Energy Management and Information Systems: State of Technology

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Lawrence Berkeley National Laboratory
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

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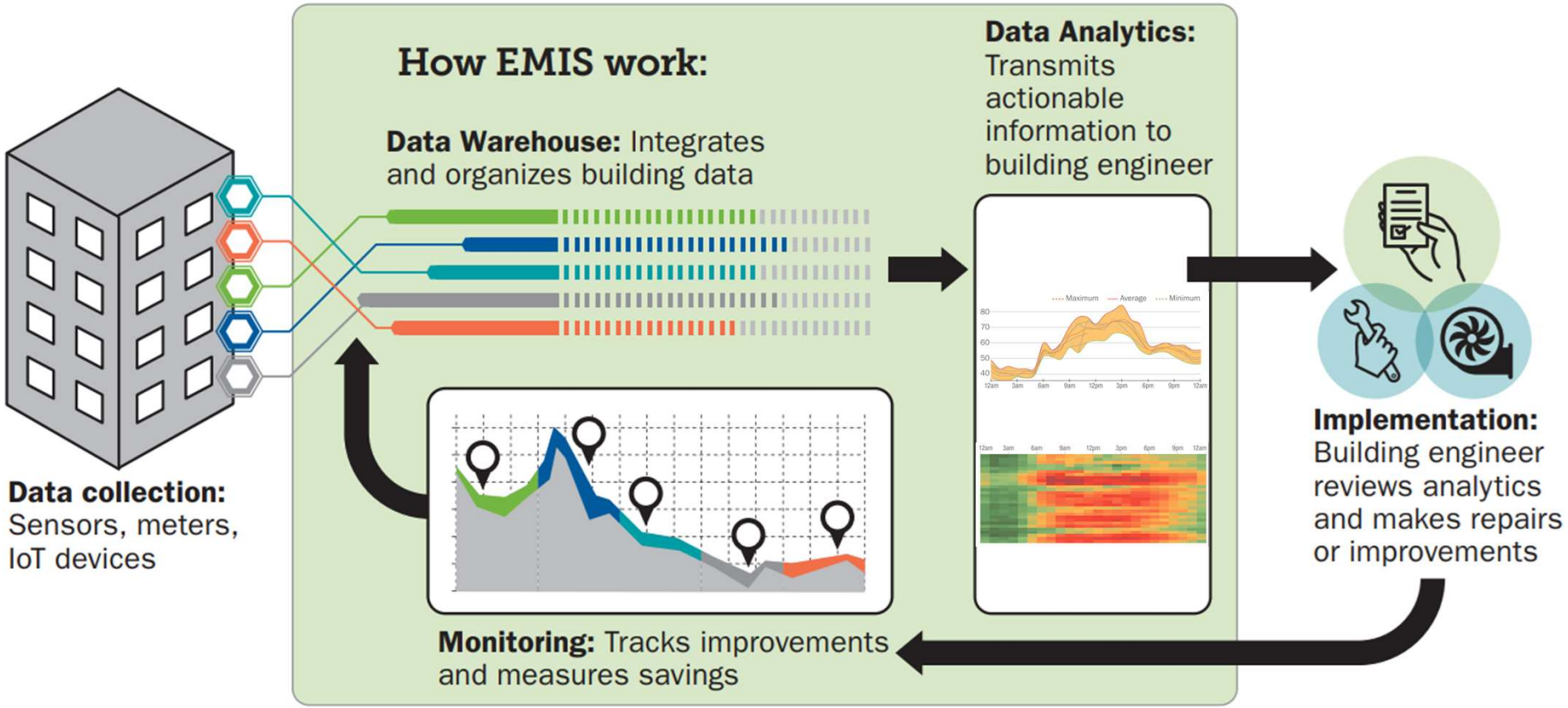
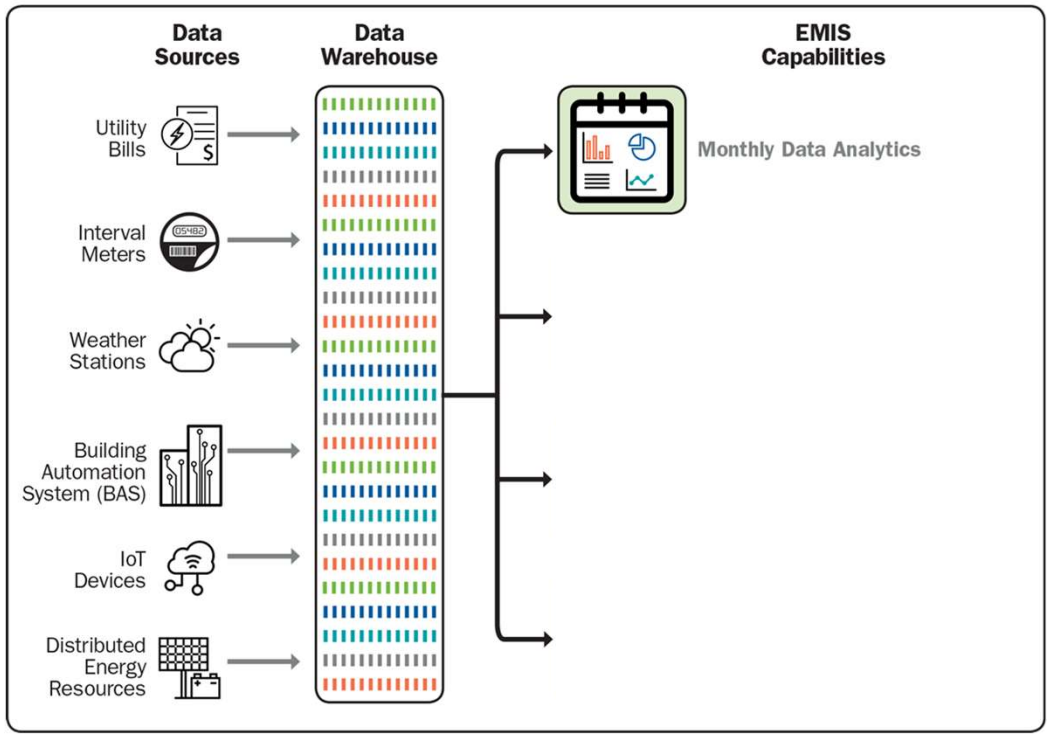
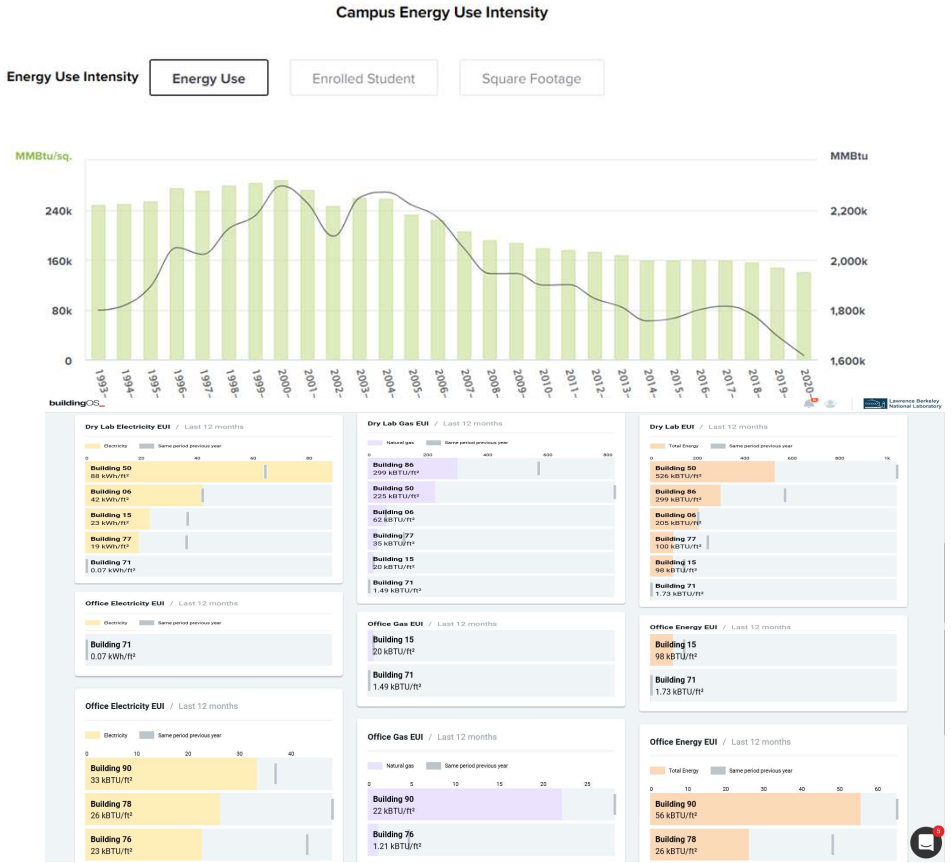
Energy Management Process with EMIS



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





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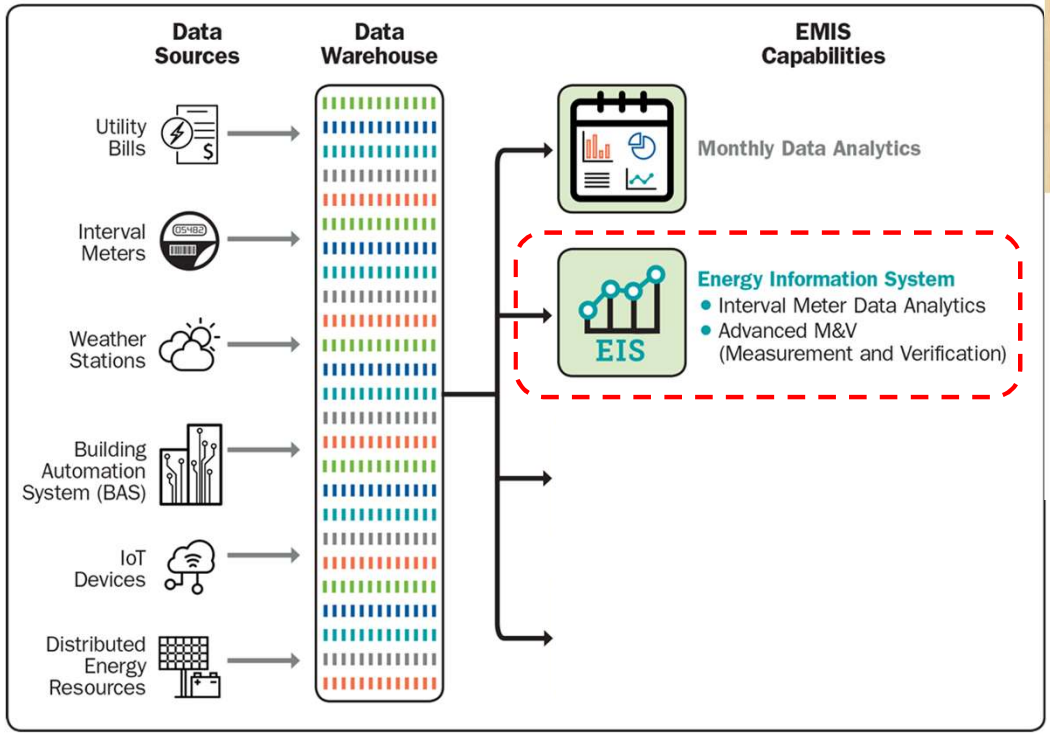
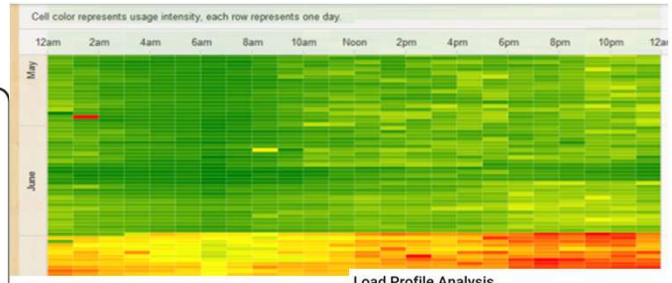
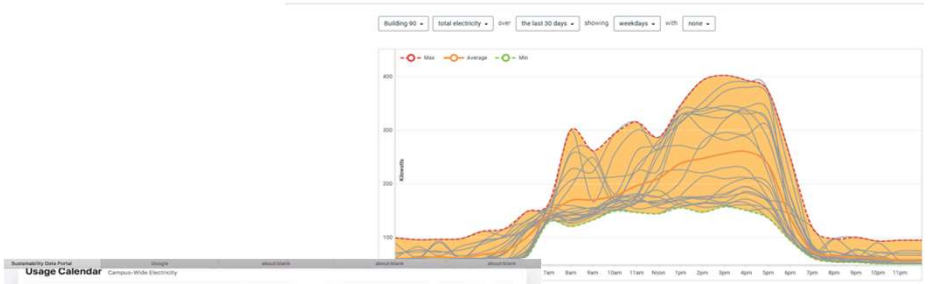
Energy Management & Information Systems: Energy Information Systems (EIS)





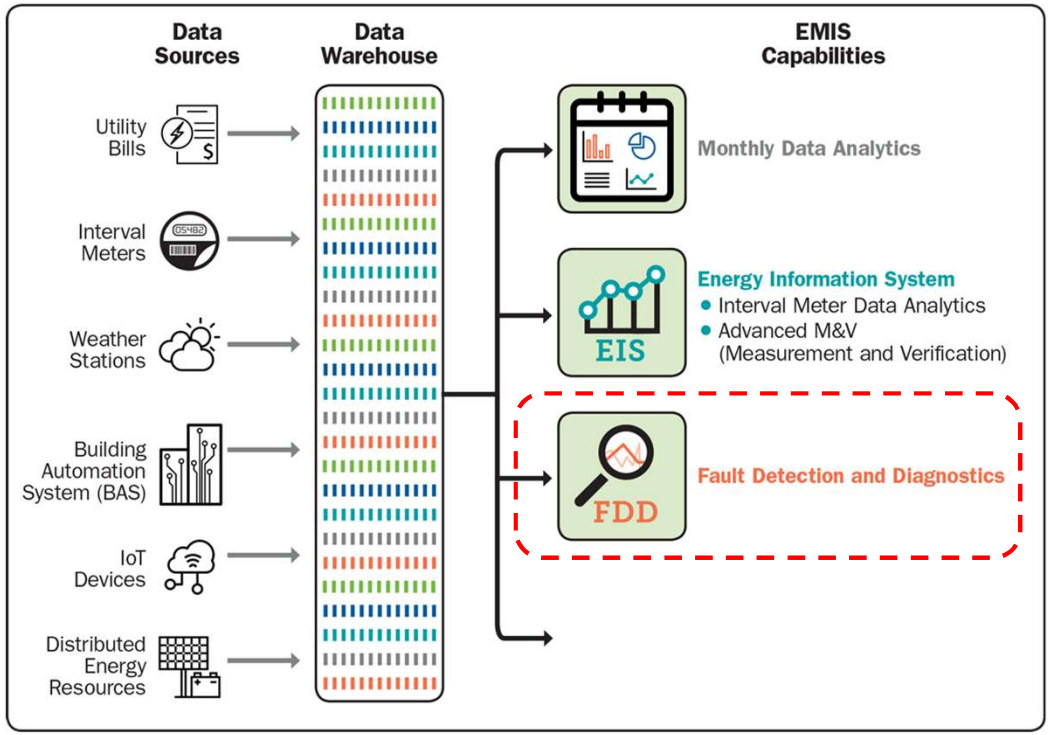
Load Profile Analysis

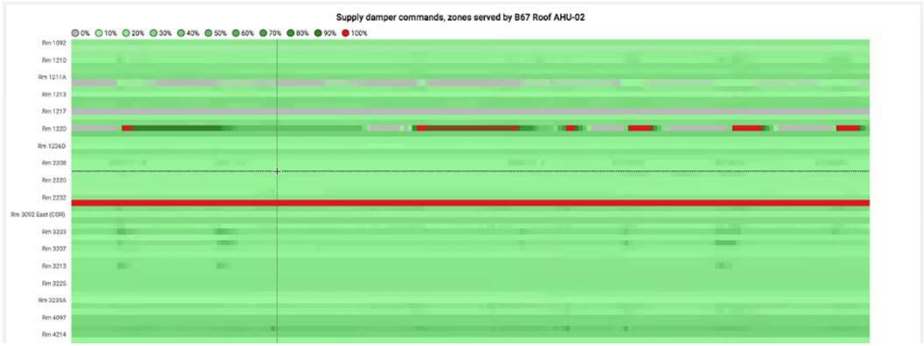


Source: LBNL

Source: Macalester College

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





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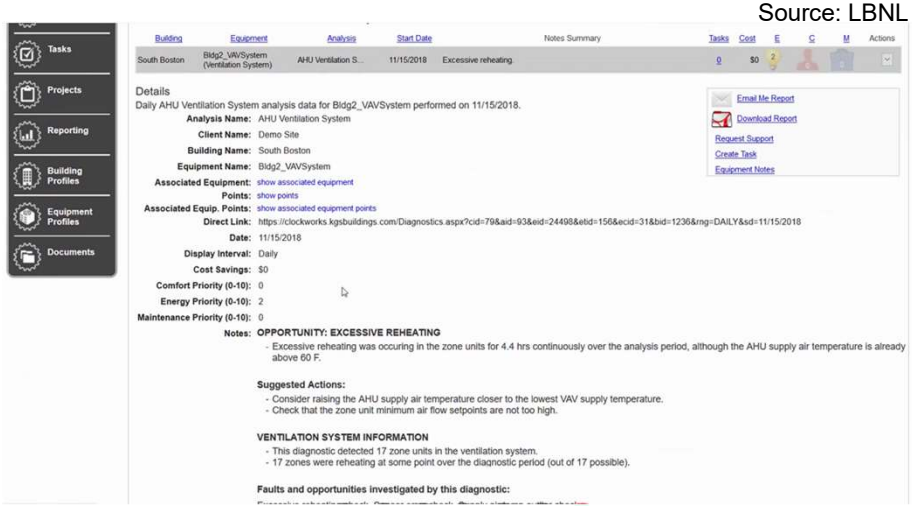
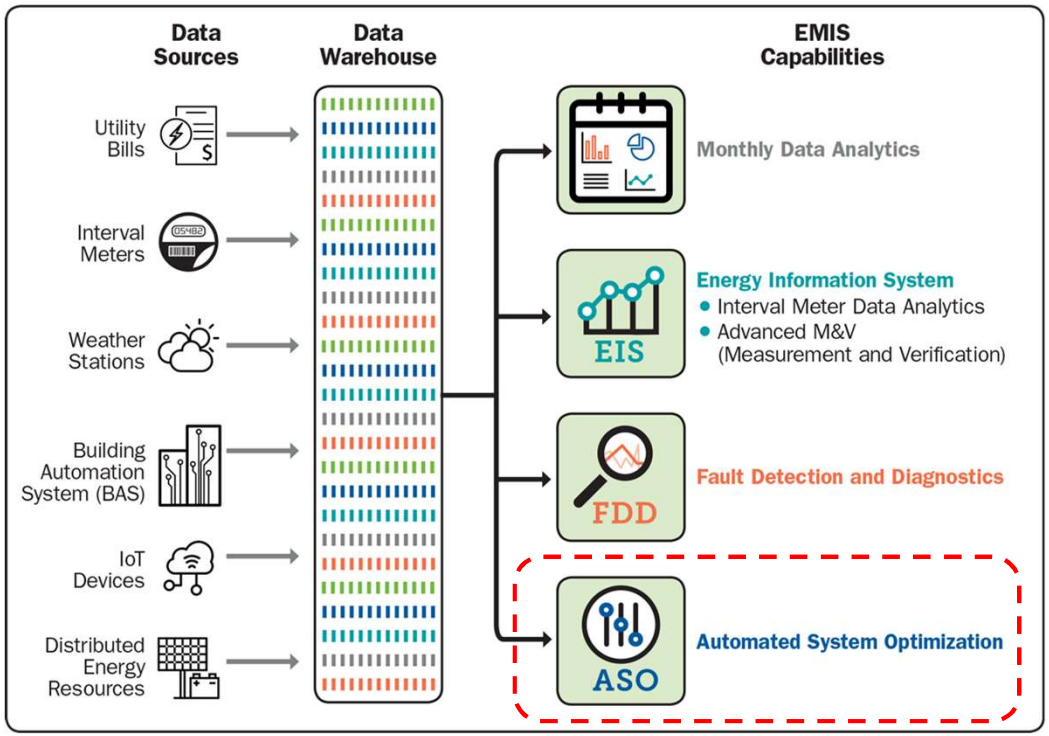
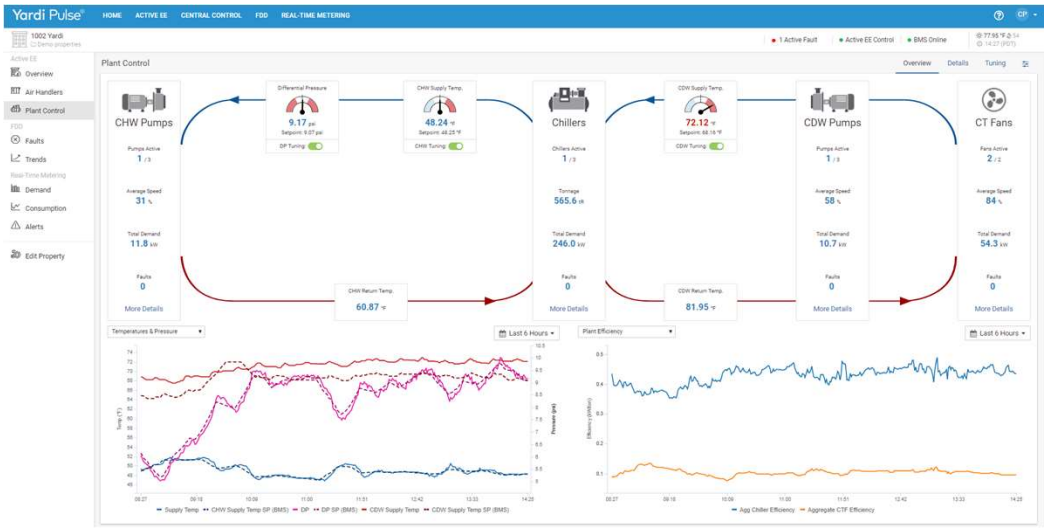


Source: Clockworks Analytics

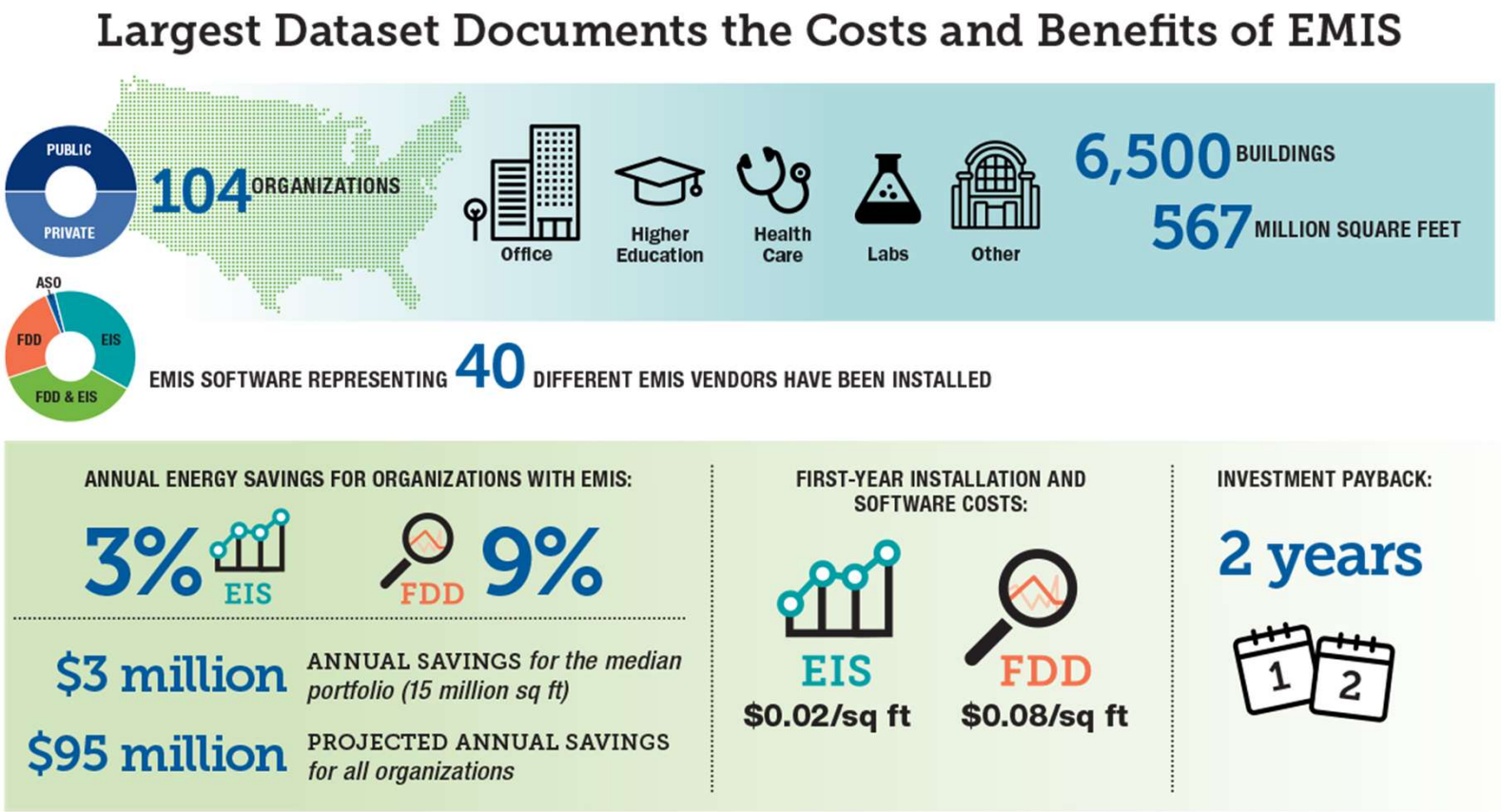
Energy Management & Information Systems: Automated System Optimization (ASO)





Source : Yardi Pulse

Smart Energy Analytics Campaign 2016-2020

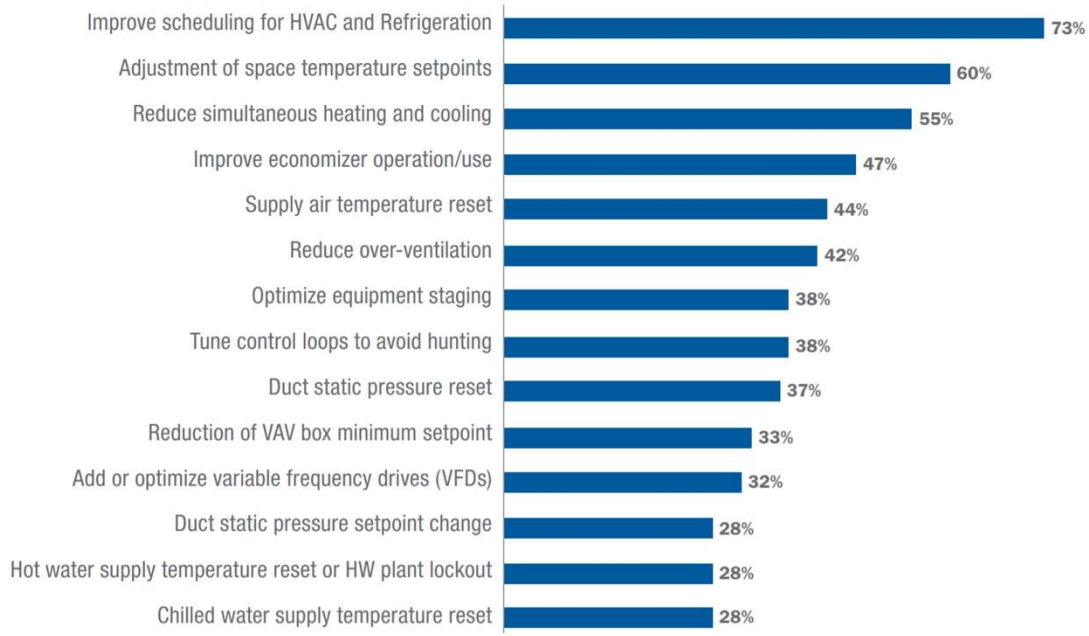


[Proving the Business Case for Building Analytics, 2020]

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

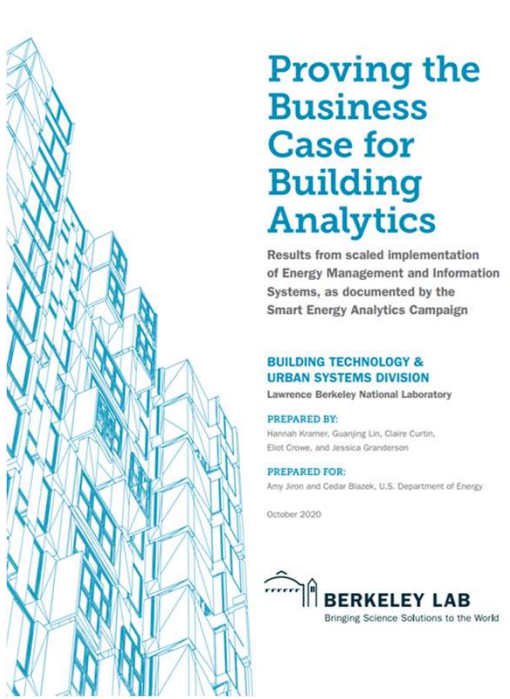
EMIS Products

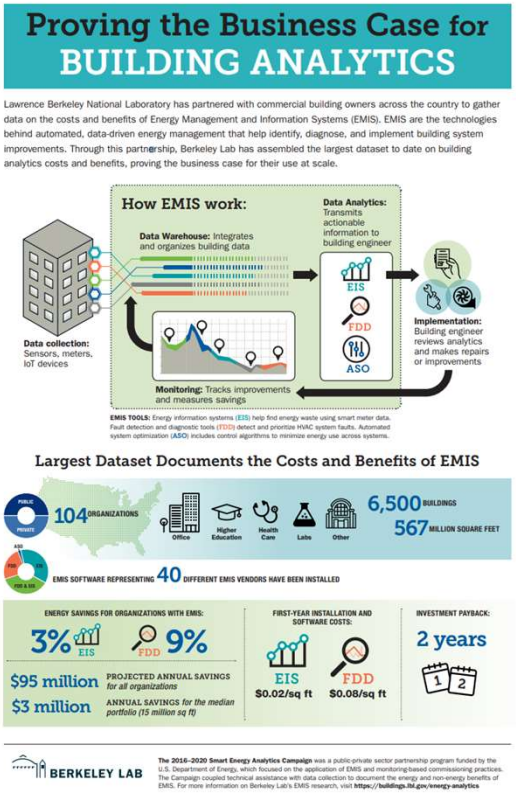
- EIS and FDD capabilities in single software
- Prioritization of faults
- Over 100 EMIS in the market and growing
  - 60% with EIS capabilities, 30% FDD, 10% ASO
- Machine learning (ML) beginning to be used for data tagging, load prediction, control optimization (ML webinar)
- CMMS integration and automated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





Smart Energy Analytics Campaign Toolkit

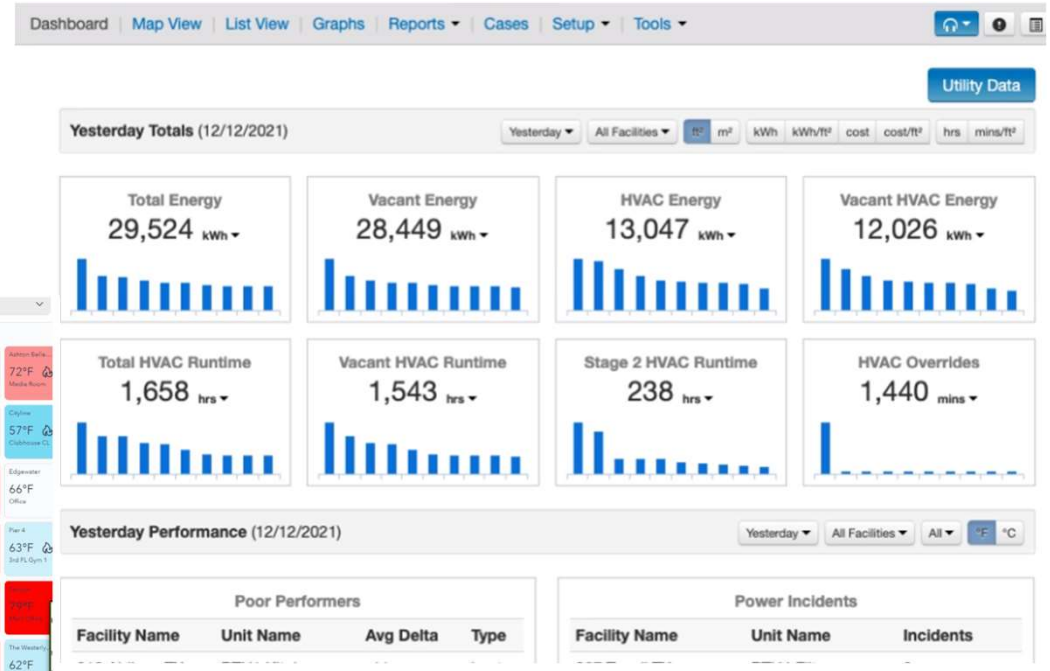
Resources, templates, and success stories

betterbuildingssolutioncenter.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

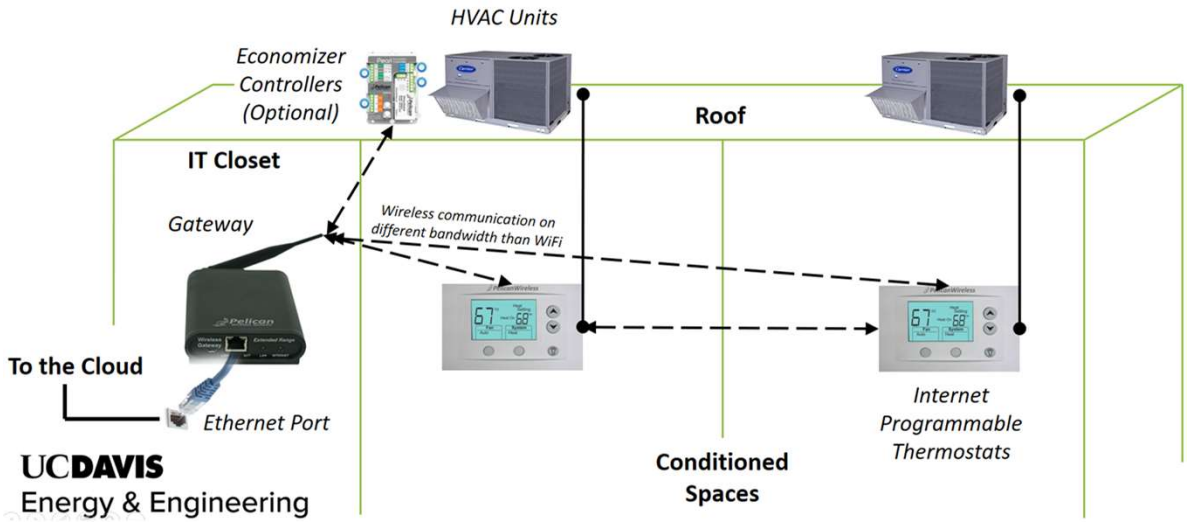
- Manage HVAC schedules and temp setpoints
- Add and monitor demand-controlled ventilation strategy (DCV)
- Review RTU FDD results
- Data visualization and benchmarking
- Monitoring additional important loads like kitchen equipment, refrigeration, and lighting

RTU Controls and Monitoring

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

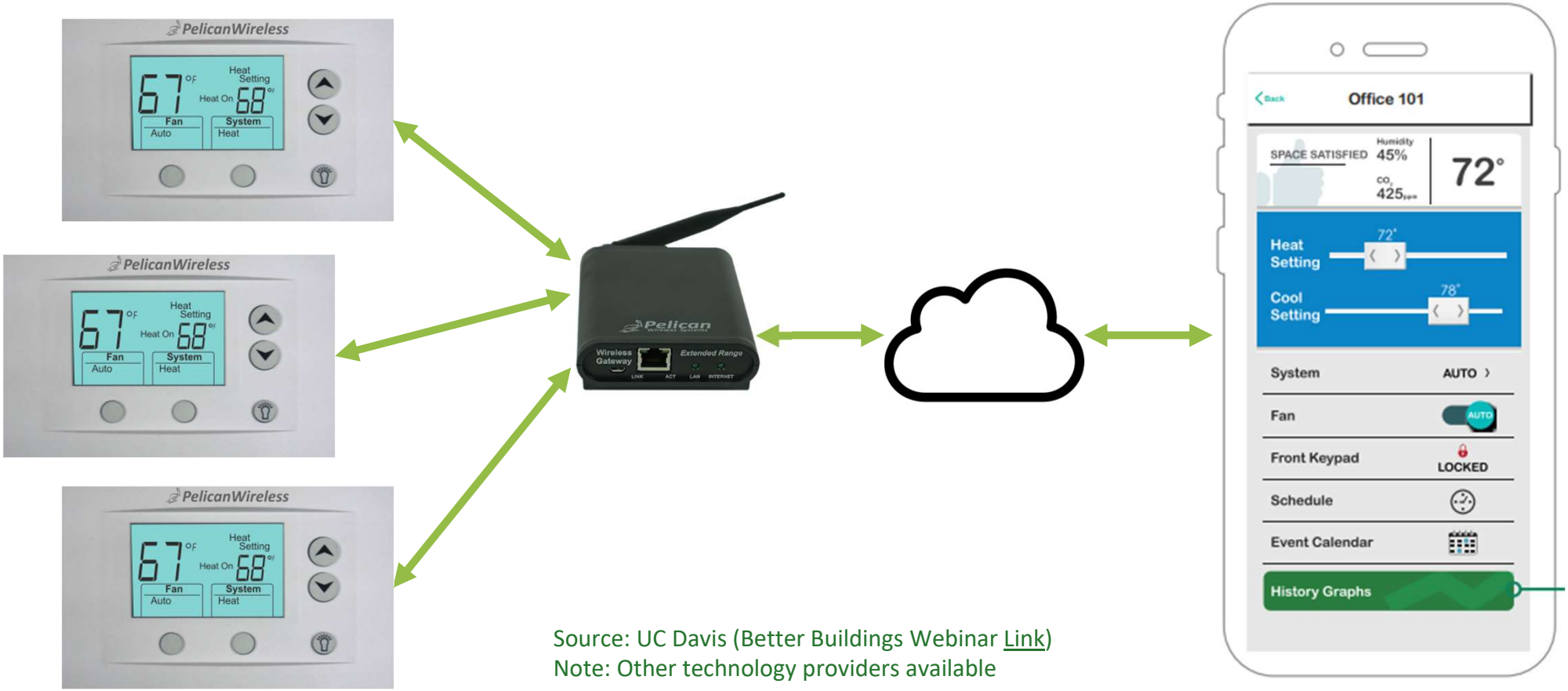
Best Practice: Network-enabled tstats allow for central web-based RTU monitoring and control [see figure]

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



Source: UC Davis (Better Buildings Webinar Link)

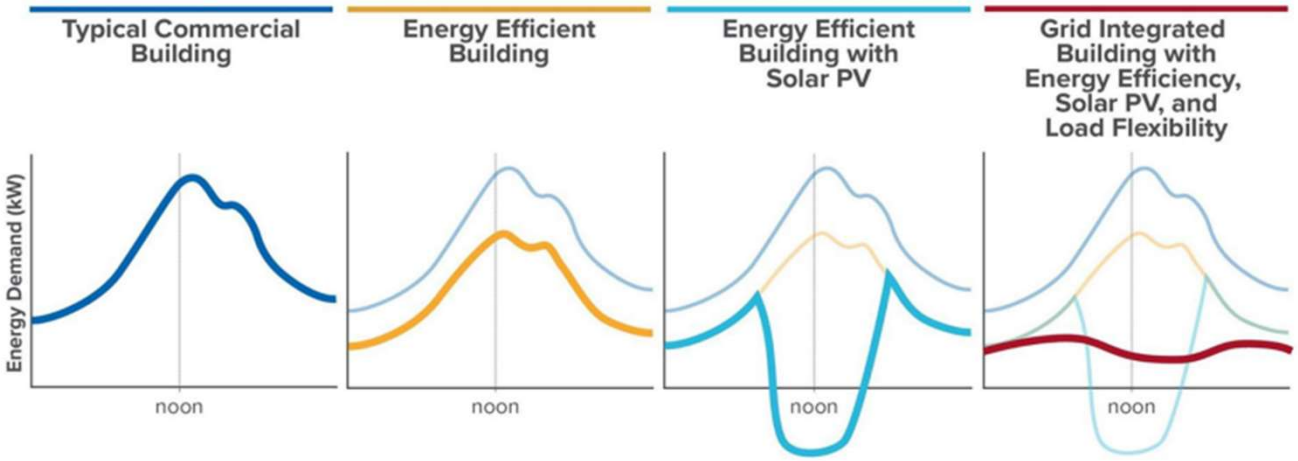
Control/Monitoring for Rooftop Units



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

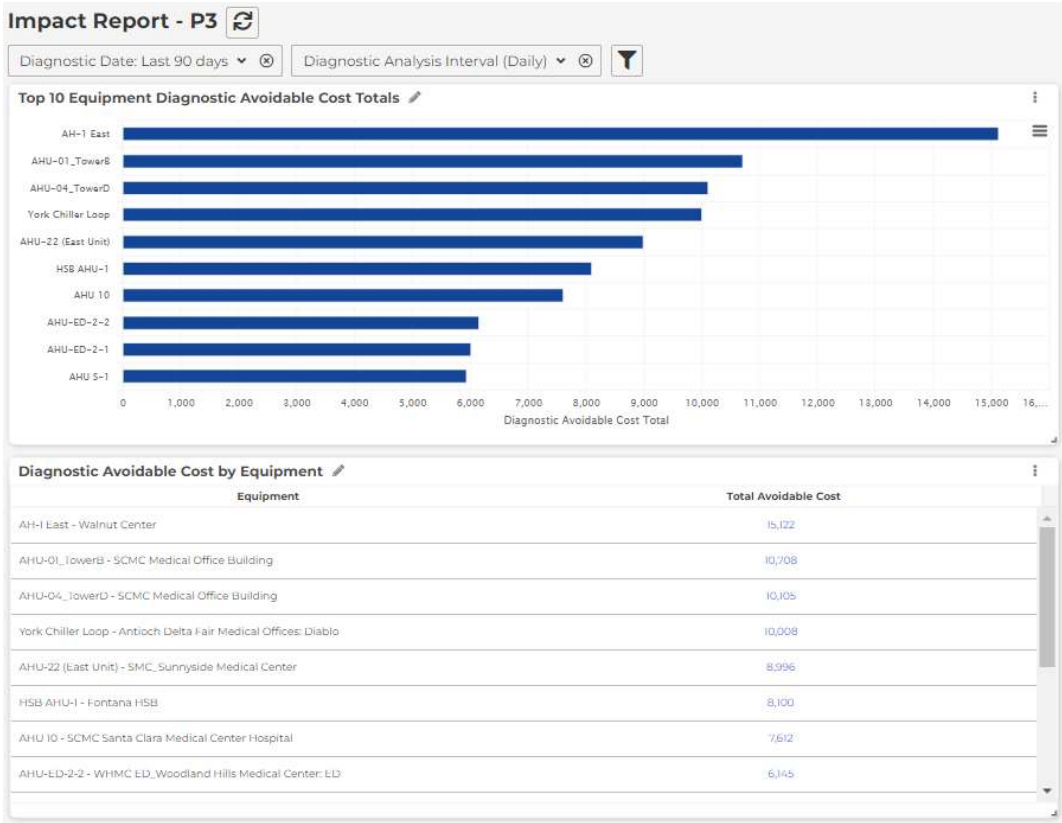
Getting Started with EMIS

- 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