ENERGY STAR® PortfolioManager®

Technical Reference

ENERGY STAR Score for Warehouses in the United States

OVERVIEW

The ENERGY STAR Score for warehouses applies to unrefrigerated or refrigerated buildings that are used to store goods, manufactured products, merchandise or raw materials. 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 warehouse applies to unrefrigerated or refrigerated warehouses and distribution centers that are used to store goods, manufactured products, merchandise or raw materials. The total floor area of warehouses should include all supporting functions such as offices, lobbies, stairways, rest rooms, equipment storage areas, and elevator shafts, but should not include outside loading bays or docks. Self-storage facilities, or facilities that rent individual storage units, are not eligible for a rating using the warehouse model.
- **Reference Data.** The analysis for warehouses is based on data from the Department of Energy, Energy Information Administration's 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
- **Release Date.** The ENERGY STAR score for warehouses is updated periodically as more recent data becomes available:
  - Most Recent Update: August 2009
  - Original Release: January 2004

This document presents details on the development of the 1 - 100 ENERGY STAR score for warehouse 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 warehouses:

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REFERENCE DATA & FILTERS

For the ENERGY STAR score for warehouse 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) 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.

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 warehouse, 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 277 properties.

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

Condition for Including an Observation in the Analysis	Rationale	Number Remaining
PBAPLUS8 = 9, 10 or 20	Building Type Filter – CBECS defines building types according to the variable "PBAPLUS." Distribution/Shipping centers are coded as PBAPLUS=9, Non-Refrigerated Warehouses are coded as PBAPLUS=10 and Refrigerated Warehouses are coded as PBAPLUS = 20.	409
Must have energy consumption data	EPA Program Filter – Baseline condition for being a full time Warehouse.	395
Must operate for at least 30 hours per week	EPA Program Filter – Baseline condition for being a full time Warehouse.	367
Must operate for at least 10 months per year	EPA Program Filter – Baseline condition for being a full time Warehouse.	347
A single activity must characterize greater than 50% of the floor space[1]	EPA Program Filter – In order to be considered part of the Warehouse peer group, more than 50% of the building must be Warehouse.	337
If propane is used, the amount category (PRAMTC8) must equal 1, 2, or 3	Data Limitation Filter – Cannot estimate propane use if it is "greater than 1000" or unknown.	321
If propane is used, the maximum estimated propane amount must be 10% or less of the total source energy	Data Limitation Filter – Estimation of propane cannot introduce too much error into the energy use value.	315

[1] This filter is applied by a set of screens. If the variable ONEACT8=1, then one activity occupies 75% or more of the building. If the variable ONEACT8=2, then the activities in the building are defined by ACT18, ACT28, and ACT38. One of these activities must be coded as warehouse/storage (PBAX=13), with a corresponding percent (ACT1PCT8, ACT2PCT8, ACT3PCT8) that is greater than 50.

Condition for Including an Observation in the Analysis	Rationale	Number Remaining
Must have square foot less than or equal to 1,000,000	Data Limitation Filter – CBECS masks actual values above 1,000,000 using regional averages.	311
Must not use chilled water	Data Limitation Filter – CBECS does not collect quantities of chilled water.	310
Must have square foot greater than or equal to 5,000	Analytical Filter – Analysis could not model behavior for buildings smaller than 5,000 ft^2.	280
Must have walk-in refrigeration density less than 0.333	Analytical Filter – Values determined to be statistical outliers.	277

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, 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., office buildings 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 warehouse properties, the score is based on individual buildings, because the primary function of the warehouse is contained within a single building and because the properties included in the reference data are single buildings. In cases where multiple warehouses are situated together, each individual building can receive its own ENERGY STAR score, but the campus cannot earn 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., 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 warehouses.

Dependent Variable

The dependent variable is what we try to predict with the regression equation. For the warehouse 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 warehouses.

Independent Variables

The reference survey collects numerous property operating characteristics that were identified as potentially important for warehouses. 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:[3]

- PBAPLUS8 – More Specific Building Activity
- SQFT8 – Square footage
- WKHRS8 – Weekly hours of operation
- NWKER8 – Number of employees during main shift
- PCNUM8 – Number of computers
- SRVNUM8 – Number of servers
- PRNTRN8 – Number of printers
- COPRN8 – Number of photocopiers
- RFGWIN8 – Number of walk-in refrigeration units
- RFGOPN8 – Number of open refrigerated cases
- RFGRSN8 – Number of residential refrigerators
- RFGCLN8 – Number of closed refrigerated cases
- RFGVNN8 – Number of vending machines
- COOK8 – Energy used for cooking (yes/no)
- FDRM8 – Commercial food preparation area (yes/no)
- CAF8 – Cafeteria or large restaurant (yes/no)
- ELEVTR8 – Elevators (yes/no)
- NELVTR8 – Number of elevators
- NFLOOR8 – Number of floors

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

[3] Note that the number 8 at the end of all variables indicates that the 2003 CBECS survey is the eighth survey conducted by the Energy Information Administration.

- MONUSE8 – Months of year in use
- MANU8 – Energy used for manufacturing (yes/no)
- HLST50 – Part of building heated to less than 50°F (yes/no)
- HEATP8 – Percent heated
- COOLP8 – Percent cooled
- HDD658 - Heating degree days (base 65)
- CDD658 - 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:

- Natural log of gross square foot
- Number of workers per 1,000 square feet
- Weekly operating hours

In addition, analysis revealed that unrefrigerated and refrigerated warehouses have different responses to weather variables and the presence of walk-in refrigeration units. Due to this behavior, the final regression also includes the following terms that interact with the warehouse type:

Additional Variables for Refrigerated Warehouses
- Refrigerated warehouse (yes/no)
- Cooling degree days

Additional Variables for Unrefrigerated Warehouses
- Heating degree days time Percent heated
- Cooling degree days times Percent cooled
- Walk-in refrigerators per 1,000 square feet

The inclusion of these terms was based on a substantial analysis of the data and the differences among types of warehouses. EPA investigated a wide variety of regression formulations. The terms described above were determined to be statistically significant when added to the warehouse regression model, improved the overall significance of the warehouse regression model, and resulted in the most equitable energy performance ratings for both unrefrigerated and refrigerated warehouses. When these unique adjustments are incorporated, both populations exhibited a good distribution of ratings, and there was no evidence of bias with respect to key operational parameters such as weather or number of workers.

These variables are used together to compute the predicted source EUI for warehouses. 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.

Additional analysis was performed to look specifically at unrefrigerated warehouses to determine whether distribution centers performed differently than other unrefrigerated warehouse facilities. This analysis was possible because the CBECS 2003 survey divided Distribution Centers into a unique category, whereas these facilities did not have a separate category in the CBECS 1999 Survey. Facilities identified in the Distribution Center category tended to be larger facilities with more workers. Thus, there are some operational differences. The variables in the updated model do account for some operational differences (e.g. size, number of workers) at distribution centers, but the analysis confirms that the single model performs a fair comparison for both unrefrigerated warehouses and distribution centers.

Another new category in the CBECS 2003 survey identified self-storage facilities. EPA included these facilities in the analysis, and performed an extensive review of their behavior. However EPA determined that their energy consumption patterns and values for key operating characteristics were notably different from all other types of warehouses. Therefore, self-storage facilities are not included in the final regression model and are unable to receive EPA energy performance ratings using the updated Warehouse model.

Testing

Finally, we test the regression equation using actual warehouse 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 building size, computer density, worker density, operating hours, 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.

REGRESSION EQUATION RESULTS

The final regression is a weighted ordinary least squares regression across the filtered data set of 277 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, as shown by the significance levels (a p-level of less than 0.10indicates 90% confidence).

The regression equation has a coefficient of determination (R^2) value of 0.3952 indicating that this equation explains 39.52% of the variance in source EUI for warehouse 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 energy[4], demonstrates that the

[4] 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.

equation actually explains 61.8% of the variation of source energy of warehouses. 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 Energy per Square Foot	85.12	0.9432	1,023
Refrigerated warehouse (yes/no)	0.0222	0.0000	1.000
Unrefrigerated warehouse (yes/no)	--	--	--
Ln (Square Feet)	9.806	8.517	13.59
Number of Workers per 1000 ft^2	0.5943	0.0000	3.909
Weekly operating hours	60.93	30.00	168.0
Heating Degree Days x Percent Heated	2707	0.0000	9944
Cooling Degree Days x Percent Cooled	378.7	0.0000	5,467
Number of Walk-in Refrigerators per 1000 ft^2	0.0096	0.0000	0.2439
Cooling Degree Days	1,570	233	5,467

Figure 3 - Final Regression Results

Summary				
Dependent Variable		Source Energy Intensity (kBtu/ft^2)		
Number of Observations in Analysis		277		
R^2 value		0.3952		
Adjusted R^2 value		0.3771		
F Statistic		21.89		
Significance (p-level)		0.0000		
	Unstandardized Coefficients	**Standard Error**	**T value**	**Significance (p-level)**
Constant	82.18	4.047	20.31	0.0000
Refrigerated warehouse	168.6	33.42	5.046	0.0000
C_Ln (Square Feet)	13.63	4.520	3.015	0.0028
C_ Number of Workers per 1000 ft^2	41.84	7.042	5.941	0.0000
C_Weekly Operating Hours	0.3111	0.1472	2.113	0.0355
Unrefrigerated x C_HDD x Percent Heated	0.0110	0.0017	6.677	0.0000
Unrefrigerated x C_CDD x Percent Cooled	0.0205	0.0073	2.787	0.0057
Unrefrigerated x C_ Number of Walk-in Refrigerators per 1000 ft^2	262.3	110.2	2.379	0.0180
Refrigerated x C_CDD	0.0708	0.0400	1.769	0.0780

Note:
- *The regression is a weighted ordinary least squares regression, weighted by the CBECS variable "ADJWT8".*
- *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**.*
- *Full variable names and definitions are presented in **Figure 2.***
- *The Refrigerated warehouse and Unrefrigerated terms are not centered because they represent a multiplier on the already centered variables C_HDD x Percent Heated, C_CDD x Percent Cooled, C_WalkinDensity, and C_CDD.*

ENERGY STAR SCORE LOOKUP TABLE

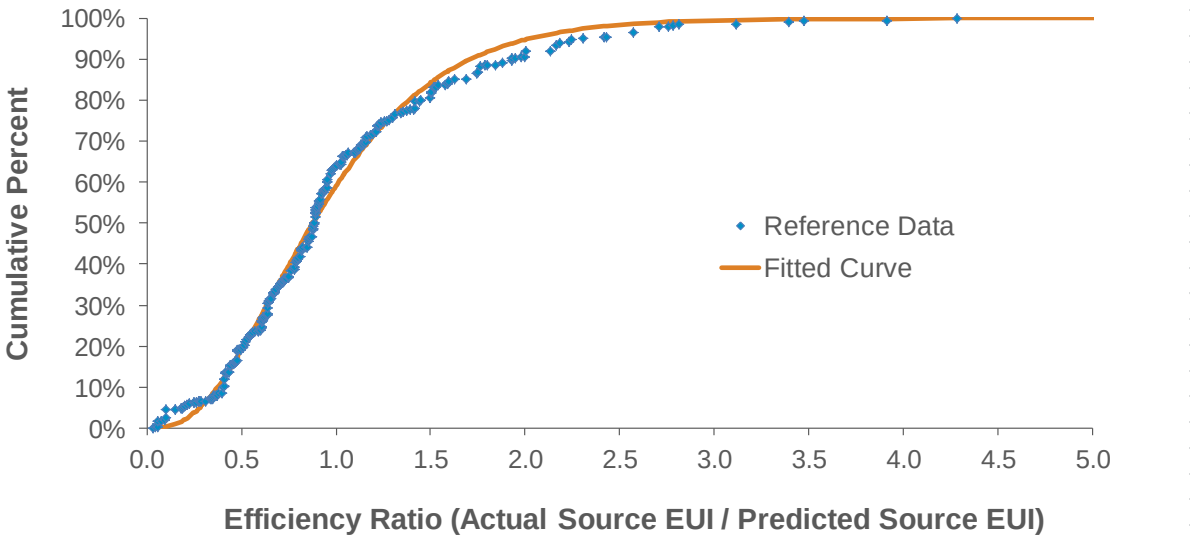
The final regression equation (presented in ***Figure 3***) yields a prediction of source EUI based on a building's operating characteristics. Some buildings in the reference data sample use more energy than predicted by the regression equation, while others use less. The *actual* source EUI of each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

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

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 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 3.184 and a scale parameter (beta) of 0.3066. For this fit, the sum of the squared error is 0.1578.

Figure 4 – Distribution for Warehouse



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 Warehouse

ENERGY STAR Score	Cumulative Percent	Energy Efficiency Ratio > =	Energy Efficiency Ratio <
100	0%	0.0000	0.1448
99	1%	0.1448	0.1861
98	2%	0.1861	0.2166
97	3%	0.2166	0.2420
96	4%	0.2420	0.2640
95	5%	0.2640	0.2841
94	6%	0.2841	0.3025
93	7%	0.3025	0.3198
92	8%	0.3198	0.3361
91	9%	0.3361	0.3516
90	10%	0.3516	0.3664
89	11%	0.3664	0.3808
88	12%	0.3808	0.3947
87	13%	0.3947	0.4082
86	14%	0.4082	0.4213
85	15%	0.4213	0.4343
84	16%	0.4343	0.4469
83	17%	0.4469	0.4592
82	18%	0.4592	0.4714
81	19%	0.4714	0.4835
80	20%	0.4835	0.4954
79	21%	0.4954	0.5071
78	22%	0.5071	0.5187
77	23%	0.5187	0.5302
76	24%	0.5302	0.5417
75	25%	0.5417	0.5531
74	26%	0.5531	0.5644
73	27%	0.5644	0.5756
72	28%	0.5756	0.5868
71	29%	0.5868	0.5980
70	30%	0.5980	0.6091
69	31%	0.6091	0.6202
68	32%	0.6202	0.6313
67	33%	0.6313	0.6425
66	34%	0.6425	0.6536
65	35%	0.6536	0.6648
64	36%	0.6648	0.6759
63	37%	0.6759	0.6872
62	38%	0.6872	0.6984
61	39%	0.6984	0.7096
60	40%	0.7096	0.7210
59	41%	0.7210	0.7323
58	42%	0.7323	0.7438
57	43%	0.7438	0.7553
56	44%	0.7553	0.7668
55	45%	0.7668	0.7785
54	46%	0.7785	0.7903
53	47%	0.7903	0.8022
52	48%	0.8022	0.8141
51	49%	0.8141	0.8262

ENERGY STAR Score	Cumulative Percent	Energy Efficiency Ratio >=	Energy Efficiency Ratio <
50	50%	0.8262	0.8384
49	51%	0.8384	0.8507
48	52%	0.8507	0.8631
47	53%	0.8631	0.8758
46	54%	0.8758	0.8885
45	55%	0.8885	0.9014
44	56%	0.9014	0.9145
43	57%	0.9145	0.9278
42	58%	0.9278	0.9413
41	59%	0.9413	0.9550
40	60%	0.9550	0.9689
39	61%	0.9689	0.9831
38	62%	0.9831	0.9974
37	63%	0.9974	1.0121
36	64%	1.0121	1.0271
35	65%	1.0271	1.0424
34	66%	1.0424	1.0580
33	67%	1.0580	1.0739
32	68%	1.0739	1.0902
31	69%	1.0902	1.1069
30	70%	1.1069	1.1240
29	71%	1.1240	1.1416
28	72%	1.1416	1.1596
27	73%	1.1596	1.1783
26	74%	1.1783	1.1974
25	75%	1.1974	1.2172
24	76%	1.2172	1.2377
23	77%	1.2377	1.2589
22	78%	1.2589	1.2809
21	79%	1.2809	1.3038
20	80%	1.3038	1.3276
19	81%	1.3276	1.3525
18	82%	1.3525	1.3788
17	83%	1.3788	1.4062
16	84%	1.4062	1.4352
15	85%	1.4352	1.4660
14	86%	1.4660	1.4987
13	87%	1.4987	1.5337
12	88%	1.5337	1.5714
11	89%	1.5714	1.6123
10	90%	1.6123	1.6571
9	91%	1.6571	1.7066
8	92%	1.7066	1.7622
7	93%	1.7622	1.8255
6	94%	1.8255	1.8994
5	95%	1.8994	1.9887
4	96%	1.9887	2.1019
3	97%	2.1019	2.2586
2	98%	2.2586	2.5198
1	99%	2.5198	>2.5198

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 warehouses:

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	850,000 kWh
Natural gas	35,000 therms

Property Use Details	Value
Gross floor area (ft²)	125,000
Weekly operating hours	60
Workers on the main shift[5]	90
Refrigerated Warehouse	0 (No)
Number of Walk in Refrigeration Units	0
Percent of the building that is heated	100%
Percent of the building that is cooled	20%
HDD (provided by Portfolio Manager, based on Zip code)	5,806
CDD (provided by Portfolio Manager, based on Zip code)	1,343

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	850,000 kWh	3.412	2,900,200	3.14	9,106,628
Natural gas	35,000 therms	100	3,500,000	1.05	3,675,000
				Total Source Energy (kBtu)	12,781,628
				Actual Source EUI (kBtu/ft²)	**102.3**

[5] 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	--	--	--	82.18	82.18
Refrigerated warehouse	0.0000	--	0.0000	168.6	0.0000
Unrefrigerated warehouse	1.000	--	--	--	--
C_Ln (Square Feet)	11.74	9.806	1.930	13.63	26.36
C_ Number of Workers per 1000 ft²	0.7200	0.5943	0.1257	41.84	5.259
C_Weekly Operating Hours	60.00	60.93	-0.9300	0.3111	-0.2893
C_HDD x Percent Heated	5806	2707	3099	--	--
C_CDD x Percent Cooled	268.6	378.7	-110.1	--	--
C_ Number of Walk-in Refrigerators per 1000 ft²	0.0000	0.0096	-0.0096	--	--
C_CDD	1,343	1,570	-227.0	--	--
Unrefrigerated x C_HDD x Percent Heated	3,099	--	3,099	0.0110	34.09
Unrefrigerated x C_CDD x Percent Cooled	-110.1	--	-110.1	0.0205	-2.257
Unrefrigerated x C_ Number of Walk-in Refrigerators per 1000 ft²	-0.0096	--	-0.0096	262.3	-2.518
Refrigerated x C_CDD	0.0000	--	0.0000	0.0708	0.0000
			Predicted Source EUI (kBtu/ft²)		**142.8**

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 = 102.3 / 142.8 = 0.7164

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 0.7164 is greater than 0.7096 and less than 0.7210

- *The ENERGY STAR score is 60*