



Update to ENERGY STAR Ratings for Hotels May 2009

Frequently Asked Questions

EPA's energy performance rating system evaluates actual, as-billed energy data to create a whole building indicator of energy performance and compare a building to its national peer group. EPA analyzes national survey data, develops regression models to predict energy use based on operation, and assigns a 1-to-100 rating to a building. Each point on the performance scale represents one percentile of buildings. A full overview of this process and specific details on the hotel model are available online.¹ A revised rating model for hotels was released into Portfolio Manager on February 23, 2009.

How was the Hotel Model Updated?

The new hotel model incorporates several updates to the original model, as described below. All of the changes have contributed to a model that EPA believes most accurately reflects the current state of the U.S. lodging industry.

- **Use of a New Data Source** – The new model is based on hotel data from the Energy Information Administration's 2003 Commercial Building Energy Consumption Survey (CBECS), which was released in 2006. CBECS data is the standard basis for EPA rating models because it is a random survey of energy consumption across the national population of commercial buildings, and it is freely available to the general public for review and analysis.² However when the first hotel model was developed, CBECS was deemed inadequate because there were not enough hotel operating parameters in the 1999 survey. The newer 2003 CBECS survey contains many more hotel-specific operating characteristics such as the number of employees, types of food service, and counts of equipment such as computers and refrigerators. As such, EPA was able to use the preferred CBECS data set for the recent Hotel model revision. With this data, EPA identified the key operational parameters that drive energy use in the lodging industry to better understand and predict the correlations between these characteristics and overall building energy consumption.
- **Analysis of Energy Use Per Square Foot** – The unit of analysis for the new model is energy intensity (energy consumption per square foot), whereas the previous model considered total energy consumption. Analyzing energy use intensity – and factoring in room density – allows the model to better capture the complex relationship between overall hotel size, room count, and energy use.
- **Service Levels Based on Operating Characteristics** – The previous model classified hotels in terms of pre-defined amenity categories (e.g. Economy, Upscale). The new model instead asks the user to input discrete operating characteristics (e.g. workers, refrigeration units). Feedback from ENERGY STAR partners suggested that the old amenity categories were not clear, and therefore subjective at times. The new operating characteristics are easier to quantify and offer a superior and consistent differentiation among service levels, allowing for an objective analysis. Additionally, a review of the updated hotel ratings in Portfolio Manager shows that the new model results in an equitable distribution of ratings across hotels based on size and level of service.

How Were the Operating Characteristics in the Model Selected?

As with all EPA energy performance rating models, the hotel model is intended to evaluate energy use while accounting for the level of service at the property being rated. To achieve this, EPA performed a statistical regression analysis on the CBECS hotel data to identify the operating characteristics that are the key drivers of hotel energy consumption. A diverse set of operating characteristics were reviewed, including the number of rooms and employees, counts of equipment such as printers, copiers, computers and commercial refrigeration, and other operational parameters such as pools, laundry facilities,

¹ http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager_model_tech_desc.

² <http://www.eia.doe.gov/emeu/cbecs/contents.html>



and cooking facilities. The regression technique enabled EPA to test simultaneous adjustments for each of the operating characteristics, in order to assess the interaction of these characteristics. EPA evaluated a thorough set of regression equations using multiple statistical tests, including residual plots, model R², and individual coefficient significance levels. Ultimately, the equation chosen for the model includes the best combination of operating characteristics that have statistically significant correlations with energy use.

Because the adjustments are based on statistical correlations, each mathematical adjustment does not attempt to quantify the power requirement of each piece of equipment. The adjustment for commercial refrigeration units is not an estimate of the energy per refrigerator. Rather, it is the correlation between commercial refrigeration and energy consumption; this correlation may embody not only the power requirement of the equipment, but also the energy associated with food service in restaurants and banquet space. Similarly, the adjustment for hotel workers is not merely the energy that a worker uses – it is an adjustment that accounts for the level service associated with the given staffing requirement.

How is a Rating Determined?

For each hotel property entered into the tool, the operating characteristics input by the user are entered into a regression equation. This regression equation is derived from the statistical analysis performed on the industry-wide CBECS data, and is used to define the hotel's predicted source energy intensity (Source EUI) – i.e., the EUI that is expected for this hotel, taking into account its specific operational parameters. The energy performance rating is based on the ratio of the hotel's actual energy intensity (i.e., as-billed utility data) to its predicted energy intensity. A low ratio means the hotel is using less energy than predicted and is performing well; a high ratio indicates the opposite. The rating is developed such that 1 point equals 1 percentile of the U.S. hotel population – i.e., a hotel with a rating of 75 is performing better than 75% of hotels nationwide.

Because this rating methodology adjusts for property-specific operational parameters, two different hotels could have the same Source EUI but achieve different ratings. For example, consider Hotel A and Hotel B, summarized in the table below. Hotel A is a smaller, limited service hotel. It has a small total floor area, high room density, no restaurant or commercial cooking, and no extended services such as spas or conference facilities that may require additional workers. Hotel B is a larger, full service hotel. The room size is larger and there are more common areas such as banquet spaces, so the room density is much lower than in Hotel A. Hotel B has on-site restaurants, a large number of employees to attend to guests, conference facilities, spas, and other amenities. Although Hotels A and B have the exact same Source EUI, Hotel B is expected to consume more energy because it offers more services; as such it earns a higher rating. In this way, the rating is based on Source EUI, while accounting for the hotel service level.

Example Hotel Performance Characteristics		
	Hotel A	Hotel B
Gross Floor Area	65,000	750,000
Number of Rooms	170	1,000
Rooms per 1,000 Square Foot	2.62	1.33
Presence of Food Preparation	No	Yes
Number of Commercial Refrigeration Cases	1	20
Commercial Cases per 1,000 Square Foot	0.015	0.026
Number of Workers	15	555
Workers per 1,000 Square Foot	0.23	0.74
Predicted Source EUI (kBtu/square foot)	195	245
Actual Source EUI (kBtu/square foot)	180	180
Rating	52	74
<i>Note: Hotels are assumed to be in the same climate so this does not impact their ratings</i>		



Why Did My Rating Change?

Most hotel operators experienced changes in energy performance ratings with the release of the new hotel model on February 23, 2009. The new model reflects the application of more recent and robust market data and an improved statistical methodology, which enables operators to receive ratings that more accurately compare them to their industry peers. On average, energy performance ratings decreased with the new hotel model, with changes varying depending on a given hotel's array of operating characteristics. Larger rating decreases were associated with small hotels with high room density (e.g. economy hotels). Smaller decreases or rating increases were more likely to be associated with larger hotels with low room density (e.g. upscale hotels).

One of the biggest factors affecting rating changes is that new model looks at the relationship between energy use *per square foot* and rooms per square foot, while the old model examined the relationship between total energy and total room count. This change enables a comprehensive assessment of the relationships between floor area, room count, and energy use. For all hotel types and operating characteristics, the new model produces the expected distribution of ratings across the 1-to-100 spectrum, underscoring EPA's confidence in the broad applicability of this tool.

Does the Model Work for My Hotel?

Yes. To verify that the model developed with CBECS data would be appropriate for use by all hotels nationwide, EPA examined energy performance ratings under the new model for over 3000 existing hotels in Portfolio Manager. The average rating, distribution of ratings across the full 1-to-100 spectrum, and the percentage of the population that qualifies for the ENERGY STAR are comparable between the two data sets. The model provides an equitable and unbiased distribution of ratings for both the CBECS and Portfolio Manager hotels, demonstrating the broad applicability of the tool for US Hotels

EPA also conducted analyses to ensure that ratings were not biased in favor of any particular segment of the hotel population. Energy performance ratings were computed for large buildings vs. small buildings, buildings with laundry vs. without laundry, and buildings with cooking vs. without cooking. In all of these groupings, average ratings were similar for each segment of the population, in both the CBECS and Portfolio Manager data. No particular characteristics (e.g., size, cooking, or laundry) are correlated with higher or lower ratings on average.

Additionally, in both the CBECS and Portfolio Manager data sets, there is a similar relationship between Source EUI values and energy performance ratings. A hotel with low Source EUI (< 75 kBtu/ft²) is likely to receive a high rating, and a hotel with high Source EUI (> 400 kBtu/ft²) is likely to receive a low rating, regardless of adjustments for operating characteristics. However, a building with Source EUI in the range of 200 kBtu/ft² may have a high rating or a low rating, depending on its specific operational parameters and level of service, as shown in the example above.