EEAC EM&V Briefing

Ralph Prahl
EEAC Consultant EM&V Team Leader
July 9th, 2013
“EM&V in Massachusetts: Past, Present and Future”

- **Past**
  - Background
  - Review of MA EM&V Framework
  - Current planning process
  - What EM&V has accomplished since 2010

- **Present**
  - Status Report
  - Selected recent results

- **Future**
  - Priorities for the future
  - Changes to planning process
EM&V Past
What is EM&V (Evaluation, Measurement and Verification)?

• Impact Evaluation, yes
  – Measurement of Gross Savings
    • Methods: End-use metering, billing analysis, site visits, engineering re-analysis
  – Measurement of Net Savings or Net-to-Gross Ratio (NTGR)
    • Methods: Survey research, sales data analysis, quasi-experimental design, econometric analysis
• But also…
  – Process Evaluation (studying how a program has been implemented and operated)
  – Market Assessment (trying to understand the markets being targeted)
  – Other: measure cost studies, baseline research, analysis of non-energy benefits, analysis of environmental benefits, etc.
How EM&V is Used in Massachusetts

• Impact evaluation:
  – Refine planning assumptions prospectively, via TRM
  – True-up savings retrospectively, via annual reports
  – Inform program screening and cost-benefit analysis

• Process evaluations
  – Improve program design and delivery

• Market assessment
  – Support program planning and implementation
  – Inform policymaking
• Under 2009 agreement:
  – All studies are statewide
  – Studies are administered by individual PAs, with responsibility systematically distributed across PAs by research area
  – Studies planned and performed collaboratively with EEAC and its consultants
  – If consensus cannot be reached between PAs and EEAC consultants, consultants have decision-making authority
    • Thus far, 100% of decisions made by consensus
• Three statewide research areas, each with assigned PA evaluators, EEAC consultant reps, and a standing contractor team
• EM&V Management Committee (EMC) provides a forum for statewide evaluation issues, and guidance, planning and direction to each evaluation research area
• 3-year budget cap of $70 million
  – Current pace of spending is well below this cap
Evaluators and Programmers: The Feedback Loop

- If evaluation is to result in program improvements, communication between evaluators and programmers is critical at every stage;
- What coordination mechanisms are in place to enhance the feedback loop?
  - EM&V liaisons to RMC and CIMC
  - Inter-team work groups (recent example: Existing Buildings Working Group)
  - Program staff participation in EM&V planning meetings
  - Informal communication between teams within organizations
  - Some individuals play joint roles (E.G., Jennifer Chiodo, EEAC C&I program and EM&V consultant)
- We are always looking for improvements
EM&V Planning Process To Date

• (Very) high-level EM&V plan and budget cap are submitted as part of each 3-year plan
• Majority of individual studies developed each year in the Spring and fleshed out over the next several months.
  – Supplemented by additional studies developed throughout the year as needs arise.
• Typical study:
  – Enters the implementation stage in July-September
  – Lasts 8-12 months
Current EM&V Planning Process: Assessment

• Current planning process is:
  – Largely annual, somewhat fragmented and ad hoc
  – Driven in part by need to complete impacts evaluations in time for application to the annual reports
  – Shaped by resource constraints
    • Pressure on EM&V from sharp ramp-up in programs and budgets
    • Shortage of project managers
    • Getting needed studies done has been prioritized over systematizing the planning process
• As discussed further later, we are in the process of overhauling the planning process
What Value Has EM&V Added Since 2010?

- Substantial increases in the reliability of savings claims
  - Programs and end-uses that showed performance problems at first have largely stabilized
  - Reliable savings claims lead to effective allocation of resources and improved programs
  - We know the resource is really there!
- Innovative program approaches have been confirmed as effective, allowing the Commonwealth to increase reliance on them
- Industry-leading research into NEBs has led to more comprehensive accounting of program benefits
  - Has allowed PAs to field wider range of measures
- Impact evaluations have shown differences in the effectiveness of different program models
  - Example: behavioral
What Program Changes Have Been Made as a Result of EM&V? Residential

- Low NTG results found in 2010 HEHE impact evaluation led to removal of lower efficiency measures and addition of high efficiency ones.
  - New HEHE impact evaluation finds NTGs have increased
- Pilot studies of heat pump water heaters and WiFi thermostats led to the addition of these measures to programs
- Pilot study of solar water heating led to decision not to pursue
- 2010 process evaluation of HES stimulated the pre-WX initiative
- Process evaluations uncovered hurdles to statewide standardization that have now been addressed
  - Implementation procedures, measure definitions, input assumptions, modeling calibration, cost estimates, calculation approaches…
- Residential lighting market assessment activities influenced evolution of program strategy
  - Introduction and positioning of LED incentives
What Program Changes Have Been Made as a Result of EM&V?
Non-Residential

• Many improvements to engineering estimation methods and processes in response to impact findings
  – These have improved the reliability of the resource
• Improvements to gas/electric integration
• Restructuring of account management and customer segmentation
EM&V Present

(Status Report and Selected Recent Results)
Status Report:
Summary of Studies in Progress

- Some 40 studies have been underway in 2013
- Wide range of studies:
  - Gross savings Impact evaluations
  - Net savings impact evaluations
  - Process evaluations
  - Market assessments
  - Baseline research
- Some 25 of the ongoing studies have recently been finalized, in time for inclusion in the 2012 Annual Reports
- Recently completed studies listed in appendix to presentation
- Remaining studies to be finalized over next 3-4 months
- A new round of studies will start in 2nd half of 2013
- The following selected study results draw on recently completed studies, as well as interim results from those still in-progress
- All studies to be posted on EEAC web-site once finalized
New Impact Evaluation Results: The View from 30,000 Feet

• At overall portfolio level, effect of new impact results should be to increase savings somewhat
• However, much variation across programs, measures, end-uses and PAs
• A few problem areas
  – Demand savings tend to be forecasted less accurately than energy savings
  – New results for HEHE are likely to adversely affect program cost-effectiveness
  – Some individual measure categories continue to be difficult to forecast
  – Some PAs have a tougher row to hoe than others
  – Due to differences in planning assumptions across program years, in a few cases, savings are increased for PY2013, but decreased for PY2012
Non-Residential Evaluation Results
So far, this large, innovative new program is holding up well under EM&V scrutiny
  – LEDs which dominate savings, show a NTG of 82%
  – Interim gross impact evaluation results suggest that gross savings are probably being forecasted accurately
  – Customers and trade allies generally satisfied
Large C&I Electric Impact Results:
Energy Savings Forecasts Accurate Where It Counts Most
But Demand Savings Remain Harder to Forecast

Gross Savings Realization Rates From Several New Studies

<table>
<thead>
<tr>
<th>Product Category</th>
<th>kWh RR</th>
<th>On-Peak Summer kW RR</th>
<th>Relative Magnitude of Forecasted Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescriptive Lighting Systems</td>
<td>112%</td>
<td>92%</td>
<td>Large</td>
</tr>
<tr>
<td>Prescriptive Lighting Controls</td>
<td>72%</td>
<td>24%</td>
<td>Moderate</td>
</tr>
<tr>
<td>Prescriptive VSDs</td>
<td>94%</td>
<td>229%</td>
<td>Moderate</td>
</tr>
<tr>
<td>Custom Refrigeration</td>
<td>111%</td>
<td>121%</td>
<td>Moderate</td>
</tr>
<tr>
<td>Custom Motors</td>
<td>91%</td>
<td>90%</td>
<td>Small</td>
</tr>
<tr>
<td>Custom “Other”</td>
<td>61%</td>
<td>63%</td>
<td>Small</td>
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Studies in 2011 and 2012 found accuracy of C&I gas savings forecasts to be a problem area, but two new studies show results appear to be stabilizing.

Custom gas measures:
- Statewide studies done in 2011 and 2012
- In 2013, new study done only for NSTAR, as desk review found no reason to expect changes for other PAs
- NSTAR realization rate improved from 68% to 82%

Prescriptive gas measures:
- New statewide study
- Overall, evaluated savings are 102% of forecasted savings
- But much variation across measures
  - Furnaces: 160%
  - Infrared heating: 20%
C&I Customer Profile Study: Untapped Potential Among Smaller Customers?

Electric Participation Rates and Total % Savings by Account Size

<table>
<thead>
<tr>
<th>Usage Size Category</th>
<th>Number of Participants</th>
<th>GWh Savings</th>
<th>Overall % Participating</th>
<th>Total % Savings Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;75 KW</td>
<td>5,042</td>
<td>81.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75-300 KW</td>
<td>1,089</td>
<td>65.4</td>
<td></td>
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<tr>
<td>300-750 KW</td>
<td>519</td>
<td>61.3</td>
<td></td>
<td></td>
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<tr>
<td>750-1000 KW</td>
<td>82</td>
<td>15.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000-5000 KW</td>
<td>248</td>
<td>89.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;5000 KW</td>
<td>41</td>
<td>152.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>7,021</td>
<td>466</td>
<td>52.6%</td>
<td>12.2%</td>
</tr>
</tbody>
</table>
Mid-Sized C&I Customer Study (Interim Report)

- Addresses whether there is a need for new services targeted specifically to customers who are:
  - Too large to qualify for DI program
  - Too small to have an account rep

- Interim Results
  - Strong relationship between size and participation rate holds when accounts are aggregated to customers
  - Challenging to come up with consistent statewide criteria for what constitutes a mid-sized customer
    - Many differences across PAs in how C&I customers are segmented, and whether and how account reps are assigned
    - Within PAs, decisions as to whether to assign account rep tend to be complex
    - Even when this complexity taken into account, inconsistencies between reported approaches and analyses of customer databases
  - No consensus among PA and implementer interviewees as to whether mid-sized customers are being optimally served
Residential Evaluation Results
Results of this NTG/market study raise significant programming and policy issues

Study featured:
- Surveys and interviews with customers, contractors and distributors (participating and non-participating)
- Collection of sales data where possible
- Comparisons of overall market conditions in MA and PA

Reshaped in mid-stream to also help resolve developing uncertainties regarding NEBs from HEHE

Results:
- Substantial portion of net program effects consists of program-induced fuel switching from oil to gas
- NTGs are up somewhat from last study, reflecting updating of qualifying criteria and incentive structure
- Some categories of NEBs found to have been significantly overstated for HEHE
- Some qualitative evidence of significant out-of-program market effects
HEHE Study:
Gas Boiler Sales Data
“Point” to Net Program Impacts

Sales of Residential Gas Boilers in Massachusetts

- Boiler Share < 90% AFUE
- Boiler Share 90% to 96% AFUE
- Boiler Share >= 96% AFUE
- Boiler Rebate 85% to 90% AFUE
- Boiler Rebate >= 96% AFUE

Graph showing sales trends from 2007 to 2012 with prices and sales data points.
• Ultimate effect of findings will be to increase savings modestly, but sharply decrease NEBs

• **Sharp reduction in NEBs, combined with decreases in avoided gas costs, raises uncertainties about continued cost-effectiveness that will need to be explored in coming months**

• Significant role of oil-to-gas fuel switching in net program effects found in the evaluation raises policy issues
  – General directive not to use EE programs to promote fuel switching -- yet fuel switching yields societal benefits
HES Impact Evaluation Follow-On Study

• Targeted impact evaluation of two Home Energy Services (HES) program measures: insulation and air sealing
• Follow-up on 2012 impact evaluation was needed to:
  – Accommodate changes in audit tool software
  – Develop PA-specific realization rates to reflect differences in software across contractors
• Larger savings and higher realization rates than found in 2012 study
  – Commonwealth-wide realization rate of 76% as compared to the 61%
  – Average savings per participating home using natural gas for heat rose to 139 therms versus 92 therms
    • Due in part to increased adoption of recommended measures by newer study participants.
• Identified differences in savings from Lead Vendors and Home Performance contractors that need to be further explored
Comprehensive Evaluation of Behavioral Programs

• **OPower programs**
  – Constitute the vast majority of tracked behavioral savings
  – Generally saving energy as forecasted
    • Evaluated savings cluster around 100% of OPower forecasts
  – Savings tend to increase after 1-2 years of messaging

• **CLC SHEMP pilot**
  – Two phases of pilot produced very different results
  – Phase 1: 8-9% savings, even years after initial participation
  – Phase 2: 1.5-2% savings

• **Western Mass Saves**
  – Those receiving home energy reports save 1%
  – Those activating portal save another 1-2% - less than expected

• **Are any approaches other than OPower ready for prime time?**
Residential Lighting: The Case of the CFL Saturation Plateau

CFL and LED Socket Saturation 2003 through 2013
Despite extensive program effort and expenditure, saturation of efficient lighting in homes increased only 4% from 2009 to 2013.

Does this mean the program is having little if any effect?

- **NO.** EM&V evidence suggests that:
  - Program continues to cause significant adoption.
  - However, at this point many program-induced bulbs are replacing burnt-out CFLs instead of incandescents.
  - In the absence of the program, many of these burnt-out CFLs would have reverted to incandescents.

Nonetheless, saturation plateau suggests that there remains significant untapped savings potential in this market.

Little if any indication that EISA is about to capture this potential.

New program approaches are needed.
Umbrella Marketing: More Progress in Non-Res Than Res?

Residential and C&I Unaided Mass Save Awareness Over Time

Have you ever seen or heard the term "Mass Save"?

- Residential
  - February 2012: 39%
  - Aug/Sept 2012: 41%
  - March 2013: 47%

- C&I
  - February 2012: 33%
  - Aug/Sept 2012: 40%
  - March 2013: 38%
EM&V Future

(Priorities for the future; changes to planning process)
Priorities for the Future

• Continue to build market assessment component of EM&V program
• Develop top-down NTG research program
  – “Top-down” means econometric analyses aimed at finding evidence of global program effects in the overall consumption patterns of MA end-users.
• Continue moving toward market-based NTG methods where possible
  – “Market-based” means studying the entire market, not just participants
• Strengthen and systematize the collection of sales data
EM&V Planning Process: In-Progress Changes

• As noted earlier, current planning process needs to be improved
  – Longer-term planning horizon
  – More strategic
  – More integrated
• Established EMC subcommittee for this purpose
• Key reality is that resource limitations impose tradeoffs between improvements to planning process and continued timeliness of EM&V results
  – Since 2010, sharp increases in scope and scale of programming have placed EM&V in continual catch-up mode
  – Time spent doing long-term planning is time not spent fielding studies
  – Sharp, sudden transition in planning process is likely to delay needed studies
• Therefore, subcommittee has developed action plan to guide transition
Refinements to EM&V Planning Process: Components of Action Plan

• Immediate:
  – Improve communication of evaluation plans and results to stakeholders

• July-August: combine results of EM&V planning summit meetings held in February and May into an integrated plan for studies to be done over next 12-18 months

• 2013 Q3:
  – Systematize budgeting criteria
  – Systematize criteria for how often various types of studies are done
  – Codify planning process and communicate to stakeholders

• 2013 Q4: Strategic plan to guide efforts for remainder of 2013-2015 period
PA Response
Thanks!

Ralph Prahl
EEAC Consultant Team Lead for EM&V
Ralph.Prahl@gmail.com
(608) 238-9942
Appendix: Recently Completed Studies

IMPACT EVALUATIONS

• **Non-Residential**
  – Upstream Lighting Impact and Process Evaluation
  – Large C&I Prescriptive Lighting Impact Evaluation
  – Large C&I Prescriptive VSD Impact Evaluation
  – Large C&I Custom Refrigeration and Motors Impact Evaluation
  – Large C&I Custom Gas Impact Evaluation
  – Large C&I Prescriptive Gas Impact Evaluation
  – Small Business Direct Install Summary Impact Evaluation

• **Residential**
  – HEHE/Coolsmart NTG/Market Study
  – HES Impact Evaluation Follow-On Study

• **Cross-Cutting**
  – Comprehensive Evaluation of Behavioral Programs

NON-IMPACT STUDIES

• **Residential**
  – Lighting:
    • On-site lighting saturation study
    • Study on early effects of EISA
    • Lighting supplier interview report
    • Lighting Retailer Shelf-Stocking Study
    • Consumer survey report
  – RNC incremental cost study
  – Pre-Weatherization Pilot Evaluation
  – Lighting Controls Pilot Evaluation

• **Non-Residential**
  – Customer Profile Study
  – Mid-Sized Customer Needs Study (Interim Report)
  – Boiler Baseline Research Interim Report

• **Cross-Cutting**
  – Marketing Pre-Campaign Snapshot
  – Marketing Campaign Evaluation