Analytics in Commercial Buildings: Second-year Outcomes on Costs, Savings and Industry Trends from the Smart Energy Analytics Campaign

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Lawrence Berkeley National Laboratory
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Welcome!

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What we’ll cover today

- EMIS and MBCx overview
- Fall Recognition
- Research Findings
- Trends in Delivery of EMIS Products and Services

smart-energy-analytics.org
Smart Energy Analytics Campaign

- Tech support for EMIS and MBCx
- Publish research on EMIS cost, savings, use
- Recognition Program
- Participation to date
  - 77 organizations
  - 100+ supporting partners

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Energy Information Systems (EIS)
Energy Information Systems (EIS)

Source: Macalester College Sustainability Data Portal

Source: Lucid BuildingOS

Source: Aquicore
## Fault Detection & Diagnostics (FDD)

<table>
<thead>
<tr>
<th>Site</th>
<th>Rule</th>
<th>Duration</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>Other Damper Hunting</td>
<td>7.5hr</td>
<td>Wed 3rd</td>
</tr>
<tr>
<td></td>
<td>Zone Airflow SP Not Met</td>
<td>9875.62hr</td>
<td>Mon 15th</td>
</tr>
<tr>
<td>62</td>
<td>Zone Damper Always Closed</td>
<td>6452hr</td>
<td>Mon 15th</td>
</tr>
<tr>
<td>67</td>
<td>Zone Damper Full Open</td>
<td>2760hr</td>
<td>Mon 15th</td>
</tr>
<tr>
<td></td>
<td>Zone Damper Full Open</td>
<td>19.25hr</td>
<td>Mon 15th</td>
</tr>
<tr>
<td></td>
<td>Zone Damper Hunting</td>
<td>584.27hr</td>
<td>Mon 15th</td>
</tr>
<tr>
<td></td>
<td>Zone Level Damper Hunting</td>
<td>55.5hr</td>
<td>Mon 15th</td>
</tr>
<tr>
<td></td>
<td>Zone Level Valve Hunting</td>
<td>2.1hr</td>
<td>Mon 15th</td>
</tr>
<tr>
<td>77</td>
<td>AHU Runs Continuously</td>
<td>1102.93hr</td>
<td>Mon 15th</td>
</tr>
<tr>
<td></td>
<td>Boiler Failure or Alarm</td>
<td>187.55hr</td>
<td>Mon 15th</td>
</tr>
<tr>
<td></td>
<td>Boiler Or Chiller Pump Mismatch</td>
<td>94.85hr</td>
<td>Mon 15th</td>
</tr>
</tbody>
</table>
## Top 5 Issues

### Energy

<table>
<thead>
<tr>
<th>Building</th>
<th>Equipment</th>
<th>Notes</th>
<th>Cost/Qtr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anon Hospital</td>
<td>AHU_6_CAVs</td>
<td>Low Damper Position – opportunity for static pressure reset.</td>
<td>$11,120</td>
</tr>
<tr>
<td>Anon Hospital</td>
<td>AHU_11</td>
<td>No supply temp reset. Cooling valve issues.</td>
<td>$7,778</td>
</tr>
<tr>
<td>Anon Hospital</td>
<td>AHU_6</td>
<td>No supply temp reset. Cooling valve issues.</td>
<td>$6,163</td>
</tr>
<tr>
<td>Anon Hospital</td>
<td>AHU_5</td>
<td>Supply temp lower than setpoint. No supply temp reset. Cooling valve issues.</td>
<td>$5,029</td>
</tr>
<tr>
<td>Anon Hospital</td>
<td>AHU_4</td>
<td>Supply temp lower than setpoint. No supply temp reset. Cooling valve issues.</td>
<td>$4,318</td>
</tr>
</tbody>
</table>

### Maintenance

<table>
<thead>
<tr>
<th>Building</th>
<th>Equipment</th>
<th>Notes</th>
<th>Severity Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anon Hospital</td>
<td>AHU_11</td>
<td>Static pressure lower than setpoint. Supply fan speed constant. Return fan speed constant.</td>
<td>6</td>
</tr>
<tr>
<td>Anon Hospital</td>
<td>AHU_10</td>
<td>Static pressure lower than setpoint. Supply fan speed constant.</td>
<td>6</td>
</tr>
<tr>
<td>Anon Hospital</td>
<td>CAV6_2</td>
<td>Room temp lower than setpoint. Stuck reheat valve.</td>
<td>4</td>
</tr>
<tr>
<td>Anon Hospital</td>
<td>CAV5_82</td>
<td>Supply flow lower than setpoint. Stuck reheat valve. – May be sensor error.</td>
<td>4</td>
</tr>
<tr>
<td>Anon Hospital</td>
<td>CAV3_11</td>
<td>Sensor error. Stuck reheat valve.</td>
<td>4</td>
</tr>
</tbody>
</table>
New Installation Recognition

- **Kerry Inc.**
  FDD in a Single Site (320,000 sq ft)

- **Clise Properties**
  EIS in a Single Site (500,000 sq ft)

- **Stanford University Residential and Dining Enterprises**
  EIS in a Portfolio (4.9 million sq ft)

MBCx Provider Recognition

- CBRE | ESI
- Sieben Energy Associates
Success Stories

Building Analytics Success Story
Stanford University Residential & Dining Enterprises

Just a few years ago, Stanford University’s Residential and Dining Enterprises could not track utility consumption in a meaningful way. With 3,000 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).

To get their EIS up and running, Stanford connected all energy, water, and waste data - 965 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, water and wastewater 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 and point 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.

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 thermostats, 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 real-time 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.

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 $45k in cost savings in the first year.
EIS Software: Lucid BuildingOS

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.

smart-energy-analytics.org/success-stories
Smart Energy Analytics Campaign Participants Recognized (smart-energy-analytics.org/success-stories)
# Webinars and Resources

## Webinars

<table>
<thead>
<tr>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018 Spring Recognition Webinar</td>
</tr>
<tr>
<td>Building Data Management: Best Practices and Lessons Learned from EMIS Installations</td>
</tr>
<tr>
<td>Dashboards and Beyond: Designing Energy Information Systems for Success</td>
</tr>
<tr>
<td>EMIS Crash Course</td>
</tr>
<tr>
<td>EMIS Meets Lighting and Electrical</td>
</tr>
<tr>
<td>Getting the Most Out of Your EIS</td>
</tr>
<tr>
<td>How to Join the Campaign and Get the Most Out of Your Participation</td>
</tr>
<tr>
<td>Implementing Fault Detection &amp; Diagnostics in Higher Education</td>
</tr>
<tr>
<td>Supporting Partner Update January 2018</td>
</tr>
<tr>
<td>Year 1 Outcomes for Smart Energy Analytics Campaign</td>
</tr>
</tbody>
</table>

[smart-energy-analytics.org/top-resources](http://smart-energy-analytics.org/top-resources)

[smart-energy-analytics.org/webinar](http://smart-energy-analytics.org/webinar)
Polling Question #1

What point are you in the process of implementing EMIS?

- Considering it
- RFP development / procurement phase
- Installing and configuring
- I am using my EMIS
- Not applicable, I’m an EMIS provider
- Not applicable, other
Year 2 Results: Smart Energy Analytics Campaign

Participants

- 77 organizations
- 5000+ buildings
- 400+ million sq ft
Who are the Campaign Participants?

Primary Market Sector

Distribution of Portfolio Floor Area

Pledged Gross Floor Area
## What do owners do with their EMIS?

<table>
<thead>
<tr>
<th>EMIS Type</th>
<th>Analytics</th>
<th>Common Measures Identified</th>
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<tr>
<td>EIS</td>
<td>• Benchmarking</td>
<td>• Start-up and shutdown schedule</td>
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<tr>
<td></td>
<td>• Heat maps</td>
<td>• Base load reduction</td>
</tr>
<tr>
<td></td>
<td>• Load profiles</td>
<td>• Peak demand reduction</td>
</tr>
<tr>
<td></td>
<td>• Predictive models</td>
<td>• High energy use relative to past or predicted performance, or relative to portfolio</td>
</tr>
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<td></td>
<td>• Automated M&amp;V with interval data models</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>• Automated M&amp;V with interval data models</td>
</tr>
<tr>
<td>FDD</td>
<td>• Expert rules</td>
<td>• Setpoint optimization</td>
</tr>
<tr>
<td></td>
<td>• Pattern recognition</td>
<td>• Simultaneous heating and cooling</td>
</tr>
<tr>
<td></td>
<td>• Prioritization of faults</td>
<td>• Economizer performance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Valve leak-by</td>
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<tr>
<td></td>
<td></td>
<td>• Terminal unit operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Detecting failed sensors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use data to inform retrofits</td>
</tr>
</tbody>
</table>
## Top Measures Implemented from EMIS Insights

<table>
<thead>
<tr>
<th>Measure</th>
<th>Percent of participants implementing measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduling Equipment Loads</td>
<td>71%</td>
</tr>
<tr>
<td>Control Problems</td>
<td>64%</td>
</tr>
<tr>
<td>Economizer/Outside Air Loads</td>
<td>59%</td>
</tr>
<tr>
<td>Controls: Setpoint Changes</td>
<td>59%</td>
</tr>
<tr>
<td>Controls: Reset Schedule Addition or Modification</td>
<td>52%</td>
</tr>
<tr>
<td>Retrofits</td>
<td>45%</td>
</tr>
<tr>
<td>Equipment Efficiency Improvements / Load...</td>
<td>34%</td>
</tr>
<tr>
<td>Occupant Behavior Modification</td>
<td>29%</td>
</tr>
</tbody>
</table>
Important benefits of implementing EMIS
(Participants may select multiple benefits)

- Energy savings: 89%
- Utility cost savings: 82%
- Data to inform retrofit strategies or validate energy savings: 79%
- Improved occupant comfort: 55%
- O&M staff labor savings due to improved operations: 45%
- Peak demand reduction: 43%
- Other: 5%
Overall Energy and Cost Savings Since EMIS Installation
(27 organizations, 679 buildings, 94 million sq ft)

Median savings = 7%; $0.19/sq ft
Energy Savings Since EMIS Installation by Year
(27 organizations, 679 buildings, 94 million sq ft)

Percent reduction in energy use, relative to the year before EMIS installation
## Energy Savings Since EMIS Installation: EIS and FDD Savings (preliminary)

<table>
<thead>
<tr>
<th>EMIS Type</th>
<th>Median Energy Savings since EMIS installation</th>
<th>Range of Energy Savings</th>
<th>Length of EMIS installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIS (n=7)</td>
<td>1%</td>
<td>-6% to 7%</td>
<td>1 year (n=7)</td>
</tr>
<tr>
<td>FDD and FDD + EIS (n=20)</td>
<td>10%</td>
<td>-2% to 26%</td>
<td>1 year (n=9); 2-4 years (n=11)</td>
</tr>
<tr>
<td>All EMIS (n=27)</td>
<td>7%</td>
<td>-6% to 26%</td>
<td>1 year (n=16); 2-4 years (n=11)</td>
</tr>
</tbody>
</table>
EMIS Base Software and Installation Cost ($/sq ft)

EMIS Median Base Cost $0.03/sq ft

- **EIS**
- **FDD or FDD + EIS**
EMIS Recurring software / service cost ($/sq ft per year)

EMIS Median Recurring Cost $0.02/sq ft per year

- EIS
- FDD or FDD + EIS
# EIS and FDD Costs (preliminary)

<table>
<thead>
<tr>
<th>EMIS Type</th>
<th>Base software &amp; install cost ($/sq ft)</th>
<th>Recurring software/ service cost ($/sq ft-yr)</th>
<th>In-house labor cost ($/sq ft-yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIS (n=12)</td>
<td>$0.01</td>
<td>$0.01</td>
<td>$0.03</td>
</tr>
<tr>
<td>FDD and FDD + EIS (n=23)</td>
<td>$0.05</td>
<td>$0.02</td>
<td>$0.04</td>
</tr>
<tr>
<td>EMIS Overall (n=37)</td>
<td>$0.03</td>
<td>$0.02</td>
<td>$0.03</td>
</tr>
</tbody>
</table>
EMIS Cost per sq ft by Portfolio size

Base Cost ($/sq ft) vs Portfolio Size

- $0.60
- $0.50
- $0.40
- $0.30
- $0.20
- $0.10
- $0.00

Building Portfolio Size (sq ft)

- $0.00
- 10,000,000
- 20,000,000
- 30,000,000
- 40,000,000
- 50,000,000
- 60,000,000

EIS  FDD
EMIS Cost per sq ft by Portfolio size

Base Cost ($/sq ft) vs Portfolio Size

- EIS
- FDD

Building Portfolio Size (sq ft)

$/sq ft

- $0.00
- $0.10
- $0.20
- $0.30
- $0.40
- $0.50
- $0.60
Polling Question #2

How would you like to be involved in the Smart Energy Analytics Campaign?

• I'm already a Campaign participant
• I would like to learn more about participation
• I know an organization that might be interested in learning about the Campaign
• As a supporting partner, I will introduce customers to the Campaign
• I'm not ready to join yet, but I'd like to stay in the loop
Trends in Delivery of EMIS Products and Services
EMIS Product Trends

New EMIS continue to enter market

- Energy Information Systems (EIS): 57
- Fault Detection and Diagnostic Systems (FDD): 28
- Automated System Optimization (ASO): 7

**Energy Information Systems**

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agilis Energy</td>
<td>Agilis Energy</td>
</tr>
<tr>
<td>Alaska Housing Finance Corp.</td>
<td>Building Monitoring System (publicly available, Open Source)</td>
</tr>
<tr>
<td>Aquicore</td>
<td>AQ-Optimization</td>
</tr>
<tr>
<td>Building IQ</td>
<td>Energy WorkSite</td>
</tr>
<tr>
<td>Buildings Alive</td>
<td>Buildings Alive</td>
</tr>
</tbody>
</table>

**Fault Detection and Diagnosis Systems**

<table>
<thead>
<tr>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>BuildPulse</td>
</tr>
<tr>
<td>Analytika</td>
</tr>
<tr>
<td>Climacheck Online (RTU)</td>
</tr>
<tr>
<td>AxcessEEM</td>
</tr>
</tbody>
</table>

smart-energy-analytics.org/product-service
EMIS Selection – What’s important to Campaign participants

- EMIS use by champion
- Flexibility for future expansion or vendor change
- Big picture metrics/charts
- Basis of FDD rules
Products used by Campaign Participants to Date

**EIS Products**
- Aquicore
- eDNA
- EnergyCAP
- EnerNOC
- EnerTrac
- Honeywell Enacto
- ICONICS
- Interval Data Systems
- Lucid BuildingOS
- MACH Energy
- Melrok
- New City Energy
- OSIsoft PI

**FDD Products**
- Parasense
- Periscope
- Schneider Ion Enterprise
- Siemens Apogee
- SiteSage
- SkySpark
- Tableau
- The Energy Detective
- Trane Energy Performance
- Vykon Energy Suite
- Wonderware

**ASO Products**
- Buildpulse
- CopperTree Analytics
- Ecorithm
- ICONICS
- Interval Data Systems
- KGS Clockworks
- Parasense
- Powerhouse Dynamics
- SkySpark
- Trane Building Performance
- BuildingIQ
Trend: FDD Summary Views

Enterprise Dashboards

Site Overview
B18 - 6550 - KSOPHR

Date Range
April 2017

6550 Sprint Parkway
Overland Park, KS 66251

Faults
$2.45/ft²
156.30 kBTU/ft²

150

N/A Tickets
$596,255
Rolling 12-Month Energy Cost

Fault Name
Cost
Count
AHU Discharge Temperature Setpoint Unreachable
$2,917.53
17
Bad Sensor (Sensor Failure)
$240.00
10
AHU Cooling Failure
$193.38
6
Terminal Unit Airflow Unreachable
$167.73
67
AHU Economizer & Cooling Simultaneously
$123.41
5

Source: Sprint in partnership with CBRE | ESI
Trend: FDD Summary Views

Source: Emory University/CopperTree Analytics
Trend: FDD Summary Views

The Diagnostics module provides a prioritized, searchable list of identified faults and energy saving opportunities across your portfolio.

132 data records found for 7/14/2016 to 7/14/2016 in daily intervals.

- **Building 2**
  - Equipment: Bldg2_AHU3 (Air Handler)
  - Category: AHU Coils
  - Start Date: 7/14/2016
  - Notes Summary: Leaking heating valve. Return RH higher than setpoint. Supply temp reset error.
  - Tasks: 1
  - Cost: $447
- **Demo Headquarters**
  - Equipment: AHU-1 (Air Handler)
  - Category: AHU Coils
  - Start Date: 7/14/2016
  - Notes Summary: Simultaneous heating and cooling. Leaking cooling valve.
  - Tasks: 1
  - Cost: $114
- **Building 1**
  - Equipment: Bldg1_AHU2 (Air Handler)
  - Category: AHU Fan
  - Start Date: 7/14/2016
  - Notes Summary: Fan on while unoccupied. Return air flow lower than setpoint. Abnormal fan current.
  - Tasks: 0
  - Cost: $93

**Last Month's Top Portfolio Diagnostic Summaries**

- **Total Faults = 89**
- **Total Avoidable Costs (USD) = $42,649**

<table>
<thead>
<tr>
<th>Building</th>
<th>Faults</th>
<th>Avoidable Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demo Headquarters</td>
<td>27</td>
<td>$22,514</td>
</tr>
<tr>
<td>Building 4</td>
<td>16</td>
<td>$6,593</td>
</tr>
<tr>
<td>Building 2</td>
<td>15</td>
<td>$4,725</td>
</tr>
<tr>
<td>Building 3</td>
<td>18</td>
<td>$4,517</td>
</tr>
<tr>
<td>Building 1</td>
<td>13</td>
<td>$4,300</td>
</tr>
</tbody>
</table>

Source: KGS Buildings
Participants with service provider supporting MBCx is increasing

Campaign Year 1

- In-house: 69%
- MBCx Provider: 31%

Campaign Year 2

- In-house: 47%
- MBCx Provider: 53%
Barriers and Enablers for Successful use of EMIS

**Barriers**
- Limited information on costs and savings
- Problems integrating data into EMIS
- Lack of staff time to review the EMIS and follow up
- Faults overload

**Enablers**
- Specifying an EMIS that meets building staff needs
- Energy savings goals and reporting drive use of EMIS
- Integration of EMIS with organizational processes like work order systems
- MBCx service provider support
EMIS Industry Needs

- Technical Improvements
  - Data quality and data management
  - Specific actions from analytic outputs
  - Meet need for EIS + FDD functionality

- Owner Support
  - EMIS review, specification and selection
  - Peer network
  - Utility incentives
EMIS Research at LBNL

- How do you test EMIS software in a standardized way?
- Which FDD faults are most prevalent and to what degree can faults be automatically fixed?
- What does it take to increase adoption of using hourly meter data to measure savings in real-time?
- What cyber-security issues most impact EMIS users?
Conclusions

- EMIS are critical in achieving persistent operational efficiency
- Industry expanding as owners show success
- Use of EMIS is what matters (not which tool you choose)
- Utility programs are beginning to incentivize MBCx
- Smart Energy Analytics Campaign accepting new participants

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Q&A

Submit your questions through chat icon on lower left of screen

Type your question here and hit Send
Upcoming Smart Energy Analytics Campaign Webinars

Open Invitation
Using an Energy Information Systems in Higher Education

December 4th, 2018
11am-12pm PST

Featured speaker:
Kristin Parineh
Stanford University
Residential and Dining Enterprises
Thank you

Interested in joining Smart Energy Analytics Campaign?
Smart-energy-analytics.org

Contact:
info@smart-energy-analytics.org

Hannah Kramer  hkramer@lbl.gov
Claire Curtin  cmcurtin@lbl.gov
Extra Slides
New Installation of FDD in a Single Site: Kerry Inc., Beliot, WI

Quick Facts

- **Floor area with EMIS:** 320,000 sq ft office/lab/manufacturing building
- **Facility Manager:** James Swarthout
- **FDD Software:** BuildPulse
- **Cx Provider:** Environmental Systems Design, Inc. (ESD)
- FDD flags HVAC faults and streamlines their EBCx process
Quick Facts

- **Floor area with EMIS:** 500,000 sq ft multi-tenant office
- **Facility manager:** Joshua Taylor
- **EIS Software:** Trane Energy Performance
- **MBCx Service:** Trane Building Performance
- Clise Properties uses EIS to determine impact of controls modifications on peak demand and energy use
New Installation of EIS in a Portfolio: Stanford University Residential and Dining Enterprises

Quick Facts

- **Floor area with EMIS:** 4.9 million sq ft; 375 interval meters
- **Sustainability and Utilities Manager:** Kristin Parineh
- **EIS Software:** Lucid BuildingOS
- **Year 1 Savings:** $450k -- 4% chilled water, 5% electric, 9% hot water, 10% gas
MBCx Provider Recognition: CBRE | ESI

- MBCx Provider for two Campaign award winners
  - **GSA (52M sq ft)** 14% energy savings for 87 buildings; Energy Performance Award
  - **Sprint HQ (4M sq ft)** 5% energy savings Best Practice Award

- Used SkySpark since 2012 to detect faults in 1500 buildings (161 M sq ft)
MBCx Provider Recognition:
Sieben Energy Associates

- **MBCx Provider for two Campaign participants, one award winner**
  - **The Franklin** (2.5M sq ft) Energy Performance award: 9% energy savings
  - **Michigan Plaza** (2M sq ft) 13% energy savings

- **EMIS**
  - Utilize both SkySpark and ComEd’s Business Energy Analyzer
  - Used SkySpark since 2011 to detect faults in over 11 M sq ft office space