



# Getting Smart About Energy Analytics

May 16, 2017

2:00-3:15pm

# Panelists

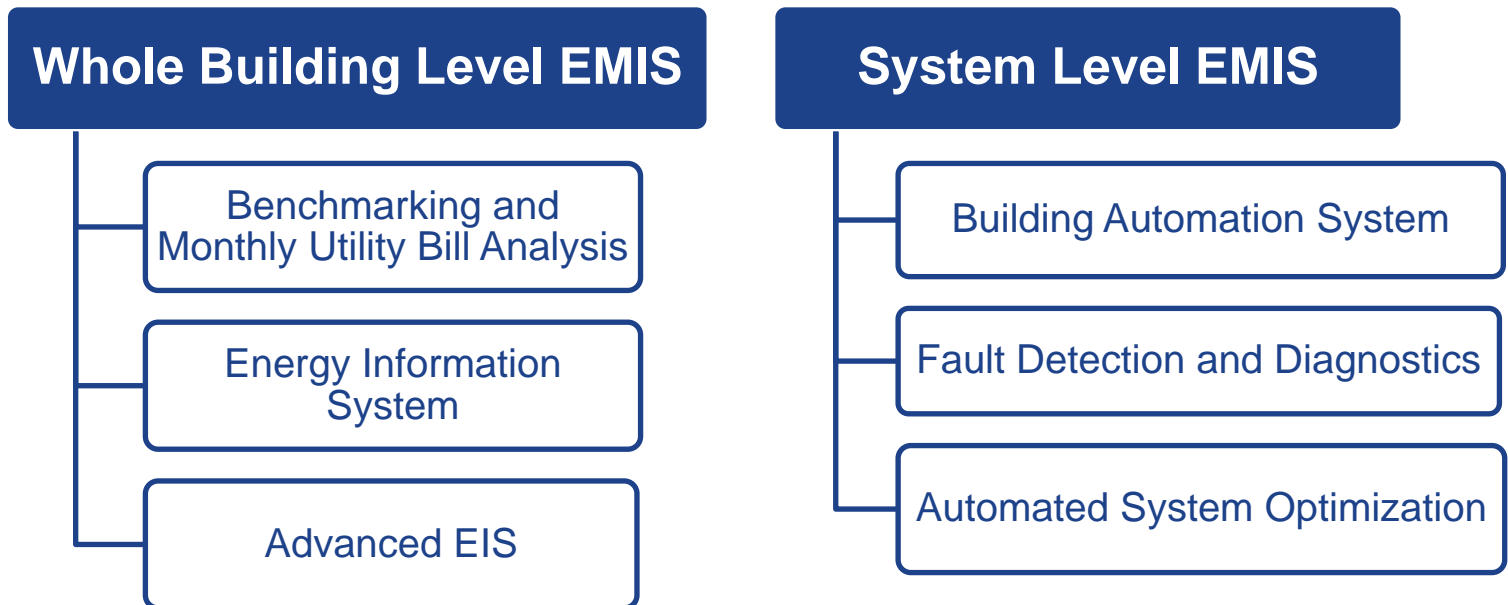
- Guy Sella, Macy's, Inc.
- John Morrill, Arlington County, VA
- Jessica Granderson, Lawrence Berkeley National Laboratory

# Welcome: Getting Smart About Energy Analytics

- Welcome
- EMIS Team Overview – 2014 to 2017
- Guest Presentations
- Q&A
- Campaign Recognition
- Wrap up

# Energy Management and Information Systems (EMIS)

**EMIS are a broad family of tools to monitor, analyze, and control building energy use and system performance**

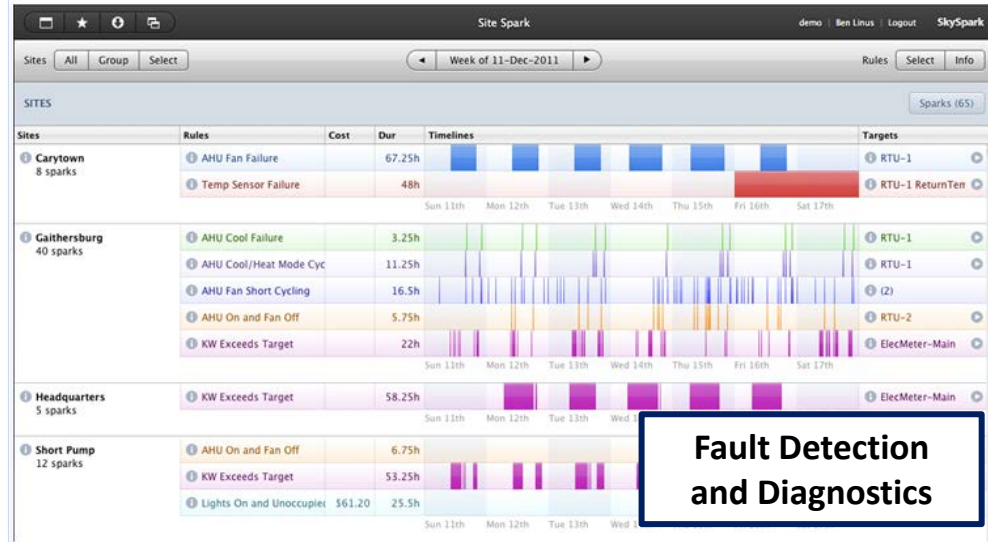


\* The boundaries can be fuzzy; some tools cross categories, e.g., energy information systems with FDD and benchmarking capabilities

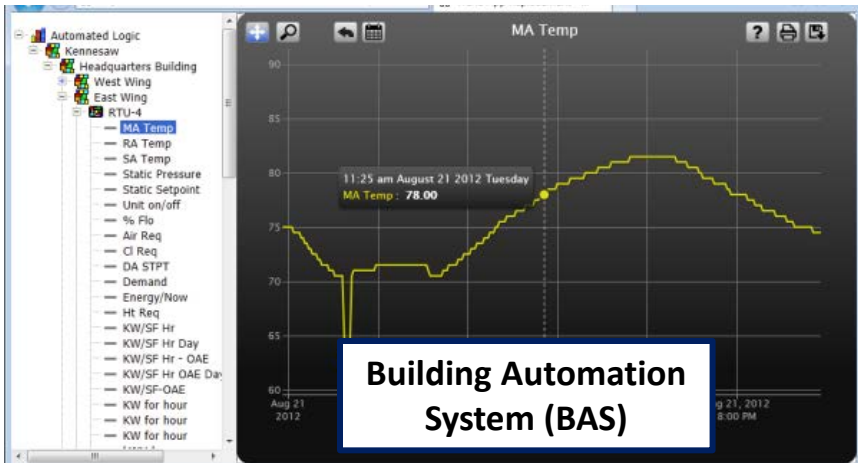
# EMIS Vendor Examples and Demos



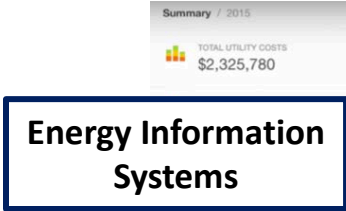
**Benchmarking and Monthly Utility Bill Analysis**



**Fault Detection and Diagnostics**



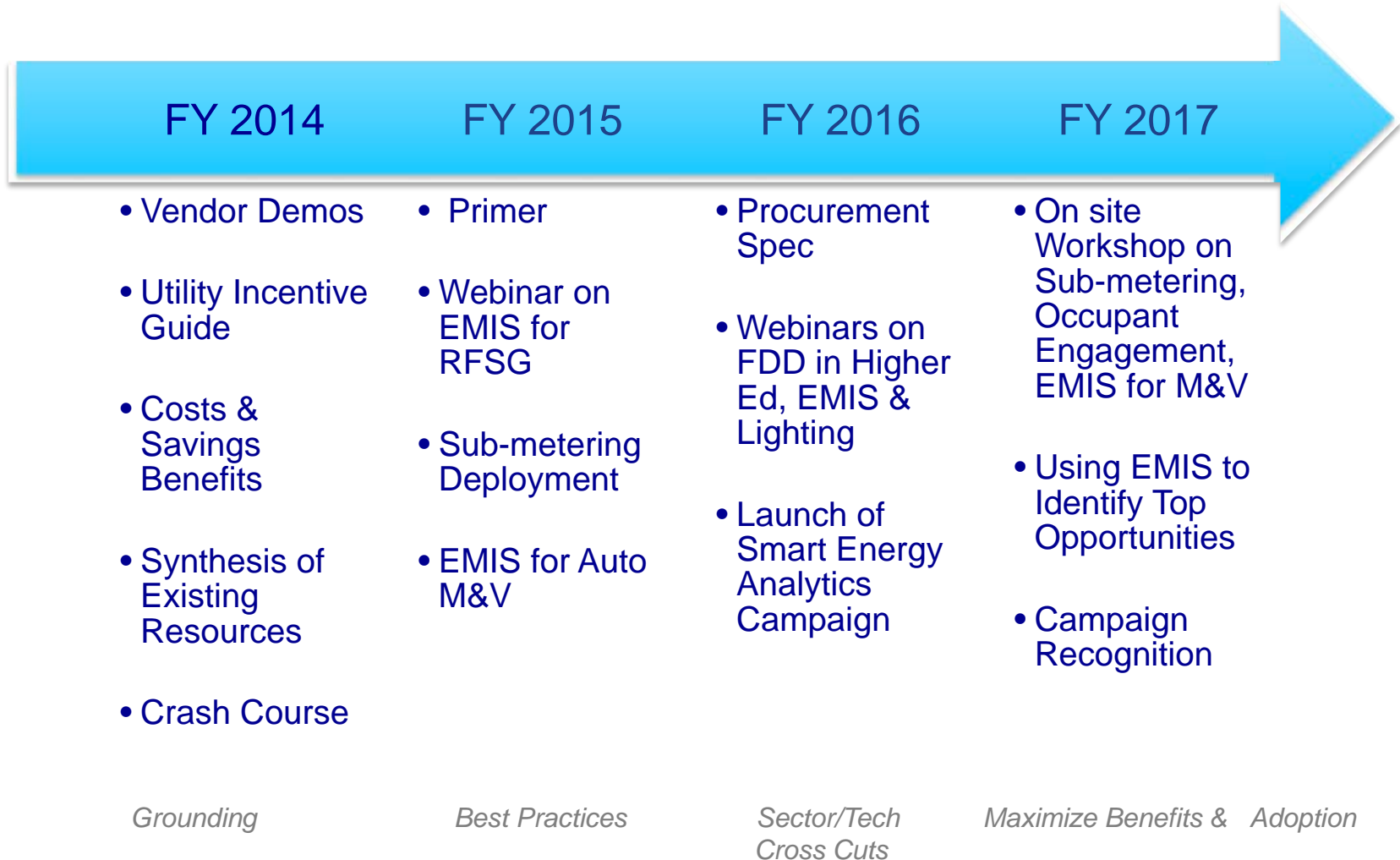
**Building Automation System (BAS)**



**Energy Information Systems**

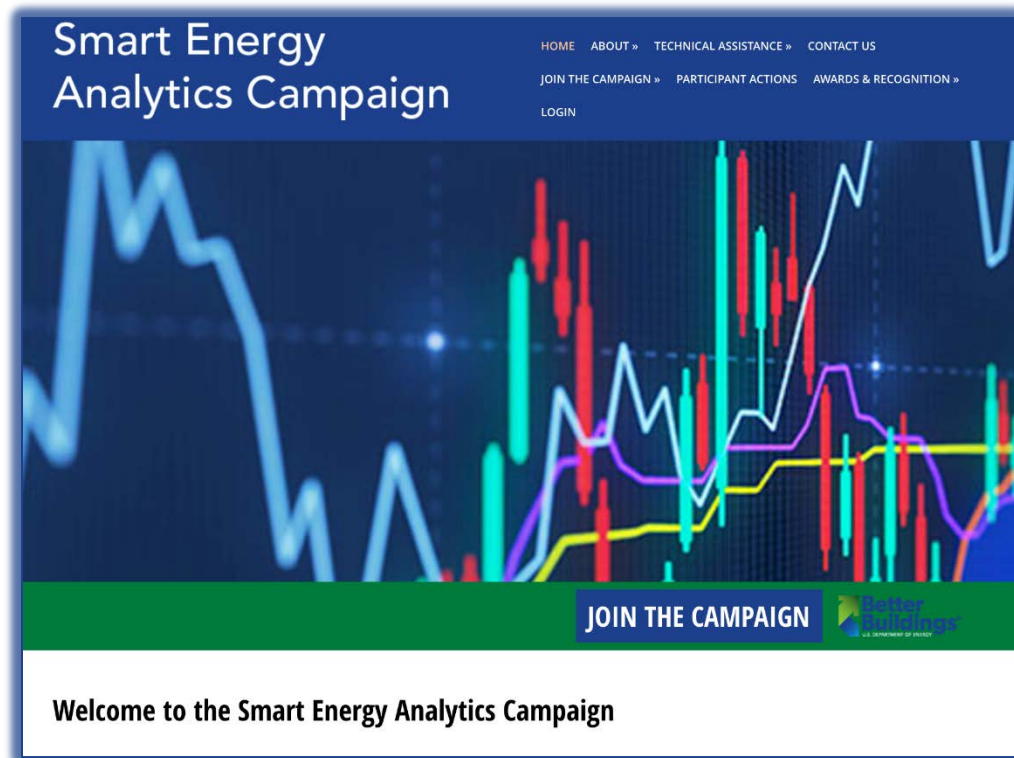


# Better Buildings EMIS Team Activity Since 2014



# Smart Energy Analytics Campaign Launched 2016

- The Smart Energy Analytics Campaign is designed to increase adoption of EMIS technologies and processes by owners and operators of commercial buildings



# Joining the Campaign: Requirements

## Who can participate?

- Commercial building owners and operators of a single site over 50,000 sq ft or a portfolio of buildings in any region of US

**EMIS installations may be new or existing** and include one of the following:

- EIS with whole building interval data, meter data stream
- FDD or ASO software with BAS data stream for at least one system (e.g. chilled water)

## Participants requested to:

- Use their EMIS to analyze data and identify energy-saving opportunities
- Implement at least one of these energy-savings opportunities during Campaign

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





# Guest Presentations

# Automated Fault Detection & Diagnostics (AFDD) as Part of an Energy Management Information System (EMIS)

Guy Sella

- Macy's EMIS Director
  - May, 2002 through January, 2017
- Macy's Systems & Technology
  - December 1985 through April 2002

## Early Energy Savings Adopter

- 2002 Baseline
  - Reporting Based on Utility Bills
  - Delay!!
- 2003 – 2011
  - Real-time Interval (kW)
  - Historical
  - Daily Financials
  - Projections
- No Mechanical
  - 23 Various BMS'

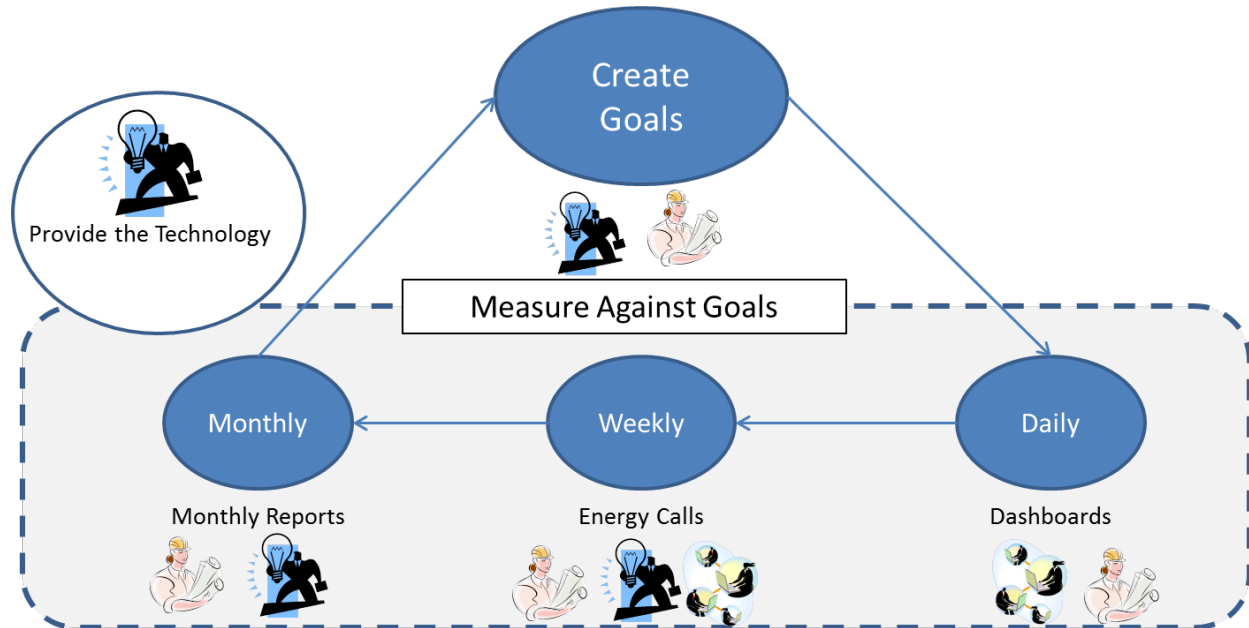
# AFDD as Part of an EMIS

2011 What Was in Place

Past    Near Past    Yesterday    Today    Near Future    Future

Supply Side / Financial  
(Cost, Budget, Billing, Commodity)

Usage  
(Interval, kWh/something, kW)



## AFDD as Part of an EMIS

### Challenges

- Cost
  - How to Justify
- Get the Mechanical Data
  - How to Get it
  - Which Points
  - How Often
- Make it Usable
  - Humans!!!
- Make it Matter – Do Something
  - More Humans!!!

# AFDD as Part of an EMIS

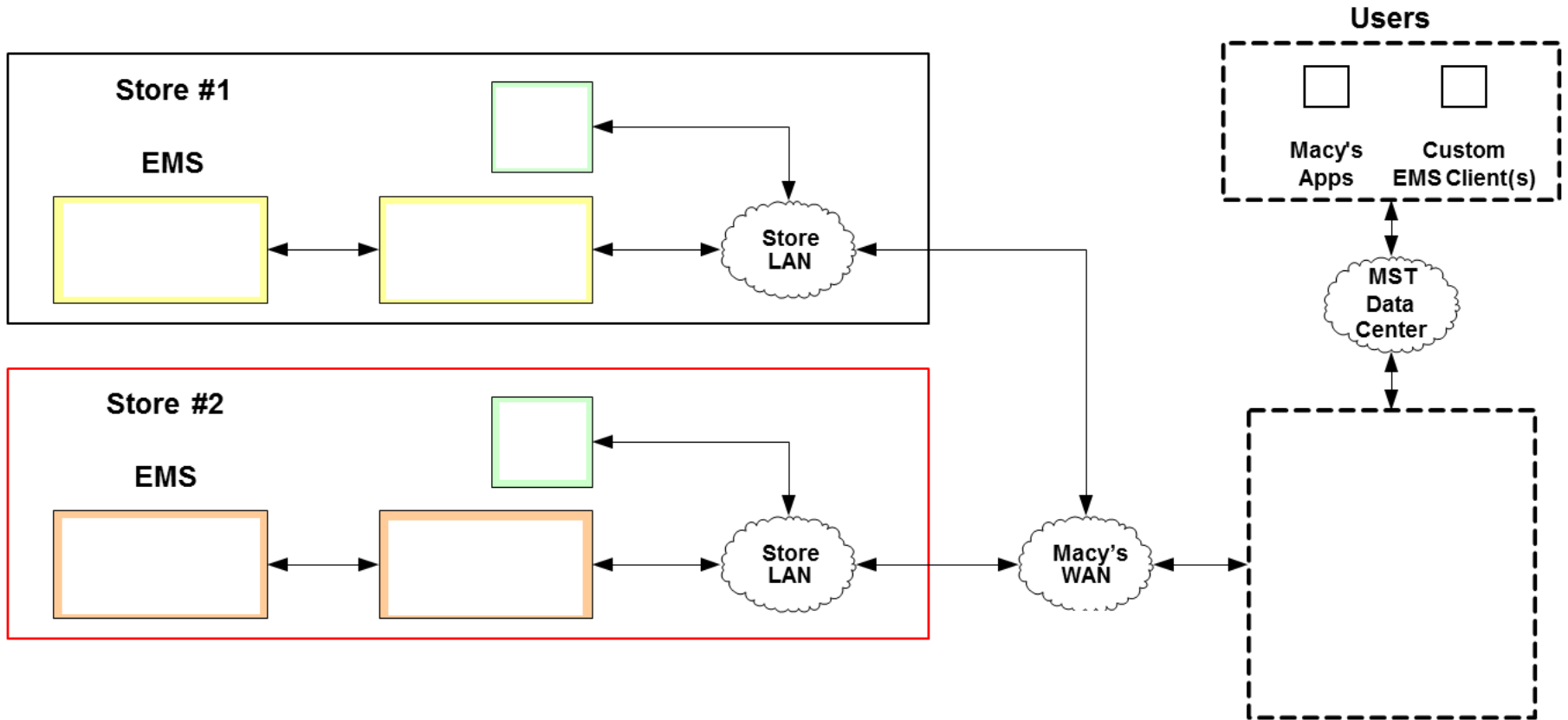
## Approached AFD as an IT Project

- Cost
  - Leverage Existing Infrastructure
  - Leverage Existing Staff
  - Leverage BMS'
    - BMS "Knows" What's There
  - Pilot Savings
- Get the Mechanical Data
  - All points that REALLY Matter
  - No Points that Don't
  - 15 Minute / Change of State
  - Get IT Involved
    - Leverage IT Infrastructure
    - Get BMS' on the Network

## AFDD as Part of an EMIS

- Make it Usable
  - Automate Questions
  - Automate Answers
  - Canned Views
    - Based on Human's Job Function
- Make it Matter – Do Something
  - Leverage Existing Processes
    - Tracking
    - Reporting
    - Training

# AFDD as Part of an EMIS





## AFDD as Part of an EMIS

- 2011 Pilot
  - 60 Locations (TX/CO/KS)
  - 9 Months
- Mechanical Data
  - Standard List (Types)
  - Standard Output names
  - 64,671 Total points
  - Standard SQL DB over Existing LAN/WAN
- Make it Usable
  - Browser Interface
  - 18 Rules to Start
  - 10 Standard Reports
  - 1 Day Training



## AFDD as Part of an EMIS

- What was Found
  - Sensors
    - Supply/Mixed/Return
    - Zone
    - CHWS/CWS
  - Dampers
    - Open
    - Closed
    - Leaking
  - Number of Fans Mattered more than CP/RTU
  - Schedules Tuned
    - Lights
    - HVAC

## AFDD as Part of an EMIS

- Rollout
  - 2012 through 2013
  - ~800 Locations
    - Stores
    - Distribution Centers
    - Average 140 Points/Location
  - 24 Rules
- Used for
  - Continuous Commissioning
  - PM Previews
  - Call Center
  - Retro Commissioning
  - New Store/Renovation Commissioning

## AFDD as Part of an EMIS

If I Had it to Do with 2017 Technology

(Thanks Jessica 😊)

- Single System
  - Supply Side
  - Demand Side
  - Dashboards
  - Alarms/Alerts/Faults
  - Primary Graphics
- Views
  - Real-time
  - History
  - Projections
- Integrate w/ EAS (work order)
- Seriously Consider “Cloud” and/or Software as a Service

## Why Macy's Joined the Campaign

### Corporate Sustainability Program

- Money Where Mouth Is (no “Green Washing”)
- Supports Corporate Social Responsibility Stance

### Access to Really Smart People for Free

- LBNL/DOE Folks
- Verify Results by Third Party

### Never Think “We Got This”

- Avoid Complacency
- Always New Approaches
- What’s New/Better

Arlington Initiative to  
**Rethink  
Energy**



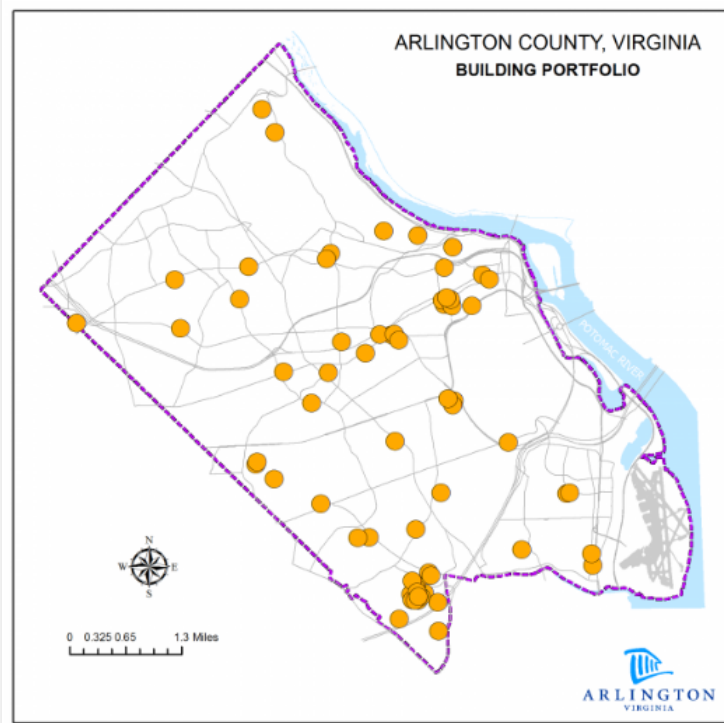
## Toward an Enterprise-wide Energy Management Information System

John Morrill, Energy Manager  
[jmorrill@arlingtonva.us](mailto:jmorrill@arlingtonva.us)



## Building Energy Report Cards

Arlington County's building portfolio includes almost 70 buildings, totaling over 2.3 million square feet. Most of them are owned and operated by the County.



Buildings contribute a significant part of the County's carbon footprint. With increased attention and retrofit projects, there is substantial opportunity for savings. These Building Report Cards highlight many of the changes that have led to energy savings.

These buildings fall into the following primary space types. Follow the links below to see energy and project information for buildings in that category.

- [Community Centers](#)
- [Libraries](#)
- [Offices](#)
- [Public Safety](#)
- [Residential Programs & Clinics](#)
- [Warehouses & Storage](#)
- [Specialty Facilities](#)



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### Quick Links

- [Greenhouse Gas Inventory Summary](#)
- [Community Greenhouse Gas Inventory](#)
- [Government Operations Greenhouse Gas Inventory](#)
- [Achieving the AIRE Goal](#)

### Contact Us

[Arlington Initiative to Rethink Energy](#)



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Energy**

We track

We benchmark

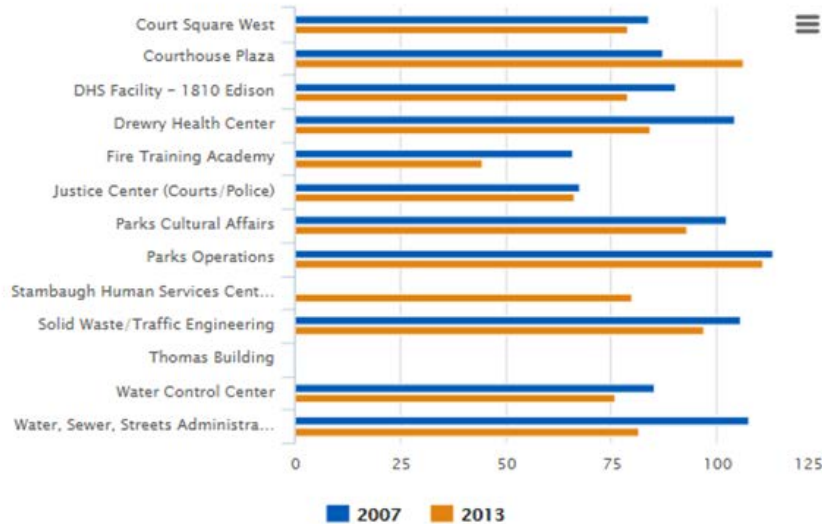
We disclose



## Offices

Arlington County's office buildings include several buildings with a combination of offices and other functional space, including theater space, trades worker shops and extensive telecommunications equipment. However, we used the ENERGY STAR guidelines and classify each as an office building if more than half of the space is used for offices.

### Offices: Site Energy Use Intensity (kBtu/ft<sup>2</sup>), 2007 and 2013



Facility	2007	2013
Court Square West	83.8	78.9
Courthouse Plaza	87.3	106.2
DHS Facility - 1810 Edison	90.3	78.9
Drewry Health Center	104.4	84.3
Fire Training Academy	65.7	44.4
Justice Center (Courts/Police)	67.4	66.2
Parks Cultural Affairs	102.4	92.9
Parks Operations	113.4	111.1
Stambaugh Human Services Center (Sequoia 1)	N/A	80.0
Solid Waste/Traffic Engineering	105.5	97.0
Thomas Building	N/A	N/A
Water Control Center	85.3	75.9
Water, Sewer, Streets Administration	107.6	81.7



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### Quick Links

- [Greenhouse Gas Inventory Summary](#)
- [Community Greenhouse Gas Inventory](#)
- [Government Operations Greenhouse Gas Inventory](#)
- [Achieving the AIRE Goal](#)

### Contact Us

Arlington Initiative to Rethink Energy



We track

We benchmark

We disclose



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Energy**

# Arlington Energy Management

- Efficiency is # 1 in the 'loading order' of energy decisions for both County gov't operations and across community
- Ambitious goals for operations and community – 76% cut in GHG emissions by 2050
- Better Buildings Challenge participant
- Building automation in majority of facilities ( ~85% building area)
- Over 15 yrs of monthly data in EnergyCAP *and* Portfolio Manager

*Why did we join Smart Energy Analytics Campaign?*

# Decisions, Decisions



Arlington Initiative to  
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Energy**



# Decisions, Decisions

## Desires

More, *better* information on energy use in County operations (buildings, parks, infrastructure) - *actionable*

An at-a-glance dashboard of key performance metrics

***versus***

## The market

Bewildering array of technology and vendor choices

Bitter experience from past IT and building automation system (BAS) decisions (built-in obsolescence, proprietary handcuffs, etc.)

# Energy Management & Information Systems

We've all heard the buzzwords and promotional claims –

“Intelligent Efficiency”

“Sustainability in the Age of Big Data”

“Smart(er) Buildings”

“O&M and behavior-driven performance improvements”

“10%-25% immediate savings”

*In contrast to ‘dumb efficiency’ – capital equipment improvements*

Mindful that technology and sensors are not infallible...

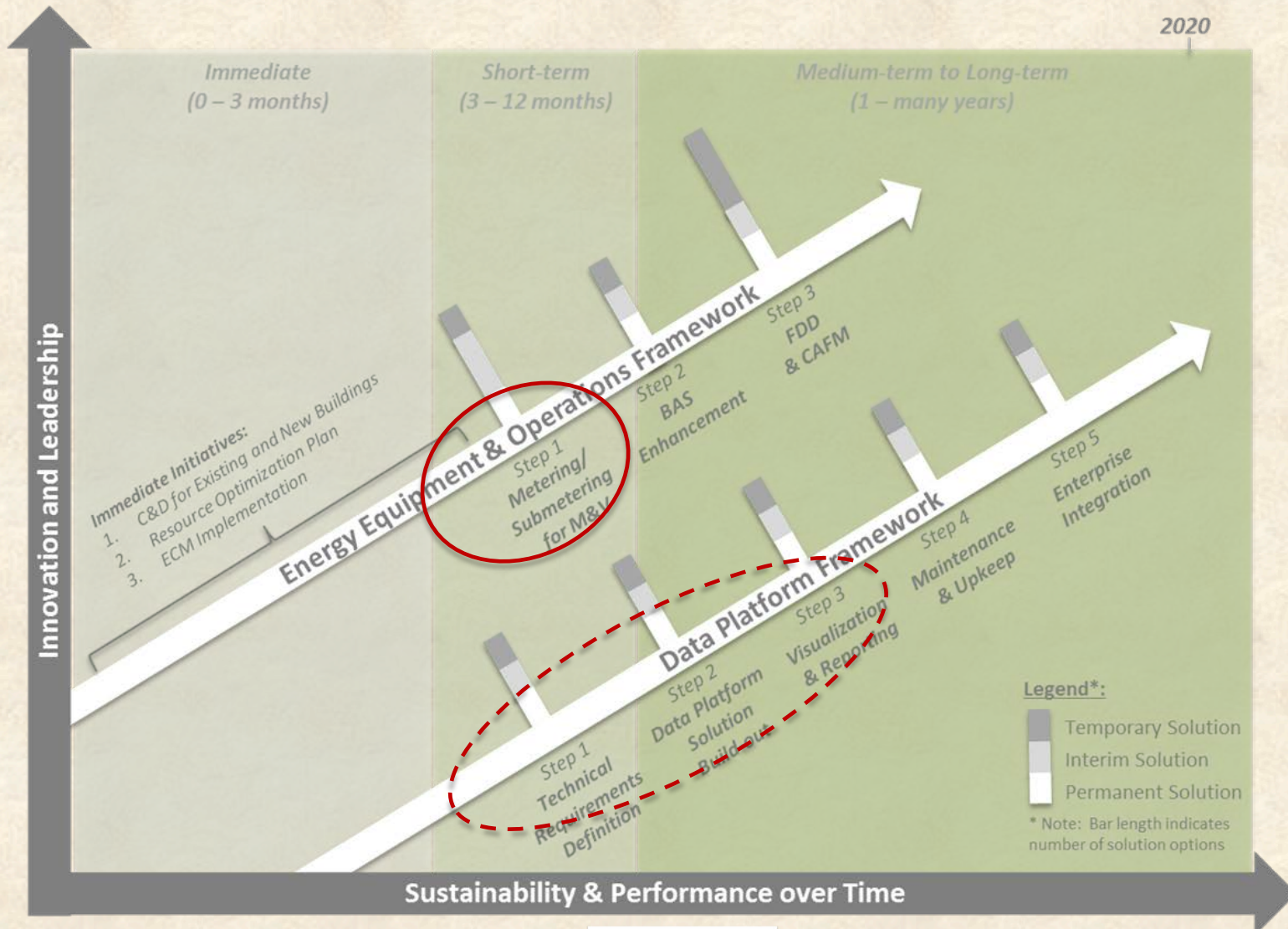


...we hired consultants to help us make sense of what is available.

# EMIS Roadmap

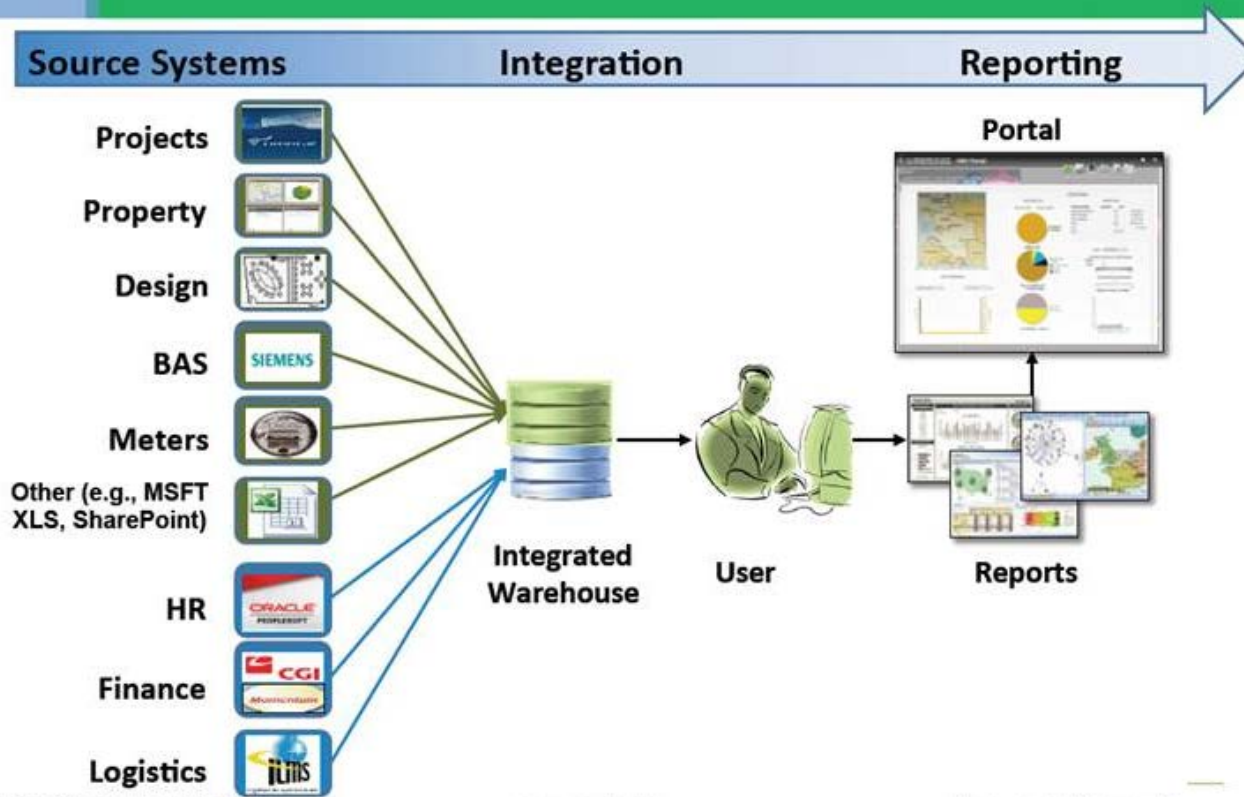


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This useful diagram gave us an “Aha!” moment

# How it Works



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Arlington County EMIS Session #1



# Meanwhile, Piloting Real-time Metering

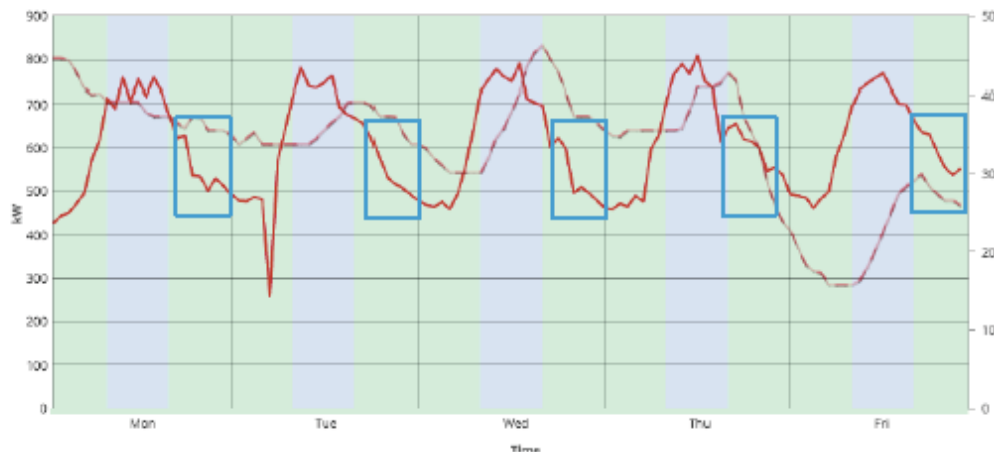


Savings Opportunities

## Slow Shutdown

Recommendation: Adjust equipment schedule to reduce shutdown time

- ① Arlington Courthouse
- 🕒 Shutdown takes 6-8 hours
- 💰 Est. Annual Savings: **\$25,000**




*Reconciling energy goals with keeping the judges happy -- tricky!*

# Meanwhile, insights from DOE & contractors



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Energy**

LBNL-6476E




**ERNEST ORLANDO LAWRENCE  
BERKELEY NATIONAL LABORATORY**

**Energy information systems (EIS):  
Technology costs, benefit, and best  
practice uses**


Jessica Granderson, Guanjing Lin, Mary Ann Piette

Environmental Energy Technologies Division

November 2013



PNNL-23892  
Release 3.0




Prepared for the U.S. Department of Energy  
under Contract DE-AC05-76RL01830

**Metering Best Practices: A Guide to  
Achieving Utility Resource Efficiency,  
Release 3.0**

SA Parker	BK Boyd
WD Hunt	KL McMordie Stoughton
KM Fowler	TM Koehler
WF Sandusky	R Pugh
GP Sullivan	

March 2015



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# Energy Management & Information Systems



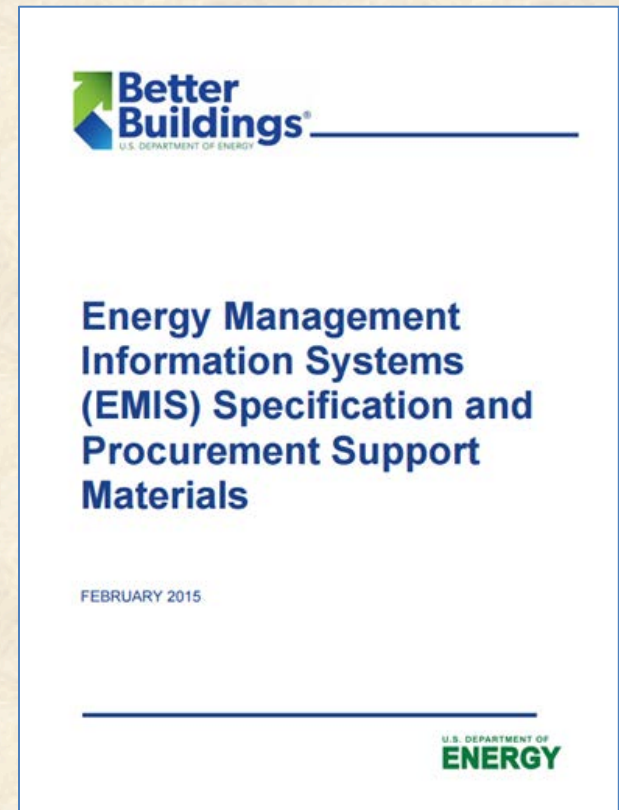
Arlington Initiative to  
**Rethink  
Energy**

We discovered DOE & LBNL work on EMIS

We welcome the guidance independent expertise can offer

We have used the *LBNL EMIS Specification and Procurement Support Materials* to prepare our own RFP for an EMIS

We are eager to continue this world, and we have funding to begin deployment



*Thank you*

**Questions?**

**John Morrill –**  
[jmorrill@arlingtonva.us](mailto:jmorrill@arlingtonva.us)

[www.arlingtonenergy.us](http://www.arlingtonenergy.us)

# Questions and Answers

# Campaign Recognition

# Campaign Recognition: MGM Resorts International

- Largest Portfolio Using EMIS
  - 38 million sq ft



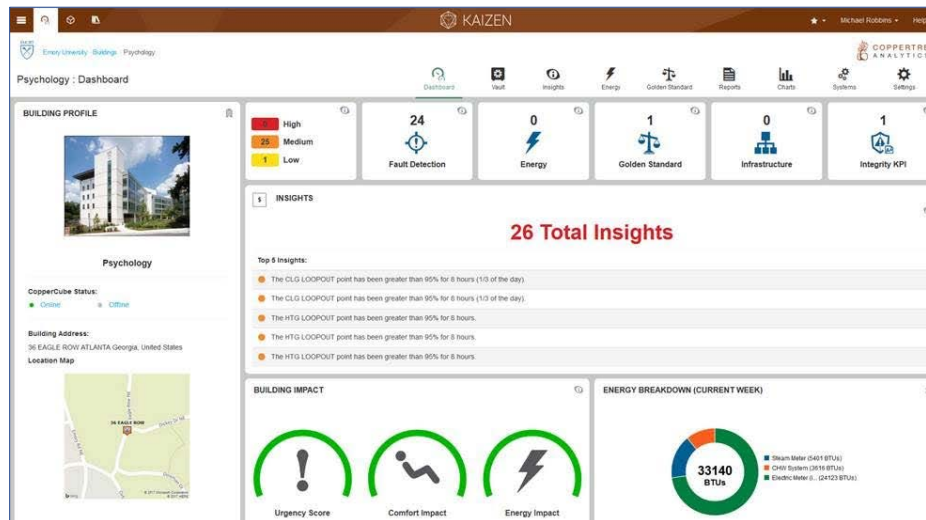
“When issues arise involving major HVAC equipment, the first call is to the EMIS team to see if it can be diagnosed in the EMIS system. This process saves an enormous amount of money in avoided service calls and unnecessary equipment replacement.” – Chris Magee, VP Sustainable Facilities

# Campaign Recognition: Emory University



EMORY  
UNIVERSITY

- Energy Performance in a Portfolio
  - 20 buildings, 2.7 million sq ft
  - 25% reduction in whole building energy use
  - Reduction driven through in-house existing building Cx paired with FDD algorithms





# Campaign Recognition: Salt Lake City

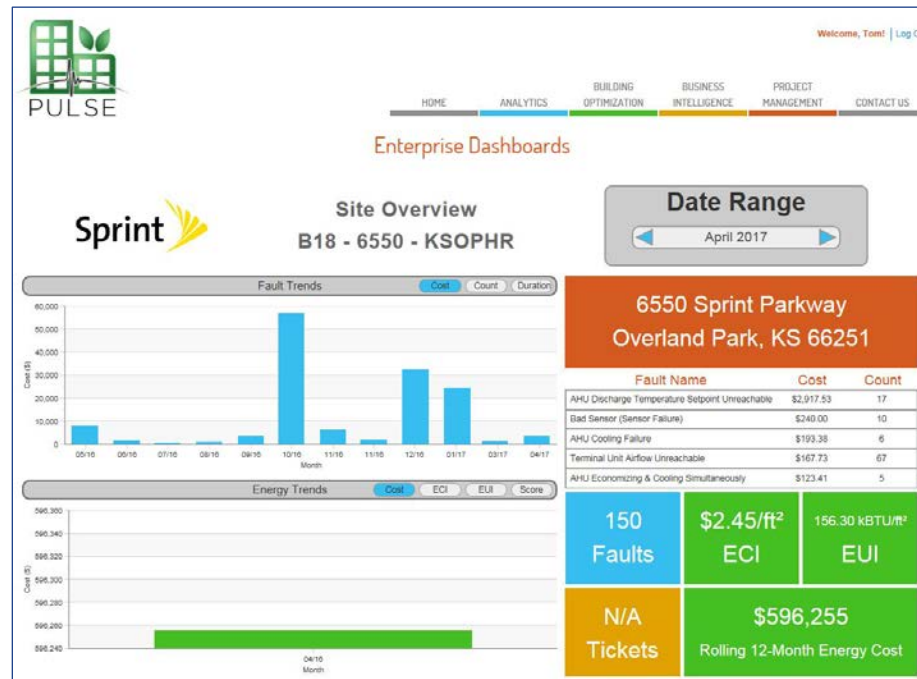
## ■ Energy Performance in a Single Site

- 167,000 sq ft building
- In one year, building reduced electric consumption by 8%, gas consumption by 57% for total Btu savings of 35%
- Simple payback 1.5 years



# Campaign Recognition: Sprint in partnership with CBRE

- Best Practice in the Use of EMIS
  - 4 million sq ft portfolio implemented FDD
  - \$431,000 cost savings (relative to 2014 baseline)
  - 4.7 million kWh energy savings, 5% of campus electric use

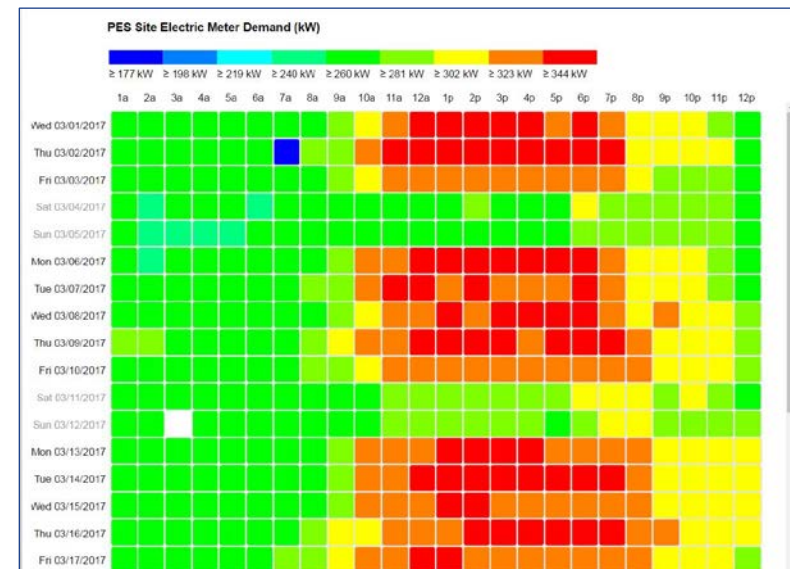
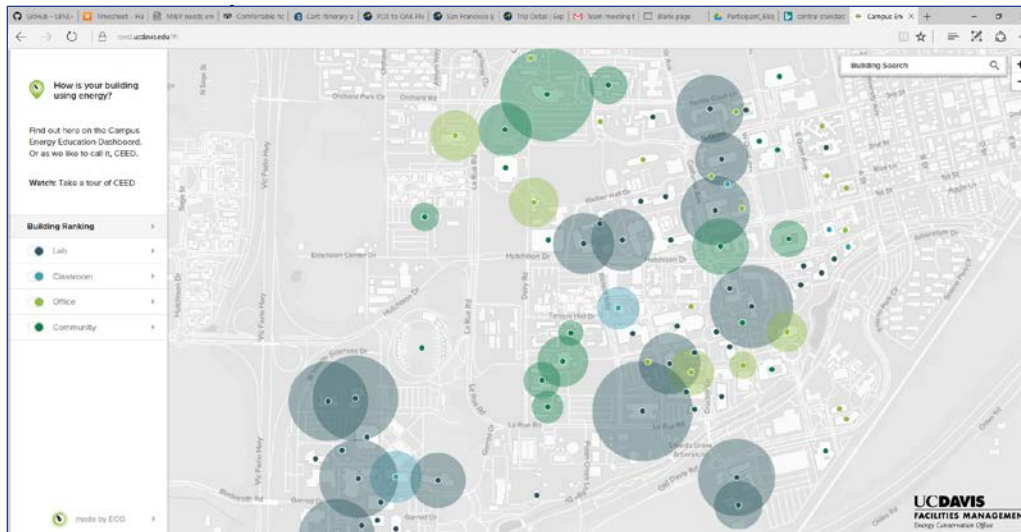


# Campaign Recognition: UC Davis



## ■ Innovation in the Use of EMIS

- 100 buildings, 8 million sq ft
- One building achieved 22% energy savings for \$44,500 cost savings, another building achieved 24% energy savings for



# Wrap Up

- Sign up as Participant in the [Smart Energy Analytics Campaign](#)
- Join the BBA EMIS team
  - Send email to [cmcurtin@lbl.gov](mailto:cmcurtin@lbl.gov) to be added to mailing list for upcoming webinars
- Join the [Better Buildings Alliance](#) for other tech team information

# Smart Energy Analytics Campaign Participants 2016-2017

- Arlington County, Virginia
- Brown University
- California State University, Dominguez Hills
- Central Piedmont Community College
- City of Boston
- City of Newburyport, MA
- City of Orlando, FL
- City of San Antonio, TX
- County of Kaua'i
- District of Columbia DGS
- Emory University
- Kohl's
- Lawrence Berkeley National Laboratory
- Macy's
- MGM Resorts International
- Michigan State University (MSU)
- National Renewable Energy Laboratory
- Oak Ridge National Laboratory
- Oregon Health and Science University
- Pacific Northwest National Laboratory
- Rhode Island Office of Energy Resources
- Sprint in partnership with CBRE
- Trane
- University of California
  - Davis
  - Office of the President
  - San Diego Health
  - San Francisco
  - Santa Barbara
  - Santa Cruz
- University of Miami
- Walmart
- Western Michigan University
- Whole Foods Market

# Thank You

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