EXHIBIT NO. ___(RWS-6)
DOCKET NOS. UE-111048/UG-111049
2011 PSE GENERAL RATE CASE
WITNESS: ROBERT W. STOLARSKI

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY, INC.,** **Respondent.**	**Docket No. UE-111048** **Docket No. UG-111049**

FIFTH EXHIBIT (NONCONFIDENTIAL) TO THE PREFILED REBUTTAL TESTIMONY OF ROBERT W. STOLARSKI ON BEHALF OF PUGET SOUND ENERGY, INC.

JANUARY 17, 2012

Puget Sound Energy
Energy Efficiency Services
Review of Measurement and Verification Practices

FINAL

Puget Sound Energy
Prepared by KEMA Inc
Oakland, California
December 19, 2011

Experience you can trust.

1. Executive Summary

Puget Sound Energy and KEMA, Inc. conducted a study to identify and analyze PSE's measurement and verification (M&V) practices and to determine whether these practices are in line with industry standards. The project team drafted PSE's Measurement & Verification Policies, Guidelines, Protocols, and Processes for conducting M&V with the goal of providing PSE guidance to ensure consistency, accuracy and cost effectiveness in achieving energy efficiency program savings.

PSE is defining the Measurement & Verification Policies, Guidelines, Protocols, and Processes to facilitate the management of growing implementation capacity as dictated by an increase in energy efficiency savings targets. Similar to other jurisdictions, PSE, working with the state commission and the Conservation Resource Advisory Group (CRAG), has aggressive energy efficiency targets. To meet these targets, PSE has developed a substantial portfolio of efficiency programs, and expanded the capacity of existing programs and resources to meet them. A portfolio of this size and scope needs the ability to track the many program and project parameters essential to implementation, and requires quality control/quality assurance (QC/QA) methods that are robust, and scalable.

The study's goals were to:

- Identify M&V Policies, Guidelines, Protocols & Processes
- Identify and review industry practices of regional peers in M&V and determine how PSE compares to industry standards.
- Identify gaps within current PSE practices and set protocols and processes to address them.
- Provide a cost study that would capture the overall EES resources dedicated to QA/QC and M&V at the portfolio and program levels

It should be noted that, this study was conducted in parallel with a number of different efforts that EES is making to comply with various conditions agreements and efforts to assess and/or improve various aspects of implementation, administration or evaluation.

Approach

The study approach included a detailed review of PSE's existing practices, completion of a literature review, interviews with peer utility program administrators and comparison of these practices with PSE's internal processes. One of the goals of the study was to identify industry best practices in M&V with the intention of further improving PSE's existing practices to help minimize errors and risk in program implementation M&V processes.

Before reviewing the M&V practices of PSE and its peers we must define M&V policies, guidelines, protocols, and processes with which to organize the areas of program implementation that are included in the review of M&V. To do this, the project team looked at common implementation processes and identified the key areas of risk. All implementation teams are required to quantify and report the energy savings achieved by their programs in a cost-effective manner. Accomplishing this effectively and accurately requires good program design and appropriate tools. Successful programs also need consistent ways of

communicating with and managing all parties including third-party implementers, contractors, customers, and internal program staff so that all participants have the same understanding of the program requirements. Implementers require program rules, policies and procedures to facilitate gathering feedback from all participants especially as programs grow and markets evolve. Being able to quantify program results also means having a robust and scalable way of tracking and reporting program data on a regular basis since ultimately the results of the program are determined by what is tracked, recorded and reported.

For the purposes of this study,the project team defined the *Programatic* Measurement & Verification (P-M&V) as something distinct from standard Measurement & Verification (M&V) or Evaluation, Meaurement & Verification (EM&V). M&V is defined as the data collection, monitoring and anlysis associated with the calculation of gross energy savings for a measure or set of measures in a particular project. EM&V relates to the independent review of a measure, project, program, and/or portfolio level impact, process and/or market evaluation. PM&V captures all verification efforts associated with programs and includes M&V. Additionally, it encompasses quality control and assurance (QA/QC) activities to ensure customer satisfaction, accurate and verifiable savings and cost-effective implementation.

The project team defines following six categories of implementation and administrative activities that make up the P-M&V policies, guidelines, protocols, and processes:

- Design or Modification of Program Rules, Policies and Measure Descriptions
- Energy Savings Verification
- Data Management & Process Tracking Strategies (collection, tracking & reporting)
- Assessment & Verification of 3rd Party Program Savings
- Contractor/Customer Training & Relations Management
- Documentation, Reporting and Optimization

For these six categories, we identified protocols and processes that reflect current PSE P-M&V practices. We also identified recommendations for improving processes using feedback from interviews with PSE staff, utility representatives and the best practice literature review.

After identifying the P-M&V policies, guidelines, protocols, and processes and defining the six categories above, the project team set out to identify PSE and industry practices related to each P-M&V category. The study included:

- Conducting internal PSE interviews to discover how PSE's internal teams implement their programs.
- Conducting external interviews with regional peer utilities to understand how these utilities approach the identified P-M&V categories and what efforts are in place to improve program quality. The interviews were generally with one or two program managers gathering high-level comments with limited details.
- Conducting reviews of published literature which included searching a wide range of implementation program types and utilities to find standards and/or definitions for any of the P-M&V categories.

Finally, the project team conducted a cost study for each business and residential program at the P-M&V category level in order to provide a reasonable estimate of all resources allocated to ensure quality design and delivery of EE programs. The project team produced a calculator with the key components of each category and asked the implementation teams to fill out the number of annual hours spent on each component in order to produce an estimate of costs for the 2011 program year. The M&V Cost Study can be found in Appendix B of this report.

Summary of Findings & Conclusions

Through the interviews, the team found that PSE has ongoing efforts for improving its implementation practices with a focus on documentation and quality control/quality assurance. The study's findings show that:

- PSE is demonstrating leadership in trying to institutionalize P-M&V policies, guidelines, protocols, and processes into its portfolio.
- PSE's existing P-M&V processes either are in line with or exceed similar practices among utility peers.
- PSE's programs are on the path to identifying and addressing gaps and risks that may impact the quality of program results.
- While PSE already strives to meet its growing need for a robust P-M&V infrastructure, there are related opportunities for PSE to further strengthen their efforts to incorporate best practices.

The team has identified areas where improvements can be made to simplify and enable efficient verification practices. Based on the review team's investigation of best practices and comparison with current PSE practices, the team has identified several key areas that could most benefit from improvements. Our hope is that implementing these recommendations will help PSE ensure a high level of data quality, and enable consistent and accurate reporting of savings. A high level of the recommendations that affect the general state of P-M&V are:[1]

- Integrate multiple PSE databases for improving tracking and reporting
- Complete verification and inspection process documentation
    - Establish consistent rigor across programs, as appropriate
    - Procedures transparent to participants, too
- Enhance and standardize verification for third-party programs
    - Ensure that there are clear processes for overseeing third party program implementers
    - Consistent tracking and reporting with PSE delivered programs.

[1] These findings included efforts conducted for the First Interim Report: Third Party Review – 2010-11 Electric Conservation Savings.

2. Project Overview

This report documents the methodology and findings of the study that PSE and KEMA conducted to formalize and improve PSE's programmatic measurement and verification (P-M&V) practices.

The following are the objectives of this study:

- Satisfy the I-937 settlement agreement
- Identify PSE's existing P-M&V practices[2]
- Develop PSE's M&V policies, guidelines, protocols, and processes for implementing P-M&V. The PSE's M&V policies, guidelines, protocols, and processes can be found in Appendix A.
- Inform PSE's M&V policies, guidelines, protocols, and processes by conducting a best practices literature review and interviews with peers
- Provide recommendations for PSE to incorporate into existing P-M&V practices
- Provide cost of current EES P-M&V efforts to ensure quality for the 2011 program year. The cost study details and results are included in Appendix B.

To accomplish these objectives, the study approach included:

- Identify best practices through reviewing industry literature on topics of process, quality control and quality assurance.
- Interview leading utilities about the various P-M&V practices and approaches in their energy efficiency programs.
- Identify current PSE operational procedures by speaking with individual implementation teams.
- Compare PSE practices with industry best practices and KEMA's own implementation experience and identify areas of opportunities to improve quality and minimize risk in program implementation and delivery.

This research, combined with KEMA's own implementation and evaluation experience, provides the basis for development of a P-M&V framework for PSE to address the QC/QA and M&V challenges most energy efficiency programs face.

The KEMA team leveraged and shared research findings and opportunities with the independent third party review of savings of PSE's 2010 annual conservation report[3]. This work

[2] Only programs that have quantifiable energy savings are included in this study.
[3] First Interim Report: Third Party Review – 2010-11 Electric Conservation Saving by SBW Consulting and KEMA, Inc.

reviewed PSE practices via analysis of project files for identifying verification, tracking, and reporting practices related to reporting 2010 electric energy savings.

2.1. PSE I-937 Settlement Agreement

The September 2010 settlement agreement, "Agreed Conditions for Approval of Puget Sound Energy, Inc.'s 2010-2011 Biennial Electric Conservation Targets under RCW 19.285, Docket No. UE-100177" includes the following conditions agreement in section K6 (f) (ii):

> *Measurement & Verification – PSE shall provide detailed descriptions of its measurement & verification (M&V) policies, protocols, guidelines, and processes to the CRAG for review and advice. Additionally, PSE shall provide to the CRAG an estimate of the costs associated with the detailed M&V plan and PSE will maintain activities at levels that are at least commensurate with regional peers.*

PSE and KEMA sought to provide the following deliverables to meet the condition:

- Detailed descriptions of PSE M&V policies, protocols, guidelines and processes to the CRAG for review and advice
- Estimated costs associated with the detailed M&V plan
- A report that would confirm EES M&V activity levels are at least commensurate with regional peers would provide various EES stakeholders with specific recommendations that would contribute to continuous improvement of QA/QC and M&V

2.2. Defining Programmatic Measurement and Verification

This report introduces the term programmatic M&V (P-M&V) which incorporates all activities by program implementation and support groups to ensure quality control/quality assurance in the delivery of consistent and accurate energy savings. PSE provides the M&V policies, guidelines, protocols, and processes in response to the first condition in the Settlement Agreement. The M&V policies, guidelines, protocols, and processes (see appendix A) also defines P-M&V.

The objectives of this task were to establish which activities and/or categories of activities fit within context of P-M&V. Therefore, before reviewing the quality control and P-M&V practices of PSE and its local peers, the project team defined the terms P-M&V and its categories. P-M&V is the combined efforts of program implementation and support teams to ensure quality and consistency within M&V and other program process. P-M&V is not limited to ensuring energy savings. It also includes administrative, tracking and reporting processes that contribute to the long term health of implementation programs. P-M&V must go beyond the minimum implementation tasks.

To define P-M&V categories, the project team looked at common implementation processes and identified the key areas of risk within an implementation program. These risks may include attribution (minimizing free-ridership), fraudulent incentive claims, and paying incentives to customers or projects that do not qualify. All implementation teams are required to quantify energy savings achieved and report those results to parties outside of these teams. To do this effectively and accurately requires a high level of performance from all program participants who are aided by good program design and appropriate tools. Programs need consistent ways of communicating with all participants including 3rd party program implementers so that everyone has the same understanding of the program requirements. To ease this process, implementers

must design program rules, policies and procedures to incorporate feedback from participants especially as programs grow and markets evolve. Being able to quantify program results also means having a robust and scalable way of tracking and reporting program data on a regular basis. Ultimately the results of the program are determined by what is tracked, recorded and reported.

These categories also frame the methodology KEMA established for conducting the best practices research that include literature review, internal PSE interviews, and external interviews. In all elements of the research, we looked for practices that fit into the policy categories or help further develop the P-M&V protocols. The findings are presented by category.

This report introduces the term P-M&V (P-M&V) which incorporates all activities by program implementation and support groups to ensure quality. PSE provides the P-M&V policies, guidelines, protocols, and processes (see Appendix A) in response to the first condition in the Settlement Agreement.

We define conventional M&V as the process of validating and quantifying the accuracy and reliability of the energy consumed by the equipment in question. There are multiple approaches and methods used to implement M&V, with several protocols that provide guidelines such as the International Program Measurement and Verification Protocols (IPMVP).

Evaluation, measurement and verification (EM&V) are the activities evaluators design according to the targeted equipment and/or programs. Their EM&V plans seek to validate energy consumption for the savings from individual programs/measures via standardized sampling protocols and methodologies. PSE has an EM&V Framework to help define the efforts of EM&V. EM&V may overlap with P-M&V, but it is pursued independently of the program implementation teams' activities.

We define P-M&V to cover a much wider scope. P-M&V looks at the quality of implementation in terms of program information disseminated, data collected, inputs and calculations used, etc. that goes into quantifying energy savings including reporting and contractor/customer communication. P-M&V processes cover all QC/QA efforts by the implementation team.

As with M&V, QC/QA activities are also dependent on the type of program implemented. PSE has employed both elements of M&V and QC/QA to create a P-M&V system that results in confident delivery of program savings for PSE. PSE uses M&V activities to validate the savings (and costs) for a particular project. M&V steps include:

- Counting equipment installed
- Verifying efficiencies
- Metering and/or monitoring
- Savings calculations
- Identifying deemed savings
- Invoice reviews

PSE adds quality assurance and quality control activities to the process to ensure program staff are properly applying and documenting their program implementation and M&V activities. QA/QC steps include:

- Proper data entry of application fields
- Proper linking of measure information to end use profile, deemed or custom savings, and measure category
- Peer reviews
- Inspection requirements with quantitative samples
- Well documented program requirements
- Survey monitoring to assess participant satisfaction
- Proper staff training

P-M&V practices are the sum of all PSE's Energy Efficiency Services (EES) quality assurance, quality control, tracking and reporting efforts of energy savings. These practices are a part of program implementation and are ongoing throughout the implementation versus EM&V activities that tend to focus on programs and occur at the conclusion or half-way through the program period[4].

2.3. P-M&V Categories

The P-M&V Policies, Guidelines, Protocols and Processes provides the structure for EES to perform M&V and QA/QC effectively. The project team established categories to help define elements of P-M&V. The categories shape the necessary processes and documentation for P-M&V to deliver cost-effective programs with high quality customer service and accurate energy savings and provide a framework that encompasses the roles of the utility, the program implementer (if different), contractors, and customers and how they all work together to deliver the savings goals. The different processes and documentation help ensure proper communication and understanding to accomplish the program and overall utility objectives. P-M&V categories within this framework are not mutually exclusive and may have overlapping, but not contradictory requirements or information. The P-M&V processes and documentation should be reviewed and updated on a regular basis.

The following are the six P-M&V categories that are further defined in the M&V policies, guidelines, protocols, and processes (Appendix A).

Design or Modification of Program Rules, Policies and Measure Descriptions

This category incorporates program design team efforts to establish policies and procedures and measure definition so that the program is easily and effectively communicated. This category also includes any regular feedback from program participants and implementers to improve program policies, procedures and measure definitions.

[4] The team recognizes that these efforts may seem to be considered standard implementation practices, however, they are the steps utilized to ensure consistent and accurate savings reported for the portfolio. For example, "proper" data entry and staff trainings refer to not the actual activities of data-entry or straff training, but the process to ensure that it is accomplished in an effective manner.

Data Management & Process Tracking Strategies (collection, tracking & reporting)

This category incorporates efforts to build and maintain robust databases that track program progress and have the ability to retrieve this data in a manner useful for all parties.

Energy Savings Verification

This category incorporates efforts to verify and/or measure savings cost-effectively and minimize evaluation risk in realization rate findings. This includes creating tools such as savings calculators and on-site inspection templates that prevent errors in analysis and fraud in customer delivery records.

Assessment & Verification of 3rd Party Program Savings

This category incorporates efforts to manage the quality of 3rd party implementers, which may include contractual requirements on inspection rates, tracking system requirements, and audits of their work.

Contractor/Customer Training & Relations Management

This category includes efforts to establish and maintain healthy relationships with program service providers and participants through trainings or other outreach forms to educate stakeholders of program processes and/or changes and improve the quality of applications and information provided by them.

Documentation, Reporting and Optimization

This category incorporates efforts to create and maintain useful reporting tools and documents that can effectively summarize program performance and inform the continuous improvement of program implementation efforts.

3. Methodology

The project team approached the study objectives in multiple phases. Since P-M&V is not a common term used in energy efficiency, the team needed to identify the activities that comprise P-M&V. Once the team defined and established a framework for P-M&V, it determined the research tools and methodology to assemble the research (interviews and literature review) results and ensure the proper use of P-M&V definitions.

Following are the steps used to conduct the research element of this study:

- Define P-M&V and its categories
- Conduct a literature review
- Interview industry peers on existing P-M&V practices
- Establish existing PSE P-M&V practices

Defining P-M&V and P-M&V Categories Approach

The objectives of this task were to establish which activities and/or categories of activities fit within context of P-M&V. To accomplish this and define P-M&V categories, the project team looked at common implementation processes and identified the key areas of risk within an implementation program. We looked at PSE program descriptions to understand the requirements of each program. That understanding was furthered by existing PSE program documentation, particularly the early draft versions of the cost calculator where PSE staff listed individual tasks performed in detail. From these program documents as well as KEMA's extensive implementation experience and implementation process flow, we created categories of P-M&V that would be necessary to address risks within implementation processes.

These categories frame the methodology KEMA established for conducting the best practices research that include literature review, internal PSE interviews, and external interviews. As we conducted our research and learned more details of PSE's program implementation process, we adjusted these categories to address any additional tasks or risks that were identified. The details of the definition are provided in section 2.2.

Literature Review Approach

The objective of this task was to identify "best practice" QA/QC activities for PSE to compare and/or adopt into their P-M&V policies and guidelines. To accomplish this, KEMA performed the following:

- Secondary research on programs considered "best" practice or report recommendations
- Leveraging KEMA's experiences in QA/QC practices
- Preparing a summary of findings for PSE to consider

KEMA conducted literature searches on various websites for evaluation studies, white papers, etc. to identify best practices in QA/AC approaches related to PSE's P-M&V. KEMA reviewed the following key sources:

- Published Internal Program M&V Guidelines (many provide their M&V requirements for applicants to use, but not their internal QA/QC)
- National Action Plan for Energy Efficiency (http://www.epa.gov/cleanenergy/documents/suca/napee_chap6.pdf)
- National Best Practice in Energy Efficiency Programs website and database (http://eebestpractices.com/)
- Consortium of Energy Efficiency (CEE) website
- California Advisory Measurement Council (CALMAC) database of evaluation reports
- ACEEE website and Best Practice study
- Northeast Energy Efficiency Partnership (NEEP) and Northwest Energy Efficiency Alliance (NEEA)

Key topics KEMA reviewed include:

- Best practices in database tracking techniques
- Inspection protocols – sampling, percent of total projects, or other methods by program area
- Varying levels of incentive approval practices
- Building relationships with program stakeholders and continuously improving their quality of work
- Properly trained staff and flexible processes to adopt to program, market, and regulatory changes effectively

External Interviews Approach

KEMA contacted utility program managers for in-depth interviews to fill-in any gaps not covered in the literature review. KEMA conducted interviews with four different utilities covering both residential and non-residential programs. Given that most evaluation reports and program filings do not provide a lot of detail on QA/QC, KEMA designed the discussion guide to gather details on specific QA/QC activities and if there was a framework to handle the P-M&V. The discussion guide is located in appendix C. Key topics covered in the interview include:

- Define P-M&V
  - Project and program QA/QC activities
  - M&V – measure savings verification

- QC/QA -- practices and any framework that exists around their approach and any targeted activities driven by QC/QA needs
- Implementation practices
    - Extent of documentation on those practices
    - Level of coordination/collaboration between programs for consistent QC/QA or M&V processes
    - Managing quality of third party contractors

KEMA targeted a mixture of regional and national utilities similarly sized to PSE. The interviewees were Avista Utilities, Energy Trust of Oregon, Seattle City and Light, and Public Service New Mexico (PNM) [5].

Internal Interviews Approach

KEMA conducted interviews with PSE staff that focus on implementation and QA/QC practices within the EES programs. The goal of the interviews was to accurately capture current practices so that KEMA can provide useful recommendations in P-M&V. While we did not interview members from every program, we interviewed at least one person from each program category. We completed a total of seven interviews that represent seven different program groups from EES, including Budget and Administration and the newly formed Verification team. Additionally, KEMA incorporated information acquired from the independent third party review study. Since the goal was to understand program processes, each interview involved multiple staff members involved either directly or indirectly in program delivery. The interviews included program engineers, administrative personnel, program managers, and a member of the Verification staff when applicable. We determined the appropriate roles of individuals in the program delivery chain and solicited perspectives on what processes are working or not working, as well as recommendations for improvements. The interview guide for program staff is located in appendix C. Below is a list of programs and teams that were represented in the interviews:

- BEM Programs
    - Small Business Lighting
    - Resource Conservation Manager
    - C&I Custom Grants/Retrofit
- REM Programs
    - Systems Channel
    - Low Income Weatherization
    - Retail Channel
    - Multi-family Retrofit & New Construction
    - Single-family Retrofit & New Construction

[5] KEMA targeted up to 8 interviews, but some utilities did not respond to our request.

- Space & Water Heat Programs
- Verification Team
- Budget and Administration

4. Findings

4.1. Literature Review Summary

KEMA conducted extensive literature review of over 20 documents from 7 sources to find out whether any study has been conducted to create a set of best P-M&V practices. We looked for information that applies to a variety of program types covering all of the PM&V categories. Through this research we found that much of the information focused on traditional M&V topics like site inspections and process evaluation topics such as customer service. There were no papers that addressed P-M&V related topics in a comprehensive manner.

The literature review yielded topics that were mostly focused on large C&I and Residential retrofit and new construction programs which cover a large portion of PSE program types but did not address some of the specialty programs like Low Income Weatherization or Small Business Lighting. There is a lack of published guidelines on implementing high quality energy efficiency program from the perspective of QC/QA and generally the writing of these topics are at a program level not portfolio level. KEMA concluded that providing a portfolio level study with the goal of improving P-M&V methods has great value for PSE and the industry in general.

Following are key findings from the literature review on prevalent practices that could also represent best practices regarding areas where implementers focus QA/QC activities.

- There appears to be abundant industry information focused on managing contractor/customer relations and verifying energy savings using site visits. Since these areas tend to present high opportunities for human error (i.e., poor paper trails, misrepresentation of energy claims, etc.), it is suggested that generally P-M&V activities focus here to minimize risk.
- The findings suggest that P-M&V activity is needed for more quality assurance in residential programs since this is an area where there is more asymmetric information barriers (i.e., the contractor is more informed about the technology/programs than customers are) and residential customers are more prone to complain if their rebate is not processed in a timely manner.

Conducting savings verification site visits for C&I programs is also a “best” practice often cited in literature review. A site visit can validate that the equipment is installed and operating correctly and especially in small business lighting programs per KEMA’s experiences.

- There was little information available to indicate that having accurate and consistent program and measure descriptions is a widely used practice, however, for evaluators, this is a very important practice where program administrators should pay attention. Too often evaluators find inconsistencies in program implementation and measure installations due to poor program descriptions and inaccurate measure listings.

4.2 Assessment of PSE Current and Evolving State of P-M&V Practices

KEMA conducted 7 interviews with PSE's key EES staff. These meetings were organized to cover multiple functions within each program or program type to give KEMA a comprehensive understanding of EES implementation processes. KEMA also interviewed four utilities that included Seattle City and Light (SCL), PNM (Public Service of New Mexico), Avista Utilities, and Energy Trust of Oregon (ETO). The following are the results of these interviews organized by the M&V categories.

After assessing PSE's portfolio and comparing it with the data products and practices we reviewed during our research efforts, we conclude that PSE's efforts are in line with best practices. Many of PSE's peers are in the same position in terms of handling an increase in program goals and building the infrastructure to handle it. KEMA itemizes in the sections below various best practices that PSE should consider incorporating into its own practices. These include best practices based on the KEMA team's extensive experience in program design and implementation and EM&V, the literature review and a review of the Best Practices study[6].

Design/Modification of Program Rules, Policies & Measure Descriptions

The design and documentation of program policies and procedures, including measure descriptions, as well as regular program updates are vital ways to keep implementation staff consistent as they operate the day to day functions of the program. When program teams are small, it is often easy to ignore documentation or implement formal updates to program rules. More often, small teams will establish these rules or communicate their changes casually. The risk here is that this approach is not scalable. As program goals increase and project teams grow, market challenges to meet goal may force the program to adjust more frequently. With more program changes and larger staff, formal documentation will become more important. PSE is currently facing these challenges of scaling and there are efforts within some programs to either create or update documents on policies and procedures.

PSE Current and Evolving Practices

Individual EES programs aim to target a specific sector or a specific set of measures, so each program team has its own approach for developing program rules, policies and measure descriptions. We saw varying levels of updated documentation and much of the process for modifying program rules and policies were informal. However, the programs teams have

[6] The Energy Efficiency Best Practices Project seeks to build off industry experience and knowledge by establishing a structure for analyzing and communicating best practices to help meet today's complex energy challenges. The project uses a benchmarking methodology to identify best practices for a wide variety of program types. This study is managed by Pacific Gas and Electric Company under the auspices of the California Public Utility Commission in association with the California Energy Commission, San Diego Gas and Electric, Southern California Edison, and Southern California Gas Company. (eebestpractices.com).

recently made efforts to standardize some of the program update process and keeping up with documenting these processes.

KEMA found that some approaches to modifying programs vary considerably from program to program. Some programs have regular review processes to evaluate program rules and policies particularly in recent years; where as other programs only have an informal process. This is also evident in the data teams provided for the cost calculator indicating minimal or no effort for making updates in 2011. Yet these programs are in the process of determining a more formal timeline for possible program design changes. Program documentation also varies in level of detail and maintenance as some programs are in the process of putting together or updating policy manuals. Program teams often cited resource limitations as the main challenge to completing program level improvements and documentation.

One example of recent efforts of standardizing processes is the Measure Metrics database which holds information on all prescriptive measures past and present. The EES has a well defined and documented methodology of adding and retiring measures from the programs. A central database ensures that all programs and staff can refer to the same pertinent information regarding a measure. The process of changing the database includes; formulating a business case, preparing regional and industry best practices energy savings analysis that must go through several levels of approval. If any issues arise with an aspect of a measure, program staff can refer back to the Measure Metrics database for technical and research information.

Standardized rules also exist when it comes to payments to customers or contractors. The Budget and Administration staff looks at individual projects from a high level across all programs including all projects with incentives over $100,000. It is the Budget and Administration group's mission to ensure that PSE programs are good stewards of ratepayer funds.

Other Utilities

Interviewees did not share information regarding program design, modification and changes to program and measure descriptions. However, the literature review did identify the importance of proper documentation for minimizing misinterpretation of eligibility and claimed savings between participants, evaluators, and the program implementers.

Energy Savings Verification

Efforts in energy savings verification is an important part of ensuring that realization rates stay consistently high. Given the volume of many implementation programs, it is often impossible and generally unnecessary to visit and verify every site, but establishing an appropriate sampling rate for verification will help identify changes that may need to occur in the assumptions used in energy savings calculations. Without this process, assumptions may veer from reality and the resulting savings calculations will be invalid. Verification can also help evaluate the quality of contractor's work or validity of initial claimed savings. Inevitably, there are program participants that require a higher than average level of verification, without which there may be large discrepancies in savings that are not uncovered until evaluation. Creating consistent tools, such as technology specific energy calculation spreadsheets can prevent calculation error and save review time. These consistent calculation tools also provide clarity to program participants as they would learn over time to provide the right set of information for the programs.

PSE Current and Evolving Practices

PSE programs have well established and consistent savings calculation and verification methods but do not generally have updated documentation on these methods. As goals increase and the program teams expand, PSE programs teams are making efforts to improve the quality of program documentation and energy savings by incorporating higher levels of measurement and verification activities.

Efforts to improve M&V can be seen in the creation of a Verification group within EES to cover multiple programs. The group is responsible for conducting on-site inspections and invoice reviews to verify installation of rebated equipment, but does not log any equipment or do any form of metering. Currently the group focuses mainly on residential and small business lighting (SBL) programs, many of which historically conducted a small percent of site inspections. These programs are now able to increase inspection rates. The team also conducts business sector inspections when needed. Program teams are in the process of figuring out how best to utilize the Verification group to maximize efficiency. Each program provides a list of projects that are eligible for on-site visits, and it is up to the Verification team to choose an inspection sample from this list. The Verification team's approval is not currently required for payment given that invoices are verified by individual program teams during review. The Verification team has also developed inspection templates so that the information type and the level of details captured are consistent at every visit. Further documentation of the site verification process is in development.

Each EES program has a different level of on-site verification depending on program needs and volume of applications received. The Low Income Weatherization program, which is contracted to a third party, has a 100% pre and post inspection requirement as dictated and conducted by the third party. On top of this, PSE will conduct on-site verification on 15% of the dwellings that were approved for rebates by the third party. This 15% sampling is picked at random. The Home Print residential energy auditing program receives a 2-4% inspection rate. Small Business Lighting receives roughly 15-20% on-site post-installation verification, but may be increased. Multi-family New construction gets 100% of their projects inspected. PSE requires documentation of lighting hours for C&I retrofit projects with estimated annual lighting energy savings of 300,000 kWh or more. Documentation of lighting hours may consist of data logging of actual lighting hours, utilization of energy interval data, or review of automated lighting control software. Metering of other C&I projects is at the discretion of the QC Reviewer and the EME. All custom C&I projects have pre and post inspections.

Energy savings calculations and application review methods do vary since PSE programs target a wide range of measures. There is a PSE review standard for all rebated applications at the budget and administration level. Invoices, calculation documentation for savings and incentives along with the appropriate checks and site visit summaries must be presented to high level reviewers for approval of high dollar amount projects. Each program however, has its own way of calculating savings and creating tools to help program team members stay consistent.

The Measure Metrics database plays a key role in ensuring consistency within prescriptive programs. Deemed savings values all come from the database and any updates or additions to the database is well documented. Since the qualification of these measures often relies on approved measure lists from organizations like the Regional Technical Forum or Consortium for Energy Efficiency or ENERGY STAR, a main challenge is to keep track of additions and deletions made by these external organizations. The REM team identified the need to have a more comprehensive master list of equipment that meets its program standards.

For custom C&I programs, a project engineer will work closely with facilities personnel or the contractor to develop an energy savings estimate. All custom C&I grants require reviews from a designated senior engineering staff QC reviewer and manager. High levels of incentive amounts will trigger reviews from department manager, director for greater $100,000 and Vice President for projects with greater than $250,000 incentive. Program engineers have developed calculators for some technologies and are working to build a full set of tools to better establish a calculation standard.

Best Practices

In review of PSE's verification practices, the team identified areas where PSE can adjust to be more in line with suggested industry standard practices specifically for quality control and verification. The P-M&V framework that defines policies, guidelines, protocols, and processes should guide the team towards best practices. Following are general elements to consider, mostly during the design phase:

- Consider administrative cost in designing the verification strategy
- Build in statistical features to the sampling protocol to allow a reduction in the number of required inspections based on observed performance and demonstrated quality of work.
- Tailor measurement rigor, including the use of sampling, to each project's contribution to the cumulative uncertainty in estimated savings for the program overall
- Use a verification method capable of confirming measure and installation quality
- Ability to modify procedures based on results from an initial set of inspections early in the implementation process

Inspection strategy may vary by measure and/or program. One that is already incorporated into PSE practices is conducting pre-and post-inspections for large or uncertain impact projects such as those with highly uncertain baseline conditions and performance variation that can significantly affect project/program savings. Some of the following are recommendations for putting best practices in this critical step of program implementation:

- Obtain a good random sample of vendor and measure types
- Always inspect the first job submitted by a new vendor, depending on program type
- Clearly define post-inspection rigor and quantity by cost-effectiveness considerations
- Ensure that inspectors have adequate training in identifying and explaining reasons for failure
- For residential new construction, require builder or builder's representative to be on-site during inspection

The actual documentation of savings, or verification, requires another set of best practices which include:

- Rely on third-party inspectors for residential new construction for quality control over the long-term

- Recognize the different inspection needs depending on experience of applicants and/or contractors
- Verify accuracy of rebates, coupons, invoices to ensure the reporting system is recording actual product installations by target market such as lighting
- Conduct either in-program measurement or measurement through an impact evaluation on the very largest projects and those that contribute most to uncertainty in overall program savings

Other Utilities

Avista makes sure all custom projects are peer reviewed. ETO has created calculators for custom projects.

SCL employs different M&V criteria or practices for different measures. Higher uncertainty measures will receive more site visits for validation and measurement. M&V practices will also depend on program-type. Small business programs, for example tend to have a high percentage of site visits. Measure reviewers use Excel based workbooks for common measures. Custom measures use 'generally accepted' engineering practices. Every project for certain programs currently uses standardized reports for pre-and post-inspections (small commercial lighting, multi-family retrofit, and medium to large industrial).

Data Management & Process Tracking Strategies (collection, tracking & reporting)

Accurately tracking data allows the implementation team to monitor the progress of the program and record in one place important information such as energy savings and customer contact information. However, tracking tools vary greatly and establishing a robust, secure and user friendly database is very important. Spreadsheet tracking systems may be functional with a small group of users, but it does not scale well. As the program increases in size and personnel, version control issues will emerge. When the reliability of tracking systems fail, staff tends to feel less of a need to keep the central tracking systems up to date and rely more on personal tracking sheets, decreasing the ability of program managers to measure the state of the program. Data entry issues are inevitable when application counts increase. This raises the importance of more sophisticated database systems that will have built in quality checks so as to catch data entry errors. Keeping a high quality database also increase the quality and accuracy of program results. PSE recognizes that some of their programs are facing these challenges and they are currently working on database solutions to resolve these issues.

PSE Current and Evolving Practices

EES programs mainly use three central database systems to track and obtain project information: Customer Systems Solution (CSY), Customer Management System (CMS) and Measure Metrics. Each program uses these databases to some extent to track project progress and to retrieve accurate customer and measure data. A few program teams have developed their own system to track program progress because the central databases could not satisfy their needs. The central databases are evolving and improving on reporting capabilities.

The Small Business Lighting group has developed its own tracking spreadsheet to track program data and inspections. The SBL tracking tool allows the SBL group to customize relevant fields and retrieve program data and track program progress. There are plans to transition the SBL tracking into CMS.

Many programs perceive CSY as having limited reporting functions that cannot adequately deliver program progress information. There are programs that use the CSY database exclusively to track projects but these projects rely on extensive calculations spreadsheets and hardcopy paperwork to track details of projects. The database is used to track all project data necessary to report savings, paid incentives, measure costs, measure lives, project location, rate schedule, etc. as necessary to evaluate program cost-effectiveness.. Each project has a paper trail of inspection reports, custom calculation worksheets, and equipment related documentation. In these cases, CSY can only capture data from completed project reviews and cannot capture in-progress information, making reporting of program progress difficult.

PSE has several semi-independent data systems in place. One example is Measure Metrics, the comprehensive database for tracking savings histories for all deemed measures. This database, however, is not dynamically linked to program tracking databases. If there is an update to a measure, such as a change in deemed values or sunset date for expired measures, then this linkage must be done manually. The review team's understanding is that PSE has already identified this as an important priority. It has been working on this dynamic linkage, and hopes to have it completed by the end of 2011. In addition, the customer relationship, incentive payment, and eligibility checks are all done in different systems. Finally, the reporting of programs is fed manually to the EES Master, which is a spreadsheet. The EES Master, ideally, would be a comprehensive database that is dynamically linked to the other systems.

Best Practices

PSE is actively working on ensuring their database tracking systems work well. One best practice item that is part of this process is integrating all program data, including measure-level data, into a single database interface.

Defining and documenting data requirements is one step in ensuring good database systems for program implementers to use and are described here:

- Define and identify the key information needed to track and report early in the program development process to measure success and to support the requirements of evaluators as well as program staff.
- Develop accurate algorithms and assumptions on which to base estimates of savings and create a process to update as the programs evolve.
- Carefully document the tracking system based on detailed process flow diagrams for guidance and provide manuals for all users.
- Assure that tracking systems are intuitive, straightforward, integrated and comprehensive.
- Integrate marketing, customer, audit, and impact data. This may occur with coordinating appropriate systems such as cross-program databases, customer information systems (CIS) and marketing or customer relationship management (CRM) systems.
- Design databases for long-term strategy and use to be scalable to accommodate changes in program scope.

The use of database and tracking systems are recommended to be aligned with the following practices:

- Use automated or otherwise regularly scheduled notification to achieve close monitoring and management of project progress, such as aging and monthly reports.
- Minimize duplicative data entry by linking databases to exchange information dynamically.
- Build in real-time data validation systems that perform routine data quality functions.
- Track market transformation program (e.g., Northwest Energy Efficiency Alliance) qualitative benefits and measures related to spillover effects, along with direct savings impacts.
- Track and utilize contractor and equipment information that aids in analyzing their activity and reporting actual installed efficiency.
- Use electronic application processes, workflow management and Web-based communications.

There are ways to handle data quality and the following are suggested best practice approaches:

- Conduct regular checks of the tracking reports to assess how the program is working and make program corrections to ensure success.
- Minimize duplicative data entry by linking databases to exchange information dynamically.
- Build in real-time data validation systems that perform routine data quality functions.
- Build in rigorous quality control screens for data entry such as minimizing duplicative entry.

Other Utilities

ETO has many third party contractors who are overseen by internal managers. All third party contractors use an online database called Fast-Track that contains all project information. The database tracks project progress. ETO also uses a Customer Relationship Management (CRM) database. The contractors will upload data in the form of spreadsheets but the format is not always consistent. They are trying to integrate the databases that now exist. ETO is currently not documenting on-site visits in the database. They currently document these visits in hard copy data files.

ETO also use QC reports. For example, they have weekly database reports that list the problem sites/applications. ETO staff looks at fields that are empty and assesses if they need to keep the field or not. One common error they discovered with this process is that residential projects commonly have incorrect addresses.

PNM has an online dashboard for contractors to upload their program documentation so PNM can track the progress of each contractor/program. The format of what gets uploaded is not standardized.

SCL has plans to develop a single centralized tracking system.

Third party implementers introduce new risks since it may be unclear whether these 3rd parties have the same level of quality standards that are required by PSE. It is not always clear what QC/QA processes are in place and any errors that arise, especially those that impact the customer, would reflect poorly on PSE and energy efficiency programs in general. Generally, PSE works closely with the 3rd party implementers and has a verification process to check up on their work. Access to real time or weekly 3rd party data would be ideal since if data suggests any necessary changes to the program, a monthly report will not allow the program to act fast enough. A consistent template for 3rd party reports will allow PSE to communicate what it considers vital information and will make processing easier and faster especially if PSE plans to expand the number of 3rd parties. A set template also allows PSE to build a set of QC/QA checks PSE can run when they receive 3rd party data.

PSE Current and Evolving Practices

PSE conducts verification and QC/QA checks on their third party implementers. The level of verification rigor depends on which program they are evaluating. PSE hired a contractor to conduct QC/QA on their Multi-Family retrofit program and it is currently, the only program where they have a contractor conduct QC/QA. This third party contractor conducts pre and post on-site inspections for 100% of approved projects.

PSE uses their internal Verification team to verify programs managed by third party implementers. The team receives a sample of sites to conduct inspections for Low Income Weatherization (LIW), residential appliance rebates, and home energy audits. Each program has a pre-established percentage of overall projects to review. This percentage ranges from 2-10% depending on the program. Fifteen percent (15%) of LIW projects have on-site inspections that are measure specific as opposed to dwelling or unit specific. The Verification team will also go on-site (2-4%) with Homeprint energy auditors to ensure that they are conducting the energy audits appropriately.

To verify and track externally-managed programs, PSE must wait for the implementers to submit monthly reports. PSE has requested access to their third party implementer's database to have more real-time information, but this has not proven to be successful. Additionally, their reports are not consistent with each other or PSE's internal reports.

Other Utilities

ETO manages many programs for several utilities in Oregon. They contract nearly all of their program implementation to third parties. ETO will write a program implementation plan as part of their contract, including expected levels of QC/QA, and will give the plan to their third party implementers to implement. ETO does not conduct any in-depth verification of their third parties. They instead expect each contractor to conduct their own QC/QA as written in the contract. ETO will conduct quarterly audits on their implementers by going to their office and verifying the information for a percentage (varies depending on program) of submitted projects to the actual information found at the implementer's office. ETO requires their contractors to submit program data into their database. Staff within ETO, conducts QC/QA checks on applications and projects submitted for approval. Most of the QC/QA is built into the database itself, and is just a matter of requesting a report to single out applications with issues. The ETO has recently added another layer of QC/QA into their program implementation practice. They hired a contractor specifically

to conduct QC/QA on their implementers. ETO conducts this additional layer of QC/QA to ensure quality within their program offerings.

PNM also mostly employs third party contractors. They also rely on the contract terms to ensure the implementers are doing the proper QC/QA and do not conduct any specific on-site or additional verification.

Contractor/Customer Training and Relations Management

Program participants need to have a good understanding of the program to effectively take advantage of EES programs. Without this understanding, the risks of application errors, misunderstandings of measure qualification and savings calculations increase along with the associated cost of implementation. There is also risk of setting high expectation of rebate amount or savings amount because of misunderstanding of a measure or calculation method, causing customer service issues for PSE and the program. Many PSE programs work closely with contractors and large customers and make sure calculations are correct. Programs that have a large number of participants rely more on group trainings. Most PSE programs seem to be aware of underperforming contractors that require further aid. As the programs grow and number of participants increase, a contractor management system with the ability to flag underperforming contractors will be helpful.

PSE Current and Evolving Practices

PSE outreach efforts vary widely from program to program depending on measure complexity or the particular delivery model and the experience of program implementers. Programs that have extensive trainings or regular meetings with contractors tend to be those that require a high level of sophistication from contractors or have had particular issues with contractors. The same can be said for the programs' interactions with customers, though customer account managers usually play a key role in managing customer relationships especially with industrial accounts.

The Resource Conservation Manager (RCM) program is an example of a program that requires the involvement of sophisticated participants. In this case, PSE offers an ongoing training to all of the participants involved in the program and has built extensive resources to ensure the success of the RCM at the facility. This level of support is inherent in the design of the program.

The Small Business Lighting (SBL) group sometimes experiences difficulties with contractors. Since the far majority of incentives are paid directly to contractors and applications almost always come from contractors, SBL has a series of trainings available to their contractors. This training is required for contractors who complete four or more applications. The program tracks who actually attends the trainings and from which contracting company so that SBL staff can maintain a point of contact.

Many other programs have an informal approach to maintain relationships with program participants. Trainings are on an as needed basis and may be very individualized. For custom projects, PSE engineers work closely with contractors on energy calculations and require very little from contractors up front. Programs sometimes rely on these relationships to communicate program changes or collect feedback from program participants, though other programs conduct satisfaction surveys and actively solicit possible improvements from participants.

C&I programs do not currently use the Customer Management System (CMS). The Small Business Lighting Program will migrate to being tracked in CMS in 2012. However it is used for REM programs. The CMS system is used to track contacts between the program and its

participants, and covers the basic details of communication (date, time, who called, brief summary of call, etc). Updating the CMS is another common way for programs to manage and track communications with participants about changes in the program.

Best Practices

Another element is quality control of the measure installation, which incorporates participation satisfaction. Both practices should be documented on what are the specifications and how to handle complaints or conduct process evaluations or use customer satisfaction surveys to assess participants' needs. Many of the strategies discussed here should be a part of the application process and handling of applicant and/or contractor relationships. These best practices include:

- Assess quality control on program's relationship with vendors, number of vendors involved, types of measures, project volume, variability of project size
- Use measure product specification in program requirements and guidelines
- Assure quality of product through independent testing procedures (such as ENERGY STAR)
- Assess customer satisfaction with the product through evaluation
- For delamping projects, use light level requirements and pre- and post-light level readings to ensure quality
- Implement a contractor screening/certification/training process
- Treat inspection visits as partnership-building & learning events
- Provide quick and timely feedback to applicants
- Write clear specifications for measure installation using "contractor-friendly" language and train contractors on what is expected
- Create processes for tracking complaints and failure by measure and by contractor
- Require that installers honor the warranties that come from product manufacturers

Other Utilities

Avista has a small service territory, and they communicate with most of their trade allies on a frequent basis. Therefore, Avista can address changes to programs easily. They work closely with the trade allies (but not via a preferred vendors list). Avista believes that trade allies are the best ambassadors for site specific custom projects. Avista works with NEEA to train trade allies.

SCL has outreach and education that vary across programs. SCL have mandatory training programs for their residential auditors. Commercial lighting programs offer at least annual contractor meetings to update contractors on program requirements. There have been some collaborative efforts to pull together contractor trainings for contractors who work across multiple service territories. SCL has done some outreach over time for new construction, building designers and architects to help stakeholders understand the programs better.

Documentation, Reporting and Optimization

Aside from properly documenting policies and procedures, measure and program descriptions, it is important that teams communicate effectively with each other and across the portfolio. This can include effective reporting, team meetings to disseminate information, and trainings. When documents are not properly maintained, inconsistent interpretation among all participants may occur resulting in improper determination/assignment of savings or approving projects when they may not be eligible for an incentive. Furthermore, EM&V reviews may also misinterpret the intent resulting in poor realization rates. Therefore, an update process must be put in place to keep these documents current and relevant. This is particularly important when programs grow and new staff is added and need to be trained.

PSE Current and Evolving Practices

PSE is in the process of developing company-wide manuals and procedures to document a standard practice of program process changes and changes in management/personnel. Currently, each program has their own method of training new hires and dealing with changes in their programs. For example, the custom grant program takes several months to ensure the new engineers are trained properly, and Verification specialists receive training in order to conduct HomePrint audits and inspections of the measures covered by single family rebates. Overall, each program has a small staff with a specific range of possible measures and so much of the training is hands on and occurs with peers or senior staff. Communicating program changes is also made easy by the size of the staff.

Recently, PSE compiled a rebate and incentive processing manual for residential programs. This document describes steps for entering data into the tracking system and CLX to ensure customer is eligible for a program. This is a good starting point for helping internal teams--as well as external ones, such as program evaluators--understand the use of the tracking systems.

In order to maintain quality in budgeting and administration, PSE initiates frequent training sessions for their staff that covers the process for using the internal booking database. These trainings are required for all EES personnel.

Other Utilities

Avista does have internal training that is not documented. Avista, similarly to PSE, believes that they are small and do not require efforts to ensure communication across staff to incorporate changes. SCL does have internal program documentation that is useful, but they are not kept up to date.

5. Conclusions and Recommendations

Many of the challenges the PSE team discussed in our interviews were related to tracking and reporting which tie into QA/QC and M&V. Both elements must work well together to have proper energy savings reported and documented. These concerns and recommendations must be viewed in the context of the substantial growth of the EES portfolio in recent years. Systems and processes need to keep with the scale of growth. With the addition of new programs and third party program implementers, coupled with increased savings goals, EES must expand their tracking systems dramatically to accommodate the increased complexity and transaction volumes, as well as upload third party data. The EES team is actively improving all of their documentation and tools to better handle this growth.

5.1 PSE Gap Analysis

Per our interviews with four different utilities (three of which are regional peers to PSE), PSE's program portfolio practices are in line with its peers in M&V practices. However, all believe they should do more regarding documenting their processes and are in the process (Avista and ETO) or have plans to (SCL) to address this gap. PSE is also moving in a direction that will not only align its existing processes with the M&V policies, guidelines, protocols, and processes, but will also address their gaps regarding standardizing and documenting processes to better align with industry best practices.

Generally, most of the program teams have a process in place to address every M&V protocol category. However, there is still room for teams to enhance and optimize practices and to improve standardization and documentation. Several program teams are in the process of providing more standardization and documentation. Below are some areas where teams discussed activity toward addressing this gap:

- RCM program team has plans for improving its process documentation to be more consistent in program structure and QA/QC practices.
- The Verification team discussed moving forward with standardized forms and tools.
- All program teams discussed the improvement of tracking and reporting.

Other gaps PSE can address include:

- Develop more program friendly, comprehensive tracking systems that are better coordinated across programs[7].
- Develop and document third party program implementers' M&V processes.. There is a gap here in PSE's portfolio on not having clear understanding on what its third party implementers are doing for verification, inconsistent reports, and no guidelines on PSE's QC of their work.

[7] PSE is actively pursuing developing one system or one coordinated system.

5.2 Recommendations for Improving PSE P-M&V Practices

The KEMA team acknowledges that PSE is moving in the right direction, however, we would like to reiterate the activities with the following recommendations.

Design or Modification of Program Rules, Policies and Measure Descriptions

- Challenges remain in identifying eligible products in an efficient manner since external sources such as ENERGY STAR and Consortium for Energy Efficiency may change unexpectedly. Downloaded product lists soon become out of date. It is also inefficient to constantly download product lists since most downloads will yield no real change. KEMA recommends that a schedule is set up for regular but not excessive updates to product lists. The lists should be stored centrally and have the version date clearly labeled in the file name. In rare cases customers may submit new products not yet captured in the product list requiring program staff to do further verification.
- PSE should put in place a process and timeline to collect feedback from staff and program participants via a process evaluation or ad hoc surveys and discuss any changes that may be necessary to lessen participation barriers and improve internal quality and efficiencies. Only some programs currently have a set process in place to accomplish this.

Energy Savings Verification

- Documentation for all programs on inspection and verification processes is encouraged. This may be implemented using standardized inspection forms or templates or documentation that provides guidelines for inspections for measures/projects.
- Inspection sampling strategy should be incorporated into program processes.
- Expand the function and capabilities of the Verification team to cover more programs and more technologies. The group is in good position to maintain consistency in field inspection and verification quality and can help identify further energy efficiency opportunities. It also has a good view of multiple programs and processes and is well positioned to help develop tools that may apply to multiple programs.
- Document incentive and savings calculation process for RCM to allow for others to replicate and allow evaluators to assess the reported savings in a similar manner, if necessary.
- Continue development of calculation tools for any calculated or custom projects, as appropriate.

Data Management & Process Tracking Strategies (collection, tracking & reporting)

- PSE data is handled in multiple forms and files. On occasion, many critical pieces of project information may only be in the hard copy files. PSE should consider incorporating all critical

elements of project review and analysis in a single program database where information can be consolidated and more potential exists to develop automated quality control checks.

- As the program activity and evaluation efforts increases, KEMA recommends that PSE develop new systems or enhance existing systems to strategically address its data needs. Additional fields such as contractor information, project milestones, including inspections, and other features can enable PSE to be in line with best practices and receive more up to date progress reports on the state of programs.
- Create a more user friendly data entry and data retrieval process for both internal and external programs. Many of the challenges of using or creating a centralized database results in individual programs developing additional tracking processes whose quality is difficult to control.
- Create database trainings not only to show how users can use the database to enter data but also to show potential reporting functions that users might not expect the database to have.
- It is unclear to the review team the status of data quality functions that are built in to the PSE systems. However, the team encourages fully implementing the data quality features described in the best practices, such as data validation and control screen functions, to the full extent possible. Additionally, this may include rolling into the system other levels of quality control checks associated to project verification into a centralized system minimizing the need for adhoc tracking or stand-alone tracking used by individual teams.

Assessment & Verification of 3rd Party Program Savings

- Third party program implementers do not have any guidelines or requirements for their verification process. PSE does not have a QC/QA process incorporated in overseeing their third party programs. It is recommended that PSE:
    - Require third party programs to document their verification processes
    - Have minimum requirements of on-site inspections
    - Fully integrate their reporting requirements to be consistent with PSE reports
    - Conduct its own random/sampling verification of 3rd party projects

Contractor/Customer Training & Relations Management

- PSE team for small business lighting does have training sessions and materials with contractors. Further enhancement of these efforts may greatly benefit the program to reduce contractor errors and improve quality installations.

Documentation, Reporting, and Optimization

- The rebate and incentive processing manual for residential programs is a good starting point for helping internal teams--as well as external ones, such as program evaluators--understand the use of the tracking systems. Additional documentation should be developed to ensure proper use of the tracking systems and understand its scope and limitations for all programs.
- During the team's review of project files and program documentation, it was discovered that many processes are not documented and no clear guideline is provided for certain programs and measures on how to verify the savings. Per the independent third party review of the portfolio savings claims, the work is being done to accurately document portfolio savings. Program engineers and inspectors (QA specialists) are receiving training and have the expertise, but consistency and level of rigor required should be documented. The following are specific examples:
    - RCM program
        - Having clear guidelines on project file documentation to ensure that appropriate savings and incentive calculations are done on all projects.
    - Small business lighting
        - Onsite verification needs to be documented if for fixture counts, equipment qualification, and other checks.
    - General
        - Some program/measure documentation seems to be comprehensive and include quality installation metrics. It is recommended to have consistency within program groups or consistent guidelines to ensure a uniform message to internal verification teams and program participants.
        - The sampling strategies vary by program but are inconsistent. PSE is developing more guidelines on expectations and tracking this process. It is encouraged to continue and to coordinate with evaluation efforts.

The overarching recommendations independent of P-M&V category are as follows:[8]

- Integrate multiple PSE databases for improving tracking and reporting so all information is incorporated or easily linked through one portal.
- Complete verification and inspection process documentation
    - Establish consistent rigor across programs, as appropriate

[8] These findings included efforts conducted for the First Interim Report: Third Party Review – 2010-11 Electric Conservation Saving,

    - Procedures transparent to participants, too
- Enhance and standardize verification for third-party programs to be fully integrated and consistent with PSE requirements.
    - Ensure that there are clear processes for overseeing third party program implementers. Conduct randomly sampled, internal verification of third party projects.
    - Establish minimum requirements for on-site inspections.
    - Consistent tracking and reporting with PSE delivered programs.

The team recognizes that PSE has ongoing efforts to improve its M&V practices to ensure it continues to be in line with best practices. These efforts dovetail with PSE's work on developing M&V policies, protocols, guidelines and processes and additional review provided by consultants to PSE. The team has identified areas where improvements can be made to simplify and enable efficient verification practices. Our hope is that implementing these recommendations will help PSE ensure a high level of data quality, and enable consistent and accurate reporting of savings.

Appendices

A. Measurement and Verification Policies, Guidelines, Protocols, and Processes

Energy Efficiency Services

Measurement & Verification

Policies, Guidelines, Protocols & Processes

2011

Version 1.0

January 1, 2012

This page is intentionally blank.

Table of Contents

A.1 Definitions

The following definitions are consistent with current and proposed operating practices by PSE EES staff. Similarly, they are consistent with definitions in the EM&V Framework:

- **EM&V** -- A catch-all term for evaluation activities at the measure, program or portfolio level; can include impact, process, market and cost effectiveness analysis. EM&V is distinguishable from M&V or programmatic M&V as described below. Please refer to the EM&V Framework for a complete description of EM&V activities as part of EES.
- **Evaluation** -- The performance of studies and activities aimed at determining the effects of a program and/or portfolio; any of a wide range of assessment activities associated with understanding or documenting program performance, assessing program or program-related markets and market operations; any of a wide range of evaluation efforts including assessing program-induced changes in energy efficiency markets, levels of demand or energy savings, and program cost effectiveness.
- **Measurement & Verification (M&V)** – The process of determining and validating savings. Per the International Performance Measurement and Verification Protocols (IPMVP), M&V activities are one of four options. However, in this document, the technical definition for developing individual measure savings is just a part of what is being considered as M&V. Here, M&V includes data collection, monitoring, and analysis associated with the calculation of gross energy and demand savings from individual sites or projects. These activities are reviewed and documented to establish the due diligence in achieving accurate energy savings and not the actual savings analysis itself (which is what is outlined in the IPMVP). These set of activities can also be a part of EM&V.
- **Measurement** – Measurement is the activity of collecting energy consumption data over time for use in energy savings analysis. This may include primary research (e.g., billing analysis, metering) for the purpose of determining the energy use/savings of the installed measures.
- **Verification** – A component of overall M&V efforts aimed at verifying installations of energy efficient measures and associated documentation through review of documentation, surveys and/or onsite inspections. Verification activities are the compilation of the processes used to report the suitability of the savings documented for the measure. This may include invoice and/or calculation review as well as on-site inspection.
- **Quality Assurance (QA)** - The purpose of QA is to validate the integrity of the data via an overall management plan or process (such as checklists, audits, standards, and methodology development). QA is process oriented to prevent any errors and is built into the implementation process.
- **Quality Control (QC)** - QC is meant to assess the quality of the analytical data or the tools used for measurement to identify any errors. QC is a subset of QA. QC may include inspections, peer reviews, and tracking database reports that test the process (i.e., did the measure meet the requirements).

A.2 Introduction

The purpose of this document is to define EES Measurement and Verification (M&V) structure and to define M&V policies, guidelines, protocols and processes to be used by the Energy Efficiency Services (EES) division of Puget Sound Energy (PSE).

This document is created in response to the September 2010 settlement agreement, "Agreed Conditions for Approval of Puget Sound Energy, Inc.'s 2010-2011 Biennial Electric Conservation Targets under RCW 19.285, Docket No. UE-100177." PSE agreed to a number of conditions related to I-937 regarding functions within EES. The conditions agreement in section K6 (f) (ii) states:

> *Measurement & Verification – PSE shall provide detailed descriptions of its measurement & verification (M&V) policies, protocols, guidelines, and processes to the CRAG for review and advice. Additionally, PSE shall provide to the CRAG an estimate of the costs associated with the detailed M&V plan and PSE will maintain activities at levels that are at least commensurate with regional peers.*

This document provides detailed descriptions of PSE M&V policies, protocols, guidelines and processes.

A.3 Overview

Over the 30+ year history of Energy Efficiency Services functions at PSE, a cornerstone business practice has been developing and implementing tracking, reporting and quality assurance practices that enable program staff, management, regulators and other stakeholders to:

- Assess EES performance,
- Have confidence that PSE is a responsible custodian of rate-payer dollars, and
- Trust that PSE's efficiency gains are realized and accurately documented.

In recent years EES' savings targets have increased significantly, and its program portfolio has become larger and more complex. Concurrently, its planning, implementation, administrative and evaluation teams have adopted more sophisticated portfolio and program data tracking and reporting capabilities. EES management and staff have created, and are committed to maintaining, a culture of continuous improvement that addresses quality assurance, quality control and verification practices.

A.3.1 M&V Roles & Responsibilities

At a macro level, the following teams are responsible for overall quality assurance and continuous improvement in their associated functions.

EES Program Implementation teams (including third party program implementers):

- Estimate energy savings
- Document and verify installations

- Establish program policies and procedures
- Market programs and educate participants
- Advocate customer interests and manage contractor relations
- Document evaluation report response (ERR) plans to integrate evaluation results

EES Evaluation team (and independent external evaluators):

- Conduct impact and process evaluations (as outlined in the annual EM&V plan)
- Provide feedback to implementation teams in identifying gaps in QA/QC, customer and/or contractor satisfaction, and other evaluation findings
- Review the documentation prepared by the implementation team
- Retain external evaluators to conduct independent impact evaluations of PSE's savings claims
- Calculate program and portfolio cost-effectiveness

EES Verification Team

- Assists EES Program Implementation teams in on-site verification
- Ensure that customers and contractors have installed qualifying measures
- Communicate with customers and contractors regarding program specifications and provide customer service
- Document and report results of site visits
- Develop proper and consistent on-site verification practices

EES Budget & Administration

- Conduct thorough reviews of all projects with incentives greater than $100,000
- Conduct an accounting and eligibility review of programs when an issue has surfaced
- Audit program engineer's work
- Provide training to EES staff on various tools and accounting practices
- Quarterly review of tracking system to ensure reference to measure metrics is correct
- Audit third party program implementers

All these M&V functions support and inform the critical EES portfolio metrics.

A.4 EES M&V Policy

In its simplest form, EES M&V policy is as follows:

- Every measure and/or program has objective and documented analysis describing kWh and/or therm savings and can be verified following installation.

- EES program planning, implementation, verification and evaluation teams are engaged in on-going quality assurance, quality control, analysis and reporting of measure/program activities.
- All M&V functions are complementary to the overall EM&V Framework.
- Transparent M&V methods are subject to review to increase quality and reliability.
- M&V efforts focus on areas of highest risk or uncertainty.

A.5 EES M&V Guidelines

The primary purpose of M&V functions is to obtain and secure the most reliable program savings and measure metric estimates while delivering high quality, cost-effective programs.

The EES division has adopted the following guidelines regarding M&V. EES will:

- Develop consistent protocols and processes for determining and verifying the measure and program metrics which include savings, cost, cost effectiveness and reliability of all energy efficiency programs and measures
- Use metrics accepted as industry best practices or adopt our own that are compatible with key objectives of the EM&V Framework
- Utilize M&V results for continuous improvement of existing programs

A.6 EES M&V Protocols & Processes

The following are the *overarching* M&V protocols used across EES functions. They also include examples of existing QA/QC processes that currently support the protocols.

A.6.1 Design or Modification of Program Rules, Policies and Measure Descriptions

Clear, consistent and well maintained program rules and measure requirements have a significant impact on the quality of program results. Such program rules and requirements are made to maximize consistency, minimize evaluation risk, and allow easy access for participation. Clear documentation of these rules and requirements is critical to the understanding of these programs for both internal and external program participants. Documentation is updated regularly as the programs grow and evolve. These documents serve as references to the program rules and an update process must be put in place to keep these documents current and relevant.

Process examples:

- Design of program rules, policies and measure eligibility criteria
- Design application approval and payment processes

- Develop and modify (as appropriate) program policies and procedures

A.6.2 Data Management & Process Tracking (collection, tracking & reporting)

PSE has systems in place that allow EES to effectively manage its data and accurately report program results. These systems assist in data collection, tracking of project and program milestones, and reporting of program results consistently and accurately across all departments within EES. Effective data management also includes built-in QA/QC functions that prevent or catch data entry errors. This category also includes the comprehensive documentation of the tracking and reporting systems to build a consistent process of managing data.

Process examples:

- Design, document, and use tracking and reporting tools
- Database training
- Confirm project/measure eligibility
- Project document/QC review

A.6.3 Energy Savings Verification

Measures within programs have documented procedures in place to fully verify savings in a manner that considers cost effectiveness and minimizes evaluation risk. Verification procedures may vary depending on measure, participant, or program type. Documentation of savings verification practices clarifies expectations for the implementation staff, evaluators, CRAG/WUTC, and program participants.

Process examples:

- Review equipment specifications
- Updates/refinements to deemed savings calculations and measure parameters
- Calculate energy savings (may include metering and/or modeling)
- Guidelines to custom savings calculations
- Peer review of application materials and calculations
- Pre and post-installation inspection & verification

A.6.4 Assessment & Verification of 3rd Party Programs

PSE has systems in place that require all of their third party program implementers to submit their verification plans for PSE approval. A set of requirements should be outlined for the third party as a minimum to meeting PSE standards. Such efforts ensure that proper M&V is included in any program processes. Finally, PSE institutes independent energy savings verification and

standard reporting requirements of third party program projects as part of an overall QA/QC plan.

Process examples:

- Training of 3rd party implementers re: program policies, compliance, reporting
- Creation of 3rd party tracking and reporting tools,
- Review of applications, calculations, reports
- Pre and post-installation inspection & verification

A.6.5 Contractor/Customer Training & Relations Management

Building and managing relationships between program implementers, customers and contractors increases the quality of applications submitted by program participants. It is important that the market has a clear and thorough understanding of EES programs and can provide regular feedback on the challenges that participants face. PSE takes into consideration the concerns of participants when determining policies and procedures and provides appropriate training resources to program stakeholders. These resources may include clear and concise language in program collateral on program expectations and/or holding seminars/webinars on program requirements.

Process examples:

- Design of customer/contractor training sessions
- Customer/contractor trainings
- Communication of program changes/adjustments

A.6.6 Documentation, Reporting & Optimization

The training and re-training of internal staff is a necessary element of consistently and accurately implementing program policies and procedures. PSE has a documented process for its portfolio to ensure that new staff is on-boarded in a comprehensive manner. This process helps to ensure that all staff whether new to the team or not, are working off the same guidelines and processes. The process includes methods of changing program policies so that implementation teams do not become disjointed as programs evolve. Internal training documentation must be properly catalogued and accessible to handle change management for all staff levels.

Process examples:

- Monthly, quarterly, annual program reporting
- Program/process optimization sessions
- Communication of program changes/adjustments

B. Measurement and Verification Cost Study

Puget Sound Energy
Energy Efficiency Services
Measurement and Verification Cost Study

DRAFT

Puget Sound Energy
Prepared by KEMA Inc
Oakland, California
October 27, 2011

B.1 Overview

This report documents the methodology and findings of a Measurement and Verification (M&V) Cost Study that Puget Sound Energy (PSE) and KEMA conducted. The objectives of this study are:

1. Satisfy the requirements of Conditions Agreement K6 (f) (ii).
2. Provide documentation of PSE's existing M&V costs that are organized and aligned with the M&V policies, guidelines, protocols, and processes.

PSE's Energy Efficiency Services (EES) division is committed to reporting accurate program energy savings in a cost-effective manner and existing EES accounting metrics do not have separate or independent M&V budget line-items. There are numerous and varied M&V tasks and functions conducted by existing EES staff and supporting (contracted) implementation and evaluation teams. These tasks aspire to be aligned with the Evaluation team which performs evaluation, measurement and verification activities, and the Budget & Administration team that tracks all expenditures and monitors and reports savings and adjustments.

The study approach included a detailed review of PSE's existing practices, completion of a literature review, interviews with peer utility program administrators and comparison of these practices with PSE's internal processes. For the purposes of this study, the project team defined P-M&V as something distinct from standard measurement and verification (M&V) or evaluation, measurement, and verification (EM&V). M&V is defined as the data collection, monitoring, and analysis associated to the calculation of gross energy savings for a measure or set of measures in a particular project. EM&V is the independent review of a measure, project, program, and /or portfolio level impacts, process, and market evaluation. P-M&V captures all efforts conducted on the implementation side and does include M&V, but in addition, it also encompasses quality control and assurance (QA/QC) activities used to ensure customer satisfaction, accurate and verifiable savings, and cost-effective implementation.

The project team defined the following six categories of implementation and administrative activities that capture all EES quality assurance and quality control efforts and make up the P-M&V policies, guidelines, protocols, and processes:

- Design or Modification of Program Rules, Policies and Measure Descriptions
- Energy Savings Verification
- Data Management & Process Tracking Strategies (collection, tracking & reporting)
- Assessment & Verification of 3rd Party Program Savings
- Contractor/Customer Training & Relations Management
- Documentation, Reporting and Optimization

For these six categories, we further identified the protocols and processes or specific activities that reflect current PSE P-M&V practices along with recommendations for improving processes using feedback from interviews with PSE staff, utility representatives and the best practice literature review.

KEMA developed a cost calculator as a tool to quantify the various M&V tasks and functions. The cost calculator defined six programmatic M&V (P-M&V) categories (see cost calculator attached Exhibit A) and each program was assigned an individual cost calculator for input/completion. The following are the six categories along with examples of specific P-M&V tasks.

Design or Modification of Program Rules, Policies & Measure Descriptions
Process examples:

- Creating program rules and measure eligibility criteria
- Creating application approval and payment processes
- Develop program policies and procedures
- Modification of program policies and procedures

Data Management & Process Tracking (collection, tracking & reporting)
Process examples:

- Design database and tracking tools
- Database creation & training
- Confirm project/measure eligibility
- Project document/QC review

Energy Savings Verification

Process examples:

- Review equipment specifications
- Calculate energy savings
- Pre-Installation site inspection
- Peer review of application materials and calculations
- Post-installation inspection & verification
- Pre or Post Metering

Assessment & Verification of 3rd Party Programs

Process examples:

- Training of 3rd party implementers re: program policies, compliance, reporting
- Creation of 3rd party tracking and reporting tools
- Updates/refinements to deemed savings calculations
- Review of applications, calculations, reports
- Post-installation inspection & verification

Contractor/Customer Training & Relations Management

Process examples:

- Design of customer/contractor training sessions
- Customer/contractor trainings
- Communication of program changes/adjustments

Documentation, Reporting & Optimization

Process examples:

- Monthly, quarterly, annual program reporting
- Program/process optimization sessions
- Communication of program changes/adjustments

B.2 Inventorying 2011 M&V Practices & Calculating Costs

This report details EES 2011 M&V costs at the P-M&V category and program level. EES program implementation teams were asked to complete a cost calculator in order to document resource allocation of staff and 3rd party support teams for each P-M&V category. Because of the variations in program delivery, each PM&V category included sub categories that would help account for different P-M&V tasks. The cost calculator template was sent out to managers of each program with instructions. Additional support resources were provided to address any questions and to ensure consistent interpretation of tasks and completion of the calculator.

After the calculators were completed, KEMA followed up with limited inquires to ensure that the tasks included were appropriately classified.

A table has been developed for Residential Energy Management (REM) and Business Energy Management (BEM) departments. We have also accounted for the Verification Team and the Systems Channel which serve multiple programs. The Budget & Administrative functions have not been included although their various oversight responsibilities clearly serve a M&V function (e.g., auditing, measure metrics development and management, and program tracking). The review team checked to make sure hours were not double counted within program costs estimates. The calculations are based upon the following inputs by P-M&V category and subcategory (or processes):

- How Often? (Annual Number of Instances)
    - Number of projects or number of occurrences for specific program/project level tasks
- How Long? (Hours per Instance)
    - Amount of time taken to perform each instance of the task in hours.
- Total Annual Hours
    - Total number of hours per year (How Often multiplied by How Long).
- Average Labor Cost per Hour
    - Average hourly cost of staff that perform task. The Budget and Administration group calculated $52 per hour for the non-manager level rate
- Staff Involved
    - Staff that is to perform the task. This may be a staff category such as engineer, inspector, manager, administrator, etc.
- Labor Cost
    - The total labor cost to complete all instances of the task which is equal to Annual Hours times Average Labor Cost per Hour
- Other Cost
    - If there are additional costs associated with completing all instances of the task.
- Total Cost
    - Total cost of each task is the sum of the labor and other cost.

B.2.1 Differentiating between program administration & P-M&V

The project team took care to ensure that the tasks included in the costs are considered M&V and not basic implementation or administrative practice. The defined categories and sub categories help distinguish between the two. For the purposes of this study, basic implementation practices are considered those minimum tasks that involve moving a project from the receipt of an application to the payment of an incentive. Examples of this would be answering emails and phone calls, or the various accounting steps required to pay an incentive.

P-M&V tasks are considered part of quality assurance/quality control or verification steps taken to ensure quality of data and accuracy of savings. Additional checks or secondary reviews of some basic implementation task can also be considered M&V. These tasks are beyond the basic implementation practices. Examples of M&V tasks include pre-inspections of customer sites, providing ongoing trainings for customers or contractors to enhance their understanding of program requirements and satisfaction of PSE program services. Peer reviews of calculations or re-calculation of savings is considered M&V, but not the production of the original savings calculation.

B.3 Summary M&V Cost Results

The results presented here are estimates based on input from the REM and BEM program managers and other EES staff. Managers of the individual programs implemented by EES were responsible for their data. The KEMA team aggregated the cost calculator inputs and then assessed the appropriateness of the task described and the relative costs. KEMA's review effort was limited and extent varied by program since it depended on the level of detail provided by the program managers. This section provides the results in this context. *These results are not an indicator if a program is or is not providing comprehensive P-M&V as described in the M&V policies, guidelines, protocols, and processes.* Relatively low or no spending in any P-M&V category may suggest that the program should investigate further to identify if more robust PM&V tasks are necessary to cover the risks of that category. This cost is broken down in the following categories by program.

Estimated 2011 M&V Costs by Category by Program

Program Name	Program Rules, Policies & Measure Descriptions	Data & Process Tracking	Energy Savings Verification	Verification of 3rd Party Programs	Contractor/ Customer Relations	Documentation Reporting & Optimization
LIWx	$5,200	$25,064	$11,024	$0	$1,456	$0
SFNC	$10,608	$17,056	$5,148	$0	$10,504	$3,952
MFNC	$11,232	$10,920	$53,040	$0	$0	$13,312
SF Existing - Home Print	$3,016	$0	$1,040	$1,820	$1,976	$13,520
SF Existing - Space Heat/Pilots	$4,160	$0	$0	$0	$4,420	$5,200
SF Existing - Water Heat	$3,120	$0	$0	$0	$3,120	$3,900
SF Existing - Wx	$4,160	$28,470	$0	$38,493	$10,322	$18,798
SF Existing - Mobile Home Wx	$2,704	$0	$0	$3,952	$2,184	$4,004
SF Existing - ES Appliances	$0	$0	$60,840	$0	$0	$0
SF Existing - Lighting	$0	$0	$166,296	$5,408	$0	$0
SF Existing - Ref DeCx	$0	$2,704	$0	$0	$0	$0
SF Existing - Showerheads	$0	$2,704	$0	$0	$0	$0
Systems Channel	$2,080	$146,016	$6,240	$17,472	$0	$24,960
Verification Team			$332,480			
C&I Retrofit	$14,820	$283,400	$331,500	$11,024	$2,600	$4,576
C&I NC	$12,064	$13,884	$41,860	$0	$2,912	$6,448
C&I Rebates	$0	$115,767	$95,583	$0	$0	$0
SBL	$16,640	$49,920	$21,840	$0	$10,608	$10,400
RCM	$4,420	$237,328	$105,820	$1,664	$17,472	$16,848
CX	$7,072	$20,280	$29,640	$0	$8,944	$4,004
Total	**$101,296**	**$953,513**	**$1,262,351**	**$79,833**	**$76,518**	**$129,922**

The aggregate totals for all P-M&V tasks equal $2,603,422 and constitutes 2.73% of EES 2011 implementation budget of $95,473,000[9]. The aggregate totals of Data & Process Tracking,

[9] 2011 Cost Calculations based on data in 2011 ACP (Annual Conservation Plan) and 2011 EES Tracking figures.

REM program $ minus Information Services $ = $44,004,000 - $1,652,000 = $42,352,000

BEM program $ minus Information Services $ = $53,385,000 - $264,000 = $53,121,000

$95,473,000

Energy Savings Verification, and Verification of 3rd Party Programs (those functions that fit a more traditional definition of M&V) equal $2,295,697and constitutes 2.40% of EES implementation budget.

Special effort has been made to differentiate generic “program administration” tasks with those tasks with focus on quality assurance, quality control (QA/QC) and/or measurement & verification (M&V).

The following two tables summarize the REM and BEM P-M&V Costs per program, respectively.

REM P-M&V Costs Per Program

Program Name	Total Cost
LIWx	$42,744
SFNC	$47,268
MFNC	$88,504
SF Existing - Home Print	$21,372
SF Existing - Space Heat/Pilots	$13,780
SF Existing - Water Heat	$10,140
SF Existing - Wx	$100,243
SF Existing - Mobile Home Wx	$12,844
SF Existing - ES Appliances	$60,840
SF Existing - Lighting	$171,704
SF Existing - Ref DeCx	$2,704
SF Existing - Showerheads	$2,704
Systems Channel	$196,768
Verification Team[10]	$332,480
Total	**$1,104,095**

BEM P-M&V Costs Per Program

Program Name	Total Cost
C&I Retrofit	$647,920
C&I NC	$77,168
C&I Rebates	$211,350
SBL	$109,408
RCM	$383,552
CX-BEOP	$69,940
Total	**$1,499,338**

[10] Includes the small business lighting program support. It is assumed that this team is 4 people at 80% time.

This 2011 P-M&V cost study includes a cost calculator and incorporates the various M&V and QA/QC steps taken annually by each program both at the measure and project levels. The costs vary by program based on its delivery method, savings source, and level of risk tolerance. The risks may include financial penalty, disallowance of savings, lost revenue, fraud and reputation risk. Some programs serve a high volume of projects with little savings and some have low volume with large savings. It is assumed that these P-M&V tasks and their associated costs may vary over time and should be updated accordingly.

Exhibit A

EES M&V Calculator										
Program: Name					**Staff**					
PM&V Category	**PM&V Subcategory**	**Comment**	**How often? (Annual # of instances)**	**How Long? (Hours per Instance)**	**Total Annual Hours**	**Average Labor Cost per Hour**	**Staff Involved**	**Labor cost**	**Other costs**	**Total cost**
Design/modification of Program Rules, Policies & Measure Descriptions	Design of program rules, policies and measure eligibility criteria.				-			$ -		$ -
	Design of application approval and payment processes.				-			$ -		$ -
	Creation of Program policies and procedures.				-			$ -		$ -
	Modification of policies, procedures and/or measures				-			$ -		$ -
	Other				-			$ -		$ -
	Other				-			$ -		$ -
	Other				-			$ -		$ -
Data Management & Process Tracking (collection, tracking & reporting)	Design and build database & tracking tools				-			$ -		$ -
	Database training				-			$ -		$ -
	Confirm project/measure/customer eligibility				-			$ -		$ -
	Project/document QC review				-			$ -		$ -
	Other				-			$ -		$ -
	Other				-			$ -		$ -
	Other				-			$ -		$ -
Energy Savings Verification	Review equipment				-			$ -		$ -
	Calculate energy savings				-			$ -		$ -
	Peer review of application				-			$ -		$ -
	Pre-installation site inspection				-			$ -		$ -
	Post-installation inspection & verification				-			$ -		$ -
	Pre & Post metering				-			$ -		$ -
	Other				-			$ -		$ -
	Other				-			$ -		$ -
	Other				-			$ -		$ -
Assessment & Verification of 3rd Party Programs	Training of 3rd Party implementors re: program policies, compliance, reporting				-			$ -		$ -
	Creation of tracking and reporting tools				-			$ -		$ -
	Updates or refinement of deemed savings calculations				-			$ -		$ -
	Review of applications, calculations, reports				-			$ -		$ -
	Post-installation inspection & verification				-			$ -		$ -
	Pre & Post metering				-			$ -		$ -
	Other				-			$ -		$ -
	Other				-			$ -		$ -
	Other				-			$ -		$ -
Contractor/Customer Training & Relations Management	Design of customer/contractor training sessions				-			$ -		$ -
	Customer/contractor trainings				-			$ -		$ -
	Process/program improvements				-			$ -		$ -
	Other				-			$ -		$ -
	Other				-			$ -		$ -
	Other				-			$ -		$ -
Documentation, Reporting & Optimization	Monthly, quarterly, annual program reporting				-			$ -		$ -
	Program/process optimization sessions				-			$ -		$ -
	Communication of program changes/adjustments				-			$ -		$ -
	Other				-			$ -		$ -
	Other				-			$ -		$ -
	Other				-			$ -		$ -
Notes:										

C. Interview Guides and Results

- Internal and external interview guides
- Internal and external interview notes
- Literature review findings and sources

External Interview Guide

Intro

Puget Sound Energy (PSE) is conducting a study to determine the best practices or standard industry practices surrounding QA/QC and M&V.

Definitions:

QA – An overarching management strategy to ensure that the program is conducted as expected, and maintains a high level of confidence.

QC – Specific tasks that are built into the program's day to day activities that control the quality of data that is being submitted/entered.

M&V – Catch all phrase for measuring energy consumption of rebated equipment to verify the energy savings that was claimed in the program documentation.

High Level categories that we are aiming towards:

- Design/ modification of Program Rules, Policies & Measure Descriptions
    - How is risk management involved with the development of programs?
    - How are the program rules and policies implemented throughout the course of the program
    - If changes in the program occur, how are those changes reflected in the documentation?
- Customer and contractor satisfaction and training
    - To ensure that the program goes smoothly, training must occur so that program participants understand the details of the programs that are being offered
    - Means to deliver expectations from the program to the participants and how most effectively to use the program.
    - Consistent contact with program participants allows the program to receive feedback and take appropriate action should problems arise.
- M&V – measure savings verification dependant on approach (Deemed, measured, custom, etc)
    - Are there templates for savings calculators?
    - What is the process for developing savings estimates?
    - Is there any peer review for the savings calculators?
    - Criteria for site visits, metering and billing analysis, custom calculation versus deemed savings.
- Tracking and reporting systems
    - Type of tracking system? (online DB, Excel, Access, etc)

- What is being tracked?
- Is there a process to control the quality of data and the reports that use that data?

- Management of internal process and personnel changes
  - How do you ensure that the program policies and guidelines remain on course when new personnel or change in management occurs?
  - How to implement changes in policies and guidelines while still maintain quality and consistency.

- Third party program implementer verification
  - What actions are taken to verify 3rd party implementers?
    - Audits of 3rd party process? On-sites?
    - Phone calls?
    - Depth of review from implementers reports?

High Level questions for interviewee

We will be talking about practices that may vary from program to program. What programs are you responsible for?

How would you define QA/QC and M&V?

Has there been an effort to look at the level of QA/QC practices as PSE is doing now?

Is QA/QC and M&V a function of implementation or evaluation or both?

- How does the feedback from evaluators make an impact of the QC process?

What level of coordination exists across energy efficiency programs to have consistent QA/QC or M&V processes?

Within the QA/QC activities, what are the most crucial areas you cover? What type of errors receive the most focus?

- Do you assign tolerance levels for errors uncovered by QA/QC?
- How do you determine the assignment of tolerance levels? Frequency of errors seen? Evaluator or commission requirements? Etc?

Design/ modification of Program Rules, Policies & Measure Descriptions

In the design of your programs, what are some of the rules set to mitigate risk?

- Are some measures paid a smaller $/kWh because of higher M&V risk?
- Are there limits to incentives given? How are those limits structured?
- What is required to prove eligibility of the program?
- What is required to qualify for incentives?

- Are there qualifications for measures that consider beyond kWh savings?

Are there documents for internal staff and or external program participants like contractors and customers?

- How are program documents kept and updated
    - How do you take into account feedback from participants or staff?
    - Is there a formal or regular process set to accomplish this?

Is there a consistent process to manage change within the programs on a regular basis? Annual? Or semi annual?

- Is there a checklist or other tools used
- How do you communicate changes though out the organization?
- How do you know when changes have not been implemented throughout?

Customer and contractor management and training

How often do formal outreach or educational efforts occur for customers and contractors?

Are there instances where outreach or educational efforts have had an ostensible impact on processing applications or program results?

What type of outreach or educational efforts receives the most positive response from program participants and what efforts have resulted in the most improvement of application quality? Has any received negative feedback?

What are some actions you have taken to deal with customers or contractors that provide inaccurate or inconsistent information?

Management of internal process and personnel changes

Are application review processes or policy changes common within a program year or across multiple program years? What is an example of a common change?

Would your program make program rule changes within a program year?

How are changes communicated between different programs, when changes are made for one program?

When there are role changes or new personnel, what is the process of training?

What are some of the issues that have come up during implementation of internal changes?

Tracking and reporting systems

What type of tracking system is in place? Which staff members use the tracking system (data entry, engineers, managers, etc?)

Are savings, payback, and incentive calculations done within a tracking system or database? Or in a spreadsheet?

What type of information is tracked?

	Pre-equipment	Installed equipment	Counts
Measure Level			

	Contractor info	Customer info	Account/billing info	Contact log
Application level				

What are the key challenges of reporting program results and what processes are in place to QA/QC these reports? How do you make sure that the data accurately reflect the state of the program?

- How is data QA/QC'ed?
- What tools are used to ensure data accuracy?
- How often do data clean-ups occur?
    - Looking for inconsistencies and errors within the data.

M&V and savings calculations: Deemed, measure, and custom

What is the approach to calculating savings in your program?

- Are savings deemed, measured, or custom?
- How does M&V depend on measure installation and delivery channel?
    - M&V criteria or practices may be different for different measures. Higher uncertainty measures will receive more site visits and measurements. Practices will also depend on what kind of program its is. Small business programs, for example tend to have a high percentage of site visits.

What QC practices are in place to assure accuracy and consistency in savings?

- Who conducts peer review, if process exists?
- Site visits?
    - Counts
    - Nameplate
    - Op. hours
- Is there a standard method or template for inspection reports?
- What are the site inspection criteria?
- What percentages of sites with installed measures are visited?
- What measure or businesses receive the most inspections?
- What percentage of projects gets a pre inspection, post inspection, both?

Does the implementation team perform M&V?

- What are the criteria for conducting M&V onsite?
- What are the common measures or business types where M&V is conducted?

Is there a peer review process in place where savings calculations require multiple reviews?

- What are the peer review guidelines that determine what projects get reviewed?

Are qualifications of peer reviewers different from the initial application reviewer?

Third party program implementer verification

How do you ensure that 3rd party implementers provide accurate data?

- Checks conducted by the utility implementation group?
- What reports are requested on a regular basis?
- What information is provided to 3rd parties with the expectation that it will be used towards QA/QC practices?
    - Usage data?

At what level are customer account managers involved in the program?

What are examples of policies that would ensure program quality from the 3rd party?

Approach to PSE Internal Interviews - Discovery of Internal Programmatic M&V Practices

KEMA will conduct interviews with PSE staff that focus on implementation and QA/QC practices within the EES programs. The goal of the interviews is to accurately capture current practices so that KEMA can provide useful recommendations in programmatic M&V. While we may not interview members from every program, we will interview at least one person from each program category. We aim to conduct 6-8 interviews. Since we aim to understand program processes, each interview will involve multiple staff members including program engineers, administrative personnel, program managers, and a member of the QC staff. We will assess whether program managers are implementing the policies and procedures as documented, if one is available, and solicit their perspective on what processes are working or not working, and their recommendations for improvements. We have designed this document to guide the discussion.

Introduction

- Introduction of purpose of the PM&V project and the internal interview process. We realize that some background in this project already exists.
- The interviews are a critical process to document internal program processes and help KEMA provide useful recommendations on QC/QA that will help increase the quality of work.
- Define PM&V and describe how it differs from M&V

Questions for all interviewees

- What is your role on the implementation team and what PM&V categories apply to you?
- Describe your process of completing your tasks/projects?
- What aspects of PSE's programmatic M&V are working well? What is not working well?
- What do you think is missing from the process?
- Is there a reference guide or program manual that cover the processes of your tasks? How might a manual or guide be valuable? Is it/Would it be helpful when questions of process need to be answered?

Interview questions by roles:

Administrative Staff

- How are applications received, and provided to technical staff for review?
- What do you think are the main causes of data entry errors?
  - What changes can be made to improve data entry quality?
- What are other common errors that are made and what type of training or tools that can help avoid these errors?
- If there are policy or process changes, how is that communicated?
  - What are the challenges of communicating these changes to you or others on staff? To customers or trade allies?
- How often do you see program participants submit incomplete applications? Do you track this data?
- How do you verify that a participant is an eligible utility customer?

Technical Staff/QC Specialist

- Do you verify that if a measure is deemed that the proper measure is selected in the database tracking and assigned the correct savings value?
- Is there guidance in regards to measures/programs to make sure the right one is selected for any measure that might be hard to classify? For instance putting a measure in a custom program vs a prescriptive program.
- Is there a set of savings calculation methods that every technical staff member uses?
- What is the criteria to chose between calculation methods such as prescriptive, or custom or a combination of the 2?

- Are there standard calculation sheets/tools?
- Do standard calculation sheets vary by technology? (??)
- Are these sheets always used when applicable?
- What are the different tasks involved in field work?
    - Metering?
    - Site Verification?
    - Counts?
    - Operating hours?
- What are the criteria for conducting a field visit?
- How do you keep track of contacts with customers? How do you keep track of contacts with trade allies/contractors?

- How do you keep track of various versions of calculations, or inspection reports?
- Do you use the database?
- If there are policy or process changes, how is that communicated?
    - What are the challenges of communicating these changes to you or others on staff? To customers or trade allies?
- How often do program participants submit for equipment that does not qualify?
- How do you verify that the submitted measures are eligible?
- Do applications get multiple reviews from technical staff?
    - What are the criteria for peer review?
    - What is checked in the peer review process?

Program Manager

- What are the P-M&V roles and responsibilities of program and program support staff?
- What are your concerns regarding increased P-M&V, if any?
- What are your plans for using the results and recommendations from this project?
- What are you hoping to see in the final P-M&V vision statement?
- How often do you review/reassess internal operations? Every new program cycle, every 2 years, or other trigger point?
- What are your essential QA/QC steps and database reports?
- What do you look for when approving payments or checking for errors?
- For your third party programs, what kind of verification do you do?
- Do applications get multiple reviews from technical staff?
    - What are the criteria for peer review?
    - What is checked in the peer review process?

- What outreach efforts train customers and trade allies on program requirements and help them participate in the program?
- What is the involvement of the program staff in the design of the tracking system?
    - What is the process of changing the tracking system structure or functionality to fit any program process or policy changes?

Evaluation Manager:

- What kind of informal process evaluations do you conduct?
- When was the last evaluation?
- How do you choose what program is evaluated?
- Have you made any recommendations regarding programmatic M&V QA/QC?

For Budget and Administration Manager:

- Do you have any critical QA/QC reports that you review?
- Do you receive all the tracking and regulatory data in a timely manner and complete from the EES group?
- What additional verification activities do you think are needed?
- What data quality issues are you experiencing?

1 Energy Trust of Oregon Interview

07/14/2011

- Oliver Kesting
- Tom Beverly – Trade Ally network Manager
- Kathleen Ortball – Operations Analyst

High Level questions for interviewee

- We will be talking about practices that may vary from program to program. What programs are you responsible for?

ETO manages four utility programs in Oregon.

Actual implementation group is lean since much of the work is contracted out to 3rd parties through Program Management contracts.

Oliver's group:

- Commercial, Existing, NC, MF
- Use 3rd party contractors
- Manages Trade Allies

- How would you define QA/QC and M&V?

There is no formal definition. QC is control on the process and conducting audits on the process, and QA is what the ETO does to manage savings and engineering analysis currently done by the Allied Technical Assistance Contractors (ATAC) which currently is HMG. The PMCs manage the ATACs.

- Has there been an effort to look at the level of QA/QC practices as PSE is doing now?

No, but a lot is defined in the contracts with the PMCs (Program Management Contractors)

- Is QA/QC and M&V a function of implementation or evaluation or both?

Both

- How does the feedback from evaluators make an impact of the QC process?

ETO conducts real time evaluation and feedback. Contractors are contractually liable for quality. EM&V results will also be used to true-up savings values even years later if the evaluation report states there needs to be a change.

- What level of coordination exists across energy efficiency programs to have consistent QA/QC or M&V processes?

Each PMC is responsible for its own QA/QC.

Design/ modification of Program Rules, Policies & Measure Descriptions

- In the design of your programs, what are some of the rules set to mitigate risk?
- Are some measures paid a smaller $/kWh because of higher M&V risk?
- Are there limits to incentives given? How are those limits structured?
- What is required to prove eligibility of the program?
- What is required to qualify for incentives?
- Are there qualifications for measures that consider beyond kWh savings?

Oliver's groups:

- Retrofit side uses ATACs that do studies and audits of sites
- ATACs report to 3rd party contractors.
- The QC/QA requirements are written into the contracts.
- Specific metrics for quality are also stated in contracts.
- Checks and balances between ATAC and PMC exist.

Customer and Trade Ally management and training

- How often do formal outreach or educational efforts occur for customers and contractors?
- Monthly updates of programs in email form.
- Trade ally newsletters
- Quarterly roundtable for contractors
- Billing inserts from the program
- New trade allies must take the trainings.

- What type of outreach or educational efforts receives the most positive response from program participants and what efforts have resulted in the most improvement of application quality? Has any received negative feedback?

- A website that is maintained and updated with the most recent program information.
- Trainings and webinars
- Trade Ally Network Managers are assigned for different trade groups and provide feedback from trade allies. The feedback is used to help improve the program.
- Customer feedback about trade allies are kept and logged.
- The ETO have auditors that check up on trade allies and rate them in their online database

Tracking and reporting systems

- What type of tracking system is in place? Which staff members use the tracking system (data entry, engineers, managers, etc?)

ETO has a lot of PMCs and internal managers manage these PMCs. All PMCs use an online database called Fast-Track and contains all project info. A CRM DB is also in use. PMCs will upload data in the form of spreadsheets but the format is not always consistent. They are trying to integrate the three databases that exist now: finance DB, CRM, and project DB. The database have very basic project level information. On-site visits typically are not documented in DB, but are documented in hard copy data file.

All contractors are required to produce program implementation manual that are supposed to cover all aspects of the program and the process (QC steps, etc). They have a compliance manager to ensure that these contractors have accurate and fully compliant manuals.

ETO has a schedule for quality controlling work of their contractors. There are quarterly audits, where ETO staff goes into PMC offices and checks roughly 20 projects in each program. ETO staff will also check DB entries versus hard copy folders at the PMC offices.

- Are savings, payback, and incentive calculations done within a tracking system or database? Or in a spreadsheet?

Calculations are not done in the online database, which acts more like a storage site. Engineers have some calculators for custom projects.

The lighting PMCs see the most errors in their DB, mainly due to the complexity and volume. PMCs have a pre-approval process. Each PMC has three people to do approval of their applications before it goes to ETO. A common Residential issue involves incorrect addresses.

ETO creates reports to get the DB to spit out problem sites/applications on a weekly basis. ETO staff looks at fields that are empty, and assesses if they need to keep the field or not.

DB will also track progress of projects.

- What are the key challenges of reporting program results and what processes are in place to QA/QC these reports? How do you make sure that the data accurately reflect the state of the program?
- How is data QA/QC'ed?
- What tools are used to ensure data accuracy?
- How often do data clean-ups occur?
    - Looking for inconsistencies and errors within the data.

ETO conducts weekly audits of data for projects >$20k. There are also quarterly random checks on data entry errors. The sample rate is usually a set number of files.

M&V and savings calculations: Deemed, measure, and custom

- What is the approach to calculating savings in your program?

- Are savings deemed, measured, or custom?
- How does M&V depend on measure installation and delivery channel?
    - M&V criteria or practices may be different for different measures. Higher uncertainty measures will receive more site visits and measurements. Practices will also depend on what kind of program its is. Small business programs, for example tend to have a high percentage of site visits.

  years of realization rates are incorporated into the savings calculations and are built into the contracts with 3rd parties.

- Does the implementation team perform M&V?
- What are the criteria for conducting M&V onsite?
- What are the common measures or business types where M&V is conducted?

Evaluation team provides real time feedback and front end evaluation is done shortly after a project is completed.

In the past, ETO has let the PMC's do their own QA/QC, but now has hired a QC contractor to double check on the PMC's. ETO will tell the PMC where the QC contractor will go. The Multifamily program used to do 100% pre and post on-site inspection, but the interviewee was not sure what it is now. ETO conducts about 10-20% QC review on projects under $20K.

Third party program implementer verification

- How do you ensure that 3rd party implementers provide accurate data?
- Checks conducted by the utility implementation group?
- What reports are requested on a regular basis?
- What information is provided to 3rd parties with the expectation that it will be used towards QA/QC practices?
    - Usage data?

QA processes are contracted out separately from main implementation. The ATAC's operate their own sampling plan, calc review and site visits.

No metering or E&MV aspects are involved in these visits but staff do verify installation and function of equipment.

- At what level are customer account managers involved in the program?

None, but the utilities will do some walkthroughs.

- What are examples of policies that would ensure program quality from the 3rd party?

The ETO requires that QC methodology be clearly spelled out in the PMC contract. Currently, the ETO has contracted with a QC company to do on-sites from each of the PMC's.

2 Public Service New Mexico

07/20.2011

- *Emma Van Moorsel*

High Level questions for interviewee

Customer and contractor management and training

- How often do you have formal outreach or educational efforts occur for customers and contractors?

They only offer trainings to contractors, and only for certain programs. They work with their contractors and implementers to develop effective marketing documents in order to get the word out about their programs.

- What are some actions you have taken to deal with customers or contractors that provide inaccurate or inconsistent information?

Third party implementers deal with these issues.

- What is the approach to designing of documents released to the public so that they minimize confusion from potential participants?

PNM works with their implementers to develop clear and concise marketing materials. For the most part, the implementers will design most of the marketing materials, and PNM will help out if needed.

Tracking and reporting systems

- What type of tracking system is in place? Which staff members use the tracking system (data entry, engineers, managers, etc?)

Currently, PNM has an online dashboard that they have their contractors upload their program documentation onto so PNM can track the progress of each contractor/program. The format of what gets uploaded is not standardized.

M&V and savings calculations: Deemed, measure, and custom

- What is the approach to calculating savings in your program?
- Are savings deemed, measured, or custom?
- How does M&V depend on measure installation and delivery channel?
    - M&V criteria or practices may be different for different measures. Higher uncertainty measures will receive more site visits and measurements. Practices

will also depend on what kind of program its is. Small business programs, for example tend to have a high percentage of site visits.

All of their programs are implemented by third party implementers, they are the ones who take care of the savings calculations

Third party program implementer verification

- What are examples of policies that would ensure program quality from the 3rd party?

PNM requires that their third party contractors use an online dashboard to upload all of their program documentation.

PNM is very trustworthy of their third party contractors and implementers. They have a good working relationship. Whenever problems or issues arise they talk about them and deal with them as they come up.

ICF – reporting process is not standard or formal. They just do a small sample, PNM doesn't have a big part. PNM doesn't really track what gets sampled, they just give the contract out to a third party implementer.

PNM designs programs – and they give their design to the third party to implement.

They work closely with implementers. So the feedback loop is tight. They work well with them.

Low income – MFA is the state wide implementer for weather assistance program – MFA gets money from many sources – and then they bill PNM. PNM works on the finances, and pays the bills from MFA.

Tracking system – most vendors have online dashboard – PNM also has an online collaboration site for all the vendors to share info. This information isn't standardized. The vendors upload in any format they want to.

They do help a little bit with marketing work with third party groups. They collaborate when re-doing their marketing materials.

They only provide training with commercial programs – no customer training. They have offered workshops and training, but funding wasn't there.

They do training programs at the beginning of each program year. Energy star new construction.

They have goals for annual energy savings. 61 GWh overall, adjusted for free ridership.

They have a design group and an implementation group.

3 Seattle City and Light Interview

08/09/2011

- *Glenn Atwood*

High Level questions for interviewee

- We will be talking about practices that may vary from program to program. What programs are you responsible for?

Resource conservation manager

- How would you define QA/QC and M&V?

"We are not where we want to be". The group leader before Glenn developed a framework for developing QA/QC efforts, but has not been carried through to the extent that SCL wants. This applies to all of their energy conservation programs.

They see QC/QA as part of the M&V and Programmatic M&V efforts they are implementing later this year and next year. The PM&V framework will look at all programs from a risk standpoint, and will determine what level of QC/QA and M&V are required for each program. The framework will define a process before evaluation occurs.

- Has there been an effort to look at the level of QA/QC practices as PSE is doing now?

Yes, the effort is ongoing. SCL hopes to establish a QC/QA process in the next 9 months.

- How does the feedback from evaluators make an impact of the QC process?

Glenn sees QAQC as M&V function. There isn't a lot of feedback from evaluation teams to the implementation team. That is mainly because of the lack of staff. SCL was subject to significant budget restrictions in the last few years and is just now rebuilding staff

- Within the QA/QC activities, what are the most crucial areas you cover? What type of errors receive the most focus?
- Do you assign tolerance levels for errors uncovered by QA/QC?
- How do you determine the assignment of tolerance levels? Frequency of errors seen? Evaluator or commission requirements? Etc?

They have not formalized tolerance levels yet, but hope to. They hope to identify risks associated with their different programs. The main concerns are related to claimed savings and the accounting of rate payer dollars. Incentive fraud is a big concern and Glenn hopes that the QA/QC imbedded in their intended M&V program will cover these financial worries.

Design/ modification of Program Rules, Policies & Measure Descriptions

- In the design of your programs, what are some of the rules set to mitigate risk?
- Are some measures paid a smaller $/kWh because of higher M&V risk?
- Are there limits to incentives given? How are those limits structured?
- What is required to prove eligibility of the program?
- What is required to qualify for incentives?
- Are there qualifications for measures that consider beyond kWh savings?

SCL doesn't have any rules set up to mitigate risk currently, but hopes to in the future. $/kWh are more set to transform markets and not mitigate risk. The incentive rates are therefore higher for measures that are newer and may have more savings risk. C&I programs have incentive caps in place. Caps are based on 70% of incremental project cost.

Small business programs have fixed incentives. SCL verifies account eligibility and conducts inspections on 100% of sites. Contractors are sometimes provided with a qualifying customer list under a non-disclosure agreement, but this is rarely done.

SCL uses national standards for qualification of measures. CEE and ENERGY STAR are often used for lighting and appliances. Local lighting lab also plays a role in developing a list of enhanced lights over baseline.

- How are program documents kept and updated
- How do you take into account feedback from participants or staff?
- Is there a formal or regular process set to accomplish this?

Internal program documentation is useful, but it has not being kept up to date. SCL has not been as diligent in document management as they would like to be. They recently had a financial audit that identified some of the issues surrounding the management of program documentation.

- Is there a consistent process to manage change within the programs on a regular basis? Annual? Or semi-annual?
- Is there a checklist or other tools used
- How do you communicate changes though out the organization?
- How do you know when changes have <u>not</u> been implemented throughout?

SCL programs are working on templates and other pertinent documentation. There are some documentation for programs, but there isn't much consistency in format and content. Some materials are a couple years old and have not been updated.

<u>Customer and contractor management and training</u>

- How often do formal outreach or educational efforts occur for customers and contractors?

Outreach and education varies across programs. SCL have mandatory training programs for their residential auditors. Commercial lighting programs offer at least annual contractor meetings to update contractors on program requirement. There have been some collaborative efforts to pull together contractor trainings for contractors who work across multiple service

territories. SCL has done some outreach over time for new construction, building designers and architects to help stakeholders understand the programs better.

Management of internal process and personnel changes

- Are application review processes or policy changes common within a program year or across multiple program years? What is an example of a common change?

SCL tries to not change program rules, but the incentives can change (once every couple years, depending on program). Appliance criteria every couple of years due to standard changes. Code is used as baseline, so programs will update rebated measure list when code changes.

Tracking and reporting systems

- What type of tracking system is in place? Which staff members use the tracking system (data entry, engineers, managers, etc?)

SCL needs to develop a single centralized tracking system and they are trying to develop one soon.

M&V and savings calculations: Deemed, measure, and custom

- What is the approach to calculating savings in your program?
- Are savings deemed, measured, or custom?
- How does M&V depend on measure installation and delivery channel?

M&V criteria or practices are different for different measures. Higher uncertainty measures will receive more site visits and measurements. Practices will also depend on what kind of program it is. Small business programs, for example tend to have a high percentage of site visits.

Measure reviewers use Excel based workbooks for major, standard measures. Lighting is custom depending on program or type of use. SCL also has HVAC, Motor, and other measures. Custom measures use 'generally accepted' engineering practices. Every project currently gets a pre-post inspection (field delivered programs – small commercial lighting, multi-family retrofit, all the way up to med-large Industrial)

Inspection reports are standardized. Each inspection uses a summary report template with details covering metering, the logs are required, and whether other monitoring is required.

SCL sees some custom projects in the industrial sector, but not a lot. Large steel plant, cement, glass manufacturing, aerospace are some major industries in the area and industrial facilities make up 12-15% of sales.

4 Avista Utilities

07/15/2011

- *Bruce Folsom, Policy Planning and Analysis*

High Level questions for interviewee

- How would you define QA/QC and M&V?
- Has there been an effort to look at the level of QA/QC practices as PSE is doing now?

Avista has submitted an EM&V framework to the commission and Bruce sees that framework as documentation of Avista's QA/QC practices. This document was the result of a collaborative effort to spell out their EM&V practices and approaches.

Avista views QA/QC from a cost/benefit perspective. Purpose and cost must be clear. The organization has built in checks for their rebates, and sometimes staff has to go back and look at projects after the fact. Before rebates go out to payment, there is another check for anomalies.

- Is QA/QC and M&V a function of implementation or evaluation or both?
- How does the feedback from evaluators make an impact of the QC process?

In 2010 Avista split apart to have a 3rd party analytical review on their processes. Cadmus is doing impact analysis and process evaluation. Avista uses the feedback from their evaluators to improve or adjust their savings estimates for the programs running into the future. Bruce didn't say much about improving the QC process, but did talk about adjusting their programs based on feedback from the evaluators.

- How are QA/QC processes institutionalized in your program and at your utility?
- Do you have program and/or evaluation operations or policy manuals?
- Do operations or policy manuals include specific QA/QC and/or M&V tasks?

Bruce's team, Policy Planning and Analysis (PPA), is an internally independent group. The group advises the implementation group to make changes based on the evaluations. The EM&V framework acts as a policy manual.

- What level of coordination exists across energy efficiency programs to have consistent QA/QC or M&V processes?

Avista uses the EM&V framework for most of their programs. It is a small utility so staff easily can coordinate changes.

Avista was mandated to have a collaborative for EM&V framework.

- Within the QA/QC activities, what are the most crucial areas you cover? What type of errors receive the most focus?

Avista addresses problems as they are found. All initiatives are analyzed on a cost-benefit basis.

Design/ modification of Program Rules, Policies & Measure Descriptions

- What are the rules built into the requirements of the program that are meant to mitigate risk?
- Are some measures paid a smaller $/kWh because of higher M&V risk?
- Are there limits to incentives given? How are those limits structured?
- What is required to prove eligibility of the program?
- What is required to qualify for incentives?
- Are there qualifications for measures that consider beyond kWh savings?

Avista looks at schedules 90 and 190 for quick payback measures that have small incentives. All projects are capped at 50% of total cost. Implementers have checks on every application to prove eligibility and qualifications for incentives. They determine if the applicants are in their service territory before proceeding to other reviews. Most of the measures qualify based on kWh savings.

Large C&I custom applications require two reviewers. Non-energy benefits are also considered. All custom projects get peer reviewed.

- How are documents kept and updated to reflect the current needs of the program?
    - How do you take into account feedback from participants or staff?
    - Is there a formal or regular process set to accomplish this?

Changes to programs are easily addressed. Avista has a small service territory and most of the changes effect the trade allies, who receive frequent updates.

- Is there a consistent process to manage change within the programs on a regular basis? Annual? Or semi-annual?
    - Is there a checklist or other tools used
    - How do you communicate changes though out the organization?
    - How do you know when changes have <u>not</u> been implemented throughout?

Avista updates trade allies on a regular basis through phone and email. Internally, staff communicates effectively when changes are made.

- Is there a peer review process in place where savings calculations require multiple reviews?

Yes, peer review is required for all custom projects.

Customer and contractor management and training

- How often do formal outreach or educational efforts occur for customers and contractors?

Implementers have done some outreach for commercial and residential programs. There are multiple channels from marketing that steer customers to their website to get info. The best ambassadors of the program on the individual customer level are the trade allies. If there are changes in programs, implementers send letters/emails to trade allies to update them on program changes. Avista works with NEEA develop training for trade allies, though they do not have a preferred vendor list.

- Are there instances where outreach or educational efforts have had an ostensible impact on processing applications or program results?

No noticeable difference have occurred.

- What type of outreach or educational efforts receives the most positive response from program participants and what efforts have resulted in the most improvement of application quality? Has any received negative feedback?

It is hard to quantify effects. Avista doesn't offer a lot of training, nor does it feel it needs to in order to increase the effectiveness of their programs.

- What are some actions you have taken to deal with customers or contractors that provide inaccurate or inconsistent information?

Not an issue.

- What is the approach to designing of documents released to the public so that they minimize confusion from potential participants?

Not an issue

Management of internal process and personnel changes

- Are application review processes or policy changes common within a program year or across multiple program years? What is an example of a common change?

Avista does make changes in the middle of a program year. Changes depend on the success of the programs. If programs aren't meeting their targets, changes will be made. Examples are changing the incentive structure or equipment type (motors).

- Would your program make program rule changes within a program year?

Yes.

- How are changes communicated between different programs, when changes are made for one program?

Communicating change is not a big challenge since the group is small.

- When there are role changes or new personnel, what is the process of training?

There is a training process, but it isn't written down.

- What are some of the issues that have come up during implementation of internal changes?

Avista is aware of its customer's sensitivity to changes since some customers are very vocal about confusion that results.

Tracking and reporting systems

- What type of tracking system is in place? Which staff members use the tracking system (data entry, engineers, managers, etc?)

There are a couple different tools for tracking. Avista uses Sales Logics and CSS (Customer Sales Services). These tools track mostly contacts and leads.

M&V and savings calculations: Deemed, measure, and custom

- What is the approach to calculating savings in your program?
- Are savings deemed, measured, or custom?

Most of the savings in Residential Program are deemed, while all of the C&I measures are custom followed by a peer review.

- What QC practices are in place to assure accuracy and consistency in savings?

Bruce referred to the EM&V framework.

Third party program implementer verification

- How do you ensure that 3rd party implementers provide accurate data?

Avista has very few third party implementers. EM&V plan for third party contractors are used.

When third party implementers are used, Avista ensures that all QC metrics are spelled out in the third party contracts.

5 BEM - Small Business Lighting

8/3/2011

- Doug Dickson – Market manager – commercial rebate project manager
- Stu Cradduck – ASSOC EME – Engineer – small business
- Joe Schmutzler – Program Manager – commercial program manager - HVAC
- Valari Uhi – Program Implementation – Commercial lighting rebate program
- Michelle Goldberg – Admin Specs – Admin in small business
- Michael – EME – lighting specialist

Questions for all interviewees

- What is your role on the implementation team and what PM&V categories apply to you?
- Describe your process of completing your tasks/projects?

Doug:

- PSE is in a period of transition at the moment.
- Doug keeps track of the progress of the applications and makes sure that the rebates and the processing goes smoothly.
- Dashboard is a non-online piece of software that SBL developed and use to track their program progress. The group is working on a new Oracle DB at the moment to improve their existing dashboard.
- 3 people 4 years ago have grown to 10-12 people, managing 280ish contractors.
- Oracle database will be shared with other aspects of EES.
- Contractors have to take their training course after they have completed at least 4 projects.

Michelle:

- 95% of payments go out to contractors, and not customers/business owners.
- Satisfaction surveys/evaluations have been sent out to each participant with 50% return rate.
- Takes the application and looks at correctness of the filled out application.
- Checks meter number/account number for eligibility, puts in tracking spreadsheet.
- Conducts administrative processes of putting together pre-approval pile to be reviewed by EME, post case paperwork and submit to payment.

- She does a lot of customer service for contractors, especially in helping them fill out applications.
- SBL tracks who in the contracting company takes the training.
- Website available that the customer can choose qualified contractors from (that have taken the training).
- SBL keeps hard copies of the applications, mainly for signatures.

Joe:

- Deals mostly with HVAC. He does a lot of application review and a lot of On-sites.
- Uses some contractors to do some on-site verifications. On-sites are mostly for verifying base-case scenarios. He deals with applications as well, in terms of QC and processing.
- Build the original tracking system.
- Joe also helps manage other measures, such as: PC management, VSD, LED traffic signals, HVAC retrofit, HVAC maintenance. Joe does some Post Case on-sites as well.

Valari:

- Manages 8-10 measures including Lighting and commercial laundry measures.
- She checks qualification of equipment, based off a list of qualified equipment. She inspects about 10% of rebates by verifying pre and post conditions.
- SBL uses cover sheets for all programs that quickly summarize each project and helps with quickly getting all of the important project data.
- SBL uses QC checklist for each project that Valari enters into the tracking spreadsheet.
- The tracking system has some QC integrated into the system as well. Most of the QC checklists are the same for each program.
- Program actively recommends new prescriptive/deemed measures and does research on costs, standards, and baseline. They check with other local utility programs as well as go through the process of updating the measure metrics.

Michael:

- Does a lot of the Pre-approval, and QC work on applications.
- Also talks to contractors and gets them on the same page if changes in programs come up.
- He has extensive lighting design background. PSE is thinking about offering a more comprehensive lighting design program, using Michael's expertise. He will be bringing in more quality into the equipment design and matching into site specific considerations to equipment.

Stu:

- Conducts on-site pre and post verification work. Pre verification involves verifying address, and other information on the application (technical information for the lighting equipment). SBL inspects all new contractors.

- SBL compares estimated savings against the meter reading. If savings are greater than usage are some of the flags that cause an on-site.
- Post-approval process for each project (invoicing checklist). The energy savings are calculated, but the incentive payments are prescriptive.
- SBL conducts roughly 13% inspections of their approved applications.
    - What do you think is missing from the process?

Valari:

Before SBL was low on inspections and QC protocols, but now the group has bumped up the QA and QC work. The program could use more training for the contractors (technical). SBL could also work on increasing their communication between contractors.

Interview questions by roles:

Administrative Staff

- How are applications received, and provided to technical staff for review?

Michelle receives the applications and goes through the standard initial QC review process:

- Checks for completeness
- Enters into the tracking system
- Project claimed by whoever has availability within PSE.

- What do you think are the main causes of data entry errors?
    - What changes can be made to improve data entry quality?

Contractors not understanding the equipment well enough.

- Example – some contractors not understanding the difference between ballast factor and power factor.

- What are other common errors that are made and what type of training or tools that can help avoid these errors?

Contractors could use some more training. Contractors with 4 or more projects must take a training session, which helps but there are still errors even after the training. Each trained contactor receives a binder with clear directions and program specific information.

- If there are policy or process changes, how is that communicated?
    - What are the challenges of communicating these changes to you or others on staff? To customers or trade allies?

Having workers in remote offices makes it difficult to make changes quickly. The program has not had too many problems with staff staying on the same page.

- How often do you see program participants submit incomplete applications? Do you track this data?

Incomplete applications are not accepted, but they still get incomplete applications.

- How do you verify that a participant is an eligible utility customer?

Check address and meter number, also uses CLX.

Technical Staff/QC Specialist

- Do you verify that if a measure is deemed that the proper measure is selected in the database tracking and assigned the correct savings value?

Yes, the SBL is all deemed and prescriptive.

- Is there guidance in regards to measures/programs to make sure the right one is selected for any measure that might be hard to classify? For instance putting a measure in a custom program vs a prescriptive program.

If it is questionable, they know who to ask.

- Is there a set of savings calculation methods that every technical staff member uses?

Yes. All the information goes into the new database system, which is being upgraded.

- What is the criteria to chose between calculation methods such as prescriptive, or custom or a combination of the 2?

NA for this program

- Are there standard calculation sheets/tools?

Yes.

- Do standard calculation sheets vary by technology?

They have different calc sheets for different types of lighting (LED, HID, fluorescent, etc)

- Are these sheets always used when applicable?

Yes.

- What are the different tasks involved in field work?
    - Metering?
    - Site Verification?

- Counts?
- Operating hours?

Counts, equipment verification, operating hours, but very little metering.

- Do you use the database?

Yes.

- If there are policy or process changes, how is that communicated?
  - What are the challenges of communicating these changes to you or others on staff? To customers or trade allies?

SBL has email setup with all of their participating contractors. The website is also used very extensively to keep the public updated on any changes.

- How do you verify that the submitted measures are eligible?

SBL has a database of eligible equipment that is used for all the verification work

.

- Do applications get multiple reviews from technical staff?
  - What are the criteria for peer review?
  - What is checked in the peer review process?

SBL has little formal engineering peer review, but there are multiple levels of review that look at over project documentation, final numbers, completeness of application and payment approval.

Program Manager

- How often do you review/reassess internal operations? Every new program cycle, every 2 years, or other trigger point?

SBL has been continuously changing for the last 3 to 4 years in major ways.

- What are your essential QA/QC steps and database reports?

They use the new tracking DB, and it has changed the way the manager is able to manage his staff and manage process.

- What do you look for when approving payments or checking for errors?

Making sure that the savings and incentives add up from various sources and that all documents and files are complete. Checks are conducted between tracking sheets, and documentation.

- What outreach efforts train customers and trade allies on program requirements and help them participate in the program?

They have mandatory training programs, and also have a lot of information online.

- What is the involvement of the program staff in the design of the tracking system?
    - What is the process of changing the tracking system structure or functionality to fit any program process or policy changes?

Valari is doing almost all of the tracking DB development. They are outgrowing their Beta version, but are working on a more substantial version currently. Data spreadsheet contains all info and manages process flow, project milestones, savings and incentives. SBL is looking to develop a more robust data system and move beyond the spreadsheets.

6 BEM – Custom Grants (retrofit/new construction)

8/3/2011

- Mark Lenssen – Supv EME
- Joel Jackman – Consulting EME – right now program planning and budgeting
- Gus Takala or – EME, senior
- Baraka Poulin - Assoc EME

Questions for all interviewees

- Describe your process of completing your tasks/projects?

This group mostly deals with custom applications, mostly HVAC, but sometimes they roll in prescriptive measures as part of the total custom grant agreement.

Sometimes they will meter equipment in order to verify energy savings, depending on the size of the project and situation. Rarely meter.

Pre-post on-site verification is mandatory for every application/site. The on-site is mostly counts, equipment type, vintage, operating characteristics.

- What do you think is missing from the process?

They are working on developing worksheets for enhanced lighting projects.

The program does not track savings or incentives in the middle of the review process so the program has no data from a project until the reviews are done.

They could use some internal evaluation work.

They could come up with a more systematic approach to determining savings.

Their QC approach could be standardized. Currently different QC reviewers will look at different aspects of a project.

- Is there a reference guide or program manual that cover the processes of your tasks? How might a manual or guide be valuable? Is it/Would it be helpful when questions of process need to be answered?

They do have a few QC checklists and documents that help guide them through their project evaluations. It could stand to be more standardized.

They use their local online Intranet to house a lot of their program materials, and anything related to program spreadsheets. This is a good centralized resource for program documents.

Administrative Staff

- How are applications received, and provided to technical staff for review?

70% of applications come from trade allies. Some also come from energy advisors that work internally. The application is very simple – more or less a letter of intent, and then the program guys will go on-site for inspections and start the custom analysis process.

Arthur (not present during interview) does the initial data entry into the CSY, which includes a fair amount of QC functionality

.

- What do you think are the main causes of data entry errors?
  - What changes can be made to improve data entry quality?

Not many major errors are seen. Because program is completely custom, data entry is done by the engineers directly from their own analysis.

- If there are policy or process changes, how is that communicated?
  - What are the challenges of communicating these changes to you or others on staff? To customers or trade allies?

The program host brown bags for changes that occur in their programs. Staff also sends emails to inform trade allies of changes and use the website, which is heavily promoted, to inform the public about any changes to their programs.

Mark mentioned that the team could work on their internal communication across multiple offices.

They have quarterly BEM meetings that are used for updating the staff on changes.

They have monthly meetings to help streamline their effectiveness in processing applications.

Technical Staff/QC Specialist

- Is there guidance in regards to measures/programs to make sure the right one is selected for any measure that might be hard to classify? For instance putting a measure in a custom program vs a prescriptive program.

All of the energy savings determination is done on a custom basis. If the applicant submits a deemed measure for their site, they will roll in the deemed savings into the custom project from measure metrics.

- Is there a set of savings calculation methods that every technical staff member uses?

They have a few, but they are working on developing more of them.

- Are there standard calculation sheets/tools?

Yes – they have a boiler worksheet, refrigeration worksheet, lighting worksheet, compressed air standard tool; they are working on HVAC control worksheets.

- Do standard calculation sheets vary by technology?

Yes.

- Are these sheets always used when applicable?

Yes.

- What are the different tasks involved in field work?

Rarely will they meter, but they do a very robust on-site inspection to determine potential. Involves counts, nameplate info, operating characteristics, etc.

- What are the criteria for conducting a field visit?

Every site gets an on-site, pre and post.

- Do you use the database?

Yes, they use CSY. The program started to use the tracking spreadsheet created by the SBL program but does not regularly update it. The functionality of the SBL spreadsheet doesn't fit the custom program and this team relies more on CSY data.

- If there are policy or process changes, how is that communicated?
  - What are the challenges of communicating these changes to you or others on staff? To customers or trade allies?

They use their website for updating program changes, but because their program is so custom, changes to the program aren't as important as other programs.

- How do you verify that the submitted measures are eligible?

The applicant does not submit for equipment, the engineers determine what is appropriate to install at the site.

- Do applications get multiple reviews from technical staff?
  - What are the criteria for peer review?
  - What is checked in the peer review process?

Yes. Everything is checked by a reviewer, but does not get a peer review. It goes up the chain, and they check certain things on the application. Program used to have more of an engineer to engineer peer review system but have since changed the approval process.

Anything over $100K: The final review gets a pretty good comb-through. They usually don't get technical reviews, but the savings estimates and incentive amounts will be check for validity. This group has a schedule that determines the intensity of review depending on certain criteria.

Program Manager

- What are the P-M&V roles and responsibilities of program and program support staff?

They have a handful of reviewers whose job it is to review many of the projects before they go to payment.

- How often do you review/reassess internal operations? Every new program cycle, every 2 years, or other trigger point?

They have mostly informal process evaluations, but they are trying to improve on this.

- What are your essential QA/QC steps and database reports?

They use CSY, which has some QC integrated into the software, but they are working on a more robust system currently. This proposed system will be able to not only track the progress of a project, but also be able to allow any EME to pick up where a colleague left off.

- What do you look for when approving payments or checking for errors?

The verification plan gets reviewed most thoroughly, and then they will look at the numbers. If everything looks good, but if there are holes in the plan, then the calculations will get re-worked and looked at closely. Also, any changes in the project, will require a more thorough walk through, and even require re-calculation of savings.

- Do applications get multiple reviews from technical staff?
  - What are the criteria for peer review?
  - What is checked in the peer review process?

Any changes in the project require a review, anything over $100K gets reviewed by a qualified QC reviewer.

- What outreach efforts train customers and trade allies on program requirements and help them participate in the program?

Not much outreach exists for this program.

- What is the involvement of the program staff in the design of the tracking system?
  - What is the process of changing the tracking system structure or functionality to fit any program process or policy changes?

They are working on designing a new tracking system currently. They have one, but it isn't being used to the fullest of its extent.

7 BEM – C&I Retrofit

8/4/2011

- Chao Chen–Supervising engineer
- Rick Rosenkilde – on the phone – EME – newest member to the group (3 years)
- Therese Sherman – admin staff – not only with commercial, but also works with other BEM

Questions for all interviewees

- What is your role on the implementation team and what PM&V categories apply to you?

Chao: His focus is on the custom C&I projects that are reviewed in house. The other EME group led by Mark Lenssen also does custom projects and is under the same umbrella group. Chao's group generally has a focus on industrial projects. Examples of custom projects are lighting, compressor, blowers, and refrigeration.

Once a project goes through pre-approval, it goes to a QC reviewer, then to Therese for payment and to get a signature.

For industrial sites that may not be running at full load, either due to layoffs or lulls in production, the rebate amount doesn't change. It is assumed that the company will recover to near full load at some point though the program doesn't have a way to check up on customers years down the road.

If grant payment is $100K or less, the application only requires a mid-level management signature. If the program savings estimates changes by 20,000 kWh or more, the project will be pulled and re-evaluated. Any grant over $100,000 or any costs that change more than $20,000 will go back to the QC reviewer.

When a new hire comes on board, they have an extensive 3-month training period to help them get on board with the process and structure of the company. NEMA is used for industrial training. There are more hands-on training with the younger engineers on a daily basis. The team feels that on-site, hands-on training is the most effective.

The program does some customer/contractor training when it is needed. Staff keeps in touch with vendors to help keep everyone on the same page about the program and its offering.

Rick: The hands-on training is most important because of the nature of the industrial implementation/evaluation beast. The NEMA classes are good at filling in the gaps and are the formal portion of training for engineers.

Therese: She is on the administrative staff that supports this program and others in BEM.

There is a log sheet for every project file that has all of the date stamps logged, which helps in tracking a project's progress.

Only invoices are accepted for verification purposes. Purchase orders or quotes are not accepted

Therese also checks for authorizing signatures and makes sure that the right person signs off on a particular project. Grants over $100K need dual signatures.

CSY tracks basic info about the project, and does not track contact info.

A copy of the payment check will be sent to the EME to let them know that the project they worked on was approved.

The program has a logged evaluation survey for program participants after the project is complete. Roughly 20% return on this survey. Rarely will the survey be negative, when they are, the entire project file gets pulled and given to a high level person to evaluate.

She gets the returned checks, and also deals with the checks that don't get cashed after a certain amount of time. Annually the accounts payable department will compare the payment ID (based on tax ID) with the name on the account to make sure they are the same. This is a requirement for tax purposes.

- What do you think is missing from the process?

Chao: PSE should create guidelines for technical projects. He would like there to be a more standard approach to evaluating programs.

Therese: There has been adding a lot of QC items recently and the process continues to evolve.

Rick: PSE has changed a lot, for the better, in its QA QC process. He is happy with the improvements in the program, and only sees more improvement in the future.

- Is there a reference guide or program manual that cover the processes of your tasks?
- How might a manual or guide be valuable? Is it/Would it be helpful when questions of process need to be answered?

A guide is being discussed currently.

Interview questions by roles:

Administrative Staff

- How are applications received, and provided to technical staff for review?

Therese receives the applications first and she starts the pre-approval, following a QC checklist. She then passes the completed ones to the technical group to begin the engineering analysis. The application then goes back to Therese before getting the final signature for another QC check.

- If there are policy or process changes, how is that communicated?
    - What are the challenges of communicating these changes to you or others on staff? To customers or trade allies?

The team is fairly small, so any changes are communicated fairly quickly.

- How often do you see program participants submit incomplete applications? Do you track this data?

Frequency of incomplete applications isn't quantified. Incomplete applications are not tracked, but staff will follow up and have them completed by getting the applicant on the phone, or through email.

- How do you verify that a participant is an eligible utility customer?

They use the CLX database.

Technical Staff/QC Specialist

- Do you verify that if a measure is deemed that the proper measure is selected in the database tracking and assigned the correct savings value?

Yes, for prescriptive measures at least.

- Is there guidance in regards to measures/programs to make sure the right one is selected for any measure that might be hard to classify? For instance putting a measure in a custom program vs a prescriptive program.

This gets decided early on in the stages of application approval. A more senior staff member will help in determining the appropriate method of incentive application.

- Is there a set of savings calculation methods that every technical staff member uses?

Yes. The savings calculators are available for the entire staff, and are centrally located for easy distribution of newer versions.

- What are the criteria to chose between calculation methods such as prescriptive, or custom or a combination of the 2?

The custom program allows for some prescriptive measures to be apart of the overall savings/incentive calculations.

- Are there standard calculation sheets/tools? Do standard calculation sheets vary by technology?

Yes. Chao: The group has procedures and calc sheets for compressors, lighting, refrigeration, VFD (fan and pumps). The tools are consistent and need to be approved by the department. They store their tools in the same network folder so that the newest worksheet gets used throughout the team.

- Are these sheets always used when applicable?

Yes

- What are the different tasks involved in field work?
  - Metering?
  - Site Verification?
  - Counts?
  - Operating hours?

All of the custom projects require pre and post on-site work. Rarely is metering conducted. The initial on-site is more or less an energy audit to determine opportunity. Post inspection verifies equipment installation and operating characteristics.

Most analysis does not use billing data, or sub-metering data. Trend data is used more often for estimating loads. The program will wait to meter/measure when evaluating the energy use for seasonal measures.

- What are the criteria for conducting a field visit?

100% of custom applications require field visits. Any sites with savings over 300,000 kWh must have some sort of on-site metering to accurately determine energy savings. Adjustments to savings estimates are made only during the post inspection.

- How do you keep track of contacts with customers? How do you keep track of contacts with trade allies/contractors?

Group uses the CMS DB to keep track of customer contact, but not trade allies or contractors contacts.

- How do you keep track of various versions of calculations, or inspection reports?

A folder is maintained by the admin staff for the most up to date calc sheets. The inspection reports stay with the project file for its entire life.

- Do you use the database?

CSY and CMS.

- If there are policy or process changes, how is that communicated?
  - What are the challenges of communicating these changes to you or others on staff? To customers or trade allies?

Generally the team does not see communication as an issue when it comes to program or process changes.

- Do applications get multiple reviews from technical staff?
  - What are the criteria for peer review?
  - What is checked in the peer review process?

There aren't any peer reviews, but there is a hierarchy of review.

Program Manager

- What are the P-M&V roles and responsibilities of program and program support staff?

Therese and the program support staff seem to handle much of the pre-approval, editing and completing applications. Not much PM&V on her side outside of the typical application approval. She does review the same application during multiple phases of the project.

- What are your concerns regarding increased P-M&V, if any?

Cost-effectiveness.

- What do you look for when approving payments or checking for errors?

Therese does a thorough job at checking everything on the application that is non-technical. Depending on the amount of payment, the signature process will be different. The higher incentive amount, the higher up the chain the application goes.

- Do applications get multiple reviews from technical staff?
    - What are the criteria for peer review?
    - What is checked in the peer review process?

There aren't any peer reviews, but the technical aspect of an application will go through a few people's hands before it gets signed.

8 MGR - Budget and Administration

8/4/2011

- Dan Anderson – Manager of budget and administration
- Andy Hemstreet – compliance program manager
- Mariana Chahian – Program implementer
- Anna Maran – senior business analyst

Questions for all interviewees

- What is your role on the implementation team and what PM&V categories apply to you?

Members of the budget administration group do not implement any programs but act as financial auditors. One of the team members, Mariana, does support a program during the implementation phase. This review is different than contract manager/project manager review, since it is a smaller sample size.

Every quarter, they choose which programs they are going to investigate. They choose programs based on the amount of mistakes that they catch during their routine QC checks, make sure once in a while check each engineer. Most are based around fraud concerns. It seems fairly informal for what programs they choose to audit but they do build a sense of what programs need the most help over time. They provide audits and recommendations to the programs. Results from the internal audits, as well as the recommendations made by the group are presented in an annual report.

The team asks 4 questions if a savings adjustment is made (see p. 30 of 2010 annual report).

Some of the items the B&A team picks up are:

- Are the participants PSE customers?
- Are they eligible
- Make sure widgets are not double counted

Anna: Conducts financial analysis and auditing for programs. She starts with looking at the reporting structures to determine which programs to analyze. She starts high level with comparing the program reported savings in the DB, to the savings reported by the annual report. She will start at the highest level of program overview, and will dig as low as she needs to go to find any errors. Anna is the person who conducts the internal financial audits on EES programs.

Dan: He is one of the staff who has the signing capability for sites larger than $100K. He checks the applications for high level completeness and general QC checks. Dan looks at who signed off on the grant agreement to see if that person has the signing power for the grant amount awarded. If that person doesn't have the signing capability to sign off on that project, then he starts digging into the details of the project. He has a background in engineering, so he is familiar with the engineering aspects of the programs, but he doesn't usually read through the

calculations to verify their accuracy. Also, the team got ESS to start instituting checking the savings against the baseline usage since once found in error in this review.

Dan has open lines of communication with the other teams to help understand the issues he may have with program documentation. He will sometimes see something that is strange, and it is easy for him to walk over to the person who signed off on the project and get clarification.

Since Dan started working at PSE, they have started doing these high level financial audits, as well as having created a system where there is individual accountability to each project, as well as each step in the project's process.

This group holds trainings that address problems they see during their audits. Everyone is required to participate in these trainings at least twice.

This group is also responsible for auditing in house expense reports.

The group also does some on-sites for their 3rd party administrators to ensure that PSE and rate payer interests are looked after. For example, PSE sent one of their staff to the office of a third party administrator and asked about the projects that it is managing. One instance where PSE found something wrong was when Anna went on-site and found that their program and customer documentation were not being kept in locked, secure cabinets.

All changes to programs or processes go through many different groups within PSE before it goes public. These include changes in program attributes or incentive amounts. When there are changes that are made to the program, Andy is really careful about NOT deleting any information, rather he 'retires' old information.

- Describe your process of completing your tasks/projects?

Measure metrics: This is a unique system (access DB) developed by PSE that tracks every bit of information that is needed to support their savings claims for all of their deemed measures. This system also contains some information related to custom measures. Data from previous programs and previous program incentive amounts are archived. The DB has links to information on the measures that is linked to either internet sources or source within their network. If PSE is audited, they have sufficient information to back up their measure incentive amounts with sufficient data.

Quarterly audits check if CSY properly maps measure metrics.

- What do you think is missing from the process?

This group wants to figure out a way to compare contract price differences by comparing different rates for same type of billing. Dan kept on talking about being able to easily see the amount of money PSE is paying for a specific service or function across different contractors. This again goes to taking care of rate payer funds.

- Is there a reference guide or program manual that cover the processes of your tasks? How might a manual or guide be valuable? Is it/Would it be helpful when questions of process need to be answered?

Some of this is in the Measure Metrics and the framework, which was being completed during the interview process. They also have a lot of training documents that they have created over the years to train their staff.

9 BEM - Resource Conservation Manager Program

8/3/2011

- Lori Moen– Supervisor EME – RCM, interval services support,
- Jason Hyatt – EME – technical support (trains RCMs)
- Ben Rupert – Program Manager – building performance team, mostly government sector
- Vince Kammeyer – Application analyst – RCM data team
- Jen Apfel – Associate application analyst

Questions for all interviewees

- What is your role on the implementation team and what PM&V categories apply to you?

Jen: Pulls interval data, both Gas and Electric, for a site that is applying for a RCM. Sometimes changes are made (meter number, etc, not actual data).

Vince: Primary function is to support RCM participants with data and tools to support their measures. He puts together 15 minute interval data for electric customers and down to hourly interval data for gas customers. Vince provides interval data to roughly 90-100 participants on a monthly basis.

Ben: Ben covers government buildings, while someone else at PSE deals with schools and institutions. They 'manage' the hired staff at the location. They provide support for the tools they provide the RCM. Scope of work provides guidelines for how the RCM needs to perform in order to save energy.

Jason: He does a lot of the ground work for training the RCM's on how to use the tools that are provided to them.

RCM uses the CSY DB to track reported savings. CSY is used for auditing purposes when data needs to be pulled for the program.

- What do you think is missing from the process?

The program needs to increase its efficiency on delivering information to the RCM. The program needs to be more consistent in program structure changes, and changes in QA/QC practices. Every customer is different, which causes a fair amount of issues.

The group also said that they are short handed. There are 6-7 people dedicated to the RCM program with Jason being part time.

Internal training processes are informal. They are improving their documentation of tools and process.

- Is there a reference guide or program manual that cover the processes of your tasks? How might a manual or guide be valuable? Is it/Would it be helpful when questions of process need to be answered?

They don't have a manual per se, but they do have the tools that they are trying to make self-explanatory.

Interview questions by roles:

Administrative Staff

- How are applications received, and provided to technical staff for review?

The administrative part of the application process is not applicable to this program. Someone on PSE's RCM group will sometimes sit in on hiring sessions when a company is looking to fill a RCM position.

- What do you think are the main causes of data entry errors?

There isn't a lot of data entry. RCM team at PSE can verify the savings that the RCM is claiming at the site.

- How do you verify that a participant is an eligible utility customer?

CLX is used directly.

Technical Staff/QC Specialist

- Is there a set of savings calculation methods that every technical staff member uses?

No.

- Are there standard calculation sheets/tools?

They are developing them currently.

- Do standard calculation sheets vary by technology?

PSE does on-site work initially to help determine how much potential there is for energy savings. This involves counts, operating characteristics, etc.

- What are the criteria for conducting a field visit?

All applicants receive a site visit.

- Do you use the database?

Yes, CSY and CLX.

- If there are policy or process changes, how is that communicated?
    - What are the challenges of communicating these changes to you or others on staff? To customers or trade allies?

At the moment, they have a small staff, so implementing changes aren't difficult.

- Do applications get multiple reviews from technical staff?
    - What are the criteria for peer review?
    - What is checked in the peer review process?

There will be a review process, not peer though.

Program Manager

- What are the P-M&V roles and responsibilities of program and program support staff?
- What are your concerns regarding increased P-M&V, if any?

Lori feels that they could use more staff to help with their PM&V. The program has grown so much, but the staff hasn't grown that much at all.

- What are your essential QA/QC steps and database reports?

There are QC checklists for their project reports.

- What outreach efforts train customers and trade allies on program requirements and help them participate in the program?

A few on staff deal specifically with training RCM's with technology and help them use the software and tools provided to them to be a part of the program.

There are also ongoing training programs and monthly check-ins. On top of trainings, PSE maintains an online toolbox that contains templates, tools, spreadsheets, etc.

10 REM/ QA Specialists

8/4/2011

- Ken Young – QA team
- Rob Elis – experience in Res. Audits.
- Josh Mitchell – newest member – QA team
- Haida May Malcolm – been on the team for 3 years

Questions for all interviewees

Rich Hazzard and team provided some history of the group. The Home Print program originally started to offer home energy audits using internal PSE staff. The program then turned to hiring contractors to do the audits, but PSE's staff more or less was still responsible for doing on-site verification for the applicable in house programs. The group now looks over a number of mainly residential programs.

- What is your role on the implementation team and what PM&V categories apply to you?

Josh (and others): Their team is responsible for on-site verification of water heating, lighting, and space heat equipment. They also give advice to customers when they are on-site relating to safety issues, opportunities in other PSE programs, and general energy efficiency. They verify about 2-4% for the home energy audits by going on-site with the contractor and ensuring that they are doing them properly. They also verify roughly 15-20% of SBL post inspections. This group conducts on-site inspections for roughly 15% of all the programs they verify, except for home audits. MF retrofit is currently being QA'ed by a contractor, Ecos, who conducts 100% pre and post installation verification. This is the only program that has a contractor for QA. MF new construction gets 100% verification, but the volume is small.

The QC group is working on standardizing forms and tools across different programs.

- Describe your process of completing your tasks/projects?

Process of completing tasks depends on which program is being QA'ed. It seems that, for the most part, each program hands this group a pile of sites/measures/projects to do on-sites for.

- What do you think is missing from the process

Rob: A few things can be improved upon – standardize on-site inspection forms for each program. He thinks that tracking communication with customers/contractors would improve the process. The reporting system is not great at the moment, and could be improved.

Josh: There is a lot of marketing opportunities that could be utilized when they go on-site.

They could use more staff because often covering the entire participating territory is an issue. The QC group all works out of the Bellevue office.

- Is there a reference guide or program manual that cover the processes of your tasks? How might a manual or guide be valuable? Is it/Would it be helpful when questions of process need to be answered?

This is being worked on, this group is relatively new, and they are constantly changing and evolving into a more efficient team.

Interview questions by roles:

Administrative Staff

- If there are policy or process changes, how is that communicated?
    - What are the challenges of communicating these changes to you or others on staff? To customers or trade allies?

They have a small group, and all changes are implemented easily. They also are in close communication with other program managers that let them know if there are any changes in the programs they are doing the QA for.

- What are the different tasks involved in field work?

Field work depends on the measure that is being evaluated. This group doesn't meter, but it does mostly on-site verification work (counts, nameplates, etc). While they are on-site they look at safety issues, and any other opportunities for increasing energy efficiency. They also informally gather input from the participant while on-site.

- What are the criteria for conducting a field visit?

Random sampling for residential space and water heat programs across different contractors. The sample gets sent to the QC group by the program group on a weekly or monthly basis. This group doesn't do a lot of their own sampling. MF new construction requires 100% verification of the sites. Home Print sampling is random and geographically based and across different contractors.

The QC group gets access to the database that SBL uses to track its programs. The sample is based on the projects that are filed under the 'waiting for final approval' section of the SBL DB. These projects will then be pulled from the approval process until the QA group signs off on it. If a visit can't be scheduled the projects are usually passed on to payment to move the process along.

The SBL program has the most inconsistencies between the paperwork and the on-site inspection results.

The QC group has its own DB to track all site visits. It is not program specific. All of the QA data that is collected on-site gets input into this DB.

The QC group is able to access and edit all of the databases throughout all of the programs within PSE.

At the moment, this group is documenting their policies and procedures to streamline their processes, but this takes the backseat at times since the top priority is completing on-site inspections.

The QC group reports any contractor issues to the relevant program while they are on-site. Their feedback on contractors is taken well, and increasing scrutiny is taken on those contractors that receive poor quality reviews.

The QA team will go on-site with contractors for the SBL program and will point out the problems. Once the problems have been pointed out to SBL, PSE will make the contractor provide the information requested before payment is sent. For every other program, this group gives their results from the inspections to the program, and then it's left up to the program to deal with the discrepancy.

- How do you keep track of contacts with customers? How do you keep track of contacts with trade allies/contractors?

The QC team uses the CMS system to help track their customer contact info.

- Do you use the database?

The QC team has the ability to access and update almost all of the DB within EES. It only makes changes if there are errors that were discovered during the on-site inspections.

- If there are policy or process changes, how is that communicated?

Changes seemed to be made often, and their processes and procedures are being streamlined. It's a small group, so any changes are easily adapted.

- How often do program participants submit for equipment that does not qualify?

This happens most in the SBL program. The errors are not so much issues with eligible equipment, but more so with inconsistent quantities.

- How do you verify that the submitted measures are eligible?

An eligible equipment list is used.

Program Manager

- What are the P-M&V roles and responsibilities of program and program support staff?

This group is responsible for doing the QA work on a number of programs that are managed in house. Each program has different levels of importance and amount of on-sites that are conducted.

- What are your concerns regarding increased P-M&V, if any?

Cost effectiveness.

- For your third party programs, what kind of verification do you do?

The QC team does some ride-along's with third party verification groups. QC team will do some on-sites with the third party verifiers to ensure that they are doing the inspections appropriately.

- What is the involvement of the program staff in the design of the tracking system?
    - What is the process of changing the tracking system structure or functionality to fit any program process or policy changes?

The QC team made their own tracking system for their own purposes. They are constantly working on adding more functionality to this DB.

11 REM

8/4/2011

- Steve Johns – overall tracking and reporting of savings
- Sandy Sieg – manages LIW program
- Laura Wilson – business dev. manager
- John Forde – Market manager for MF channel, MF retrofit, SF NW, MF new cons.
- Dave Henson – system channel, many programs
- Joel – retail channel, home energy reports program
- Dennis – program manager for space water and heat program

Questions for all interviewees

The REM programs all run separately but get similar support from central databases and a newly formed QC team. Each interviewee presents views from his/her own program. Because of the high number of interviewees in the room, all from different programs, we were only able to capture some program specific information and focused on general themes that may apply to all REM programs.

- What is your role on the implementation team and what PM&V categories apply to you?

Joel: Uses a third party for some aspects for his program's QA processes. PSE asks for all of the applicable information for upstream equipment information from a third party contractor that conducts in-store checks to make sure that products are stocked.

Most of the REM programs have methods of tracking projects on top of the CSY database. This may either be a side database or a spreadsheet tool. They are trying to tie these tools to increase functionality and consistency. The CSY database will also be able to improve reporting functionality so that data can be more useful.

The group uses the CMS to help track and log customer contact information. Within this DB, they also have some rebate processing info, but this is not its primary function.

Retailer and 3rd party reports are QA'ed and are submitted on a regular basis.

Dennis: He works mainly with the space and water heat rebate programs. Most rebates are handled through customer mail-ins. The program also uses contractors that can apply for the rebate without customer involvement. Some on-site visits are done to verify installation. Rebate processors pull a sample of projects to do on-sites. Percentage of on-sites vary by measure, anywhere from 2% to 10%. They determined these percentages based on their gut and general focus on newer programs, or newer contractors. The site visits are a recent development. The newly formed QA team does the on-sites.

Sandy: The LIW program contracts with 11 social service agencies that conduct the audits and they decide what measures to install. PSE has a online portal with and Access DB for tracking LIW progress. Each agency submits its information to the DB. Each month, they issue checks to

the agencies and these agencies inspect and verify 100% of measures. PSE conducts inspections on 15% of sites. There are procedures for on-site verification. Projects are randomly picked to verify. The 11 agencies use multiple funding sources, PSE is just one of them. Statewide program is managed by Dept of Commerce. The quality of data and work across different agencies is satisfactory and consistent.

- What aspects of PSE's programmatic M&V are working well? What is not working well?

They are currently, along with every program sector at PSE, revising and evolving their program implementation and QA/QC practices.

- What do you think is missing from the process?

Joel: They could use a more updatable system that pulls together qualified equipment to make sure that their equipment is still on the list of qualified equipment. Joel was talking about the difficulty keeping up with equipment that goes on and off the ENERGY STAR lists, and how there should be a way to easily incorporate these changes in PSE's programs. The programs do big marketing campaigns and it would be nice to get a QA/process evaluation to determine its effectiveness.

Live access to data is an issue both with 3rd party contractors and internal PSE personnel. PSE does not have direct access to 3rd party data and must make special requests to see data. CSY extracts need to be requested as well. Internal staff would like to improve data reporting capabilities so that data can be extracted more easily.

It would be nice to have a centralized DB system. This is something that is being tossed around as being feasible.

Dennis: He wants to come up with a tiered rating/inspection system for their contractors based on the amount of projects individual contractors have completed. Current contractors should be rated by how many projects they do, and any feedback from customers and site inspections.

Interview questions by roles:

Administrative Staff

- If there are policy or process changes, how is that communicated?
  - What are the challenges of communicating these changes to you or others on staff? To customers or trade allies?

Internally, changes are communicated easily due to the size of their team. They also have close relationships to trade allies and the agencies for LIW. Email works well, and the website gets updated if any changes occur.

Technical Staff/QC Specialist

- Do you verify that if a measure is deemed that the proper measure is selected in the database tracking and assigned the correct savings value?

REM programs use deemed savings so the distinction isn't applicable here.

- What are the different tasks involved in field work?

No metering is conducted on site. On-sites are to verify installation of measures, anywhere from water heaters to ceiling insulation. The QA team is responsible for the majority of site visits.

- What are the criteria for conducting a field visit?

There are no official, written criteria for field visits. Programs try to do on-sites for new contractors, and they do anywhere from 2-10% of the sites, depending on what measure is being looked at. A higher percentage of on-sites are done for smaller programs. There seems to be a method to their sampling procedure, but it may not be written down.

- How do you keep track of contacts with customers? How do you keep track of contacts with trade allies/contractors?

CMS is used to track communication with their customers.

- Do you use the database?

There are many databases being used, depending on which program is being discussed. All groups use the CSY database to some extent.

- How often do program participants submit for equipment that does not qualify?

Frequency isn't quantified but it does seem to be an issue in some programs.

- How do you verify that the submitted measures are eligible?

A qualifying measure list is kept that incorporate changes to the ENERGY STAR list.

Program Manager

- What are your concerns regarding increased P-M&V, if any?

Risk/cost assessment would be crucial for developing any in-depth PM&V plan.

- What are your essential QA/QC steps and database reports?

For their third party programs, they rely on monthly reports in order to QA/QC the programs, although they would like to have more live access to their third party data.

- For your third party programs, what kind of verification do you do?

Depends on the measure/program, but they send out on-site verification personnel for installed measures.

- Do applications get multiple reviews from technical staff?

REM programs are essentially all prescriptive so there are no savings calculations and no review.

- What is the involvement of the program staff in the design of the tracking system?
- What is the process of changing the tracking system structure or functionality to fit any program process or policy changes?

REM programs are working on their own tracking system, but they are hoping to have a centralized DB for all of the REM and BEM programs.

Literature Review Resources

Reference Number	File Name	Source
001	2006-2008_SCE_RCx_Program_FINAL_061109.pdf	CALMAC
002	Appendix_B_-_Due_Diligence_and_Verification_Memo.3183840.pdf	Illinois Stakeholders Advisory Group - Evaluation Documents
003	BPSummaryTable_NR-HVAC.PDF	Best Practices Benchmarking for Energy Efficiency Programs (PG&E)
004	BPSummaryTable_NR-large comprehensive inventives.PDF	Best Practices Benchmarking for Energy Efficiency Programs (PG&E)
005	BPSummaryTable_NR-lighting.PDF	Best Practices Benchmarking for Energy Efficiency Programs (PG&E)
006	BPSummaryTable_NR-new construction.PDF	Best Practices Benchmarking for Energy Efficiency Programs (PG&E)
007	BPSummaryTable_R - new constrution programs.PDF	Best Practices Benchmarking for Energy Efficiency Programs (PG&E)
008	BPSummaryTable_R- audit programs.PDF	Best Practices Benchmarking for Energy Efficiency Programs (PG&E)
009	BPSummaryTable_R- comprehensive weatherization.PDF	Best Practices Benchmarking for Energy Efficiency Programs (PG&E)
010	BPSummaryTable_R- multi family programs.pdf	Best Practices Benchmarking for Energy Efficiency Programs (PG&E)
011	BPSummaryTable_R1.pdf	Best Practices Benchmarking for Energy Efficiency Programs (PG&E)
012	BPSummaryTable_R-AC programs.PDF	Best Practices Benchmarking for Energy Efficiency Programs (PG&E)
013	BPSummaryTable_R-lighting.pdf	Best Practices Benchmarking for Energy Efficiency Programs (PG&E)
014	CPACS_2007-2008_Review_Final.pdf	CALMAC
015	EM&V_report_-_CUWCC_Phase_2_PRSV_Distribution_Program_(2-21-07_FINAL).pdf	CALMAC
016	Energy_Efficiency_Measurement_and_Attribution.pdf	CALMAC
017	napee_chap6- best practices.pdf , napee_report.pdf	NAPEE
018	quality_assurance_for_residential_retrofit_programs_slides.pdf	DOE
019		KEMA
020	BP_Self_Benchmarking_Tool _Final 110707_with Scoring Sheets-Electronic.xls	Best Practices Benchmarking for Energy Efficiency Programs (PG&E)

Website	Organization	Year
	SCE	2006-08
http://ilsag.org/yahoo_site_admin/assets/docs/Appendix_B_-_Due_Diligence_and_Verification_Memo.3183840.pdf		2010
eebestpractices.com	Quantum Consulting	~2003
eebestpractices.com	Quantum Consulting	~2003
eebestpractices.com	Quantum Consulting	~2003
eebestpractices.com	Quantum Consulting	~2003
eebestpractices.com	Quantum Consulting	~2003
eebestpractices.com	Quantum Consulting	~2003
eebestpractices.com	Quantum Consulting	~2003
eebestpractices.com	Quantum Consulting	~2003
eebestpractices.com	PG&E	2004
eebestpractices.com	Quantum Consulting	~2003
eebestpractices.com	Quantum Consulting	~2003
	SCE	2007-08
	CPUC	2007
	CIEE	2009
	DOE, EPA	2006
http://www1.eere.energy.gov/wip/solutioncenter/pdfs/quality_assurance_for_residential_retrofit_programs_slides.pdf	VEIC / DOE	
		2007
Eebestpractices.com		

Sector	Program Type	Retrofit or NC	Other Details
Commercial	RCx	Retrofit and NC	
C&I	RCx	Retrofit and NC	
C&I	HVAC	Retrofit and NC	HVAC
C&I	Comprehensive	Retrofit and NC	Comprehensive
C&I	Lighting	Retrofit and NC	Lighting
C&I	New Construction	NC	New Construction
Res	New Construction	NC	New Construction
Res	Audit programs	Retrofit and NC	Audit programs
Res	Comprehensive weatherization	Retrofit and NC	Comprehensive weatherization
Multi Family	MF programs	Retrofit and NC	MF programs
Res	Lighting	Retrofit and NC	Lighting
Res	AC programs	Retrofit and NC	AC programs
Res	Lighting	Retrofit and NC	Lighting
Commercial & Res	HVAC - high efficiency PAC unit	Retrofit and NC	
Commercial	replacement - low flow valves	Retrofit and NC	
Commerical & Res	EUL	Retrofit and NC	
All	Comprehensive	Retrofit and NC	All
RES	Residential Retrofit Programs	Retrofit	Lighting
All	All	Retrofit and NC	

Reference Number	Sector	Program Type	Retrofit or NC	Other Details	Guideline	Protocol	Process	Category

005	C&I	Lighting	Retrofit and NC	Lighting			For delamping projects, use light level requirements and pre- and post-light level readings to ensure quality	Accurate & Consistent Program and Measure Descriptions
005, 010, 020	C&I, Res	Lighting - Multifamily	Retrofit and NC	Lighting		Define product specifications in program requirements and guidelines		Accurate & Consistent Program and Measure Descriptions
009, 010	Res	Weatherization - Multifamily	Retrofit and NC				Require that installers honor the warranties that come from product manufacturers	Accurate & Consistent Program and Measure Descriptions
018	Res	Residential Retrofit Programs	Retrofit				Collect detailed info about jobs: address, names, meter numbers, existing conditions, improved conditions, costs, estimated savings, health and safety conditions corrected, material specifications	Accurate & Consistent Program and Measure Descriptions
018	Res	Residential Retrofit Programs	Retrofit				Have specific participation agreement regarding working standards of equipment, install quality and professionalism	Accurate & Consistent Program and Measure Descriptions

019	C&I	Comprehensive	Retrofit and NC				Some measures including custom require pre application to be submitted to insure that pre install data is collected.	Accurate & Consistent Program and Measure Descriptions
003, 012	C&I, Res	HVAC/Res AC	Retrofit and NC	HVAC	Consider administrative cost in designing the verification strategy			All
004	C&I	Comprehensive	Retrofit and NC				Conduct either in-program measurement or measurement through an impact evaluation on the very largest projects and those that contribute most to uncertainty in overall program savings	All
006	C&I	New Construction	NC		Track every project at every phase			All
018	Res	Residential Retrofit Programs	Retrofit		QA system should include integrated feedback mechanism to update program methods			All
018	Res	Residential Retrofit Programs	Retrofit		Integrated Quality Assurance as part of the program process			All
003, 018	C&I, Res	HVAC/Res Retrofit	Retrofit and NC	Low Flow Valves		Continued training for internal staff create platform for feedback.		Change Management (internal training documentation)

004	C&I	Comprehensive	Retrofit and NC				Tie staff performance to independently verified results	Change Management (internal training documentation)
006	C&I	New Construction	NC			Make sure that project inspectors are equipped with the training and experience required for the task		Change Management (internal training documentation)
007	Res	New Construction	NC			Ensure that inspectors have plenty of hands-on construction experience		Change Management (internal training documentation)
010, 018	Res	Mulitfamily/Res Retrofit	Retrofit and NC				Inspector training: must have same competencies as installers, protect confidence in the program brand; can identify reasons for failure	Change Management (internal training documentation)
010, 018	Res	Mulitfamily/Res Retrofit	Retrofit and NC				work in progress inspection - opportunity for on the spot training	Change Management (internal training documentation)
001	C&I	RCx	Retrofit			Set uniform and consistent provider expectations and provide a forum for discussion and the answering of questions.		Contractor/Customer Training, Relations Management
001	C&I	RCx	Retrofit			Standardize service providers' energy savings calculation methodologies		Contractor/Customer Training, Relations Management

001	C&I	RCx	Retrofit				Require providers to attend a workshop on preferred savings estimate methodologies.	Contractor/Customer Training, Relations Management
002, 005, 009	C&I	New Construction - Weatherization	Retrofit and NC			Implement a contractor screening/certification/training process		Contractor/Customer Training, Relations Management
003, 015	C&I	HVAC Replacement - Low Flow Valves	Retrofit and NC	Low Flow Valves		Continued training for contractors create platform for feed back.		Contractor/Customer Training, Relations Management
007	Res	New Construction	NC			Encourage home inspectors to organize their own professional organization		Contractor/Customer Training, Relations Management
007	Res	New Construction	NC			Host pre-construction meetings with the builder, key subcontractors, and suppliers to review project specifications and program requirements		Contractor/Customer Training, Relations Management
007	Res	New Construction	NC			Provide timely feedback to builders, home inspectors, and other parties		Contractor/Customer Training, Relations Management
007	Res	New Construction	NC			Treat inspection visits as partnership-building & learning events rather than just regulatory enforcement activities		Contractor/Customer Training, Relations Management

007	Res	New Construction	NC				Require builder or builder's representative to be on-site during inspection	Contractor/Customer Training, Relations Management
009	Res	Weatherization	Retrofit and NC			Write clear specifications for measure installation using "contractor-friendly" language and train contractors on what is expected		Contractor/Customer Training, Relations Management
009, 018	Res	Audit programs -Weatherization	Retrofit and NC			Create processes for tracking complaints and failure by measure and by contractor		Contractor/Customer Training, Relations Management
018	Res	Residential Retrofit Programs	Retrofit			Data can justify contractor probation/suspension		Contractor/Customer Training, Relations Management
018	Res	Residential Retrofit Programs	Retrofit				formal and informal interview during field verification	Contractor/Customer Training, Relations Management
018	Res	Residential Retrofit Programs	Retrofit			Set Work Quality Standards for contractors, identify training opportunities and areas of non compliance. For contractors these standards should be required for participation		Contractor/Customer Training, Relations Management
018	Res	Residential Retrofit Programs	Retrofit			Clear remediation process for complaints and deficiencies		Contractor/Customer Training, Relations Management

018	Res	Residential Retrofit Programs	Retrofit				Marketing and customer satisfaction survey , act as platform of receive feedback	Contractor/Customer Training, Relations Management
018	Res	Residential Retrofit Programs	Retrofit				Accreditation of contractors can shift some QA work to accrediting organizations. Accreditation can include reference checks, required course/info session on the program	Contractor/Customer Training, Relations Management
018	Res	Residential Retrofit Programs	Retrofit				Work with contractors to resolve technical issues.	Contractor/Customer Training, Relations Management
018	Res	Residential Retrofit Programs	Retrofit				Track customer surveys and corrective actions	Contractor/Customer Training, Relations Management
019	C&I	Comprehensive	Retrofit and NC				Familiarize with work with contractors and note issues especially with direct install model. Inspect more or less according to experience with contractor. May ban contractors to control quality.	Contractor/Customer Training, Relations Management
007	Res	New Construction	NC		Build in rigorous quality control screens for data entry			Data Management & Process Tracking Strategies (collection, tracking & reporting)

018	Res	Residential Retrofit Programs	Retrofit			Monitor accuracy of reported data		Data Management & Process Tracking Strategies (collection, tracking & reporting)
019	C&I	Comprehensive	Retrofit and NC			Data is checked periodically for database calculation errors and data entry errors.		Data Management & Process Tracking Strategies (collection, tracking & reporting)
019	C&I	Comprehensive	Retrofit and NC				Data check looks for fields that are missing, inconsistencies in various sums, unexpected high or low savings or incentives per measure	Data Management & Process Tracking Strategies (collection, tracking & reporting)
019	C&I	Comprehensive	Retrofit and NC				Various levels of checks for weekly, monthly, semi annual and annual basis	Data Management & Process Tracking Strategies (collection, tracking & reporting)
020	C&I	Comprehensive	Retrofit and NC			Define & identify key information needed to track & report early in the program development process		Data Management & Process Tracking Strategies (collection, tracking & reporting)
020	C&I	Comprehensive	Retrofit and NC			Clearly articulate the data requirements for measuring program success		Data Management & Process Tracking Strategies (collection, tracking & reporting)
020	C&I	Comprehensive	Retrofit and NC			Design program tracking system to support the requirements of evaluators as well as program staff		Data Management & Process Tracking Strategies (collection, tracking & reporting)

020	C&I	Comprehensive	Retrofit and NC				Use Internet to facilitate data entry & reporting; build in real time data validation systems that perform routine data quality functions	Data Management & Process Tracking Strategies (collection, tracking & reporting)
020	C&I	Comprehensive	Retrofit and NC				Develop electronic application processes	Data Management & Process Tracking Strategies (collection, tracking & reporting)
020	C&I	Comprehensive	Retrofit and NC			Conduct regular checks of tracking reports to assess program performance		Data Management & Process Tracking Strategies (collection, tracking & reporting)
002	C&I	RCx	Retrofit				Eligibility checks	Energy Savings Verification (Documentation Review)
002	C&I	RCx	Retrofit				Engineering review	Energy Savings Verification (Documentation Review)
002	C&I	RCx	Retrofit				Verification survey (RSP)	Energy Savings Verification (Documentation Review)

002, 011, 013, 020	C&I, Res	RCx/Res Lighting/ Comprehensive	Retrofit and NC			Verify accuracy of rebates, coupons, and/or invoices to ensure that the reporting system is recording actual lighting product purchases by the target market		Energy Savings Verification (Documentation Review)
008	Res	Audit programs	Retrofit and NC				Conduct follow-up telephone calls to provide an accurate estimate of the number of measures installed	Energy Savings Verification (Documentation Review)
011, 013, 020	C&I, Res	Lighting - Comprehensive	Retrofit and NC			Assure quality of rebated bulbs through independent testing procedures, such as PEARL		Energy Savings Verification (Documentation Review)
019	C&I	Comprehensive	Retrofit and NC			Peer review conducted by a equal or more senior engineer or manager		Energy Savings Verification (Documentation Review)
019	C&I	Comprehensive	Retrofit and NC				Invoices are required for all material and labor	Energy Savings Verification (Documentation Review)
019	C&I	Comprehensive	Retrofit and NC				Some programs are fine with general invoices	Energy Savings Verification (Documentation Review)
019	C&I	Comprehensive	Retrofit and NC				Peer review done for projects greater than 10k dollar amount, or any custom projects.	Energy Savings Verification (Documentation Review)

019	C&I	Comprehensive	Retrofit and NC				Peer review on technical analysis, calculations, classification of technology, savings, incentive amount, and documentation requirements	Energy Savings Verification (Documentation Review)
019	C&I	Comprehensive	Retrofit and NC				Require specification sheets from manufacturers that list parameters of qualification for the equipment.	Energy Savings Verification (Documentation Review)
019	C&I	Comprehensive	Retrofit and NC				Some programs will require that the invoices are itemized and there is proof of payment for specific equipment and model numbers. Ex: ballast and lamps need to be listed separately on the invoice so that model numbers can be documented and checked	Energy Savings Verification (Documentation Review)
019	C&I	Comprehensive	Retrofit and NC				Specification sheets need to match the invoices model numbers	Energy Savings Verification (Documentation Review)

002, 003, 004, 020	C&I	RCx - Comprehensive - HVAC	Retrofit and NC			Require pre-project inspections for large projects with highly uncertain baseline conditions that significantly affect project savings		Energy Savings Verification (On Site)
002, 003, 006, 012	C&I, Res	RCx/HVAC/Res AC/NC	Retrofit and NC			Design inspection criteria and protocol before program start. Inspections can also be used as a method of training contractors and customers		Energy Savings Verification (On Site)
002, 004, 005	C&I	RCx - Comprehensive - Lighting	Retrofit and NC			Conduct an independent audit or pre-installation inspections		Energy Savings Verification (On Site)
002, 005	C&I	RCx/Lighting	Retrofit and NC			Conduct on-site post-installation inspections		Energy Savings Verification (On Site)
002, 005	C&I	RCx/Lighting	Retrofit and NC				Always inspect the first job submitted by a new vendor	Energy Savings Verification (On Site)
002, 019	C&I	RCx - Comprehensive	Retrofit and NC				Inspect a sample of projects from single customers especially if individual projects are small ~10%	Energy Savings Verification (On Site)
003 ,018	C&I	RCx - Comprehensive	Retrofit and NC				Increase inspection rate if deficiencies found	Energy Savings Verification (On Site)

003, 005, 009, 012, 010	C&I, Res	HVAC -Lighting -Weatherization - Res AC - Multifamily	Retrofit and NC			Build statistical features into the sampling protocol to allow reduction in required inspections based on observed performance and demonstrated quality work		Energy Savings Verification (On Site)
004	C&I	Comprehensive	Retrofit and NC			Tailor measurement rigor, including the use of sampling, to each project's contribution to the cumulative uncertainty in estimated savings for the program overall		Energy Savings Verification (On Site)
005	C&I	Lighting	Retrofit and NC	Lighting		Govern post-inspection levels by cost-effectiveness considerations and results from an initial set of inspections early in the implementation process		Energy Savings Verification (On Site)
006	C&I	New Construction	NC			For complex projects, especially those involving controls, consider requiring performance verification		Energy Savings Verification (On Site)
007	Res	New Construction	NC			Recognize the different inspection needs of experienced builders and builders who are new to the program		Energy Savings Verification (On Site)

007	Res	New Construction	NC		Plan to rely on third-party inspectors for quality control over the long-term			Energy Savings Verification (On Site)
007, 012	Res	New Construction - Res AC	Retrofit and NC		Establish a streamlined inspection scheduling process			Energy Savings Verification (On Site)
008	Res	Audit programs	Retrofit and NC			Conduct on-site post-installation inspections by a third party where appropriate		Energy Savings Verification (On Site)
018	Res	Residential Retrofit Programs	Retrofit				Inspection tolerance of within 10%	Energy Savings Verification (On Site)
018	Res	Residential Retrofit Programs	Retrofit				Onsite inspection -5% of jobs	Energy Savings Verification (On Site)
018	Res	Residential Retrofit Programs	Retrofit				Post inspection - completed job meet proposal?	Energy Savings Verification (On Site)
018	Res	Residential Retrofit Programs	Retrofit				Pre inspection- checking audit expectations	Energy Savings Verification (On Site)
018	Res	Residential Retrofit Programs	Retrofit				visit first 5-10 sites of new contractors	Energy Savings Verification (On Site)
018	Res	Residential Retrofit Programs	Retrofit			site visits while work is in progress		Energy Savings Verification (On Site)
018	Res	Residential Retrofit Programs	Retrofit				Track Inspections	Energy Savings Verification (On Site)
019	C&I	Comprehensive	Retrofit and NC				Inspect projects that are custom non-lighting	Energy Savings Verification (On Site)

019	C&I	Comprehensive	Retrofit and NC				Inspection reports should specify quantity of measures found, potential other EE opportunities, conditioned/unconditioned space, operating hours and if operating hours vary drastically within the same facility	Energy Savings Verification (On Site)
019	C&I	Comprehensive	Retrofit and NC				Stratify inspection rates: 10% of projects under 10k, 25% of 10-25k, 50% of projects 25k -50k, 100% of 50k or above	Energy Savings Verification (On Site)