Better Buildings Tools and Resources for Achieving Energy Savings

Boston Green Tourism
December 8, 2018
Cindy Zhu
Agenda

- Better Buildings Challenge
- Case Studies
- Financing Navigator Tool
- Smart Energy Analytics Campaign
Problem we are trying to solve

U.S. spends $600 billion each year to power homes, plants, & buildings

- Great opportunities in residential, commercial and industrial sectors
- 20%+ savings average; cost effective
- Other benefits: Jobs, Environment, Competitiveness

BUT persistent barriers exist….

- Efficiency not integrated into business planning & corporate decision making
- Perceived risk
- Confused by options; lack of unbiased information
- High hurdle rates
- Split incentives /tenant-employee behaviors at odds with efficiency goals
- Not enough/qualified workforce
Results to date

$1.9 Billion saved

$7 Billion in financing committed

240 Trillion BTUs of energy saved

4 Billion gallons in water saved

900+ Better Buildings Partners

1000+ solutions published
Better Buildings Partners Are

- **30** of the Fortune 100 Companies
- **13%** of all U.S. Commercial Building Space
- **8** National Laboratories
- **93** Local Governments
- **28** State Governments
- **12** of the Top 25 U.S. Employers
- **12%** of the U.S. Manufacturing Energy Footprint
Better Buildings Hospitality Partners

Hilton Worldwide
HEI Hotels & Resorts
Loews Hotels
Marriott
InterContinental Hotels Group
Saunders Hotel Group
MGM Resorts International
Hyatt
Las Vegas Sands Corp.
AHLA American Hotel & Lodging Association
AAHOA Asian American Hotel Owners Association
Wyndham Worldwide
NEEMA Hospitality
The Walt Disney Company
U.S. Department of Energy
Through Better Buildings ….

- Profile leadership
- Demonstrate the value of sharing solutions and ideas – ACROSS industries, building types and ownership models
- Make energy efficiency tangible, real and even, entertaining
- Get out of the boiler room and into the C-suite
- Leaders know they can always be better and continue to learn, evolve and act…..
More than 1,000 solutions are available publicly in the Better Buildings Solution Center

**Showcase Projects:**
- Large and small buildings
- All sectors
- Specific building types such as schools, hospitals, hotels, grocery stores, universities, civic centers, libraries, offices and labs

**Implementation Models (Playbooks):**
- Overcome barriers: finance, data, energy management, staff training, community and customer outreach, partnering with utilities, and more
- Multi-faceted and applicable across sectors

FINANCE
- Facilities Infrastructure Pool
- Update Internal Purchasing Systems To Facilitate A Portfolio-Wide Energy Upgrade With Maintenance Funds
- Energy Finance Strategy
- Building Upgrade Value Calculator
- On-Balance Sheet, Off-Debt Capacity Performance Contracting
- Internal Green Revolving Fund
- Capital Set Aside Fund
- Green Initiatives Trust Fund
- Utility Savings Initiative
- ESA in BAE Facilities Nationwide
- Commercial PACE Financing at Pier 1
- On-Bill Financing

DATA/ENERGY MANAGEMENT
- Energy Looking Glass Dashboard
- Real-Time Energy Monitoring And Weekly Engagement With Field Staff
- Accessing Tenant Utility Data in Triple-Net Leased Buildings
- Data Update and Certification Scorecard
- Centralized Energy Management And Capital Set-Aside Fund
- Submetering Initiative and Energy Dashboards
- Uniform Methodology To Measure Energy Efficiency Improvement
- Inventory and Tracking Process
- Designing A Comprehensive Energy Plan
- Mass Benchmarking
- Energy Benchmarking Program

EMPLOYEE /CUSTOMER ENGAGEMENT
- Engaging Clinicians To Reduce Resource Use In Operating Rooms
- Chasing Quarters With Energy Set-Points
- Student Fellowships To Kickstart In-House Energy Programs
- Eco-Treasure Hunts at Fulfillment Centers
- Leveraging Green Leases To Reduce Energy And Water Use
- Wyndham Vacation Ownership Green Certification Program
- Leverage Student-Faculty Research
- Linking Energy Efficiency to Performance-based Compensation
- Energy Champion Program
- Operations Management Leadership Program

OVERCOMING ORGANIZATIONAL HURDLES
- Enterprise-wide Coordination
- Good, Better…BEST Standards of Sustainability
- Developing an Integrated “Smart Lab” Program
- Integrated Model For Long Term Campus Energy Planning
- Creating a Culture of Energy Efficiency
- Streamlined Tri-resource Efficiency Programs

INTEGRATING EMERGING TECHNOLOGIES
- Gallery Walks
- Lessons Learned from EMIS Pilot & Deployment
- Near-Zero Net Energy Retrofits for Low Income Housing
- Smart Meter Resident Energy Savings Program
- Using Technology to Meet Portfolio-Wide Energy Reduction Goals
- Energy Dashboards
- Project Energy Saver
<table>
<thead>
<tr>
<th></th>
<th>Habits of successful organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Know the goal.</td>
</tr>
<tr>
<td>2</td>
<td>Data matters.</td>
</tr>
<tr>
<td>3</td>
<td>Look beyond technology.</td>
</tr>
<tr>
<td>4</td>
<td>It takes an (energy) champion and a team.</td>
</tr>
<tr>
<td>5</td>
<td>Learn, teach and evolve.</td>
</tr>
</tbody>
</table>
# Fab Four Energy Buddy Program and Checklist

Engaging employees from the top down in maintenance procedures and smart operations to achieve the full value of energy efficiency projects

## BARRIER
How to engage employees and motivate your organization

## SOLUTION
- Fab Four leaders from the most energy-intensive departments (Housekeeping, engineering, Kitchen, and Banquet)
- Fab Four and intradepartmental Energy Buddies responsible for identifying and carrying out energy savings measures
- Weekly and Daily [Energy Checklists](#)

## PROGRAM SUCCESS FACTORS
- Creating a green culture
- Fab Four teams recognized for highest energy savings
- “What’s the Buzz?” newsletter
Implementing Energy Set-points

Using an energy set-point standard operating procedure as a low cost mechanism for achieving energy savings without compromising guest comfort

**BARRIER**
Lack of standard operating procedure for key energy set-points for HVAC systems, Domestic Hot Water and Food & Beverage areas at managed properties

**SOLUTION**
Partner with chief engineers and hotel department heads to develop and certify building-specific temperature set-points and implement standard operating procedures for set-point maintenance

**PROGRAM SUCCESS FACTORS**
- Educate Chief Engineers about set-points
- Enhance the hotel’s ability to read and adjust set-points
- Increase visibility into set-points for hotel staff by using educational tools
- Make adjustments gradually

Example set-point SOP and other resources [here](#)
Showcase Project: Comfort Inn & Suites Boston Logan International Airport

SECTOR TYPE
Commercial

LOCATION
Boston, Massachusetts

PROJECT SIZE
115,200 Square Feet

Annual Energy Use

<table>
<thead>
<tr>
<th></th>
<th>Energy Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (2013)</td>
<td>231 kBtu/sq. ft.</td>
</tr>
<tr>
<td>Actual (2016)</td>
<td>183 kBtu/sq. ft.</td>
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</table>

Energy Savings: 21%

Annual Energy Cost

<table>
<thead>
<tr>
<th></th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (2013)</td>
<td>$259,700</td>
</tr>
<tr>
<td>Actual (2016)</td>
<td>$234,800</td>
</tr>
</tbody>
</table>

Cost Savings: $24,900

Read more here
There are many ways to finance energy efficiency projects in buildings you own or occupy. The Navigator helps you cut through this complexity to secure financing that works for you.

What would you like to do?

Explore financing options

Find financing that fits your needs

Connect with Financial Allies
The Better Buildings Financing Navigator

The Navigator is an online tool that helps public and private organizations find financing solutions for energy efficiency projects.

With the Navigator, you can…

1. **Explore**: Learn the basics of the efficiency financing market
2. **Find**: Answer a few simple questions to see which financing options might be a fit for your project
3. **Connect**: Speak to Better Buildings Financial Allies who may be able to finance your project

Now available at: [https://betterbuildingssolutioncenter.energy.gov/financing-navigator](https://betterbuildingssolutioncenter.energy.gov/financing-navigator)
Smart Energy Analytics Campaign
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

smart-energy-analytics.org
Campaign Participation To Date

As of Feb 2018:
62 organizations
4000+ buildings
329 million sq ft

Goals for 2018:
80 organizations
Varied market sectors

Participating Organizations

20 Higher education
21 Office
8 Hospital
5 Laboratory
4 K-12 Schools
2 Retail
1 Food service
1 Grocery
Energy Information Systems (EIS)

Source: Macalester College Sustainability Data Portal

Source: Lucid BuildingOS

Source: Aquicore
## 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>
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<tr>
<td>Anon Hospital</td>
<td>AHU_6</td>
<td>No supply temp reset. Cooling valve issues.</td>
<td>$6,163</td>
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<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>
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</tbody>
</table>

### Maintenance

<table>
<thead>
<tr>
<th>Building</th>
<th>Equipment</th>
<th>Notes</th>
<th>Severity Priority</th>
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</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>
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<tr>
<td>Anon Hospital</td>
<td>AHU_10</td>
<td>Static pressure lower than setpoint. Supply fan speed constant.</td>
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<td>Anon Hospital</td>
<td>CAV8_2</td>
<td>Room temp lower than setpoint. Stuck reheat valve.</td>
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<td>Anon Hospital</td>
<td>CAV5_82</td>
<td>Supply flow lower than setpoint. Stuck reheat valve. – May be sensor error.</td>
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<tr>
<td>Anon Hospital</td>
<td>CAV3_11</td>
<td>Sensor error. Stuck reheat valve.</td>
<td>4</td>
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</table>
Year 2 Results: Smart Energy Analytics Campaign

Participants
- 77 organizations
- 5000+ buildings
- 400+ million sq ft

![Pie chart showing participation statistics]

- EIS: 29%
- EIS + FDD: 30%
- FDD: 19%
- EIS + ASO: 1%
- Not Yet Installed: 21%
Who are the Campaign Participants?

Primary Market Sector

Distribution of Portfolio Floor Area

Pledged Gross Floor Area

<table>
<thead>
<tr>
<th>Frequency</th>
<th>&lt;100k</th>
<th>100k–1M</th>
<th>1M–5M</th>
<th>5M–10M</th>
<th>10M–15M</th>
<th>15M–20M</th>
<th>&gt;20M</th>
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<tbody>
<tr>
<td>0%</td>
<td>5</td>
<td>18</td>
<td>36</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>5</td>
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<tr>
<td>5%</td>
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<td>25%</td>
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<td>30%</td>
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<tr>
<td>35%</td>
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<td>40%</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>34%</td>
<td>34%</td>
<td>11%</td>
<td>7%</td>
<td>5%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Pledged Gross Floor Area
Top Measures Implemented from EMIS Insights

- Scheduling Equipment Loads: 71%
- Control Problems: 64%
- Economizer/Outside Air Loads: 59%
- Controls: Setpoint Changes: 59%
- Controls: Reset Schedule Addition or Modification: 52%
- Retrofits: 45%
- Equipment Efficiency Improvements / Load Reduction: 34%
- Occupant Behavior Modification: 29%
Benefits of Implementing EMIS

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%

% of Participants responding
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

Median

0 1 2 3 4 5
Post-EMIS installation year

0% 10% 20% 30% 40%

-10%

27 organizations
94,181,965 sq ft
20 organizations
59,895,296 sq ft
6 organizations
44,286,646 sq ft
4 organizations
42,019,256 sq ft

Percent reduction in energy use, relative to the year before EMIS installation
## 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>
THANK YOU!!

Cindy Zhu

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VISIT: betterbuildingssolutioncenter.energy.gov