ASHRAE’s Building EQ

Be an Energy Genius

Par Ronald Gagnon, Vice directeur GGAC région II (Est du Canada) ASHRAE & Frédéric Genest ing. M.Sc.A., PA LEED®, ASHRAE BEMP/HBDP
ASHRAE’s Building Energy Quotient program provides a quick energy analysis that compares your building to similar buildings with the same climate. The two complementary options are:

- *In Operation* (Compare actual building energy use to similar buildings)
- *As Designed* (Compare potential building energy use to similar buildings)

Building EQ can help identify means to improve your building’s energy performance and provide data on Indoor Environmental Quality.

This presentation provides details on how to use the Building EQ program as an integral part of new building design and to manage actual building energy consumption.
ASHRAE’s Building EQ

Rate Your Building’s Efficiency
  • Compare your building to similar buildings with the same climate.

Improve Your Building’s Energy Performance
  • Act on As Designed and/or In Operation assessments.

Powered by ASHRAE
  • Rests on ASHRAE methodologies and standards and the experience of credentialed practitioners for reliable, consistent results.

Building EQ is the most comprehensive assessment program providing actionable recommendations for today’s commercial and institutional buildings.
ASHRAE’s Building EQ

- Two separate ratings that work together
  - In Operation rating assesses a building’s actual energy use
  - As Designed evaluations a building’s potential energy use
- Allows for comparison of As Designed (asset) and In Operation (operational) ratings
- Complements other building rating/labeling programs
- Voluntary rating/labeling program
Benefits of Building EQ

• Helps building owners make informed decisions managing their building portfolios
• Assists in the preparation of an ASHRAE Level 1 Energy Audit
• Identifies actionable recommendations, costs, and payback ranges for energy improvements via retrofits, maintenance, and upgrades
• Provides the credentialed practitioner with a consistent methodology to follow
• Provides the building owner with easily understood and applied information
Value of Building EQ

Building EQ provides a framework for realizing energy improvements in existing buildings

• **Greatest Value:**
  • Streamlining of the energy audit process
  • Actionable recommendations for improving building energy performance
  • Documentation of the assessment and results
  • Building Label to recognize high performance

• **Long Term Value:**
  • Ability to assess effectiveness of EEMs after implementation
  • Standard and consistent process to track improvement over time
Current US/Canada Labeling Efforts

- EPA ENERGY STAR Portfolio Manager (benchmarking)
- DOE Commercial Building Energy Asset Score
- USGBC LEED (sustainability rating)
- GBI Green Globes (sustainability rating)
- BOMA 360 (six O&M focused criteria including energy)
- State and municipal building energy reporting and disclosure ordinances (BERDO)
Current Global Labeling Efforts

• Widespread acceptance internationally
Building EQ is 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 Buildings and New Construction programs
Building EQ is Different

From benchmarking programs:

• Consistent process to assess energy performance
• Identifies actionable recommendations for improving energy performance (In Operation)
• Connects Building owners with a credential practitioner to help implement recommendations identified in the assessment process
• Unified system for assessing assets and operations
• Greater differentiation for high performing buildings
• Label score emphasizes zero net energy
In Operation Rating

- Assessment of actual energy performance with the existing characteristics and how it is operated
- Based on metered energy use of a building
- Confirmation that indoor environmental quality is not compromised for energy savings.
- On-site assessment with actionable recommendations for improving energy performance
- Applicable for buildings after at least 12 months of operation
As Designed 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

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

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

- Building EQ tracks a building’s energy performance with the Building Performance Score.
- The score compares the candidate building’s EUI to a baseline EUI for that building type.
  \[
  \left( \frac{\text{EUI}_{\text{building}}}{\text{EUI}_{\text{baseline}}} \right) \times 100
  \]
- EUIs are calculated for source energy using US national site-to-source ratios.
Rating Scale

- Rating based on Building Performance Score
- Excellent set to “zero net energy”
- Score below zero for net energy producing buildings
- Average set to U.S. median EUI for existing buildings of that building type, with adjustments
- Score exceeding 100 for buildings with higher than average energy usage.
# Rating Scale

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Energy Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 0</td>
<td>Net zero or energy producer</td>
</tr>
<tr>
<td>1-25</td>
<td>75-99% energy savings over median</td>
</tr>
<tr>
<td>26-55</td>
<td>45-74% energy savings over median</td>
</tr>
<tr>
<td>56-85</td>
<td>15-44% energy savings over median</td>
</tr>
<tr>
<td>86-115</td>
<td>Within 15% of median energy use</td>
</tr>
<tr>
<td>116-145</td>
<td>16-45% more energy than median</td>
</tr>
<tr>
<td>&gt;145</td>
<td>&gt;45% more energy than median</td>
</tr>
</tbody>
</table>
Introducing
Building EQ Portal
Building EQ Portal

- Web Portal for In Operation Rating – Launched in November 2017
- Web Portal for As Designed – Launched in February 2018
Building EQ Portal Features

- Online data entry and submission process
- Metered energy data exchange from Portfolio Manager
- Median EUI calculation aligned with ENERGY STAR™
- Reports can be automatically generated by credentialed users
- Improved submission approval process with help and validation built in
- Redesigned label award with letter grades eliminated
- Customized reporting capabilities in development
Using the Building EQ Portal

- Create a log-in and password to register as a user
- The menu on the left hand side of the screen is used to navigate around the Portal.
- Set up an account to manage users and projects
- Create a project to begin entering building data
- Projects must be submitted by a credentialed practitioners for an official Building EQ rating
Using the Building EQ Portal

Data input screens are arranged by tabs and accordions
System Outputs/Reports

- Building EQ Performance Score – available to all users
- User Input Report – available for all submissions
- Building EQ Label Report – available for all submissions
- Disclosure Form – Coming Soon for approved submissions
- Audit Report Spreadsheets – Coming Soon for approved submissions
- Building EQ Database – Under development
Building EQ Performance Score

• Rates the building’s performance
• Visible on input screens to all users
• No cost
User Input Report

• Use blank version to collect data off-line
• Print final version to document data entered
• Available to all users
• No cost
Building EQ Label Report

- Provides visual indicator of Building EQ Performance Score on a barometer/scale
- Generated by credentialed user for approved submissions
- No cost
Building EQ Disclosure Form

- Presents key energy information for compliance with disclosure ordinances
- Generated by credentialed practitioners for approved submissions
- Fee charged per building submission
Coming Soon / In Development

• Audit Report Spreadsheets – Coming Soon
  • Automatically populated with information gathered during the In Operation assessment
  • For use in a final audit report
  • Available to credentialed users for a fee per building submission

• Building EQ Database – In Development
  • Access to aggregated information from submitted buildings
  • Customized reporting capabilities for a fee per project or account
Getting Started with an In Operation Rating
In Operation
Building Performance Score

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

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

- Location / Climate
- Operating Hours
- Building gross area
- Building use type
- Multiple-use Buildings or Properties
  - Apportioned by % of area
- Output of this data determines EUI_{baseline}
IEQ Screening

- Review issues logs and conduct occupant survey (optional).
- Requires representative measurements
- Thermal comfort
- Lighting quality review
- Indoor Air Quality
  - Problems noted
  - Ventilation
  - HVAC system observation (drains, filters, etc.)
## Energy Calculations

- Metered energy use and cost by fuel type
  - Electricity
  - Natural Gas
  - Biomass, etc.
- Data exchange from Portfolio Manager
- Review of utility information
- Output of this data determines $\text{EUI}_{\text{measured}}$

<table>
<thead>
<tr>
<th>Fuel Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
</tr>
<tr>
<td>Natural Gas</td>
</tr>
<tr>
<td>LP Gas</td>
</tr>
<tr>
<td>Steam</td>
</tr>
<tr>
<td>Hot Water</td>
</tr>
<tr>
<td>Chilled Water</td>
</tr>
<tr>
<td>Wood / Biomass</td>
</tr>
<tr>
<td>Fuel Oil</td>
</tr>
<tr>
<td>Additional Fuel Type</td>
</tr>
</tbody>
</table>
Energy Savings Opportunities

- ASHRAE Level 1 Energy Audit process
- Actionable Recommendations with estimated costs and payback
- Standardized EEMs including:
  - Building Envelope
  - Lighting/Daylighting
  - HVAC Systems
  - Refrigeration
  - Energy Generation
  - Other EEMs
Getting Started with an As Designed Rating
As Designed
Building Performance 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 CBECs median for the building type, corrected for location
- Uses standardized modeling inputs of 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
Standardized Modeling Inputs

- Building energy models contain hundreds of variables.
- In typical energy modeling, buildings are modeled to operate as envisioned by modelers.
- Buildings often operate differently than originally envisioned.
- The same building modeled by different modelers will almost certainly show different energy outcomes because of different assumptions.
Standardized Modeling Inputs

- Building EQ As Designed models are required to use standardized inputs from COMNET
- COMNET is a quality assurance initiative to standardize building energy modeling, by creating consistent baselines relative to various energy codes and standards
- Use the Building EQ tab on the COMNET spreadsheets.
Standardized Input Variables

- Automatic Lighting Controls
- Plug Loads
- Occupancy
- Ventilation Rates
- Processes
- Schedules – includes lights, receptacles, HVAC Operating hours, HVAC set points, domestic hot water use, refrigeration, elevators, etc.
Building Specific Input Variables

- Building envelope/enclosure
- HVAC system type
- Cooling type/source
- Heating Type/source
- Service water heating
- Fuel types
- Energy efficiency measures modeled.
Using the As Designed Rating

- Compare buildings in terms of energy consumption characteristics
- Scale highlights normalized energy costs among similar buildings
  - Linear Scale
  - Building that matches baseline will receive a 100 rating
  - Building that uses half the energy of the baseline will get a 50 (by using half the energy, the cost should be roughly half)
  - Building that is designed as net-zero will get a 0
Qualifications for Building EQ Submissions
Credentialed Users

Official submissions require:

• PE licensed in the jurisdiction where project located
  or
• ASHRAE Certified Provider
  • Building Energy Assessment Professional (BEAP) for the In Operation rating. [www.ashrae.org/BEMP](http://www.ashrae.org/BEMP)
  • Building Energy Modeling Professional (BEMP) for the As Designed Rating [www.ashrae.org/BEMP](http://www.ashrae.org/BEMP)
Why Get Certified?

- Recognition of ability to deliver components of Building EQ rating
- Demonstrates understanding of respective body of work
- Keeps that understanding current through professional development
- Allows use of Building EQ Certified Provider logo.
- Aligns with DOE Better Buildings Workforce Guidelines (BEAP)
- ANSI accredited (BEAP & BEMP)
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 EEMs
• Assist with EEM implementation

www.ashrae.org/BEAP
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.

www.ashrae.org/BEAP
Exemple d’application

Centre de service de Laval d’Hydro-Québec
Mandat confié

- Réalisation d’un audit énergétique ASHRAE de niveau 1
  - Pour cumuler l’information nécessaire pour le Building EQ « en opération »

- Expérimentation de l’entrée des données en-ligne
  - Formulaires en anglais

- Essai des formulaires Excel traduits en français
  - Servirons éventuellement à la traduction des formulaires en-ligne
Centre de services de Laval d’HQ

Description du bâtiment

• Bureaux administratifs, centre d’appel et centre de surveillance du réseau
• Ateliers d’entretien de la flotte de véhicules de services
• Entreposage de matériel et d’équipement pour le réseau
• ±100 000 pi²
Centre de services de Laval d’HQ
Description du bâtiment

• Systèmes de CVC
  • Cinq UTA à chauffage/refroidissement hydronique et deux unités monoblocs en toiture
    • Bureaux et espaces régulièrement occupés
  • Chauffage périphérique hydronique (convecteur et aérothermes)
  • Ventilation des aires véhiculaires et des ateliers

• Thermopompes hydroniques centrales couplées à un échangeur géothermique vertical (remplaçant des puits ouverts)
Audit énergétique ASHRAE niveau 1

• Audit de type « balade dans le bâtiment » (*walk-through*)
• N’est pas un prérequis « rigide » pour le bEQ
  • Aucun rapport à téléverser
  • Permet de collecter l’information nécessaire
  • Informations additionnelles requises

• Référence:
  • *ASHRAE Procedures for Commercial Buildings Energy Audits*
Audit énergétique ASHRAE niveau 1
Tâches à accomplir

1. Analyse préliminaire de l’usage de l’énergie (PEA)
   • Examen de la consommation énergétique et des coûts
   • Calculer les indices de consommations et des coûts de l’énergie
     • EUI / ECI
   • Comparer avec les EUI de bâtiments équivalents
Audit énergétique ASHRAE niveau 1
Tâches à accomplir

2. Réaliser la « balade du bâtiment »
   • Examen de la documentation technique
   • Visite du bâtiment
     • Prendre des photos intérieures/extérieures
     • Faire des relevés de la température et de l’humidité de certains espaces
     • Faire des relevés de l’illumination dans certains espaces
   • Entrevues de l’opérateur et des occupants
     • Identifier les problèmes particuliers ou les améliorations planifiées
       • Incluant problèmes de QEI
     • Déterminer si des pratiques ou problèmes d’entretien affectent la performance
Audit énergétique ASHRAE niveau 1
Tâches à accomplir

3. Analyser l’utilisation des espaces
   • Analyse par fonctions d’espace
     • Relevé des population et des PC
     • Horaires d’activités
     • Systèmes desservant l’espace
     • Etc.

   • Pour déterminer si la performance du bâtiment est influencé par des changements d’usage par rapport au concept original
Audit énergétique ASHRAE niveau 1
Tâches à accomplir

4. Identifier des opportunités d’amélioration à faible coût
5. Recommander des opportunités d’investissement

- Amélioration au bâtiment
- Amélioration aux pratiques d’exploitation et d’entretien

- Estimer les coûts et les économies en résultant
Entrées de données bEQ en-ligne

- Disponible seulement en anglais
  - Traduction en français en cours
Entrées de données bEQ en-ligne
Liste de projet

<table>
<thead>
<tr>
<th>Index</th>
<th>Project Id</th>
<th>Project Name</th>
<th>Description</th>
<th>Account</th>
<th>Date Last Updated</th>
<th>IO Status</th>
<th>AD Status</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1193</td>
<td>Hydro-Quebec Laval Service Center (TEST RUN)</td>
<td>The Hydro-Quebec Laval Service Center provides administrative and support services to the grid network maintenance activities. Half the building is occupied by administrative offices, including a call center and a grid monitoring center. The other half of the building is a maintenance/repair center for grid service vehicles. It also has storage spaces for materials and equipment.</td>
<td>Frederic Genest</td>
<td>2018-03-12 01:05:46</td>
<td>Submitted</td>
<td>NA</td>
<td>Edit</td>
</tr>
</tbody>
</table>
Entrées de données bEQ en-ligne
Caractéristiques du bâtiment
Entrées de données bEQ en-ligne
Bâtiments à usages multiples

Données d'Energy Star
Entrées de données bEQ en-ligne
Consommation d’énergie
**Entrées de données bEQ en-ligne**
**Consommation d’énergie**

### Total Building Energy Use and Building EQ Performance Score

#### Utility Information

#### Electricity

**ELECTRICITY METERED DATA**

Use 12 consecutive months of billing data starting at least 6 months after the building is fully occupied.

<table>
<thead>
<tr>
<th>Start Date</th>
<th>End Date</th>
<th>Days</th>
<th>KWH</th>
<th>$</th>
<th>Energy Use/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-12-21</td>
<td>2016-12-20</td>
<td>365</td>
<td>2330000</td>
<td>223455</td>
<td>6383.6</td>
</tr>
<tr>
<td>2015-12-21</td>
<td>2016-12-20</td>
<td>365</td>
<td>2330000.0</td>
<td>223455.0</td>
<td></td>
</tr>
</tbody>
</table>
**Entrées de données bEQ en-ligne**

**Consommation d’énergie**

![Image of energy consumption interface]

<table>
<thead>
<tr>
<th>Total Building Energy Use and Building EQ Performance Score</th>
<th>Site Energy (MBTU)</th>
<th>Source-Site Ratio</th>
<th>Source Energy (MBTU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Building Energy Use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qualified Renewable Energy</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Percent Qualified Upstream Renewable Energy</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Net Energy Use</td>
<td>7962250.0</td>
<td>24579190.6</td>
<td></td>
</tr>
<tr>
<td>Gross Floor Area (ft²)</td>
<td>97095.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separately Metered Excluded Area (ft²)</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Rated Floor Area (ft²)</td>
<td>97095.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modeled Standardized EUIs (MBTU/ft²-yr) - Site EUI</td>
<td>81.9</td>
<td></td>
<td>257</td>
</tr>
<tr>
<td>Building Type</td>
<td>Multi-Use Property</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Cost Index (ECI) ($/ft²-yr)</td>
<td>2.30</td>
<td></td>
<td>192</td>
</tr>
<tr>
<td>Building EQ Performance Score</td>
<td>134</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Facteurs source-site

Électriété: 3,14
Gaz naturel: 1,05
Entrées de données bEQ en-ligne
Consommation d’énergie
Entrées de données bEQ en-ligne
Survol de la QEI
Entrées de données bEQ en-ligne
Mesures d’efficacité énergétique

<table>
<thead>
<tr>
<th>HVAC System Suggestions</th>
<th>Cost Range (Lower Limit, Upper Limit, Payback)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reset static pressure set point dynamically, as low as is practical to meet the zone set-points.</td>
<td>3000, 5000, 5-10 yrs</td>
</tr>
<tr>
<td>Use variable-speed drives (VSDs) and DDC on water circulation pump and fan motors and controls</td>
<td>10000, 14000, 5-10 yrs</td>
</tr>
<tr>
<td>Install occupancy sensors with HVAC systems; set back temperatures and shut off fans</td>
<td>0, 0, 5-10 yrs</td>
</tr>
</tbody>
</table>

Additional HVAC System Suggestions:
The only variable flow system that would benefit from VFD is the geothermal loop (others already have VFD)
Entrées de données bEQ en-ligne
Photos et fichiers additionnels

<table>
<thead>
<tr>
<th>Image</th>
<th>Description</th>
<th>Image Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="#" alt="Image 1" /></td>
<td>Aerial view of the building</td>
<td>Exterior of Building (use multiple shots if necessary)</td>
</tr>
<tr>
<td><img src="#" alt="Image 2" /></td>
<td>Street view of the building</td>
<td>Exterior of Building (use multiple shots if necessary)</td>
</tr>
</tbody>
</table>
Cotation bEQ
Sommaire des informations nécessaires

- Soumission réalisée par un professionnel agréé ASHRAE BEAP ou un ingénieur inscrit au tableau de l’OIQ
- Tous les champs “requis” doivent être complétés
- Au moins 12 mois d’opération avec consommation énergétique mesurée
- Une recommandation de mesure d’efficacité énergétique
Cotation bEQ
Sommaire des informations nécessaires

- Lors de la « balade du bâtiment », ne pas oublier :
  - Au moins une photographie
  - Mesures des conditions thermiques et d’illumination d’au moins un espace
  - Mesures du débit d’air extérieur à au moins une prise d’air
  - Relevés visuels des conditions physiques d’au moins une UTA
    - Serpents, intérieurs des plenums et des gaines, etc.
Questions?

www.ashrae.org/buildingEQ
buildingEQ@ashrae.org