Better Buildings®
U.S. DEPARTMENT OF ENERGY

Quietly Plotting the Next Revolution: Smart Buildings

Wednesday, May 11

2:00-3:15 PM

U.S. DEPARTMENT OF ENERGY

The Next Revolution: Smart Buildings

Amy Jiron

U.S. DEPARTMENT OF ENERGY

Building Energy

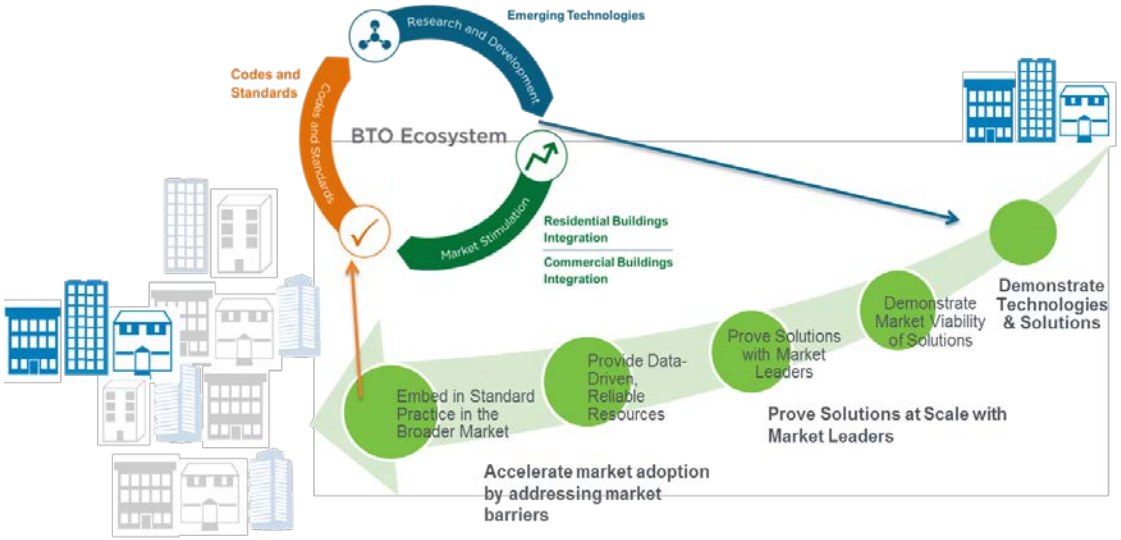
- $410 billion/year
- 75% of the nation's electricity
- Contributes 40% of greenhouse gas emissions

Building efficiency products represent $60 billion in U.S. revenue; up 43% over the last 4 years.

Efficiency through High Impact Technology

Goal: The High Impact Technology (HIT) Catalyst is designed to help identify and prioritize cost-effective, underutilized, energy-efficient technologies so that DOE can focus resource development and deployment activities.

Strategic Emphasis: Accelerate underutilized technologies into the market through pre-identified and pre-defined pathways (Innovation Challenge, Technology Demonstration, Technical Resource development, Adoption Campaign). The focus at all stages is on collaboration across applicable stakeholder groups.



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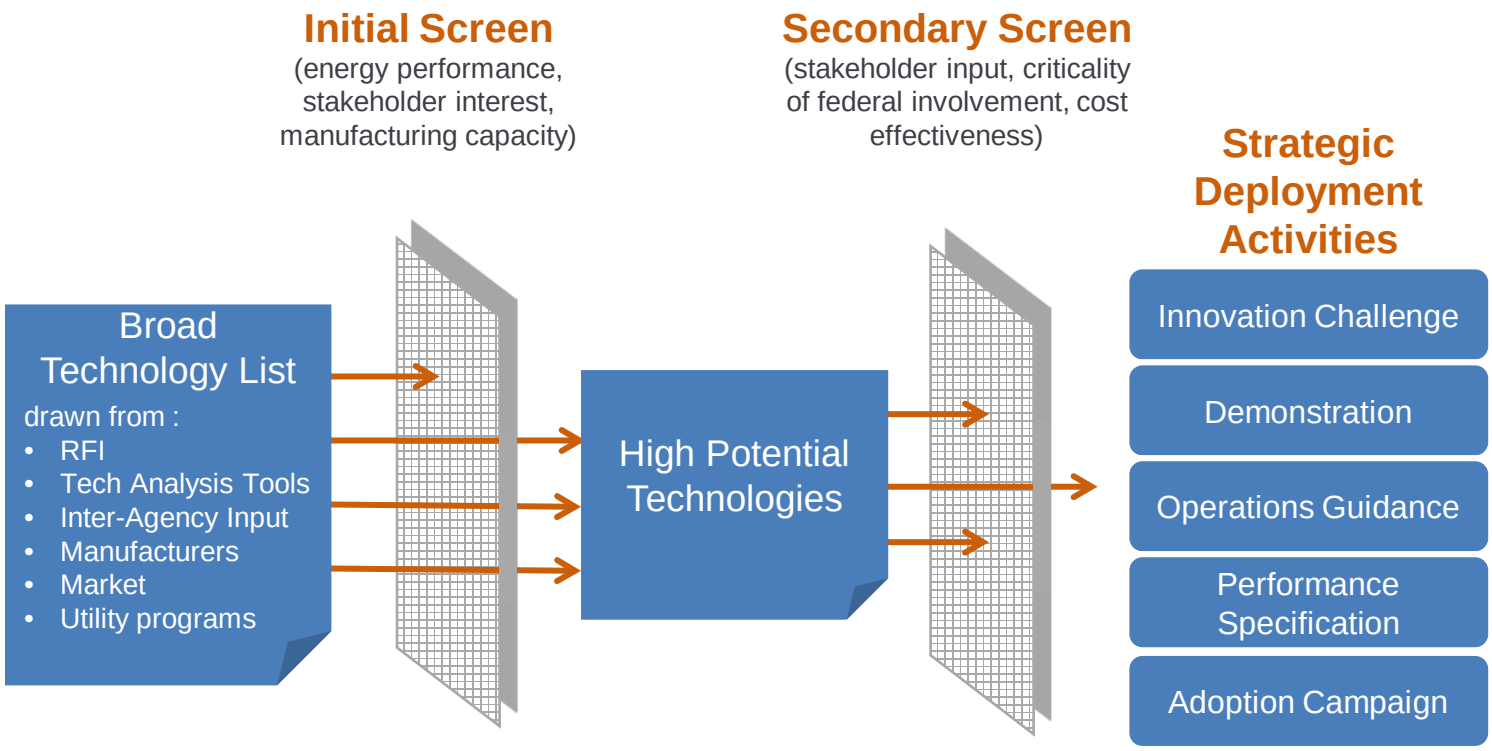
Identify, Evaluate, Prioritize Building Technologies

Deployment prioritization enables partners to focus on market-ready, high potential technologies in a shifting landscape with multiple, complicated choices.



Evaluating the Next Technologies: Prioritization

Phase 1: The **HIT Matrix** helps us identify market ready technologies including:

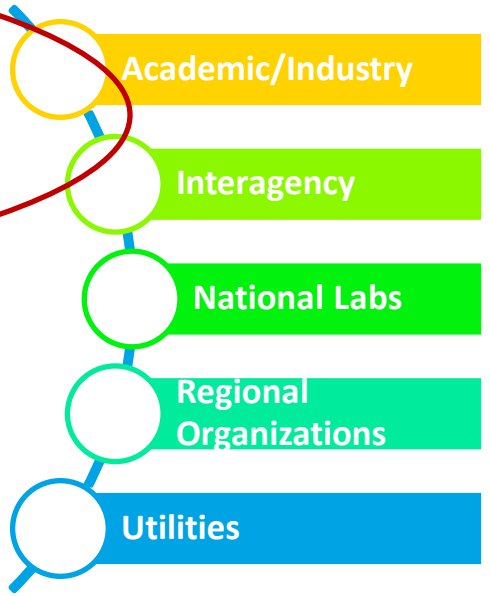
- Information on technologies developed through annual RFI, ET, P-Tool measure input form and past/current DOE projects.
- Technology-specific and national energy savings potential values.
- In total, over **400 measures** to evaluate.
- The Matrix includes screens for: 1) energy savings opportunity and deployment readiness and 2) market factors.

Phase 2: **Workshops** provide perspective on market factors and feedback on priority technologies identified in the Matrix:

- HIT Industry Roundtable + Tech Day at the Better Buildings Summit
- 25 organizations from academia, owner/operators, utilities, regional energy organizations, technology providers and industry
- Joint GPG/HIT RFI open to receive information from technology providers

Prioritization: Major Takeaways from Workshops

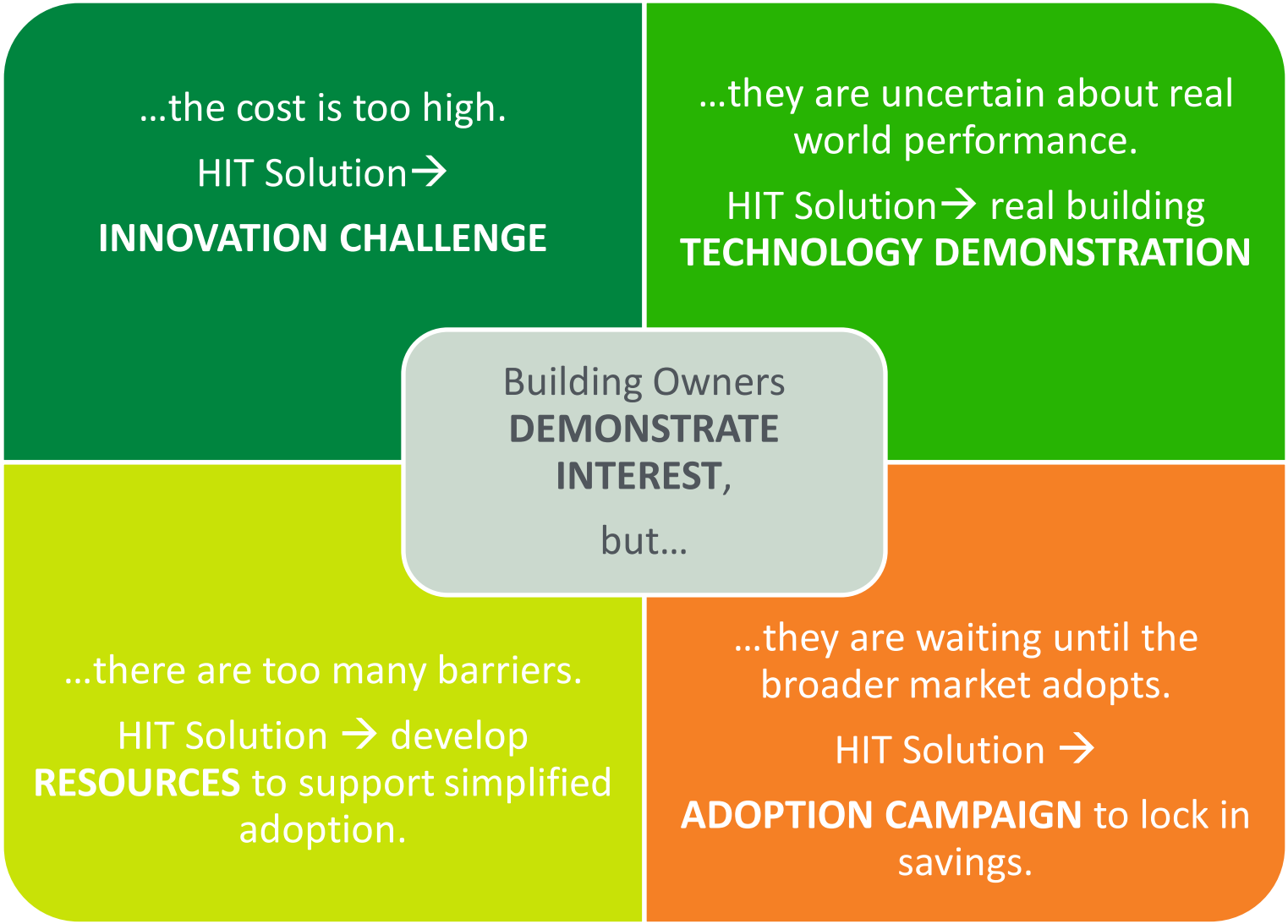
- Remain aware of the need for **technology groupings, applications and packages** rather than specific technology types; address the synergies between technologies
- **Controls** in general – across all load types – are an area where much work needs to be done. There are many competing platforms, protocols, etc. and many different ways to implement the control systems (individual fixture/load level, building level, etc.). **End users are confused by the choices, afraid of technology obsolescence, and need guidance in this space.**
- Don't always assume that a pure technology solution is the answer. In some cases, **best practice or operational solutions can yield the same results at much lower costs.**
- Data on "real use" and end user behavior is extremely important in weighing the benefits of a technology, as the **gap between "real use" and "ideal use"** can be large.
- There is value in **enabling technologies** such as smart metering, though it may be difficult to quantify independently.
- Generally speaking, **there can never be too much independent, third-party demonstration data**.



HIT Prioritization List 2016

Measure Name	National Potential (Tbtu/Yr)	Market Criteria
LED Troffers with Controls (Ongoing from 2015)	500-1000	LED technology offers new controllability for whole building energy reductions; assess rapidly changing offerings and interactions.
Energy Management and Information Systems (Ongoing from 2015)	**1000+**	Provide end-users with access to verified solutions for better cost-effectiveness and to address data overload by end-users. Track market needs and adoption of energy savings enabled through building information, control and automation.
Exterior Shading Attachments (Ongoing from 2015)	100-500	Widely adopted in other parts of the world; assess barriers to retrofits in the U.S. including case studies with real performance information.
Cold-Climate Heat Pumps	1000+	Cold-climate heat pumps offer significant savings and benefits over other heating options with a high level of market interest, but end-users still have questions about performance.
AFDD for RTUs and Air Handling Units	100-500	The installed base of RTUs and AHUs in commercial buildings is vast. Simplified and streamlined alerting and automation for unit performance will enable low cost energy improvements.
Alternative Refrigerants	GWP reductions + 100-500	Alternative refrigerants are necessary to meet the quickly-evolving domestic and international regulatory landscape while balancing the need for energy efficient operation.

Core Activities Support National Impact



Stimulating Adoption: Campaigns

- Key industry **partnerships** for outreach and technical assistance
- Joint DOE/industry **recognition** for best practices
- Resources and technical **assistance** from national experts
- **Hub** for technology information: case studies, specifications, guidance, incentives
- Commitments enable DOE to track **metrics**

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Results!

- **500 leading stakeholders (YOU!)**
- retrofit or replacement of:
  - **56,600 packaged heating/cooling units (Advanced RTU Campaign)**
  - **500,000 troffer lights (Interior Lighting Campaign)**
  - **500 million sq. ft. of parking space lights (LEEP)**
- 2 innovation challenges, 20 ongoing and completed real building demonstrations and 3 (soon to be 4) adoption campaigns.

The energy savings from these activities is equivalent to:

38,000 homes

340,000 acres

960,000 barrels of oil

$57 million saved and
590 million pounds of avoided greenhouse gases.

Agenda

- What are smart building analytics? What resources are available to help make better choices about Energy Management and Information Systems?
- Real Time Energy Management: Unlock Data to Drive Market Transformation
- Strategic Energy Management and Advanced Energy Management and Information System Offerings: Join and Learn
- DOE's Newest Campaign: Smart Energy Analytics
- Questions and Discussion

Today's Presenters

- Amy Jiron
- Josh Clyburn, NYSERDA (here in spirit)
- Drew Quirk, Xcel Energy

Moderating:

Jessica Granderson, Lawrence Berkeley National Laboratory

Energy Management and Information

Jessica Granderson

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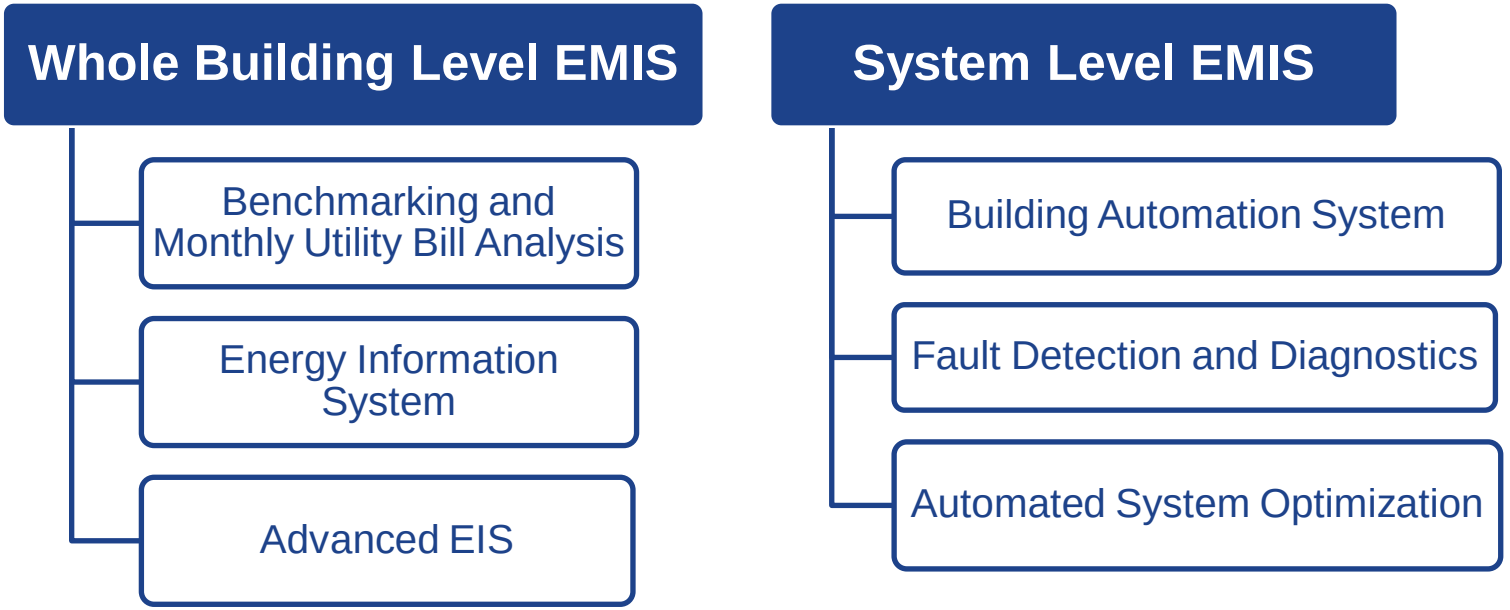
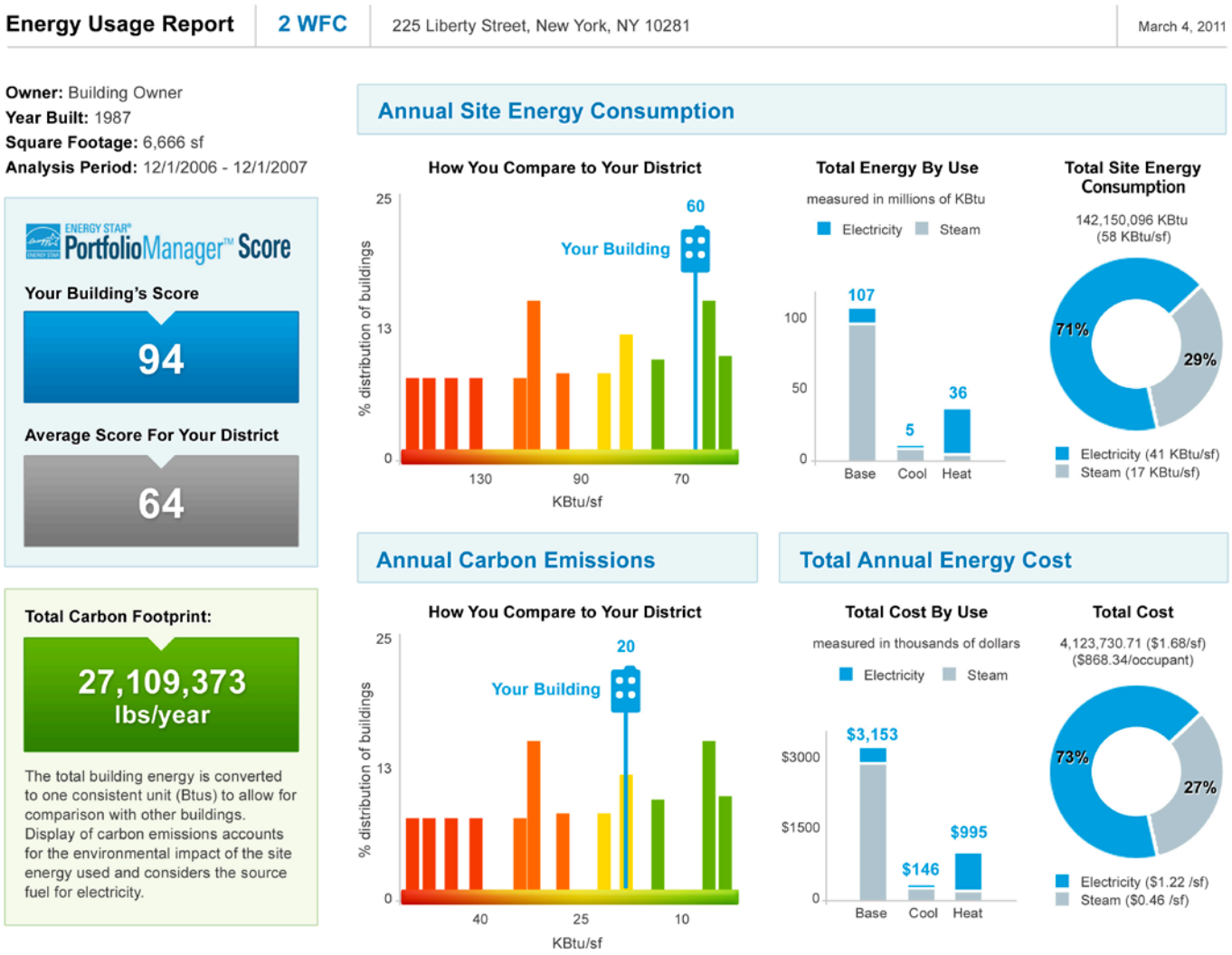
Energy Management and Information Systems (EMIS)

EMIS are a broad family of tools to monitor, analyze, and control building energy use and system performance; save up to 20% through *operational* measures



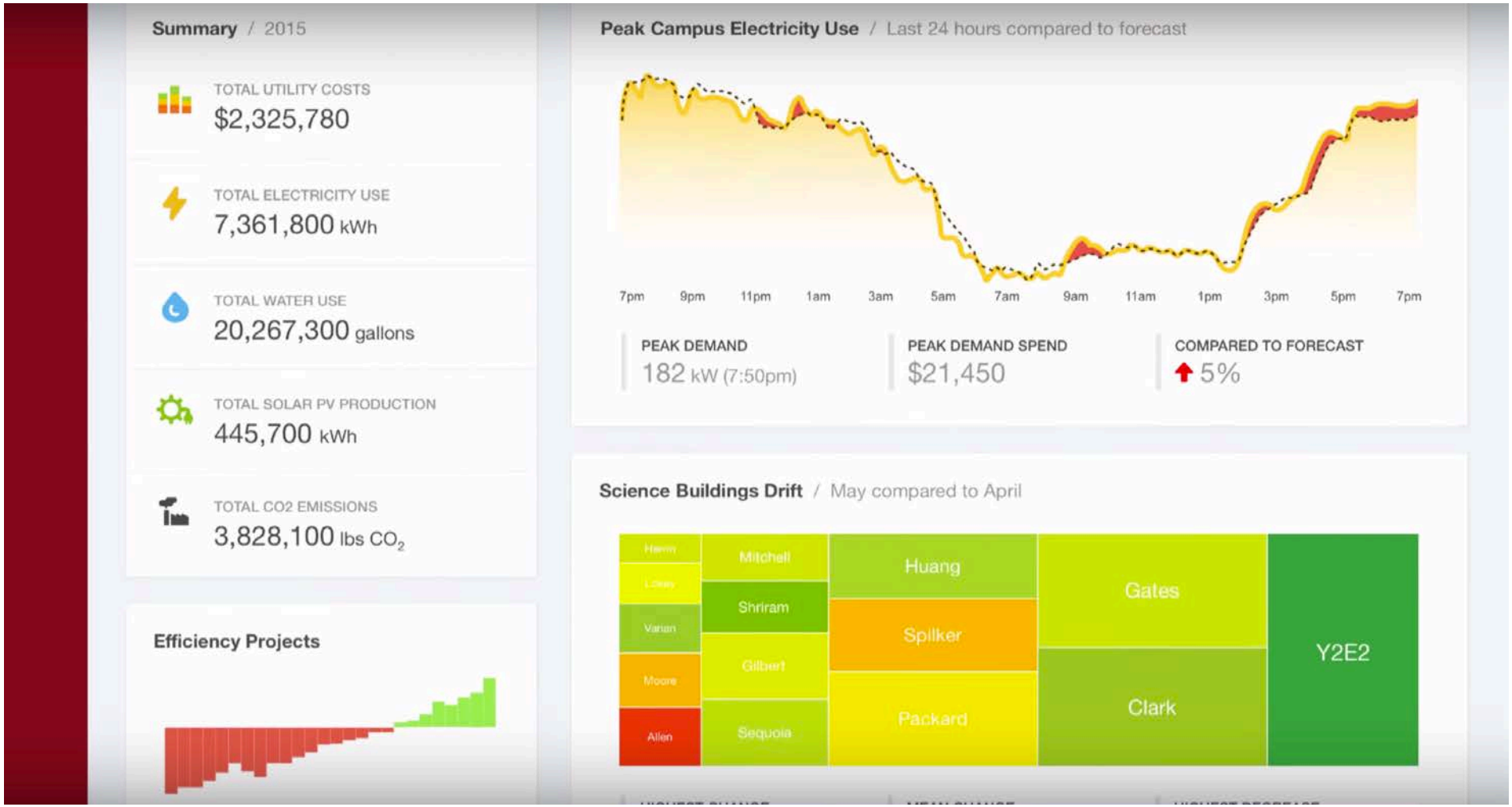
* The boundaries can be fuzzy; some tools cross categories, e.g., energy information systems with FDD and benchmarking capabilities

EMIS Example: Benchmarking



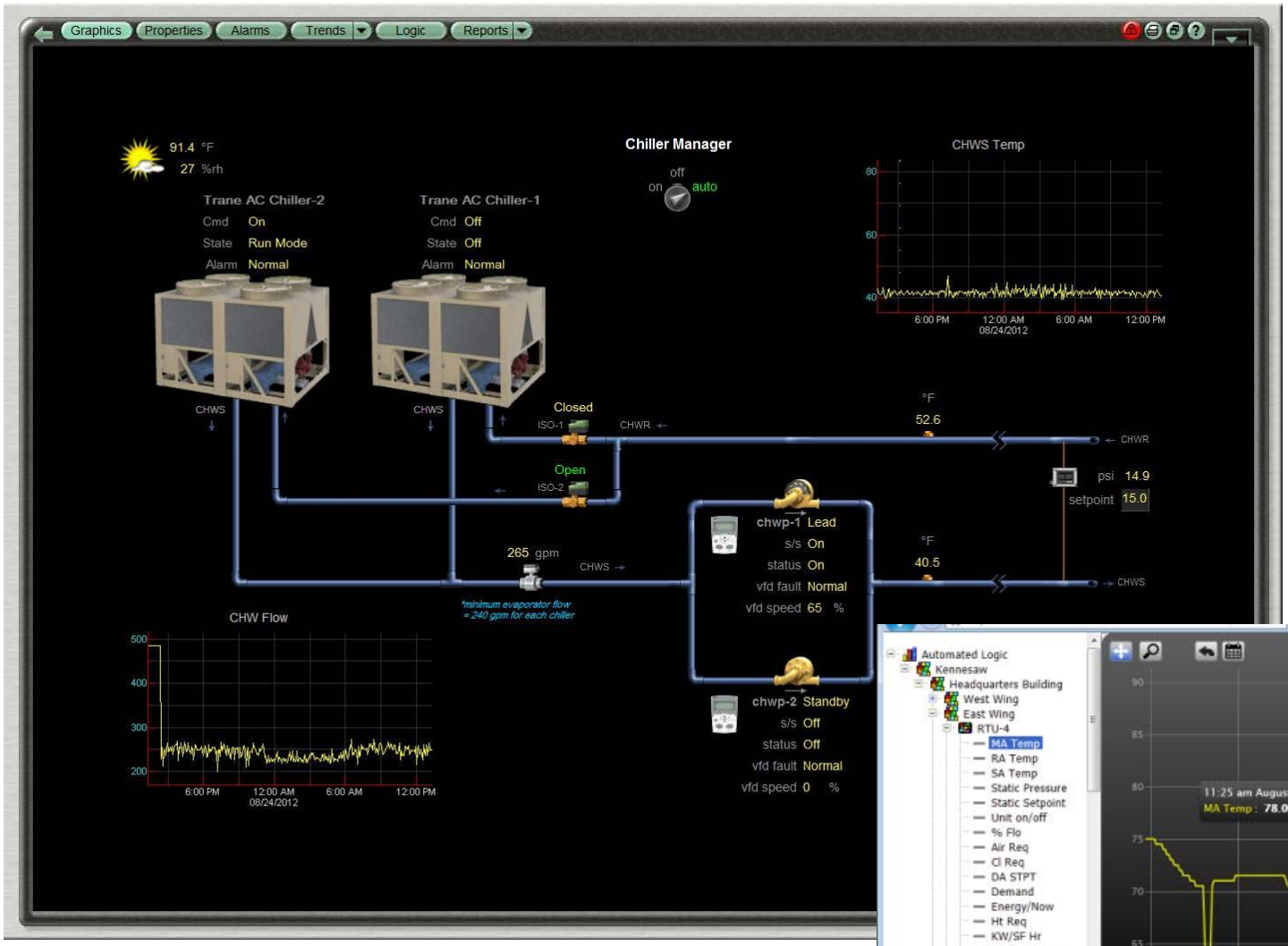
Source: Performance Systems Development

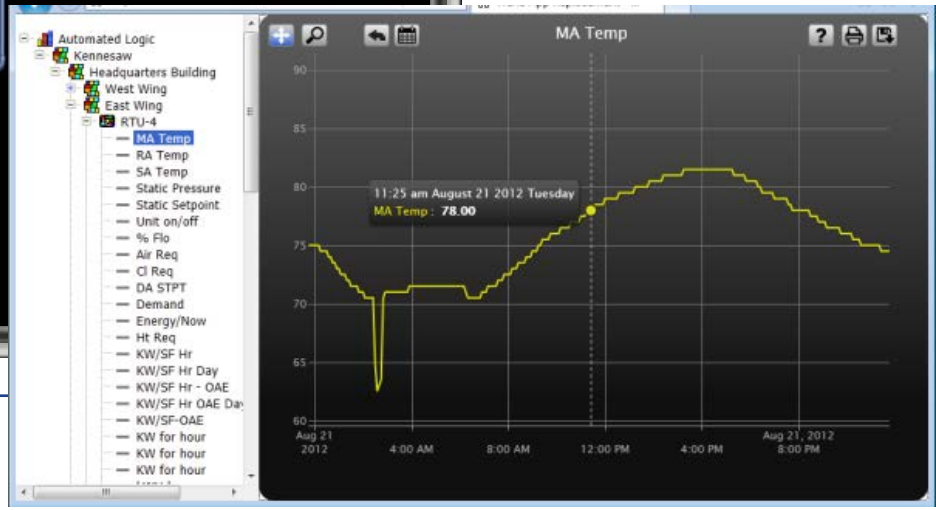
EMIS Examples: Energy Information System



Source: Lucid

EMIS Example: Building Automation System





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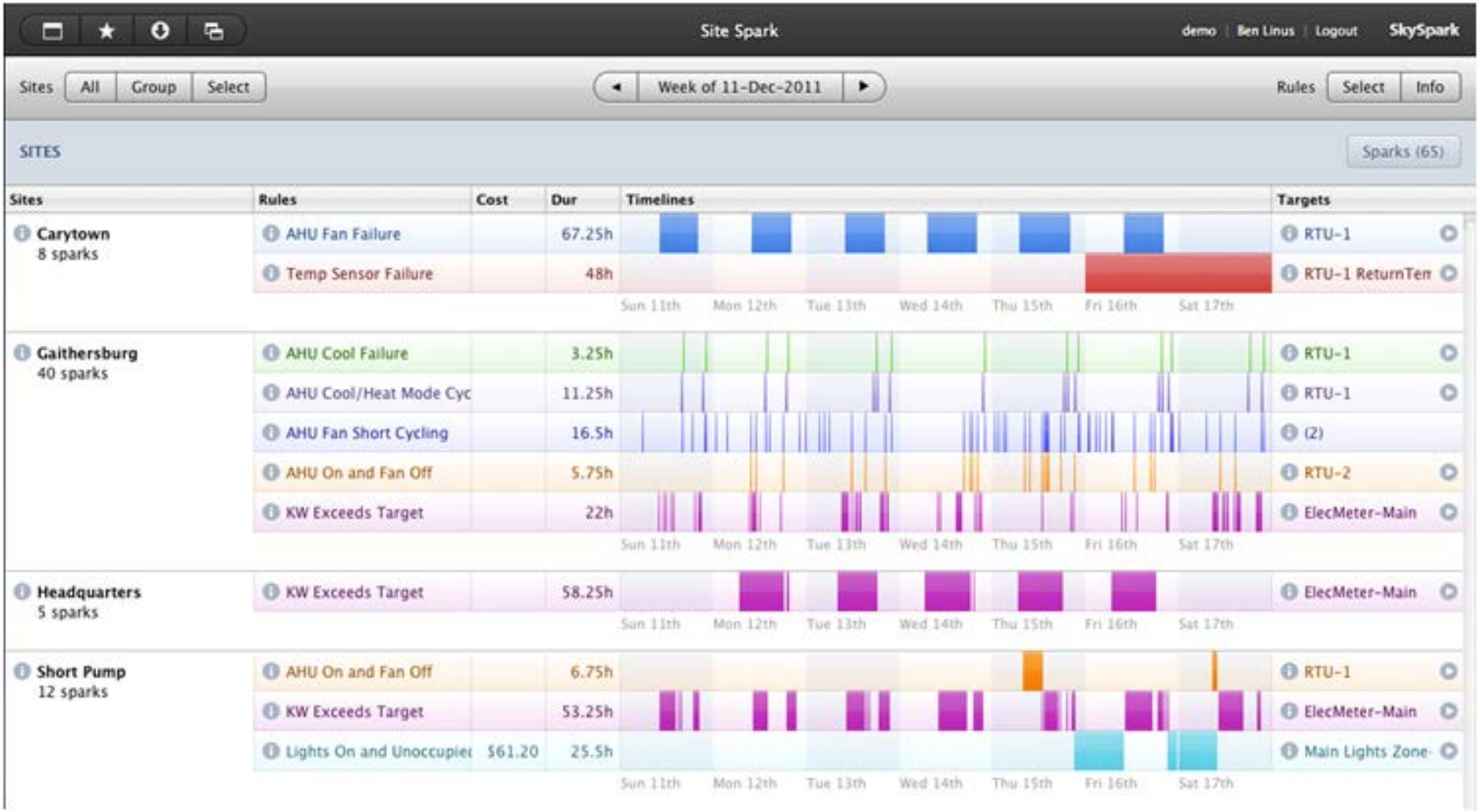
Source: Automated Logic

EMIS Examples: Fault Detection and Diagnostics



Source: SkyFoundry

EMIS Examples: Automated System Optimization

Source: BuildingIQ

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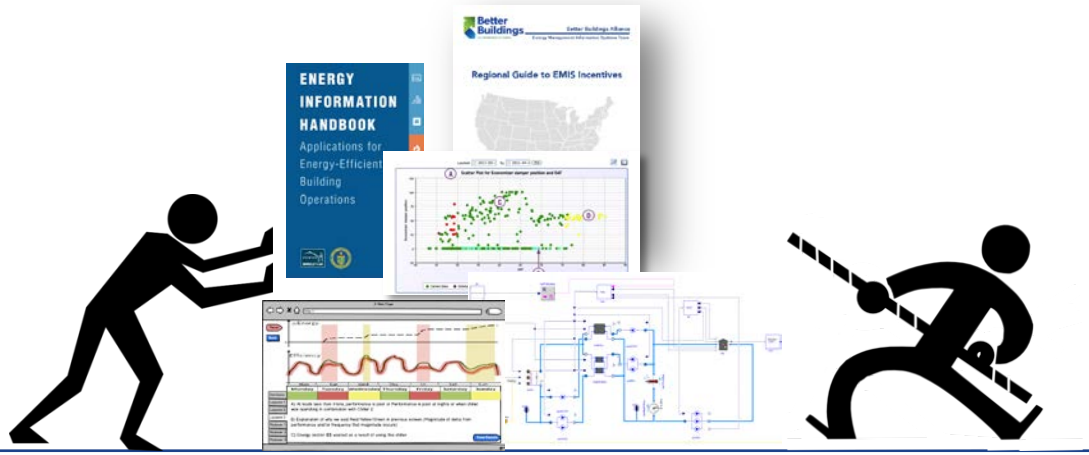
EMIS Project Team Overview

Support members in adopting or expanding use of EMIS

- Laboratory technical expertise and market intelligence connects utilities, owner/operator community, vendors of commercial tools
- Development of new analytical approaches, **identification of best-practice uses**
- **Knowledge and technology transfer** to **facilitate market push and market pull**



LBNL w/vendor community

LBNL w private and public sector, vendor community, utilities

EMIS Resource Examples

- Synthesis of existing EMIS resources, “Cliff’s Notes”
- Hyperlinked regional guide to EMIS utility incentives
- Vendor overviews and guest login access
- Procurement support materials – spec, RFP, selection guidance
- Primer to organizational EMIS use
- Peer learning, guest presentations

BBA EMIS Team

THANK YOU

eere.energy.gov/betterbuildingsalliance/EMIS

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Real Time Energy Management: Unlock Data to Drive Market Transformation

Josh Clyburn, NYSERDA

U.S. DEPARTMENT OF ENERGY

What is Real Time Energy Management?

RTEM involves the installation of monitoring sensors and software systems to track and analyze energy usage data.

More granular the data (e.g. from building systems and devices) = more that potential savings.

Identified energy efficiency improvements often include both daily operations and capital improvements.

RTEM Systems:

- Monitoring equipment
- Energy related tracking software

RTEM Services:

- Review energy usage data in real-time
- Detect anomalies and correct abnormal patterns immediately
- Search data trends for energy efficiency opportunities

Unique Need for RTEM Advisor(s)

The RTEM Advisors will:

- Document and evaluate best practices for RTEM
  - installation, savings calculations, and reported savings
- Help vendors and customers implement lessons learned
- Help identify the direct and indirect benefits of RTEM
- Provide insights into technology, market vulnerabilities, and customer expectations
- Assist NYSERDA in evaluating vendor capacities and new business models
- Leverage understanding of customer needs to help NYSERDA build an effective training platform.

RTEM Overview

- Proposed 10 year budget
  - $46.5 Million total
    - $30.5 Million in incentives 2016-2020
    - $6.6 Million pilots
    - $9.4 Million training, tools, implementation
- Direct Savings
  - 170,000 annual metric tons CO2 reduction
  - 1,400,000 lifetime metric tons CO2 reduction
- Indirect Savings
  - Additional 830,000 annual metric tons CO2 reduction
- RTEM Investment Plan, NYSERDA CEF Commercial, filing number 244. New York State Public Commission website Case Number: 14-M-0094.

RTEM Activity Roll-out

2Q 16: Establish Prequalified Vendor List, Launch Incentive Offer, Provide RTEM Advisor

3-4Q 16: Establish Steering Committee, Develop Training Program, Build Pilots

2017: Launch Pilots, Provide Training and Advisor Services, Refine Approach

2018 & Beyond: Develop Guide book, Complete Pilots, Develop Case Studies

Strategic Energy Management and Advanced Energy Management and Information System Offerings: Join and Learn

Drew Quirk, Xcel Energy

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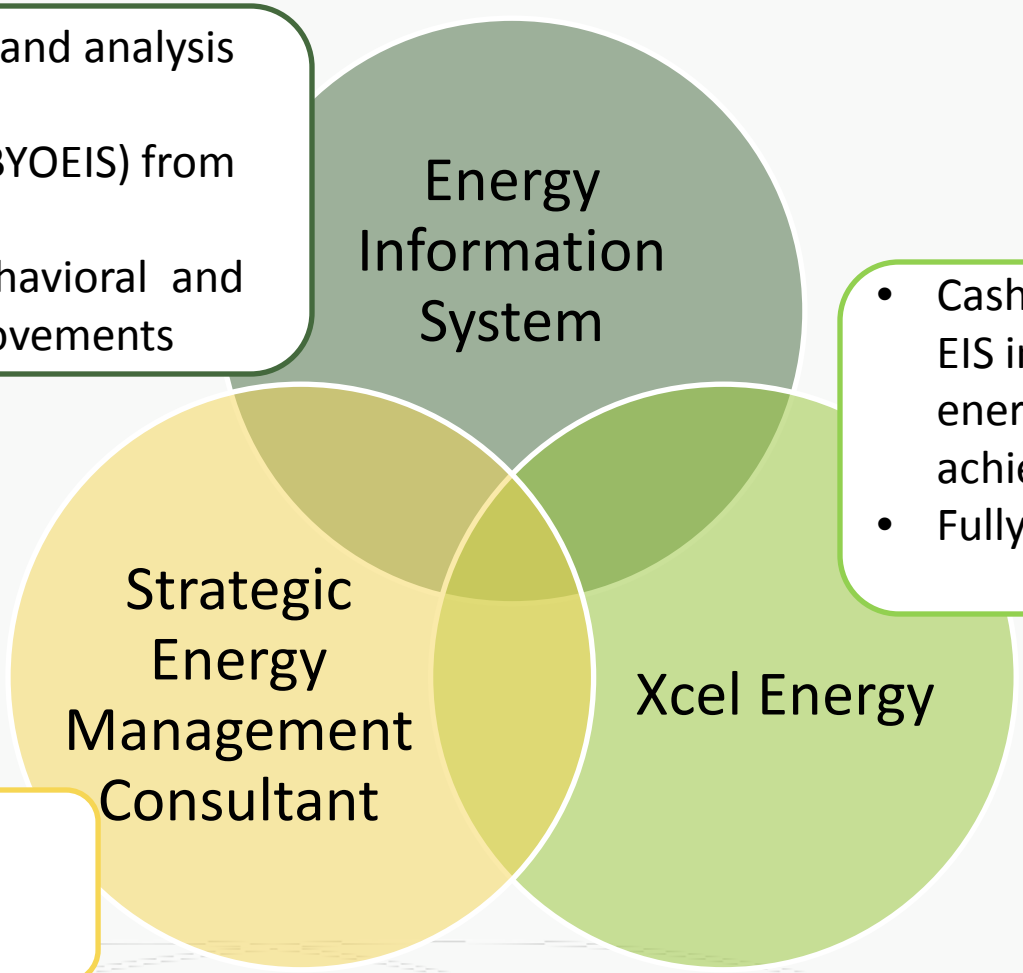
ENERGY INFORMATION SYSTEMS WITH XCEL ENERGY

Drew Quirk – Product Developer

ENERGY INFORMATION SYSTEMS PROGRAM DESIGN

- In depth tracking and analysis of energy usage
- Bring your own (BYOEIS) from XE approved list
- Auto-M&V for behavioral and operational improvements



- Cash incentives for EIS install and energy savings achieved
- Fully-fund SEMC

- SEM Best practices
- EIS Expertise

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THE BUSINESS CASE FOR AN EIS PROGRAM REQUIRED

Energy Savings

- What is the mechanism for energy savings?
- How much energy savings can be expected?
- How can they be measured and verified?

Financial Return

- What are the costs?
- What are the benefits?

Customer Interest

- Is the market ready?
- What additional support is needed?

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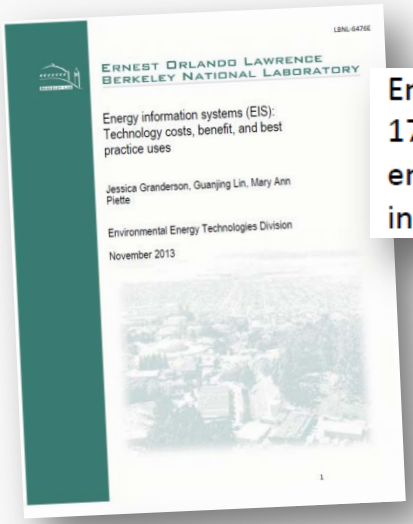
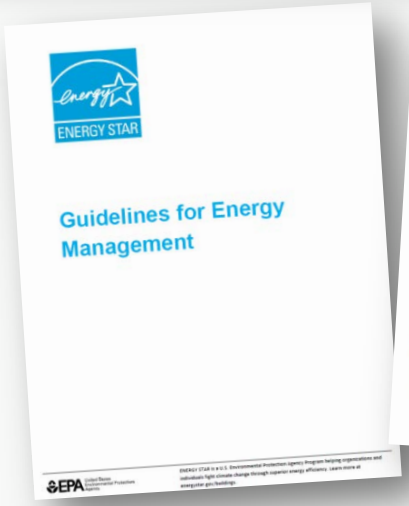
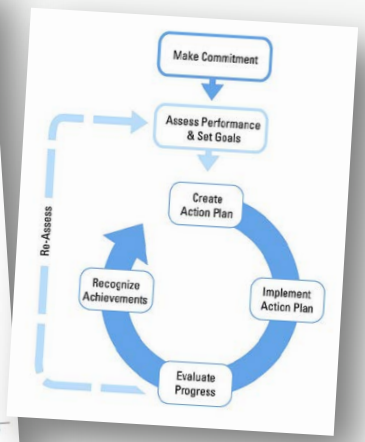
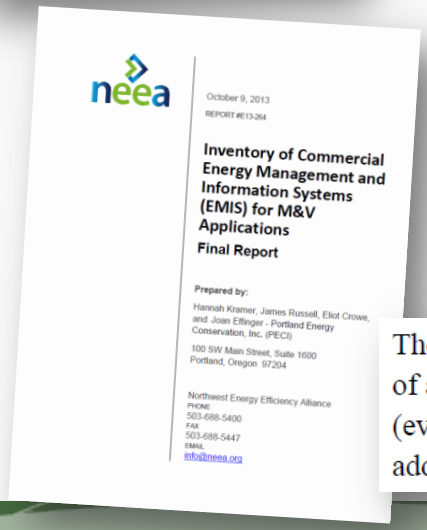
ENERGY SAVINGS



Energy information systems were cited as a critical component in achieving 17 percent median site savings, and 8 percent median portfolio savings; these energy savings were calculated to represent approximately $56,000 and $1.3 million in utility cost savings.



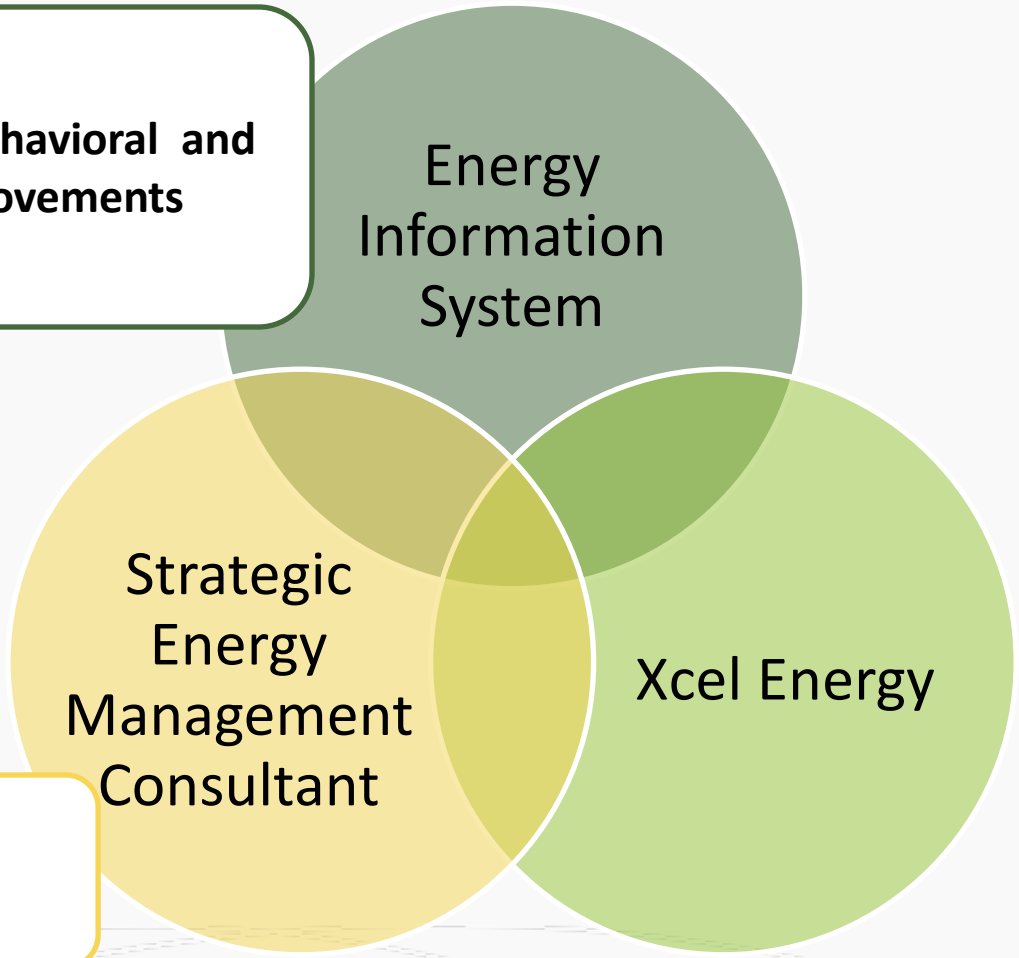




The state of the art in EMIS technology has progressed markedly when compared to capabilities of a few years ago. Utilities have a number of options for EMIS that can support program M&V (even if smart metering infrastructure is not in place), and that offer other beneficial features in addition to the software's M&V capabilities.

ENERGY SAVINGS

- **Auto-M&V for behavioral and operational improvements**



- **SEM Best practices**

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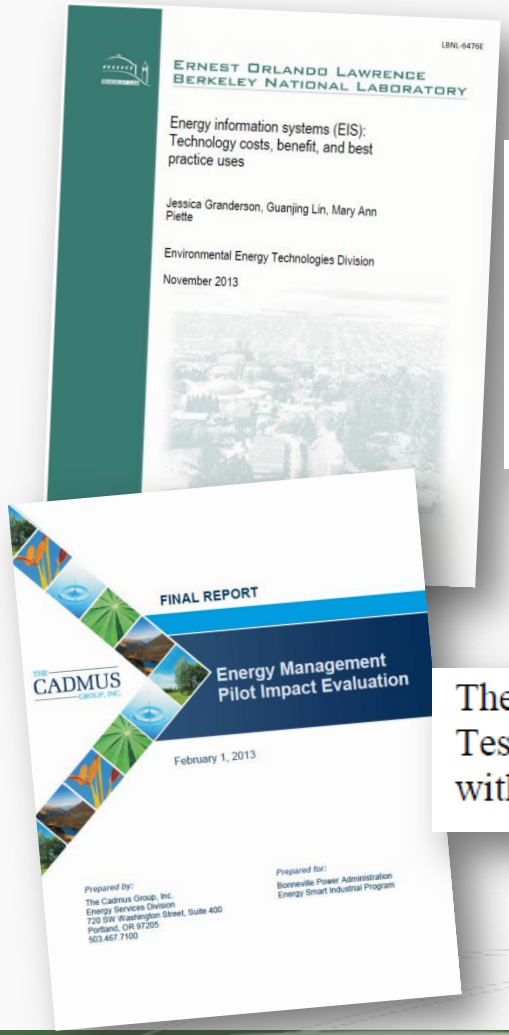
FINANCIAL RETURN



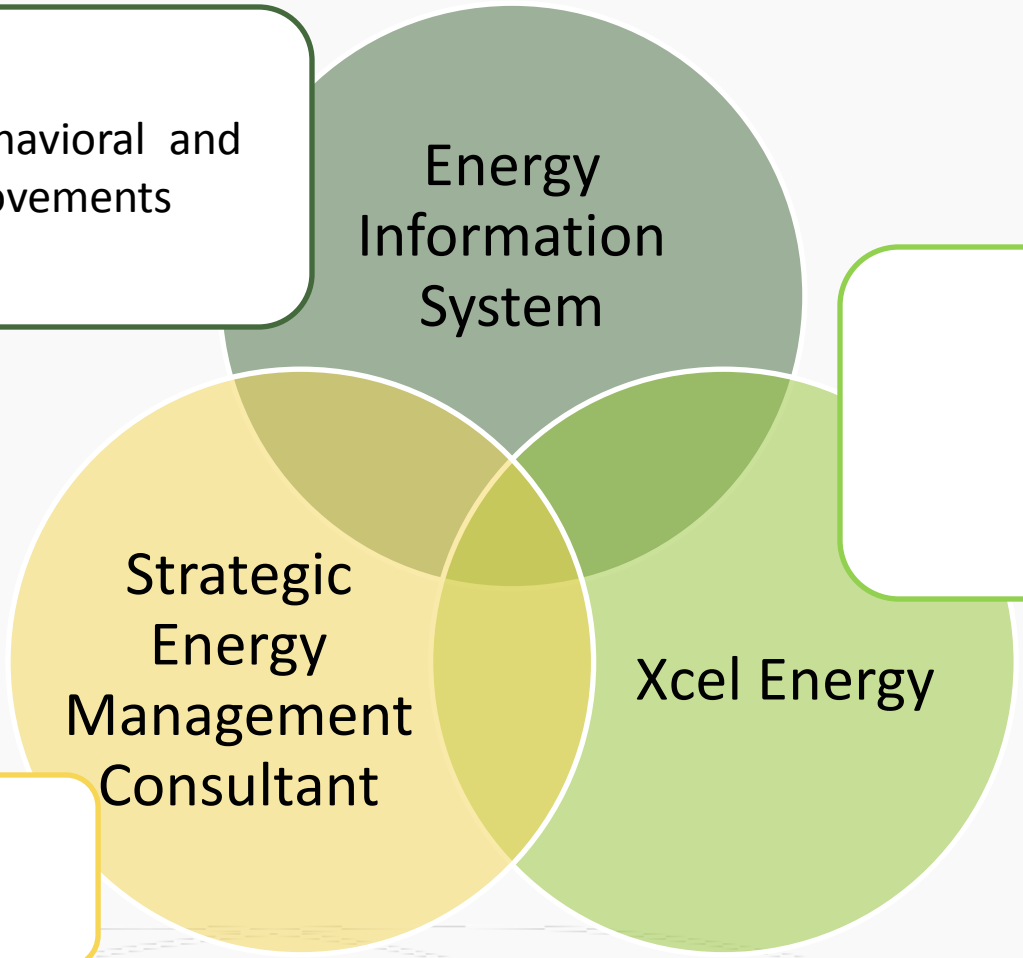
Technology Cost Models and Procurement Costs

- The most common cost models comprised annual or monthly billing, with costs assessed per building or according to a single lumped rate for the entire portfolio.
- The five-year cost of ownership, based on up-front and extrapolated ongoing costs were $150,000, or $1,800/pt, or $.06/sf.
- Costs spanned several orders of magnitude, indicating some economies of scale, and significant variation across offerings, and across the market.

The program was cost-effective from the Total Resource Cost (TRC) test, Utility Cost Test (UCT), and Participant Cost Test (PCT) perspectives if participants are engaged with the program for at least three years.

FINANCIAL RETURN

- Auto-M&V for behavioral and operational improvements



- SEM Best practices

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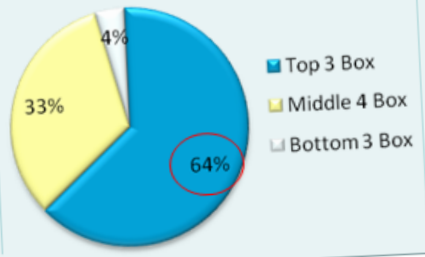
CUSTOMER INTEREST

EXECUTIVE SUMMARY: CONCEPT REACTION

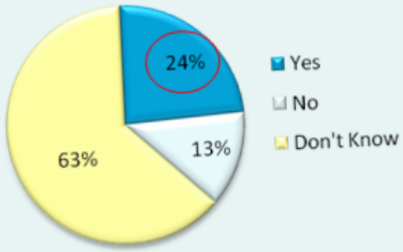
- **Xcel Energy's current business customers are interested in the EMIS Tools program concept description; however, likelihood to consider paying for these additional services is low.**
  - Those customers who currently use an energy management system and / or that have used EMIS information in the past for goal planning are more likely to consider participating in and paying for the potential program.
  - Those willing to pay for these potential services place a high importance on reporting to and educating company management as well as identifying and monitoring energy efficiency.

LIKELIHOOD TO CONSIDER



Customers who have used **EMIS information to develop energy efficiency plans** are more likely to consider this program for their business than all other respondents who have not used the tools in the past for goal planning.

WOULD CONSIDER PAYING FOR SERVICES



Among those who would consider paying for EMIS Tools, the following benefits are most important:

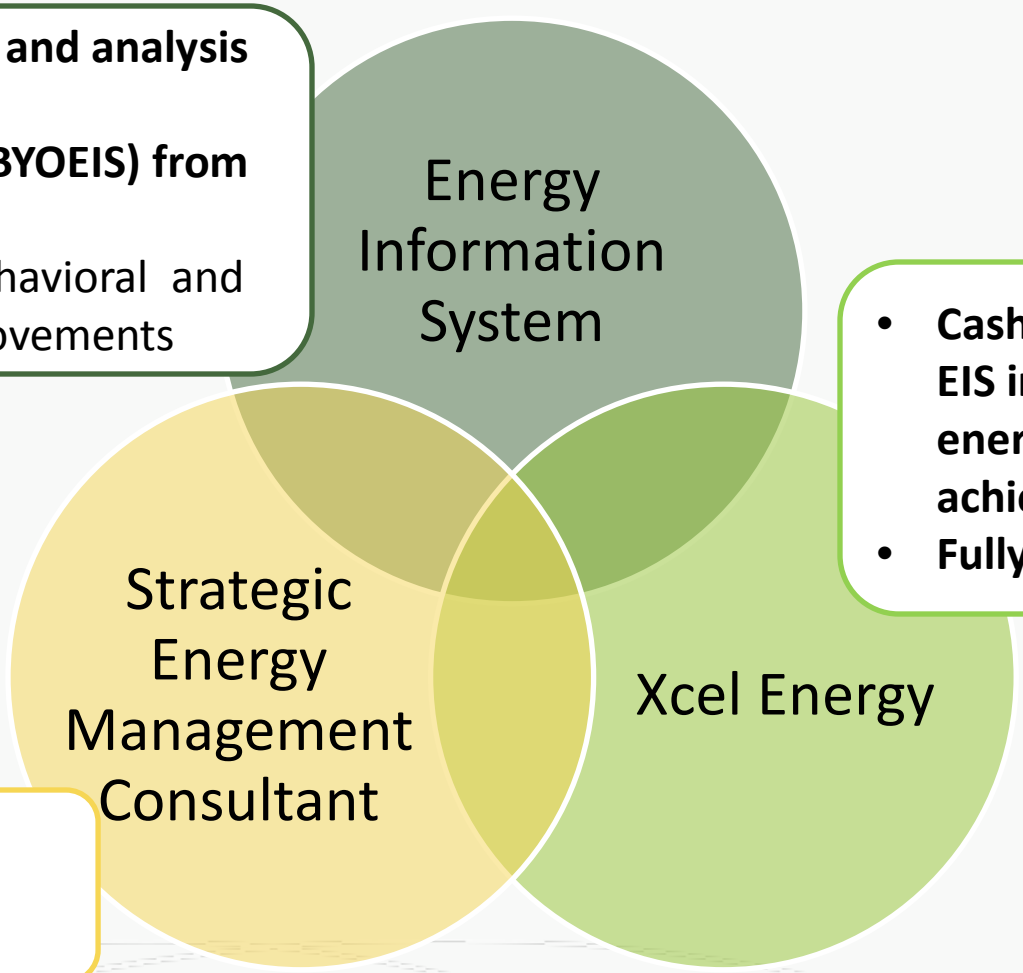
- Report energy information to management
- Identify energy efficiency opportunities
- Manage / monitor energy efficiency investment
- Educate management and other employees
- Identify cost savings opportunities

Those who have used **EMIS information to develop energy efficiency plans** are more likely to consider paying for these services.

Total Respondents (n=107)

ENERGY INFORMATION SYSTEMS PRODUCT OVERVIEW

- **In depth tracking and analysis of energy usage**
- **Bring your own (BYOEIS) from XE approved list**
- Auto-M&V for behavioral and operational improvements



- **Cash incentives for EIS install and energy savings achieved**
- **Fully-fund SEMC**

- SEM Best practices
- **EIS Expertise**

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THANK YOU

Xcel Energy®

RESPONSIBLE BY NATURE®

Smart Energy Analytics: DOE's Newest Adoption Campaign

Jessica Granderson, LBNL

U.S. DEPARTMENT OF ENERGY

Smart Energy Analytics Campaign

- The Smart Energy Analytics Campaign is designed to increase adoption of EMIS technologies and processes by owners and operators of commercial buildings
- Campaign activity planned for 2016-2018
  - Engage Participants to use EMIS and monitoring-based commissioning to increase energy savings
  - Provide resources that will support new EMIS projects, and encourage the expansion of existing EMIS implementations
  - Convene early adopters to share successes
  - Award and recognize Participant's exemplary performance
  - Enlist Supporting Partners from Cx community, utilities, EMIS vendors, EE organizations to bring their members/customers into Campaign

Smart Energy Analytics Campaign

Join the Campaign to receive

- Energy Management and Information Systems (EMIS) best practice resources and technical support
- Recognition for exemplary performance

What does Campaign Participation look like?

- Participants pledge to install or use existing EMIS to analyze data and identify energy-saving improvements

www.smart-energy-analytics.org

Campaign is delivered in partnership with

BOMA International · IFMA · TRANE · ComEd powering lives · BCxA Building Commissioning Association · Commissioning CAcx Collaborative

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Questions?

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