

MODULE: 6

MEASUREMENT AND VERIFICATION OF ENERGY PERFORMANCE OF ORGANIZATION



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INTRODUCTION

- M&V adds value by increasing the acceptability of energy performance and energy performance improvement results.
- M&V techniques can be used by facility owners or energy efficiency project investors for the following purposes
 - Increase Energy Savings
 - Document Financial Transactions
 - Enhance Financing for Efficiency Projects
 - Improve Engineering Design and Facility Operations and Maintenance
 - Manage Energy Budgets

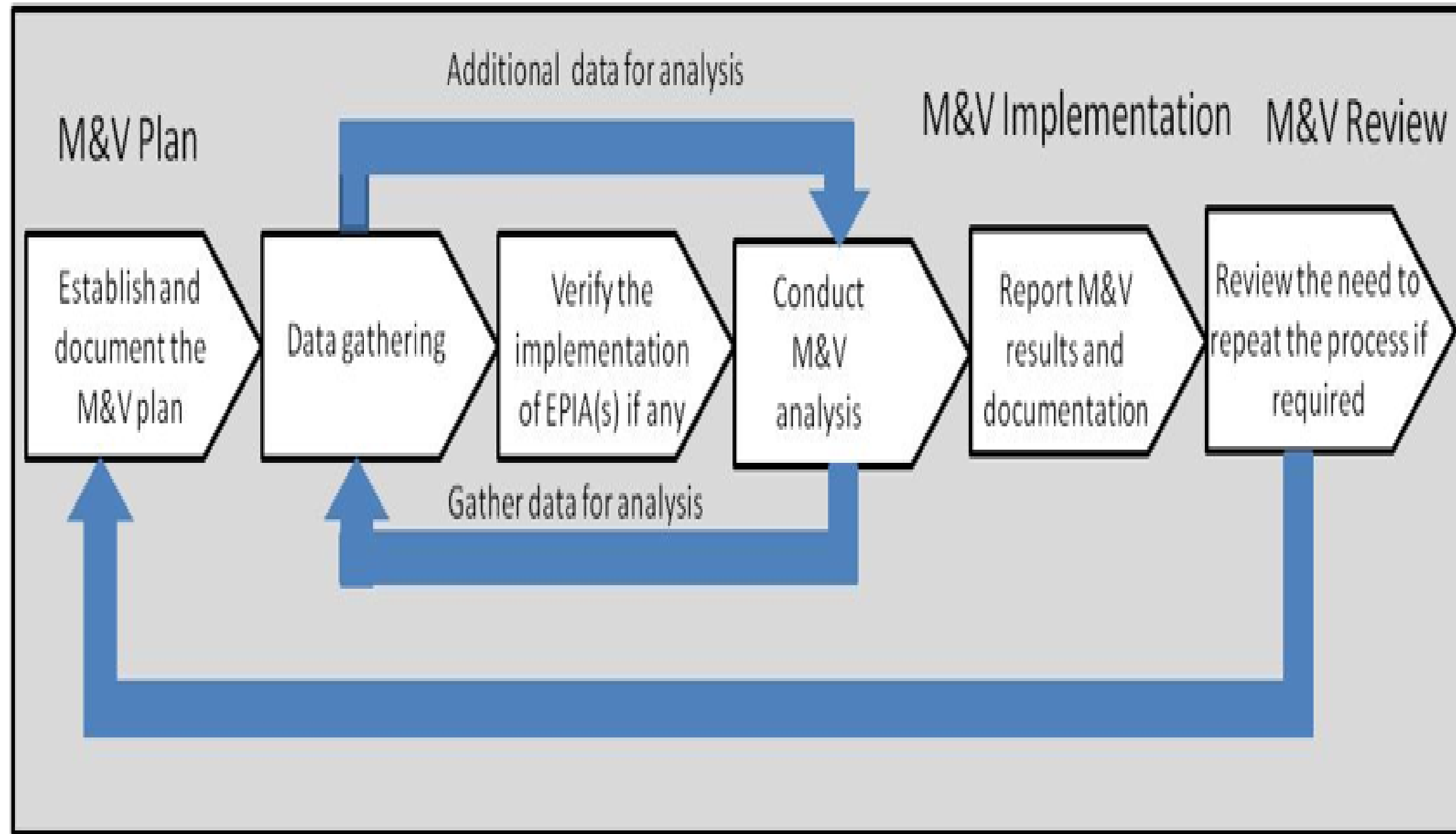
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M&V Applications

- Energy Performance Contracts
- Use of M&V in PAT Scheme
- M&V for Effective ISO 50001 Implementation

The fundamental principles of good M&V practice are described as follows:

- Accurate
- Complete
- Confidential
- Conservative
- Consistent
- Impartial
- Relevant
- Transparent & Reproducible

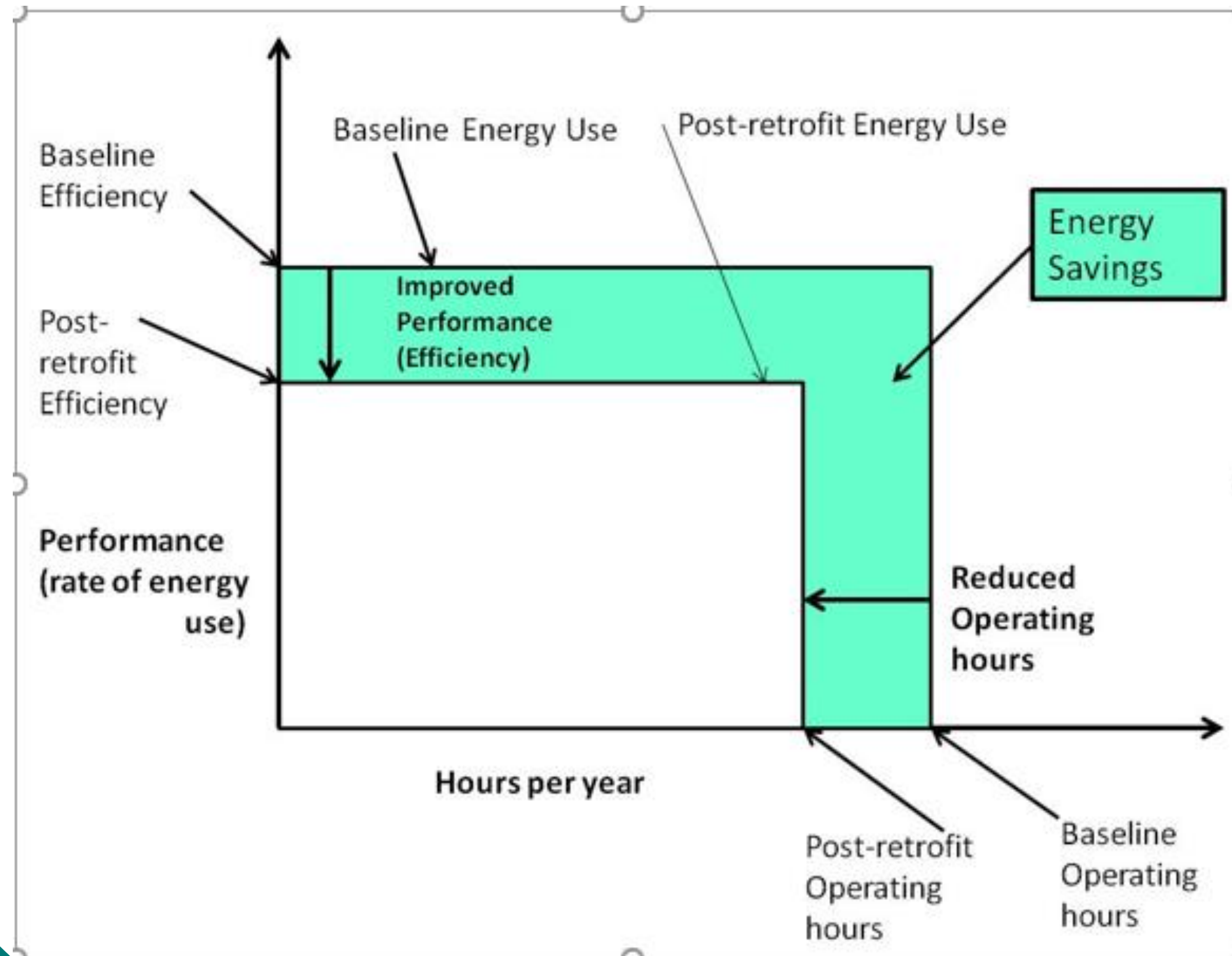


The complete M&V process involves the following six steps:

- Develop an M&V plan
- Verify EEM installation
- Data Gathering
- Compute Savings
- Report Savings
- Review the need to repeat process



FACTORS DRIVING ENERGY SAVINGS



- There are two fundamental factors that drive energy savings:
 - Performance
 - Usage
- Performance describes how much energy is used for a specific task; while usage describes how much time is required for task.



Current status of ESCO

- Currently, **149** ESCOs are empaneled by BEE. The energy efficiency market in India is estimated to be worth INR 150,000 Crore, out of which only 5% potential has been tapped by ESCOs so far.
- ESCOs operates by providing a savings guarantee, risk management in the implementation of the energy efficiency projects and also perform measurement & verification(M&V) activities to quantify actual energy savings post implementation of energy efficiency projects etc.



ESCO CONTRACTS

1

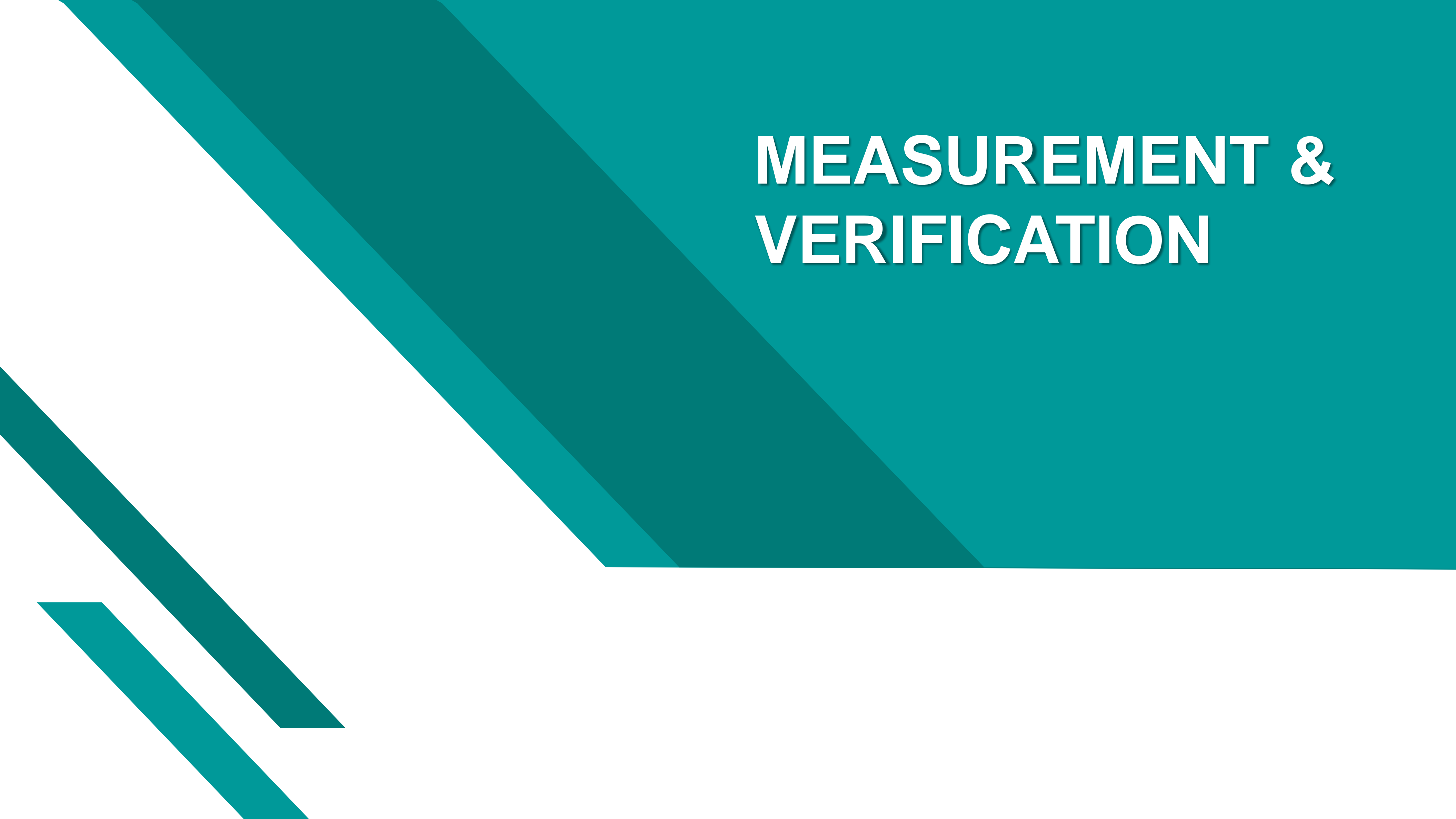
Guaranteed savings model

- The ESCO guarantees a certain savings on the client's energy bill. The ESCO takes on the technical risk. The client obtains a bank loan, or uses their own equity, to pay contractually determined fees to the ESCO and the bank, and keeps the difference.

2

Shared savings model

- The ESCO can provide financing, as well as project development and implementation costs, with the energy savings shared between the ESCO and the client over the contract period.
- This model requires the ESCO to have the capacity to borrow and to have projects with revenue streams that will ensure the loans can be repaid.



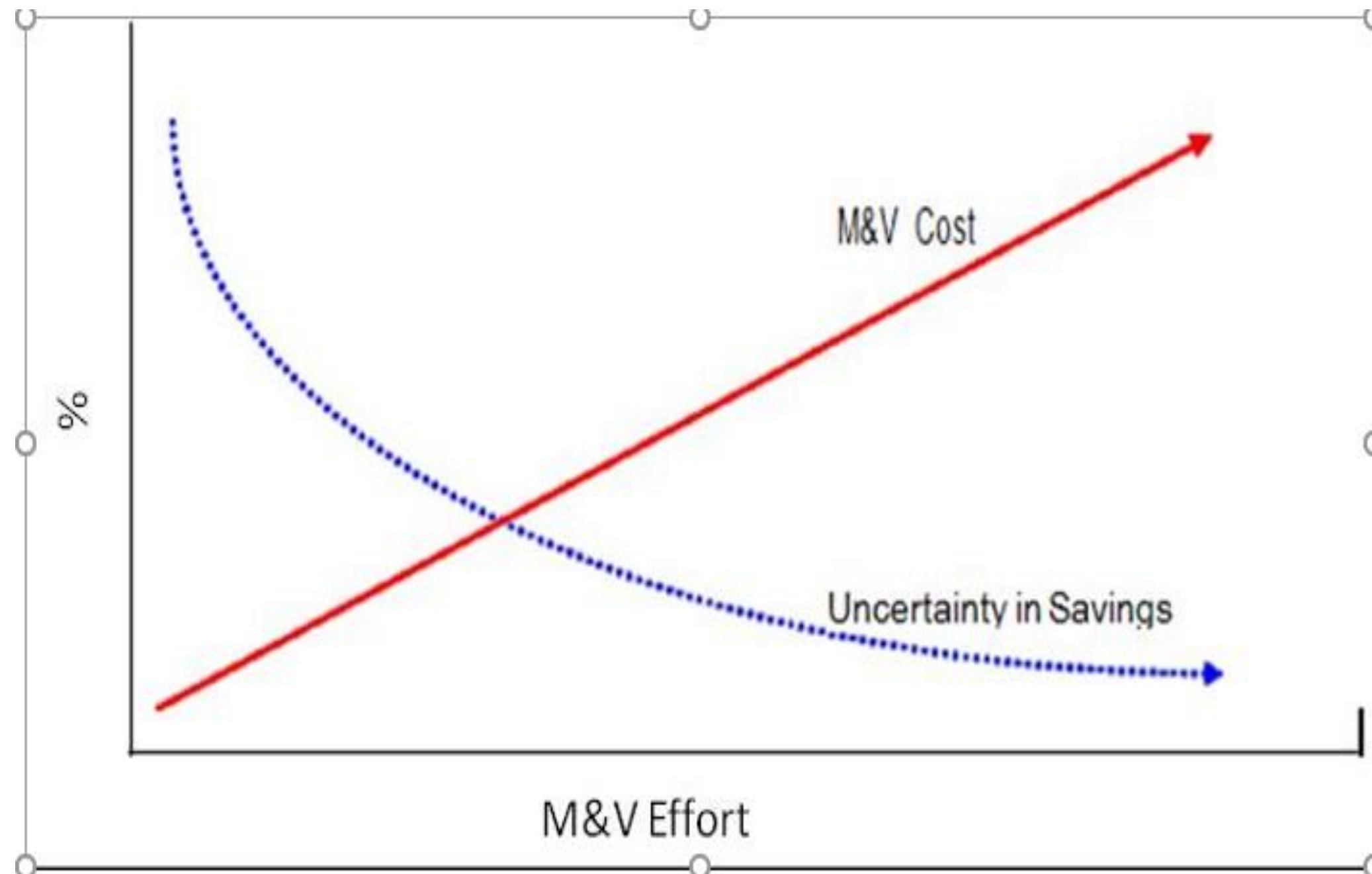
MEASUREMENT & VERIFICATION

OPTIONS OR METHODS FOR CONDUCTING

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Basic Options or Methods for conducting M&V

Option		Important Features	EEM Examples
A	Retrofit Isolation: Key Parameter Measurement	Possible reduction in measurement cost, but introduces some uncertainty in the estimated saving.	<ul style="list-style-type: none">• Simple Lighting retrofits• Motor replacement• Steam trap replacement
B	Retrofit Isolation: All Parameter Measurement	More accurate results due to measurements of all parameters	<ul style="list-style-type: none">• Complex lighting retrofits• Motor Replacement• Variable Speed Drive• Renewable energy generation
C	Whole Facility Analysis	Need baseline as well as reporting period data	<ul style="list-style-type: none">• Whole facility/building retrofits (involving lighting, HVAC and other EEMs)
D	Whole Facility: Calibrated Simulation	When there is no meter in the baseline, baseline data can be 'manufactured' under controlled circumstances (simulation)	<ul style="list-style-type: none">• New Building• Building Envelope improvement• Energy management control system• Variable air volume conversion



- Measurement is one of the basic elements of M&V, however it may include errors.
- Errors are the differences between observed and true energy use.
- Any statement of measured energy savings includes some degree of uncertainty.
- Reductions in uncertainty are obtained by limiting errors in the measurements and analyses conducted.



NOT MEASUREMENT & VERIFICATION

- Measurement and Verification (M&V) is the process of using measurement to reliably determine actual savings created within an individual facility by implementing an energy management program.
- Monitoring is the process of observing energy use for prediction, cost control, diagnostic purposes and even legal compliance and may or may not involve measurement.

- Monitoring and targeting includes the traditional energy monitoring, accounting, analysis and reporting functions.
- M&T ignores non-routine adjustments and interactive effects, whereas M&V considers such effects fully.
- M&V is concerned with measurement of actual energy performance while Monitoring & Targeting is concerned with the gap between actual energy performance.

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