Launching Into Space: Advanced M&V For Our Region

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Sam Fernandes, LBNL
Chris Balbach, PSD
Teri Lutz, Michaels Energy
Pasi Miettinen, Sagewell
Standardized, Sustainable and Transparent EM&V – Integrating New Approaches in Connecticut

Michele Melley
NEEP Public Meeting: Stellar EM&V
Providence, Rhode Island
May 21, 2019
Standardized, Sustainable and Transparent EM&V- Integrating New Approaches in Connecticut

**Funding**

DOE Funding: Office of Energy Efficiency
Renewable Energy.
Cost Match: Project Partners

**Project Goals:**

This project will test the use of advanced data analytics and collection tools (M&V 2.0) through a statewide pilot and compare these findings with traditional M&V practices. The project team will transfer those results and experiences to other states along with additional EM&V 2.0 research and experiences from across the country.

**Impact:**

- Develop M&V 2.0 software tool standards and protocols
- Broad scale adoption and use of M&V 2.0 tools in CT based on pilot results
- State and regional education on automated versus traditional approaches to EM&V

**Partners:**

- NH, NY, RI, VT, NEEP, LBNL
- Eversource Connecticut (utility)
- United Illuminating (utility)

**Stakeholders:**

- State energy offices, regulators, utilities, program administrators, evaluators, system planners, facility managers
CT Advanced M&V Pilot: Status

Commercial Pilot-Completed

• Targeted 2-3 Dozen Commercial Buildings
• AMI Data
• RCx, Energy Opportunities, SBEA
• Compared Advanced M&V to “Traditional – savings estimates, time and cost.”
CT Advanced M&V Pilot: Status

Commercial Pilot- **Completed**

Resources/Deliverables-

- Utilities Traditional Savings Memo
- LBNL’S Implementation Resource Guide
- Pilot Results Memo-Coming Soon
- State Partner Workshops
- Outreach Plan
- Research Briefs/Guidance
Connecticut Department of Energy and Environmental Protection

CT Advanced M&V Pilot: Status

Progress

Transfer M&V Tool to Industry

• Utilities - Considering Use of Tool in Implementation Phase
  
  Project Criteria: expected savings > 5%, retrofit baseline, no DG

• LBNL-Trained CT Utility Staff
Residential Pilot - Planning Phase

Scope:

• Targeting ~ 2,000-3,000 CT “HES” homes
• Monthly Consumption Data- (not AMI)
• Compare the advanced M&V to “Traditional” savings estimates, time and costs
• NEEP will track the process of using these tools and share results with states.
NEXT STEPS

• Residential Tool Selected-Finalize Contract
• CT Utilities Provide HES Data –input Advanced M&V tool.
• Finalize Pilot Design
THANK YOU

• Michele Melley
• Michele.L.Melley@CT.gov
• 860-827-2621
Advanced M&V Savings Estimate Process

3-step project review sequence:

• Expected savings > 5%
• CUSUM chart profile relatively straight
• Compare advanced M&V savings estimate to traditional M&V savings estimate
## Findings kWh and Fractional Savings

<table>
<thead>
<tr>
<th>Category</th>
<th>Trad. kWh</th>
<th>Adv. kWh</th>
<th>Fractional Savings</th>
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</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>234,032</td>
<td>231,361</td>
<td>12%</td>
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<tr>
<td>Category 2</td>
<td>588,840</td>
<td>254,604</td>
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<tr>
<td>Category 3</td>
<td>59,738</td>
<td>-16,555</td>
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<tr>
<td>Category 4</td>
<td>49,013</td>
<td>39,377</td>
<td>2.3%</td>
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</table>
Key Takeaways

• Early feedback + visibility into savings as they accrue.
• Identify underperforming projects
• Non-routine events could be detected in a timely manner

• Advanced M&V not proposed as a direct replacement for comprehensive EM&V
• Pilots in other regions reveal similar trends
For more information:  https://buildings.lbl.gov/emis/assessment-automated-mv-methods

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THANK YOU!

More details on our tool:

https://github.com/LBNL-ETA/RMV2.0
M&V Lessons Learned –

Duke Energy “Smart Energy Now” Behavioral Energy Savings Program

Chris Balbach, PE, CMVP, CEM, BESA
NEEP Stellar EM&V
Annual Public Meeting
May 21, 2019
High Level Overview

~ 65 participating buildings
  • 11 million+ conditioned square foot
  • Savings compared to “2010” baseline period
  • Savings target (%) set at community level

Variety of Building Types
  • Offices / Financial Services
  • Hotels / Retail
    • Mixed Use Buildings
  • Municipally Owned Buildings
    • Jail / Courthouse

All Buildings represented by EPA Portfolio Manager
GOAL:
- Leverage large quantities of data

BARRIERS / ISSUES:
- Need to create *meaning* from the flood of *measured* data
- Real time (max 15 minute delay) feedback required
- Maintain Privacy

PSD SOLUTION:
- Real time *Whole Community* “efficiency meter” with a *community wide view of performance*
- Real time *Whole Building* “efficiency meter” for Building mngrs

INNOVATIONS REQUIRED:
- Provide guidance to building owners & occupants to operate efficiently *and neither reward nor penalize economic growth*
- Use *transparent* M&V approach to developing savings adjustments (eventual third party EM&V review)
Issues with Non Routine Event(s)

Issue 1: Buildings gain / lose tenants...

Issue 2: Building Specific “Savings” can be difficult to interpret...

Issue 3: Automated analysis of ‘savings’ data can reveals patterns - but not causes...

Behavioral Experiment Savings

Reduced lighting use due to behavioral experiment

Recording Changes (Non-routine Adjustments)

Overestimated Savings

- Reduced number of PCs
- Reduced number of occupants

Office Bldg x - Total Conditioned Gross ft²

Thousands of ft²

Issue 2: Building Specific “Savings” can be difficult to interpret...

Issue 3: Automated analysis of ‘savings’ data can reveals patterns - but not causes...
• **Issues Discovered**
  - Customers lacked incentive to record/ update “Building Characteristics”.
  - Building Managers lacked a “Peer Comparison” to drive competition.
  - Economic Impact of recession was significant (2011+).
  - Duke Energy unable to leverage system data for program claimed savings (3rd party EM&V)

• **Lessons Learned**
  - Improve approach by ‘custom’ building generation of ‘EPA Scaling Factor’.
  - Onboard EM&V consultant with technology approach as soon as possible.
Thank you for your time and attention!

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Pay for Performance

✓ What is P4P?
✓ What are the objectives?
✓ How can it be achieved?
✓ What else should be considered?
Pay for Performance

What is it?

- P4P programs reward energy savings on an ongoing basis as the savings occur
- Savings - and payments - based on metered data

Sort of like this… but smarter.
What are the objectives?

- Procure EE investment
- Shift from flat-rate rebate to market-based
- Increase EE savings and persistence over time
- Deliver locational and time savings to support/secure grid
- Stimulate innovation in program design
Pay for Performance

How can it be achieved?

✓ Smart metering infrastructure
✓ NMEC: Normalized Metered Energy Consumption
✓ Transparent open source tools, such as OpenEEMeter
✓ Empirically tested methods, such as CalTRACK
Considering Actionable Intelligence to...

Engage Customers
What are customers likely to do in the near and longer-term future?

Pay for Performance
What financial incentives drive the desired behavior?

Energy Forecasts/Grid Management
How does a program design change affect energy forecasts?

Inform Design & Delivery
What is the baseline? How are customers using energy?
THANK YOU!

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Common Sense M&V
Goals, AMI Analytics Methods & Outcomes
NEEP Stellar Evaluation
May 21, 2019

Pasi Miettinen
CEO, Sagewell, Inc.
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Total housing stock: 100 %
% of all homes that get energy audit/yr: 3 %
% of above homes that weatherize: 33 %
Avg. weatherized home energy Savings: 10 % 100%
Annual energy savings from weatheriz.: 0.1 %
Weatherization savings from last 10 years: 1 %
Spending on EE programs/yr in MA: $500 Million

Peak reduction: typically 10% to 15%
Programs often assume 40%+
Effectiveness requires: $Q \times I$
(Quantity times impact)
Heat pump trends

MA Heat pump sales Q4 2014 – Q4 2018

MA Residential Heat Pump Market share – through ‘17

Excludes municipal utilities

MA Residential Heat Pump Market share – through ‘18

More than 3%
2% - 3%
1% - 2%
0.5% - 1%
Less than 0.5%

Excludes municipal utilities
If we electrify home heating, what technology should we use?

- Not all heat pumps are worth the same environmentally or economically
- Ductless heat pumps are typically not used for heating
  - Must remove fossil fuel system to achieve results
- Ducted heat pumps use about 4,000 kWh/yr more than average home
  - Reduce CO2 by 30% to 50% over natural gas and oil

Data from **Sagewell SageSight**^SM^ AMI meter data analytics software and Sagewell's AMI meter data library
Importance of experimentation & failure

- “Fail fast” is important
- Celebrate failure, but change programs!
- EV Case study: trial and error
- Success! Finally! AMI data to the rescue.

<table>
<thead>
<tr>
<th></th>
<th>Option 1: AMI Data-driven prgm</th>
<th>Option 2: hardware</th>
<th>Option 3: hardware</th>
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<td>85%</td>
<td>&lt;30%</td>
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<tr>
<td>Effective off-peak charging success</td>
<td>95%+</td>
<td>80%+</td>
<td>50%+</td>
<td>33%</td>
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<tr>
<td>Works with Teslas?</td>
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<td>✗</td>
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<tr>
<td>Works without connectivity issues?</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
</tr>
</tbody>
</table>

|                      | Market penetration potential     | 85%                | 30%                | 30%      | 25%     |
|----------------------|---------------------------------|--------------------|--------------------|----------|
| Effective off-peak charging success | 95%                            | 80%                | 50%                | 33%      |
| Maximum peak reduction | 81%                            | 24%                | 15%                | 8%       |

**WHAT IF:**

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<tr>
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<td>Maximum peak reduction</td>
<td>26%</td>
<td>24%</td>
<td>15%</td>
<td>5.0%</td>
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Load shapes – EV, load management & solar
Afternoon Break is sponsored by: