



CBEA Food Service Project Team

Discussion Materials for
Energy Efficiency Forum

May 23-24, 2012



EPA Data Collection Guidance for Associations_FS_RS.pdf



Methodology for EPA's ENERGY STAR Energy Performance Scales

Mike Zatz
US EPA, ENERGY STAR

May 2012

- Free online tool for existing buildings:
 - Assess the energy use of existing buildings
 - Compare your energy use against your peers
 - Track changes in energy use over time in single buildings, groups of buildings, or entire portfolios
 - Receive an energy performance score (1-100 scale)
 - Apply for ENERGY STAR certification
 - Track cost savings and CO₂ reductions
 - Track water usage
- <http://www.energystar.gov/benchmark>

ENERGY STAR Score Objectives



- Help businesses protect the environment through superior energy efficiency
- Motivate organizations to develop a strategic approach to energy management
- Convey information about energy performance in a simple metric that can be understood by all levels of the organization as well as the general public
- Be accessible through a simple and easy to use tool

ENERGY STAR Score Key Principles



- Measured
 - Based on actual as-billed energy data for all fuel types
 - No modeled data or extrapolations
- Whole building indicator
 - Includes all energy use in a building
 - Captures interactions of building systems not individual equipment efficiency
 - Accounting for weather and operational changes over time
- Peer group comparison
 - Compares a building's energy performance to its national peer group
 - Track how changes at a building level alter the building's standing relative to its peer group

ENERGY STAR Score

Statistical Methodology



- Analyze national survey data
 - Commercial Building Energy Consumption Survey (CBECS)
 - Independent industry surveys
- Develop regression models to predict energy use for specific space types based on operations
- Create scoring lookup table
 - Scores are based on the distribution of energy performance across commercial buildings
 - Compares actual energy use with predicted energy use.
 - One point on the ENERGY STAR scale represents one percentile of buildings
- Buildings that perform in the 75th percentile or better can earn the ENERGY STAR label

Which Building is More Efficient?



	Office A	Office B
Location	Philadelphia	Philadelphia
Square Footage	200,000	200,000
Actual Energy Use (kBtu)	40,000,000	40,000,000
Actual Energy Intensity (kBtu/ft ²)	200	200

What About Now?

	Office A	Office B
Location	Philadelphia	Philadelphia
Square Footage	200,000	200,000
Actual Energy Use (kBtu)	40,000,000	40,000,000
Actual Energy Intensity (kBtu/ft ²)	200	200
Number of Workers	700	400
Weekly Hours of Operation	112	60
Number of Computers	750	475

The Answer is . . .



	Office A	Office B
Location	Philadelphia	Philadelphia
Square Footage	200,000	200,000
Actual Energy Use (kBtu)	40,000,000	40,000,000
Actual Energy Intensity (kBtu/ft ²)	200	200
Number of Workers	700	400
Weekly Hours of Operation	112	60
Number of Computers	750	475
Predicted Energy Intensity (kBtu/ft ²)	353	289
ENERGY STAR Score	81	67

ENERGY STAR Score Statistical Methodology



- Develop the regression model

$$\text{Energy Intensity} = C_0 + C_1 * \text{Operating Hours} + C_2 * \text{Workers per Square Foot} + C_3 * \text{Computer per Square Foot} + C_4 * \text{HDD} + C_5 * \text{CDD} + \dots$$

- Coefficients represent average responses
- Coefficients provide adjustments for each operational characteristic
 - **Does not** add the kWh of each piece of equipment
 - **Does** adjust energy based on correlation between operating characteristic and energy use

ENERGY STAR Score Statistical Methodology



The Score Does

- ✓ Evaluate as-billed energy use relative to building operations
- ✓ Normalize for operational characteristics (e.g., size, number of employees, cash registers, computers, climate)
- ✓ Depend on a statistically representative sample of the commercial building population

The Score Does Not

- ✗ Sum the energy use of each piece of equipment
- ✗ Normalize for technology choices or market conditions (e.g., type of lighting, energy price)
- ✗ Explain why a building operates as it does

Eligible to Receive an ENERGY STAR Score and Certification



Bank/Financial Institutions



Courthouses



Data Centers



Dormitories



Hospitals



Hotels



Houses of Worship



K-12 Schools



Medical Offices



Office Buildings



Retail Stores



Senior Care Communities



Supermarkets



Warehouses



Wastewater Treatment Plants*



* Certification not available

2003/2004 Restaurant Effort



- Results
 - Energy use not strongly correlated with number of transactions
 - Energy use not strongly correlated with square footage
 - Energy consumption was brand-specific – different amounts and different relationships with operational characteristics
- Data Issues
 - Sites with missing electricity data
 - Many sites with missing natural gas data
 - One brand used the same 3 natural gas values for all buildings
- Is it time to try again?

ENERGY STAR Energy Performance Scale Data Sources



- CBECS
 - Bank/Financial Center, Courthouse, Hotel, House of Worship, K-12 School, Medical Office, Office, Residence Hall/Dormitory, Retail, Supermarket, Warehouse (refrigerated/unrefrigerated)
- Industry Surveys
 - Data Center – Conducted by EPA
 - Hospital – Conducted by American Society for Healthcare Engineering (ASHE)
 - Senior Care – Conducted by Assisted Living Federation of America (ALFA), American Association of Homes and Services for the Aging (AAHSA), American Health Care Association (AHCA), and National Center on Assisted Living (NCAL)
 - Wastewater Treatment Plant – Conducted by American Waterworks Association Research Foundation

ENERGY STAR Energy Performance Scale Data Source Requirements



- Sample must, at a minimum:
 - Be random
 - Be nationally representative
 - Diverse in size
 - Diverse in geography
 - Diverse in ownership/management
 - Sufficiently large to be representative of population
 - Include measured whole building energy (and water) use data for all fuel types
 - Include data on numerous operational characteristics