

Charting a Course to Energy Independence

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Measurement & Verification of Energy Savings –
It's easy as ABC (and D)!

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Overview

- Why does M&V get so much attention?
- Why should you do M&V on your energy projects (especially when it costs money)?
- Basic M&V concepts
- The ABCDs of M&V
- Guidance for conducting M&V
- Applications of M&V



Why does M&V get so much attention?

- Savings from EE can only be measured indirectly
 - ☐ because the goal is to measure energy use that's not there anymore – i.e., you're trying to measure something that's gone!
- And lots of other factors affect energy use besides energy projects
 - ☐ EXs: weather, occupancy, operating hours, plug load
- These things make assessing savings difficult, especially over long time periods



Why should you do M&V on your energy projects?

- After all, it costs money
 - ☐ average on DOE Super ESPC projects is 3% of project investment and then 3% of annual savings
- But there are several compelling reasons for doing M&V:
 - 1) because you have to, sometimes
 - E.g., on fed. ESPC projects or to qualify for some utility incentives
 - 2) because even when you don't, it can tell you how well (or not) your projects are performing ... and justify more
 - Makes compelling argument for more funding when convincing results from existing projects can be demonstrated
 - 3) because it helps you keep your contractors honest
 - E.g., on utility energy services contracts (UESCs), where M&V (and savings guarantees) not required, they're still often worthwhile to assure performance
- Some research and many anecdotes demonstrate that savings are much more likely to persist over time when projects have M&V



Basic M&V Concepts

- Goal in designing project's M&V is to balance savings assurance with added cost
- Good M&V plans involve measurement of at least key performance parameter of energy conservation measure (ECM)
 - ☐ E.g., for occupancy sensors controlling lights, hours of operation – before and after installation – should be measured
- The degree of M&V should be proportional to:
 - 1) The amount of savings from the ECM
 - 2) The ECM's performance risk



ABCD – the M&V options

- Option A: Retrofit Isolation, Key Parameter
 - ☐ e.g., for lighting, measure watts before and after change
- Option B: Retrofit Isolation, All Parameters
 - ☐ e.g., for lighting with occupancy sensors, measure both watts as well as on-hours (before and after)
- Option C: Utility Billing Analysis
 - ☐ e.g., for steam decentralization, create regression model of fuel use as function of HDDs; then compare predicted use of old system with new (post-project) fuel use (from gas bill)
- Option D: Calibrated Simulation
 - ☐ e.g., for multiple-ECM project on un-metered building (part of campus or base), model building before and after changes, calibrating with data from meters applied during project



Where can I get M&V guidance?

- *International Performance Measurement and Verification Protocol (4/07)*
 - ☐ This is the Bible of M&V
 - ☐ DOE initially developed; now run by the Efficiency Valuation Organization (EVO), www.evo-world.org
- *M&V Guidelines: Measurement and Verification for Federal Energy Projects, v. 3.0 (4/08)*
 - ☐ This document is an application of IPMVP specifically geared for federal projects, esp. ESPCs
 - ☐ FEMP develops and maintains these guidelines
 - ☐ www.eere.energy.gov/femp/financing/espcs_resources.html
- Association of Energy Engineers
 - ☐ Offer 3-day M&V course and certification (CMVP)



Applications of M&V

- ESPC project – yes, obligatory
- UESC project – optional; some agencies insist on it but some utilities won't provide it (b/c of risk to ratepayers)
- Appropriations-funded projects, e.g.:
 - ☐ Solar PV installation: apply meter and get actual output
 - this allows accurate accounting of renewable energy credits (RECs)
 - ☐ Boiler replacement: measure combustion efficiency of old boiler and then new condensing boilers
 - this allows before/after comparison to fortify savings claims
 - it also identifies combustion problems with the new boilers
- Existing building energy tracking
 - ☐ Correlate energy use with HDD/CDDs and watch trends
 - this M&V can alert you to system problems