Verification of Existing Building Commissioning Project Savings

Presentation to the California Commissioning Collaborative

June 9, 2011
Project Team

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Agenda

• Project Summary
  – Recent Developments
• Feedback on Outreach Plans
Verification of Savings Project

• Develop additional VoS guidelines for existing building commissioning projects

• Pilot demonstrations and case studies

• Refine existing Option B/C guideline

• Develop criteria and guidance on selecting appropriate methods

• Conduct outreach
2008 CCC VoS Guideline

• Based on interval data method:
  – Hourly or daily regressions
  – Applied to whole building or subsystems
  – IPMVP adherence if strictly applied
    • Option B (retrofit isolation)
    • Option C (whole building)

• Downside:
  – Cannot verify individual ECMs, when many ECMs within system or building, only total savings within
Current VoS Project

• Additional methods developed:
  – Engineering calculations & field verification
  – Equipment or system energy measurement
  – Energy models using interval data
  – Calibrated simulation
Method 1

• Engineering Calculations & Field Verification
  – Verifies individual ECM savings
  – Applies to equipment or systems
  – Mirrors industry practice
  – Recommends best practices
  – Describes use of post-installation operational verification in “truing up” savings estimates
  – Not IPMVP adherent
Method 2

• Equipment or System Energy Measurement
  – Verifies individual ECM savings
  – Applies to equipment or systems
  – Methodology framework based on
    • Baseline load and schedule characteristics
      – constant or variable
    • Impact of ECM
    • Post-install load and schedule characteristics
  – IPMVP adherent
Method 3

- Energy Models using Interval data
  - Verifies system or whole building total savings
  - Regression-based methodology
    - ASHRAE RP1050 change-point models
  - Hourly or daily time intervals
  - Improved based on feedback from pilots, previous guideline comments
  - IPMVP adherent
Method 4

• Calibrated Simulation
  – Whole building or systems, depending on software
  – Can identify individual ECM savings
  – Useful when simulation used for ex-ante savings
  – Can be most difficult and expensive method
  – IPMVP adherent
Essential Components of M&V

**Operational Verification**

- **Least Rigorous**
  - One-time visual inspection & review of contractor invoices

- **Most Rigorous**
  - Functional testing of system operations, monitoring and analysis of operational parameters under all expected conditions
  - One time collection and analysis of short term trends of key operational parameters
  - Spot measurements of key operational parameters

**Savings Verification**

- **Least Rigorous**
  - A “sanity check” on the percentage of savings from annual usage totals

- **Most Rigorous**
  - Savings determined from baseline or post-installation model development and projection to the same set of conditions (IPMVP)
  - Peer review of savings calculations and use of collected post-installation data to correct them
  - Comparison of results from an alternate savings calculation
Integrating Savings Verification in EBCx

• EBCx Project Phases
  – Planning
  – Investigation (ex-ante savings estimates)
  – Implementation
  – Hand-off
  – Ongoing Commissioning

• Operational Verification is already a part of EBCx
  – in Hand-Off Phase
Integrating Savings Verification into EBCx

• Each method describes what activities are required in different phases of an EBCx project

• EBCx is a quality assurance process
  – Savings Verification is one more attribute
Pilot Project Summary

• Understand how Interval Data Method can be used in EBCx industry
  – Advantages/Disadvantages

• Engage two EBCx providers to:
  – Implement method on an existing project
  – Obtain feedback to improve Guideline
  – Understand technical issues involved

• Develop Case Studies
  – demonstrate use & results
  – highlight key issues
Method Selection Criteria & Guidance

• Methods vary:
  – Meet different verification goals
    • ECM vs. whole building savings
    • Yield savings uncertainty estimates
    • Check savings persistence
  – Require different resources and impose constraints
    • Have different data and analysis requirements
    • Shorter or longer monitoring requirements
    • Tool availability
    • Expertise
Summary

• Guideline in “book” format with chapters:
  1. Introduction
  2. Integrating Savings Verification into EBCx projects
  3. Method Selection
  4. Method 1: Engineering Calculations with Field Verification
  5. Method 2: Equipment or System Energy Measurements
  7. Method 4: Calibrated Simulation
  8. Appendices

• Near-final drafts of chapters & appendix to Technical Editor
Connections to external research/activities

• Other CCC/CEC projects:
  – EBCx Tools Development
  – EBCx Persistence Improvement

• Other Tools
  – ECAM and Universal Translator for data preparation
  – Private sector tools (QuEMS, Energy Explorer, etc.)
  – LBNL/CEC UT-M&V Tool Module (future)

• Program evaluation requirements/directives from CPUC
  – IPMVP methods

• ASHRAE Research Project 1404
  – Minimum data requirements for energy models
Outreach Goals

• EE-EBCx programs reference guideline
  – For a specific method
  – For any method
  – Add savings verification as a process requirement
• EBCx providers apply methods in projects
• Improve industry understanding of M&V
  – Appropriate data
  – Baseline requirements
  – Methods and algorithms
• EE and Cx industry endorse guideline
Outreach Plan

• Overall Goal
  – Owners & Program Managers have high confidence in EBCx savings & lifetimes
  – Raise realization rates for EBCx programs
    • Programs and evaluators work from same verification standards
Outreach Activities - High Priority

• Post guideline & case studies on CCC website
  – Track downloads

• Conduct utility program-focused workshops
  – ½ to 1 day for program managers
  – Northern CA (SMUD, PG&E)
  – Southern CA (SCE, SoCalGas, SDG&E, LADWP)
  – High-level discussion, not rigorously technical
  – What is needed for program endorsement?
  – What follow-up?
Outreach Activities – High Priority

• Training for service providers
  – Series of web-based meetings
  – On integrating M&V in EBCx & selecting a method
  – On the methods (1 or many webinars)

• Other ideas?
Outreach Activities – Next Priorities

• Present guide to industry groups
  – Obtain endorsement and promotion
  – Efficiency Valuation Organization (IPMVP)
    • NR Canada has agreement for EVO to review & endorse if OK
    – ASHRAE
  – Others?

• Conference presentations
  – e.g. ASHRAE, NCBC, AEE EMC, etc.
Questions? Comments?

Thank you for your participation!