Calling all Pilots!

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Dick Oswald, United Illuminating
Salil Gogte, EcoMetric Consulting
Steve Bonanno, National Grid
Claire Miziolek, NEEP


9N - AHW

Key Elements

- Testing
- New territory
- Build upon each other
- Hopefully transform into longer term programs

Today's presentation

Speakers

C&I:

- Michele Melley, CT Department of Energy and Environmental Protection
- Dick Oswald, United Illuminating
- Salil Gogte, EcoMetric Consulting

Residential:

- Steve Bonanno, National Grid
- Claire Miziolek, NEEP

Discussion

Connecticut Department of Energy and Environmental Protection

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

Standardized, Sustainable and Transparent EM&V – Integrating New Approaches in Connecticut

2017 Regional EM&V Forum
October 3,2017
Hartford, CT

Connecticut Department of Energy and Environmental Protection

Standardized, Sustainable and Transparent EM&V- Integrating New Approaches in Connecticut

Funding:

DOE Funding: $743,998
Cost Match: $538,100 (72%)

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 in terms of savings certainty, timeframe, and other aspects. 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

Project Objectives

Task 1- CT Automated M&V Pilot-

LBNL, Utilities, will

Test advanced data collection and analytics tools in Commercial and Residential Buildings.

Task 2

NEEP will track the process of using these tools and share results with states.

Project Task Summary

Task 3

Regulators hope that these auto-M&V tools to be a valid method for determining energy savings.

Project Partners will develop acceptance criteria and rules to test M&V 2.0 software.

CT Commercial Pilot: Scope

- Targeting 2-3 Dozen Buildings
- Compare Advanced M&V 2.0 to “Traditional”

  -Accuracy, labor time, savings estimates
- Study design Intended to compliment program evaluation.

CT Commercial Pilot: Programs

CT's Energy Efficiency Programs-included:

Energy Opportunities, Small Business Energy Advantage

O&M Services

O&M, Retro-Commissioning

CT Commercial Pilot: Project Selection

Project Selection Criteria

Required

1) AMI Data
2) Commercial Building

Preferred

1) >750,000KWh annual consumption
2) RCx project- New, ongoing, completed

Advanced M&V 2.0 Tool

LBNL Commercial M&V Tool

- Screen Customer Load Profiles for Model Fitness
- Determine Baseline-Participants/Non-Participants

CT Commercial Pilot: Moving Ahead

Next Steps:

- Identify Projects
- Install Measures
- Continuous Data –Post Energy Consumption

CT Commercial Pilot: Planning

Lessons Learned

- Potential Utility Benefits
- Type of Projects in Pipeline
- Data Challenges

Thank You

Michele Melley

energize CONNECTICUT

Empowering you to make smart energy choices

Dick Oswald, United Illuminating

CT EM&V 2.0 Pilot

UI Metering Information

- Electric Utility in CT (New Haven –Bridgeport)
- 332,000 electric customers
- Advanced Metering Infrastructure
  - AMI meters
    - ~ 70% of Residential meters
    - ~ 45% of C&I meters
    - Continuously to converting meters to AMI
    - Not all AMI meters have 12 month historical data

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Project Selection

- Projects need to have interval data available
  - LBNL preferred Retro-Commissioning (Retro Cx)
    - UI had very small population of Retro-Cx Projects
    - Expanded view to include:
      - Large Retrofit Projects
      - Small Business Retrofit Program
- Identified Projects from these programs that had interval data available

Project Selection

- Working with LBNL the following projects were selected for the pilot
  - Large C&I Projects
    - 4 advanced lighting controls
    - 1 chilled water control project
    - 4 large lighting Retrofits (LED)
    - 1 Interior Storm windows/lighting (ele heat)
    - 4 Small business lighting retrofits
    - 1 Campus water loop

Project progress

- Interval data (12 + months) sent to LBNL
  - LBNL testing of Data
    - 14 of 15 projects base the initial screening
- Provided Baseline interval data for
  - 140 accounts (>500,000 kwh/yr.)
  - LBNL processing this data

Next Steps

- UI – trying to identify more projects for the pilot
  - Initial Screening of Projects with LBNL
- Obtain Interval Data for Selected Projects

Advanced Metering

Opportunities and Challenges of Pilots

October 3, 2017

Agenda

1. Advanced Metering Overview
2. AMI Data Availability
3. Applicability
4. Other Issues
5. Opportunities

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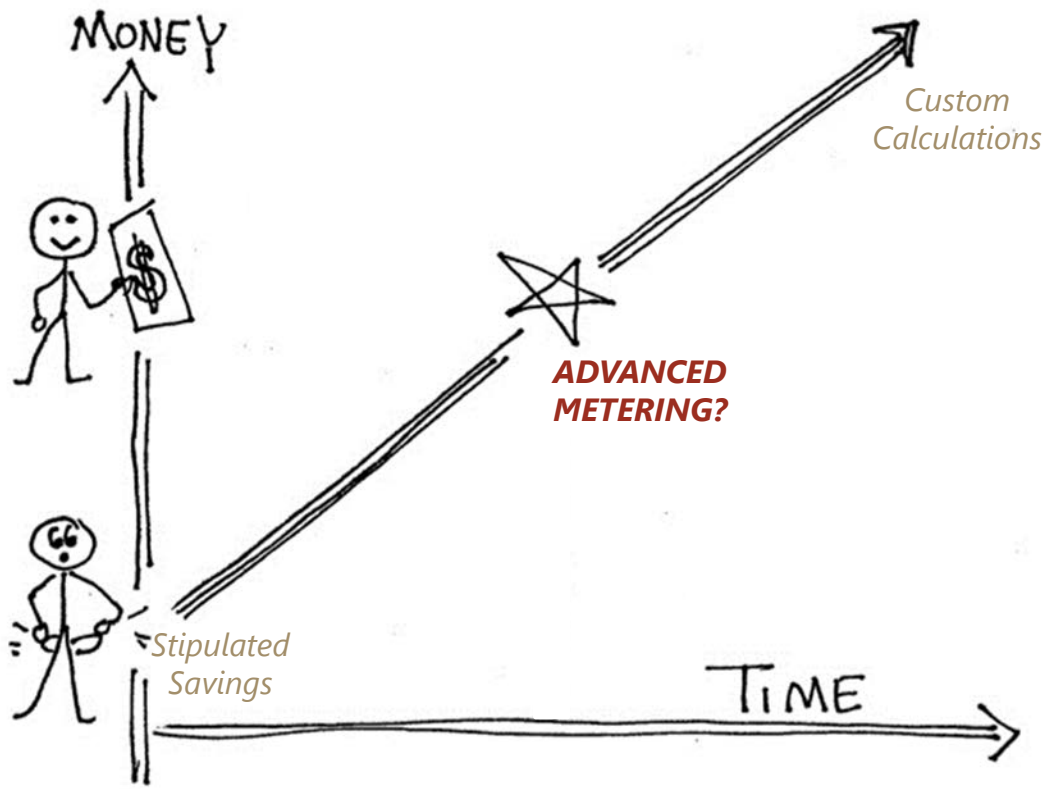
1. Overview: Purposes and Objectives



1. Overview: Definitions

Traditional Metering	Advanced Metering
IPMVP Options A&B	IPMVP Option C
Data logging level: End-use	Data logging level: Whole facility
Use measured parameter to *estimate* true power	AMI Data • Medium to high frequency meter data collected by utility installed smart meter
Measurement Equipment • Passive CT amp loggers • Lighting on/off loggers • Power meters • Spot measurements	Nonintrusive Load Monitoring (NILM) • High frequency data collected externally by installed metering device • Utility meter reading devices (“optical sensors”) • Wi-fi connected meters • Whole electrical panel CTs

ECOMETRIC

1. Overview: Advantages & Disadvantages

Traditional Metering	Advanced Metering
Advantages • Improved accuracy at end-use level • Interactive effects can be resolved better • No cyber security concerns	**Advantages** • Real-time data allows for periodic quality control checking and data cleaning • High frequency data provides more realistic load shape of equipment that ramps up and down • Faster results? • *Could* reduce costs
Disadvantages • Low frequency, relies on averages and trends over long periods of time • Does not provide real-time information • Battery powered, trading metering duration for measurement frequency • Cost *could* be higher than other methods	**Disadvantages** • AMI data not readily available • Higher failure rates *could* inflate costs • Cyber security concerns • Some methods require a licensed electrician for install

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2. AMI Data Availability

Commercial

Source: U.S. Energy Information Administration, Electric power sales data files, August 2017

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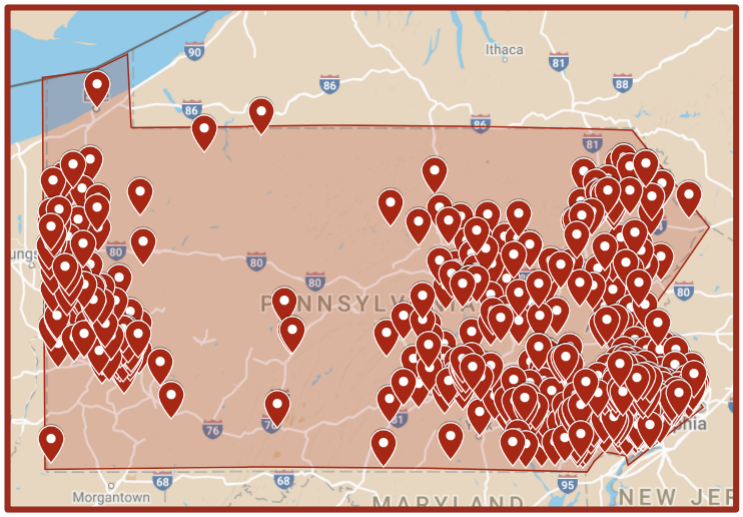
2. AMI Data Availability

Pennsylvania



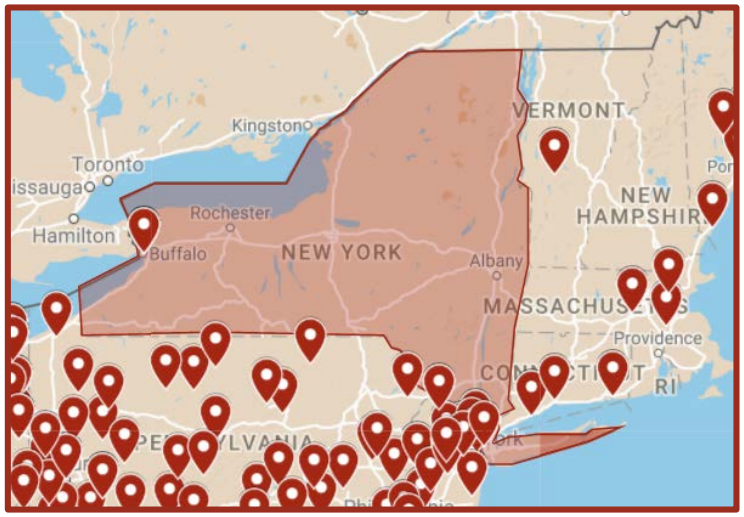
Massachusetts

Source: U.S. Energy Information Administration, Electric power sales data files, August 2017

2. AMI Data Availability

Ontario

New York



Sources: Ontario Ministry of Energy, Smart Meters and Time of Use Pricing
U.S. Energy Information Administration, Electric power sales data files, August 2017

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3. Applicability

Offices use an average of **250,000 kWh** annually.

Lodging facilities use an average of **563,291 kWh** annually.

Source: U.S. Energy Information Act, CBECS Survey Data, May 2016

End Use	Average Per Project Savings* (kWh)	Percent Office Consumption	Percent Lodging Consumption
HVAC	6,940	3%	1%
Small Lighting	8,944	4%	2%
Large Lighting	**26,857**	**11%**	5%

**Source: PECO PY8Q4 Participation Data*

ECOMETRIC

3. Applicability

Grocery stores use an average of **344,633 kWh** annually.

Healthcare facilities use an average of **681,529 kWh** annually.

Source: U.S. Energy Information Act, CBECS Survey Data, May 2016

End Use	Average Per Project Savings* (kWh)	Percent Grocery Consumption	Percent Healthcare Consumption
Small Refrigeration	1,315	2%	1%
Large Refrigeration	**174,863**	**52%**	
Motors & Drives	**290,849**		**43%**

**Source: PECO PY8Q4 Participation Data*

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3. Applicability

Small manufacturing facilities use an average of **659,932 kWh** annually.

General manufacturing facilities use an average of **4,000 MWh** annually.

Source: U.S. Energy Information Act, MECS Survey Data, Mar. 2013

End Use	Average Per Project Savings* (kWh)	Percent Small Manufacturing Consumption	Percent General Manufacturing Consumption
Motors & Drives	290,849	44%	7%
Compressed Air	122,954	19%	3%

**Source: PECO PY8Q4 Participation Data*

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3. Other Issues

When are your reports due?

Does your utility adhere to a Technical Reference Manual?

What confidence and precision goals do you need to meet for regulator compliance?

How predictable is your data?

3. Other Issues

When are your reports due?
AMI analysis requires 12 months of post-retrofit data collection.
Does your utility adhere to a Technical Reference Manual?
Use of AMI presents a paradigm shift.
What confidence and precision goals do you need to meet for regulator compliance?
Quantification of uncertainty is less granular in AMI disaggregation.
How predictable is your data?
AMI data relies on "autocorrelation" where load is predicted off previous readings.

4. Opportunities

How much do you value customer satisfaction?

How much data do you ordinarily collect with traditional loggers?

What is your data retention rate with traditional loggers?

How much does traditional metering cost?

4. Opportunities

How much do you value customer satisfaction?
Advanced metering techniques place less burden on the customer.
How much data do you ordinarily collect with traditional loggers?
Advanced metering techniques don't rely on internal batteries.
What is your data retention rate with traditional loggers?
Advanced metering techniques provide rapid continuous feedback.
How much does traditional metering cost?
CAN ADVANCED METERING BE THE COST EFFECTIVE SOLUTION?

ECOMETRIC

Questions?

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NEEP EM&V Fall Forum

Controlled Move To Advanced M&V

October 3, 2017

Reforming the Energy Vision (REV)

nationalgrid

- REV is driving change, and data is at the heart of it…

> *The electric industry is in a period of momentous change. The innovative potential of the digital economy has not yet been accommodated within the electric distribution system. Information technology, electronic controls, distributed generation, and energy storage are advancing faster than the ability of utilities and regulators to adopt them, or to adapt to them.**

**REV Track 1 Order Adopting a Regulatory Policy Framework and Implementation Plan. February 26, 2015. p.1*

- New York's regulators have explicitly called out the field of Evaluation, Measurement & Verification (EM&V)…

*"…advances in technology [can] be used to challenge and enhance our traditional approach to EM&V"**

*"Any earnings adjustments related to net savings should be tied to advances in EM&V that utilize direct customer information."***

**REV Track 1 Order Adopting a Regulatory Policy Framework and Implementation Plan. February 26, 2015. p. 307-308*
***REV Track 2 Order Adopting a Ratemaking And Utility Revenue Model Policy Framework. May 19, 2016. p.82-83*

New York's EM&V Guidance (Nov 2016)*

nationalgrid

#1 – Encouragement
"Program administrators and evaluators are encouraged to use advanced M&V techniques when appropriate and cost effective, to collect, aggregate and analyze data.

#2 – Budget sharing
"In instances where advanced M&V tools support program implementation and evaluation, the costs of implementing systems that generate data may be shared between program implementation and evaluation budgets."

#3 – Formal impact analysis
"In instances where advanced M&V tools are providing continuous savings estimates for a particular energy efficiency activity, and the data and analysis has been assessed to determine the reliability of the information, program administrators may be able to extend program EM&V cycles and rely on the advanced M&V tools to provide interim impact results."

**New York Dept. of Public Service, EM&V Guidance: http://on.ny.gov/2uxX7LO*

National Grid and AM&V

- How can we make REV succeed?
- What can we do better in the interim, during the transition, to improve the way we use data and perform evaluations?
- Can we better target EE activities that are all competing for the same dollar?

*The Company will incorporate, as applicable, "real-time EM&V" to provide timely feedback to the program implementation team as the evaluation is proceeding. The EM&V plan will also look at the market as a whole to maximize feedback to the energy efficiency programs. The Company will also explore new evaluation methods that utilize automation, smart devices, and/or software solutions.**

**National Grid 2017-2020 Energy Efficiency Transition Implementation Plan (ETIP). June 1, 2017. p. 12.*

National Grid AM&V Pilot

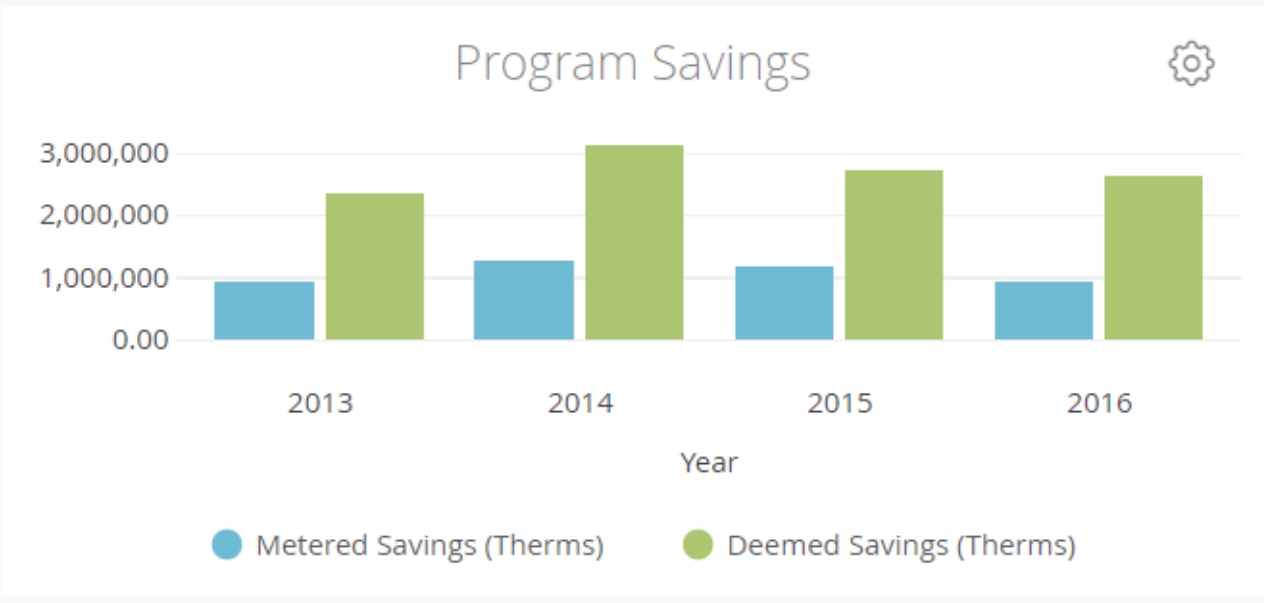
nationalgrid

- Specs:
  - NY Residential High Efficiency Heating Equipment (HEHE)
  - Historical analysis (PY 2013 – 2016)
  - Joint effort with NMR and EnergySavvy
  - Monthly billing data
  - Past/future participant comparison groups
- Pilot Objectives:
  - Compare billing analysis methods and outputs of both firms
  - Determine when reliable savings estimates would be generated, if the analysis were run in “real-time”
  - Assess impact of non-participant data limitations
  - Gain familiarity with new tools and methods

- Both analyses produced similar results

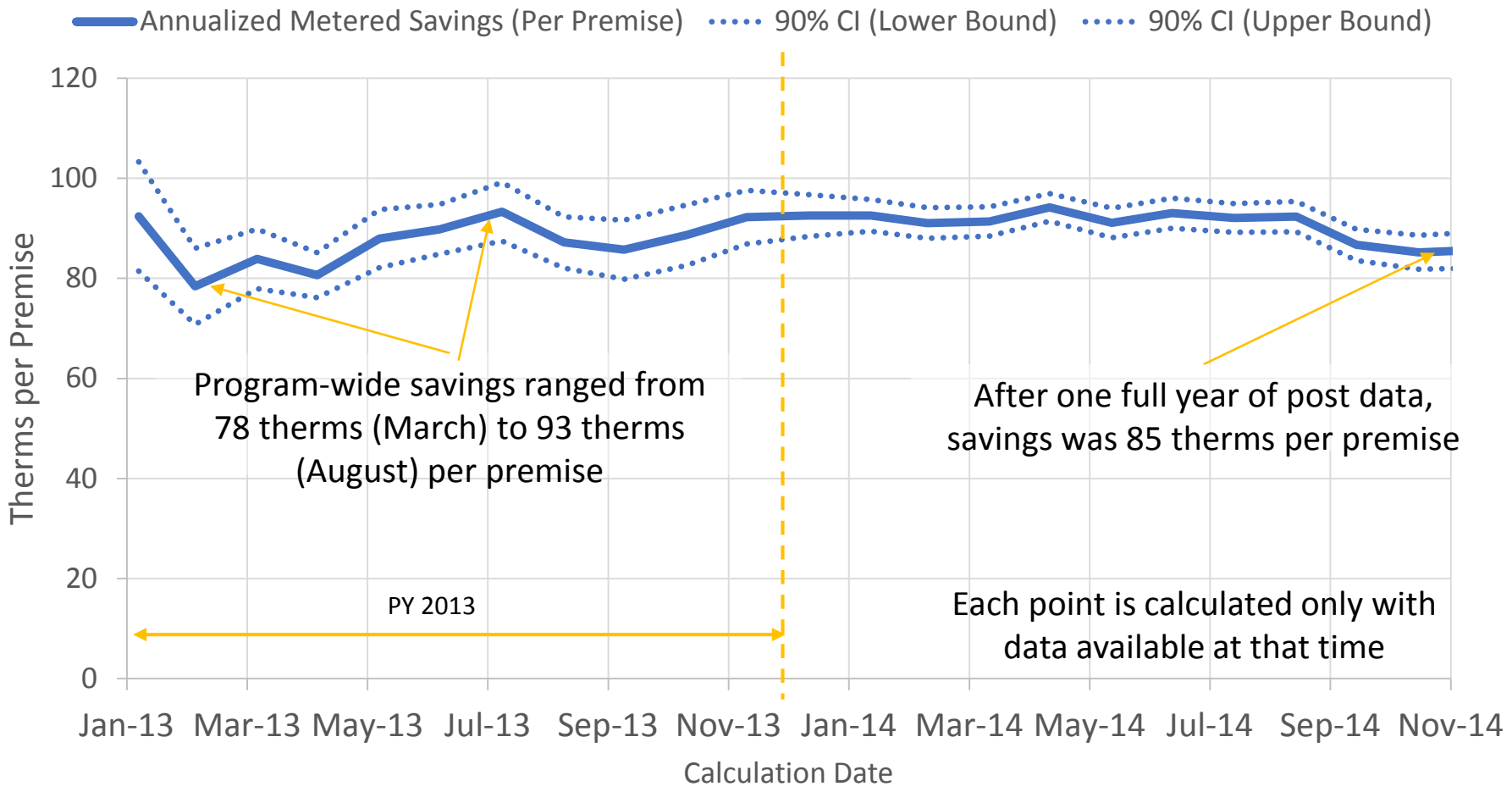
Program Overview

Year	Project Count	Metered Savings (Therms)	Deemed Savings (Therms)	Achievement Rate
2013	9,947	931,700 ± 32,765	2,357,188	40% ± 1%
2014	14,289	1,280,888 ± 38,222	3,134,951	41% ± 1%
2015	12,672	1,189,608 ± 44,578	2,718,664	44% ± 2%
2016	14,839	945,305 ± 33,960	2,631,036	36% ± 1%



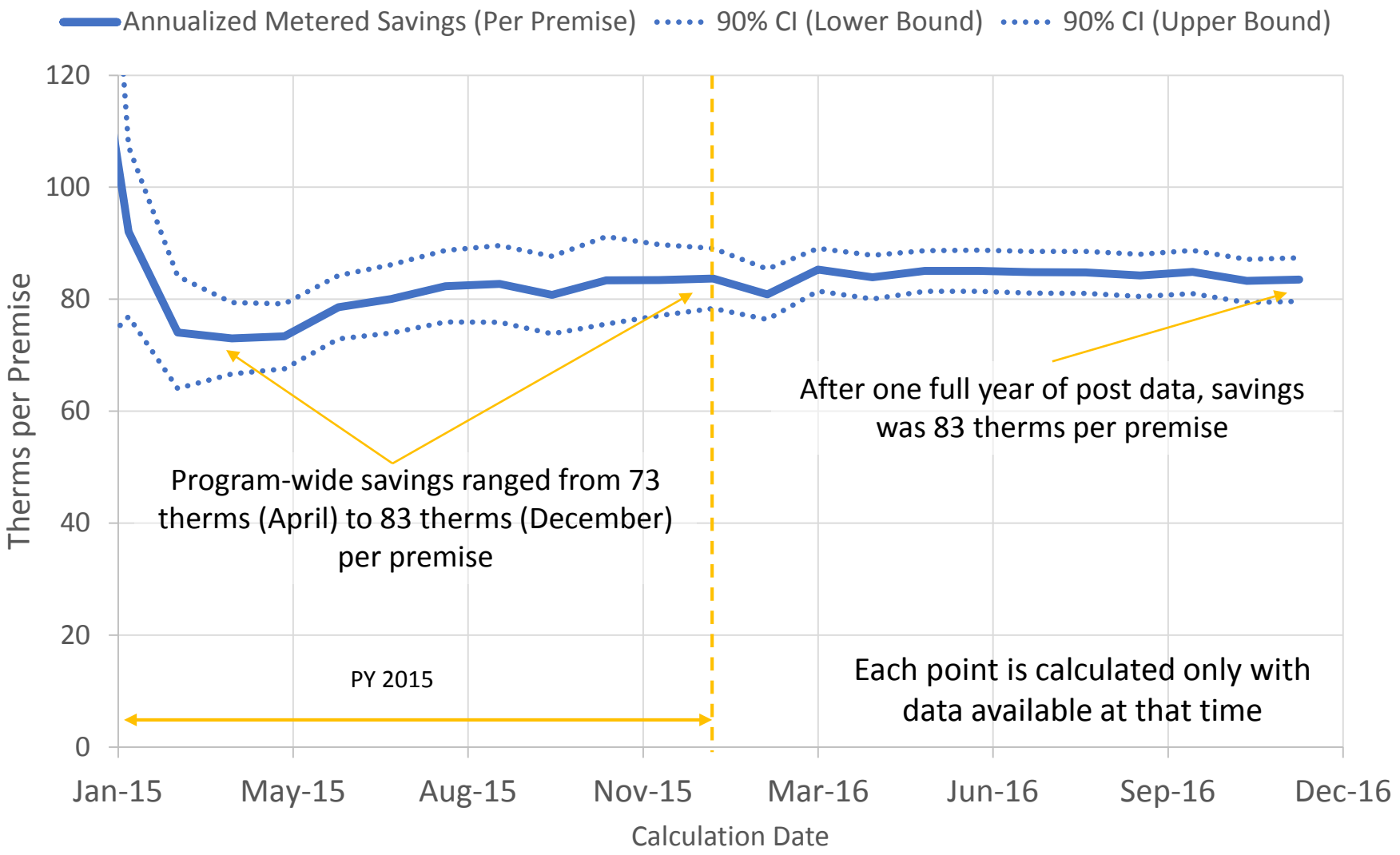
Source: EnergySavvy analysis of 2013-2016 Res HEHE data

- AM&V provides reliable, early savings estimates



Source: EnergySavvy analysis of 2013 Res HEHE data

National Grid AM&V Pilot – Findings



Source: EnergySavvy analysis of 2015 Res HEHE data

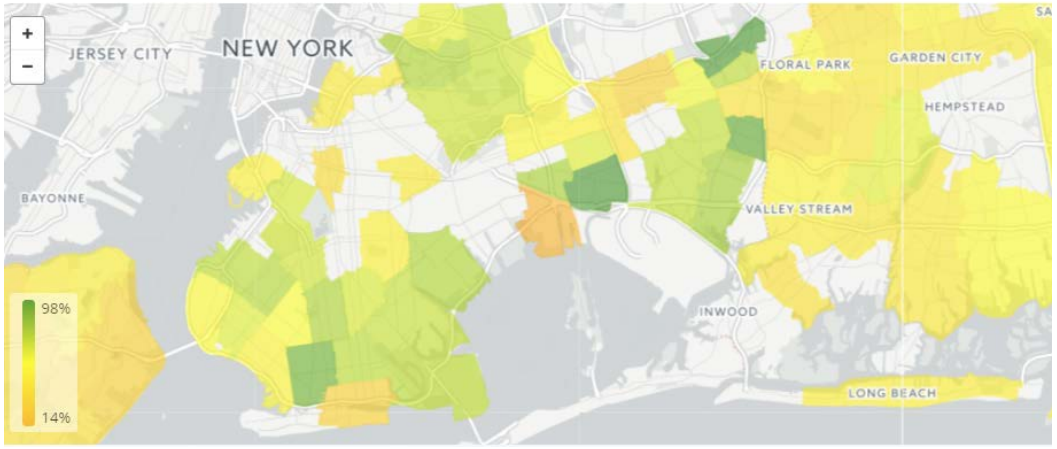
National Grid AM&V Pilot – Findings

- Savings estimates by location, measures, and contractors can inform evaluation efforts and program operations

Measures

Measure Names	Count of Projects	Average Deemed Savings	Average Metered Savings	Achievement Rate
Furnace, Thermostat	25,766	300	85 ± 2	28% ± 1%
Boiler	11,869	153	115 ± 4	75% ± 3%
Thermostat	8,772	78	11 ± 3	14% ± 4%
Furnace	8,252	219	84 ± 3	38% ± 1%
Boiler, Thermostat	7,826	311	135 ± 7	44% ± 2%
Boiler, Thermostat, WaterHeater	5,490	337	106 ± 10	31% ± 3%
Boiler, WaterHeater	4,588	187	107 ± 8	57% ± 5%

Savings Achievement Rate by ZIP



Vendors

Project Count	Metered Savings
3,011	30,161 ± 14,872
2,852	36,850 ± 12,222
1,278	101,032 ± 9,702
826	76,347 ± 6,154
639	52,293 ± 6,664
608	44,319 ± 6,362
555	54,725 ± 5,968
507	33,473 ± 5,617
452	31,337 ± 5,524
442	59,046 ± 7,945

**Vendor names excluded.*
Source: EnergySavvy analysis of 2013-2016 Res HEHE data

Conclusions

- Partnership with EM&V firm and Advanced M&V vendor was critical to pilot success
- Advanced M&V:
  - Aligned with traditional billing analysis
  - Generated reliable savings estimates early in the program year
- Continuous, automated impact measurement can be integrated into evaluation to inform:
  - Where to target evaluation efforts
  - TRM updates
  - Program planning
  - Implementation efforts
- AMI data not critical, but would enhance results for electric programs
- Rules on non-participant data need to be addressed

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Residential Advanced M&V Pilot Potentials

Claire Miziolek
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For this discussion…

Advanced M&V

Imagine this…

- You want to know if your measure worked to save energy in a home
  - Whole home large-scale retrofit
  - Basic weatherization measures
  - HVAC/appliance replacement
  - Lighting measures

- What data streams might you have in a home?
  - Monthly billing
  - Smart Meter?
  - Smart thermostat?
  - Load monitor (installed in breaker panel)
  - Other smart devices (appliances, light bulbs)

The data stream you can access may determine the Advanced M&V Approach

Smart Meter

- Interval electrical data…how granular can you go?
- How much historical data do you have?
- Not ubiquitous, growing
- Consumer benefit?

Smart thermostat

- Interval central HVAC data (many fuels)…besides runtime, what can you learn?
- Can you access the data?
- Not ubiquitous, but growing quickly through programs and customer demand
- Demand & energy savings (especially for ENERGY STAR Smart Thermostats)

The data stream you can access may determine the Advanced M&V Approach

Load monitor (installed in breaker panel)

- Frequent interval electrical data, can see a lot of measures
- Likely needs professional installation
- Rare, will consumers buy them?
- Behavioral energy/BDR savings?

Other smart devices (appliances, light bulbs)

- Varies, could include:
  - Operational mode/Cycle
  - Hours of use
  - Dimming light level

- Not ubiquitous, but growing through programs and customer demand
- Demand (& energy??) savings
- Other Research opportunities

Might you already have the data stream to answer your question?

- If your source of data is also:
  - Savings energy or demand
  - Providing other consumer benefits
- Is that a preferred option?
- Could those data sources be as trustworthy? As reliable?
  - Does the scale-ability help here?
  - Impact sampling bias?
  - RCT through other means?

THANK YOU!

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Discussion Questions

- Can this work for compliance?
- What other questions can future pilots help answer?
- How can we all test Advanced M&V in our work?
- How can we minimize the risk of new pilots?