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CERTIFIED MEASUREMENT & VERIFICATION SPECIALIST
CMVS
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CERTIFIED MEASUREMENT AND VERIFICATION
PROFESSIONAL - CMVP OVERVIEW
ONLINE TRAINING BY KRISHNAJI PAWAR
LEED AP(BD+C),GSAS CGP,GCP,ISO 14001
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MODULE 3

Basic Concepts of Measurement and Verification

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CERTIFIED MEASUREMENT AND VERIFICATION CMVP OVERVIEW

Measurement and verification (M&V) is a critical component of the plan-do-Check-Act cycle for increasing efficiency. Understanding the fundamentals of good measurement and verification is vital for project monitoring, reporting, and assessment.

Learning Objectives

- Introduction
- Knowing the Process of CMVP Credentialing
- Basic Concepts of Measurement & Verification
- Organizational Fundamentals
- Measurement and Verification Process
- Specialist Certification in Measurement and Verification
- Protocols and Advantages of M&V
- Summary and Resources

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INTRODUCTION

- Ensures knowledge, experience, and ethical standards for accurate M&V in energy industry.
- Issued by the Association of Energy Engineers (AEE) to raise professional standards.
- Role in energy projects: designing, measuring, collecting, evaluating, and confirming energy savings.
- Certification ensures industry reliance on skilled individuals for M&V operations, plans, energy consumption models, and monitoring reports.
- Produces transparent reports in accordance with international standards like the International Protocol for Measurement and Verification of Energy Performance.

WHAT IS M&V

"Measurement and Verification" (M&V) involves planning, measuring, collecting, and analyzing data to verify and report energy savings from energy conservation measures (ECMs) in a facility. Energy savings cannot be directly measured. Instead, we calculate savings by comparing the measured use before and after a project, taking conditions into account.





M&V ACTIVITIES



- Meter installation calibration and maintenance,
- Data gathering and screening,
- Development of a computation method and acceptable estimates,
- Computations with measured data, and
- Reporting, quality assurance, and third party verification of reports.

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M&V ACTIVITIES CONSIST OF SOME OR ALL OF THE FOLLOWING:

01 Evaluating energy flows and sources of savings

02 Meter installation, calibration, and maintenance

03 Data gathering, storage, and quality control







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M&V ACTIVITIES CONSIST OF SOME OR ALL OF THE FOLLOWING:

04 Development of a computation method & acceptable estimates; computations with measured data

05 Planning and verifying the completion of operational verification

06 Reporting, quality assurance, and third-party verification of reports







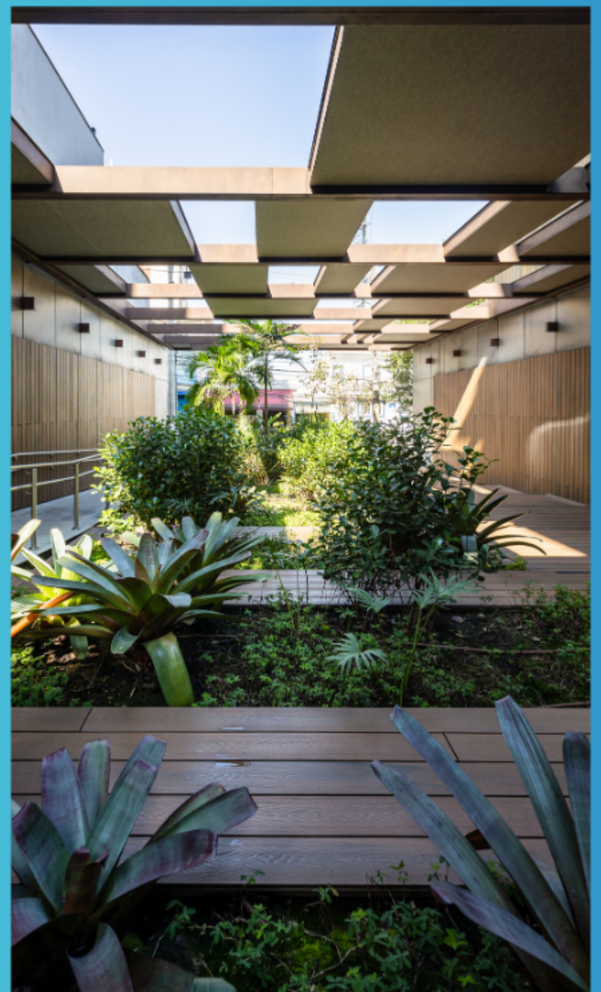
MEASUREMENT AND VERIFICATION IMPORTANCE

- Process of designing, measuring, collecting, and evaluating data to confirm and report energy savings from energy conservation measures (ECMs).
- Energy savings are immeasurable, evaluated by comparing measured use before and after ECMs.
- M&V provides reliable feedback to maintain savings and identify improvement areas.





MEASUREMENT AND VERIFICATION IMPORTANCE +

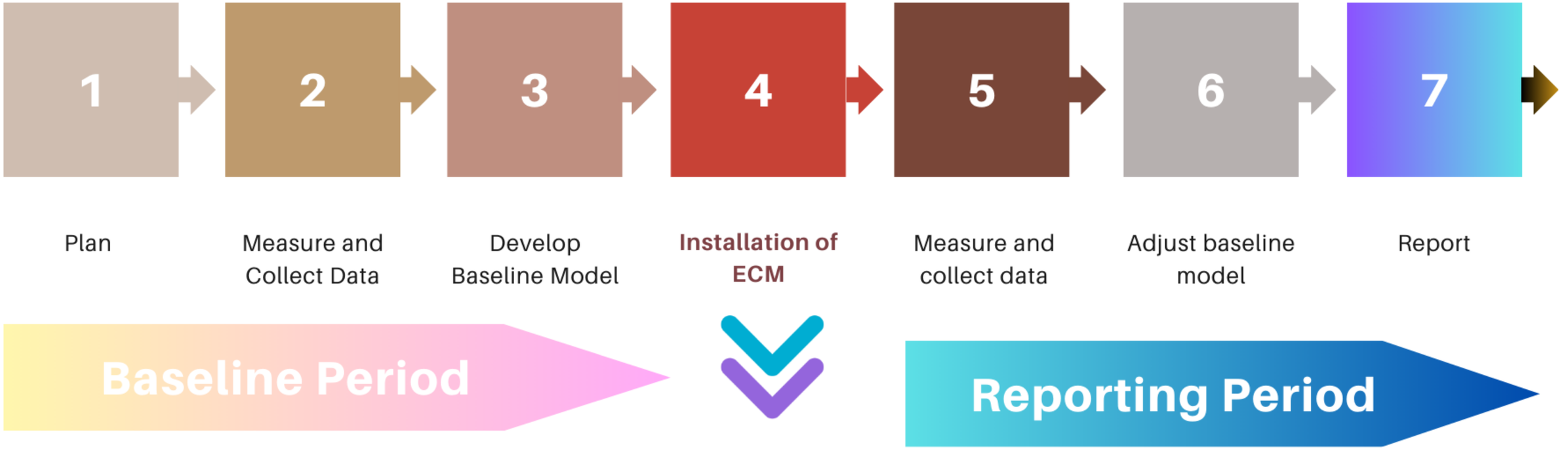


- Assists facility managers in smooth operations and maintenance.
- Discusses financial implications of energy-saving improvements.
- Offers ability to analyze and manage EPC risks.
- Reports energy savings for regulatory compliance or carbon trading.

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M&V, STEP BY STEP



M&V PROCESS

01.	Step 1: Determine Goals for M&V Efforts
02.	Step 2: Select IPMVP Option(s) and Approaches
03.	Step 3: Document Baseline Data
04.	Step 4: Develop M&V Plan
05.	Step 5: Set-up Metering and Ongoing Data Collection Processes
06.	Step 6: Monitor for Changes in Site Conditions

PRINCIPLES OF M&V PRACTICE

- Accurate: M&V reports should be as accurate as possible, considering the project's value and goals. M&V costs should be small compared to the monetary value of the savings under evaluation.
- Complete: The report on energy savings should consider all of the project's effects, using measurements to quantify energy use and document energy-influencing factors.
- Conservative: M&V procedures should be designed to reasonably estimate savings, ensuring they are neither over- nor under-stated.



PRINCIPLES OF M&V PRACTICE +

- Consistent: The reporting of a project's energy performance should be consistent and comparable across all types of energy efficiency projects.
- Relevant: The savings determination should be based on current measurements and information about the facility where the project occurs.
- Transparent: All M&V activities should be clearly documented and fully disclosed, including all plan elements and savings reports. Data and information collected, data preparation techniques, algorithms, spreadsheets, software, assumptions used, and analysis should follow industry standard best practices.



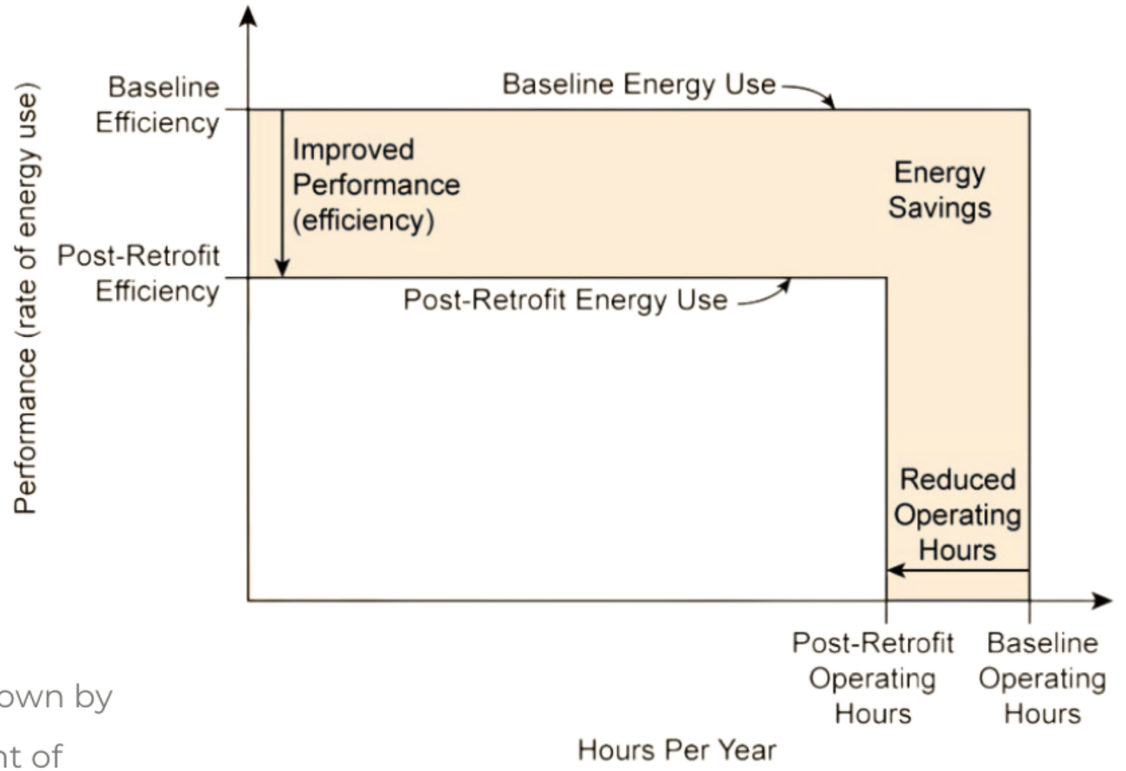
Fundamental Factors Driving Energy Savings

ECM PERFORMANCE

THE RATE AT WHICH ENERGY IS USED TO ACCOMPLISH A SPECIFIC TASK.

ECM USE

HOW MUCH OF THE TASK IS REQUIRED.



In Figure 1, the total amount of energy used in the baseline case is shown by the area of the large box. The smaller box shows how the total amount of energy used goes down when either the rate of energy use goes down (performance goes up) or the amount of energy used goes down (operating hours go down). The amount of energy saved is shown by the shaded area between the two boxes.

M&V Methods and Measurement Options

M&V Methods and Measurement Options

M&V approaches are divided into two general methods, and IPMVP defines four options to measure savings that are termed "Options A, B, C, and D."

1. Retrofit isolation methods look only at the affected equipment or system, independent of the rest of the facility.
2. Whole facility methods, which consider only the total energy use while ignoring specific equipment performance.

Figure 3.4 provides an illustration of the measurement boundaries associated with the different M&V options.





Figure 3.4: Illustration of Measurement Options: retrofit-isolation method (options A and B), whole-facility method (options C and D)

FIGURE 3.2: ILLUSTRATION OF SAVING MEASUREMENTS

Purpose of M&V

01

Increase energy savings

Facility managers benefit from accurate energy savings calculations. This feedback helps them improve ECM design or operations to increase savings, persistence, and consistency.

02

Document financial transactions

Energy efficiency savings can be used for performance-based financial payments and performance contracts. A well-defined and implemented M&V plan can document performance transparently and independently verify it.

03

Enhance financing for efficiency projects

Good M&V plans make efficiency investment reports more transparent and credible. Efficiency investment projections become more credible. This credibility can boost energy efficiency project financing by boosting investor and sponsor confidence.

04

Improve engineering design and facility operations and maintenance

A good M&V plan includes all M&V costs in project economics, encouraging comprehensive project design. Good M&V helps managers find and fix maintenance and operating issues, improving facility management. Good M&V also informs future project designs.

05

Manage energy budgets.

M&V helps managers evaluate and manage energy usage to account for budget variances, even without savings. M&V methods adjust budgets for changing facility operating conditions.

06

Enhance the value of emission-reduction credits

Emission reductions boost efficiency projects. Energy savings reports with an M&V Plan improve emissions-reduction reports.

PURPOSE OF M&V TECHNIQUES IN ENERGY EFFICIENCY

- Increase energy savings: Accurate determination of energy savings provides valuable feedback on energy conservation measures (ECMs), aiding in adjustment to improve savings and persistence over time.
- Document financial transactions: A well-defined M&V Plan can be used to document performance in a transparent manner and subjected to independent verification.
- Enhance financing for efficiency projects: A good M&V Plan increases transparency and credibility of reports on efficiency investments, boosting investor confidence in energy efficiency projects.





PURPOSE OF M&V TECHNIQUES IN ENERGY EFFICIENCY +

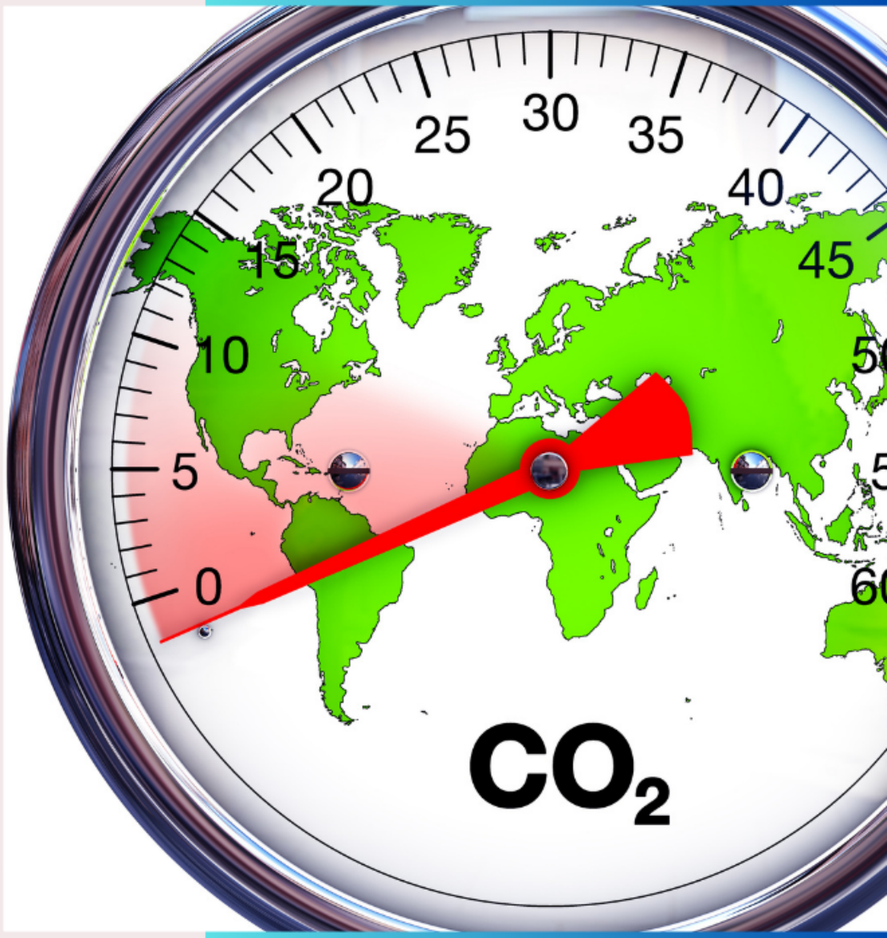


- Improve engineering design and facility operations and maintenance: A good M&V Plan encourages comprehensive project design, helps identify and reduce maintenance and operating problems, and provides feedback for future project designs.
- Manage energy budgets: M&V techniques help managers evaluate and manage energy usage, accounting for variances from budgets.
- Enhance the value of emission-reduction credits: An M&V Plan improves emissions-reduction reports.

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PURPOSE OF M&V TECHNIQUES IN ENERGY EFFICIENCY ++

- Support evaluation of regional efficiency programs: M&V techniques can evaluate savings at selected energy user facilities.
- Increase public understanding of energy management as a public policy tool: M&V improves the credibility of energy management projects, increasing public acceptance of emission reductions and encouraging investment in energy-efficiency projects.



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