Building Energy Quotient
ASHRAE’s Building Energy Labeling Program

What is Building Energy Labeling?

As the nation looks to reduce its energy use, information is the critical first step in making the necessary choices and changes.

Information for Consumers to Allow Educated Choices is Not New

Restaurant Sanitation Ratings
Nutrition Fact Label

Car Fuel Economy Estimates

A Shared Problem

“Most buildings will lose up to 30% of their efficiency in the first three years of operation.”

– Bill Harrison, ASHRAE Presidential Member
(Data based on Texas A&M Study)
Building Energy Labels:

- Promote energy efficiency in real estate
- Differentiate efficient buildings in the marketplace (for tenants/buyers)
- Provide feedback on a building’s designed and measured energy use
- Identify energy efficiency measures and value in reducing long-term energy costs
- Add to building performance databases

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 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 and municipal Building Energy Reporting and Disclosure Ordinances (BERDO)

Current State/Local Status

Why ASHRAE? Why now?

- Over 100 years of experience in the building sciences and technology
- Strong technical expertise across all aspects of building design and operation
- Historic focus on developing consensus-based, non-commercial documents
- Respect and credibility within the building community
- Opportunity to support consistent mandatory programs worldwide

ASHRAE’s Building EQ

- Voluntary labeling program that draws on successful features of other building labeling & certification programs
- Complements other green building and energy rating/labeling programs
- Provides a way to benchmark performance
- Stimulates adoption of high performance building techniques
- Allows for comparison of As Designed (asset) and In Operation (operational) ratings

How is bEQ Different?

Different from Benchmark programs:

- Greater differentiation for high performing buildings and emphasis on zero net energy
- Identifies actionable recommendations for improving energy performance (In Operation)
- Expanded building categories covered via a table of median EUI values by climate zone
- Consistent process to assess energy performance
- Unified system for assessing assets and operations
- Builds a relationship with an ASHRAE Certified Professional or licensed PE
How is bEQ Different?
Different from Green Building programs:
• Based solely on a building’s energy use
• Focused on understanding energy use
• Identifies actionable recommendations for improving energy performance (In Operation)
• Allows for comparison between buildings with different operating variables (As Designed)
• bEQ could serve as a consistent energy rating method for both Existing Building and New Construction programs.

Benefits of bEQ
• Consistent analysis of a building’s designed (as built) and actual energy performance
• Actionable recommendations for reducing energy use with rough costs and paybacks
• Ability to track and show effectiveness of improvements
• Demonstration of corporate responsibility
• Relationship with an ASHRAE certified professional or licensed PE

bEQ User Feedback
“Thanks to bEQ we were able to investigate the steam consumption data ... and to realize that the EMS was totaling the data wrongly. Without the thorough approach encouraged by bEQ, we would likely not have caught that.”

bEQ User Feedback
“We were also able to identify several operational issues ... that will provide large savings with a very quick payback, and will by themselves pay for several times the cost of the evaluation.”

bEQ Rating Types
In Operation (operational) rating
• Assessment of the building’s structure and systems and how it is operated
• Based on actual metered energy use of a building
• Applicable for buildings after at least 12-18 months of operation

bEQ Rating Types
As Designed (asset) rating
• Assessment of the building’s physical characteristics and systems
• Independent of a building’s 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 bEQ Ratings

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

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

Notable Features

- Basis of In Operation rating analogous to ENERGY STAR®
  - CBECS median EUI for baseline
  - Map ENERGY STAR® score to bEQ score
- Provides actionable recommendations to improve building performance
- Recognition for high performance buildings
- Integrates As Designed and In Operation performance
- Applies to mixed-use buildings and entire campus of multiple buildings

Most Comprehensive Energy Assessment Program for Today’s Buildings

The bEQ Rating Scale

- Letter grade based on a score from a dimensionless rating 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

bEQ In Operation Score

\[(\text{EUI}_{\text{measured}} / \text{EUI}_{\text{median}}) \times 100\]

- Compares actual metered energy use of candidate building to baseline EUI
- Baseline EUI is based on CBECS’ median for the building type, corrected for location and hours of operation
  - Tables of median EUI and corrections from ASHRAE Standard 100 as prepared by ORNL
  - Separate corrections for local HDD/CDD
- EUIs calculated for source energy using U.S. national site-to-source factors

bEQ As Designed Score

\[(\text{EUI}_{\text{standardized}} / \text{EUI}_{\text{baseline}}) \times 100\]

- Compares simulated energy use of candidate building to baseline EUI
- Baseline EUI is based on CBECS median for the building type, corrected for location
  - Tables of median EUI and corrections from ASHRAE Standard 100 as prepared by ORNL
- 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
Building Certification Requires Qualified Professionals

- bEQ program requires an ASHRAE certified professional or a PE licensed in the jurisdiction where the project is located
  - Building Energy Assessment Professional (BEAP) for the In Operation rating
  - For information: www.ashrae.org/BEAP
  - Building Energy Modeling Professional (BEMP) for As Designed Rating
  - For information: www.ashrae.org/BEMP

Building Energy Modeling Professional (BEMP)

Certifies ability to:
- Evaluate, choose, use, calibrate, and interpret results of energy modeling software when applied to building and systems energy performance and economics.
- Competence to model new and existing buildings and systems with their full range of physics.

Building Energy Assessment Professional (BEAP)

Certifies ability to:
- Audit and analyze buildings
- Determine project scope and collect data
- Analyze building performance and interpret results
- Evaluate alternatives and recommend energy conservation measures (ECMs)
- Assist with ECM implementation

Why Get Certified?

- Recognition of ability to deliver components of bEQ rating
- Demonstrates understanding of respective body of work
- Keeps that understanding current through professional development
- Allows use of bEQ Certified Provider logo

Getting Started with a bEQ In Operation Rating

- Includes an ASHRAE Level 1 Energy Audit
- Recommends actions to reduce energy use
- Recognizes energy use from on-site renewables
- Includes measurement-based IEQ indicators to assure levels of service are maintained
- Illustrates benefits of equipment and system investments
- Leads to informed energy management decisions
Level 1 Energy Audit

- Preliminary energy-use analysis (PEA) with review of utility bills, rate 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
- Identifies peak demand reduction and energy management opportunities

bEQ User Feedback

“The bEQ workbook serves as a good model for information to gather during a Level 1 audit, and also provides a standardized way to present the information.”

In Operation Procedures

- Identify building type(s) and construction characteristics
- Assemble building utility bills for continuous 12 month period
- Site visit with ASHRAE Level 1 Energy Audit
- Assess adequacy of indoor air quality, thermal comfort, lighting levels
  - Interview with operators/occupants to identify problems
  - Representative measurements to confirm acceptable levels
- Complete workbooks

In Operation Workbook

- Form 1 Building Characteristics
- Form 2 Energy Calculations for Rating
- Form 3 IEQ Screening Information
- Form 4 Energy Savings Suggestions
- Form 5 Energy End-Use Breakdown (Optional)
- Form 6 Water Use (Optional)
- Multiple Use Building/Campus Worksheet
- Metered Data Worksheets
- HVAC Inventory Worksheet (Optional)
- Additional Notes

Getting Started with a bEQ As Designed Rating

www.buildingenergyquotient.org
**bEQ As Designed Features**

- Isolates impact of a building’s physical characteristics and systems
- Based on an energy model that normalizes for operational variables using standardized inputs and schedules
- Does not predict actual building energy consumption because operational and occupancy parameters aren’t customized to the candidate building

**Problems with Existing Asset Rating Methodologies**

- Results are not comparable among buildings of the same type
- Occupancy parameters not normalized
- Impact of some physical variables neutralized
  - Building Massing
  - Percent of glazing below 40%
- Calculation procedures insufficiently rigorous
- Discrepancies between asset ratings and operational results misunderstood

**As Designed Procedures**

- Identify building type and physical characteristics
  - Confirm as-built documentation as available
- Identify energy modeling software to comply with ASHRAE Standard 90.1, Appendix G
- Develop energy model of candidate building and its assets, using standardized neutral variable inputs for building type from COMNET
  - Occupancy, plug and process loads, schedules, setpoints
- Complete workbook

**As Designed Workbooks**

- Form 1 Building Characteristics
- Form 2 Energy Calculations for Rating
- Form 3 Candidate Building Modeling Inputs
- Form 4 Energy End Use Breakdown
- Additional Notes
- Standardized Modeling Input Workbook

**bEQ Documentation**

- **bEQ Workbook**
  - Documents Rating Calculation
  - Provides Supplemental Information
- **bEQ Certificate**
  - Contains Key Building Information
  - Satisfies Disclosure Requirements
  - Provides Info for Tenants & Governments
- **bEQ Dashboard**
  - Illustrates Level of Performance
- **bEQ Plaque**
  - Public Display of Building’s Rating
bEQ Certificate

bEQ Dashboard

bEQ Plaque

bEQ Status

• In Operation Rating Available for 49 building types & multiple use applications
  – Workbook updated Aug 2015
• As Designed Rating Available for select building types
  – Workbook update coming Sep 2015
• Website: www.buildingenergyquotient.org
  – Download forms & instructions
  – Access brochures & resources
  – Find a certified professional
  – Frequently asked questions

Thank You for Your Attention!

For More Information on bEQ:
www.buildingenergyquotient.org

General questions about bEQ:
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Questions?

www.buildingenergyquotient.org