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MODULE

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ESCO's Guide to Measurement and Verification

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Measurement and Verification (M&V) is a crucial aspect of energy efficiency projects, especially for Energy Service Companies (ESCOs). It is a systematic process used to quantify the energy savings resulting from energy efficiency measures and ensure that these measures are performing as intended. M&V serves as a foundation for accountability, performance assurance, and investment risk management in energy projects.

Learning Objectives

- Instrument metering and calibration
- Fieldwork: formal accreditation, safety, OSHA, and NFPA
- Data accessibility, communication, and valuation
- Reporting on Measurement and Verification (M&V) Projects
- Definitions of IPMVP Options
- The future of measurement and verification
- Sample M&V Plan
- Sample M&V Report
- ESCO's Guide to Measurement and Verification
- Summary and Resources



INTRODUCTION

- Contract structure impacts the role and importance of M&V.
- Performance contracts can be guaranteed savings or shared savings.
- Guaranteed savings model: ESCO guarantees a certain amount of energy "savings" and is responsible for any shortfall.
- Shared savings model: Customer and ESCO share the risks and benefits of the energy efficiency project.
- Choice between guaranteed and shared savings depends on project scope, financial risk level, and ESCO's capabilities and preferences.
- Guaranteed savings models may be suitable for projects with predictable intervention, while shared savings models may be suitable for projects with less certain outcomes.



PURPOSE OF M&V

- Quantification of Energy Savings: Accurately measure the energy savings achieved by implementing energy conservation measures (ECMs).
- Verification of Performance: Confirm that the savings are realized and that the systems are functioning as designed.
- Facilitating Financial Assurance: Provide stakeholders with confidence in the projected savings and financial returns.





Purpose of M&V

Increase energy savings

Document financial transactions

Enhance financing for efficiency projects

Improve engineering design and facility operations and maintenance

Manage energy budgets

Enhance the value of emission-reduction credits

Support the evaluation of regional efficiency programs

Increase public understanding of energy management as a public policy tool.



HISTORICAL CONTEXT OF "M&V" PROGRAM IN ENERGY EFFICIENCY

- Energy Savings Performance Contracting (ESPC) is a transformative approach to energy efficiency projects.
- Measurement and Verification (M&V) is a core component of ESPC, ensuring predicted energy savings occur as projected.
- Early development of M&V was rudimentary, focusing on simple pre- and post-installation measurements of energy usage.
- Determining energy savings involves measuring post-retrofit energy use and comparing it to pre-retrofit use.
- Demand-side management (DSM) programs emphasized energy efficiency and the adoption of new technologies.
- Major developments in DSM programs during the 1980s included building energy codes, advances in energy efficiency technology, and time-of-use pricing.
- Energy conservation measures, energy baseline, energy savings performance contract, energy unit savings, and energy cost savings are key terms in the energy conservation measures.
- ESCOs often rely on established protocols and standards for M&V.
- The most widely recognized standards include the International Performance Measurement and Verification Protocol (IPMVP) and ASHRAE Standards.



EMERGENCE OF FORMAL MEASUREMENT AND VERIFICATION PROTOCOLS

- FEMP, NEMVP/IPMVP, and ASHRAE 14 are foundational documents of "M&V."
- FEMP's guidelines focus on U.S. federal government contracts and procurement, emphasizing compliance with federal procurement rules.
- IPMVP provides general guidance on M&V concepts and best practices, establishing a general framework for users to establish their own applications.
- ASHRAE 14 calls for more scientifically rigorous engineering methods but offers practical guidance on how to comply with the document's specifications.
- The U.S. Department of Energy introduced the "International Performance Measurement and Verification Protocol" (IPMVP) in 1996, providing a structured approach to M&V.
- The IPMVP outlined four options for M&V: Retrofit Isolation (Key Parameter Measurement), Retrofit Isolation (All Parameter Measurement), Whole Facility Measurement, and Calibrated Simulation.
- The IPMVP's development established a common language and framework for stakeholders, promoting transparency and consistency, building trust among participants in ESPC projects.



CURRENT STATUS OF M&V PROGRAMS

- M&V is integral to ESPC and energy efficiency programs across North America and beyond.
- Regulatory frameworks often mandate M&V to ensure accountability and demonstrate the effectiveness of energy-saving initiatives.
- Advances in technology have refined M&V practices, enhancing the accuracy and efficiency of energy consumption measurements.
- The term "options" has transitioned to more strategic language, emphasizing the decision-making aspect of M&V.
- The shift from "options" to "strategies" reflects a broader trend in energy management that prioritizes strategic decision-making.
- Understanding this history and its implications is crucial for professionals engaged in energy management, policy-making, and related fields.



M&V OPTIONS

- Option A (Measured Savings): Utilizes direct measurements of energy consumption before and after the implementation of ECMs.
- Option B (Calculated Savings): Involves calculations based on measured data but may not require continuous monitoring.
- Option C (Savings Estimation): Applies when measurement is not feasible, and estimates are based on engineering calculations or historical data.
- Option D (Other): Includes any approach that does not fit the above categories, often involving a combination of measurement and estimation.



M&V Options as per the IPMVP



OPTION A
Retrofit Isolation with Key Parameter Measurement
E.g.; Lighting retrofit projects

OPTION B
Retrofit Isolation with All Parameter Measurement
E.g.; Installation of new electric motor with a variable-speed drive and associated controls

OPTION C
Whole Facility Measurement
E.g.; Replacement of a chiller plant and lighting

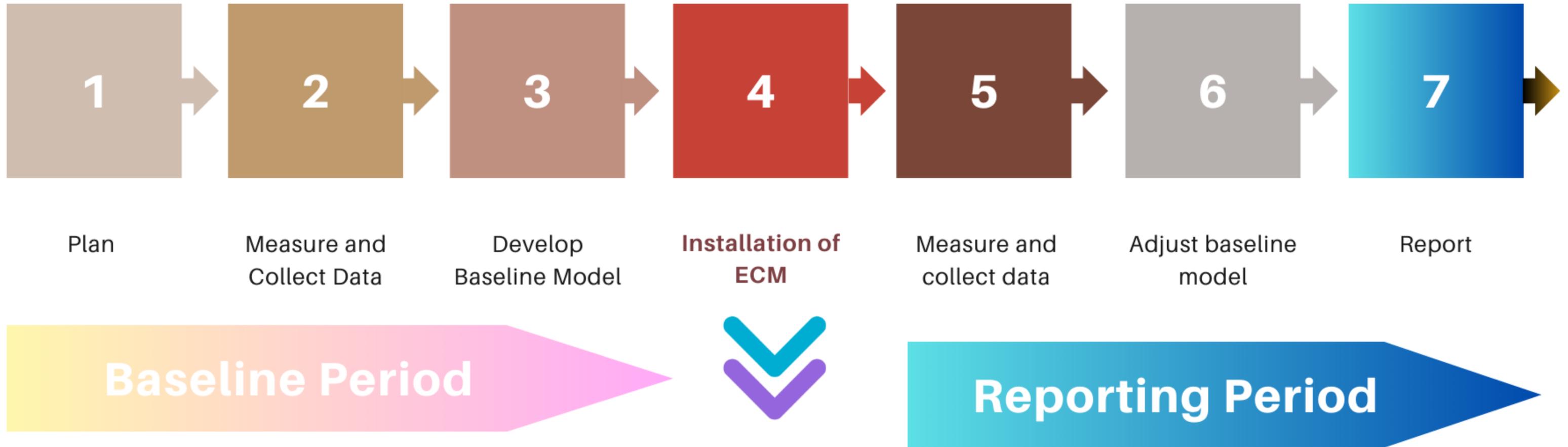
OPTION D
Calibrated Simulation
E.g.; Comprehensive retrofit involving multiple interactive conservation measures in a large building with lack of utility data

STEPS IN THE M&V PROCESS



- Planning: Defines the scope of the M&V effort, including goals, methodologies, and baseline conditions.
- Analogy: Establishes a clear hypothesis and methodology before proceeding.
- Baseline Measurement: Establishes baseline energy consumption before implementing ECMs.
- Implementation of ECMs: After establishing a baseline, the energy-saving measures are implemented.
- Post-Implementation Measurement: Collects new data on energy consumption for a specified period to evaluate performance.
- Analysis and Reporting: Compares post-implementation data to baseline data to quantify savings.
- Verification: Implements an independent verification process, if necessary.

M&V, STEP BY STEP



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THANK YOU

