



ENERGY STAR Score for Hotels in the United States

OVERVIEW

The ENERGY STAR Score for Hotels applies to properties renting overnight accommodations on a room/suite and nightly basis. The objective of the ENERGY STAR score is to provide a fair assessment of the energy performance of a property relative to its peers, taking into account the climate, weather, and business activities at the property. To identify the aspects of building activity that are significant drivers of energy use and then normalize for those factors, a statistical analysis of the peer building population is performed. The result of this analysis is an equation that will predict the energy use of a property, based on its experienced business activities. The energy use prediction for a building is compared to its actual energy use to yield a 1 to 100 percentile ranking of performance, relative to the national population.

- **Property Types.** The ENERGY STAR score for hotels applies to properties renting overnight accommodations on a room/suite and nightly basis. The score applies to an entire hotel whether it is a single building or a campus of buildings.
- **Reference Data.** The analysis for hotels is based on data from the Department of Energy, Energy Information Administration’s 2012 Commercial Building Energy Consumption Survey (CBECS).
- **Adjustments for Weather and Business Activity.** The analysis includes adjustments for:
 - Number of Guest Rooms
 - Number of Workers
 - Number of Commercial Refrigeration/Freezer Units
 - Presence of a Commercial/Large Kitchen
 - Weather and Climate (using Heating and Cooling Degree Days, retrieved based on Zip code)
 - Percent of the Building that is Heated and Cooled
- **Release Date.** The ENERGY STAR score for hotels is updated periodically as more recent data becomes available:
 - Most Recent Update: August 2018
 - Prior Update: February 2009
 - Original Release: April 2002

This document presents details on the development of the 1 - 100 ENERGY STAR score for hotel properties. More information on the overall approach to develop ENERGY STAR scores is covered in our Technical Reference for the ENERGY STAR Score, available at www.energystar.gov/ENERGYSTARScore. The subsequent sections of this document offer specific details on the development of the ENERGY STAR score for hotels:

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REFERENCE DATA & FILTERS

For the ENERGY STAR score for hotels, the reference data used to establish the peer building population in the United States is based on data from the Department of Energy, Energy Information Administration’s (EIA) 2012 Commercial Building Energy Consumption Survey (CBECS). Detailed information on this survey, including complete data files, is available at: <https://www.eia.gov/consumption/commercial/index.php>.

To analyze the building energy and operating characteristics in this survey data, four types of filters are applied to define the peer group for comparison and to overcome any technical limitations in the data: Building Type Filters, Program Filters, Data Limitation Filters, and Analytical Filters. A complete description of each of these categories is provided in our Technical Reference for the ENERGY STAR Score, at www.energystar.gov/ENERGYSTARScore. **Figure 1** presents a summary of each filter applied in the development of the ENERGY STAR score for hotels, the rationale behind the filter, and the resulting number of properties in the data set after the filter is applied. After all filters are applied, the remaining data set has 139 properties.

Figure 1 – Summary of Filters for the ENERGY STAR Score for Hotels

Condition for Including an Observation in the Analysis	Rationale	Number Remaining
PBAPLUS = 38 or 39	Building Filter – CBECS defines building types according to the variable “PBAPLUS.” Hotels are coded as PBAPLUS = 38 and Motels/Inns are coded as PBAPLUS = 39.	220
Must have at least 1 room	EPA Program Filter – Baseline condition for being a full time hotel.	220
Must operate for 168 hours per week	EPA Program Filter – Baseline condition for being a full time hotel.	218
Must have at least 1 worker	EPA Program Filter – Baseline condition for being a full time hotel.	215
Must operate for at least 10 months per year	EPA Program Filter – Baseline condition for being a full time hotel.	209
A single activity must characterize greater than 50% of the floor space ¹	EPA Program Filter – In order to be considered part of the hotel peer group, more than 50% of the building must be defined as a hotel.	204
Must report energy usage	EPA Program Filter – Baseline condition for being a full time hotel.	204

¹ This filter is applied by a set of screens. If the variable ONEACT=1, then one activity occupies 75% or more of the building. If the variable ONEACT=2, then the activities in the building are defined by ACT1, ACT2, and ACT3. One of these activities must be coded as lodging (PBAX=22), with a corresponding percent (ACT1PCT, ACT2PCT, ACT3PCT) that is greater than 50.

Condition for Including an Observation in the Analysis	Rationale	Number Remaining
Must be less than or equal to 1,000,000 square feet	Data Limitation Filter – CBECS masks surveyed properties above 1,000,000 square feet by applying regional averages.	196
If propane is used, the amount category (PRAMTC) must equal 1, 2, or 3	Data Limitation Filter – Cannot estimate propane use if the quantity is “greater than 1000” or unknown.	185
If propane is used, the unit (PRUNIT) must be known	Data Limitation Filter – Cannot estimate propane use if the unit is unknown.	183
If propane is used, the maximum estimated propane amount must be 10% or less of the total source energy	Data Limitation Filter – Because propane values are estimated from a range, propane is restricted to 10% of the total source energy.	183
Must not use chilled water, wood, coal, or solar	Data Limitation Filter – CBECS does not collect quantities of chilled water, wood, coal, or solar.	177
Must be at least 5,000 square feet	Analytical Filter – Analysis could not model behavior for buildings smaller than 5,000 ft ² .	169
Must have Source EUI less than or equal to 400 kBtu/ft ²	Analytical Filter – Values determined to be statistical outliers.	163
Must have no more than 4 rooms per 1,000 square feet	Analytical Filter – Values determined to be statistical outliers.	152
Must have average occupancy greater than 40%	Analytical Filter – Values determined to be statistical outliers.	139

The reasons for applying filters on the use and quantity of propane are worthy of additional discussion. In CBECS, major fuel use is reported in exact quantities. However, if a building uses propane, the amount of propane is reported according to the variable PRAMTC, which uses ranges rather than exact quantities (e.g., less than 100 gallons, 100 to 500 gallons, etc.). Therefore, the quantity must be estimated within the range. To limit error associated with this estimation, EPA applies three filters related to propane.

1. The quantity of propane expressed by PRAMTC must be 1000 gallons or smaller.
2. The unit (e.g., gallons) for the quantity of propane used must be known.
3. The value of propane cannot account for more than 10% of the total source energy use. Because the exact quantity of propane is not reported, this cap ensures that the quantity of propane entered will not introduce undue error into the calculation of total energy consumption. In order to determine if the 10% cap is



exceeded, the value at the high end of the propane category is employed (e.g., for the category of less than 100, a value of 99 is used). If the 10% cap is not exceeded, then EPA will use the value at the middle of the range to calculate total energy use for the regression analysis (e.g., for the category of less than 100, a value of 50 is used).

Of the filters applied to the reference data, some result in constraints on calculating a score in Portfolio Manager and others do not. Building Type and Program Filters are used to limit the reference data to include only properties that are eligible to receive a score in Portfolio Manager, and are therefore related to eligibility requirements. In contrast, Data Limitation Filters account for limitations in the data availability, but do not apply in Portfolio Manager. Analytical Filters are used to eliminate outlier data points or different subsets of data, and may or may not affect eligibility. In some cases, a subset of the data will have different behavior from the rest of the properties (e.g., hotels smaller than 5,000 ft² do not behave the same way as larger buildings), in which case an Analytical Filter will be used to determine eligibility in Portfolio Manager. In other cases, Analytical Filters exclude a small number of outliers with extreme values that skew the analysis, but do not affect eligibility requirements. A full description of the criteria you must meet to get a score in Portfolio Manager is available at www.energystar.gov/EligibilityCriteria.

Related to the filters and eligibility criteria described above, another consideration is how Portfolio Manager treats properties that are situated on a campus. The main unit for benchmarking in Portfolio Manager is the property, which may be used to describe either a single building or a campus of buildings. The applicability of the ENERGY STAR score depends on the type of property. For hotels, the score is based on a campus of buildings, because each building on the campus is necessary to make the complete function of the property. For property types that earn a campus score, the entire campus will receive a 1 - 100 score and no individual buildings on the campus can earn a separate score. When there is a single building property of this type (e.g., entire hotel in one building), it is also eligible for a score.

VARIABLES ANALYZED

To normalize for differences in business activity, we perform a statistical analysis to understand what aspects of building activity are significant with respect to energy use. The filtered reference data set described in the previous section is analyzed using a weighted ordinary least squares regression, which evaluates energy use relative to business activity (e.g., number of guest rooms, number of workers, and climate). This linear regression yields an equation that is used to compute energy use (also called the dependent variable) based on a series of characteristics that describe the business activities (also called independent variables). This section details the variables used in the statistical analysis for hotels.

Dependent Variable

The dependent variable is what we try to predict with the regression equation. For the hotel analysis, the dependent variable is energy consumption expressed in source energy use intensity (source EUI). This is equal to the total source energy use of the property divided by the gross floor area. The regressions analyze the key drivers of source EUI – those factors that explain the variation in source energy use per square foot in a hotel.

Independent Variables

The reference survey collects numerous property operating characteristics that were identified as potentially important for hotels. Based on a review of the available variables in the data, in accordance with the criteria for inclusion in Portfolio Manager,² the following variables were analyzed:

- SQFT – Square footage
- NFLOOR – Number of floors
- NELVTR – Number of elevators
- NESLTR – Number of escalators
- DRYCL – Dry cleaning onsite
- LODGRM – Number of guest rooms
- COURT – Food court (yes/no)
- MONUSE – Months in use
- LODOCCP – Lodging room percent occupancy
- NWKER – Number of employees during the main shift
- COOK – Energy used for cooking (yes/no)
- HEATP – Percent heated
- COOLP – Percent cooled
- SNACK – Snack bar or concession stand (yes/no)
- FASTFD – Fast food or small restaurant (yes/no)
- CAF – Cafeteria or large restaurant (yes/no)
- FDPREP – Commercial or large kitchen (yes/no)
- KITCHN – Small kitchen area (yes/no)
- BREAKRM – Employee lounge, breakroom, or pantry (yes/no)
- OTFDRM – Other food prep or serving area (yes/no)
- LAUNDR – Laundry onsite
- CONFSP – Percent conference or event space
- POOL – Indoor swimming pool (yes/no)
- HTPOOL – Heated indoor swimming pool (yes/no)
- RFGRES – Number of full-size residential-type refrigerators
- RFGCOMPN – Number of half-size or compact refrigerators
- RFGWIN – Number of walk-in refrigeration units (also includes freezers)
- RFGOPN – Number of open refrigerated cases
- RFGCLN – Number of closed refrigerated cases
- RFGVNN – Number of refrigerated vending machines
- RFGICN – Number of ice makers
- PCTERMN – Number of computers
- LAPTPN – Number of laptops
- PRNTRN – Number of printers
- SERVERN – Number of servers
- TVVIDEON – Number of TV or video displays

² For a complete explanation of these criteria, refer to our Technical Reference for the ENERGY STAR Score, at www.energystar.gov/ENERGYSTARScore.

- RGSTRN – Number of cash registers
- COPIERN – Number of photocopiers
- HDD65 – Heating degree days (base 65)
- CDD65 – Cooling degree days (base 65)

We perform extensive review on all of these operational characteristics. In addition to reviewing each characteristic individually, characteristics are reviewed in combination with each other (e.g., Heating Degree Days times Percent Heated). As part of the analysis, some variables are reformatted to reflect the physical relationships of building components. For example, the number of workers on the main shift is typically evaluated in a density format. The number of workers *per square foot* (not the gross number of workers) is expected to be correlated with the energy use per square foot. In addition, based on analytical results and residual plots, variables are examined using different transformations (such as the natural logarithm, abbreviated as Ln). The analysis consists of multiple regression formulations. These analyses are structured to find the combination of statistically significant operating characteristics that explain the greatest amount of variance in the dependent variable: source EUI.

The final regression equation includes the following variables:

- Number of Guest Rooms per 1,000 Square Feet
- Number of Workers per 1,000 Square Feet
- Number of Commercial Refrigeration/Freezer Units (walk-in, open, and closed) per 1,000 Square Feet
- Heating Degree Days times Percent of the Building that is Heated
- Cooling Degree Days times Percent of the Building that is Cooled
- Presence of a Commercial/Large Kitchen (1 = yes, 0 = no)

These variables are used together to compute the predicted source EUI for hotels. The predicted source EUI is the mean EUI for a hypothetical population of buildings that share the same values for each of these variables. That is, the mean energy use for a building that operates just like your building.

Room Density

Guest rooms per 1,000 square feet is a strong driver of hotel energy use. However, the relationship between room density and energy use was observed primarily for hotels with a room density between 3 and 4 rooms per 1,000 square feet. Therefore, both a cap and a floor were added to this term. This means that hotels with fewer than 3 rooms per 1,000 square feet will be scored as if they had 3 rooms per 1,000 square feet, and hotels with greater than 4 rooms per 1,000 square feet will be scored as if they had 4 rooms per 1,000 square feet.

Testing

Finally, we test the regression equation using actual hotel buildings that have been entered in Portfolio Manager. This provides another set of buildings to examine in addition to the CBECS data, to see the average ENERGY STAR scores and distributions, and to assess the impacts and adjustments. This analysis provides a second level of confirmation that the final regression equation produces robust results that are unbiased with respect to the key operational characteristics such as room density, worker density, and heating and cooling degree days.

In addition to Portfolio Manager data, EPA tested the regression results for hotels against data from an industry survey conducted by the American Hotel and Lodging Association (AH&LA). This survey was not sufficiently representative to be used for model development, but, like Portfolio Manager, was very helpful in validating model results.

It is important to reiterate that the final regression equation is based on the nationally representative reference data, not data previously entered into Portfolio Manager.

REGRESSION EQUATION RESULTS

The final regression is a weighted ordinary least squares regression across the filtered data set of 139 observations. The dependent variable is source EUI. Each independent variable is centered relative to the mean value, presented in **Figure 2**. The final equation is presented in **Figure 3**. All variables in the regression equation are significant at the 90% confidence level or better, with the exception of cooling degree days times the percent of the building that is cooled (a p-level of less than 0.10 indicates 90% confidence). Cooling degree days times the percent of the building that is cooled has a slightly lower level of significance (88.8%). However, given the physical relationship between cooling degree days and energy consumption, this result was considered acceptable, and therefore cooling degree days times percent of the building that is cooled was retained in the analysis.

The regression equation has a coefficient of determination (R^2) value of 0.2675 indicating that this equation explains 26.75% of the variance in source EUI for hotel buildings. Because the final equation is structured with energy per square foot as the dependent variable, the explanatory power of square foot is not included in the R^2 value, thus this value appears artificially low. Re-computing the R^2 value in units of source energy³ demonstrates that the equation actually explains 90.59% of the variation of source energy of hotels. This is an excellent result for a statistically-based energy model.

Detailed information on the ordinary least squares regression approach is available in our Technical Reference for the ENERGY STAR Score, at www.energystar.gov/ENERGYSTARScore.

Figure 2 - Descriptive Statistics for Variables in Final Regression Equation

Variable	Mean	Minimum	Maximum
Source EUI (kBtu/ft ²)	152.5	39.40	381.1
Number of Workers per 1,000 ft ²	0.3359	0.04938	2.000
Number of Guest Rooms per 1,000 ft ² (min value of 3, max value of 4)	3.022	3.000	3.659
Number of Commercial Refrigeration/Freezer Units per 1,000 ft ²	0.05219	0.0000	0.2979
Percent Heated x Heating Degree Days	2,873	0	8,180
Percent Cooled x Cooling Degree Days	1,722	77	5,651
Commercial/Large Kitchen (yes/no)	0.1275	0	1

³ The R^2 value in Source Energy is calculated as: $1 - (\text{Residual Variation of Y}) / (\text{Total Variation of Y})$. The residual variation is sum of $(\text{Actual Source Energy}_i - \text{Predicted Source Energy}_i)^2$ across all observations. The Total variation of Y is the sum of $(\text{Actual Source Energy}_i - \text{Mean Source Energy})^2$ across all observations.

Figure 3 - Final Regression Results

Summary				
Dependent Variable	Source Energy Intensity (kBtu/ft ²)			
Number of Observations in Analysis	139			
R ² value	0.2675			
Adjusted R ² value	0.2342			
F Statistic	8.03			
Significance (p-level)	<0.0001			
	Unstandardized Coefficients	Standard Error	T value	Significance (p-level)
Constant	146.5	4.808	30.47	<0.0001
C_ Number of Workers per 1,000 ft ²	34.93	19.66	1.776	0.078
C_ Number of Guest Rooms per 1,000 ft ² (min value of 3, max value of 4)	103.7	41.55	2.495	0.0138
C_ Number of Commercial Refrigeration/Freezer Units per 1,000 ft ²	178.7	83.51	2.140	0.0342
C_Percent Heated x Heating Degree Days	0.006324	0.002990	2.116	0.0362
C_Percent Cooled x Cooling Degree Days	0.008473	0.005300	1.599	0.1123
Commercial/Large Kitchen	46.73	14.82	3.152	0.002

Notes:

- The regression is a weighted ordinary least squares regression, weighted by the CBECS variable "FINALWT".
- The prefix C_ on each variable indicates that it is centered. The centered variable is equal to difference between the actual value and the observed mean. The observed mean values are presented in **Figure 2**.
- Commercial/Large Kitchen is a yes/no variable (1 for yes, 0 for no) indicating whether the property contains a large kitchen, commercial kitchen, or other large food preparation area.
- Number of Commercial Refrigeration/Freezer Units per 1,000 ft² includes open, closed, and walk-in refrigeration/freezer units, as well as commercial ice makers.
- The adjustment for Number of Guest Rooms per 1,000 ft² is capped at a maximum value for 4 rooms per 1,000 ft², and has a floor value of 3 rooms per 1,000 ft².

ENERGY STAR SCORE LOOKUP TABLE

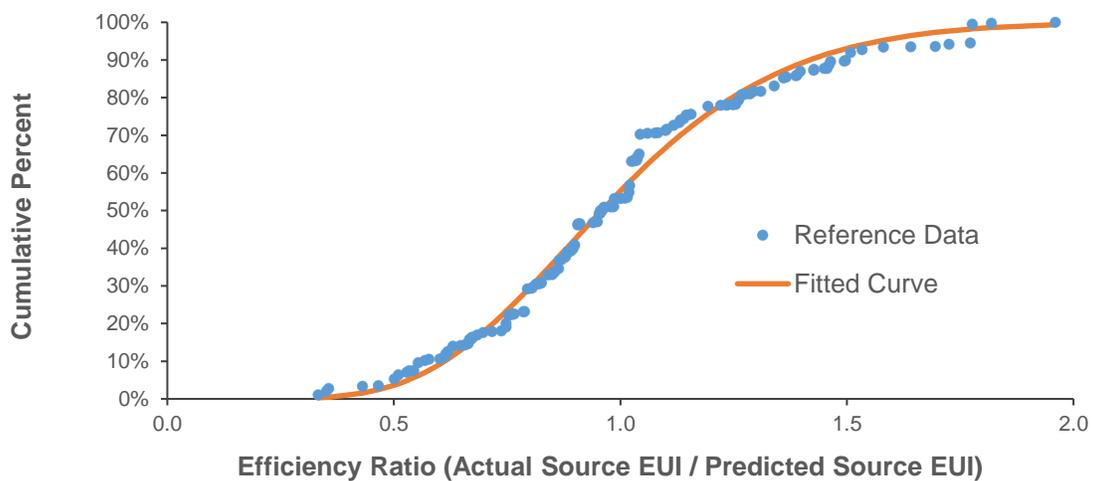
The final regression equation (presented in **Figure 3**) yields a prediction of source EUI based on a building's operating characteristics. Some buildings in the reference data sample use more energy than predicted by the regression equation, while others use less. The *actual* source EUI of each reference data observation is divided by its *predicted* source EUI to calculate an energy efficiency ratio:

$$\text{Energy Efficiency Ratio} = \frac{\text{Actual Source EUI}}{\text{Predicted Source EUI}}$$

A lower efficiency ratio indicates that a building uses less energy than predicted, and consequently is more efficient. A higher efficiency ratio indicates the opposite.

The efficiency ratios are sorted from smallest to largest and the cumulative percent of the population at each ratio is computed using the individual observation weights from the reference data set. **Figure 4** presents a plot of this cumulative distribution. A smooth curve (shown in orange) is fitted to the data using a two parameter gamma distribution. The fit is performed in order to minimize the sum of squared differences between each building's actual percent rank in the population and each building's percent rank with the gamma solution. The final fit for the gamma curve yielded a shape parameter (alpha) of 9.659 and a scale parameter (beta) of 0.1028. For this fit, the sum of the squared error is 0.1104.

Figure 4 – Distribution for Hotel



The final gamma shape and scale parameters are used to calculate the efficiency ratio at each percentile (1 to 100) along the curve. For example, the ratio on the gamma curve at 1% corresponds to a score of 99; only 1% of the population has a ratio this small or smaller. The ratio on the gamma curve at the value of 25% will correspond to the ratio for a score of 75; only 25% of the population has ratios this small or smaller. The complete score lookup table is presented in **Figure 5**.

Figure 5 – ENERGY STAR Score Lookup Table for Hotel

ENERGY STAR Score	Cumulative Percent	Energy Efficiency Ratio		ENERGY STAR Score	Cumulative Percent	Energy Efficiency Ratio	
		> =	<			>=	<
100	0%	0.0000	0.4025	50	50%	0.9589	0.9668
99	1%	0.4025	0.4512	49	51%	0.9668	0.9747
98	2%	0.4512	0.4842	48	52%	0.9747	0.9827
97	3%	0.4842	0.5102	47	53%	0.9827	0.9907
96	4%	0.5102	0.5320	46	54%	0.9907	0.9988
95	5%	0.5320	0.5510	45	55%	0.9988	1.0069
94	6%	0.5510	0.5681	44	56%	1.0069	1.0152
93	7%	0.5681	0.5838	43	57%	1.0152	1.0235
92	8%	0.5838	0.5982	42	58%	1.0235	1.0319
91	9%	0.5982	0.6118	41	59%	1.0319	1.0404
90	10%	0.6118	0.6245	40	60%	1.0404	1.0490
89	11%	0.6245	0.6367	39	61%	1.0490	1.0577
88	12%	0.6367	0.6483	38	62%	1.0577	1.0666
87	13%	0.6483	0.6594	37	63%	1.0666	1.0755
86	14%	0.6594	0.6701	36	64%	1.0755	1.0846
85	15%	0.6701	0.6804	35	65%	1.0846	1.0939
84	16%	0.6804	0.6905	34	66%	1.0939	1.1033
83	17%	0.6905	0.7002	33	67%	1.1033	1.1129
82	18%	0.7002	0.7098	32	68%	1.1129	1.1226
81	19%	0.7098	0.7191	31	69%	1.1226	1.1326
80	20%	0.7191	0.7282	30	70%	1.1326	1.1427
79	21%	0.7282	0.7371	29	71%	1.1427	1.1531
78	22%	0.7371	0.7459	28	72%	1.1531	1.1638
77	23%	0.7459	0.7545	27	73%	1.1638	1.1747
76	24%	0.7545	0.7630	26	74%	1.1747	1.1859
75	25%	0.7630	0.7714	25	75%	1.1859	1.1974
74	26%	0.7714	0.7797	24	76%	1.1974	1.2092
73	27%	0.7797	0.7879	23	77%	1.2092	1.2214
72	28%	0.7879	0.7960	22	78%	1.2214	1.2340
71	29%	0.7960	0.8040	21	79%	1.2340	1.2471
70	30%	0.8040	0.8120	20	80%	1.2471	1.2606
69	31%	0.8120	0.8199	19	81%	1.2606	1.2748
68	32%	0.8199	0.8277	18	82%	1.2748	1.2895
67	33%	0.8277	0.8355	17	83%	1.2895	1.3049
66	34%	0.8355	0.8433	16	84%	1.3049	1.3210
65	35%	0.8433	0.8510	15	85%	1.3210	1.3381
64	36%	0.8510	0.8587	14	86%	1.3381	1.3561
63	37%	0.8587	0.8664	13	87%	1.3561	1.3753
62	38%	0.8664	0.8741	12	88%	1.3753	1.3959
61	39%	0.8741	0.8818	11	89%	1.3959	1.4180
60	40%	0.8818	0.8894	10	90%	1.4180	1.4421
59	41%	0.8894	0.8971	9	91%	1.4421	1.4686
58	42%	0.8971	0.9047	8	92%	1.4686	1.4981
57	43%	0.9047	0.9124	7	93%	1.4981	1.5315
56	44%	0.9124	0.9201	6	94%	1.5315	1.5701
55	45%	0.9201	0.9278	5	95%	1.5701	1.6163
54	46%	0.9278	0.9355	4	96%	1.6163	1.6743
53	47%	0.9355	0.9433	3	97%	1.6743	1.7534
52	48%	0.9433	0.9511	2	98%	1.7534	1.8827
51	49%	0.9511	0.9589	1	99%	1.8827	> 1.8827

EXAMPLE CALCULATION

As detailed in our Technical Reference for the ENERGY STAR Score, at www.energystar.gov/ENERGYSTARScore, there are five steps to compute a score. The following is a specific example for the score for hotels:

1 User enters building data into Portfolio Manager

- 12 months of energy use information for all energy types (annual values, entered in monthly meter entries)
- Physical building information (size, location, etc.) and use details describing building activity (hours, etc.)

Energy Data	Value
Electricity	4,500,000 kWh
Natural gas	110,000 therms

Property Use Details	Value
Gross floor area (ft ²)	300,000
Number of rooms	360
Workers on the main shift ⁴	180
Commercial/large kitchen	1 (Yes)
Number of commercial refrigeration/freezer units	20
Percent of the building that is heated	100%
Percent of the building that is cooled	100%
HDD (provided by Portfolio Manager, based on Zip code)	4,532
CDD (provided by Portfolio Manager, based on Zip code)	1,388

2 Portfolio Manager computes the actual source EUI

- Total energy consumption for each fuel is converted from billing units into site energy and source energy
- Source energy values are added across all fuel types
- Source energy is divided by gross floor area to determine actual source EUI

Computing Actual Source EUI

Fuel	Billing Units	Site kBtu Multiplier	Site kBtu	Source kBtu Multiplier	Source kBtu
Electricity	4,500,000 kWh	3.412	15,354,000	2.80	42,991,200
Natural gas	110,000 therms	100	11,000,000	1.05	11,550,000
Total Source Energy (kBtu)					54,541,200
Actual Source EUI (kBtu/ft²)					181.8

⁴ This represents typical peak staffing level during the main shift. For example, in an office if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.



3 Portfolio Manager computes the predicted source EUI

- Using the property use details from Step 1, Portfolio Manager computes each building variable value in the regression equation (determining the natural log or density, or applying any minimum or maximum values used in the regression model, as necessary).
- The centering values are subtracted to compute the centered variable for each operating parameter.
- The centered variables are multiplied by the coefficients from the regression equation to obtain a predicted source EUI.

Computing Predicted Source EUI

Variable	Actual Building Value	Reference Centering Value	Building Centered Variable	Coefficient	Coefficient * Centered Variable
Constant	--	--	--	146.5	146.5
Number of Guest Rooms per 1,000 ft ² (min value of 3, max value of 4)	3.000	3.022	-0.022	103.7	-2.281
Number of Workers per 1,000 ft ²	0.6000	0.3359	0.2641	34.93	9.225
Number of Commercial Refrigeration/Freezer Units per 1,000 ft ²	0.06667	0.05219	0.01448	178.7	2.588
Percent Heated x HDD	4,532	2,873	1,659	0.006324	10.49
Percent Cooled x CDD	1,388	1,722	-334	0.008473	-2.830
Commercial/Large Kitchen	1.000	--	1.000	46.73	46.73
Predicted Source EUI (kBtu/ft²)					210.4

4 Portfolio Manager computes the energy efficiency ratio

- The ratio equals the actual source EUI (Step 2) divided by predicted source EUI (Step 3)
- Ratio = 181.8 / 210.4 = 0.8641

5 Portfolio Manager uses the efficiency ratio to assign a score via a lookup table

- The ratio from Step 4 is used to identify the score from the lookup table
- A ratio of 0.8641 is greater than 0.8587 and less than 0.8664
- **The ENERGY STAR score is 63**

