

→ CONSULTANT TEAM

EEAC EM&V RESULTS WEBINAR: RESIDENTIAL

June 1, 2015

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ORGANIZATION OF PRESENTATION

Refresher

- What is EM&V?
- How is EM&V used in Massachusetts?
- How is EM&V organized in Massachusetts?

Summary of current status

Discussion of Recent Residential EM&V Results

- Residential Products
- Residential Retrofit
- Residential Aspects of Cross-Cutting Studies

REFRESHER: KEEP IN MIND THAT EM&V IS A BIG TENT

- Many different kinds of studies
- Many different stakeholders
- Many different applications for the results
- Different stakeholders tend to be interested in different studies, and different results from the same studies

WHAT'S UNDER THE BIG TENT: TYPES OF EM&V STUDIES

Type of Study	Methods	How Applied	
Impact evaluation (gross)	End-use metering, billing analysis, site visits, engineering re-analysis	•Refine planning assumptions prospectively, via TRM	
		•True up savings retrospectively, via annual reports	
		 Inform program screening and cost-benefit analysis 	
Impact evaluation (net to gross)	Survey research, sales data analysis, quasi-experimental design, econometric analysis	•Same as above, but only applied prospectively	
Market assessment	Surveys, interviews, focus groups, secondary research	•Support program planning and implementation •Inform policymaking	
Process Evaluation	Surveys, interviews, focus groups, database review	•Improve program design and delivery	
Data-Mining	Detailed analysis of tracking, billing and other databases	Inform policymakingImprove program design and delivery	
Other (Measure cost, baseline, persistence, NEBs, etc.)	Various	Various	

REFRESHER: MA EM&V FRAMEWORK

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

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SUMMARY OF CURRENT STATUS

- Strategic Evaluation Plan (SEP) submitted to Council in Fall of 2013 laid out some 45-50 studies to be performed over following two years
- The majority of the studies described in SEP have now been completed
 - First quarter of 2015 was a particularly heavy reporting period
 - As a result we have many new results to share, spanning most of the study types
- Some of the studies in SEP remain in progress, and additional ones have been added over last year
 - As a result, overall EM&V study portfolio remains in a roughly steady state

RECENT RESIDENTIAL EM&V RESULTS COVERED TODAY

Residential Products

- Lighting Market Assessment and Attribution Research
- LED Market Effects Baseline Study
- Other Residential Lighting Studies
- Tube TV Program Recycling Assessment

Residential Retrofit

- Multifamily Process Evaluation
- HES Program Delivery and HEAT Loan Study
- HEHE Gross Savings Impact Evaluation
- Furnace Baseline Issue

Residential Aspects of Cross-Cutting Studies

- Umbrella Marketing Tracking Study
- Top-Down NTG Work
- Behavioral Evaluations

PROVISOS

We can only scratch the surface today

- Not all recent reports discussed
- Only highlights from each study discussed
- Most of reports discussed have been finalized and posted, but a few are still in draft form



RECENT RESULTS: RESIDENTIAL PRODUCTS

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RESIDENTIAL LIGHTING MARKET ASSESSMENT AND ATTRIBUTION RESEARCH

Major EM&V effort in this area

- Drivers: major contribution of lighting to residential savings, rapid change in market, substantial uncertainties about future
- Recent research activities:
 - Interviews with manufacturers and retailers
 - On-site visits to homes in MA and 3 comparison states (KS, GA, NY)
 - Saturation, in-person interviews, recent purchases
 - Panel component in which some MA homes visited repeatedly over years
 - Econometric modeling:
 - Study relating efficient lighting sales across 44 states to level of program activity
 - Study relating intra-year changes in MA efficient lighting sales to changes in incentive levels

RESIDENTIAL LIGHTING: KEY FINDINGS, 30,000 FOOT VIEW

As of now the program is continuing to have strong positive effects on the market

- We are highly confident of this conclusion
- Conclusion is true despite commercialization of LEDs and the progress of federal standards (EISA)
- Savings claimed in 2013-2015 are reliable

The real uncertainty lies in the future

- Delta watts falling due to more halogens and CFLs being replaced
- Net-to-gross ratios for LEDs also forecasted to decline in 2016-2018 as LED prices continue to fall
- Close to half of sockets now occupied by efficient bulbs
- Market trends suggest that balancing promotion of CFLs vs LEDs will be challenging

RESIDENTIAL LIGHTING: LONG-TERM SATURATION TRENDS IN MA



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RESIDENTIAL LIGHTING: A NATURAL EXPERIMENT DEMONSTRATING STRONG PROGRAM EFFECTS

- **•** Throughout 2000s, MA and NY both intervened heavily in residential lighting markets.
- ▶ In 2012, NY largely suspended lighting programs, while MA redoubled its efforts
- Here's what happened to lighting saturation in the two states



RESIDENTIAL LIGHTING: EM&V'S ESTIMATES OF FUTURE NET TO GROSS RATIOS (2016-2018)

	2016	2017	2018
Non-HTR Standard CFLs	54%	53%	53%
HTR Standard CFLs	93%	92%	91%
Non-HTR LEDs	90%	80%	70%
HTR LEDs	100%	99%	98%
All LEDs (if HTR and Non-HTR not Differentiated)	90%	80%	70%
CFL Fixtures	96%	96%	96%
LED Fixtures	98%	93%	89%

RESIDENTIAL LIGHTING: SUMMARY OF OTHER CHANGES TO IMPACT PARAMETERS

- Updating of model estimating delta watts (demand reduction for each bulb) results in reductions on average
 - Increasing frequency of CFLs replacing halogens
 - Increasing frequency of LEDs replacing CFLs instead of incandescents
 - Progress of EISA
- Updating of HVAC interaction factor increases unit savings for electric, at the cost of an MMBTU penalty for heating
- Newly completed study estimating % of retail program sales going to C&I end-users will increase first-year savings
 - C&I has longer operating hours (and thus shorter measure life)
- In-Progress Study of LED incremental costs forecasts continuing reductions throughout 2016-2018 period
 - Increases net benefits but drives falling NTGRs
- On balance, EM&V expects upstream residential lighting savings to get somewhat more expensive to achieve

TUBE TV RECYCLING ASSESSMENT: RESEARCH OBJECTIVES & METHODS

Objective was to assess potential for a tube TV recycling program

 Program gets old tube TVs off the grid by picking them up for free, perhaps offering an incentive

Study made use of 150 on-site visits to homes

- Count and describe all TVs found in home
- Characterize type, size, age, usage patterns
- Inquire about occupant interest in program
- In order to contain costs, task was tacked on to on-site visit for residential lighting saturation study

TUBE TV RECYCLING ASSESSMENT: KEY FINDINGS

There is little potential for such a program

- While 20% of TVs in Massachusetts homes are tube TVs, they tend to be:
 - Secondary, and thus lightly used
 - Small
 - Being naturally replaced by users



RECENT RESULTS: RESIDENTIAL RETROFIT

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MULTIFAMILY PROCESS EVALUATION: RESEARCH OBJECTIVES & METHODS

Research Objectives

- Assess progress toward integration
- Examine barriers to participation, effectiveness of program operations, and customer experience

Methods

- Interviews—PAs and Implementers (16); Condo Reps (8);
 Owners/Managers (30); C&I Contractors (10); MF Program Experts (8)
- Focus Groups--Owners/Managers (27); Tenants (10)
- Survey of Owners/Managers (103)
- Assessment of Foregone Opportunities--Site Visits (20)
- Review Tracking System

MULTIFAMILY PROCESS EVALUATION: KEY FINDINGS AND RECOMMENDATIONS

Key Findings

- Multifamily Market Integrator has helped in initiating projects, however,
- Projects still must coordinate across res and C&I programs and fuels if multiple PAs
- Opportunities are foregone because assessment process is often focused on single-sector and/or lacks comprehensiveness
- The inability to easily identify and link all billing accounts associated with a multifamily property hampers coordination

Recommendations

- Create a single point of contact
- Improve tracking systems—unique premise ID for each property that can work across C&I/Residential and fuels.
- Ensure consistent energy assessment process

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HES PROGRAM DELIVERY AND HEAT LOAN STUDY: RESEARCH OBJECTIVES & METHODS

Research Objectives

- Determine the relative strengths and weaknesses of the HES
- Assess effectiveness of current overlap in the HES, HEHE and COOL SMART programs and HEAT Loan.

Methods

- Key Performance Indicator Analysis
- In-depth Interview—PAs (9); LV (5); HPCs (25); HEHE/CS Contractors (27); HEAT Loan Lenders (11)
- On-line HEAT Loan Lenders (51)
- Customer Surveys—Participants (965); Non-Part. (201)

HES PROGRAM DELIVERY AND HEAT LOAN STUDY: DRAFT REPORT KEY FINDINGS

- Program did more than 225,000 audits in July 2011-June 2014 period
- 64% of audited homes do not install any major measure
 - Only 1 in 5 homes does air sealing, even though it's free
 - HPCs and LVs getting similar install rates
 - However, HPCs recommend more often, but close less than LVs do.
- 5.3% of homes cross-participate with HEHE or CoolSmart



THE RELATIVE IMPORTANCE OF THE HEAT LOAN

Heat Loan pushes Heat Loan participants to do more—

- 81% of loan takers said the loan enabled them to make improvements they would not otherwise have made
- 85% of loan takers said it enabled them to install more of the recommended measures
- Heat loan participants installed 70% of recommended insulation measures, others only 44%
- Most contractors say Heat Loan very important to business and pushes customers to do more and choose higher efficiency
- Those taking loan rated Heat Loan 50% more important than incentive, and 300% more important than energy specialists.
 - However, only 9% of HES participants took loans, only 6% of HES participants rated HEAT Loan as most important factor.
 - 14% were unaware that they existed
 - 77% knew of loans and did not use them.
 - Heat loan is tool in toolbox, but is not something that should replace incentives and energy specialist.

HEHE GROSS SAVINGS IMPACT EVALUATION: RESEARCH OBJECTIVES & METHODS

Research Objectives

- How much energy is being saved for the average installation of efficient space heating equipment through the Massachusetts HEHE program?
- What is *in situ* efficiency of standard furnaces and boilers?
- How are condensing boilers being installed and controlled?

Methods

- Spot measurement of baseline and new equipment in situ efficiency
- Long-term metering of post-retrofit high efficiency equipment

HEHE GROSS SAVINGS IMPACT EVALUATION: KEY FINDINGS

Savings for Replace on Failure (ROF) Furnaces half 2013 TRM

- Collaborative agreed in 2015 to change baseline from 80% to 85%
- Consumption less than assumed—furnaces are smaller than assumed

Savings for ROF Boilers about 10% higher than 2013 TRM

- Boilers larger than assumed and thus consumption higher, but
- Efficiencies 5 to 6 percentages points lower because return water temperatures too high to achieving condensing

Recommendations

 The PAs should consider ways to improve boiler operating efficiency through quality installation

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RECENT RESULTS: RESIDENTIAL ASPECTS OF CROSS-CUTTING STUDIES

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TOP-DOWN NET-TO-GROSS (NTG) STUDY: BACKGROUND

- A typical NTG study uses *bottom-up* methods: detailed research to assess whether individual measures were induced by individual programs
- Top-down methods estimate global savings by correlating trends in consumption with trends in overall program activity across geographic regions
- Top-down research uses sophisticated econometric methods and is still largely experimental
 - Only a handful of studies nationally
- Top-down and bottom-up NTG research are intended to complement each other, not compete
 - Top-down can capture long-term effects and synergies between programs
 - Bottom-up can tell us what is and isn't working and why

TOP-DOWN NET-TO-GROSS (NTG) STUDY: METHODS

Study focused on electric

Covered both Residential and C&I; only residential results discussed in this webinar

Two approaches were used

- PA-Municipal Approach capitalized on differences in program activity between PA and Municipal territories within MA
- PA Data Approach capitalized on differences in program activity between different towns/counties within PA service territories
- For each approach:
 - Key researchable question: are geographic differences in program activity reflected in overall consumption trends?
 - Wide range of data sources marshalled to control statistically for nonprogrammatic differences across regions
- PA Data approach encountered data limitations
- Remainder of presentation thus focuses on PA-Municipal Approach

PA-MUNICIPAL NTG APPROACH: A VISUAL ILLUSTRATION

RESIDENTIAL ELECTRIC CONSUMPTION TRENDS IN PA VS MUNICIPAL TERRITORIES (KWH PER CAPITA, UNADJUSTED)



TOP-DOWN NTG STUDY: RESIDENTIAL RESULTS FROM PA-MUNICIPAL APPROACH

- Single best model yields an estimated realization rate of 187%
- Realization rate = ratio of top-down net savings estimate to cumulative bottom-up net savings estimate over 10 years

However, this estimate is quite uncertain

- Wide confidence interval
- Sensitive to model specification, although results look good for most models

So what does this all mean?

- Are we confident that net savings are 87% higher than previously thought? NO.
- However, finding constitutes meaningful evidence that long-term net savings may have been higher than thought
- This could be due to market effects or spillover
- Top-down NTG work is an important addition to methodological tool-chest

UMBRELLA MARKETING TRACKING STUDY: RESEARCH OBJECTIVES AND METHODS

- Since 2012, EM&V has performed regular waves of market research studies to assess progress of umbrella marketing efforts
- Specific objectives and methods have varied with each wave, but studies have consistently assessed end-user:
 - Brand awareness
 - Exposure to marketing messages
 - Depth of program knowledge
 - Attitudes
- Most recent wave completed in January 2015 focused on surveys of residential and non-residential end-users

UMBRELLA MARKETING TRACKING STUDY: KEY FINDINGS

Residential awareness of MassSave brand appears to have surged in 2014 after several years of stagnation

- Also increases in:
 - Self-reported exposure to marketing messages
 - Depth of knowledge of program offerings

However, awareness of MassSave website unchanged

UMBRELLA MARKETING TRACKING STUDY: RESIDENTIAL AWARENESS OF MASS SAVE OVER TIME



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BEHAVIORAL PROGRAMS: ROUND-UP OF RECENT EM&V FINDINGS

Opower savings are reliable and are little changed overall

- Comprehensive impact and process evaluation in process; initial impact analysis completed
- Many behavioral programming options are available beyond Opower
 - Draft report reviews cutting edges being used around the country

A CHALLENGE: NGRID'S RESIDENTIAL ELECTRIC EM&V BUDGET

- NGRID has experienced continuing strong demand for residential electric programs in 2015
- One of its responses has been to convert all remaining uncommitted 2013-2015 EM&V funds in this sector to program funds
 - "Uncommitted" means there is not a detailed plan for a specific study
- Result is that it will be difficult to initiate any new studies in remainder of 2015 that draw on Residential electric funds
 - NGRID accounts for roughly half of statewide EM&V funding
 - Budget crunch does not extend to Gas or to C&I, but rules make budget transfers difficult
 - We have been working with PAs on implications and potential solutions but few of the latter identified yet

In the absence of solutions, we expect a significant gap in the availability of Residential electric EM&V results in 2016

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APPENDIX: LINKS TO FINALIZED REPORTS DISCUSSED TODAY

Report	Link(s)
Lighting Market Assessment and Attribution Research	http://ma-eeac.org/studies/ (Multiple links; look under Residential/2015, top of section)
LED Market Effects Baseline Study	http://ma-eeac.org/wordpress/wp-content/uploads/LED-Market-Effects- Baseline-Characterization-Final-Draft.pdf
Other Residential Lighting Studies	http://ma-eeac.org/wordpress/wp-content/uploads/Residential-Lighting- Cross-Sector-Sales-Research-Memo.pdf
Tube TV Program Recycling Assessment	http://ma-eeac.org/wordpress/wp-content/uploads/Tube-TV-Recycling- Program-Assessment-Memo.pdf
HEHE Gross Savings Impact Evaluation	<u>http://ma-eeac.org/wordpress/wp-content/uploads/High-Efficiency-</u> <u>Heating-Equipment-Impact-Evaluation-Final-Report.pdf</u>
Multifamily Process Evaluation	http://ma-eeac.org/wordpress/wp-content/uploads/Mass-Save- Mutlifamily-Program-Process-Evaluation-Report.pdf
Umbrella Marketing Tracking Study	http://ma-eeac.org/wordpress/wp-content/uploads/Top-down-Modeling- Methods-Study-Final-Report.pdf
Top-Down NTG Study	<u>http://ma-eeac.org/wordpress/wp-content/uploads/Top-down-Modeling-</u> <u>Methods-Study-Final-Report.pdf</u>
Comprehensive Evaluation of Behavioral Programs – Initial Impact Analysis	http://ma-eeac.org/wordpress/wp-content/uploads/Behavior-Program- Impact-Evaluation-Memo.pdf

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Thanks!

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