Data Collection Instrument – Evaluation Consultants

California Energy Efficiency Evaluation, Measurement and Verification Outreach Initiative

EVALUATION SURVEY DATA COLLECTION INSTRUMENT

Evaluation Consultants

Introduction:

California public agencies, utilities, environmental and other groups have started a project to support energy efficiency EM&V best practices in California, nationally and internationally. The project includes, among other activities, a Model Program EM&V Guideline to be prepared in conjunction with the National Action Plan for Energy Efficiency. In order to better understand the current state of the art and EM&V needs and gaps, this survey is being conducted with a select group of industry professionals. We appreciate your taking a bit of time to answer the questions. The survey results are expected to be made available in March or April of 2007.

Signed: Commissioner Dian Grueneich and Steve Schiller, co-chairs, California EM&V Outreach Initiative

Please complete this survey and fax or e-mail to:
Betsy Wilkins
e-mail: XXXXX
fax: XXXXX

1. General Information

Name of person(s) completing survey	
Phone:	
E-mail:	
Company:	
Title:	
Date Completed	

2. Program or Portfolio Types

In completing this survey, your answers are based on experience/expertise with which of the following program, markets types, and end-users (please check all that apply):

A. Programs

- ☐ Climate mitigation program (general or project protocols)
- ☐ Climate program with EE element
- ☐ EE Resource Program
- ☐ EE Market Transformation Program
- ☐ EE Outreach & Training Program
- ☐ EE Emerging Technology Program
- ☐ Codes and/or Standards
- ☐ Other (specify):

B. Market Events Targeted

- ☐ All
- ☐ New Construction
- ☐ Retrofit
- ☐ General Consumer Education/Outreach
- ☐ Other (specify):

C. End-User Target Markets

- ☐ All
- ☐ Residential
- ☐ Residential Low Income
- ☐ Commercial
- ☐ Industrial
- ☐ Agricultural
- ☐ Public (Municipal) Facilities
- ☐ Other (specify):

D. Evaluation Type

- ☐ Process evaluations
- ☐ Impact evaluations
- ☐ Market evaluations
- ☐ Other (specify):

3. Evaluation Documents

A. Do you use (through choice or requirement) any of the following EM&V guidelines? (check all the apply)

- ☐ 2006 California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals
- ☐ 2004 California Evaluation Framework
- ☐ 2001 California Framework for Planning and Assessing Publicly Funded Energy Efficiency Programs
- ☐ 1999 Guidelines for the Monitoring, Evaluation, Reporting, Verification, and Certification of Energy-Efficiency Projects for Climate Change Mitigation (prepared by LBNL for US EPA)
- ☐ 1994 California CADMAC Quality Assurance Guidelines for Statistical and Engineering Models
- ☐ 2004 Protocols to Measure Resource Savings (New Jersey Clean Energy Program)
- ☐ 2005 Program Savings Documentation (PSD) (prepared as part of CL&M plan filing)
- ☐ Northwest Regional Technical Forum (RTF) documents
- ☐ Technical Reference Manual (TRM) (prepared by Vermont Energy Investment Corporation)
- ☐ 2002 IPMVP (new version forthcoming in 2007)
- ☐ 2006 US Dept of Energy EERE Guide for Managing General Program Evaluation Studies
- ☐ Other (please specify title, date and author):

B. If you checked any of the above (including specifying "Other") EM&V guidance and/or requirements document

(if you checked more than one choice, please indicate to which your comments relate):

What about the documents do you find the most (and least) useful?

Are they required by an external body (if so, which) or internally?

If you listed an "other" document, is that document available on the Web and if so, where:

With respect to any "other" documents, is it based entirely or in part on other EM&V documents? If so, please list:

What, if any, other related information sources were used to prepare EM&V guidance or requirements?

4. EM&V Needs and Gaps

A. Is consistency among evaluation guidelines between different programs and jurisdictions (states, etc.) important to you and why:

B. What additional needs do you have for EM&V resources? For what types of evaluations (process, market, impact, MT, cost-effectiveness, etc.)?

C. Are there particular EM&V issues that you or your clients need (or feel there is a general need for) additional information or support on (check all that apply, related comments encouraged). Please fill in the following two-page table:

Issue Consultant Requires More Info or Support	Issue Clients Require More Info or Support	Topic	Comment
☐	☐	Defining and/or adjusting baselines	
☐	☐	Defining additionality	
☐	☐	Calculating Net to Gross (NTG) ratios	
☐	☐	Issues of free-ridership	
☐	☐	Uncertainty analysis	
☐	☐	Documented data for assumptions used in developing savings estimates	
☐	☐	Stipulated savings values data	
☐	☐	Data tracking and databases, tracking of evaluation results	
☐	☐	Defining appropriate level of rigor (accuracy, precision)	
☐	☐	Controlling costs of EM&V	
☐	☐	Having adequate funding for EM&V	
☐	☐	Program Cost-effectiveness analysis	
☐	☐	Defining market penetration of efficient equipment/measures	
☐	☐	Measuring long-term program effects, persistence	
☐	☐	Consistent definition of EM&V terms	
☐	☐	Preparing EM&V guideline/requirements for your program/portfolio	
☐	☐	Program Evaluation Guidelines from which to prepare your Program Evaluation Protocols that are consistent with other jurisdictions' protocols	
☐	☐	Examples of Program Evaluation Protocols that can be used as a guide for your programs	
☐	☐	Examples of Project M&V plans that can be used as a guide for your programs	

Issue Consultant Requires More Info or Support	Issue Clients Require More Info or Support	Topic	Comment
☐	☐	Sampling guidance	
☐	☐	Guidance on M&V for individual projects	
☐	☐	Measurements guidance	
☐	☐	Emission factors	
☐	☐	Training on EM&V issues	
☐	☐	Finding trained EM&V professionals to conduct or review evaluations	
☐	☐	Guidance on measurement and/or analysis of social behavioral factors	

D. Other comments or suggestions related to EM&V?

Thank you!

Appendix E: Data Collection Instrument – Program/Organization Representatives

California Energy Efficiency Evaluation, Measurement and Verification Outreach Initiative

EVALUATION SURVEY DATA COLLECTION INSTRUMENT

Introduction:

California public agencies, utilities, environmental and other groups have started a project to support energy efficiency EM&V best practices in California, nationally and internationally. The project includes, among other activities, a Model Program EM&V Guideline to be prepared in conjunction with the National Action Plan for Energy Efficiency. In order to better understand the current state of the art and EM&V needs and gaps, this survey is being conducted with a select group of industry professionals. We appreciate your taking a bit of time to answer the questions. The survey results are expected to be made available in March or April of 2007.

Signed: Commissioner Dian Grueneich and Steve Schiller, co-chairs, California EM&V Outreach Initiative

Please complete this survey and fax or e-mail to:
Betsy Wilkins
e-mail: XXXXX
fax: XXXXX

1. General Information

Name of person(s) completing survey	
Phone:	
E-mail:	
Company:	
Title:	
Date Completed	

2. Program or Portfolio-Specific Information

A. Implementing or Administering Organization Name:

B. Implementing or Administrating Organization Type

- ☐ Utility
- ☐ Non-profit
- ☐ Private Firm
- ☐ Other (specify):

C. Program Type/s (check all that apply to your program or portfolio):

- ☐ Climate mitigation program (general or project protocols)
- ☐ Climate program with EE element
- ☐ EE Resource Program
- ☐ EE Market Transformation Program
- ☐ EE Outreach & Training Program
- ☐ EE Emerging Technology Program
- ☐ Codes and/or Standards
- ☐ Other (specify):

D. Program Schedule

- ☐ When did your organization first starting implementing or administering efficiency programs? _____ (year)
- ☐ When did the current program or portfolio programs begin? _____ (year)
- ☐ Do you expect efficiency programs to continue, expand or decrease over the next several years? _____
- ☐ When did you first start conducting formal evaluations of your programs? _____ (year)

E. Program Portfolio Budget and Goals (please indicate whether annual or cumulative)

- ☐ Portfolio Budget: _____
- ☐ Portfolio EM&V Budget: _____
- ☐ Energy Savings:
  - kWh _____
  - kW _____
  - Therms _____
- ☐ GHG Emission Reduction _____
- ☐ Load Management: _____
- ☐ Equity/Social Justice: _____
- ☐ Economic Benefits:_____
- ☐ Other: list

F. Primary Market Events Targeted

- ☐ All
- ☐ New Construction
- ☐ Retrofit
- ☐ General Consumer Education/Outreach
- ☐ Other (specify):

G. End-User Target Markets

- ☐ All
- ☐ Residential
- ☐ Residential Low Income
- ☐ Commercial
- ☐ Industrial
- ☐ Agricultural
- ☐ Public (Municipal) Facilities
- ☐ Other (specify):

H. Program Portfolio Objectives and Description

Please summarize the goals and objectives of the programs in the portfolio and provide a list of programs in the portfolio.

3. Evaluation Measurement and Verification (EM&V) Information

A. What is the overall philosophy of evaluation efforts for your portfolio/region? (check all that apply)

- ☐ Evaluation is an on-going process
- ☐ Evaluations are conducted annually
- ☐ Evaluations are conducted from time to time, as required by regulators/external body or internally by implementer/administrator
- ☐ Evaluation is not performed
- ☐ Evaluation is required by regulators/external body
- ☐ Evaluation is required internally by implementer/administrator
- ☐ Evaluation is not required

B. What types of EM&V studies are or are anticipated to be conducted?

- ☐ Process evaluations
- ☐ Impact evaluations
- ☐ Market evaluations
- ☐ Other (specify):

C. Do you use (through choice or requirement) any of the following EM&V guidelines? (check all the apply)

- ☐ 2006 California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals
- ☐ 2004 California Evaluation Framework
- ☐ 2001 California Framework for Planning and Assessing Publicly Funded Energy Efficiency Programs
- ☐ 1999 Guidelines for the Monitoring, Evaluation, Reporting, Verification, and Certification of Energy-Efficiency Projects for Climate Change Mitigation (prepared by LBNL for US EPA)
- ☐ 1994 California CADMAC Quality Assurance Guidelines for Statistical and Engineering Models
- ☐ 2004 Protocols to Measure Resource Savings (New Jersey Clean Energy Program)
- ☐ 2005 Program Savings Documentation (PSD) (prepared as part of CL&M plan filing)
- ☐ Northwest Regional Technical Forum (RTF) documents
- ☐ Technical Reference Manual (TRM) (prepared by Vermont Energy Investment Corporation)
- ☐ 2002 IPMVP (new version forthcoming in 2007)
- ☐ 2006 US Dept of Energy EERE Guide for Managing General Program Evaluation Studies
- ☐ Other (specify title, date and author):

D. If you checked any of the above (including specifying "Other") EM&V guidance and/or requirements document *(if you checked more than one choice, please indicate to which your comments relate):*

What about the documents do you find the most (and least) useful?

Are they required by an external body (if so, which) or internally?

If you listed an "other" document, is that document available on the Web and if so, where:

With respect to any "other" documents, is it based entirely or in part on other EM&V documents? If so, please list:

What, if any, other related information sources were used to prepare EM&V guidance or requirements?

E. Is EM&V conducted by the program implementer, program administrator or a third party? **If a third party, how is the third-party selected?**

F. Are evaluation results approved, and if so, by whom and how frequently?

G. Are evaluation reports available on the Web, and if so, where can they be found?

H. When evaluating savings from projects, is each project evaluated or only a sample?

- ☐ All (census)
- ☐ Sample
- ☐ Combination

I. What is the objective of the evaluations (check all that apply):

- ☐ Document energy savings
- ☐ Document emission reductions
- ☐ Verify cost-effectiveness
- ☐ Confirm performance for approval of payments or assessing of penalties
- ☐ Improving program performance

J. Are any non-energy (and demand) benefits considered when evaluating the program/s?

- ☐ Cost savings and/or cost-effectiveness
- ☐ Environmental benefits
- ☐ Market transformation
- ☐ Job creation and/or other economic benefits
- ☐ Other (specify):

K. Are adjustments made to calculate net (versus gross) savings, and how are these developed and maintained? What are the factors considered (e.g., free riders)?

4. EM&V Needs and Gaps

A. In what ways do your EM&V activities meet the indicated EM&V objectives?

B. In what ways do your EM&V activities not meet your objectives and needs?

C. What resources do you use for EM&V information:

- ☐ Internal staff
- ☐ Consultants
- ☐ Government agencies (list)
- ☐ Guidelines and manuals (list)
- ☐ Other (specify):

D. Is consistency among evaluation guidelines between different programs and jurisdictions (states, etc.) important to you and why:

E. What additional needs do you have for EM&V resources? For what types of evaluations (process, market, impact, MT, cost-effectiveness, etc.)?

F. Are there particular EM&V issues that you need (or feel there is a general need for) additional information or support on (check all that apply, related comments encouraged). Please fill in the following two-page table:

Require More Info or Support	Topic	Comment
☐	Defining and/or adjusting baselines	
☐	Defining additionality	
☐	Calculating Net to Gross (NTG) ratios	
☐	Issues of free-ridership	
☐	Uncertainty analysis	
☐	Documented data for assumptions used in developing savings estimates	
☐	Stipulated savings values data	
☐	Data tracking and databases, tracking of evaluation results	

Require More Info or Support	Topic	Comment
☐	Defining appropriate level of rigor (accuracy, precision)	
☐	Controlling costs of EM&V	
☐	Having adequate funding for EM&V	
☐	Program Cost-effectiveness analysis	
☐	Defining market penetration of efficient equipment/measures	
☐	Measuring long-term program effects, persistence	
☐	Consistent definition of EM&V terms	
☐	Preparing EM&V guideline/requirements for your program/portfolio	
☐	Program Evaluation Guidelines from which to prepare your Program Evaluation Protocols that are consistent with other jurisdictions' protocols	
☐	Examples of Program Evaluation Protocols that can be used as a guide for your programs	
☐	Examples of Project M&V plans that can be used as a guide for your programs	
☐	Sampling guidance	
☐	Guidance on M&V for individual projects	
☐	Measurements guidance	
☐	Emission factors	
☐	Training on EM&V issues	
☐	Finding trained EM&V professionals to conduct or review evaluations	
☐	Guidance on measurement and/or analysis of social behavioral factors	

Other comments or suggestions related to EM&V?