



Energy Management and Information Systems: State of Technology

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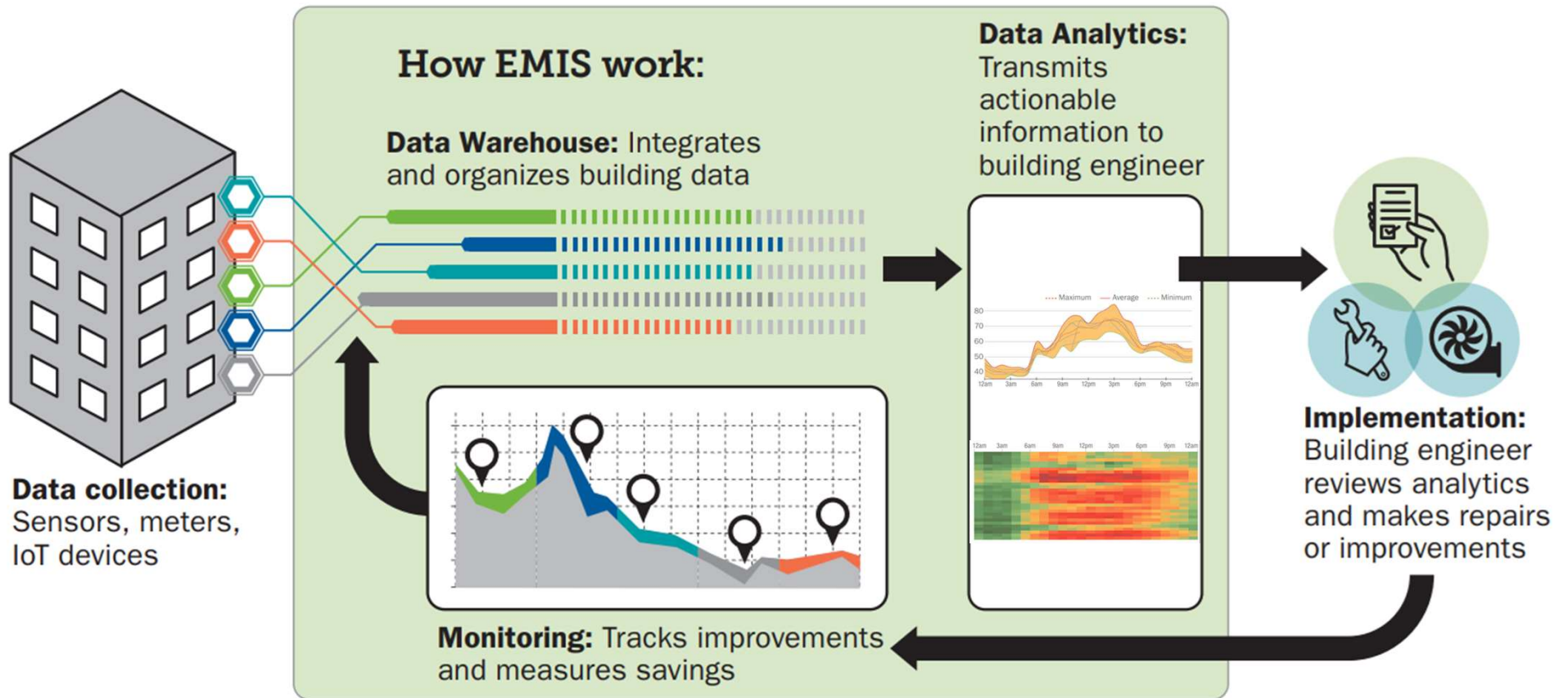
RILA Energy Management Meeting, April 11, 2022

Overview

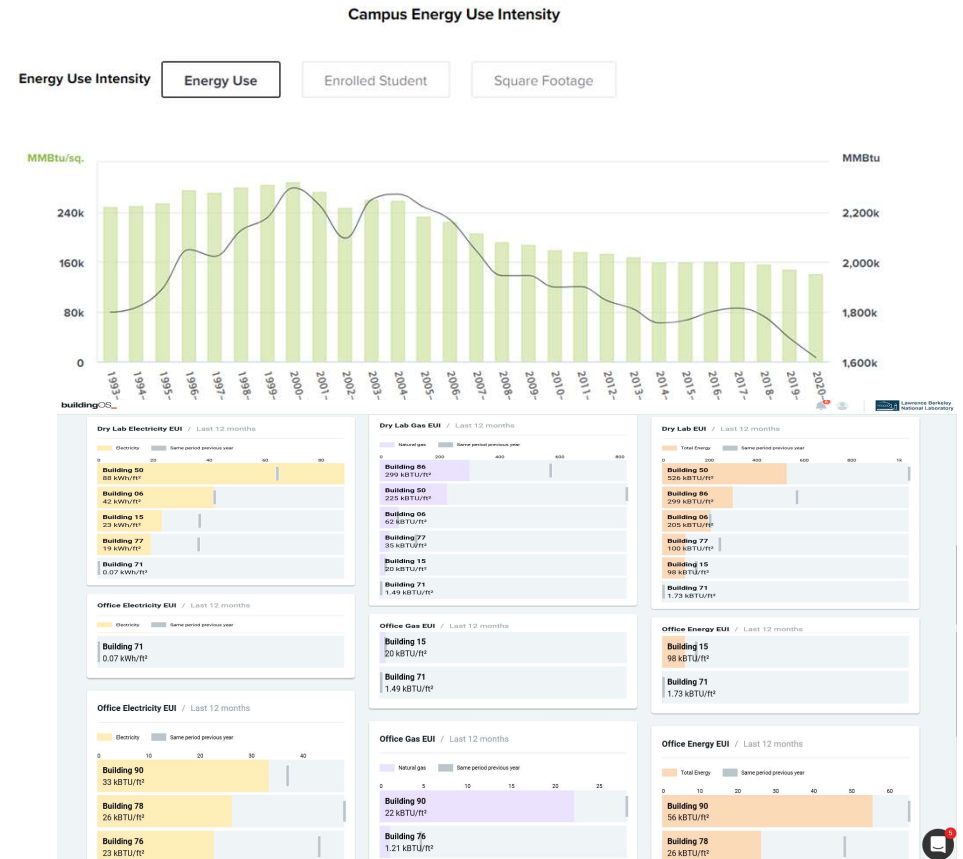
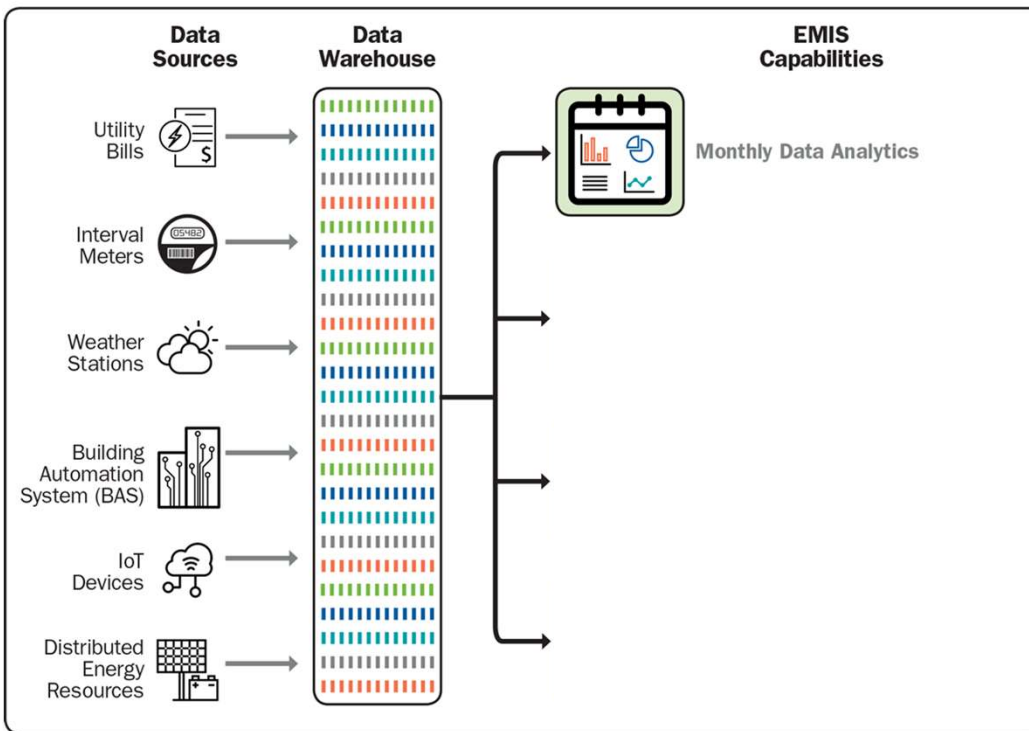
- Energy Management & Information Systems (EMIS)
 - Capabilities of EMIS
 - Latest EMIS cost-benefit study
- Bringing the benefits of EMIS to RTUs
- Q&A



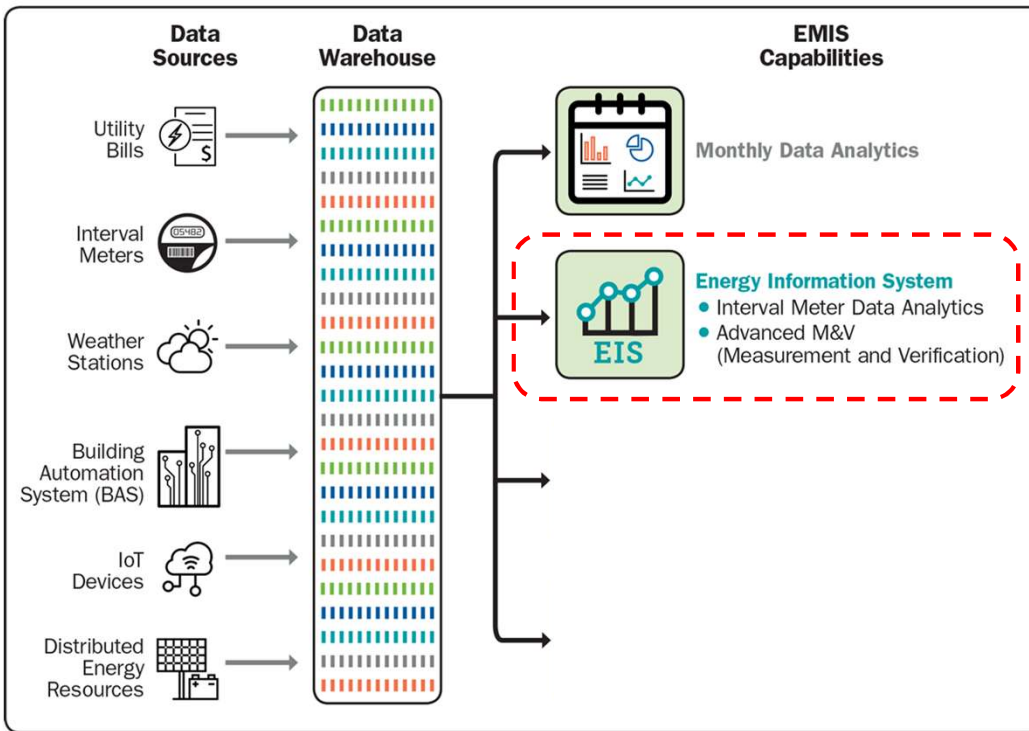
Energy Management Process with EMIS



Energy Management & Information Systems (EMIS): Monthly Data Analytics



Energy Management & Information Systems: Energy Information Systems (EIS)



Load Profile Analysis

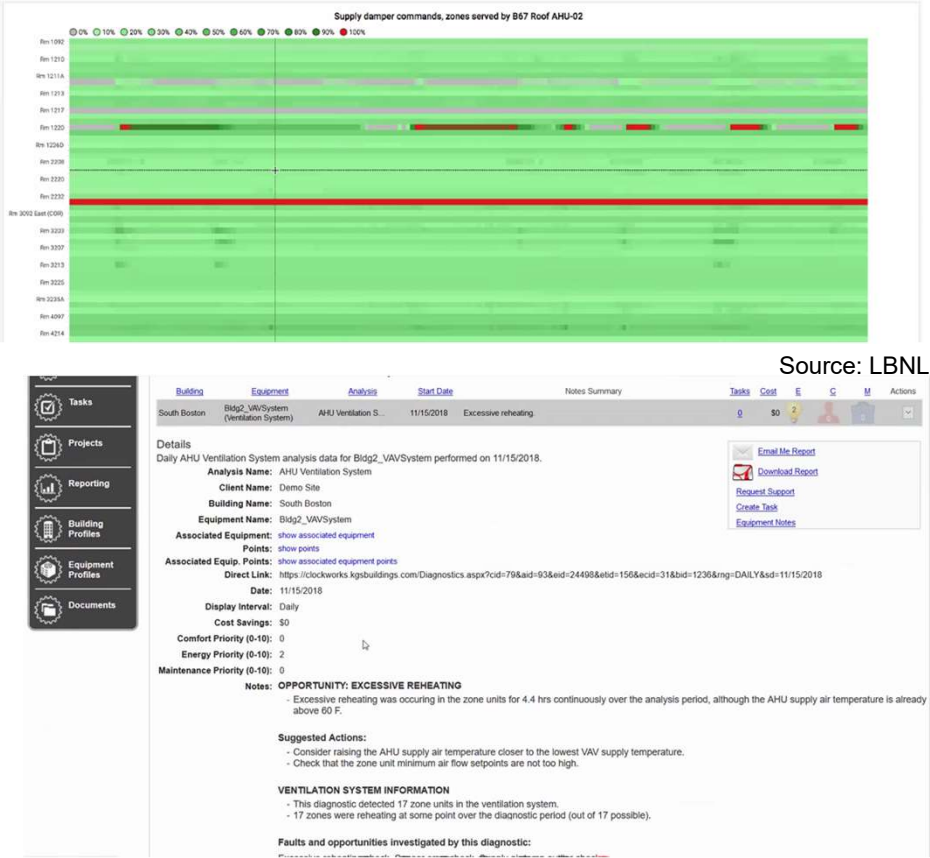
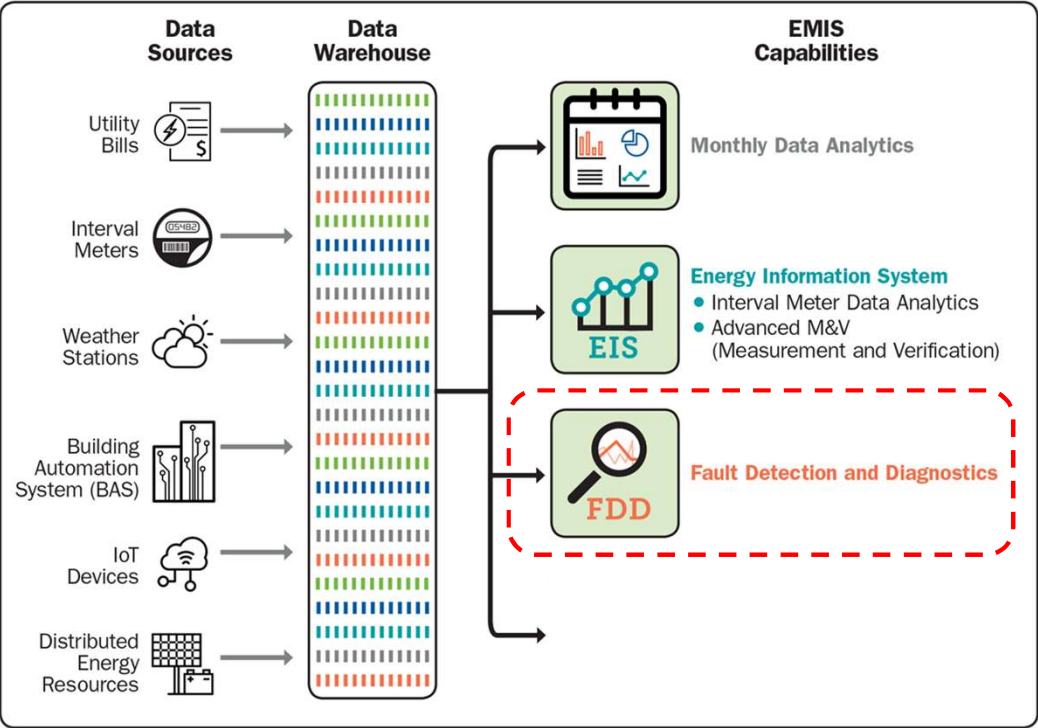


Source: LBNL



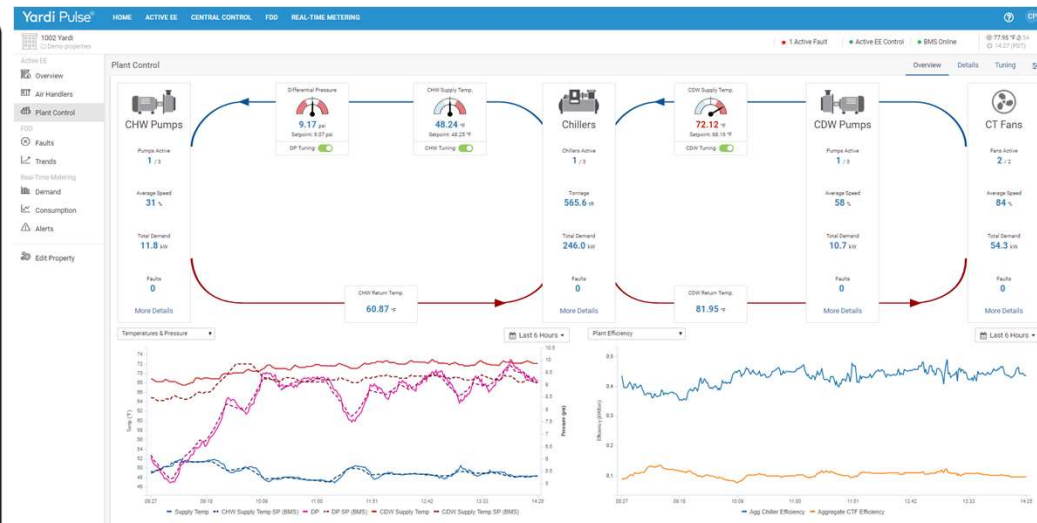
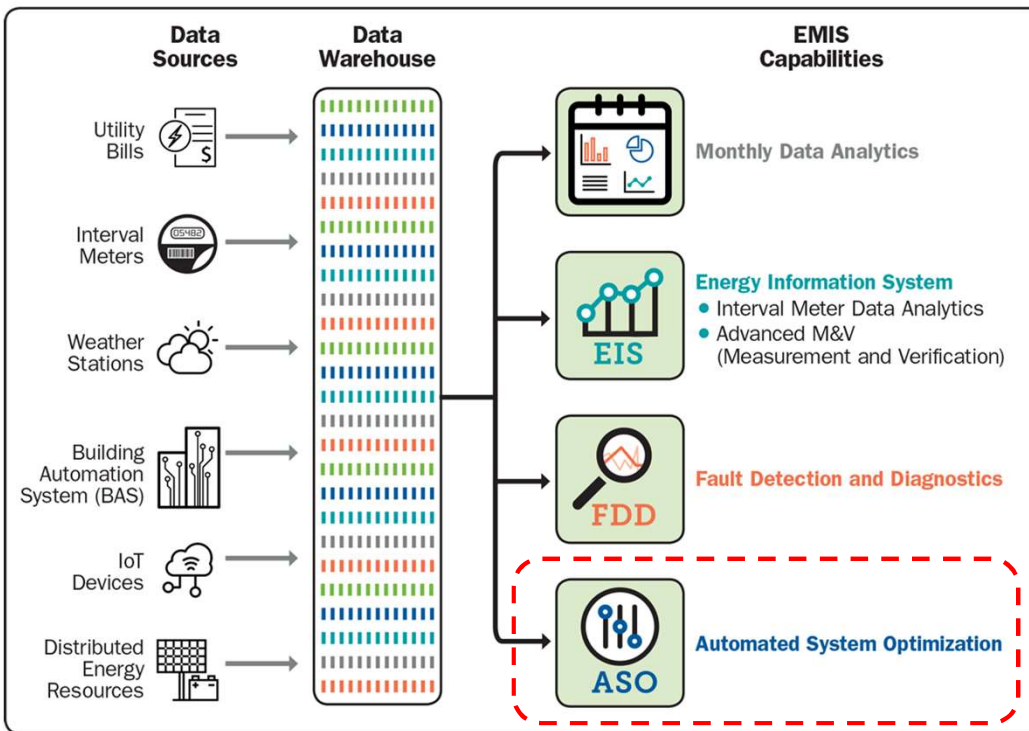
Source: Macalester College

Energy Management & Information Systems: Fault Detection and Diagnostics (FDD)



Source: Clockworks Analytics

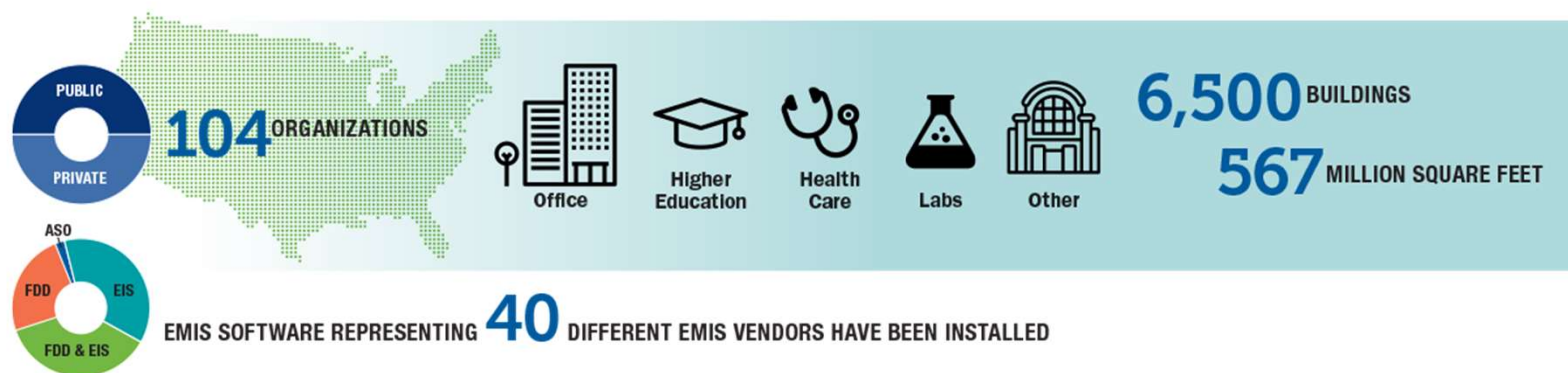
Energy Management & Information Systems: Automated System Optimization (ASO)



Source : Yardi Pulse

Smart Energy Analytics Campaign 2016-2020

Largest Dataset Documents the Costs and Benefits of EMIS



ANNUAL ENERGY SAVINGS FOR ORGANIZATIONS WITH EMIS:

3% EIS



9% FDD

\$3 million

ANNUAL SAVINGS for the median portfolio (15 million sq ft)

\$95 million

PROJECTED ANNUAL SAVINGS for all organizations

FIRST-YEAR INSTALLATION AND SOFTWARE COSTS:



EIS

\$0.02/sq ft

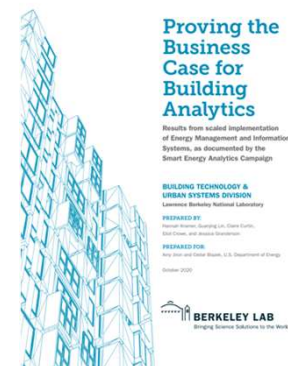


FDD

\$0.08/sq ft

INVESTMENT PAYBACK:

2 years

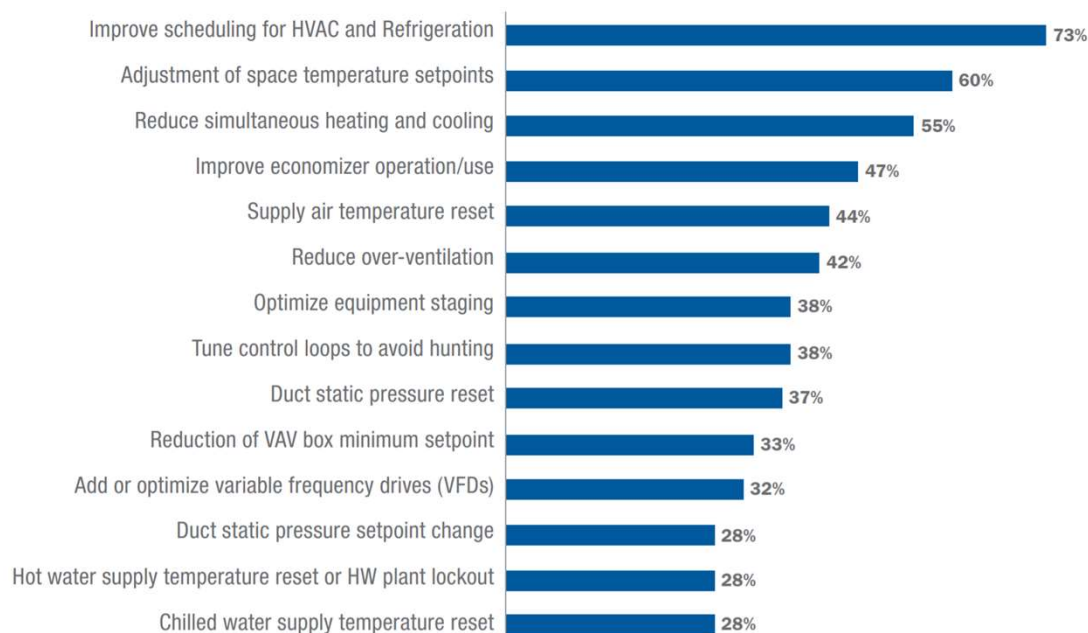


[Proving the Business Case for Building Analytics, 2020](#)

Energy Savings Since EMIS Installation

EIS	
Number of portfolios	10
Floor area (millions sq ft)	82
Median energy savings	3%
Median energy savings (\$/sf/yr)	\$0.03
FDD	
Number of portfolios	18
Floor area (millions sq ft)	90
Median energy savings	9%
Median energy savings (\$/sf/yr)	\$0.24

Top measures implemented with the support of EMIS



EMIS Cost Summary

Costs by EMIS Type	Median Costs		
	Per point	Per building*	Per sq ft
EIS (n = 37)			
Base software and installation (one-time cost)	\$400	\$1,500	\$0.01
Recurring costs (\$ per year)	\$150	\$400	\$0.01
FDD (n = 35)			
Base software and installation (one-time cost)	\$9	\$13,000	\$0.06
Recurring costs (\$ per year)	\$4	\$3,500	\$0.02

*For each participant, a “per building” cost was established. This column represents the median of the participant “per building” costs. Since the median participant in the “per building” and “per sq ft” columns reference different building sizes, the “per building” and “per sq ft” costs do not have the same basis and therefore do not scale.

Industry Trends

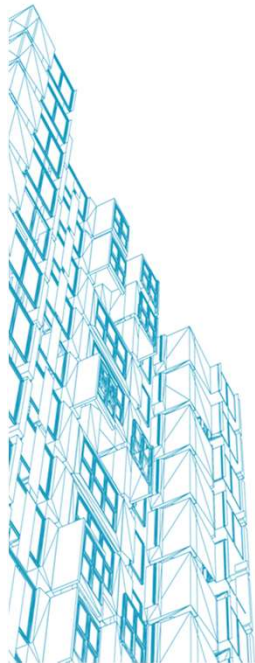
EMIS Products

- EIS and FDD capabilities in single software
- Prioritization of faults
- Over 100 EMIS in the market and growing
 - 60% with EIS capabilities, 30% FDD, 10% ASO
- Machine learning (ML) beginning to be used for data tagging, load prediction, control optimization ([ML webinar](#))
- CMMS integration and automated M&V

Monitoring Services

- Use of Monitoring-based Commissioning (MBCx) Service providers to support owner's staff
- Transition from periodic retro-commissioning (RCx) to ongoing monitoring-based Cx (MBCx)

Smart Energy Analytics Campaign Toolkit



Proving the Business Case for Building Analytics

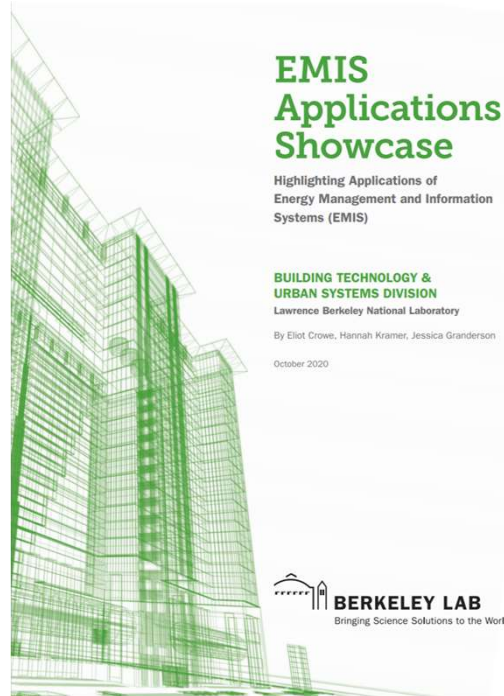
Results from scaled implementation of Energy Management and Information Systems, as documented by the Smart Energy Analytics Campaign

BUILDING TECHNOLOGY & URBAN SYSTEMS DIVISION
Lawrence Berkeley National Laboratory

PREPARED BY:
Hannah Kramer, Guanying Lin, Claire Curtin, Eliot Crowe, and Jessica Granderson

PREPARED FOR:
Amy Itron and Cedar Blazek, U.S. Department of Energy

October 2020



EMIS Applications Showcase

Highlighting Applications of Energy Management and Information Systems (EMIS)

BUILDING TECHNOLOGY & URBAN SYSTEMS DIVISION
Lawrence Berkeley National Laboratory

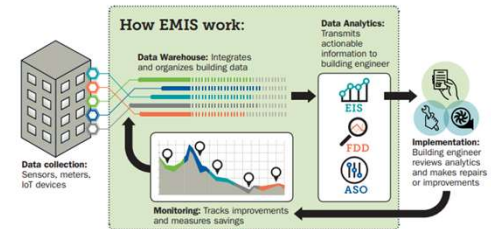
By Eliot Crowe, Hannah Kramer, Jessica Granderson

October 2020

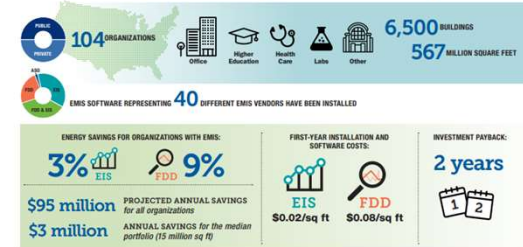


Proving the Business Case for BUILDING ANALYTICS

Lawrence Berkeley National Laboratory has partnered with commercial building owners across the country to gather data on the costs and benefits of Energy Management and Information Systems (EMIS). EMIS are the technologies behind automated, data-driven energy management that help identify, diagnose, and implement building system improvements. Through this partnership, Berkeley Lab has assembled the largest dataset to date on building analytics costs and benefits, proving the business case for their use at scale.



Largest Dataset Documents the Costs and Benefits of EMIS



BERKELEY LAB The 2016-2020 Smart Energy Analytics Campaign was a public-private sector partnership program funded by the U.S. Department of Energy, which focused on the application of EMIS and monitoring-based commissioning practices. The Campaign coupled technical assistance with data collection to document the energy and non-energy benefits of EMIS. For more information on Berkeley Lab's EMIS research, visit <https://buildings.lbl.gov/energy-analytics>

Smart Energy Analytics Campaign Toolkit

Resources, templates, and success stories

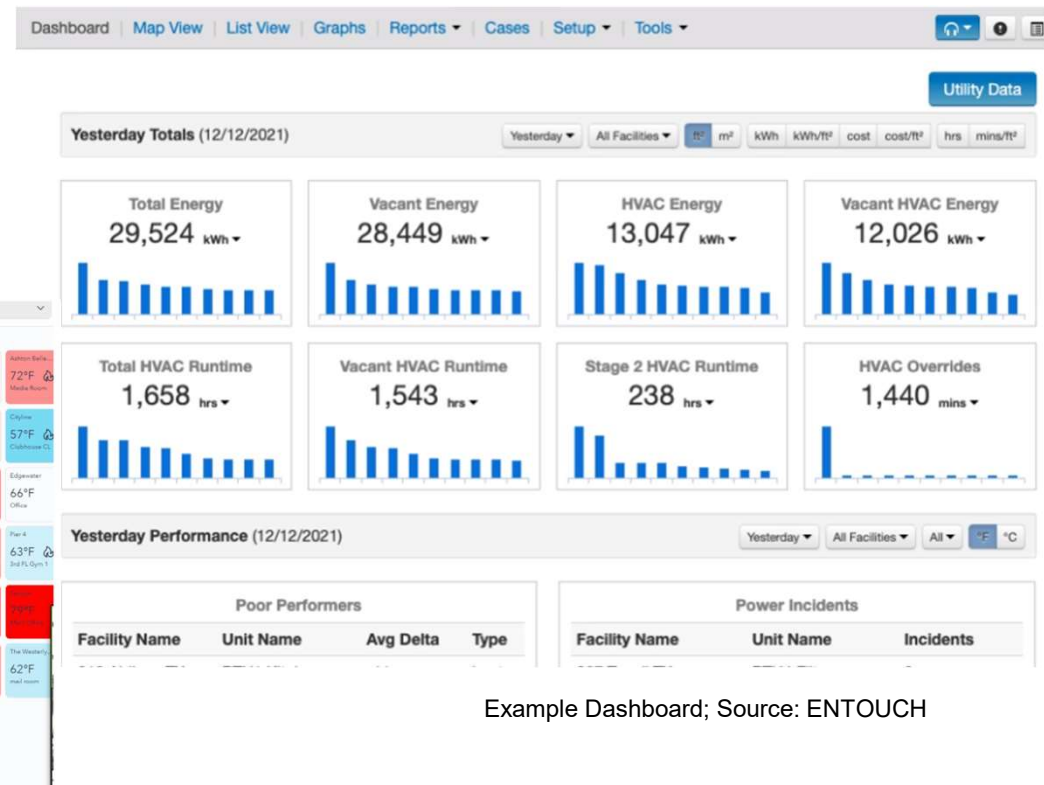
betterbuildingsolutioncenter.energy.gov/smart-energy-analytics-campaign-toolkit

EMIS and Control for Rooftop HVAC Portfolios

- Remote monitoring
- Portfolio-level control
- Automated demand management



Example Dashboard; Source: Logical Buildings



Example Dashboard; Source: ENTOUCH

Benefits of an EMIS for RTUs

- Manage HVAC schedules and temp setpoints
- Add and monitor demand-controlled ventilation strategy (DCV)
- Review RTU FDD results
- Data visualization and benchmarking
- Monitoring additional important loads like kitchen equipment, refrigeration, and lighting

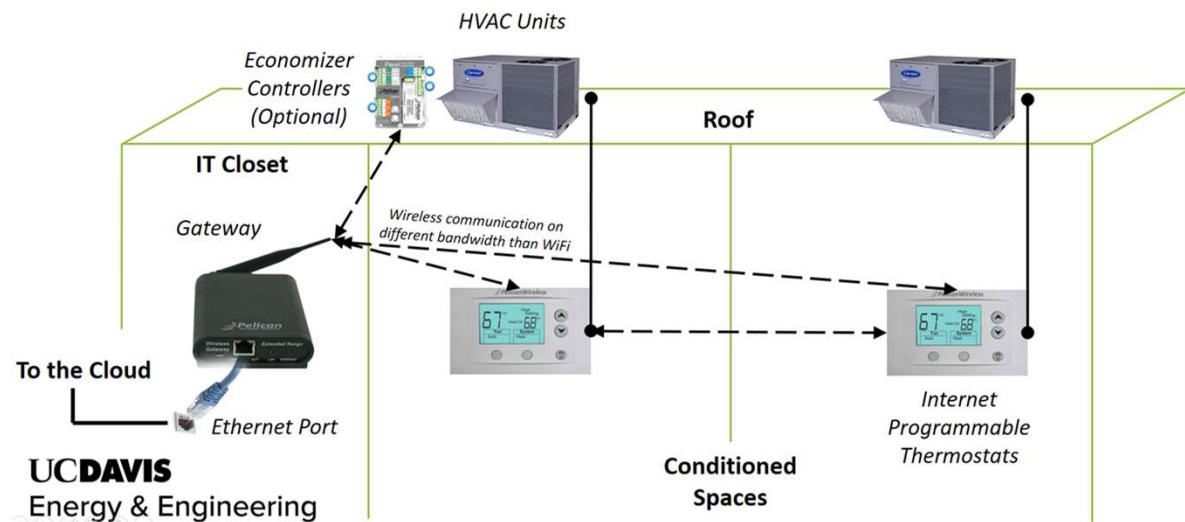


RTU Controls and Monitoring

Base: building-level tstats controlling rooftop units, but data not collected or accessible. Limited on-board fault detection within RTU.

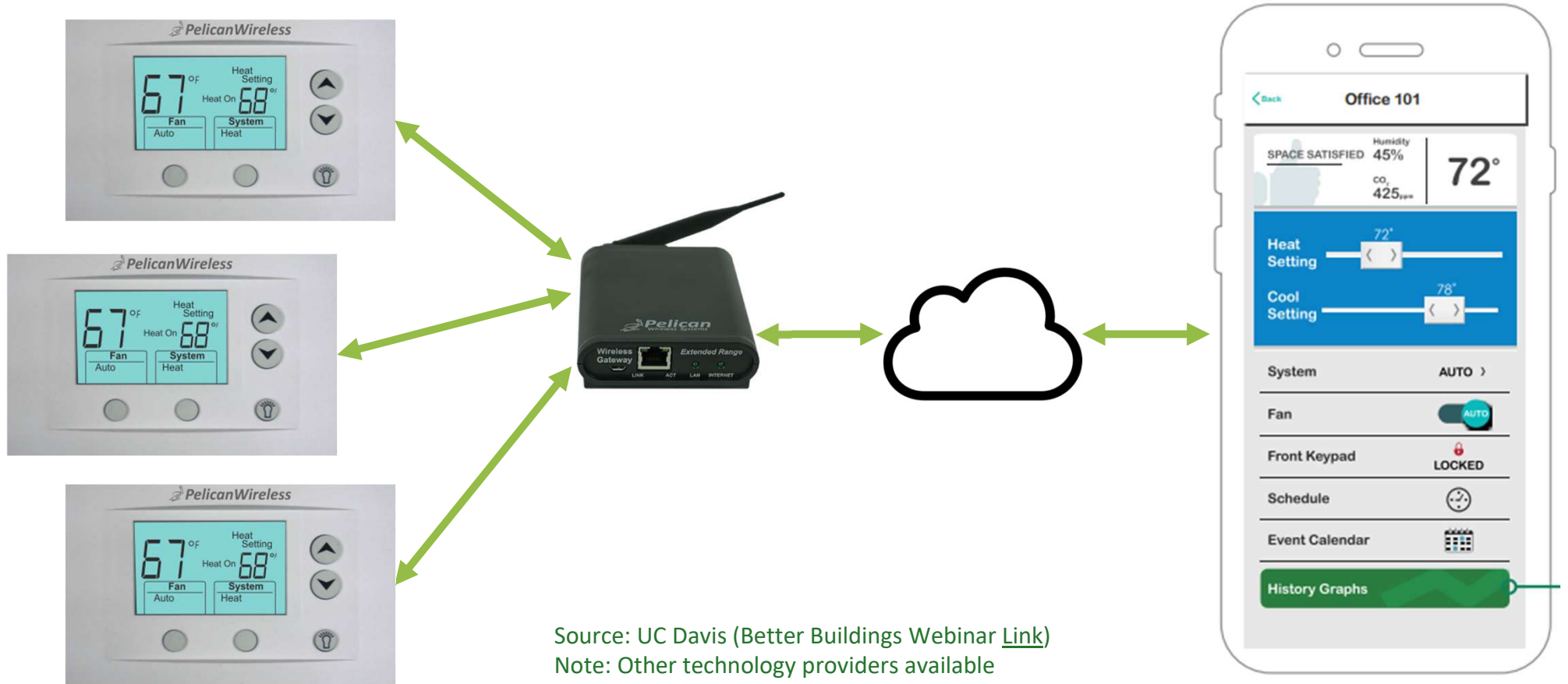
Best Practice: Network-enabled tstats allow for central web-based RTU monitoring and control [see figure]

Advanced: Best practice + RTU-level FDD + Automated demand management strategies



Source: UC Davis (Better Buildings Webinar [Link](#))

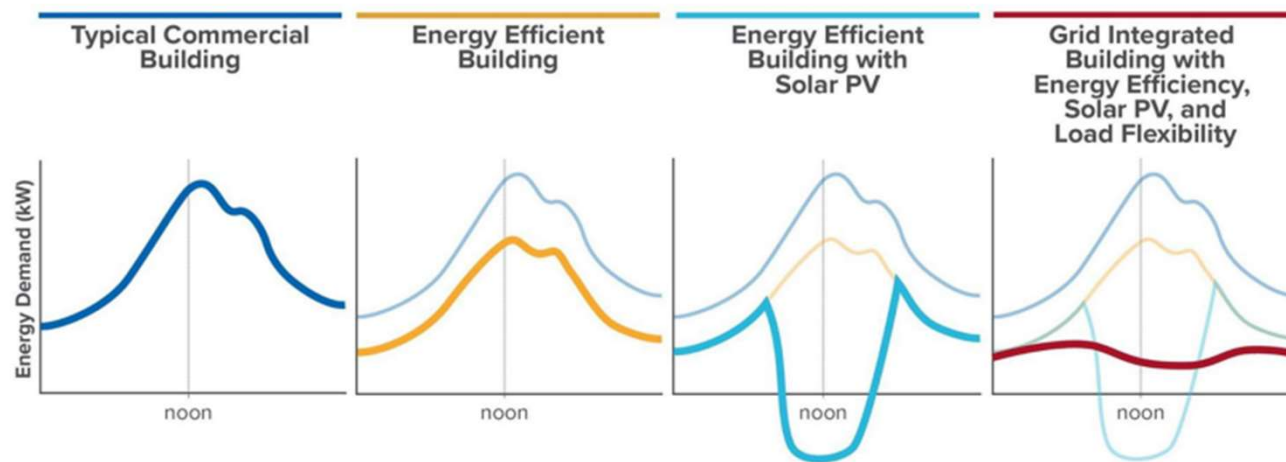
Control/Monitoring for Rooftop Units



Source: UC Davis (Better Buildings Webinar [Link](#))
Note: Other technology providers available

Automating demand management & load flexibility

- Automated demand management with EMIS to visualize peak demand
- Event-based automated demand response
- Integrate electric batteries to balance PV production and provide load flexibility



Source: [RMI presentation for Better Buildings](#)



[Study for the Retail Sector](#)
[RMI/NREL](#)

Getting Started with EMIS

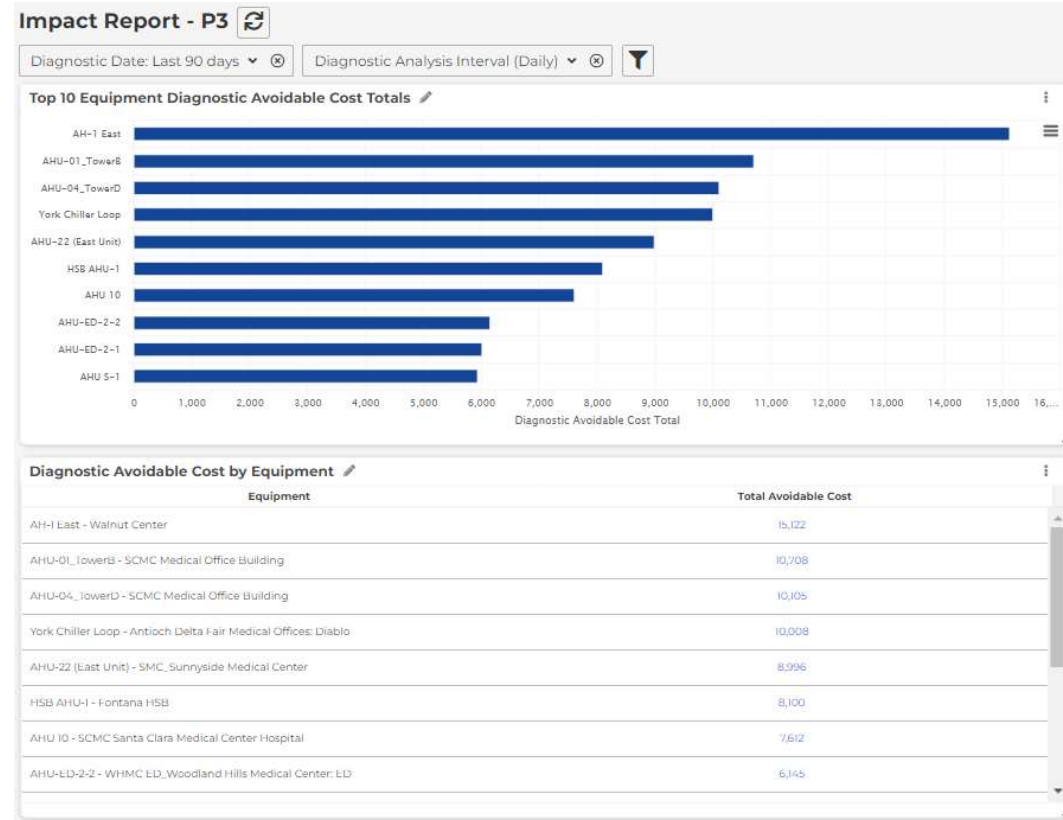
- Start with the data you have
- Kick off with a pilot to avoid overload
- Combine with other efforts like commissioning or controls retrofits
- Consider EMIS as enhancing staff capabilities
- Start with a specific goal
- Consider using third parties to support



Source: Carleton College

EMIS Best Practices

- Integrate EMIS with regular meetings
- Leverage EMIS reporting to maintain management support
- Use EMIS analytics to make energy waste visible
- Use EMIS in newly-constructed buildings as well as existing buildings



Source: [Kaiser Permanente, Better Buildings Webinar](#)

Thank you

- Building owners, operators, and managers
 - Invitation to [join](#) the Better Buildings Alliance
 - Contact bba@ee.doe.gov with questions
- Invitation to join the Better Buildings EMIS Tech Team email list
 - Webinars, technology updates, and peer presentations
 - Hannah Kramer hkramer@lbl.gov

