



## **Energy Savings Performance Contracting Guidelines for State Agencies**

### **Part 6 Measurement and Verification of Savings**

Measurement and Verification (M&V) of savings are central to determining the satisfactory performance of contracts subject to Government Code §2166.406. Normally, the ESCO provides the M&V. Additionally, the State Agency ESPC Guidelines require third party review of the M&V and the sample periodic utility savings reports as a part of the UAR review.

The choice of an M&V provider is an Agency decision and the circumstances and capabilities of the parties involved are widely varied. The M&V plan, its implementation, and the Periodic Utility Savings Reports may be provided by the Owner, the ESCO, a third party contractor or some combination of these as determined by contract agreement. The requirements set forth in this chapter apply regardless of the provider.

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## **Introduction to Measurement and Verification**

SECO requires the use of the International Performance Measurement and Verification Protocol (IPMVP) which was developed as a cooperative effort between industry and the U.S. Department of Energy.

The methodology for calculating savings varies by the type of modifications implemented in the building system. Modifications implemented under these Guidelines should be easily grouped into one of the categories listed in Figure 1. Each category modification has a specific principle associated with calculating savings that adheres to the current version of the International Performance Measurement and Verification Protocol in effect at the time of the development of the UAR. This IPMVP provides current best practice techniques available for verifying results of energy efficiency, water efficiency, and renewable energy projects in commercial and industrial facilities. The IPMVP is maintained with the sponsorship of the U.S. Department of Energy by a broad coalition of facility owners/operators, financiers, energy services companies, and other interested parties. The IPMVP outlines a number of methodologies for calculating savings that vary by the type of project installed.

### **Measurement and Verification Services Agreement**

The agreement between the Agency and provider of Measurement and Verification (M&V) services must contain a detailed scope of work and deliverables that clearly define the outputs and service levels expected for services provided after the installation of equipment. This should include detailed descriptions of individual services and costs associated with each service. Individual services may include, but are not limited to:

- Metering of equipment and systems
- Tracking performance of equipment and systems
- Reporting savings from equipment and system improvements
- Training for the Agency operations and maintenance staff
- Technical support and warranty for installed equipment
- Commissioning and maintenance of equipment and systems

The term of the M&V services agreement should only be for the length of time necessary for actual savings to be adequately established, predictable and agreed to by both the Agency and service provider as determined under the terms of the agreement and consistent with the statutory requirements. It may be appropriate as well to include a provision that allows the Agency to terminate or change the frequency of individual service elements if savings can be established, predictable and agreed to by both the parties prior to the stated termination date of the agreement. Agencies should carefully consider the cost of M&V services, as these costs can diminish or counterbalance realized savings.

## Standard Calculation Methodologies

The standard calculation methodology used to calculate Utility Cost Reduction Measures (UCRM) consumption savings are as follows:

- IPMVP Option A – Partially Measured Retrofit Isolation.** Savings are determined by calculating the energy use of the system(s) to which an UCRM was applied, separate from the energy use of the rest of the facility. Measured parameters may be continuously measured or periodically measured for short periods. Option A is most useful for constant load retrofits where the operating hours can be determined. The models will use data from a variety of sources including, but not limited to, field measurements, manufacturer’s data, and/or reasonable engineering estimates.
- IPMVP Option B – Retrofit Isolation.** Savings are determined by measurement of the energy use of the isolated system to which a UCRM was applied; separate from the energy use of the rest of the facility. Option B is most useful in retrofits which can be isolated from the rest of the system and have sufficient savings to justify the cost of monitoring. Monitoring can range from periodic spot measurements to continuous measurements.
- IPMVP Option C – Whole Building.** Savings are determined by measuring energy use at the whole building or facility level. Short-term or continuous measurements are taken throughout the post-retrofit period. Option C is most useful where several retrofits are implemented and are difficult to isolate into separately measurable quantities.

## Selection of Standard Calculation Methodologies

The table below lists several calculation methodologies that may be used to calculate savings in connection with a UCRM. The project category types correspond to the typical types of energy efficiency retrofit modifications.

Type 1: Simple Efficiency Improvement – Constant Operating Hours	For retrofits resulting in fixed demand reduction in equipment that is always operating, i.e., exit signs or operating at a known schedule.	Option A
Type 2: Simple Efficiency Improvement – Variable Operating Hours	For modifications resulting in fixed demand reductions from new equipment or equipment upgrades (i.e., lighting upgrades).	Option A
Type 3: Simple Operational Modification	For modifications resulting in reduced operating hours (i.e., on/off controls).	Option A or Option B
Type 4: Variable Operational Modification	For modifications resulting in reduced mechanical cooling when outdoor air economizers are being used and where savings are weather dependent.	Option B or Option C
Type 5: Variable Efficiency Improvement	For modifications that create savings from efficiency improvements in equipment that operate with variable output (i.e., air conditioning equipment and cooling towers).	Option B or Option C

Type 6: Modulating Efficiency Improvement	For modifications that create savings from installation of variable frequency drives that allow variable output for fixed consumption equipment.	Option B or Option C
Type 7: System Modifications	For modifications that affect the way entire subsystems are operated, performance improvements, and operational modifications are deployed (i.e., chiller or boiler plants, or compressed air systems).	Option B or Option C
Type 8: Whole Building	Where numerous modifications and operational changes are implemented, are difficult to isolate, or may not be significant enough to justify independent savings calculations. Also, the expected savings need to be large enough to be reasonably detected by monitoring the whole building consumption.	Option C

These methodologies can generally be applied to measure savings resulting from performance improvements, operational modifications, or equipment upgrades. Where specific site conditions make a listed methodology impractical, a case specific methodology conforming to IPMVP principles should be applied.

**Qualifications and Responsibilities of the M&V Analyst and M&V Reviewer**

The M&V Plan and the Periodic Utility Savings Reports produced using the data derived from it is how the agency determines how well the project is performing with respect to the guaranteed performance of contracts subject to Government Code §2166.406. The M&V Plan becomes part of the Contract and must be reviewed by an independent third party licensed engineer.

The analyst who develops or reviews the M&V Plan must meet the following criteria:

- Have a working knowledge of utility-using systems typical of those found in institutional and commercial buildings, have a working knowledge of energy and water efficient retrofits utilizing state-of-the-art technologies, and have a specific understanding of the subject building’s operation and maintenance procedures;
- Be experienced in conducting utility monitoring, identifying and measuring elements of utility consumption in institutional or commercial buildings, preparing comprehensive savings reports, have experience in on-site work to gather project data, and direct or perform all aspects of the data collection, data selection, data analysis, cost estimation, and provide final recommendations for the project.

It is the responsibility of the analyst to expedite the preparation of the report and to respond in a timely manner to any comments, questions, or necessary revisions resulting from the technical review.

**M&V Plans: Purpose and Minimum Content**

Any performance contract submitted must first and foremost provide substantial proof that the UCRM in fact will perform as stated in the project proposal and provide savings greater than or equal to those estimated. It is the overriding purpose of the M&V Plan to describe a method for achieving that proof.

M&V plans should contain, at a minimum, the following information:

- Name and qualifications of the M&V firm and individual technical analyst that will perform the M&V.
- A list of what will be measured.
- Time interval(s) to be used for the measurements.
- The total cost of the M&V Plan over the term of the Contract.
- Instruments that will be used for measurement and method of installation.
- How the instruments will be calibrated and the frequency of calibration.
- What baseline and post-retrofit analysis will be performed on the data that are collected.
- A sample calculation of the savings analysis including format (ASCII flat file recommended).
- A table that shows M&V approach to measure each UCRM or O&M measure.
- A Sample Periodic Utility Savings Report including examples of all required documents and showing all data elements, calculations and representative results.
- Certification of review by a licensed engineer.

### **Measurement and Verification Plan Review**

The M&V Plan must be submitted along with the UAR, sample Periodic Utility Savings Report, and the proposed contract for an independent review by a licensed engineer.

### **Periodic Utility Savings Report**

The Periodic Utility Savings Report will be reviewed by the Agency and /or third party reviewer based on the following criteria:

- Are the savings greater than or equal to those estimated or guaranteed in the UAR and the Contract? (If the estimated and guaranteed savings are not the same, both numbers must be shown throughout the documents.) Do they meet the requirements of Government Code §2166.406?
- Does the report contain the minimum required elements as listed in this document?
- Does the report present the data elements, calculations, and results as set forth in the M&V Plan?
- Do the parties (i.e., Owner, ESCO Contractor, or third party contractor) have any disputes or concerns regarding the report?

If it is determined that an independent third party review of the utility project savings report is needed, the contractually designated third party reviewer should respond to the review request within fifteen working days of its receipt. If the answers to the above questions are satisfactory to the contractually designated third party reviewer and the Owner, the report will be filed for future reference. If the answers are not satisfactory, closer review of the project will begin and the costs of that review along with the contractual remedies will be assigned to the party deemed responsible for the discrepancy, as determined by the third party reviewer and specified in the Contract.

## **Certifications**

The following certifications address:

- 1) The preparation of the M&V Plan;
- 2) The Periodic Utility Savings Report, which is provided by the ESCO/Contractor;
- 3) The third party review of the Utility Savings Report; and,
- 4) Conflict of interest issues by third party providers.

Third party providers should either sign the certification for providing M&V services or the alternate certification for reviewing M&V reports.

Energy Savings Performance Contracts  
MEASUREMENT AND VERIFICATION PROVIDER CERTIFICATION  
(Submit with M&V Plan for Evaluation)

State Agency/Owner: \_\_\_\_\_

ESCO /Contractor:  
\_\_\_\_\_

Contract Name/Number: \_\_\_\_\_

Date of Review: \_\_\_\_\_

SECO requires the use of the International Performance Measurement and Verification Protocol (IPMVP), latest edition, which is administered by the Efficiency Valuation Organization (EVO).

Does the Measurement and Verification (M&V) plan contain, at a minimum, the following information?

Yes      No  
            1) A detailed scope of work and deliverables that clearly define the outputs and service levels provided after the installation of equipment.  
  
   Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes      No  
            2) Name and qualifications of the M&V firm and individual technical analyst that will perform the M&V.  
  
   Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes      No  
            3) A list of what will be measured.  
  
   Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes      No  
            4) Time interval(s) to be used for the measurements.  
  
   Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes      No  
            5) The total cost of the M&V Plan over the term of the Contract.

Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes No

- 6) Instruments that will be used for measurement, method of installation, how the instruments will be calibrated and the frequency of calibration.

Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes No

- 7) What baseline and post-retrofit analysis will be performed on the data that are collected.

Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes No

- 8) A sample calculation of the savings analysis including format (ASCII flat file recommended).

Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes No

- 9) What baseline and post-retrofit analysis will be performed on the data that are collected.

Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes No

- 10) A table that shows M&V approach to measure each UCRM or O&M measure.

Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes No

- 11) A Sample Periodic Utility Savings Report including examples of all required documents and showing all data elements, calculations and representative results.

Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes No

- 12) Certification of review by a licensed engineer.

Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

I certify that this Measurement and Verification Plan has been prepared in accordance with the requirements of the Performance Contracting technical Guidelines for state agencies and that this knowledge is based on the my study of the proposed projects and on-site investigation of the facilities involved.

Additionally, I certify that the Measurement and Verification approaches, plans, and specifications presented are factual, accurate, reasonable, and in accordance with generally accepted engineering practices to the best of my knowledge and in my best professional judgment.

\_\_\_\_\_  
*(signature)*

\_\_\_\_\_  
*(printed name)*

\_\_\_\_\_  
*(title or position)*

\_\_\_\_\_  
*(mailing address)*

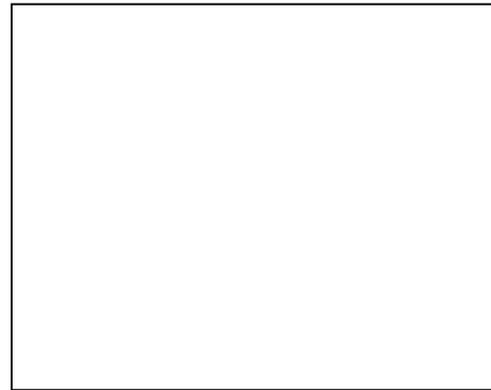
\_\_\_\_\_  
*(street address)*

\_\_\_\_\_  
*(City, TX)*

\_\_\_\_\_  
*(office telephone number)*

\_\_\_\_\_  
*(email address)*

\_\_\_\_\_  
*(Texas P.E. Registration Number)*



Affix Official P.E. Seal  
(Only if signed by an Engineer)

**FOR SECO USE ONLY**

Date Received: \_\_\_\_\_

Approved By: \_\_\_\_\_

Date Approved: \_\_\_\_\_

OR

Date Returned to Agency: \_\_\_\_\_

Comments: \_\_\_\_\_

Energy Savings Performance Contracts  
PERIODIC UTILITY SAVINGS REPORT CERTIFICATION  
(Submit with each Periodic Utility Savings Report)

State Agency/Owner: \_\_\_\_\_

ESCO/Contractor: \_\_\_\_\_

Contract Name/Number: \_\_\_\_\_

Date of Review: \_\_\_\_\_

The Periodic Utility Savings Report will be reviewed based on the following criteria:

Yes      No  
       1) Are the savings are greater than or equal to those estimated or guaranteed in the UAR and the Contract? (If the estimated and guaranteed savings are not the same, both numbers must be shown throughout the documents.)  
  
Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes      No  
       2) Do they meet the requirements of Government Code §2166.406?  
  
Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes      No  
       3) Does the report contain the minimum required elements as listed in this document?  
  
Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes      No  
       4) Does the report present the data elements, calculations, and results as set forth in the M&V Plan?  
  
Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes      No  
       5) Do the parties (i.e., Owner, ESCO/Contractor, or third party contractor) have any disputes or concerns regarding the report?  
  
Document \_\_\_\_\_ Page reference(s): \_\_\_\_\_

Yes      No  
       6) Has an independent third party reviewed this utility savings report?

Date of review: \_\_\_\_\_

Yes      No  
       7) Has this utility savings report been submitted to the State Energy Conservation Office?

Date submitted: \_\_\_\_\_

I certify that this Utility Savings Report accurately presents the savings reported with those estimated as set forth in the Sample Utility Savings Report and that any adjustments or variations from the previously approved documents are fully documented and reported.

\_\_\_\_\_  
*(signature)*

\_\_\_\_\_  
*(printed name)*

\_\_\_\_\_  
*(title or position)*

\_\_\_\_\_  
*(mailing address)*

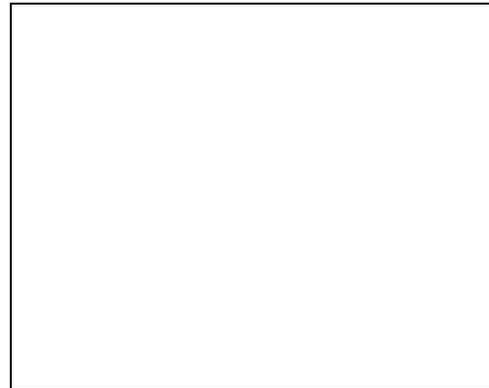
\_\_\_\_\_  
*(street address)*

\_\_\_\_\_  
*(City, TX)*

\_\_\_\_\_  
*(office telephone number)*

\_\_\_\_\_  
*(email address)*

\_\_\_\_\_  
*(Texas P.E. Registration Number)*



Affix Official P.E. Seal  
(Only if signed by an Engineer)

**FOR SECO USE ONLY**

Date Received: \_\_\_\_\_

Approved By: \_\_\_\_\_

Date Approved: \_\_\_\_\_

OR

Date Returned to Agency: \_\_\_\_\_

Comments: \_\_\_\_\_

\_\_\_\_\_

Energy Savings Performance Contracts  
CONFLICT OF INTEREST CERTIFICATION FOR THIRD PARTY REVIEWER OF  
UTILITY MEASUREMENT AND VERIFICATION SAVINGS REPORTS

State Agency/Owner: \_\_\_\_\_

ESCO/Contractor: \_\_\_\_\_

Contract Name/Number: \_\_\_\_\_

Date of Review: \_\_\_\_\_

As third party reviewer of periodic energy and water savings reports, I certify that I/we have no financial interest in this project or contractual relationship with the energy service company retained to implement the energy cost-saving retrofits under a guaranteed savings agreement.

\_\_\_\_\_  
*(signature)*

\_\_\_\_\_  
*(printed name)*

\_\_\_\_\_  
*(title or position)*

\_\_\_\_\_  
*(mailing address)*

\_\_\_\_\_  
*(street address)*

\_\_\_\_\_  
*(City, TX)*

\_\_\_\_\_  
*(office telephone number)*

\_\_\_\_\_  
*(email address)*

\_\_\_\_\_  
*(Texas P.E. Registration Number)*



Affix Official P.E. Seal  
(Only if signed by an Engineer)

**FOR SECO USE ONLY**

Date Received: \_\_\_\_\_

Approved By: \_\_\_\_\_

Date Approved: \_\_\_\_\_

OR

Date Returned to Agency: \_\_\_\_\_

Comments: \_\_\_\_\_

\_\_\_\_\_