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# The Business Case for Conducting Measurement and Verification In State and Local Government Energy Savings Performance Contract Projects

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# Introduction

Energy savings performance contracts (ESPCs) enable public agencies to implement facility improvements with little or no upfront capital by leveraging a guaranteed multi-year stream of avoided utility and other costs. The measurement and verification (M&V) process documents the impacts of projects implemented through ESPCs. M&V is a good example of the phrase "things that are measured tend to improve." M&V can identify opportunities to optimize energy savings performance, improve financial outcomes, and document other benefits, such as reduced water use and operations and maintenance (O&M) cost savings.

### Energy Savings Performance Contracts

Energy Savings Performance Contracts enable facility owners to pay for energy efficiency upgrades and other facility improvements with energy savings and sometimes water, maintenance, and other savings generated by the upgrades over time. ESPCs typically specify a period of performance in years, over which the dollar value of the guaranteed energy and non-energy savings must exceed the payments for the project financing. The ESPC framework is most often used for public sector investments in energy efficiency, but also allows municipal and state organizations, universities and colleges, K-12 schools, hospitals (MUSH), and other public institutional facilities to pay for upgrades without diverting funds from the capital budget or other programs. The project implementer—usually an energy service company—typically designs and installs the project and guarantees the savings in turnkey fashion. For more information, see the "Resources" section at the end of this document.

When effectively implemented, M&V enables ESPCs to succeed by documenting the quantity of energy savings (and sometimes demand, water, O&M, and other savings) over an extended period of time. Thus, M&V tracks whether guaranteed savings have been achieved. Without M&V, there would be no way to document whether contractual obligations have been met or whether they will continue to be met through the term of the performance contract, and there would be no paper trail for resolving disputes.

This document highlights the substantial, cost-effective benefits of incorporating well-documented M&V in ESPCs—M&V that includes ongoing data collection and regular reporting of M&V results. Effective M&V, in which energy service companies (ESCOs) and their customers are partnered, can demonstrate savings and document the variables that impact project savings. Such M&V enables the ESPC customer to hold its ESCO accountable and documents whether the customer is meeting its obligations under the contract (e.g., properly maintaining equipment or using agreed-upon control setpoints). M&V can also uncover shortfalls in savings. When these shortfalls are due to factors under the ESCO's responsibility, the ESCO must take corrective action to prevent future lost savings and, if appropriate, financially compensate the ESPC customer.

M&V also provides additional benefits for ESPC customers and contractors. These include identifying opportunities to improve equipment and system performance, documenting project performance to justify future projects, and providing data to improve and lower risks in future projects.

These benefits demonstrate that the cost of M&V (e.g., taking measurements, conducting analyses, etc.) does not have to be considered solely as an ESPC compliance expense. While M&V is a fundamental underpinning of performance contracting, the business case for investing in comprehensive M&V can be most effectively made when ESPC customers take advantage of the full range of value provided by comprehensive M&V. To ensure this value is captured, the ESPC customer can commit to a plan internally for how ongoing benefits realized within the organization will be used to help pay for M&V costs.

## M&V PROVIDES THE PROOF

ESPCs require the documentation of project energy savings and sometimes other impacts, such as water or O&M savings. The documentation is accomplished by either: (1) confirming proper installation and then stipulating savings[1] or (2) M&V activities over a period of time (often for at least several years) as specified in the ESPC project contract. The most widely used M&V methods are the four options (A, B, C, and D) described in the industry-standard International

[1] The stipulated savings are typically savings values assigned to specific measures (e.g., kWh savings per year for a specific lighting retrofit) and are agreed to by the ESCO and the ESPC customer prior to the project's implementation. This stipulation does not provide the benefits ascribed to M&V that are discussed in this document.

### Summary of M&V's Benefits for State and Local Public Sector Facilities and Programs

In addition to meeting minimum legal or organizational requirements for accurately demonstrating energy or cost savings per contractual ESPC guarantees, M&V provides a number of significant benefits to public agencies, including:

- Identifying the cause(s) of and correcting for any savings shortfalls, whether they are the responsibility of the ESPC customer, ESCO, or both
- Enabling reporting of accurate project results to internal and external stakeholders, including regulators and policymakers, which also helps safeguard public trust in an organization's ESPC projects
- Identifying opportunities to optimize performance of implemented equipment or systems
- Identifying additional cost-saving opportunities, whether for energy, water, O&M, or other savings
- Quantifying non-energy benefits that may not be subject to ESPC guarantees, such as productivity improvements, emissions reductions, or O&M or water savings in cases where they are not included in the ESPC guarantee.

Performance Measurement and Verification Protocol (IPMVP).[2] These options provide a range of methods for determining energy savings with varying levels of savings certainty and cost. In practice, typically one or more options are chosen based on the specific features of each project and its constituent energy-efficiency measures. Effective M&V involves activities that are specific to each project and may include some combination of measuring key parameters (e.g., equipment energy use or operating hours), comparing energy consumption in bills before and after a project's implementation, generating engineering calculations, performing statistical analyses, and/or modeling computer simulations.[3]

## THE BUSINESS CASE FOR M&V, OR "WHY SHOULD I PAY FOR M&V?"

Effective and meaningful M&V, which costs a small percentage of the project's savings, provides multiple benefits to ESPC customers. As mentioned above, M&V enables accurate documentation of ESPC project performance and whether guaranteed savings are being achieved.[4] For many public agencies, statute or other policies direct that the project savings must cover the ESPC financing payments for each year of the contract term. For this reason, the guaranteed quantity of energy (and sometimes water and O&M) savings must be converted to monetary terms to determine financial equivalent savings.

### Business Case for M&V: A University that Caught Significant Shortfalls Undetectable by Meter Data Alone

Project Description: A university campus with chiller upgrades, new laboratory fume hoods, and upgrades to controls

Capital Project Value: $1,300,000

Guaranteed annual savings: $81,000

Performance Monitoring/M&V Period: Three years

M&V Options: IPMVP Options A and D

M&V Benefit: At the scheduled three-month M&V "check-up," the ESCO discovered that the project was heading toward an annual shortfall of about 40%. The cause was a combination of the university staff not operating the building controls according to contract specifications and the ESCO's overoptimistic design assumptions based on an engineering study provided by university engineers. The university team was pleased that the ESCO's M&V report clearly identified the issues and noted that, with only a few energy meters on this campus, the shortfall and opportunities to improve performance would not have been identified without the M&V data collection and reporting. The successful resolution involved a combination of the ESCO providing remuneration and performing additional work to make up for the shortfall and the university improving its operating protocols for the equipment and building controls.

[2] The four IPMVP Options are Retrofit Isolation with Key Paramater (A), Retrofit Isolation with All Parameter (B), Whole Facility Measurement (C), and Calibrated Simulation (D). Further description of these options can be found in "Measurement and Verification for Performance-Based Contracts, Version 4.0".

[3] Effective M&V involves trained experts collecting data on key parameters, analyzing the data, and reporting on the savings achieved as a result of project(s) in a manner that allows the ESPC customer and ESCO to clearly understand whether the project has met the savings obligation(s) and, if there are shortfalls, to understand the reasons for them.

[4] For more details on what specifically is guaranteed in an ESPC, please see Understanding Your ESPC Savings Guarantee, another document in this series from the U.S. Department of Energy.

Insights from ESCO and public agency representatives indicate that the primary business case reasons for conducting M&V are:

- Documenting whether guaranteed savings levels are being achieved
- Determining whether any corrective actions (including, but not limited to, compensation by the ESCO) are required by the ESCO or the ESPC customer to resolve project performance issues.

### Business Case for M&V: Maryland Department of General Services, Office of Energy Performance and Conservation

Project Description: Various energy efficiency upgrades in approximately 30 state buildings

Capital Project Value: $18,361,746

Annual Savings Guarantee: $1,803,967

Performance Period: 1/1/2010–12/31/2023 (13 years)

M&V Method: IPMVP Option C

M&V Benefit: Following its first performance year, the ESCO reported a substantial savings shortfall but maintained that most of the shortfall was due to the failure of the customer to adhere to contract-mandated equipment operating schedules and setups, and the addition of energy-consuming equipment. However, as a result of required ongoing M&V using Option C, the state had documentation that enabled it to hold the ESCO accountable for a $900,000 annual shortfall. Without the benefit of rigorous, ongoing M&V, the state would most likely have settled for a far lower (and less accurate) shortfall amount.

Facility owners and managers with substantial ESPC experience report multiple instances where M&V identified guarantee shortfalls and necessary corrective actions that would not have been identified without the M&V. For ESCOs, M&V helps build trust with their clients by demonstrating that they have done a good job with their highly-performing projects in reducing energy and other costs over an extended period time and that they will take responsibility in the event of a shortfall.

In addition, M&V can provide other beneficial information to both ESPC customers and ESCOs. These benefits can apply to individual ESPC projects and ESPC programs. For individual projects, additional benefits can include:

- Improving or optimizing the performance of facilities and maximizing savings. M&V can identify deficiencies in equipment performance and general building operation as well as methods to optimize energy savings performance. This can improve savings levels, minimize unnecessary repairs, and extend the useful life of equipment.
- Documenting non-energy benefits that may not be guaranteed in the ESPC but that have value for ESPC customers.[5] In many cases, projects may be designed to achieve non-energy objectives as well as energy savings. These can include improving occupant comfort and productivity, addressing deferred maintenance, or meeting environmental sustainability goals. Water and O&M cost savings may also be identified and quantified by the ESPC customer even when they are not included in an ESPC guarantee (e.g., if they are not allowed in the jurisdiction).

### M&V, Commissioning, and Retro-commissioning

M&V differs from stipulating savings in that M&V involves measuring and assessing energy efficiency project performance, often throughout the term of an ESPC. M&V is similar in many ways to commissioning (Cx) and retro-commissioning (RCx). M&V, Cx and RCx all involve measurement of a facility's equipment and systems performance, which can result in building energy system and equipment performance optimization. However, the main focus of M&V is to determine savings impacts, while the focus of Cx and RCx are to make sure a facility's systems are operating per design intent.

For ESPC programs implemented by public agencies over multiple years, M&V also has longer term strategic benefits such as:

- Documenting the ESPC by redirecting money spent on wasted energy and the maintenance of obsolete equipment can deliver need capital improvements with no additional cost to taxpayers

[5] M&V of non-energy benefits should not be expected to be covered as part of an ESPC M&V plan, unless specific non-energy benefits are included in the contract savings calculations or are specifically requested by the ESPC customer as an additional service from the ESCO. ESPC customers may of course conduct their own M&V of energy and non-energy benefits.

- Ongoing education of internal and external stakeholders on the value of energy efficiency and ESPCs as worthwhile investments and contracting mechanisms
- Identifying and planning future efficiency projects and forecasting energy budgets (such as forecasting of utility bills)
- Providing key indicators, such as those relating to state or local energy, environmental, and budget goals (e.g., via benchmarking) to safeguard public trust in ESPC project investments.

### Effective M&V Starts Early in the Project

A state hospital implemented a project that involved lighting retrofits and the decentralization of the heating system on a hospital campus of about 30 buildings. The project cost was about $19.7 million, with guaranteed annual savings of about $2.4 million. At the conclusion of the first year of operation, the M&V (using IPMVP Option C), indicated that the contract savings projections had been overly conservative by about $700,000 a year. A review of the initial project proposal and M&V plan by an experienced owner's representative could have caught this overly cautious savings estimate during the project design phase, which would have enabled the customer to add additional and much-needed capital improvements to the project.

## GETTING THE BEST VALUE OUT OF M&V

Designing cost-effective M&V for a project involves planning and analyses to quantify the potential upsides (e.g., additional savings through enhanced operations) and potential downsides (failure to meet the savings guarantee) associated with the efficiency measures that make up a project and matching these with the costs of the various M&V approaches. The approach used for M&V should be addressed early in the process of developing and negotiating a project. The ESPC customer and ESCO should, upfront and transparently, agree on such topics as the baseline from which savings will be determined and the frequency and duration of M&V activities. These and other details are specified in the M&V plan, which will be agreed upon by the ESCO and the customer and incorporated into the contract.[6]

Many ESPC customers may lack the in-house technical knowledge or experience needed to perform these analyses. Experienced ESPC practitioners strongly recommend that all ESPC customers obtain qualified technical assistance by retaining a technical consultant (often called an "owner's representative") or availing themselves of technical assistance that may be provided by their state's ESPC program. The owner's representative or state technical assistance provider should provide benefits that exceed their cost. Owner's representatives should provide input on project design, review the proposed M&V plan, ensure that the ESCO's proposed savings and costs are reasonable, and help select the most applicable M&V approach. Typically, the contracting ESCO conducts the M&V, but in some cases a third party may provide the actual M&V instead.

Analysis of ESPC projects in the federal sector reveal that M&V costs can range from about 2% to 3% of project annual savings, with some complex projects' M&V representing as much as 5% of project annual savings.[7] Generally, more M&V effort goes into projects that have more potential upsides and/or risk. The M&V plan will sometimes include different M&V options for different measures that make up a project or will vary the type or rigor of the M&V activities over time. The plan is typically tailored to fit the needs of the ESPC customer and/or specific projects. For example, an ESPC customer may choose to use IPMVP option C for the first three years to demonstrate that the whole project is producing the guaranteed savings, then may switch to IPMVP options A or B for the duration of the contract to demonstrate that the higher-risk, individual efficiency measures are performing as specified, perhaps in combination with retro-commissioning activities.

Once the ESPC customer and the ESCO have agreed on the M&V approach(es) and specific method(s) for measuring and documenting project impacts, the ESCO incorporates this information into a draft M&V plan. M&V plans also indicate the format and frequency of ESCO M&V reports that will be provided to the customer.[8] The M&V plan then becomes part of the project contract. Two other important considerations for designing and implementing the M&V plan are:

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[6] For more information on developing and implementing successful ESPCs, see the companion document, Energy Performance Contracting in the State and Local Markets: Strategies for Successful M&V.

[7] Oak Ridge National Laboratory, 2019.

[8] For additional guidance on M&V plan details, see the companion document, Energy Performance Contracting in the State and Local Markets: Strategies for Successful M&V.

- Both the ESCO and ESPC customer need to confirm that they can meet their obligations as indicated in the M&V plan for the term of the contract (e.g., proper equipment maintenance and maintaining agreed-upon controls setpoints).
- It is important that ESPC customers and ESCOs keep a full record of the development and implementation of an ESPC project from project development (including the project Request for Proposal and the ESCO's proposal) to the periodic M&V reports for the full term of the contract. The documentation of issues that arose and how they were addressed should be included as part of ongoing recordkeeping.

### M&V's Benefits Exceed the Cost

Oak Ridge National Laboratory recently reviewed 178 projects that were implemented for federal government facilities under the U.S. Department of Energy's Federal Energy Management Program. For these projects, the total annual expense for the ESCOs to perform annual M&V audits and reporting was $6.8 million, about 2% of the total cost savings guaranteed. This M&V verified about $343.5 million in savings—about 107% of what was guaranteed.

The M&V effort also revealed opportunities to obtain an additional $8.7 million in savings. These results indicate that, in addition to verifying the ESPC guarantees, M&V provided additional opportunities to garner savings in an amount that exceeded the cost of the M&V.

Source: *Reported Energy and Cost Savings from the DOE ESPC Program: FY 2018 Update*. Oak Ridge National Laboratory 2019, Forthcoming.

When effectively implemented, M&V provides a number of significant benefits to public agencies. In addition to accurately demonstrating energy or cost savings according to the contractual ESPC guarantees, M&V provides a range of additional benefits to public agencies, including: 1) attributing and correcting any savings shortfalls caused by the ESPC, ESCO, or both; 2) enabling accurate reporting of project results, which helps safeguard public trust in an organization's ESPC projects; 3) identifying opportunities to improve installed equipment and system performance, as well as opportunities for additional or future cost-saving opportunities; and 4) identifying and, in some cases, quantifying non-energy benefits that may not be subject to the ESPC guarantee but are of value to the ESPC customer.

### M&V Benefits for ESCOs

This document primarily covers M&V's benefits to facility owners, but there are direct benefits to ESCOs as well, including:

1. Helping identify opportunities to optimize (and maximize) performance of efficiency measures for existing and new clients to better ensure performance guarantees are met
2. Documenting performance to minimize the potential for disputes with ESPC customers and to support holding the customer accountable for their responsibilities as defined in the contract
3. Providing data to inform and improve savings projections and reduce risks and uncertainties in future projects (e.g., being able to guarantee more savings).

Understanding how the ESCO can benefit from M&V helps ESPC customers negotiate the most effective and cost-effective M&V approach with their ESCO.

# Resources

## Further Information on ESPCs

National Association of Energy Services Companies (NAESCO) resources: https://www.naesco.org/resources.

U.S. Department of Energy, Energy Savings Performance Contracts for Federal Agencies: https://www.energy.gov/eere/femp/energy-savings-performance-contracts-federal-agencies.

Lawrence Berkeley National Laboratory, Energy Saving Performance Contracting: https://emp.lbl.gov/projects/energy-saving-performance.

Energy Savings Performance Contracting: A Primer for K-12 Schools, April 2016, Oak Ridge National Laboratory for the U.S. Department of Energy: https://www.energy.gov/eere/slsc/downloads/energy-savings-performance-contracting-primer-k-12-schools.

The U.S. Department of Energy's Better Buildings Initiative offers the online ESPC Toolkit,which includes decision tools, model documents and templates, data management tools, a guide on how to launch a state ESPC program, and more: https://betterbuildingsinitiative.energy.gov energy-savings-performance-contracting-espc-toolkit.

## Further Information on M&V for ESPCs

Understanding Your ESPC Savings Guarantee, U.S. Department of Energy, 2019, provides a summary of some important aspects of savings guarantees in ESPCs and  includes links to reference documents for readers who want more detail: (link forthcoming).

Energy Savings Performance Contracting for State and Local Governments: Strategies for Successful Measurement and Verification of Savings, U.S. Department of Energy, 2019, provides state ESPC program administrators—that the individuals who oversee or provide ESPC technical support to constituent state, local, healthcare, and/or educational facilities—with a selection of tested strategies to support successful M&V of ESPCs implemented in the state and local public sector: (link forthcoming).

The International Performance Measurement and Verification Protocol (IPMVP) is a product of the Efficiency Valuation Organization: https://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp.

The Federal Energy Management Program offers its standard procedures and guidelines for M&V in federal ESPC projects: "M&V Guidelines: Measurement and Verification for Performance-Based Contracts (Version 4.0)." A number of ESCOs and state ESPC programs reference this document for developing their own M&V practices: https://www.energy.gov/eere/femp/downloads/mv-guidelines-measurement-and-verification-performance-based-contracts-version.

FEMP has also developed guidance for how to calculate and verify O&M savings: https://www.energy.gov/eere/femp/downloads/operations-and-maintenance-best-practices-guide.

Reported Energy and Cost Savings from the DOE ESPC Program: FY 2018 Update, Oak Ridge National Laboratory, 2019, compares the total annual M&V expense of federal ESPC projects with the measured and verified savings: (link forthcoming).

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