Creating a Competitive Advantage with ASHRAE’s bEQ program

Big 10 and Friends
University of Iowa
October 13, 2014

Where Have You Heard This Before?

• You have to do more with less
• You must manage and reduce energy costs
• Budgets will be tight next year
• There will be new regulations
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Cost of Ownership


State Budgets

Student Tuition Accounts for Over Half of Higher Education Costs at 4-year Colleges

State funding as a share of higher education costs, FY2000 - FY2013

Source: Budget & Policy Center analysis; data from LEAP, reflected in tuition fund 149-B
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Current Labeling/Benchmarking Efforts

- Building certification becoming widespread
- U.S. efforts:
  - EPA ENERGY STAR – Portfolio Manager benchmarking
  - DOE Commercial Building Energy Score (pilot phase)
  - USGBC LEED Rating – Broader sustainability rating
  - GBI Green Globes – Broader sustainability rating
  - BOMA 360 – Six O&M focused criteria (incl. energy)
  - State labeling and disclosure programs

Current State/Local Status

U.S. Building Benchmarking and Disclosure Policies

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Solutions

- bEQ allows building owners to take the next step in measuring, controlling and managing energy costs

What is bEQ?

- Voluntary rating system that applies an easily understood scale to compare a building’s energy use with similar buildings in similar climate zones.

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What is bEQ?

- Accurately and consistently compares energy consumption
- Potential side by side comparison
  - ‘As Designed’ (asset)
  - ‘In Operation’ (operational)
- Identifies gaps between design and operation

What is bEQ?

- Identifies potential and measured energy use
- Benchmarks a building’s energy performance
- Insight into potential long-term energy costs
- Identification of energy efficiency measures
- Complements other rating programs
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What is bEQ?

- Draws on successful features of other US and European building labeling & certifications

As Designed Rating

- Energy model of new and existing buildings based on:
  - Mechanical
  - Envelope
  - Orientation
- Energy model uses standardized operational and occupancy variables
- ASHRAE certified BEMP required or Professional Engineer (licensed in project location)
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**As Designed Rating**

- Based upon “as-built” conditions
- Evaluates the physical characteristics and systems

**As Designed Rating**

- \( EUI_{As-Built} \)
  - Source energy use of as-built conditions computed using standard occupancy and operational schedules
  - Site-source conversion based on typical conversion factors

\[
bEQ_{As\,Designed} = \frac{EUI_{As-Built}}{EUI_{Median}} \times 100
\]
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As Designed Rating

- Expanded building types available with a table of Median/Baseline EUIs by Climate Zone from ASHRAE
  - 52 different building types

In Operation - bEQ

- Based on actual metered energy use via energy invoices
- Takes account of building structure/features and how it is operated
- Applicable for existing buildings
- Applicable for new buildings after 12-18 months of operation
- Conducted by an ASHRAE Certified BEAP or Professional Engineer (licensed in project location)
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In Operation - bEQ

- $EUI_{\text{Measured}}$
  - Metered energy use intensity
- $EUI_{\text{Median}}$
  - Median energy provided by ASHRAE, calculated to represent the median of the building stock for that building type, normalized for climate

$$bEQ_{\text{Operational}} = \frac{EUI_{\text{Measured}}}{EUI_{\text{Median}}} \cdot 100$$

In Operation Case Study

- Four fire stations
  - FS – 2, 4, 10 & 15
  - Sarasota, Florida
  - Conditioned spaces included dormitories, kitchen, dining, offices, dayrooms, etc
  - Unconditioned spaces included equipment bays, storage, etc.
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In Operation Case Study

- DX cooling systems with electric reheat
- Solar thermal panels for domestic water heating (3 of 4 FS)
- Ventilation and exhaust complies with ASHRAE 62.1

In Operation Features

- ASHRAE Level 1 Energy Audit
  - Preliminary energy-use analysis (PEA) with review of utility bills, rates classes, and peak energy demand
  - Space function analysis and energy end use summary
  - Identification of low-cost/no-cost energy improvement measures with estimated costs and savings
  - Recommended capital improvements with estimated costs and savings
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In Operation

• ASHRAE Level 1 audit revealed:
  – Dehumidifier not working properly
  – DX unit operating as a 100% OA unit
  – Abandoned grey-water system
  – One toxic gas monitoring system missing

In Operation Workbook
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### bEQ Dashboard

**Building Energy Quotient Dashboard**

### bEQ Rating Scale

<table>
<thead>
<tr>
<th>Scale Range</th>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 0</td>
<td>A+</td>
<td>Zero Net Energy</td>
</tr>
<tr>
<td>1-25</td>
<td>A</td>
<td>High Performance</td>
</tr>
<tr>
<td>26-55</td>
<td>A-</td>
<td>Very Efficient</td>
</tr>
<tr>
<td>56-85</td>
<td>B</td>
<td>Efficient</td>
</tr>
<tr>
<td>86-115</td>
<td>C</td>
<td>Average</td>
</tr>
<tr>
<td>116-145</td>
<td>D</td>
<td>Inefficient</td>
</tr>
<tr>
<td>&gt;145</td>
<td>F</td>
<td>Unsatisfactory</td>
</tr>
</tbody>
</table>
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Case Study

- FS-10
  - LEED Silver
  - bEQ ‘A’
- FS – 4
  - LEED – not rated
  - bEQ ‘B’
- FS -3 and 15
  - LEED certified
  - bEQ ‘C’

In Operation Case Study

- Energy Efficiency Measures (EEM):
  - Adjust room temperature and humidity settings for occupied/unoccupied
  - Added thermostats and occupancy sensors for exhaust and supply fans
  - Zone AC units based upon space use/occupancy
  - Reset hot water set points to 100°F allowing greater efficiency of solar
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In Operation Case Study

- Fire Stations FS – 3, 4, 10 and 15
- Summary of 13 top EEMs:
  - EEMs recommended saved 119,225 kWh
  - Cost savings = $9,588 per year
  - Repair costs = $39,300
  - Simple payback = 4.1 years
  - bEQ costs for all four = $7,820
  - Simple payback = 4.9 years

<table>
<thead>
<tr>
<th>Building</th>
<th>Area (ft²)</th>
<th>Savings Proposed (kWh)</th>
<th>Original Rating</th>
<th>Proposed Rating</th>
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</thead>
<tbody>
<tr>
<td>FS-3</td>
<td>7,191</td>
<td>45,000</td>
<td>C</td>
<td>A-</td>
</tr>
<tr>
<td>FS-4</td>
<td>8,221</td>
<td>34,875</td>
<td>B</td>
<td>A-</td>
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<tr>
<td>FS-10</td>
<td>13,345</td>
<td>11,250</td>
<td>A-</td>
<td>A-</td>
</tr>
<tr>
<td>FS-15</td>
<td>8,706</td>
<td>23,000</td>
<td>C</td>
<td>A-</td>
</tr>
</tbody>
</table>

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**In Operation Outcomes**

- Leads to informed energy management (better decision making!)
- Provides information on building’s IEQ
  - Measurement-based IEQ indicators to assure levels of service are maintained
- Illustrates benefits of equipment and system investments
- Demonstrates corporate responsibility

**As Designed v. In Operation**

**As Designed Rating:**
- Based on simulated, standardized energy use
- Independent of operational and occupancy variables
- Improved only by upgrading building fabric or systems

**In Operation Rating:**
- Based on actual metered energy use
- Influenced by operational and occupancy variables
- Improved through upgrade of either operating procedures or building fabric
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**How is bEQ Different?**

- Consistent energy rating method for both new and existing buildings
- Requires certified or licensed professionals
- Allows smaller buildings (less than 5,000 ft²)
- Full spectrum scale incentivizes improvement

**bEQ as the Next Step**

- bEQ provides:
  - Accurate consistent method of measuring energy consumption
  - Compares similar buildings in the same climate zone
  - Focus on building performance
  - Better decision making
  - Holistic approach
  - Identifies “low hanging fruit”
  - Motivates continuous improvement
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More Information

- www.buildingenergyquotient.org

Questions

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