

Introduction to Measurement & Verification in Super ESPCs



Why do you need M&V?

- Savings guarantees are contractually and legally required.
- But guarantees are only as good as the M&V behind them.
- When done right, M&V verifies that guarantees are being met and savings will persist
- M&V helps allocate risk and identify problems.



“What you don’t measure, you can’t manage.”

—Jack Welch, former GE CEO

Basic M&V Concepts

- Goal in designing project M&V is to balance savings assurance against added cost
- Good M&V plans require ESCOs to measure key performance parameters of ECMs
- If M&V plan is weak, guarantee may be met only on paper
- The degree/cost/rigor of M&V should be proportional to:
 - 1) the ECM's savings; and
 - 2) the ECM's performance risk



FEMP M&V Guidelines, v. 3.0

- For federal energy projects specifically
- Application of International Performance Measurement and Verification Protocol (IPMVP)
- Detailed explanations of main M&V options (A, B, C & D)
- Addresses M&V methods by ECM type
- ESCOs must develop and follow the project M&V plan in compliance with these Guidelines.

M&V in the Super ESPC Process

Baselines

- Defined in IGA and Final Proposal

M&V Plan

- Developed as part of Final Proposal

Post-Installation M&V Report

- Verification of ECMs' performance

Annual M&V

- Activities per M&V Plan
- Findings documented in M&V reports

Baselines

- Typically proposed for each ECM by ESCO as part of investment-grade audit — Agency reviews/approves
- Baselines are compared to post-installation energy use to determine savings
- Once project is installed, it's difficult or impossible to revisit baselines, so it's important to get them defined properly and documented
- Baselines, particularly for Options C and D, may be models, not point estimates
 - e.g., gas usage = 2500 MMBtu + 460 × (Heating Degree Days)

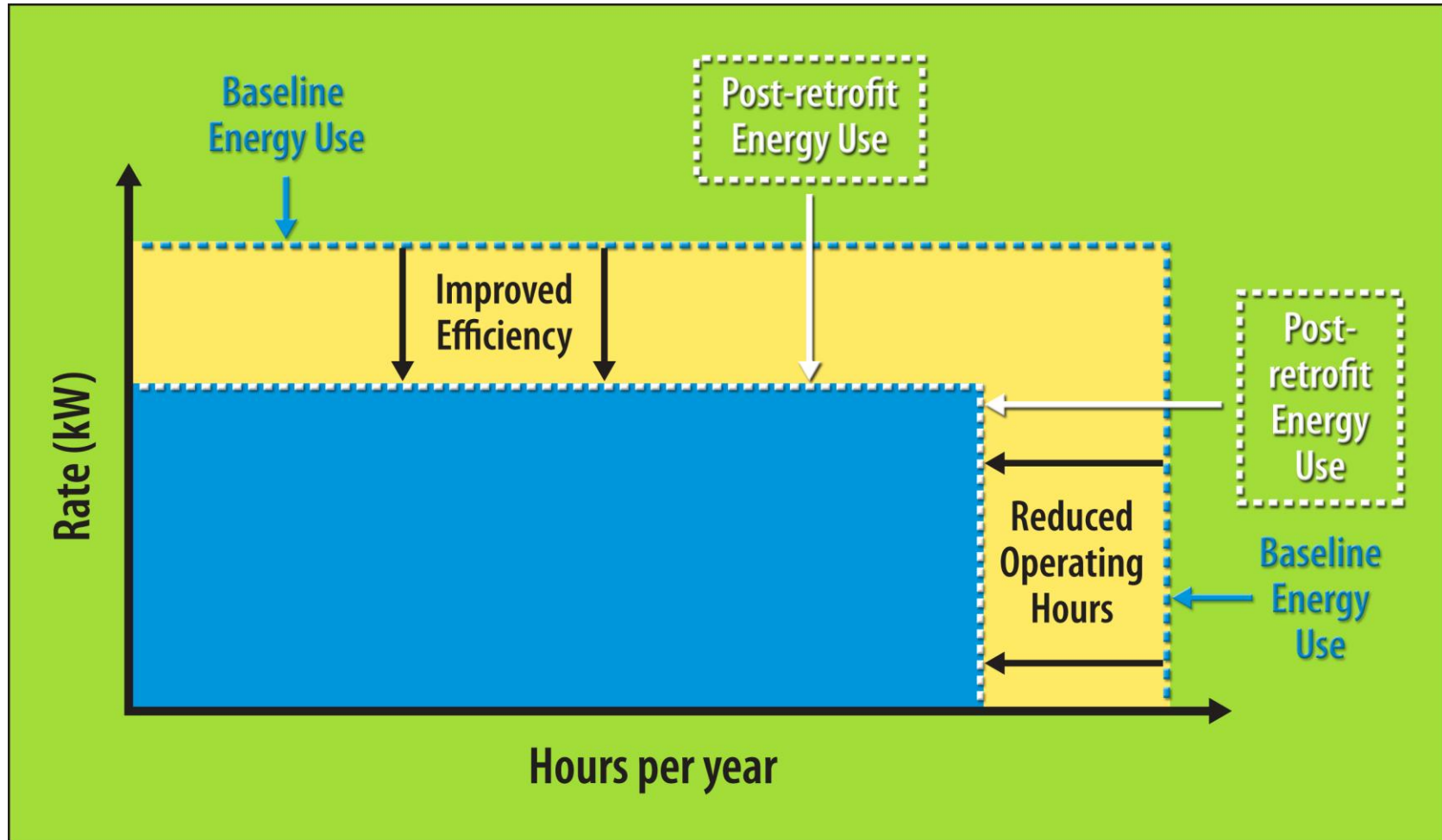
How is the guarantee met?

- Savings must exceed payments
- Savings that may be used to pay the ESCO are categorized as:
 - Energy and water cost savings
 - Energy- (and water-) related cost savings

Calculating Savings

- There are two components to energy use and energy savings:
 - Performance (rate of energy use)
 - Usage (hours of use)
- Energy use is the product of the two
 - Example: kW (rate) \times hours = kWh (total energy)
- Reducing the rate of energy use and/or the number of hours reduces the total energy use

Performance and Usage: Ideal



Savings Uncertainty

- We can't measure savings directly
 - Because it's the absence of something – i.e., it's energy use that's not there any more!
- We measure energy use before and after — the savings are the difference
- We usually don't know the exact energy use before and after
 - there is almost always some uncertainty in each
- And even when we do, we can't know for sure what's responsible for all the change

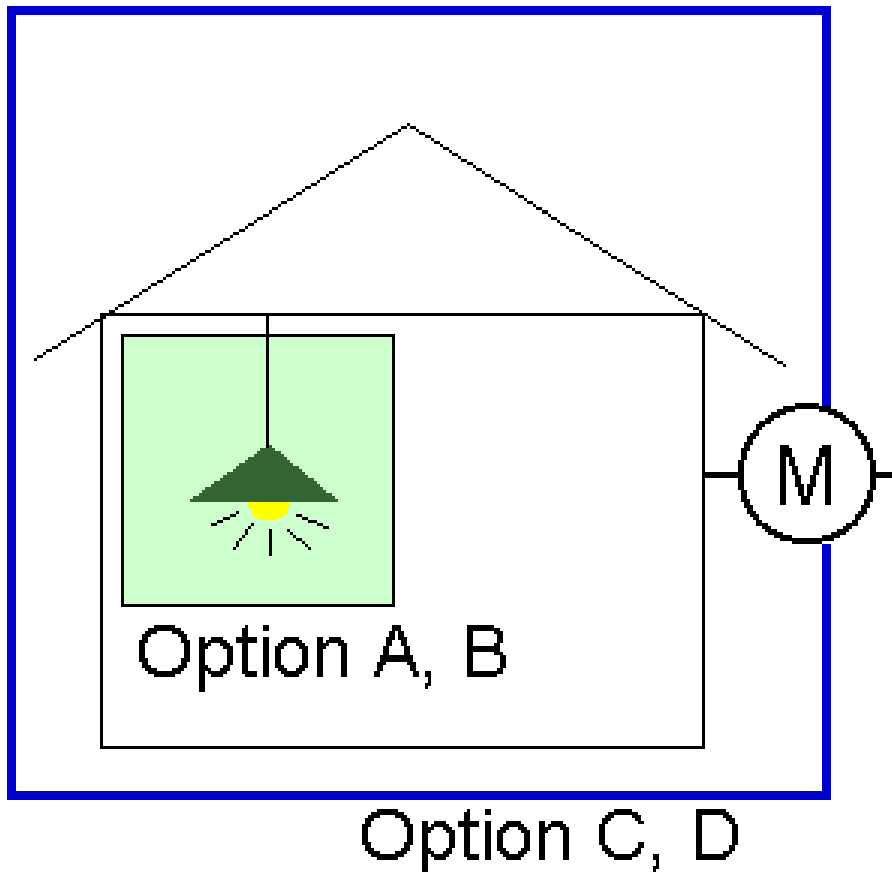
Options A, B, C, and D

- Options address risk allocation
- Each ECM assigned an M&V option
- Measurements differ by:
 - Level – individual system vs. whole building
 - Duration – spot, short-term, periodic, continual
 - Degree of stipulation
 - Expense
 - Up-front – can range from 1 to 15% (avg. 3%) of project investment
 - Annual – averages about 3% of annual savings

FEMP and IPMVP M&V Options

M&V Option	How savings are calculated
Option A: "Retrofit Isolation, Key Parameter" – Based on <i>measured</i> equipment performance, measured or <i>estimated</i> operational factors, and annual verification of " <i>potential to perform.</i> "	Engineering calculations using measured and estimated data
Option B: "Retrofit Isolation, All Parameters" – Based on <i>measurements</i> (usually <i>periodic or continuous</i>) taken of all relevant parameters.	Engineering calculations using measured data
Option C: Based on <i>whole-building</i> or facility-level utility meter data adjusted for weather and/or other factors.	Analysis of utility meter data
Option D: Based on <i>computer simulation</i> of building or process; simulation is calibrated with measured data.	Comparing different models

Options A and B vs. Options C and D



Options A&B are retrofit-isolation methods.

Options C&D are whole-facility methods.

The difference is where the boundary lines are drawn.

