THE BUILDING EDUCATION SERIES 2016
PRESENTED BY:

AIA Cleveland
CLEVELAND
2030 DISTRICT
ASHRAE Cleveland Chapter
NEO NEORTHEAST OHIO CHAPTER OF THE USGBC
CLEVELAND BEC Building Enclosure Council
council of smaller enterprises
cose
THANKS TO OUR EVENT SPONSORS:

AM Higley
Oswald
THE BUILDING EDUCATION SERIES 2016:
THE OSWALD BUILDING, 1100 SUPERIOR
7:30 AM COFFEE AND REGISTRATION
8:00 – 10:00 AM PRESENTATION

JANUARY 21: THE WELL BUILDING

MARCH 9: AUDITS AND COMMISSIONING

MAY 19: WATER MANAGEMENT AND CONSERVATION

JULY 28: BUILDING ENVELOPE

SEPTEMBER 15: HVAC AND CONTROLS

NOVEMBER 10: OPERATIONS, MAINTENANCE, STAFF/TENANT ENGAGEMENT
HVAC AND CONTROLS

OUR SPEAKERS:

HOY BOHANON, PRESIDENT, HOY BOHANON ENGINEERING, PLLC
• Understand how HVAC controls are a vital part of a well functioning, energy efficient building and how existing buildings can achieve improved energy performance without a system replacement or large capital investments.
• Learn how the ASHRAE building EQ process standardized modeling so comparisons can be meaningful and which buildings can benefit from this process.

NATE SMIK, GARDINER TRANE
• Real examples of local buildings that have improved performance without breaking the bank.
Hoy Bohanon, PE, LEED AP, BEAP is principal in Hoy Bohanon Engineering, PLLC, a firm that focuses on improving the performance of existing mission critical buildings. Mr. Bohanon began his engineering career as a research and design engineer, and then gained experience as a project engineer, facilities engineer, facilities manager, indoor air quality research engineer, environmental engineer, and business owner. He has a master’s degree in engineering from North Carolina State University, and a bachelor’s degree in mechanical engineering from Georgia Institute of Technology. Mr. Bohanon has written technical papers and articles on indoor air quality, operations, and maintenance and is a frequent presenter at technical society meetings. He is a recipient of the ASHRAE Distinguished Service Award and is chair of ASHRAE Standard 62.1 committee, *Ventilation for Acceptable Indoor Air Quality*. He also serves on the bEQ committee,. He is chair of the US Technical Advisory Group panel 1 (general principles) and panel 4 (indoor air quality) for ISO TC205 *Building Environment Design*. He is a co-author of *The Indoor Air Quality Guide: Best Practices for Design, Construction and Commissioning* and *Performance Metric Protocols for Commercial Buildings: Best Practices Guide*. He also teaches multiple courses for the ASHRAE Learning Institute addressing ASHRAE 62.1 and IAQ. Mr. Bohanon is also a member of the Professional Engineers of North Carolina, US Green Building Council, and I2SL (International Institute for Sustainable Laboratories).
Building Energy Quotient

Slides for ASHRAE Distinguished Lecturers
ASHRAE’s Building EQ

- Voluntary labeling program that draws on successful features of other building labeling and certification programs
- Complements other green building and energy rating/labeling programs
- Provides a way to benchmark performance
- Includes ASHRAE Level 1 Energy Audit and IEQ Survey
- Allows for comparison of As Designed (asset) and In Operation (operational) ratings
Benefits of Building EQ

• Rate your building against your peers: energy analysis that compares your building to similar buildings in similar locations

• Greatest value: Building EQ as framework for realizing energy improvements in existing buildings
  • Actionable recommendations for improving building energy performance
  • Standard and consistent process
  • Platform for integrating and promoting ASHRAE standards (e.g., SPC 211P), guidelines, and publications
  • Vehicle for delivering related education and certification
Notable Features

- Beyond Benchmarking: Provides actionable recommendations to improve building energy performance
- Recognition for high performance buildings
- Integrates As Designed and In Operation performance
- Applies to mixed-use buildings and entire campus of multiple buildings
- Powered by ASHRAE
Refocused Role for Building EQ

- Maintain labeling and rating program
- Focus on building performance improvement
- Developing web portal for online entry and automated data exchange
- Collaborations, e.g., EPA, LEED® EBOM, NYSERDA, New Jersey P4P, global jurisdictions
- Developing university course for delivery through student branches and local chapters
- Growing international interests
- Opportunities with utilities and efficiency program administrators
Current Labeling Efforts

Building certification is becoming widespread

International efforts:
• European Union, Singapore and Canada

U.S. efforts:
• EPA ENERGY STAR® – Portfolio Manager benchmarking
• DOE Commercial Building Energy Asset Score
• USGBC LEED® Rating – Broader sustainability rating
• GBI Green Globes – Broader sustainability rating
• BOMA 360 – Six O&M focused criteria (incl. energy)
• State and municipal building energy reporting and disclosure ordinances (BERDO)
How is Building EQ Different?

Different from green building programs:
- Based solely on a building’s energy use
- Focused on understanding energy use
- Identifies opportunities for improved energy performance (In Operation)
- Allows for comparison between buildings with different operating variables (As Designed)
- Consistent energy rating method for both Existing Building and New Construction programs
How is Building EQ Different?

Different from benchmarking programs:

- Greater differentiation for high performing buildings and emphasis on zero net energy
- Identifies actionable recommendations for improving energy performance (In Operation)
- Consistent process to assess energy performance
- Unified system for assessing assets and operations
- Builds a relationship with an ASHRAE Certified Professional or licensed PE
ASHRAE Building EQ Ratings

B
AS DESIGNED
June 2013

A-
IN OPERATION
June 2012

Zero Net Energy A+
High Performance A
Very Good A-
Efficient B
Average C
Inefficient D
Unsatisfactory F

BUILDING ENERGY QUOTIENT

As Designed: Indicates the estimated energy consumption of the building as designed.
In Operation: Indicates the actual energy consumption of the building in operation.
Rating Types

In Operation (operational) rating
- Assessment of energy performance with the existing characteristics and how it is operated
- Based on actual metered energy use of a building and on-site audit
- Confirmation that indoor environmental quality is not compromised for energy savings
- Actionable recommendations for improving energy performance
- Applicable for buildings after at least 12 months of operation
Rating Types

As Designed (asset) rating
Assessment of energy performance potential, based on building’s physical characteristics and systems
Independent of building occupancy and operating conditions
Based on results of a standardized energy model as compared to a baseline
Applicable to both new and existing buildings
Comparing Ratings

As Designed Rating
- Simulated standardized energy use
- Independent of operational and occupancy variables
- Improved only by upgrading building fabric or systems

In Operation Rating
- Actual metered energy consumption
- Influenced by operational and occupancy variables
- Improved by upgrading building fabric, systems, or operating procedures

DESIGNED TO WORK TOGETHER
The Rating Scale

- Rating based on a score from a dimensionless scale
- Zero point on scale set to “zero net energy”
- Median value (100) set to U.S. median energy use intensity (EUI) for existing buildings of that building type, with adjustments
- Score can go below zero for net energy producing buildings
- Score exceeds 100 for “inefficient” and “unsatisfactory” buildings with high energy usage
In Operation Score

\[
\left( \frac{\text{EUI}_{\text{measured}}}{\text{EUI}_{\text{baseline}}} \right) \times 100
\]

Compares actual metered energy use of candidate building to baseline EUI.

Baseline EUI is based on CBEC\(^*\) median for the building type, corrected for location and hours of operation.

EUIs calculated for source energy using U.S. national site-to-source factors.

As Designed Score

\[
\left( \frac{\text{EUI}_{\text{simulated}}}{\text{EUI}_{\text{baseline}}} \right) \times 100
\]

Compares simulated energy use of candidate building to baseline EUI
Baseline EUI is based on CBEECS median for the building type, corrected for location
Uses standardized modeling inputs of building operating parameters (COMNET*)
  • Occupancy, plug and process loads, schedules, setpoints
  • Depends on building and space type
EUIs calculated for source energy using US national site-to-source factors

* COMNET Commercial Buildings Energy Modeling Guidelines and Procedures
# Rating Scale

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Description</th>
<th>Energy Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 0</td>
<td>Zero Net Energy</td>
<td>Net zero or energy producer</td>
</tr>
<tr>
<td>1-25</td>
<td>High Performance</td>
<td>75-99% energy savings over median</td>
</tr>
<tr>
<td>26-55</td>
<td>Very Good</td>
<td>45-74% energy savings over median</td>
</tr>
<tr>
<td>56-85</td>
<td>Efficient</td>
<td>15-44% energy savings over median</td>
</tr>
<tr>
<td>86-1115</td>
<td>Average</td>
<td>Within 15% of median energy use</td>
</tr>
<tr>
<td>116-145</td>
<td>Inefficient</td>
<td>16-45% more energy than median</td>
</tr>
<tr>
<td>&gt;145</td>
<td>Unsatisfactory</td>
<td>&gt;45% more energy than median</td>
</tr>
</tbody>
</table>
Dashboard: Supporting Data

Building Energy Quotient Dashboard

As Designed

- Previous Rating Scores/Dates
- Total Modeled Bldg Energy Use (kWh)
- Modeled Renewable Energy kBtu and %
- Total Modeled Net Bldg Energy Use (kWh)
- Modeled Site EUI (kBtu/ft²-yr)
- Modeled Source EUI (kBtu/ft²-yr)
- ENERGY STAR Target Finder
- Other Ratings Awarded

BEST

Net Zero Energy

0

25

55

In Operation

80

As Designed

In Operation

67

85

100

Typical

115

145

Worst

175+

In Operation Rating Date

Previous Rating Scores/Dates

Total Measured Bldg Energy Use (kWh)

Measured Renewable Energy kBtu and %

Total Measured Net Bldg Energy Use (kWh)

Measured Site EUI (kBtu/ft²-yr)

Measured Source EUI (kBtu/ft²-yr)

Measured ECI (5/sf²-yr)

ENERGY STAR Portfolio Manager

Other Ratings Awarded
## Actionable Recommendations

<table>
<thead>
<tr>
<th>Suggested Energy Savings Measures by Category:</th>
<th>Cost Range</th>
<th>Payback</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Envelope Suggestions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1A. Building envelope commissioning every 3 years</td>
<td>$1,000 - $5,000</td>
<td>1-4yrs</td>
</tr>
<tr>
<td>2A. Consider installing high albedo roof when roof needs to be replaced (differential cost)</td>
<td>$25,000</td>
<td>5-10yrs</td>
</tr>
<tr>
<td>3A.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lighting/Daylighting Suggestions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1B. Replace light bulbs in can lights with LED's</td>
<td>$500 - $1,000</td>
<td>1-4yrs</td>
</tr>
<tr>
<td>2B. Change light controller from manual switches to occupancy sensors where applicable</td>
<td>$1,000 - $5,000</td>
<td>1-4yrs</td>
</tr>
<tr>
<td>3B. Upgrade all exit lights to LED</td>
<td>$1,000 - $1,500</td>
<td>1-4yrs</td>
</tr>
<tr>
<td>4B. Install lighting controls so individuals can vary light levels within their space</td>
<td>$2,000 - $5,000</td>
<td>5-10yrs</td>
</tr>
<tr>
<td>5B. Consider installing daylighting controls on offices on exterior walls</td>
<td>$2,000 - $5,000</td>
<td>1-4yrs</td>
</tr>
<tr>
<td>6B.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Qualifications for Submission

Rating requires an ASHRAE certified professional or a PE licensed in the jurisdiction of the project

- Building Energy Assessment Professional (BEAP) for the In Operation rating.
  www.ashrae.org/BEAP
- Building Energy Modeling Professional (BEMP) for As Designed Rating
  www.ashrae.org/BEMP