ENERGY STAR® Portfolio Manager® Technical Reference

ENERGY STAR Score for Supermarkets/Grocery Stores in the United States

OVERVIEW

The ENERGY STAR Score for Supermarkets/Grocery Stores applies to properties used for the retail sale of primarily food and beverage products. 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 supermarkets/grocery stores applies to properties used for the retail sale of primarily food and beverage products. The score applies to individual buildings only and is not available for campuses.
- **Reference Data.** The analysis for supermarkets/grocery stores is based on data from the Department of Energy, Energy Information Administration's 1999 and 2003 Commercial Building Energy Consumption Survey (CBECS).
- **Adjustments for Weather and Business Activity.** The analysis includes adjustments for:
  - Building Size
  - Number of Workers
  - Hours of Operation per Week
  - Number of Walk-in Refrigeration units
  - Whether or not there is Energy Used for Cooking
  - 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 supermarkets/grocery stores is updated periodically as more recent data becomes available:
  - Most Recent Update: July 2008
  - Original Release: July 2001

This document presents details on the development of the 1 - 100 ENERGY STAR score for supermarkets/grocery stores. 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 supermarkets/grocery stores:

REFERENCE DATA & FILTERS

For the ENERGY STAR score for supermarket/grocery store properties, 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) 1999 and 2003 Commercial Building Energy Consumption Survey (CBECS). Detailed information on this survey, including complete data files, is available at: http://www.eia.doe.gov/emeu/cbecs/contents.html. The survey results from two different years were combined to yield as large a dataset as possible.

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 supermarkets/grocery stores, 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 83 properties.

Figure 1 – Summary of Filters for the ENERGY STAR Score for Supermarkets/Grocery Stores

Condition for Including an Observation in the Analysis	Rationale	Number Remaining CBECS 1999	Number Remaining CBECS 2003
Filters used to define the ENERGY STAR Population			
PBAPLUS7 = 16 or PBAPLUS8 = 14	Building Filter – The category "Grocery Store/Food Mart is coded as PBAPLUS7=16 (1999 set) and PBAPLUS8=14 (2003 set).	74	63
Must operate for at least 30 hours per week	Program Filter – Baseline condition for being a full time supermarket/grocery store.	74	63
Must operate for at least 10 months per year	Program Filter – Baseline condition for being a full time supermarket/grocery store.	70	59
A single activity must characterize greater than 50% of the floor space[1]	Program Filter – In order to be considered part of the supermarket/grocery store peer group, more than 50% of the building must be Supermarket/Food Sales.	68	55
Must have at least 1 personal computer or cash register	Program Filter – Baseline condition for being a full time supermarket/grocery store.	60	54

[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 food sales (for the 1999 set, PBAX7=13; for the 2003 set, PBAX8=14), with a corresponding percent (ACT1PCT, ACT2PCT, ACT3PCT) that is greater than 50.

Condition for Including an Observation in the Analysis	Rationale	Number Remaining CBECS 1999	Number Remaining CBECS 2003
Must have commercial refrigeration equipment[2]	Program Filter – Baseline condition for being a full time supermarket/grocery store.	58	53
Must have square foot >= 5,000	Analytical Limitation Filter– Analysis could not model behavior for buildings smaller than 5,000 ft^2.	53	35
Additional data limitation filters used to define the Modeling Population			
If propane is used, the amount category (PRAMTC) must equal 1, 2, or 3	Data Limitation Filter – Cannot estimate propane use if it is "greater than 1000" or unknown.	50	34
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.	50	34
Must not use chilled water	Data Limitation Filter – CBECS does not collect quantities of chilled water.	50	34
Source EUI must be greater than 100 kBtu/ft^2	Analytical Limitation Filter – Data determined to be statistical outliers.	49	34

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 PRAMT8, 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 two filters related to propane.

1. The quantity of propane expressed by PRAMT8 must be 1000 gallons or smaller.
2. 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,

[2] For the 1999 dataset, this can be determined by the variable RFGEQP; a value of 1 indicates the presence of open cases, closed cases, or walk-in refrigeration. For the CBECS 2003 data set, this must be determined by a "yes" answer (i.e. a value of 1) to for the presence of open cases (RFGOP8), closed cases (RFGCL8), *or* walk-in refrigeration (RFGWI8).

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., supermarkets/grocery stores smaller than 5,000 ft^2 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 supermarket/grocery store properties, the score is based on individual buildings, because the primary function of the supermarket/grocery store is contained within a single building and because the properties included in the reference data are single buildings.

Combining Survey Years

Before any filters are applied, there are fewer than 75 observations in each survey year. To increase the number of observations for a superior analysis, the most recent two survey years are combined (1999 and 2003). In the CBECS data for each year, every observation has a weight. For a given year the sum of all CBECS survey weights represents the total number of supermarkets/grocery stores in the country. When two years are combined, the weights in each survey year must be adjusted so that the weights in the combined data set add up to this same total number of supermarkets/grocery stores. The process of creating these combined weights involves a few steps, in order to make sure the population is correctly represented. The combination depends on the filters, which are used to characterize the population of supermarkets/grocery stores in two ways (as shown in ***Figure 1***):

1. ENERGY STAR Population. This population is defined by the Building Filter, EPA Program Filters, and any analytical limitation filters that systematically restrict the population. The filters in this section define the set of supermarkets/grocery stores that are eligible to earn an ENERGY STAR score in Portfolio Manager. These conditions must be met by any building in order to receive an ENERGY STAR score (e.g., a building must be at least 5,000 square foot and open 30 hours per week). The sum of the CBECS weights across this population represents the size of the population covered by the ENERGY STAR scores.

2. Modeling Population. This population reflects additional filters which are applied to address data limitations (such as missing or estimated data, or statistical outliers). These restrictions (e.g., must not use chilled water) do ***not*** apply as criteria for a building to see an ENERGY STAR score in Portfolio Manager. However, due to the CBECS data limitation, these observations cannot be included in the analysis.

Theoretically, the regression analysis should include all observations in the ENERGY STAR Population. However, due to CBECS data limitations, some additional observations must be removed to define the Modeling Population. The first stage of calculating a combined weight is to adjust the weights in the Modeling Population upward for each survey year. This process results in interim weights. The sum of these interim weights across the Modeling Population should equal the original sum weights across of ENERGY STAR Population. The second stage is to adjust the interim weights proportionally so that each year's modeling sample is weighted to represent the same

ENERGY STAR Population[3]. This process can be broken into the following 5 steps (corresponding calculations are presented in ***Figure 2***):

1. Identify the *ENERGY STAR Population* in each data year.
    a. Sum the weights across this population for each data year. For the 1999 survey year, the sum of weights is 21,574.09.
2. Identify the *Modeling Population* in each data year.
    a. Identify the number of observations in each data year. For the 1999 survey year, the total number of observation is 49.
    b. Sum the weights across this population for each data year. For the 1999 survey, the sum of weights is 14,353.60.
3. Assign each observation with an interim weight. This weight adjusts the CBECS weight of each observation upward so that the sum of the interim weights across the *Modeling Population* equals the sum of weights across of the *ENERGY STAR Population*.
    a. For each year, multiply the weight of each observation by the ratio of the sum of weights across the observations in Step 1a to the sum of weights across the observations in Step 2b. For the 1999 data, the interim adjustment is: 21,574.09/14,353.6 = 1.5030438.
    b. After each observation's weight has been multiplied by the interim adjustment factor, the sum of these interim weights across the Modeling Population will equal the original sum of weights across the ENERGY STAR Population. For the 1999 survey year, the sum of the interim weights is 21,574.09.
4. Assign each observation a combined weight. This adjustment is performed based on the number of observations from each year that are included in the Modeling Population. The combination assumes that the two survey years represent the same target population.
    a. For each year, multiply the interim weight (from Step 3) by the ratio of the number of observations in that year to the total number of observations in the analysis. For the 1999 data, the final adjustment is: 49/83 = 0.593416.
5. Combine the two data sets. The modeling populations from each year are combined, to yield a final set of 83 observations. The combined weights (from Step 4) are employed in all calculations performed on this combined set.

Figure 2 – Summary of Weighting Calculations

	CBECS 1999	CBECS 2003
Step 1a: Sum of CBECS Weights – ENERGY STAR Population	21,574.09	27,273.56
Step 2a: Number of Observations – Modeling Population	49	34
Step 2b: Sum of CBECS Weights – Modeling Population	14,353.6	26,908.1
Step 3a: Interim adjustment factor	1.5030438	1.0135814
Step 4a: Final adjustment Factor	0.593614	0.4096386
Sum of final combined weights to be used in regression	12,736.51	11,172.30

[3] This combination assumes that the ENERGY STAR population is the same for 1999 and 2003 (i.e., the same number of supermarkets/grocery stores in the country are larger than 5,000 square foot, open 30 hours per week, etc.). If these populations are assumed to be the same, then the combined weights can be based on the sample size of each survey. In a simplified scenario:
New Weight 1999 observation = actual weight * (Sample size 1999) / (sum of sample sizes 1999 and 2003)
New Weight 2003 observation = actual weight * (Sample size 2003) / (sum of sample sizes 1999 and 2003).
This adjustment formula is given in the textbook *Analysis of Health Surveys.* Edward Korn and Barry Graubard. Wiley, 1999, Section 8.1.

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., operating hours, 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 supermarkets/grocery stores.

Dependent Variable

The dependent variable is what we try to predict with the regression equation. For the supermarket/grocery store 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 supermarkets/grocery stores.

Independent Variables

The reference survey collects numerous property operating characteristics that were identified as potentially important for supermarkets/grocery stores. Based on a review of the available variables in the data, in accordance with the criteria for inclusion in Portfolio Manager[4], the following variables were analyzed[5]:

- SQFT7 / SQFT8 – Square footage
- PCNUM7[6] / PCNUM8 & RGSTRN8 – Number of personal computers
- FDRM7 / FDRM8 – Commercial food preparation area (yes/no)
- WKHRS7 / WKHRS8 – Weekly hours of operation
- MONUSE7 / MONUSE8 – Months of year in use
- NWKER7 / NWKER8 – Number of employees during the main shift
- NFLOOR7 / NFLOOR8 – Number of floors
- RFGWIN7 / RFGWIN8 – Number of walk-in refrigeration units
- RFGOPN7 / RFGOPN8 – Number of open refrigerated cases
- RFGCLN7 / RFGCLN8 – Number of closed refrigerated cases
- COPIER7 / COPIER8 – Number of copiers
- PRNTR7 / PRNTR8 – Number of printers
- COOK7 / COOK8 – Energy used for cooking (yes/no)
- HDD657 / HDD658 – Heating degree days

[4] For a complete explanation of these criteria, refer to our Technical Reference for the ENERGY STAR Score, at www.energystar.gov/ENERGYSTARScore.
[5] Note that the 7 at the end of variables indicates that the 1999 CBECS survey is the seventh survey conducted by the Energy Information Administration and the 8 at the end of variables indicates that the 2003 CBECS survey is the eighth survey conducted by the Energy Information Administration.
[6] Note that in the 1999 Survey, PCNUM7 indicates the number of personal computers and registers. In the 2003 survey this is divided into two variables: PCNUM8 and RGSTRN8.

- CDD657 / CDD658 – Cooling degree days
- COOLP7 / COOLP8 – Percent cooled
- HEATP7 / HEATP8 – Percent heated

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:

- Natural log of gross square foot
- Natural log of the number of workers per 1,000 square feet
- Natural log of weekly operating hours
- Number of walk-in refrigeration units per 1,000 square feet
- Presence of cooking (density)[7]
- Heating degree days times Percent of the building that is heated
- Cooling degree days times Percent of the building that is cooled

These variables are used together to compute the predicted source EUI for supermarkets/grocery stores. 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.

Testing

Finally, we test the regression equation using actual supermarkets/grocery stores 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 building size, worker density, operating hours, number of refrigeration units, and heating and cooling degree days.

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.

[7] COOK7 and COOK8 are yes/no variables, which are coded yes if the supermarket/grocery store uses energy for commercial or institutional cooking or food services. If the building has responded "yes" then this variable is included in a density format (1 * 1000 / Square Foot). This density format makes the contribution of cooking more compatible with the use of EUI as an independent variable.

REGRESSION EQUATION RESULTS

The final regression is a weighted ordinary least squares regression across the filtered data set of 83 observations. The dependent variable is source EUI. Each independent variable is centered relative to the mean value, presented in ***Figure 3***. The final equation is presented in ***Figure 4***. All variables in the regression equation are significant at the 95% confidence level or better, as shown by the significance levels, with the exception of operating hours per week and cooking density (a p-level of less than 0.05 indicates 95% confidence). The operating hours and the cooking density coefficients have slightly lower levels significance (84%). However, given the physical relationship between operating hours per week and energy consumption and cooking density and energy consumption, the results were considered acceptable, and therefore operating hours per week and cooking density were retained in the analysis.

The regression equation has a coefficient of determination (R^2) value of 0.5136, indicating that this equation explains 51.36% of the variance in source EUI for supermarkets/grocery stores. 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 energy[8], demonstrates that the equation actually explains 83.3% of the variation of source energy of supermarkets/grocery stores. 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 3 - Descriptive Statistics for Variables in Final Regression Equation

Variable	Mean	Minimum	Maximum
Source EUI (kBtu/ft^2)	581.1	135.2	1469
Ln (Square Foot)	9.679	8.517	11.92
Ln (Weekly Operating Hours)	4.657	3.871	5.124
Ln (Number of Workers per 1000 ft^2)	-0.1084	-1.299	1.306
Number of Walk In Refrigerators per 1000 ft^2	0.2345	0	0.6
Cooking Density	0.0254	0	0.125
Heating Degree Days x Percent Heated	3510	0	10121
Cooling Degree Days x Percent Cooled	1219	0	4143

[8] The R^2 value in Source Energy is calculated as: 1 – (Residual Variation of Y) / (Total Variation of Y). The residual variation is sum of (Actual Source Energy$_i$ – Predicted Source Energy$_i$)^2 across all observations. The Total variation of Y is the sum of (Actual Source Energy$_i$ – Mean Source Energy)^2 across all observations.

Figure 4 - Final Regression Results

Summary				
Dependent Variable	Source Energy Intensity (kBtu/ft^2)			
Number of Observations in Analysis	83			
R^2 value	0.5136			
Adjusted R^2 value	0.4682			
F Statistic	11.31			
Significance (p-level)	0.0000			
	Unstandardized Coefficients	**Standard Error**	**T value**	**Significance (p-level)**
Constant	581.1	19.83	29.31	.0000
C_Ln (Square Foot)	84.97	29.04	2.926	.0045
C_Ln (Weekly Operating Hours)	125.8	79.72	1.578	.1187
C_Ln (Number of Workers per 1000 ft^2)	115.6	37.77	3.061	.0031
C_Number of Walk In Refrigerators per 1000 ft^2	794.4	167.1	4.755	.0000
C_Cooking Density	902.8	647.6	1.394	.1674
C_Heating Degree Days x Percent Heated	.0326	.0119	2.739	.0077
C_Cooling Degree Days x Percent Cooled	.0947	.0313	3.028	.0034

Note:

- *Values are weighted by the combined weights, see Reference Data and Filters section*
- *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 3.***

ENERGY STAR SCORE LOOKUP TABLE

The final regression equation (presented in ***Figure 4***) 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:

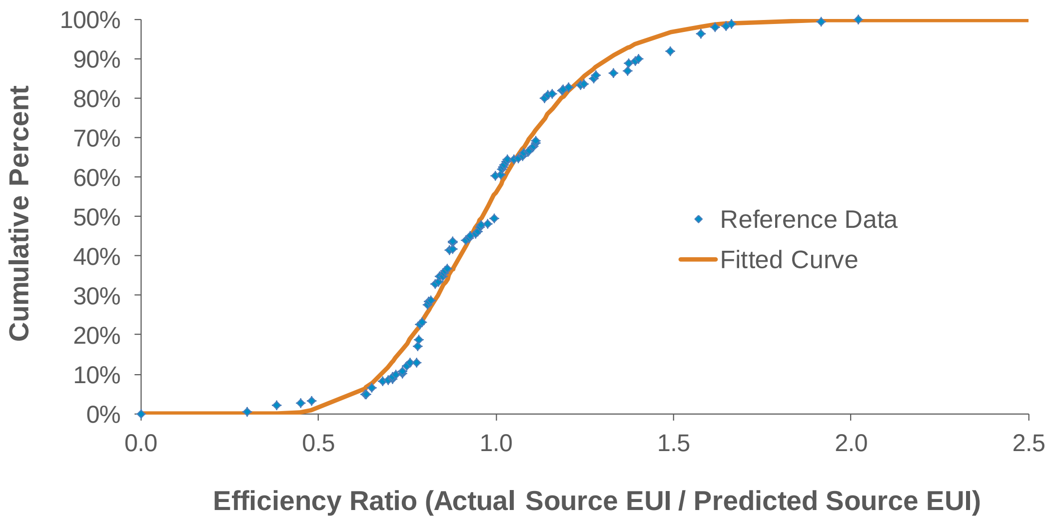
$$Energy\ Efficiency\ Ratio = \frac{Actual\ Source\ EUI}{Predicted\ Source\ EUI}$$

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 5*** 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 15.23 and a scale parameter (beta) of 0.06444. For this fit, the sum of the squared error is 0.1008.

Figure 5 – Distribution for Supermarket/Grocery Store



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 6***.

Figure 6 – ENERGY STAR Score Lookup Table for Supermarkets/Grocery Stores

ENERGY STAR Score	Cumulative Percent	Energy Efficiency Ratio	
		> =	<
100	0%	0.0000	0.4638
99	1%	0.4638	0.5054
98	2%	0.5054	0.5331
97	3%	0.5331	0.5546
96	4%	0.5546	0.5725
95	5%	0.5725	0.5881
94	6%	0.5881	0.6020
93	7%	0.6020	0.6146
92	8%	0.6146	0.6263
91	9%	0.6263	0.6371
90	10%	0.6371	0.6473
89	11%	0.6473	0.6570
88	12%	0.6570	0.6662
87	13%	0.6662	0.6750
86	14%	0.6750	0.6835
85	15%	0.6835	0.6916
84	16%	0.6916	0.6995
83	17%	0.6995	0.7072
82	18%	0.7072	0.7146
81	19%	0.7146	0.7219
80	20%	0.7219	0.7290
79	21%	0.7290	0.7359
78	22%	0.7359	0.7427
77	23%	0.7427	0.7494
76	24%	0.7494	0.7560
75	25%	0.7560	0.7625
74	26%	0.7625	0.7689
73	27%	0.7689	0.7752
72	28%	0.7752	0.7814
71	29%	0.7814	0.7875
70	30%	0.7875	0.7936
69	31%	0.7936	0.7997
68	32%	0.7997	0.8057
67	33%	0.8057	0.8116
66	34%	0.8116	0.8176
65	35%	0.8176	0.8235
64	36%	0.8235	0.8293
63	37%	0.8293	0.8351
62	38%	0.8351	0.8410
61	39%	0.8410	0.8468
60	40%	0.8468	0.8525
59	41%	0.8525	0.8583
58	42%	0.8583	0.8641
57	43%	0.8641	0.8699
56	44%	0.8699	0.8757
55	45%	0.8757	0.8814
54	46%	0.8814	0.8872
53	47%	0.8872	0.8931
52	48%	0.8931	0.8989
51	49%	0.8989	0.9047

ENERGY STAR Score	Cumulative Percent	Energy Efficiency Ratio	
		>=	<
50	50%	0.9047	0.9106
49	51%	0.9106	0.9165
48	52%	0.9165	0.9225
47	53%	0.9225	0.9284
46	54%	0.9284	0.9345
45	55%	0.9345	0.9405
44	56%	0.9405	0.9466
43	57%	0.9466	0.9528
42	58%	0.9528	0.9590
41	59%	0.9590	0.9653
40	60%	0.9653	0.9717
39	61%	0.9717	0.9781
38	62%	0.9781	0.9846
37	63%	0.9846	0.9912
36	64%	0.9912	0.9979
35	65%	0.9979	1.0047
34	66%	1.0047	1.0116
33	67%	1.0116	1.0186
32	68%	1.0186	1.0258
31	69%	1.0258	1.0331
30	70%	1.0331	1.0405
29	71%	1.0405	1.0481
28	72%	1.0481	1.0558
27	73%	1.0558	1.0637
26	74%	1.0637	1.0719
25	75%	1.0719	1.0802
24	76%	1.0802	1.0888
23	77%	1.0888	1.0977
22	78%	1.0977	1.1068
21	79%	1.1068	1.1162
20	80%	1.1162	1.1260
19	81%	1.1260	1.1362
18	82%	1.1362	1.1467
17	83%	1.1467	1.1578
16	84%	1.1578	1.1694
15	85%	1.1694	1.1816
14	86%	1.1816	1.1945
13	87%	1.1945	1.2082
12	88%	1.2082	1.2229
11	89%	1.2229	1.2387
10	90%	1.2387	1.2558
9	91%	1.2558	1.2745
8	92%	1.2745	1.2954
7	93%	1.2954	1.3189
6	94%	1.3189	1.3461
5	95%	1.3461	1.3785
4	96%	1.3785	1.4190
3	97%	1.4190	1.4740
2	98%	1.4740	1.5635
1	99%	1.5635	>1.5635

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 supermarkets/grocery stores:

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	2,400,000 kWh
Natural gas	20,000 therms

Property Use Details	Value
Gross floor area (ft^2)	42,000
Weekly operating hours	168
Workers on the main shift[9]	20
Percent of the building that is heated	100 %
Percent of the building that is cooled	100 %
Cooking	1 (Yes)
Walk-in refrigeration units	10
HDD (provided by Portfolio Manager, based on Zip code)	1450
CDD (provided by Portfolio Manager, based on Zip code)	3250

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	2,400,000 kWh	3.412	8,188,800	3.14	25,712,832
Natural gas	20,000 therms	100	2,000,000	1.05	2,100,000
				Total Source Energy (kBtu)	27,812,832
				Actual Source EUI (kBtu/ft²)	**662.2**

[9] 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 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	--	--	--	581.1	581.1
Ln (Square Foot)	10.65	9.679	0.971	84.97	82.51
Ln (Weekly Operating Hours)	5.124	4.657	0.467	125.8	58.75
Ln (Number of Workers per 1000 ft^2)	-0.7419	-0.1084	-0.6335	115.6	-73.23
Number of Walk-in Refrigerators per 1000 ft^2	0.2381	0.2345	0.0036	794.4	2.86
Cooking Density	0.0238	0.0254	-0.0016	902.8	-1.444
HDD x Percent Heated	1450	3510	-2060	0.0326	-67.16
CDD x Percent Cooled	3250	1219	2031	0.0947	192.3
			Predicted Source EUI (kBtu/ft^2)		**775.7**

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 = 662.2 / 775.7 = 0.8537

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 0.8537 is greater than or equal to 0.8525 and less than 0.8583
- ***The ENERGY STAR score is 59***