



CBECS 2012: Update on EPA's Schedule and Methodology

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ENERGY STAR for Commercial Buildings



Agenda

- CBECS 2012 Overview
- EPA Schedule for Score Revisions
 - When will scores be revised?
 - What new factors will be analyzed?
 - Will there be scores for new types?
- ENERGY STAR Score Methodology
 - Overview
 - Technical Review
- Questions and Discussion



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
- **Final data anticipated in early 2016**
 - For updates and available microdata: <http://www.eia.gov/consumption/commercial/>
 - Data on building size and operation is already available
 - Data on energy and cost is still under review at EIA

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



EPA Schedule for Score Revisions

- **Receive final CBECS 2012 data**
- **Perform detailed regression analysis (~18 months)**
 - Hundreds of regressions
 - Explore new variables, when available
 - Compare CBECS and Portfolio Manager Data
 - Determine appropriate changes to score calculations (regression models)
 - Currently have 9 different regression models based on CBECS data
- **Program new scores into Portfolio Manager (~6 months)**
 - Document software requirements
 - Code changes to the system
 - Perform extensive testing
- **Release new scores to the public**

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



Early 2018? Really?

- **Yes**
- Considered 2 alternatives for model release:
 - Rolling – Release new scores as the analysis is complete, meaning that some scores would be updated in mid-late 2016
 - One Time – Release new scores for all property types together, in 2018
- Benefits of a One Time release
 - Scores for mixed use properties will only change once
 - A property with Office and Retail will not see changes at two different times
 - Scores across a portfolio of different property types will only change once
 - Economy of scale for combining regression analysis and software programming
- ***This date is still tentative***
 - Will be assessed once data is published
 - Look for a final schedule next year



We plan to keep you informed

- **Program-wide webinars**
 - Share results/highlights across sectors
 - Announce the final schedule
 - Provide advice to prepare for score changes
 - Hold two webinars per year with overall updates
- **Sector-specific webinars**
 - Share results and proposed model changes when they are made
 - Listen to your questions and input
 - Hold webinars on a rolling basis throughout 2016 and 2017

→ **Contact us at www.energystar.gov/BuildingsHelp if you have questions or want to be more involved**



Which Property Types will be updated?

- **All Property Types in Portfolio Manager will be affected**
- **Properties with scores based on CBECS**
 - Will have an entirely new model based on the most recent data
 - Property types include:
 - Office, Bank Branch, Financial Center, Courthouse, K-12 School, Hotel, Warehouse and Distribution Center, Medical Office Building, Supermarket, Retail Store and Wholesale Club/Supercenter, Worship Facility, Dormitory/Barracks
- **Properties with scores based on other data sets**
 - Will be re-estimated using more current source energy factors
 - Score changes will be relatively small
 - Property Types include:
 - Multifamily, Hospital, Senior Care Community, Data Center, Wastewater Treatment Plant
- **Properties without scores**
 - Will have a new national median for comparison, based on the CBECS 2012 data



What types of updates are anticipated?

- **Data is more recent**
 - Data may reflect trends and changes in the market
- **New variables will be assessed**
 - Survey collected several new variables
 - We do not yet know which of these will have a statistically significant relationship with energy

- **Example new variables under consideration**

Office	Medical Office	Hotel	Warehouse
<ul style="list-style-type: none"> • Occupancy • Presence and Square Foot of Data Center • Presence of Open Plan Office Spaces 	<ul style="list-style-type: none"> • Yes/No for the presence of MRI and CT Scan • Count of X-Rays • Operating Rooms for Outpatient Surgery 	<ul style="list-style-type: none"> • Occupancy • Presence of conference/ event space • Separate counts of commercial ice makers and mini-refrigerators 	<ul style="list-style-type: none"> • Ceiling Height



Will there be scores for new property types?

- **Probably Not**
- Property types that cover a diverse group of buildings and do not have many specific questions to help differentiate
 - Social/Meeting (convention center, community center, etc.)
 - Recreation (gym, bowling alley, ice rink)
- Property types with insufficient sample size (*fewer than 60 observations*)
 - Library
 - Police Station/Fire Station
 - Laboratory
- But, we will explore whether it is possible to broaden the scope of any existing property types
 - For example, is it possible to cover Convenience Store along with Retail and/or Supermarket?



ENERGY STAR Score Methodology



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
 - Account for the combined effects of technology, operation, maintenance, and usage patterns
 - Recognize that these factors all affect each other and the bottom line measured energy consumption
- Provide a comparative national benchmark
 - Adjust for weather and certain business choices (e.g. hours of operation) to enable fair comparisons
 - Rank buildings relative to existing buildings in the market
- Identify the best performers in the market
 - Like the ENERGY STAR on products
 - Help consumers and business make smart choices



ENERGY STAR Score Development Process

- Analyze national survey data
- Develop regression model
 - Model computes average energy use for a building, given its operation
 - This is how we normalize for important factors like heating degree days and weekly hours of operation
- Use the model to assess the efficiency of each building
 - More efficient: Actual Energy < Normalized Mean
 - Less efficient: Actual Energy > Normalized Mean
- Create scoring lookup table
 - Score is based on the distribution of energy efficiency
 - One point on the scale represents 1% of the population



Technical Methodology Review

- Objective
 - Review our underlying technical approach and statistical methods
 - Ensure that we continue to have a robust and meaningful metric for the market to use
 - We're always open to new ideas for assessing energy performance
- Process
 - Consider questions/comments received via customer support and previous webinars
 - Review academic studies and other papers regarding the ENERGY STAR scores
 - Perform analysis of alternate/additional statistical techniques and processes
 - Propose changes to the technical approach



Technical Input Meeting – January 2015

- Included both academics and practitioners (energy efficiency services/consultants)
- Topics discussed
 - Possible alternate/additional data sources
 - Approach to regression weighting
 - Different “Dependent Variables”
 - LN(Source Energy), Source Energy, EUI, etc.
 - Variability in EUI and statistical uncertainty
 - Methodologies for mixed use properties
- Meeting kicked off a year of internal review of our methodology in preparation for the new CBECS data



Fundamental Aspects of our Methodology Will Not Change

- **CBECS Data**
 - CBECS is the best, most nationally representative data set we can use
 - Portfolio Manager is not an acceptable alternative
 - Large sample, but not representative
 - Skewed by individual companies, especially in certain sectors
- **Weighted Regressions**
 - Continue to use weighted regressions
 - Make sure to compare weighted and unweighted results
 - Ideally results should be robust to both approaches
- **Source EUI**
 - Will continue to serve as the main dependent variable of analysis
- **Adjustments for Business Activity**
 - Regression adjusts for aspects of business activity (hours, workers, etc)
 - Regression does not include factors like technology
 - We want to compare all buildings with all technologies, not to compare buildings with like technologies
 - Variability in EUI among buildings with the same business activity is the basis of the score



New Techniques will Complement and Enhance our Approach

- **Outliers and Influence Points**
 - Incorporate additional statistical techniques to identify any individual observations that have a large influence on the results
 - Ensure that models work for the full population and are not driven by a handful of buildings
- **Portfolio Manager Data**
 - Expand our use of this data as a point of comparison
 - Perform stratification/weighting of Portfolio Manager data to increase its representativeness
- **Model Validation**
 - Where possible, withhold subset of the CBECS data from the initial analysis for additional validation tests
 - Consider/compare results across survey years
- **Consolidated Roll Out Schedule**
 - Releasing all models together will allow time to compare the results
 - We can evaluate filters and coefficients to better understand similarities and differences across property types



Model Development

- **Analysis steps**
 - Review raw data
 - Compute variables
 - Like Source EUI and Worker Density
 - Use box plots, scatter plots, and distributions to assess relationships and outliers
 - Perform regression models
 - Stepwise to begin
 - Listwise to explore specific permutations based on findings
 - Compare CBECS and Portfolio Manager Data
 - Evaluate top models to make a selection
 - Perform final model validation
 - Develop software specifications for programming
- **Stakeholder Involvement**
 - Consider suggestions, questions, and other input
 - Hold webinars as a forum for input
 - Share results on a rolling basis
 - Even before the official release in 2018

→ We will get started as soon as the data is available!



What's next?

- **EIA**
 - Finalize review of energy consumption and expenditure data
 - Publish detailed energy consumption tables and microdata
- **EPA**
 - Review CBECS energy data, when available
 - Explore relationships with new variables
 - Update regression models and program Portfolio Manager
 - Hold webinars to share results
 - Finalize the schedule for revised ENERGY STAR scores
- **You!**
 - Remember that your score is likely to change when EPA updates Portfolio Manager
 - Participate in webinars to keep informed along the way



Questions & Discussion