Smart Energy Analytics Campaign

2019 Building Technologies Office Peer Review

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

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Project Summary

Timeline:

Start date: October 2015

Planned end date: September 2020

Key Milestones

- 90 participating organizations, 430M+ sq ft, 5500+ buildings
- Median installed cost $0.04/sq ft, recurring cost $0.02/sq ft.
- EMIS enabled median savings 7%
- Technical assistance to maximize savings, O&M benefits
- Recognition, case studies of 17 exemplary organizations with EMIS implementation

Budget:

Total Project $ spend to Date:

- DOE: $1.345M ($413K in last 12 mo.)

Total Project $ budget thru FY2019:

- DOE: $1.695M

Key Partners

Organizing Partners: BOMA, IFMA, Building Commissioning Association, ComEd

Supporting Partners:
122 total from Associations, EE Orgs, Utilities, Service Providers, EMIS Product Vendors

Project Outcomes:

1. Provide support in adopting and maximizing benefits of EMIS technology
2. Provide EMIS technology cost, benefit, and market information to channel partners to facilitate adoption at scale

CBI MYPP Strategy 1 - Demonstrate performance in commercial buildings, drive adoption with market leaders; application resources, adoption campaigns

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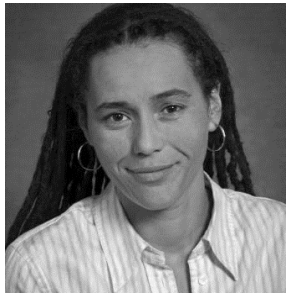
Team



Jessica Granderson
Staff Scientist, Deputy for Research Programs

Hannah Kramer
Technical Lead

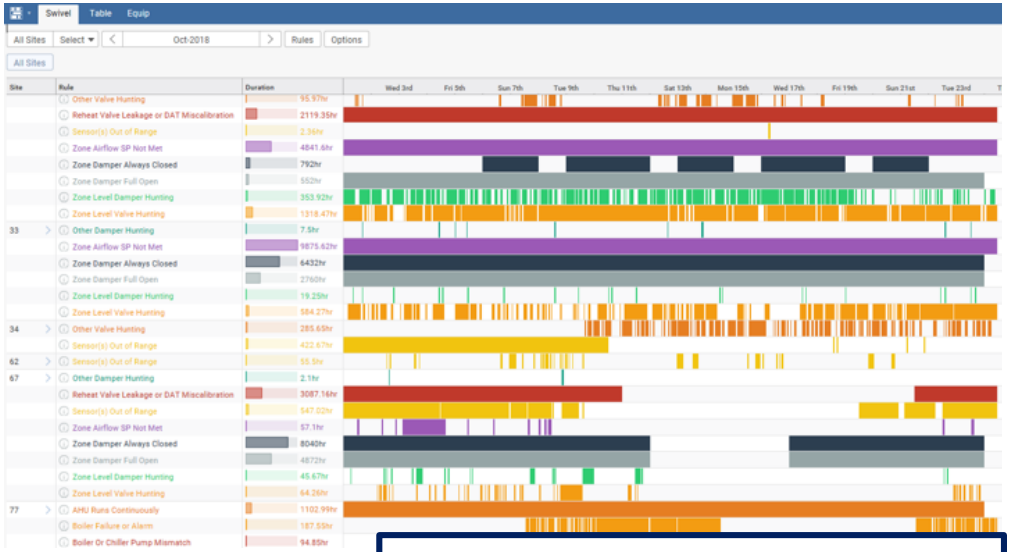
Claire Curtin
Program Manager

Eliot Crowe
Technical Assistance Coordinator

Guanjing Lin
Senior Scientific Engineering Associate

Grounding Definitions

Energy management and information systems (EMIS): broad family of information technologies for no/low-cost operational efficiency



Fault Detection and Diagnostics (FDD)

Automated System Optimization (ASO)

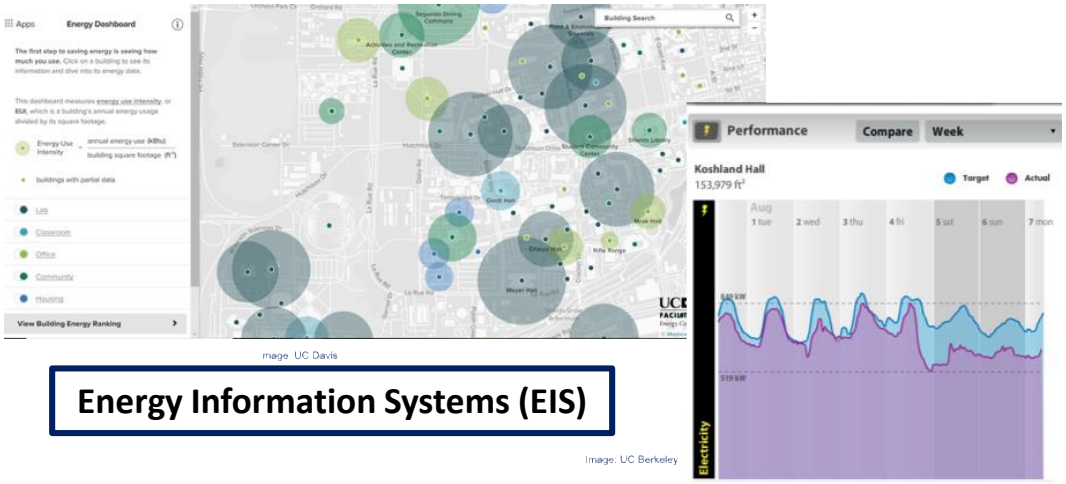


image: UC Davis

image: UC Berkeley

Energy Information Systems (EIS)

Clockwise from top right: SkyFoundry, UC Berkeley, UC Davis, BuildingIQ

Challenge

Problem:

- EMIS used to analyze data, ID low-cost savings, enabling median 7% savings
- YET are not yet widely adopted
- Managers and operators face data overload instead of actionable insights

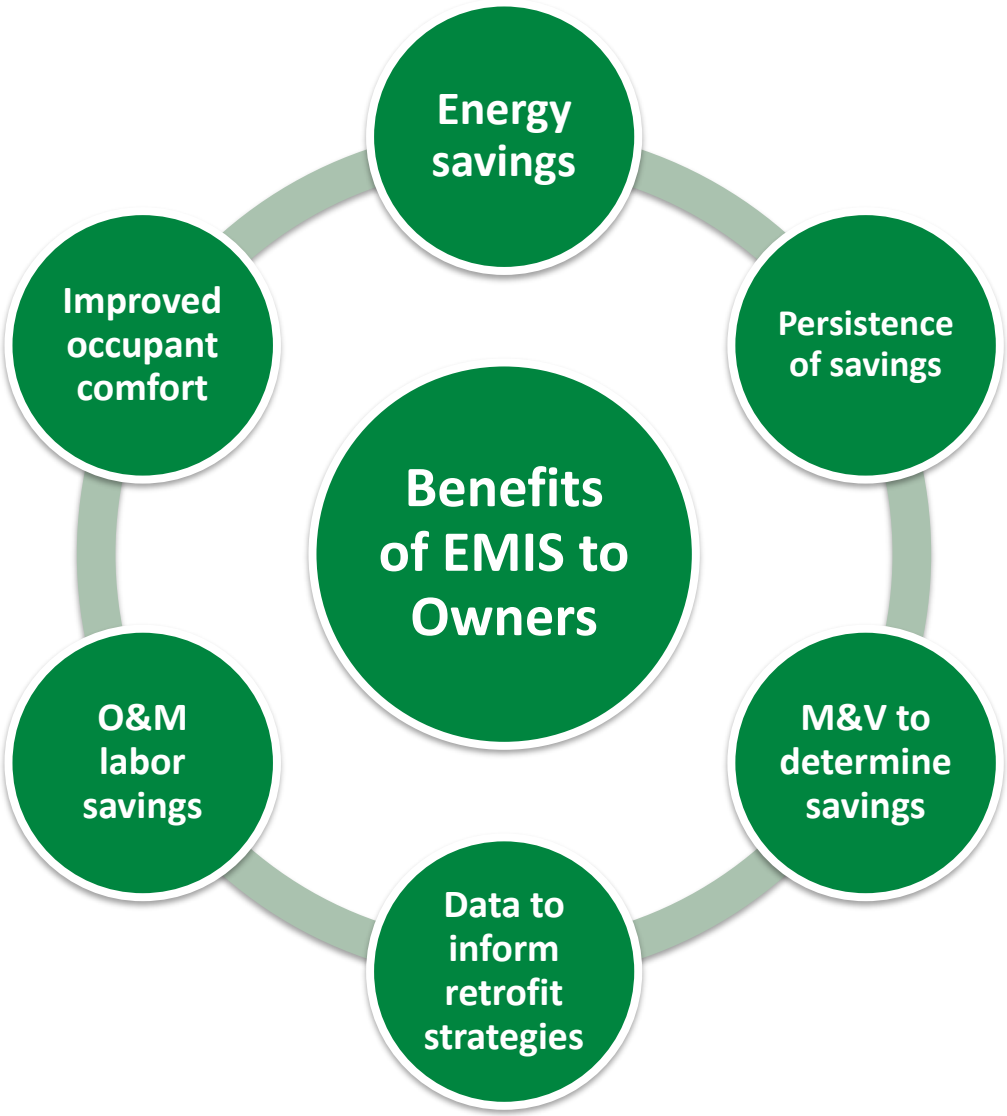
Typical 50 building portfolio:
100,000 BAS points + 100 energy meters =
energy data reviewed quarterly for budgeting,
Basic BAS alarms in place, no analytics/diagnostics

Size of Problem:

- Market potential: 30 billion square feet*
- Estimate ~90% of the market does not use EMIS
- Technical savings potential: 423 TBtu / $4.2B

* US commercial buildings over 100k sq ft

Building Owners Miss Out on EMIS Benefits

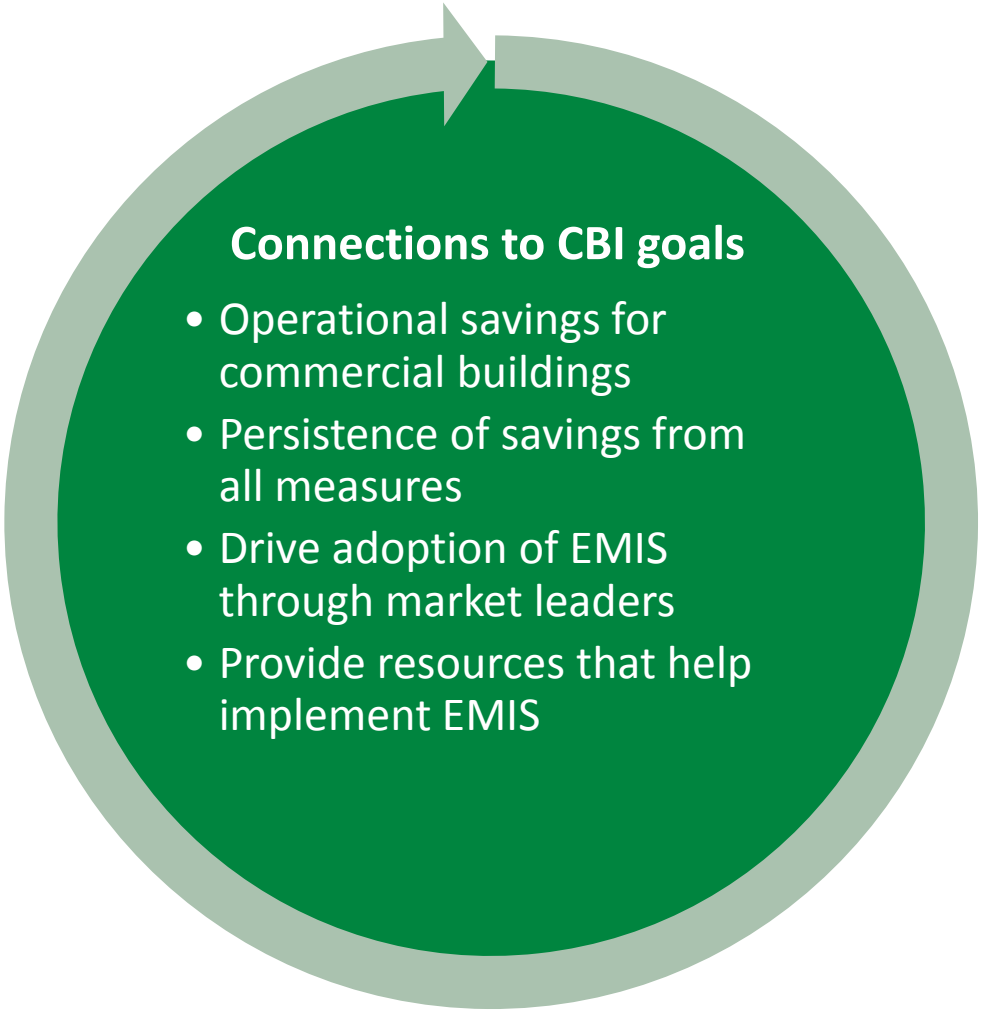


CBI and Campaign Goals

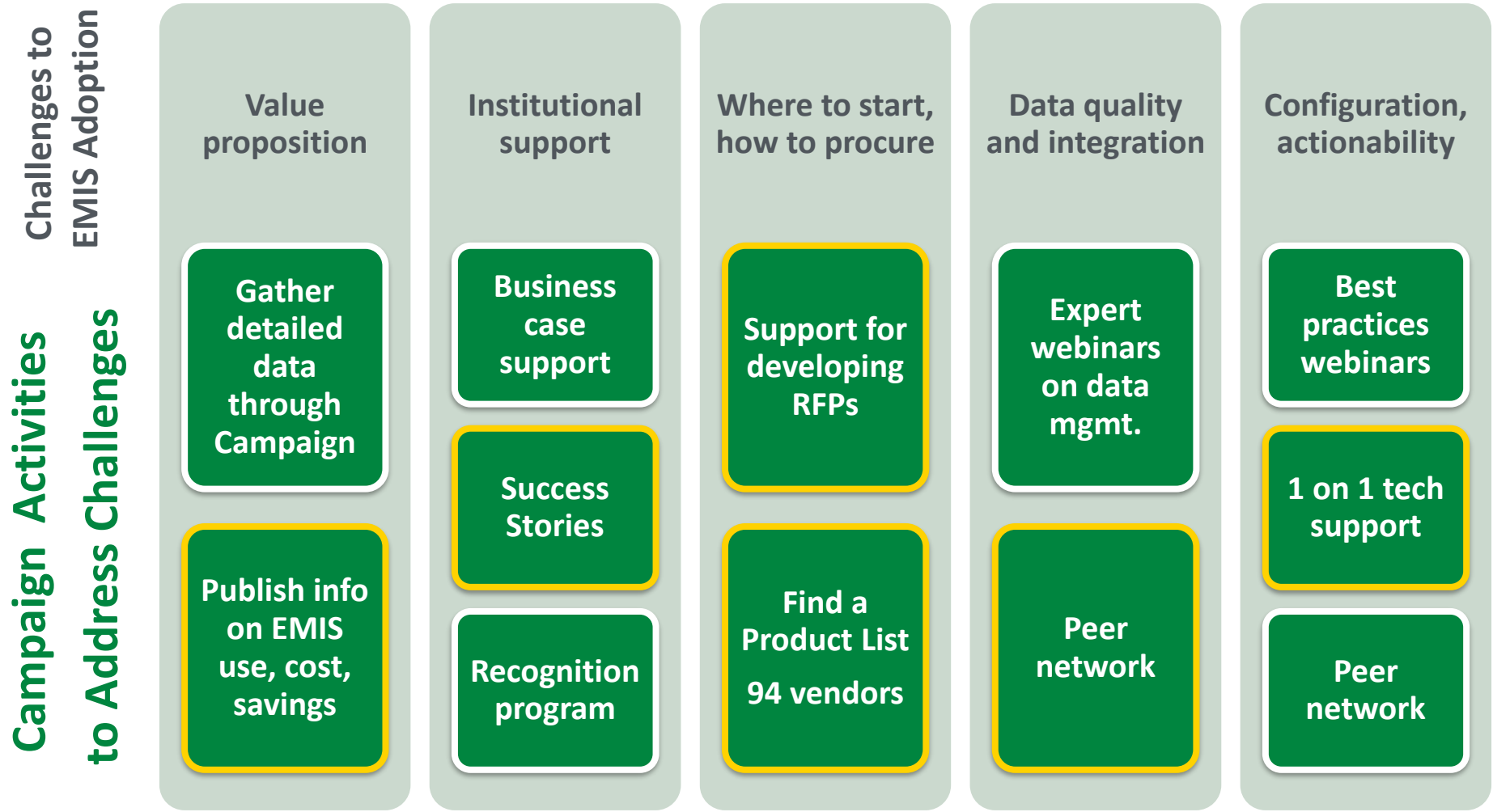
Campaign Goals:

1. **Support users of EMIS to obtain maximum technology value**

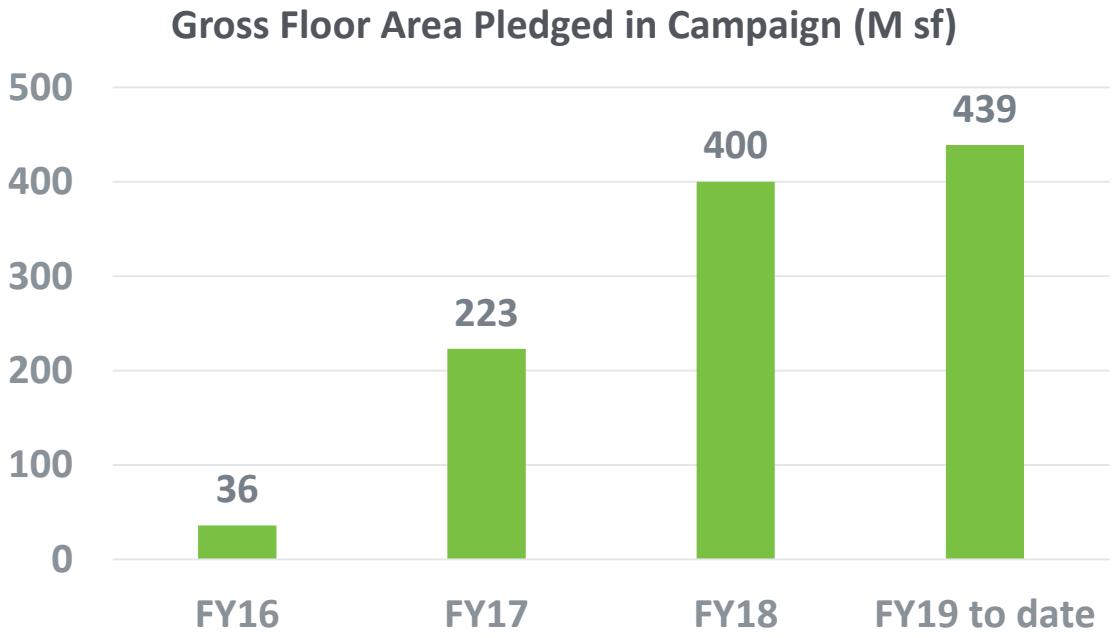
2. **Data analysis of costs, benefits, best practice to inform broader uptake**

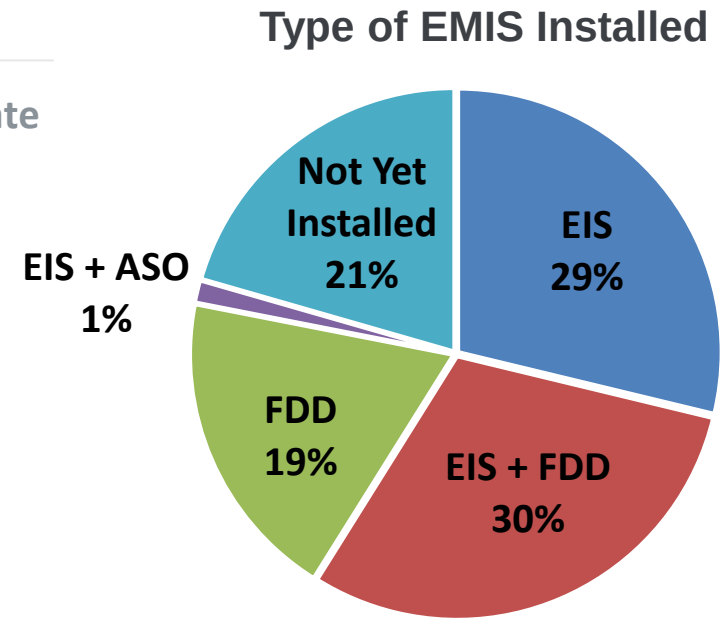


Campaign Addresses Challenges in Adopting EMIS



Progress - Campaign Participation





Largest Study of As-Installed EMIS Use

- **90 organizations**
- **5500+ buildings**
- **430+ M sq ft**
- **Sectors:** office, higher ed, healthcare, labs, retail, K-12

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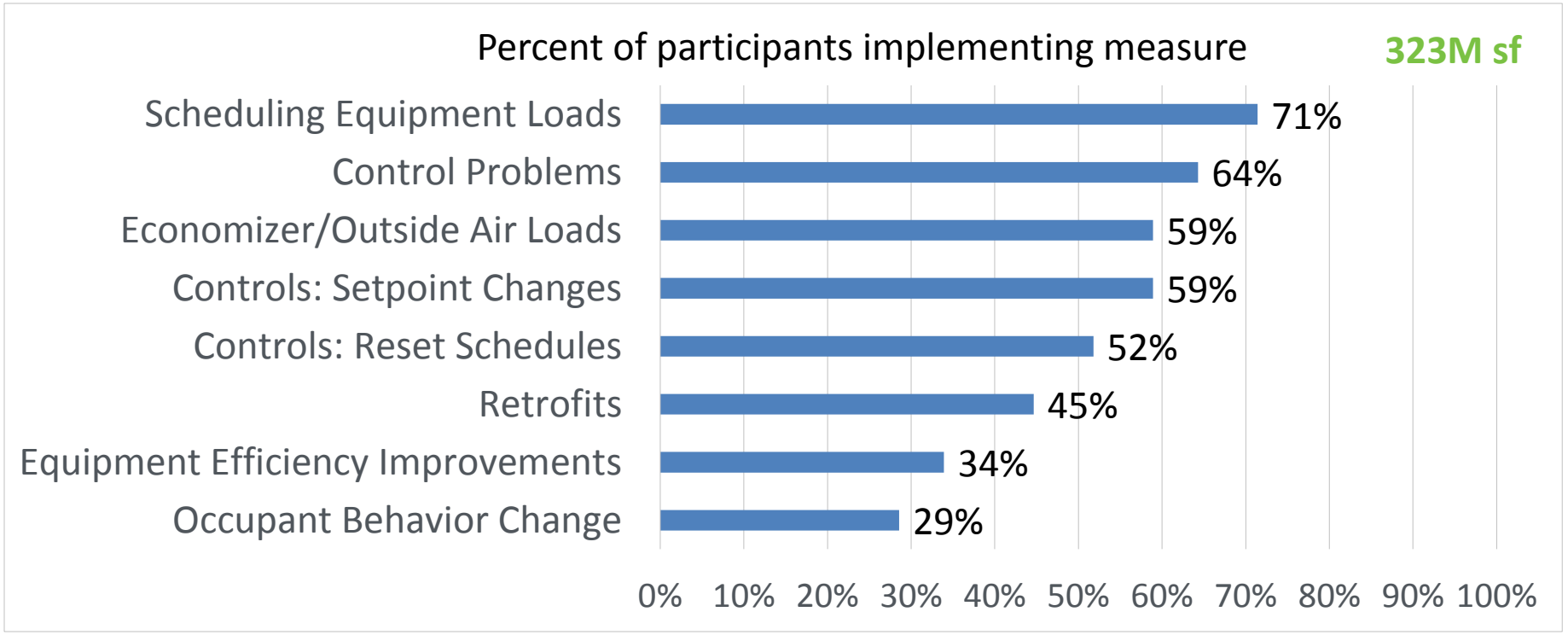
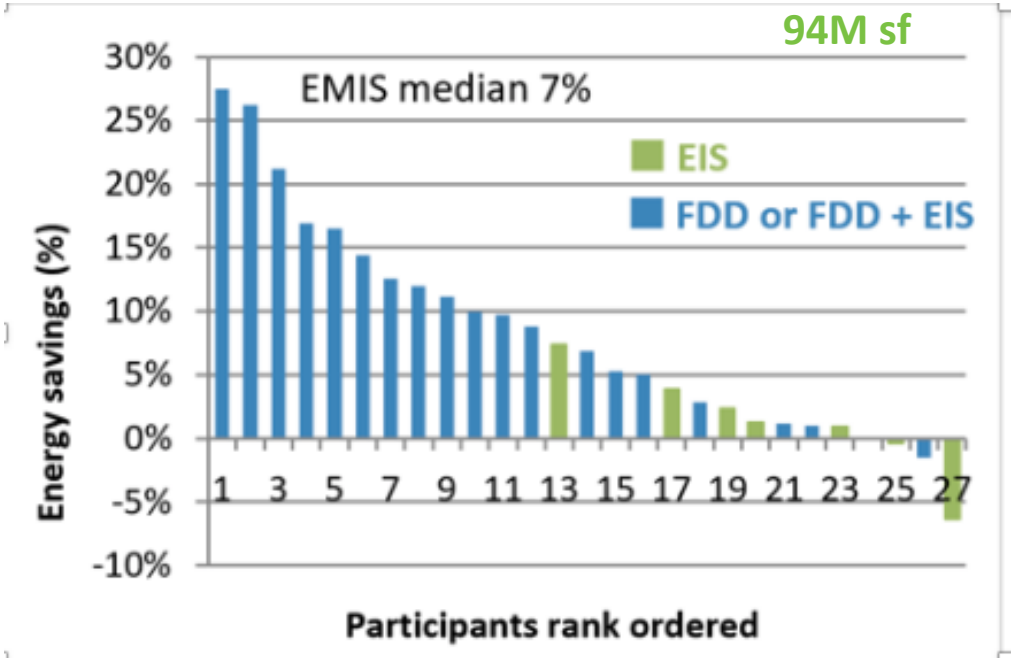
Top Measures Implemented from EMIS Insights



Progress – Energy Savings Since EMIS Installation



Energy Savings (n=27)

Median: 7%

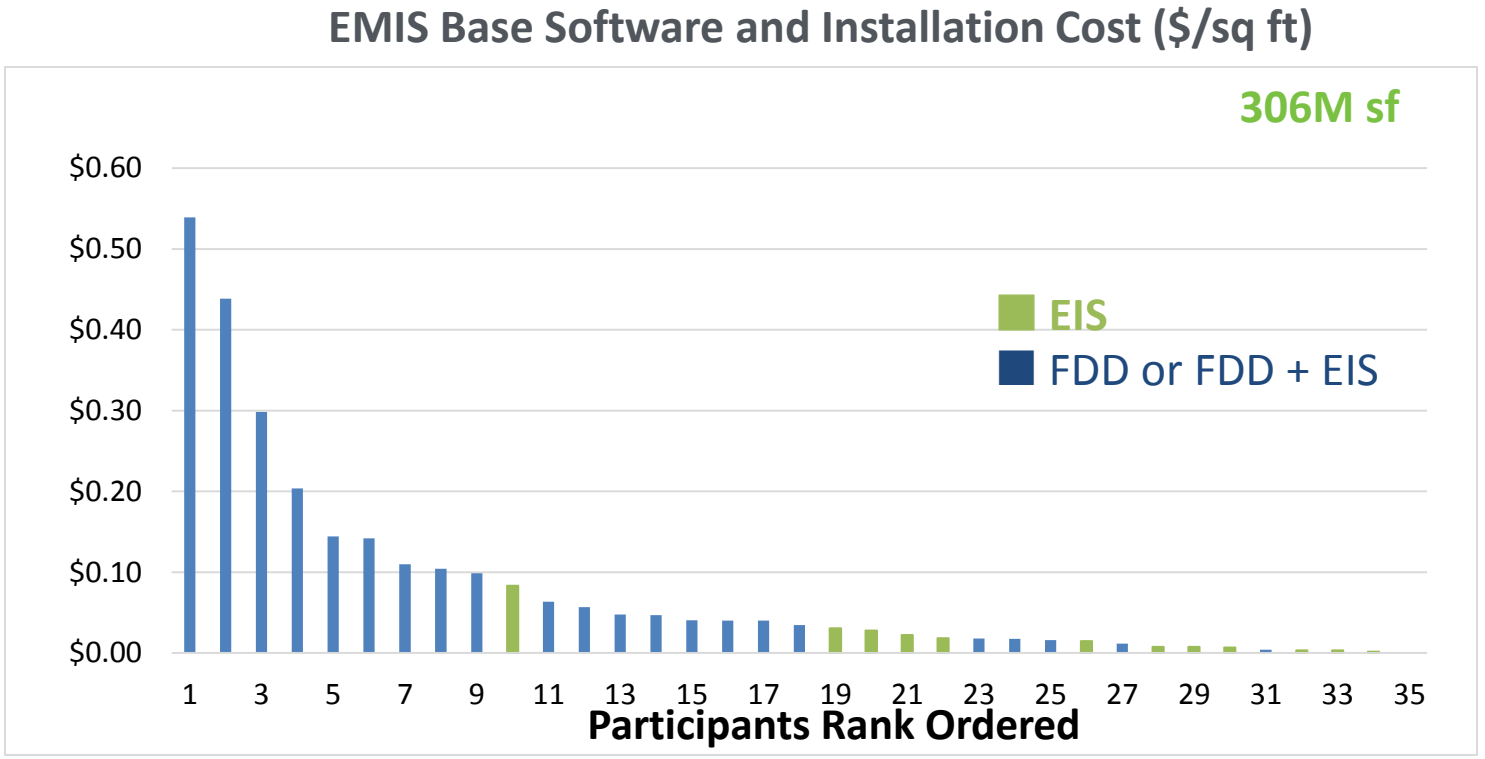
Range: -6%- to 26%

Savings not *exclusively* attributable to EMIS use – participants don't track at level of savings due to EMIS vs. other interventions

Participants *do* report EMIS instrumental in obtaining and sustaining saving over time

Progress – EMIS Cost data

EMIS Type	Base software & install cost ($/sq ft)	Recurring software/ service cost ($/sq ft-yr)	In-house labor cost ($/sq ft-yr)
EMIS Overall (n=37)	$0.03	$0.02	$0.03



Progress – Success Stories

Success stories for 17 exemplary EMIS implementations

Document and share best practices

Building Analytics Success Story

Stanford University Residential & Dining Enterprises

Stanford University

Just a few years ago, Stanford University's Residential and Dining Enterprises could not track utility consumption in a meaningful way. With 2,000 utility accounts across three different utility providers and no software to monitor consumption, it was a challenge to manage. Stanford was 'just paying the bills,' a scenario that is all too common. This changed when they added hundreds of meters and an energy information system (EIS) to track utilities and locate savings opportunities.

What is an EIS?

An EIS is a combination of software, data acquisition, and communication systems used to store, analyze, and display building energy meter data on an hourly or more frequent basis. EIS is one type of energy management and information system (EMIS).

We have over 50 individuals responsible for building management that had never seen any consumption information. With EIS, now we can all be utility managers.

Kristin Parineh

Sustainability & Utilities Manager

To get their EIS up and running, Stanford connected all energy, water, and waste data - 963 meters, including 375 electric interval meters. Through this process, they focused on data quality so the meter data could be trusted. Stanford uses their EIS in the following ways:

- Review daily, monthly and annual energy, waste and water use trends and targets for groups of similar buildings such as dining halls, undergraduate dorms and apartment style residences.
- Track the performance of efficiency projects and behavioral change programs with students.
- Use 'heat map' charts to identify periods of unnecessary operation sing the heat map function

By creating a systematic way to review key performance indicators and analytics in the EIS, the university has saved $450,000 across their portfolio.

Quick Facts

Location: Stanford, CA

Building type: University residences and dining

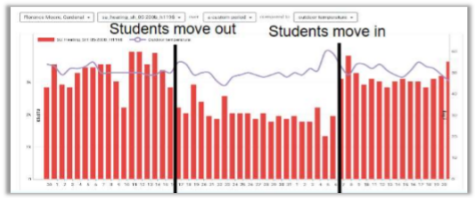
Floor area with EMIS: 4.9 million sq ft, 315 facilities

Energy savings: 4% chilled water, 5% electric, 9% hot water, 10% gas for $451k in cost savings in the first year.

EIS Software: Lucid BuildingOS

Smart Energy Analytics Campaign: Recognition for New Installation of EIS in a Portfolio

Stanford Residence and Dining Enterprises was recognized by Lawrence Berkeley National Laboratory and the U.S. Dept. of Energy during the Building Commissioning Association conference in October 2018 for their exemplary work to save energy using an EIS.



Stanford's energy tracking in the residence halls over winter break shows a reduction (Graphic: Lucid BuildingOS)

Driving Action with Data

In addition to energy, water, and waste data, Stanford collects data on the number of meals served in their dining halls, and they decided to bring this data stream into their EIS. Stanford was able to benchmark dining halls against one another and focus their efforts towards lowering consumption at the most energy-intensive locations. Now they track energy cost per meal served on an ongoing basis.

Stanford is also working with students to reduce energy use when the residence halls are unoccupied. During last year's winter break, they asked students to turn off their thermostat, lights, and appliances, and followed up with residences that didn't show reduced energy usage. These efforts resulted in a 17% reduction in energy use over three weeks relative to the previous year – a savings of $34,000.

EIS and Asset Management

Nearing completion with the integration of their work order and asset data with their EIS, Stanford will have a view into the relationship between the condition of thousands of energy-consuming assets and their buildings' overall energy consumption. Through a combination of analytic tools and a sound process for using those tools, Stanford is well on their way to transforming their energy management practices.

Integration of meals served data with energy data to create an 'energy cost per meal' metric

The Smart Energy Analytics Campaign is a public-private sector partnership program focused on commercially available Energy Management and Information Systems (EMIS) and monitoring-based commissioning practices. The campaign couples technical assistance with qualitative and quantitative data collection to inform research, development, and field study priorities. Partnering participants are encouraged to share their progress and may receive national recognition for implementations that demonstrate exemplary practices.

Emory University · Kentucky Unbridled Spirit · The Franklin Think Forward · Sprint in partnership with CBRE · Salt Lake City · Carleton · GSA · DGS The Department of General Services · Aurora Public Schools · The University of Iowa · Kerry · Stanford University · UC Davis · MGM Resorts International · Central Piedmont Community College · California State University Dominguez Hills · Clise Properties

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Stakeholder Engagement

- Participant Peer Group webinars - 203 total attendees
- General public webinars - 380 total attendees
- 1-2 conferences per year
- 122 Supporting Partners
- 74 EMIS vendors

Impacts

"This is exactly what I needed to know – I wish I had this information years ago."
– Participant

"The Campaign is a neutral and independent place to go. We've seen an unwillingness for customers to let us publish a case study but through the Campaign, they allowed it."
– EMIS Vendor

90 participants, 430M+ sq ft

Projected 7% median savings (year 2 results)

2.3 TBtu projected savings at sites with EMIS

"Your input and guidance as well as the website materials and webinars have been tremendously helpful to me, and I do not feel as lost anymore."
– Participant

Transferring and Scaling Campaign Impacts

Codes and standards

- FDD cost-benefit evidence for ASHRAE 90.1 & 189.1
- Analytics-ready new construction

Programs

- Support EMIS in programs (NYSERDA, CEE, ComEd, others)

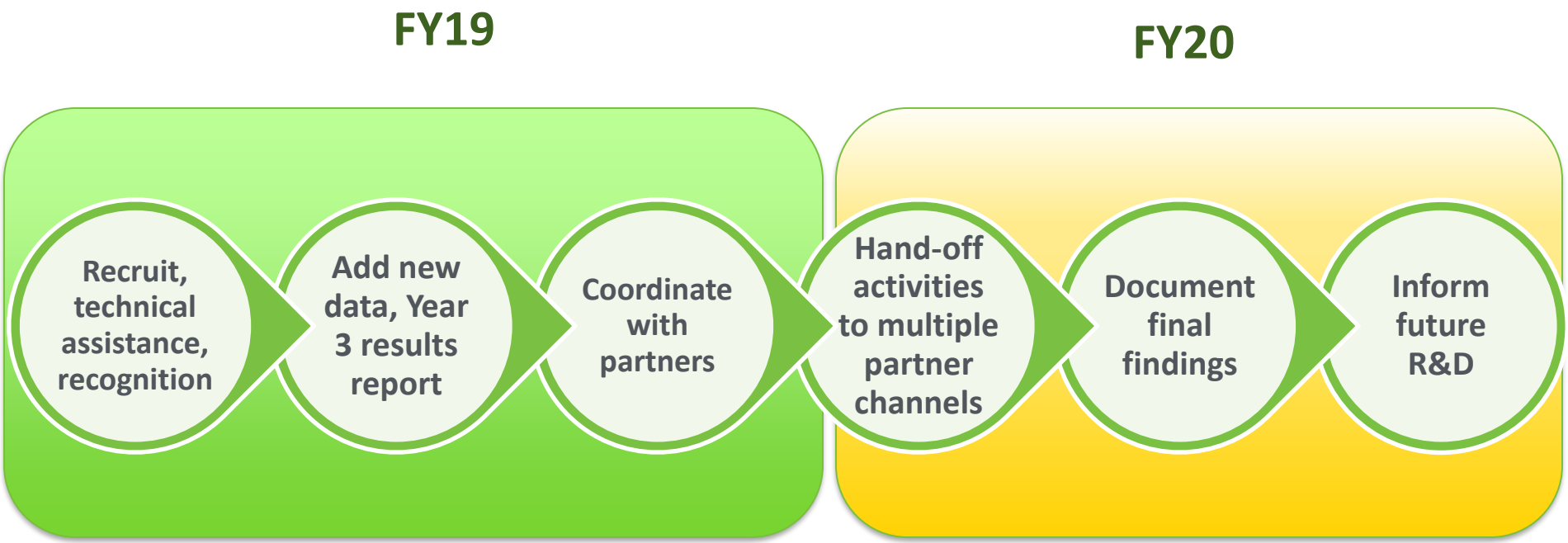
Industry Groups

- ASHRAE or AEE carry forward EMIS focus
- BCxA: MBCx Awards
- Industry groups provide EMIS support to members

Partners

- Cost-benefit findings to engage clients
- Share success stories

Remaining Project Work



THANK YOU!

REFERENCE SLIDES

Project Budget

Project Budget: $1.695M from FY16-FY19

Variances: None

Cost to Date: $1.351M (through Feb 2019)

Additional Funding: None

Budget History		
FY 2016-2018 (past)	FY 2019 (current)	FY2020 (planned)
$1,270,000	$425,000	TBD

Project Plan and Schedule

Project Schedule									
Project Start:FY'16			Completed Work						
Projected End:FY'20			Active Task (in progress work)						
		x	Completed task						
		◆	Milestone/Deliverable						
		FY2016	FY2017	FY2018	FY2019				
Task					Q1	Q2	Q3	Q4	
Past Work									
Approval of Camp focus and definition	COMPLETE	X							
Tracking Metrics and award Categories list	COMPLETE	X							
Campaign plan finalized	COMPLETE	X							
Impact assessment of Campaign with calc method to indicate 1% mkt opp	COMPLETE		X	X					
Website updates	COMPLETE	X	X	X					
Soft Launch Phase update	COMPLETE	◆							
Resource Development	COMPLETE	X	X						
Eval of Campaign Effectiveness	COMPLETE		◆						
EOY Outcomes Report and Webinar	COMPLETE		X	X					
Current/Future Work									
Website Updates	ONGOING				X	X			
EOY Outcomes Report and Initial Transitioning Efforts	ONGOING							◆	
Impact Assessement	COMPLETE					◆			
Host webinars to facilitate Peer Groups, general interest webinars	ONGOING				X	X			