ENERGY STAR® Portfolio Manager®

Technical Reference

Analysis and Key Findings from EPA's Review of the ENERGY STAR Model for U.S. Retail Properties

On August 26, 2018, EPA updated the ENERGY STAR score models and related performance metrics for buildings in ENERGY STAR Portfolio Manager® based on the most recent market data available. The data shows that energy use and business practices in U.S. commercial buildings have changed since EPA last updated the ENERGY STAR score models. These changes require that EPA update the score models so that they are as reflective as possible of current market trends and performance.

On September 13, 2018, EPA implemented a review period, during which we solicited feedback on the application of the models to various commercial building sectors and the resulting scores. The review period included three phases: gathering feedback; analyzing the models and evaluating score changes on buildings benchmarking in Portfolio Manager; and communicating the results. With this document, we are communicating the results and concluding our review period for the retail store ENERGY STAR model.

During the feedback phase, we heard from several partners about trends they observed in the scores of their buildings. Four partners provided specific feedback about retail properties, noting that scores of individual buildings changed in unexpected ways. This feedback was very helpful during the analysis phase in focusing our efforts on the factors that changed from the previous model. We looked at each of these factors extensively and determined that the model is working as intended for most types of retail stores.

Background on Underlying Industry Data

The current model for Retail Stores was developed using data collected for the Energy Information Administration's (EIA) 2012 Commercial Building Energy Consumption Survey (CBECS). The previous model was developed using data from the 2003 CBECS. EPA had planned to update the model in the intervening years, using data from a 2007 CBECS. However, EIA did not publish the 2007 survey data, after determining that it did not meet their rigorous quality standards.

Between 2003 and 2012, the stock of retail stores in the United States experienced changes, as illustrated in the table below. The estimated number of retail stores decreased by 1%, while the average energy use decreased by 9% in terms of site energy use intensity (EUI) and 4% in terms of source EUI.

Changes in U.S. Retail Stores (CBECS Data)

CBECS Year	Number of Retail Buildings in U.S.	Floorspace (million sf)	Average Site EUI	Average Source EUI*
2003	443,000	4,317	73.9	167.9
2012	438,000	5,439	66.9	161.1

**CBECS Retail (other than mall) category; Calculated using new ENERGY STAR source factors from August 2018*

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Review Period Key Findings

Key Finding #1: The model is working as intended for the retail sector as a whole

Despite data challenges (detailed below), EPA has concluded that the model is working as intended to deliver appropriate energy performance metrics for the retail sector. No further changes have been made to the performance metrics released in August 2018. ENERGY STAR certification for retail stores will resume on July 31, 2019.

Key Finding #2: Use of default values rather than actual use details is affecting scores for a substantial number of retail stores

Analysis showed that, for a substantial portion of retail stores in Portfolio Manager, default values for certain use details are affecting scores. We encourage users to review and appropriately edit property use details and basic property information, such as Gross Floor Area, Number of Workers, and Number of Refrigeration/Freezer Units — you may see significant changes in your retail store ENERGY STAR scores.

Key Finding #3: Additional EPA-industry collaboration with certain retail sub-sectors would be valuable

Assessing the model with the set of retail properties benchmarking in Portfolio Manager is particularly challenging for certain types of retail stores, i.e.: drug stores, wholesale clubs, and stores with very high use of electronics and/or specialty equipment (such as stores that sell cellular phones and other wireless devices, as well as electronics retailers). The prevalence of retail chains, incomplete and/or inaccurate data, and other factors limit the model evaluation and testing possible for these types of stores. Therefore, EPA would like to continue collaborating with retailers that own and operate these types of stores to gather verified data and conduct further testing.

The rest of this document provides additional details about the ENERGY STAR model for retail stores and the results of the score review analysis.

Summary of Review Period Feedback, Analysis, and Findings

During the review period, we solicited feedback from all Portfolio Manager users and ENERGY STAR partners. In total, we received 14 survey responses from organizations that have retail properties as part of their building portfolio. Of these, four provided substantive feedback on the retail store model. These responses mentioned that certain properties experienced much larger drops than the average, and that there was unexpected variation in score changes among different properties.

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An individual retailer's change in score is the result of interactions among the components of the model, and difficult to attribute to a single factor. The fuel mix of a building, the amount of energy used, the building activity level, and how the combination of these factors compares to the U.S. population of retail stores on a percentile scale all influence the change in score.

In developing the current retail model, EPA analyzed the potential impact of dozens of factors on retail energy use. The final model adjusts for those listed in the table below, which shows what changed from the previous model to the current model.

Changes in Retail Model Adjustments

Adjustments in Previous Retail Model Based on 2003 CBECS	Kept?	Adjustments in Current Retail Model Based on 2012 CBECS
Number of Workers per 1,000 square feet	✓	Number of Workers per 1,000 square feet
Weekly Operating Hours	✓	Weekly Operating Hours
Number of Walk-in Refrigeration Units per 1,000 square feet	✓	Number of Walk-in Refrigeration Units per 1,000 square feet
Number of Open and Closed Refrigeration Cases per 1,000 square feet	✓	Number of Open and Closed Refrigeration Cases per 1,000 square feet
Weather and Climate (HDD and CDD)	✓	Weather and Climate (HDD and CDD)
Percent of the Building that is Heated and Cooled	✓	Percent of the Building that is Heated and Cooled
Building Size	✗	N/A
Number of Personal Computers per 1,000 square feet	✗	N/A
Number of Cash Registers per 1,000 square feet	✗	N/A

✓ Kept ✗ Deleted

The 2012 CBECS data showed a weaker relationship between energy use per square foot and building size, number of computers, and number of registers. EPA believes these changes reflect some of the myriad changes in the retail market since 2003, the vintage of the last CBECS.

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Evaluating the model with data in Portfolio Manager is informative, but presents challenges, especially for certain retail subsectors

Testing the model with Portfolio Manager data is a helpful exercise as it allows us to see how model changes will impact the scores for properties using our tool. With thousands of property owners and managers benchmarking in Portfolio Manager, EPA can conduct relatively robust analyses to evaluate model performance. EPA always tests the ENERGY STAR models with Portfolio Manager data before releasing them, a process that can lead to insights and reveal areas for further analysis.

However, because Portfolio Manager data may not be nationally representative nor verified for accuracy, it is important to interpret the results carefully. Evaluating the ENERGY STAR model for retail stores with Portfolio Manager data presents additional challenges, for two reasons:

1. Many of the retail stores benchmarked in Portfolio Manager are part of large retail chains, which are likely to have similar technology and management practices across their portfolios. The results may be skewed by the predominance of these large chains.
2. There are indications of a high prevalence of incomplete and/or inaccurate data in the retail stores benchmarked in Portfolio Manager. Examples include widespread use of default values for property use details, extensive use of rounded estimates, clearly incorrect data mistakenly uploaded, and the entry of identical use detail values across entire chains (e.g., the same number of workers entered for every store regardless of store size).

To address these limitations, EPA filtered the data prior to conducting analysis. This filtering likely removed much, but not all, of the questionable and/or biased data. Results of the analysis are shown below.

The filtered data set has a low representation of certain store types. Therefore, EPA hopes to collaborate further with certain types of retailers to conduct additional testing with verified data, specifically for: drug stores, wholesale clubs, and stores with very high use of electronics and/or specialty equipment.

The new model more appropriately scores retail stores across a range of sizes, and computer and register density

Removing an adjustment for retail store size means that larger stores were more likely to see greater score drops when EPA updated the model in August 2018. This does not mean there is a bias against larger retail stores in the current ENERGY STAR scores. In the table below, the second column shows that the previous ENERGY STAR score for retail stores in Portfolio Manager increased with size. While average scores in the current model still follow this general trend, it is less pronounced.

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Average Score in Previous and Current Models by Building Size

Building Size	Average Score Previous Retail Model	Average Score Current Retail Model	Percent Scoring 75 or above (Previous Model)	Percent Scoring 75 or above (Current Model)
<15,000	58	57	20%	23%
15,000 – 50,000	67	59	40%	25%
50,000 +	75	67	63%	40%
All	68	61	43%	30%

Likewise, removing adjustments for both computer density and register density (i.e., the number of computers and registers per 1,000 square feet) means that buildings with high values for these use details were more likely to see large score drops. This does not indicate a bias against buildings with high computer density or register density in the current ENERGY STAR scores. The table below shows that average scores prior to August 2018 increased steadily with higher computer and register density. Average scores in the current model are more balanced across the range of computer and register densities.

Average Score in Previous and Current Models by Computer and Register Density

Number of Computers and Registers per 1,000 Square Feet	Average Score Previous Retail Model	Average Score Current Retail Model	Percent Scoring 75 or above (Previous Model)	Percent Scoring 75 or above (Current Model)
0 - 0.25	59	61	28%	26%
0.25 - 0.5	66	63	38%	34%
0.5 - 0.75	69	58	43%	25%
0.75 +	76	58	61%	26%
All	68	61	43%	30%

Other variables were studied and found to be accounted for appropriately in the model

Prior to releasing the current score model in August 2018, EPA evaluated many other building and operating characteristics to ensure the model scores different types of retail properties appropriately. During the review period, we verified that the current model produces balanced scores for retail properties across various hours of operation, number of workers, regions, and more.

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The overall results fall within the expected average score and percentile distribution

The ENERGY STAR score is intended to represent a percentile ranking of the nationwide retail building population, with a score of 50 indicating a retail store with median energy performance, and a score of 75 – 100 indicating performance in the top 25% of the retail store population.

In the current retail ENERGY STAR model, the average score for the filtered dataset of buildings benchmarking in Portfolio Manager is 61, and 30% of retail stores score 75 or above. In the previous model, the average score was 68, and 43% of retail stores were scoring 75 or above, as illustrated in the table below.

Average Retail Score and Percent Scoring ≥75 (Portfolio Manager Buildings)

	Average ENERGY STAR Score	Percent scoring 75 or above
Previous Retail Model	68	43%
Current Retail Model	61	30%

Additional Resources

- General Information on ENERGY STAR Score Updates
- ENERGY STAR Score for Retail Stores and Supermarkets Technical Reference