ENERGY STAR® PortfolioManager® Technical Reference

Analysis and Key Findings from EPA's Review of the ENERGY STAR Model for Worship Facilities

On August 26, 2018, EPA updated the ENERGY STAR score models and related performance metrics for U.S. 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 undergone substantial change since EPA last updated the ENERGY STAR score models. These important 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 Worship Facility ENERGY STAR model.

After careful review and analysis during the review period, we have determined that the model is scoring worship facilities properly.

Background on Underlying Industry Data

The current Worship Facility model 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, worship facilities in the United States experienced important changes, as illustrated in the table below. The estimated number of worship facilities increased by 11%, while the average energy use per building decreased by 12% in terms of site energy use intensity (EUI) and 5% in terms of source EUI.

Changes in U.S. Religious Worship Buildings (CBECS Data) from 2003-2012

CBECS Year	Number of Worship Buildings in US	Floorspace (million sf)	Average Site EUI	Average Source EUI*
2003	370,000	3,754	43.4	74.5
2012	412,000	4,557	38.0	70.9

**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

After extensive analysis, EPA has concluded that the Worship Facility model is working as intended to deliver appropriate energy performance metrics. Based on these results, no further changes have been made to the performance metrics released in August 2018. ENERGY STAR certification for worship facilities will resume on May 20, 2019.

Key Finding #2: Small worship facilities experienced greater score changes

Under the previous model, smaller facilities tended to have higher scores than large worship facilities. Average scores in Portfolio Manager with the current model demonstrate that it scores worship facilities of all sizes more evenly than the previous model.

Key Finding #3: A significant portion of worship facilities could raise their ENERGY STAR scores by replacing default values with actual use details

Analysis also showed that, for a significant portion of worship facilities in Portfolio Manager, default values for certain use details are influencing scores. With the introduction of the current model, the Presence of Commercial Food Preparation (y/n) was replaced with Gross Floor Area Used for Food Preparation. Since this is a new use detail, EPA assigned it a default value of zero for all worship facilities. We encourage users to enter the actual values for Gross Floor Area Used for Food Preparation, as well as any other defaulted values – you may see significant changes in your worship facility ENERGY STAR scores.

The rest of this document provides additional details about the ENERGY STAR model for Worship Facility properties 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 ENERGY STAR stakeholders, including all Portfolio Manager users and ENERGY STAR partners. We did not receive any comments specific to changes observed in scores for worship facilities. Nevertheless, we conducted a careful review of the Worship Facility model and analyzed the key factors that influenced changes in scores.

Variations in score change are 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 worship facilities on a percentile scale all influence the change in score.

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

Changes in Worship Model Adjustments

Adjustments in Previous Worship Model Based on 2003 CBECS	Kept?	Adjustments in Current Worship Model Based on 2012 CBECS
Weather and Climate (using Heating and Cooling Degree Days)	✓	Weather and Climate (using Heating and Cooling Degree Days)
N/A	NEW	Percent of the Building that is Heated and Cooled
Number of Religious Worship Seats per 1,000 square feet	✓	Number of Religious Worship Seats per 1,000 square feet
Weekly Operating Hours	✓	Weekly Operating Hours
Presence of Commercial Food Preparation (yes/no)	△	Gross Floor Area Used for Food Preparation
Number of Personal Computers per 1,000 square feet	×	N/A
Number of Commercial Refrigeration Units per 1,000 square feet	×	N/A
Open All Five Weekdays (yes/no)	×	N/A

✓ Kept
△ Kept with changes
× Deleted

Our analysis found that two factors had a relatively large influence on score variation:

1) Worship Facility Size (square feet)
2) Gross Floor Area Used for Food Preparation

Both are discussed in detail below.

The new model scores worship facilities of all sizes more evenly

In the table below, the second column shows that the previous ENERGY STAR score for worship facilities in Portfolio Manager decreased with worship facility size. Buildings under 25,000 square feet had an average score of 57, while buildings above 50,000 square feet had an average score of 46 under the previous model. The average scores for worship facilities of all sizes in Portfolio Manager are more even under the current model.

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ENERGY STAR Score vs. Building Size (Portfolio Manager Buildings)

Building Size (sq. ft.)	Average Score Previous Worship Model	Average Score Current Worship Model
Under 25K	57	49
25K - 50K	54	49
50K and above	46	47

Note that scores in Portfolio Manager may increase as users enter values for Floor Area Used for Food Preparation, as described below.

Gross Floor Area Used for Food Preparation is a new, more appropriate variable for capturing building activity

The previous model included an adjustment for the presence of commercial food preparation in a worship facility. The current model replaced that yes/no variable with an adjustment for the percent of the facility's gross floor area used for food preparation. The new Gross Floor Area Used for Food Preparation variable, available for the first time in the 2012 CBECS, is a better measure of commercial food preparation than the previous binary variable.

With the introduction of the current model, EPA defaulted the new commercial food preparation use detail to zero for all worship properties in Portfolio Manager. As a result, worship facilities that include commercial food preparation were more likely to experience large score drops relative to the previous model.

Replacing the default value of zero with the actual value for total gross floor area used for commercial food preparation should raise the scores for these properties.

During the review, EPA also found that a significant portion of worship facilities use default values for Weekly Operating Hours. Updating this use detail with actual values will also impact scores.

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

Although EPA did not receive comments on any other worship facility characteristics, we did evaluate many other building and operation characteristics to ensure our model scores different types of worship facilities fairly. We verified that the current model produces more balanced scores than the previous model for worship facilities across various hours of operation, number of workers, climates, regions, year of construction, and more.

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The results fall within the expected average score and percentile distribution

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

In the current worship facility ENERGY STAR model, the average score for facilities in Portfolio Manager is 49, and 19% score 75 or above (these averages are likely to increase as users enter values for floor area used for food preparation). In the previous model, the average score was 54, and 32% of worship facilities were scoring 75 or above, as illustrated in the table below.

Average Worship Score and Percent Scoring ≥75 (Portfolio Manager buildings)

	Average ENERGY STAR Score	Percent scoring 75 or above
Previous Worship Model	54	32%
Current Worship Model	49	19%

Additional Resources

- General Information on ENERGY STAR Score Updates
- ENERGY STAR Score for Worship Facilities Technical Reference
- Definition of Gross Floor Area Used for Food Preparation