Rapid Fire:
Advanced M&V Software Overview

Northeast Energy Efficiency Partnerships

December 11, 2017

Northeast Energy Efficiency Partnerships

"Assisting the Northeast & Mid-Atlantic Region in Reducing Total Carbon Emissions 80% by 2050"

Mission

Accelerate energy efficiency as an essential part of demand-side solutions that enable a sustainable regional energy system

Vision

That the region embraces next generation energy efficiency as a core strategy to meet energy needs in a carbon-constrained world

Approach

Overcome barriers and transform markets through *Collaboration, Education, and Enterprise*

Introduction

WELCOME

This webinar is part of US DOE grant:

“Standardized, Sustainable and Transparent EM&V - Integrating New Approaches”

BACKGROUND

Participants in this webinar were selected on first-come basis from among organizations contributing to NEEP M&V research activities to date

2018

Outreach will include workshops, webinars, briefs

Agenda

2 POLLS

LINE UP

1. Daniel Kauffman, ResiSpeak
2. Rich Huntley, EEme
3. Ethan Goldman, VEIC
4. Nick Gayeski, KGS Buildings
5. Jason Roeder, Powerhouse Dynamics
6. Will Duckett, Plotwatt
7. Barbara Dusicka, Cascade Energy
8. Tom Arnold, Gridium
9. Tim Guiterman, EnergySavvy

WRAP UP- QUESTIONS & FINAL POLL

ResiSpeak
Daniel Kauffman
dk@resispeak.com

How ResiSpeak Works

Utility Data
- From online accounts
- From utilities
- Manually uploaded

Weather Data
- National Weather Service

Retrofit Data
- Start & end data
- Work done
- Money spent

Facility Data
- Zip code (for weather)
- Square footage
- Heating method

ResiSpeak

Find Saving Opportunities
- Within homes & buildings
- Within portfolios

Measure Saving
- For individual retrofits
- For programs

ResiSpeak is a database, a calculator, and a web service for home & building energy data analysis

ResiSpeak

ResiSpeak Services

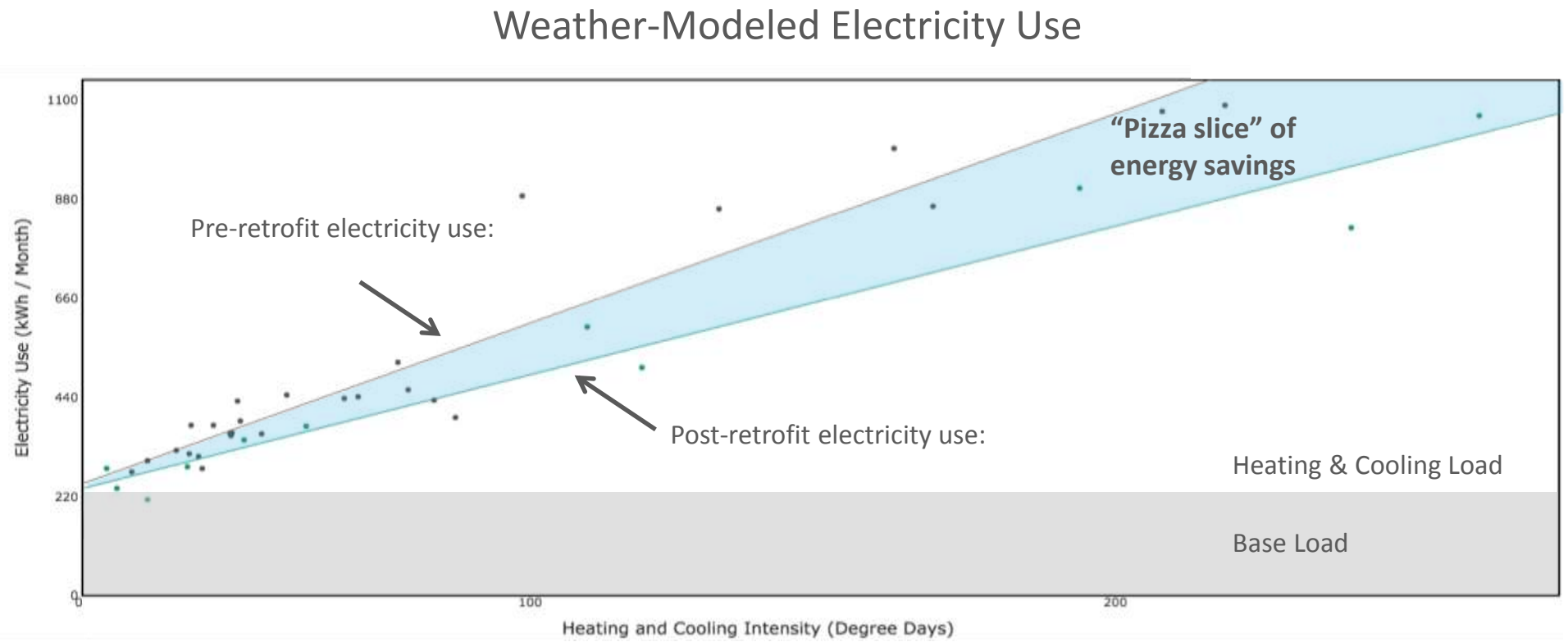
Homeowners & Contractors
Basic data analysis
Valuing energy savings
Safely sharing data

Utilities & Programs
Efficiency program optimization and outreach
Automated energy savings measurement & verification
Load management analytics

Building Portfolios
Energy management and information system
Building performance diagnostics
Energy Star Portfolio Manager integration

ResiSpeak

Measuring Electricity Savings



Complies with all standard Measurement & Verification protocols

ResiSpeak

EEme

Rich Huntley

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EEme is a proven machine learning platform that transforms smart meter data into appliance/equipment-level insights, using only whole home interval data

Richard Huntley
rich@eeme.io

ee·me

/ˈēmē/
noun · an enterprise analytics-as-a-service company based in Pittsburgh.

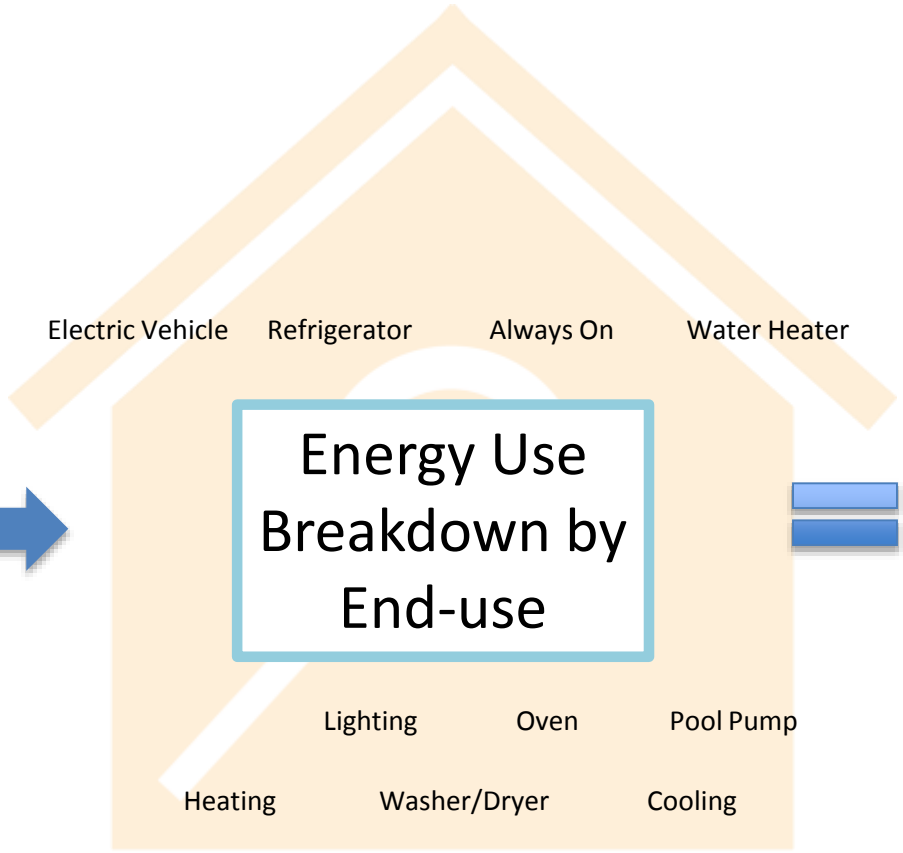
EEme's proven analytics engine requires only 2 inputs to create appliance-level intelligence

Historical Interval Data

- Wattage
- Timestamp

Location Information

- Weather data



Appliance consumption insight as an input stream for other EM&V platforms

M&V use cases include

Identifying actual appliance consumption

- Leveraging existing consumption data sets such as 15 minute interval data, we can provide daily consumption across 8 to 12 end uses
- The daily consumption can be used pre and post the installation of a measure to determine actual drop, or not
- Without utility metered interval data, other data collection methods can be used such as CT clamps, optical port readers, etc.

Refining the idea of a peer

- For evaluation methods that rely on a the comparison of a treatment group to a control group, end use appliance disaggregation can significantly refine the relevance of the peer homes
- Make sure that similar end uses are present, i.e., make sure groups include common appliances such as water heat type, pools, A/C, etc.
- Further refine the groups by including homes with similar consumption ranges at the appliance level

VEIC - STAT

Ethan Goldman

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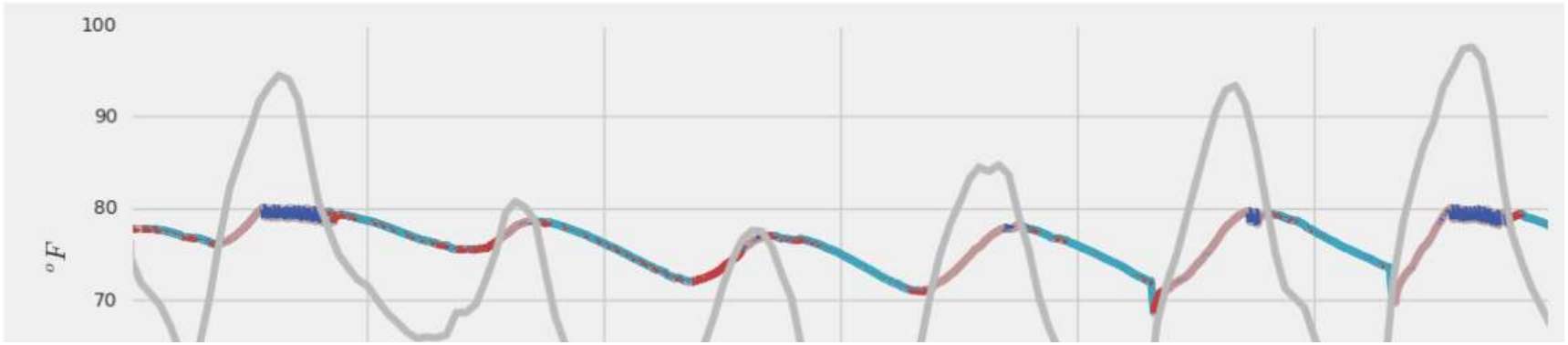
STAT: Smart Thermostat Analytics Toolkit

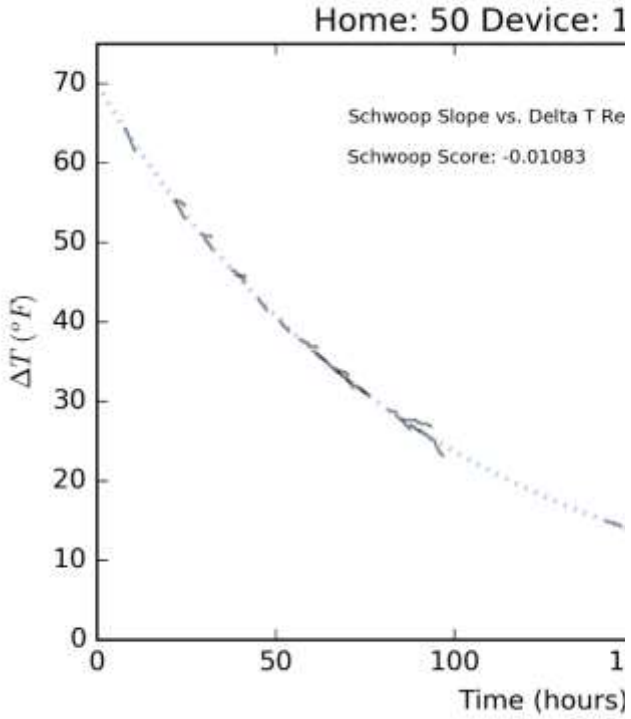
veic.org

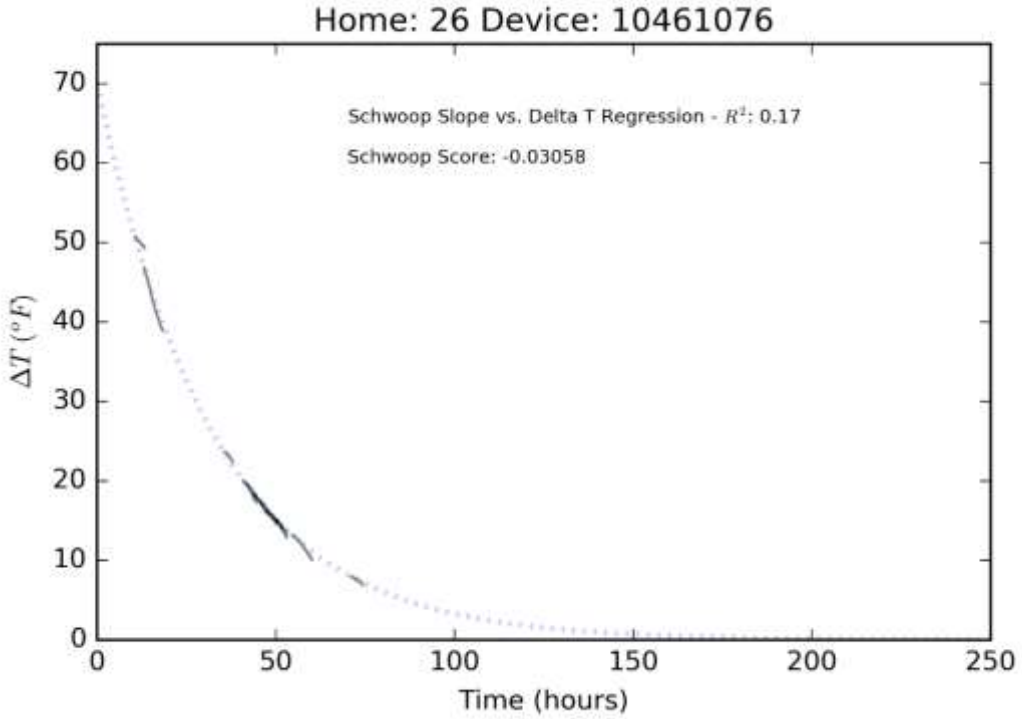
Automated Analytics

- **Reports**
- **CSV Files**
- **API Feeds**

Patented Algorithm: Shell Performance from Temperature Trends



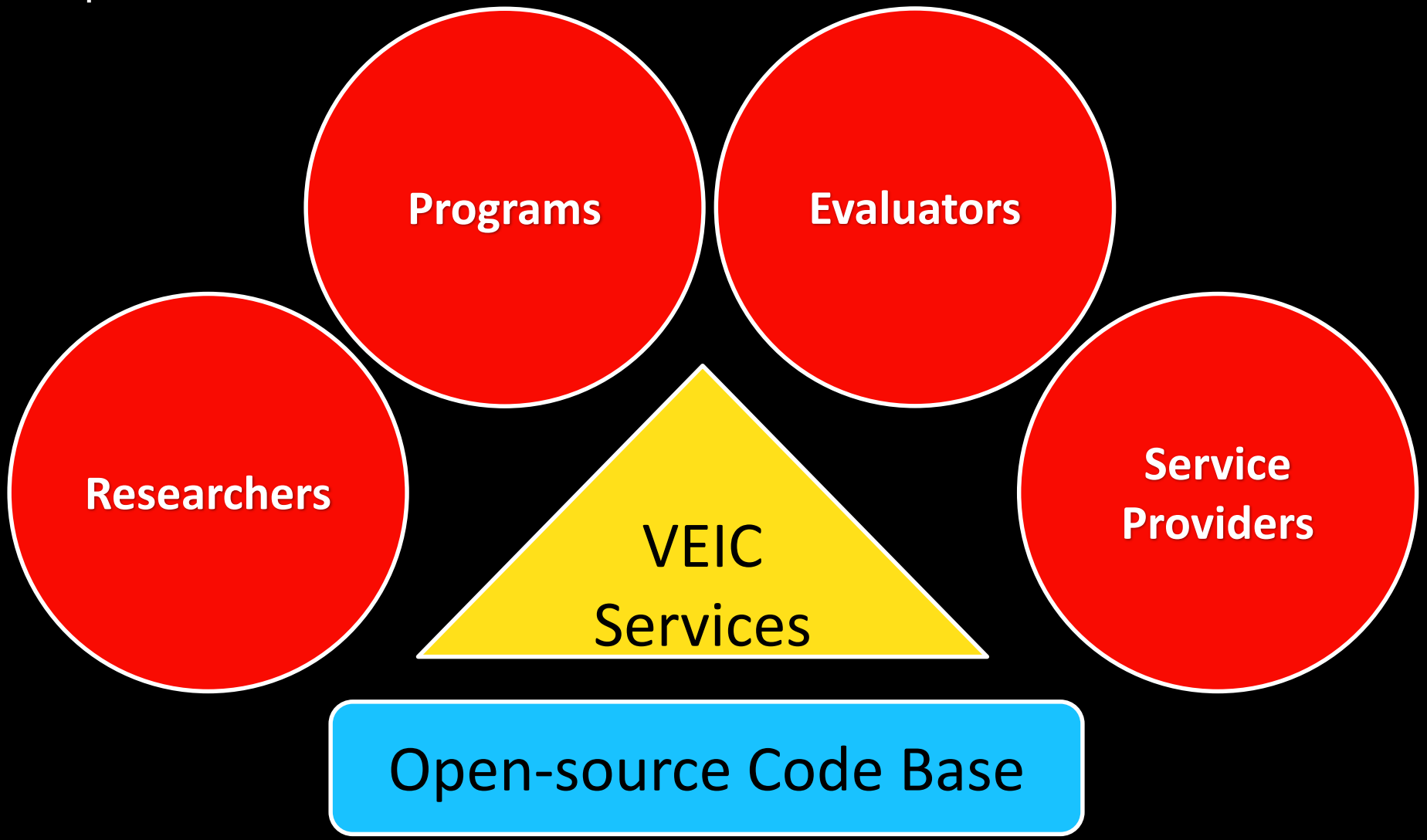




Metrics Calculated by STAT

Thermal Flow Rate	Savings Potential	HVAC Oversizing
Runtime Reduction	AMI Disaggregation	kW & kWh Savings

Open-source Model



KGS Buildings - Clockworks

Nick Gayeski
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We empower facilities teams to run better, smarter buildings with automated analytics

Nick Gayeski, PhD
nick@kgsbuildings.com

Automated analytics help facility managers prioritize issues to reduce energy cost, enable condition-based maintenance, improve comfort, and extend equipment life

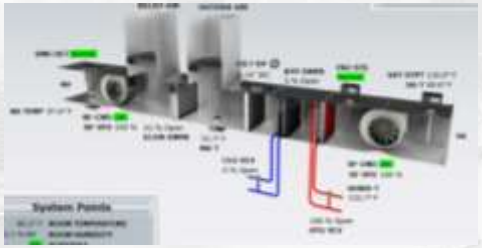
175M+
Square feet of facilities monitored

130,000+
Equipment monitored

850,000+
Building automation and metering points monitored

Unlocking equipment data from building automation systems to automate fault detection, KPI tracking, and equipment level M&V

ClockWorks



Equipment data

Online tools, notifications, reporting

Fault Prioritization
e.g. $8,900 Avoidable cost identified on AHU1

Equipment M&V
e.g. 74,000 kWh saved on static pressure reset for AHU1

KGS BUILDINGS

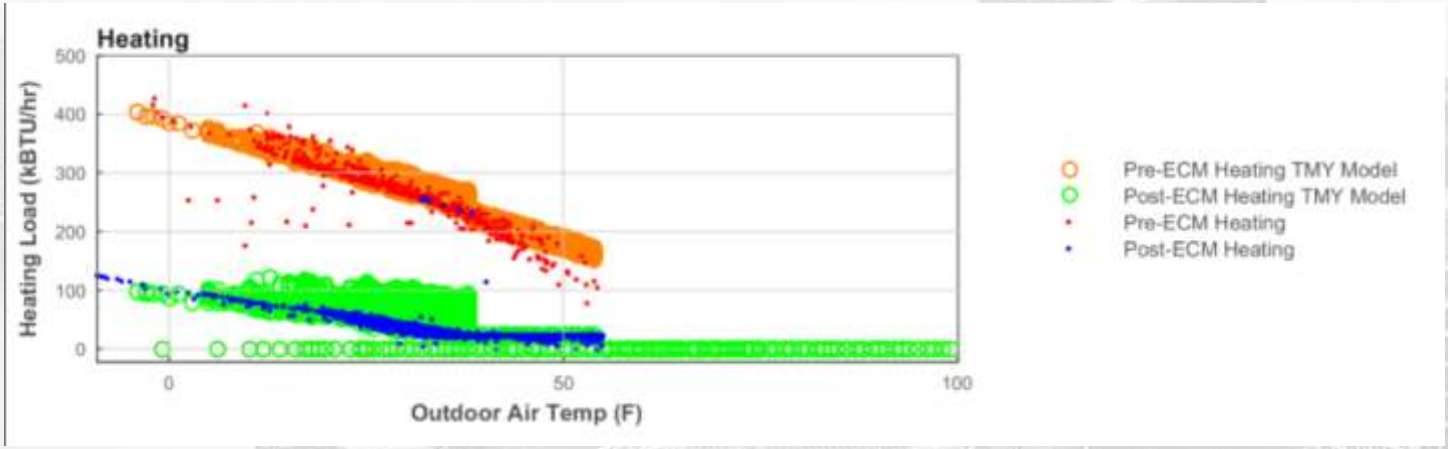
Working with large consumers to comprehensively mine for efficiency and document savings

$1.2M

Annual energy cost savings by major pharmaceutical company, incentivized by performance based program

$1M+

Annual energy cost savings by a major university validated by their utility under a memorandum of understanding



Example reduction in steam consumption on an air handler coil as demonstrated by multi-variable change point analysis on building automation data providing transparency to the utility and the customer on low cost efficiency measures

KGS BUILDINGS

Powerhouse Dynamics - SiteSage

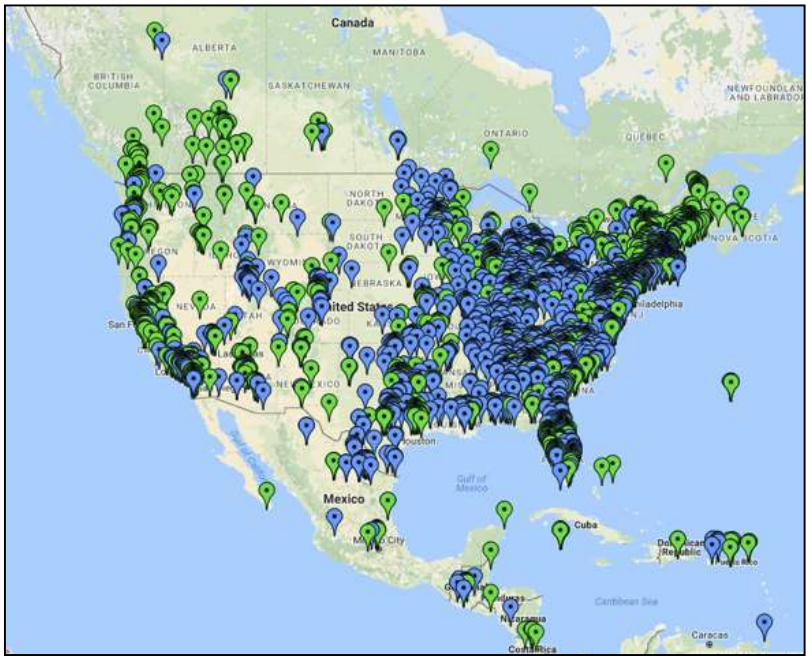
Jason Roeder

Jason@powerhousedynamics.com

Who is Powerhouse Dynamics?

- Developer of SiteSage®: managing assets, operations, and energy for restaurant, convenience store, and retail chains

- SiteSage connects, monitors, analyzes, and controls equipment to:
  - Provide operational transparency
  - Enhance equipment performance
  - Reduce energy expenses

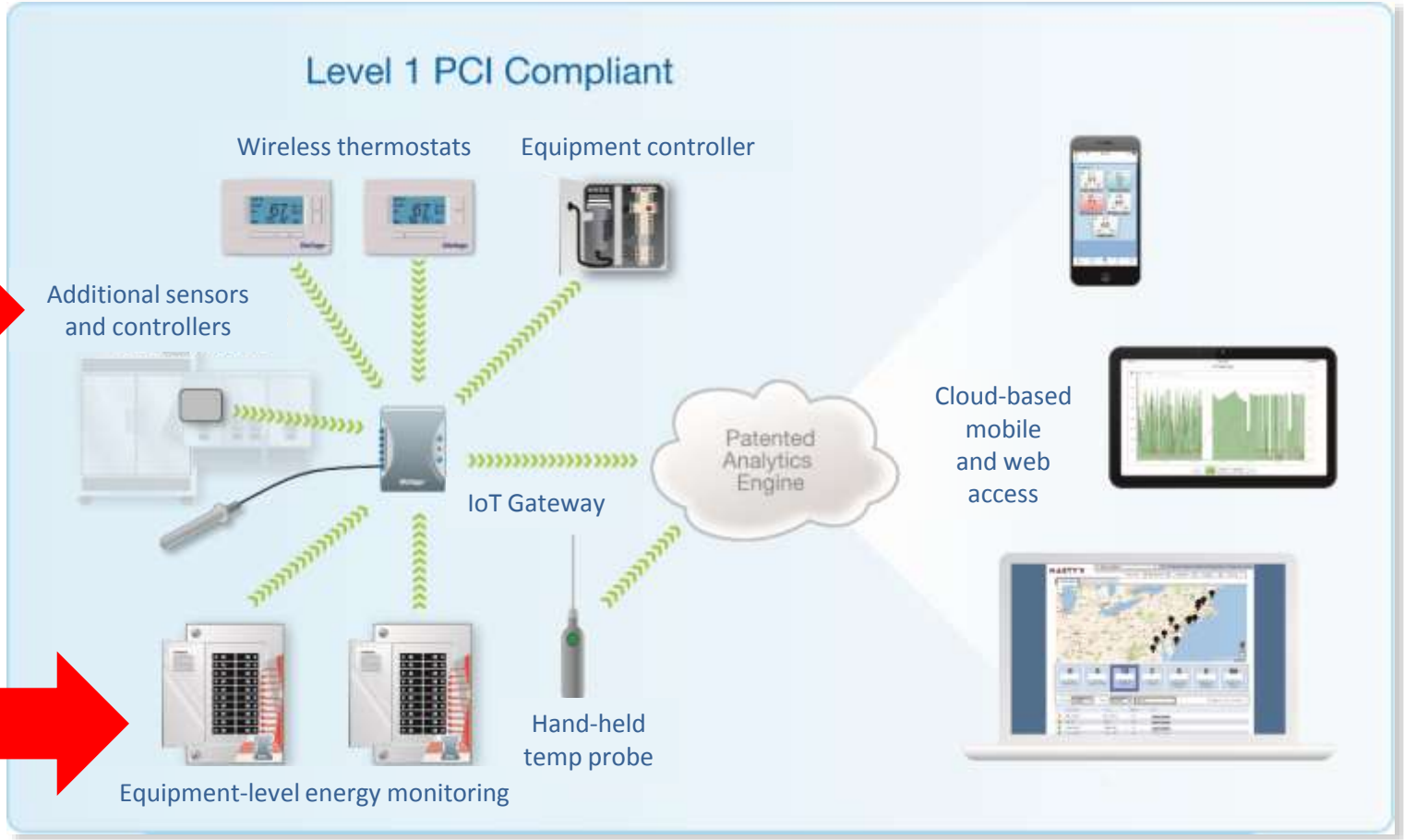


- 5,000+ customer installations, including: Arby's, Wendy's, Dunkin' Donuts, Pizza Hut, Texas Roadhouse, Speedway, Ann Taylor, Five Below

Contact Jay Fiske: jay@powerhousedynamics.com
https://powerhousedynamics.com

SiteSage for Advanced M&V

- 1 minute data intervals
- Wired and Wireless Sensors
- Data types include temperatures, weather, humidity, etc.



Powerhouse Dynamics

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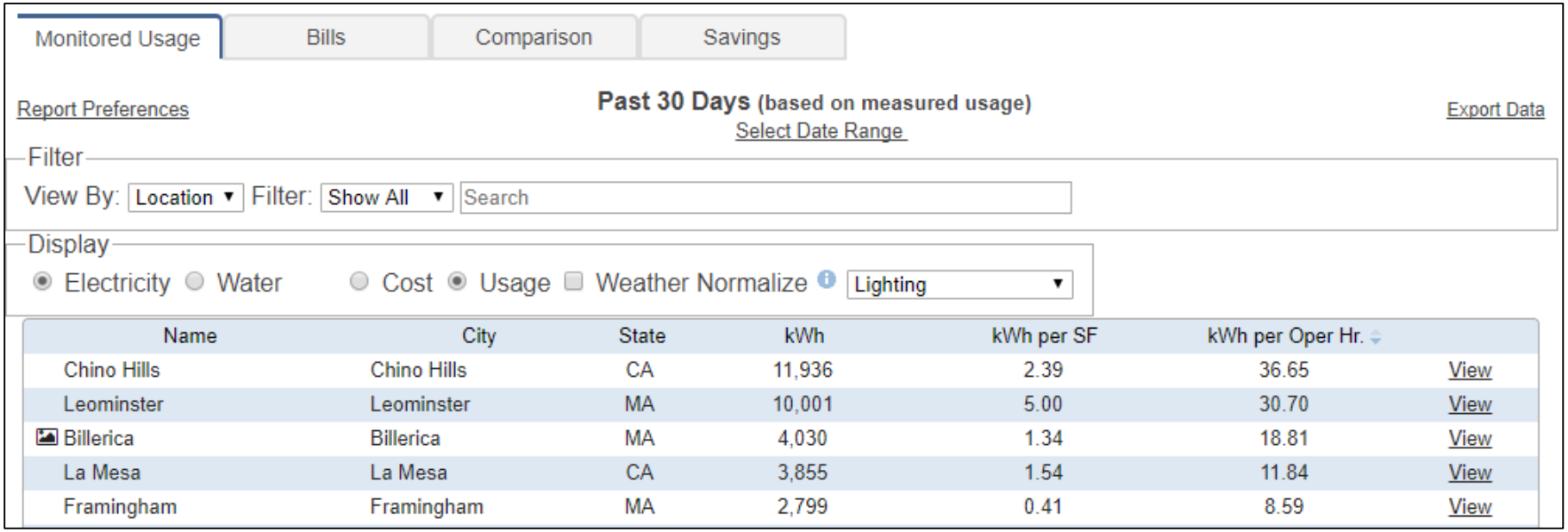
https://powerhousedynamics.com

Variety of Analytical Tools

- Benchmark use/cost by equipment type
- Utility bill savings analysis – control vs. test or weather normalized
- Demand charge heat map
- Benchmark thermostat settings
- Benchmark room temperature (comfort)
- Equipment runtime and kWh/CDD



Name	City	State	kWh	kWh per SF	kWh per Oper Hr.	
Chino Hills	Chino Hills	CA	11,936	2.39	36.65	View
Leominster	Leominster	MA	10,001	5.00	30.70	View
Billerica	Billerica	MA	4,030	1.34	18.81	View
La Mesa	La Mesa	CA	3,855	1.54	11.84	View
Framingham	Framingham	MA	2,799	0.41	8.59	View

Contact Jay Fiske: jay@powerhousedynamics.com
https://powerhousedynamics.com

Intermission: POLL # 3

Plotwatt

Will Duckett

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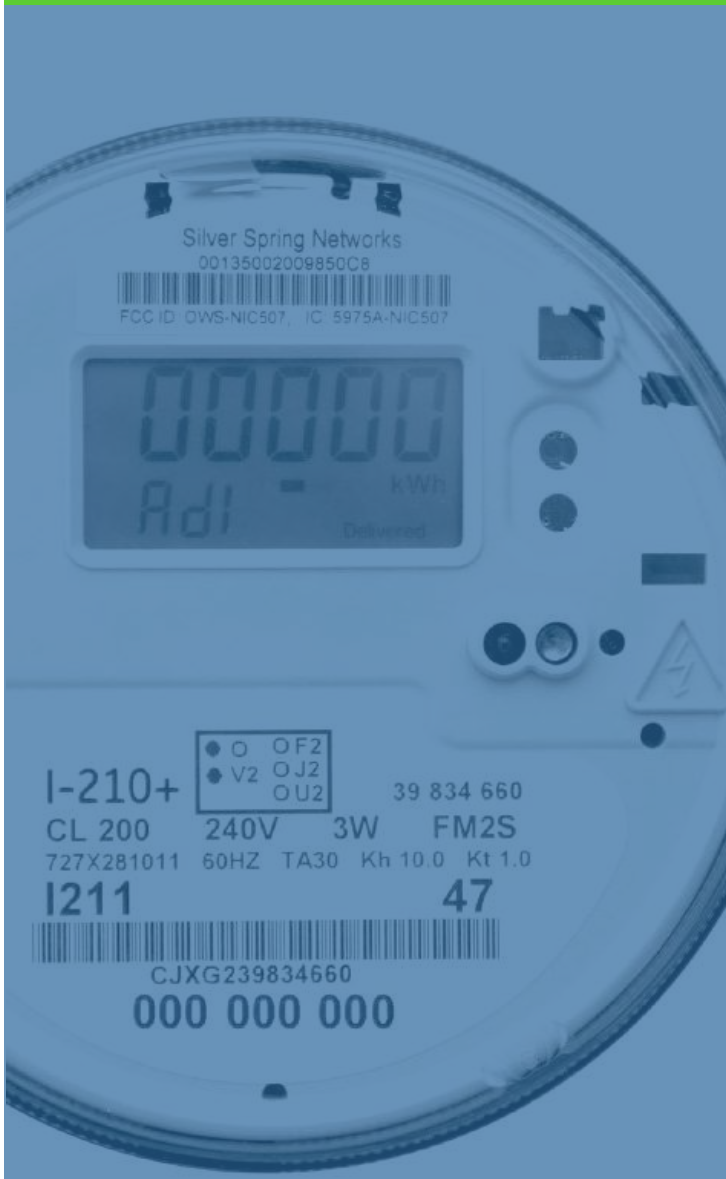
What is PlotWatt?

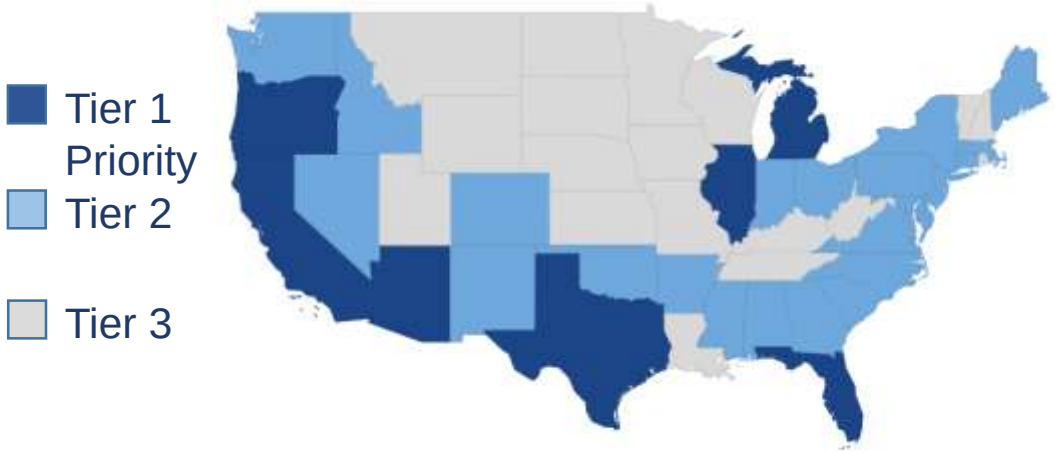
- Energy efficiency via machine learning
- B2B software, serving national multi-location enterprise customers
- Data source agnostic, cost sensitive, results-first orientation, transactional
- Dynamic software platform, built from customer input and designed to meet customers “where they are”
- 9 year track record of no-cost efficiency

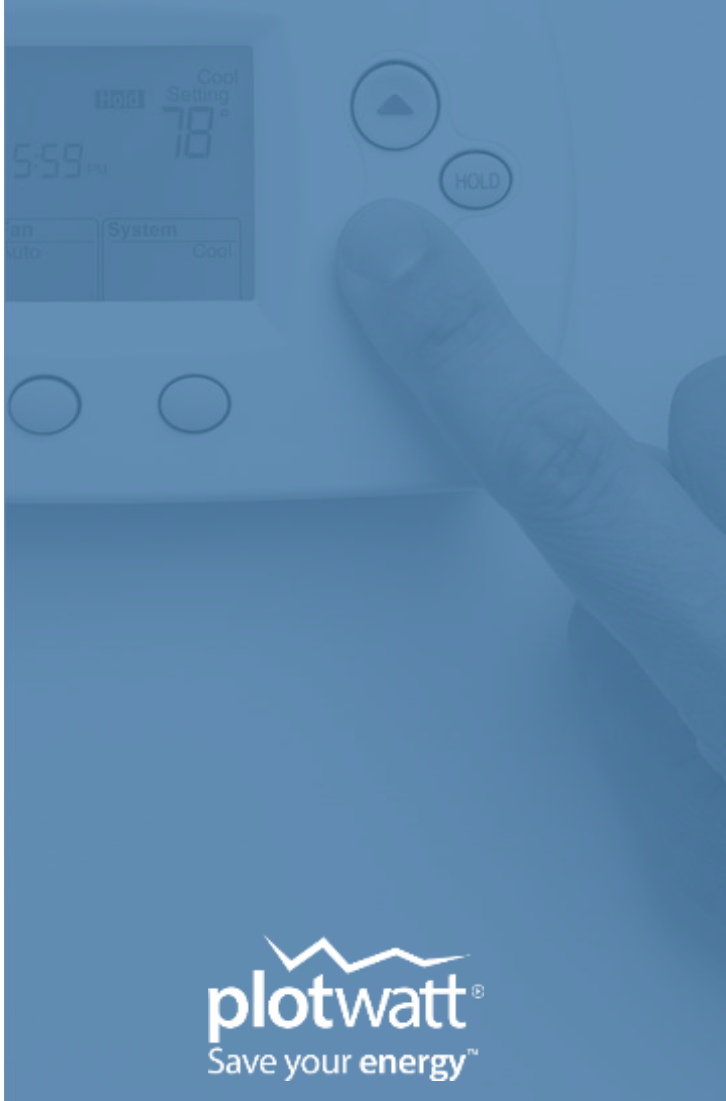


PlotWatt Impact

- Customers in the following verticals:
  - Restaurant
  - Retail
  - Grocery
  - Private Equity
  - Telecom
  - Specialty Healthcare

- Representing 96,000+ meters in the U.S.





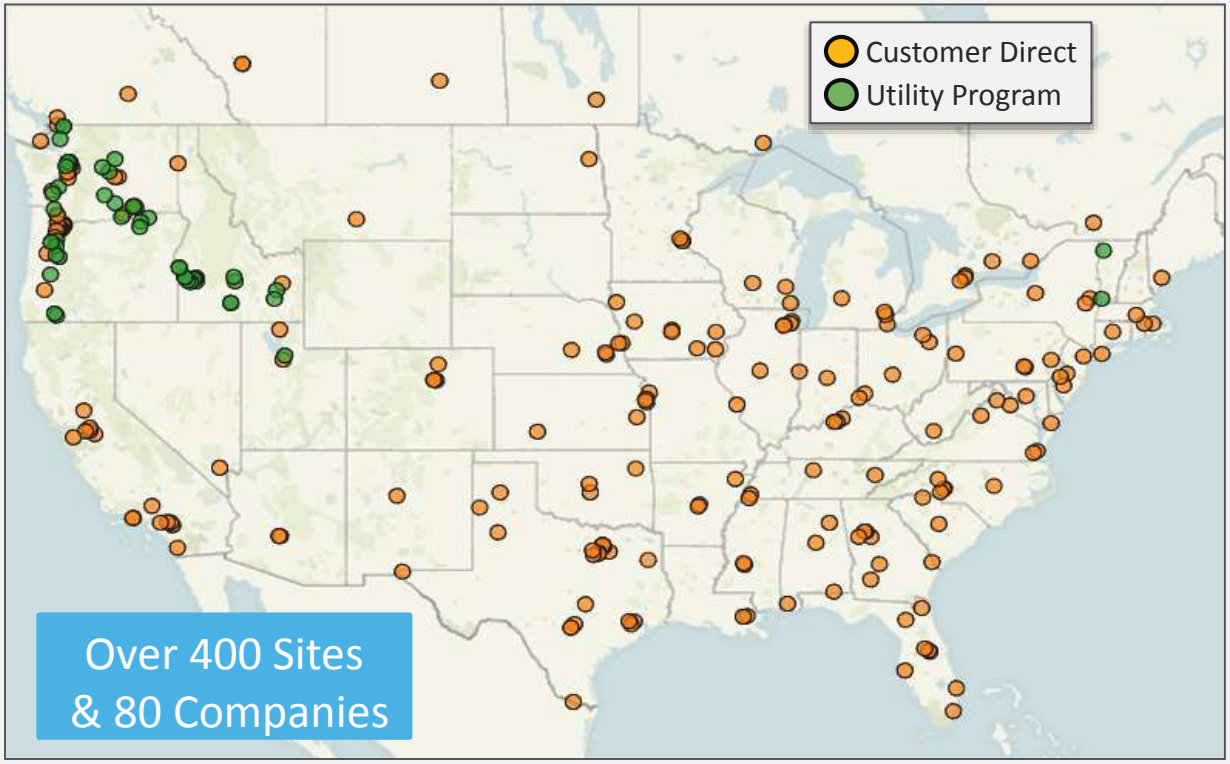
plotwatt®
Save your energy™

PlotWatt Customer Value

Data Consolidation	PlotWatt aggregates AMI interval data, EMS/BAS data, tariffs and metadata, otherwise siloed by utilities and hardware vendors, in one centralized place.
Targeted Site Selection	A national perspective allows for smarter initiatives and simulations, rolled out in the most cost-effective and data-driven manner possible.
Facilities Management	PlotWatt drives operational efficiency with automated messages and budget alerts; saving our customers time, effort, and money.
Independent Verification	Don’t rely on vendor promises of performance. Hold everyone accountable with PlotWatt normalized utility analyses using revenue-grade data streams.

Cascade Energy
Barbara Dusicka
Barbara.Dusicka@cascadeenergy.com

CASCADE ENERGY



Industries Served:

- Food Processing, Distribution, & Cold Storage
- Pulp & Paper
- Primary & Secondary Wood Products
- Mining
- Manufacturing
- Water/Wastewater

Data → Acquire and Store → Share, Analyze, Report

Data Collection and Analysis

Energy Data

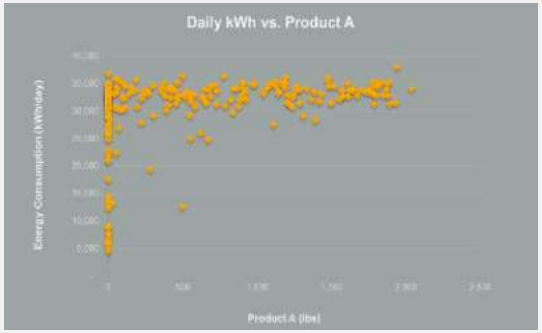
- Metering hardware over cellular or ethernet
- Utility-direct via Greenbutton or sFTP

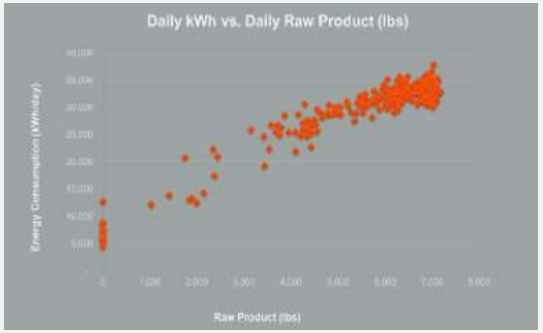
Weather Data

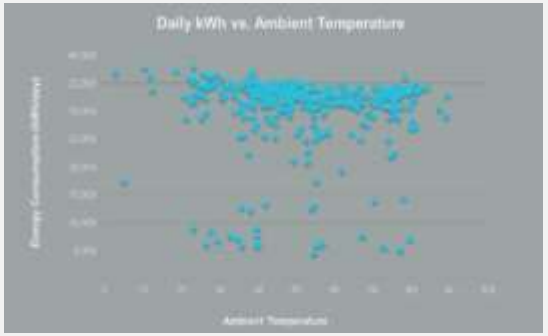
- Darksky.net “hyperlocal” hourly data

Production and Facility Data

- Facility systems regularly send data by sFTP
- Facility staff directly enter or upload data
- Installed metering connected to cellular enabled data acquisition systems







SENSEI®

Cascade Energy®

Whole Building Regression Models

Daily kWh = **A** + **B** (°F) + **C** (weekend) + **D** (lbs) – **E** (Capital Project)

Real-Time Data and Reports with Event Tracking

Gridium

Tom Arnold

tom@gridium.com

Gridium turns smart meter data into *actionable* insights for thousands of C&I customers

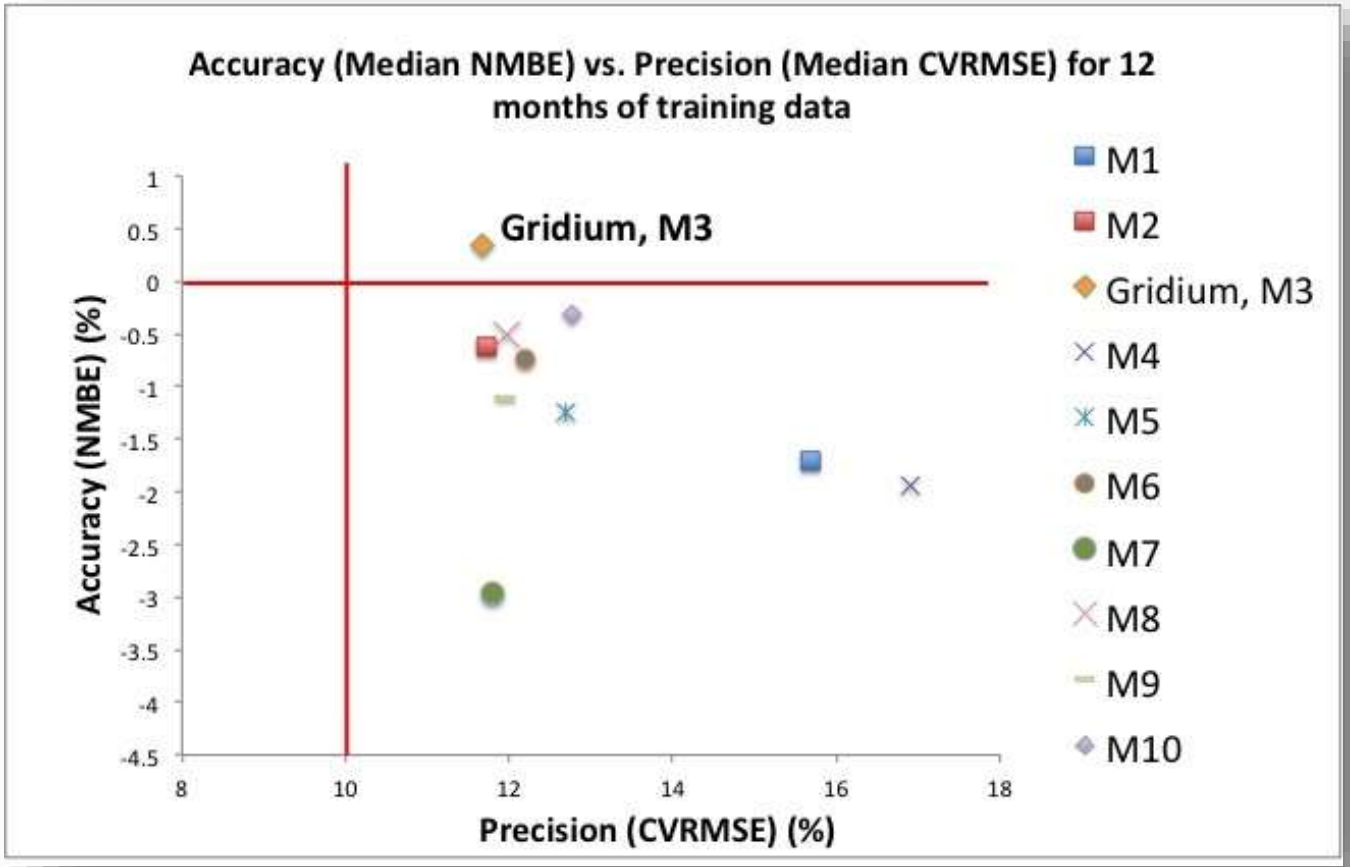
- Identify energy efficiency and demand management opportunities
- Demonstrate operational savings, measure and verify projects
- Prepare and track energy budgets, understan

Gridium | How it works

Gridium extracts data on behalf of C&I customers. Three utility programs also use this technique to reduce IT burdens on data transfer.

Gridium | M&V

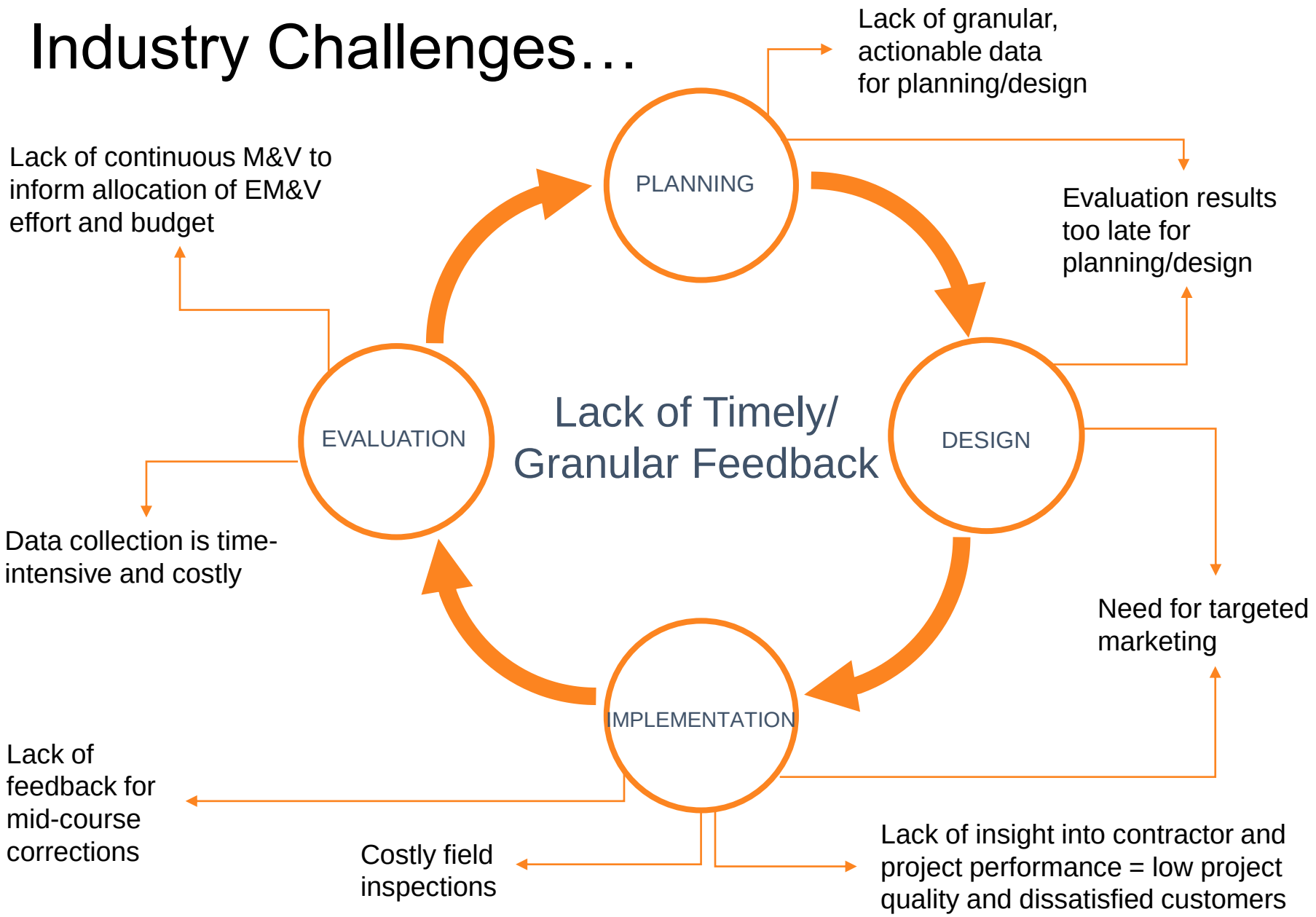
- C&I customers ahead of utilities, leveraged AMI based M&V for a decade
- Gridium M&V algorithm peer reviewed by LBNL. Best-in-class out of sample performance accuracy and precision. Most peers performed well.
- Gridium M&V used in programs in Maine, CA (HOPs).



Source: *Assessment of Automated Measurement and Verification (M&V) Methods*, Granderson et el, July 2015

EnergySavvy
Tim Guiterman
tim@energysavvy.com

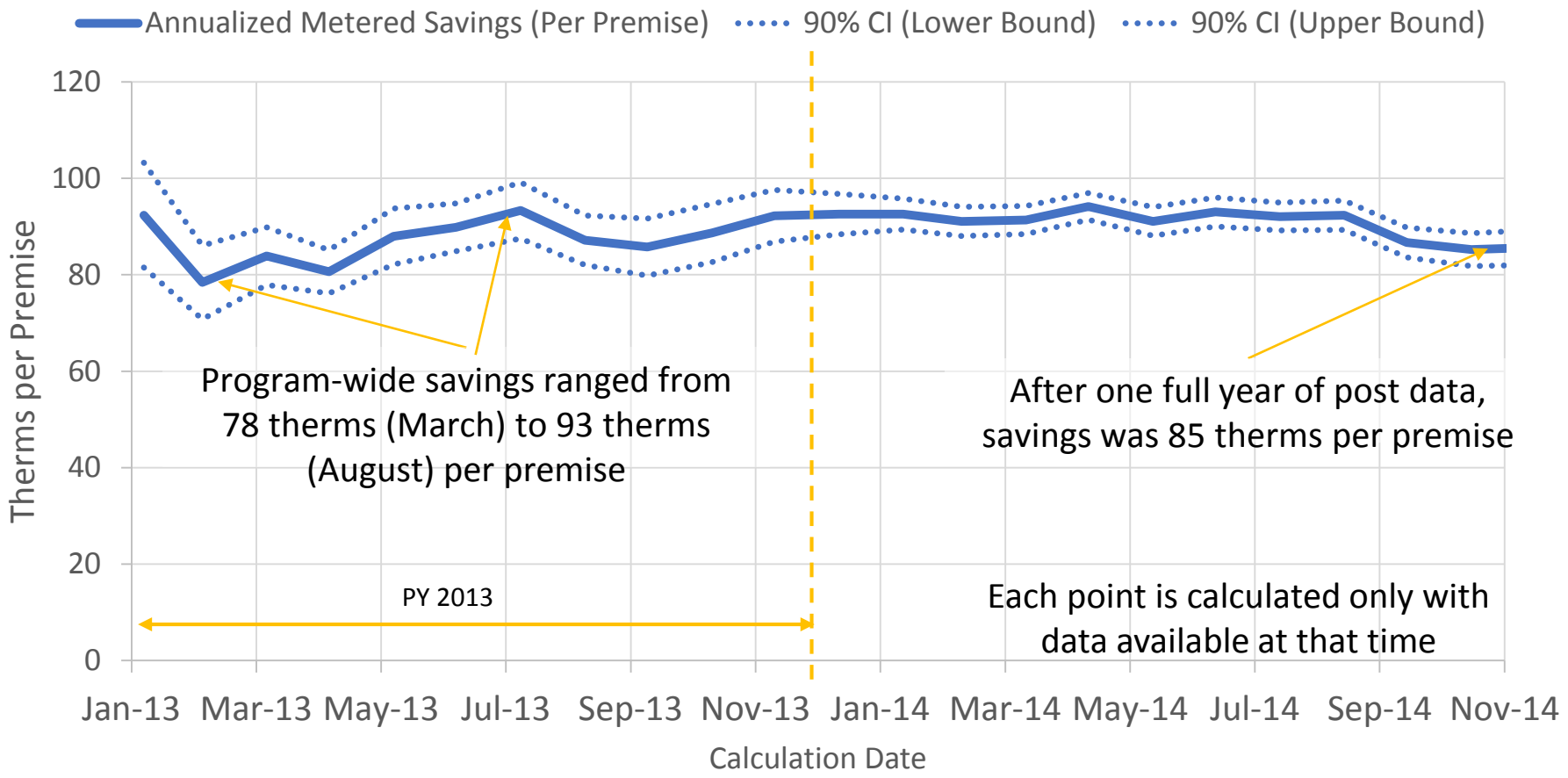
Industry Challenges…



National Grid AM&V Pilot – Findings

nationalgrid

- Aligned with traditional billing analysis
- AM&V provides reliable, early savings estimates



Source: EnergySavvy analysis of 2013 Res HEHE data

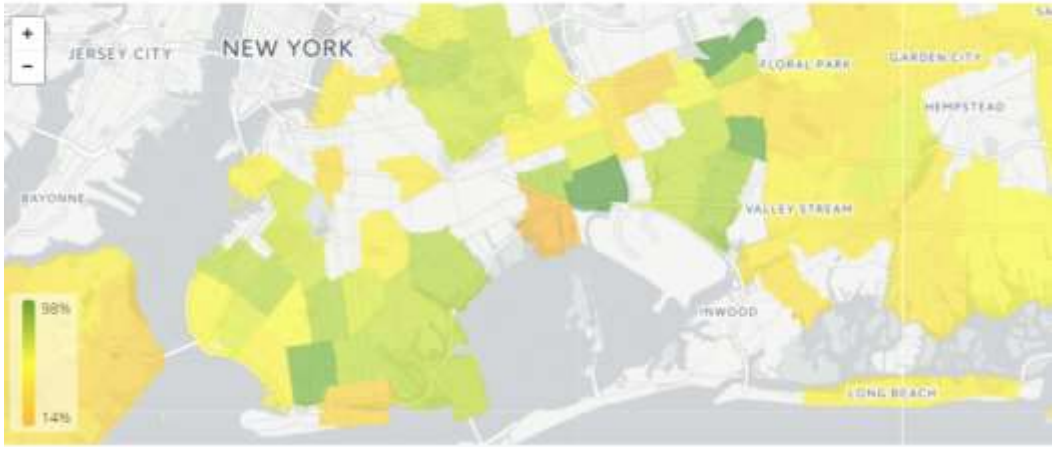
National Grid AM&V Pilot – Findings

- 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



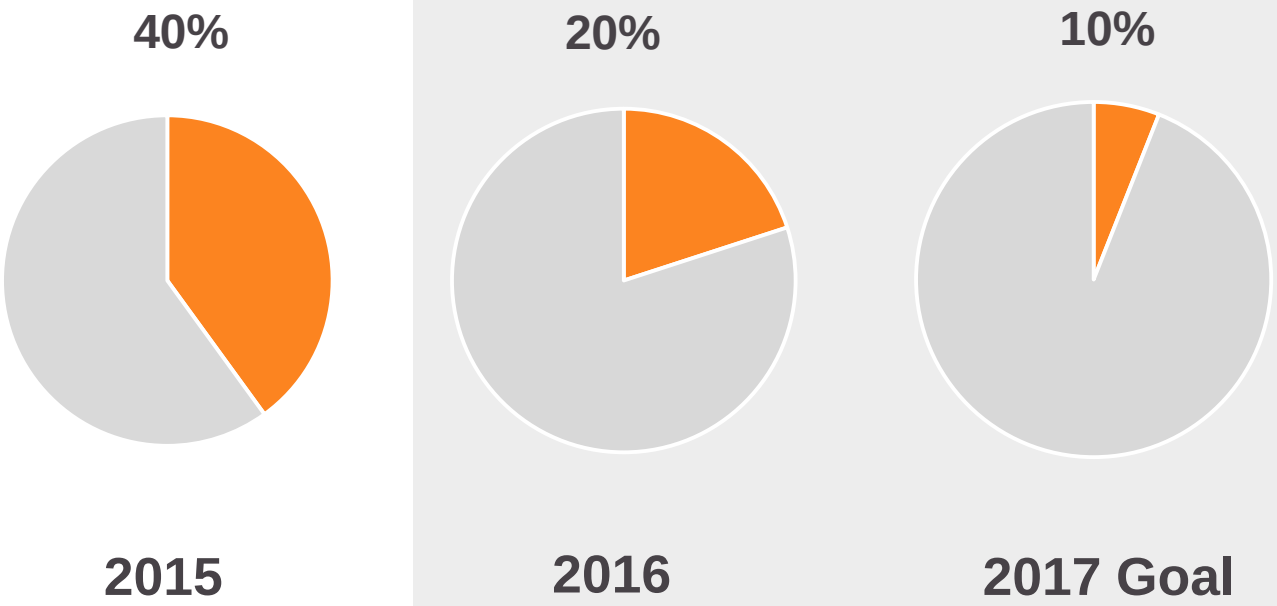
Vendors

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

Attic Inspections

Introduced Intelligent QA/QC



Challenge

Reduce costs and intrusiveness of QA/QC process

Solution

Use intelligent monitoring to reduce and target # of QA/QC inspections

APS shifted approximately 25% of the overall inspection budget to directly improve the program.

**All percentages are the percent of total annual projects (assumes 2,000 projects/year)*

Q&A
???

Links to NEEP Resources

- The Many Flavors of M&V Workshop Slides (http://neep.org/events/2017-regional-emv-forum-fall-meeting)
- Advanced M&V Brief: An Evolving Industry (http://neep.org/sites/default/files/resources/Advanced%20Measurement%20%26%20Verification%20%28M%26V%29%20Brief%20-%20An%20Evolving%20Industry.pdf)
- Auto M&V Industry Brief: How Fast is the EM&V Paradigm Changing? (http://neep.org/auto-mv-industry-brief-how-fast-emv-paradigm-changing)
- Advanced Building Analytics Tool List (http://neep.org/initiatives/emv-forum)

- Contacts

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- Claire Miziolek, cmiziolek@neep.org, 781-860-9177 x115

Upcoming Events

NEEP webinars:

- Smart Energy Homes Virtual Workshop - Dec 13
- Another Rapid-Fire Software Webinar – TBD 2018

Industry events:

- HPC New York—Feb 13-14
- AESP Annual Conference – February 19-22
- Smart Energy Summit —February 19-21
- GLOBALCON – March 21-22
- Getting to Zero Forum – April 17-19
- HPC National- April 23-26

THANK YOU and HAPPY HOLIDAYS