



ENERGY STAR Score for Retail Stores & Supermarkets Plan for Updates with 2012 CBECS



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Agenda

- CBECS Overview
- EPA Update Schedule
- ENERGY STAR Score Methodology
- Retail and Supermarket Update
 - Objectives
 - Changes in the CBECS Survey
 - Opportunities for Input
- Next Steps



CBECs 2012 Overview

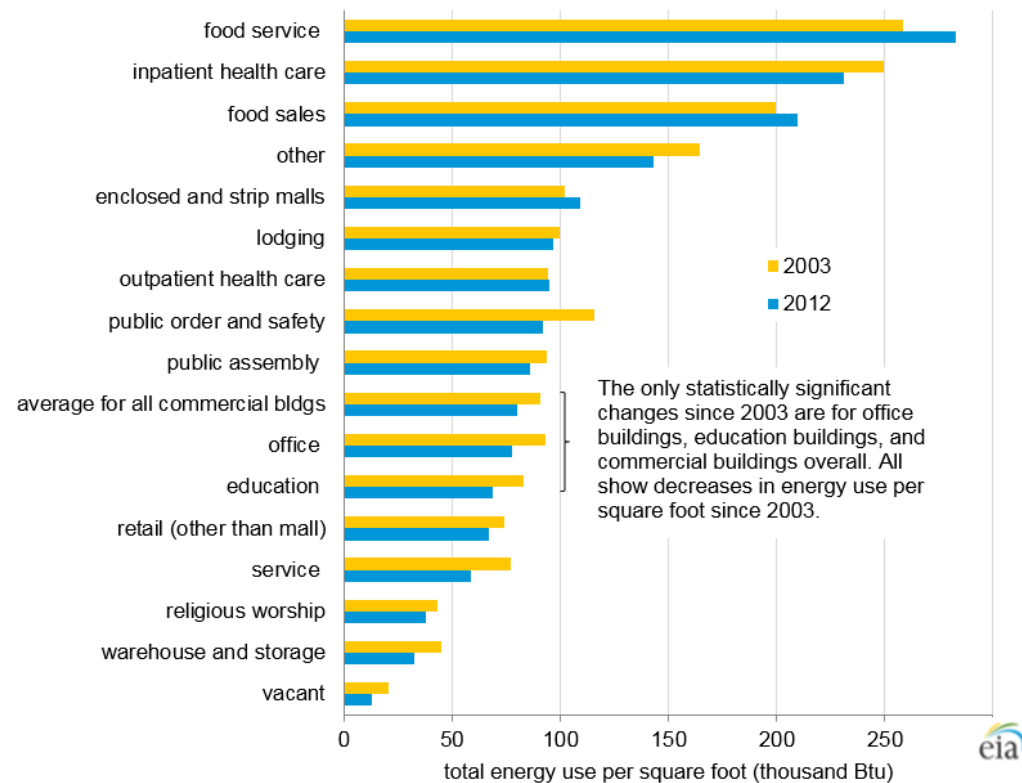
- **2012 survey sample size is over 6,700 observations**
 - 29% larger than 2003 survey
- **Estimate 5.6 million commercial buildings representing 87 billion ft²**
 - 14% increase in the number of buildings since 2003
 - 22% increase in floor space since 2003
- **EIA Data**
 - For updates and available microdata: <http://www.eia.gov/consumption/commercial/>
 - EIA has already published some energy comparisons for 2003 and 2012
- **EPA Analysis**
 - Some provisional energy data shared by EIA
 - Able to embark on preliminary analysis

Top Market Sectors	
1	Office 16.0 Billion ft ²
2	Warehouse 13.0 Billion ft ²
3	Education 12.2 Billion ft ²
4	Mercantile (Retail & Mall) 11.3 Billion ft ²
5	Lodging 5.8 Billion ft ²



CBECS 2012: Energy Use by Sector

- EIA has published a 2003 to 2012 comparison chart
- On the whole the aggregate intensity of commercial buildings is going down
- No statistically significant change for Retail
 - Takes into account the magnitude and also the number of observations



Source: U.S. Energy Information Administration, Commercial Buildings Energy Consumption Survey.



EPA Schedule for Score Revisions

- **Perform detailed analysis (~18 months)**
 - Hundreds of regression model formulations
 - Explore new variables captured by CBECS
 - Compare CBECS and Portfolio Manager Data
 - Determine appropriate changes to regression models used for score calculations
- **Program new scores into Portfolio Manager (~6 months)**
 - Document software requirements
 - Program code changes to the system
 - Perform extensive testing
- **Release new scores to the public**

→ ***Tentative target release in early 2018***



Order of Analysis by Property Type

- Office & Retail
- Supermarket & Medical Office
 - Will be important to compare results with Retail and Office
- Hotel & K-12 School
- Warehouse & House of Worship

→ ***Plan to focus on two models at a time*** (for 3-4 months each)

→ ***Once all models are completed will have some cross-model analysis and finalization***



Retail Schedule: Specifics

- The intensive review of CBECS for Retail is at the start of our 18 month review process
- The model may be re-visited based on what we learn from other sectors
- Near the end of the process, all models will be updated with the most current possible source factors prior to release

Activity	Timeframe
Project Launch	April 2016
Intensive Development	April – July 2016
Consideration of Supermarkets and Convenience Stores	June – September 2016
Recommendations for Next CBECS	October – November 2016
Re-Assess Model Based on Other Property Types	Ongoing, As Needed
Incorporate Revised Source Energy Factors	June – August 2017
Program and Test in Portfolio Manager	August – December 2017
Launch new Score	Early 2018



ENERGY STAR Score Objectives

- Reduce greenhouse gas emissions from energy use in buildings
 - Relies on actual, measured energy bill data
- Evaluate whole building energy use
 - Accounts for combined effects of technology, operation, maintenance, and usage patterns
 - Recognizes that these factors all affect each other and the bottom line measured energy consumption
- Motivate organizations to develop a strategic approach to energy management
- Provide a comparative, national benchmark
 - Adjusts for weather and certain business choices (e.g. hours of operation) for fair comparisons
 - Ranks performance relative to existing buildings in the market
- Identify best performers in the market, like the ENERGY STAR on products, so consumers and businesses can make smart choices



ENERGY STAR Score Development Process

- **Analyze national survey data**
 - Commercial Building Energy Consumption Survey (CBECS)
- **Develop regression models**
 - Normalize for different business activities
 - Assign a “normalized mean” to each property based on its operation
- **Compare actual energy use with normalized mean from the model**
 - More efficient: Actual < Normalized Mean
 - Less efficient: Actual > Normalized Mean
- **Create scoring lookup table**
 - Scores are based on the distribution of energy performance across commercial buildings
 - One point on the ENERGY STAR scale represents one percentile of buildings



What does a regression model look like?

- Example model

$$\begin{aligned} \text{Energy Intensity} = & C_0 + \\ & C_1 * \text{Workers per 1,000 ft}^2 + \\ & C_2 * \text{Computers per 1,000 ft}^2 + \\ & C_3 * \text{Hours of Operation} + \\ & C_4 * \text{Heating Degree Days} + \dots \end{aligned}$$

- 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



EPA Criteria for Inclusion in Analysis

- Focus on business activity/service provided
- Do not include variables for specific technologies:
 - For example: if 100% LED lighting saves energy, we don't want to compare properties with 100% LED only to each other; we want to compare them to **everyone**. The least efficient among the buildings with 100% LED may still be better than the typical building without.

✓ Characteristics Included	✗ Characteristics Excluded
<ul style="list-style-type: none"> ✓ Describe how a building operates ✓ Explain physical conditions and parameters ✓ Are determined by the business activity and needs <p><i>Examples: Hours, Workers, Floor Area, Computers, Weather</i></p>	<ul style="list-style-type: none"> ✗ Describe why a building performs a certain way ✗ Specify technologies used ✗ Reflect market conditions that may motivate behavior but are not related to thermodynamic performance <p><i>Examples: Lighting Technology, Window Type, Energy Price</i></p>



Specific Example of Two Retail Stores

- **What is the Same?**
 - Size
 - Climate zone
 - **Energy Use**

- **What is Different?**
 - Hours of Operation
 - Number refrigerated cases
 - **Score**

- **Why?**
 - Retail B is expected to use more energy
 - Longer hours
 - More refrigerators
 - Since it is expected to use more, but actually uses the same → it scores better

	Store A	Store B
Size	50,000	50,000
Hours of Operation	70	95
Number Open/Closed Refrigerated Display Cases	2	7
Expected EUI (kBtu/ft ²)	140	185
Actual EUI (kBtu/ft ²)	110	110
ENERGY STAR Score	65	81



ENERGY STAR Score Interpretation and Application

The Score Does

- ✓ Evaluate actual billed energy use
- ✓ Normalize for operational characteristics (e.g., size, number of workers, operating hours, climate)
- ✓ Express the performance of a building compared to its peers, as described by a nationally representative survey

The Score Does Not

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



How does EPA pick the “best” model?

- No single statistic will identify the best model
- EPA will review many alternatives (100+)
- Statistical properties of CBECS to assess:
 - Regression model statistics (F, p, R²)
 - Individual variable statistics (t-stats)
- Additional factors evaluated with both CBECS and Portfolio Manager
 - Distribution of scores
 - Average score
 - Percent in each 10-point bin
 - Number and percent above 75
 - Residual plots
 - Scatterplots of score as compared with key characteristics (size, workers, hours, etc)
 - Physical understanding of results
 - Relationship between EUI and score

→ Your data in Portfolio Manager helps us test the models!



Objectives: Retail Model Update

- Leverage the most recent market data
 - This will show us if retail stores are becoming more or less efficient
 - If the market is getting more efficient, then it may become harder to qualify for ENERGY STAR
- Re-assess key drivers of energy use
 - Has the relationship between hours and energy intensity changed in the last 10 years?
 - Are there new variables in CBECS that we should be adjusting for going forward?
- Explore the similarities between Supermarket and Retail
 - How do these types compare in terms of energy and operation?
 - Is it possible to leverage a single model? Would this avoid confusion for big box stores that straddle the definition?
 - If a lower size threshold were possible, could convenience stores be covered with one of these property types?



New Information in the CBECS Survey

- **Change in question about “registers”**
 - 2003: About how many cash registers are used in this building?
 - 2012: About how many cash registers or "point-of-sales" terminals are used in this building?
 - The new question appears to cover a wider spectrum of devices, which could have a different correlation with energy
- **New question about refrigerated storage about “Large Cold Storage Areas”**
 - New category of refrigeration, separate from walk-in
 - May be helpful in understanding stores that sell refrigerated products
- **Also possible that trends for factors like hours and workers have changed**
 - May be different typical values or changes in the correlation with energy



What should you expect?

- **Expect some changes**
 - Median energy use for a retail store or supermarket
 - Correlations between energy use and key activities (hours, workers, refrigerators)
 - Variables included in EPA's model
 - ***The scores of your properties!***
- **EPA's Methodology will not change**
 - Provide a national level benchmark
 - Use source energy to provide equitable scores for all fuel mixes
 - Leverage ordinary least squares (OLS) regressions to assess factors that impact energy consumption
 - Incorporate variables that capture weather and business activity
 - Exclude from analysis terms about technology, in order to reward technology that saves energy



Opportunities for Involvement

- **Main Webinar Series**
 - Updates approximately every 6 months until Portfolio Manager launch
 - Hear the latest findings
 - Participate in polls, Ask questions & Offer observations
 - Next session: May 12
 - <https://esbuildings.webex.com/>
- **Retail Webinar Series**
 - Two more webinars between now and July (*peak development*)
 - Learn more detail about analytical results
 - Respond to polls to share your opinions and recommendations
 - Next session in late May/early June (date TBD)
 - <https://esbuildings.webex.com/>
- **Portfolio Manager Help Desk**
 - www.energystar.gov/BuildingsHelp
 - Every time you ask a question about your score, you contribute to our process!
 - You can always email us with suggestions or observations about our score and your portfolio



Kick-off Survey

- Available until this Friday, April 29
 - https://www.surveymonkey.com/r/EnergyStar_Retail_Score
- Tell us what you really think!
 - What are important factors with respect to energy efficiency?
 - How do you think the market has changed in the last 10 years?
 - Is there anything in particular you want EPA to analyze?



Schedule Reminder

- **Spring/Summer 2016**
 - Bulk of Retail analysis will occur over next 3-4 months
- **Fall 2016 – Spring 2017**
 - Focus will be on other property types (hotel, K-12, etc.)
 - Based on our findings we may revisit our retail analysis
- **Summer 2017**
 - Re-estimate all models with updated source factors
- **Fall 2017**
 - Programming/Testing in Portfolio Manager

→ Hope is to launch new scores in early 2018



Next Steps

- Take our kick-off survey by this Friday!
 - https://www.surveymonkey.com/r/EnergyStar_RetailScore
- Attend the May 12 webinar for the latest updates pertinent to all sectors
 - <https://esbuildings.webex.com/>
- Be on the lookout for our next Retail webinar in early June
 - Date TBD
- If you see something, say something
 - Feel free to reach out with suggestions or questions at any time: www.energystar.gov/BuildingsHelp
- EPA will be hard at work with regression analysis for the next 18 months 😊

ENERGY STAR. The simple choice for energy efficiency.



Questions & Discussion