ENERGY STAR® PortfolioManager®

Technical Reference

ENERGY STAR Score for Warehouses in the United States

OVERVIEW

The ENERGY STAR Score for warehouses applies to buildings that are used to store goods, manufactured products, merchandise or raw materials, including non-refrigerated warehouses, refrigerated warehouses, and distribution centers. 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 non-refrigerated warehouses, refrigerated warehouses, and distribution centers. Self-storage facilities, or facilities that rent individual storage units, are not eligible for a rating using the warehouse model. The score applies to individual buildings only and is not available for campuses.
- **Reference Data.** The analysis for warehouses 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 Workers
    - Weekly Operating Hours
    - Weather and Climate (using Heating and Cooling Degree Days, retrieved based on Zip Code)
    - Percent of the Building that is Heated and Cooled
    - Percent of the Building used for Cold Storage
- **Release Date.** The ENERGY STAR score for warehouses is updated periodically as more recent data becomes available:
    - Most Recent Update: August 2018
    - Previous 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:

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) 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 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 472 properties.

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

Condition for Including an Observation in the Analysis	Rationale	Number Remaining
PBAPLUS = 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.	678
Must operate for 30 hours per week	EPA Program Filter – Baseline condition for being a full time warehouse.	621
Must have at least 1 worker	EPA Program Filter – Baseline condition for being a full time warehouse	597
Must operate for at least 10 months per year	EPA Program Filter – Baseline condition for being a full time warehouse.	580
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 defined as distribution/shipping center, non-refrigerated warehouse, or refrigerated warehouse.	549
Must report energy usage	EPA Program Filter – Baseline condition for being a full time warehouse.	543
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.	536

[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 Warehouse/Storage (PBAX=13), with a corresponding percent (ACT1PCT, ACT2PCT, ACT3PCT) that is greater than 50.

Condition for Including an Observation in the Analysis	Rationale	Number Remaining
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.	511
If propane is used, the unit (PRUNIT) must be known	Data Limitation Filter – Cannot estimate propane use if the unit is unknown.	507
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.	504
Must not use chilled water, wood, coal, or solar	Data Limitation Filter – CBECS does not collect quantities of chilled water, wood, coal, or solar.	493
Must have no more than 2.8 workers per 1,000 square feet	Analytical Filter – Values determined to be statistical outliers.	483
Source EUI cannot be greater than 500 kBtu/ft^2	Analytical Filter – Values determined to be statistical outliers.	480
Percent Cooled plus Percent Cold Storage must be less than or equal to 100%	Analytical Filter – Values exceed what is physically expected to be possible.	474
Percent Heated plus Percent Cold Storage must be less than or equal to 100%	Analytical Filter – Values exceed what is physically expected to be possible	472

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 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:

- SQFT – Square footage
- NFLOOR – Number of floors
- FLCEILHT – Floor to ceiling height
- NELVTR – Number of elevators
- NESLTR – Number of escalators
- COURT – Food court
- MONUSE – Months in use

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

- OPNWE – Open on weekend
- WKHRS – Total hours open per week
- NWKER – Number of employees
- COOK – Energy used for cooking
- MANU – Energy used for manufacturing
- HEATP – Percent heated
- HTLS50 – Heated to less than 50 degrees
- COOLP – Percent cooled
- SNACK – snack bar or concession stand
- FASTFD – Fast food or small restaurant
- CAF – Cafeteria or large restaurant
- FDPREP – Commercial or large kitchen
- KITCHN – Small kitchen area
- BREAKRM – Employee lounge, breakroom, or pantry
- OTFDRM – Other food prep or serving area
- LABEQP – Laboratory equipment
- MCHEQP – Machine equipment
- POOL – Indoor swimming pool
- HTPOOL – Heated indoor swimming pool
- RFGSTO – Large cold storage areas
- RFGWIN – Number of walk-in refrigeration units
- RFGOPN – Number of open case refrigeration units
- RFGCLN – Number of closed case refrigeration units
- RFGVNN – Number of refrigerated vending machines
- RFGICN – Number of ice makers
- RFGSTP – Percent cold storage
- PCTERMN – Number of computers
- LAPTPN – Number of laptops
- PRNTRN – Number of printers
- SERVERN – Number of servers
- TVVIDEON – Number of TV or video displays
- 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:

- Weekly Operating Hours
- Number of Workers per 1,000 Square Feet
- Percent Cold Storage
- Heating Degree Days times Percent of the Building that is Heated
- Cooling Degree Days times (Percent of the Building that is Cooled plus Percent Cold Storage)

Refrigeration and Climate Analysis

Additional analysis was performed to understand how refrigerated warehouses perform compared to non-refrigerated warehouse facilities. Facilities identified in the refrigerated warehouse category had higher EUI values than non-refrigerated warehouses on average, and higher EUI values were correlated with higher values for percent cold storage. Some non-refrigerated warehouses also included cold storage space, though the percent of floor area was typically lower than refrigerated warehouses. A similar relationship between EUI and percent cold storage was observed for these facilities. As a result, it was determined that a percent cold storage variable could equitably account for refrigeration at both property types.

We analyzed the percent cold storage in a variety of formulations. Results showed that cold storage has an impact on energy consumption in multiple ways. Analysis indicated that the energy required to refrigerate cold storage space in warehouses is affected by the climate zone in which the property is located. As a result, a climate adjustment term was developed that incorporated both the percent cooled and percent cold storage for the property, in order to reflect the entire floor area that is cooled or refrigerated. Accordingly, the final regression equation includes terms for Percent Cold Storage and Cooling Degree Days times (Percent of the Building that is Cooled plus Percent Cold Storage).

Distribution Center and Self-Storage Facility Analysis

Additional analysis was performed to determine whether distribution centers performed differently than other non-refrigerated warehouse facilities. Facilities identified in the Distribution Center category tended to be larger facilities with more workers. The variables in the updated model do account for some operational differences (e.g. number of workers per square foot) at distribution centers. Analysis confirms that the single model provides a fair comparison for both unrefrigerated warehouses and distribution centers.

Another category identified in the CBECS 2012 dataset was 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 ENERGY STAR score 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, 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 472 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 95% confidence level or better, as shown by the significance levels (a p-level of less than 0.05 indicates 95% confidence).

The regression equation has a coefficient of determination (R^2) value of 0.4015 indicating that this equation explains 40.15% 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[3] demonstrates that the equation actually explains 79.72% 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 EUI (kBtu/ ft^2)	69.62	1.333	473.2
Weekly Operating Hours	59.25	30	168
Number of Workers per 1,000 ft^2	0.8502	0.004444	2.667
Percent Cold Storage	0.007669	0.0000	0.9800
Percent Heated x Heating Degree Days	1,602	0	8,532
(Percent Cooled + Percent Cold Storage) x Cooling Degree Days	552.1	0	5,284

[3] 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 3 - Final Regression Results

Summary				
Dependent Variable		Source Energy Intensity (kBtu/ft^2)		
Number of Observations in Analysis		472		
R^2 value		0.4015		
Adjusted R^2 value		0.3950		
F Statistic		62.51		
Significance (p-level)		< 0.0001		
	Unstandardized Coefficients	**Standard Error**	**T value**	**Significance (p-level)**
Constant	69.62	1.978	35.19	<0.0001
C_Weekly Operating Hours	0.1943	0.06284	3.092	0.0021
C_Number of Workers per 1,000 ft^2	25.83	3.205	8.059	<0.0001
C_Percent Cold Storage	239.3	27.56	8.683	<0.0001
C_Percent Heated x Heating Degree Days	0.009370	0.0009534	9.829	<0.0001
C_(Percent Cooled + Percent Cold Storage) x Cooling Degree Days	0.01209	0.002710	4.464	<0.0001

Note:

- *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**.*

ENERGY STAR SCORE LOOKUP TABLE

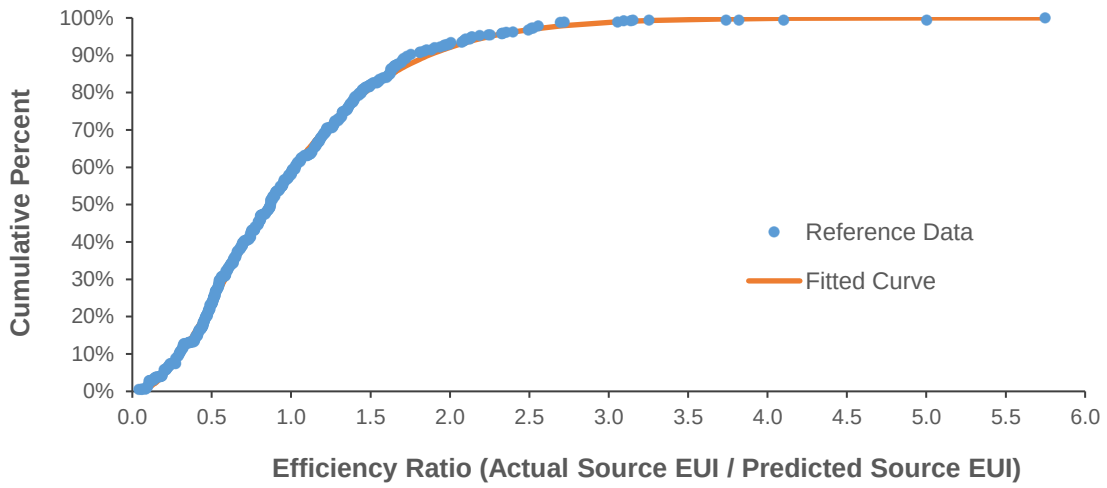
The final regression equation (presented in ***Figure 3***) yields a prediction of source EUI based on a building's operating characteristics. Some buildings in the reference data sample use more energy than predicted by the regression equation, while others use less. The *actual* source EUI of each 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 2.349 and a scale parameter (beta) of 0.4243. For this fit, the sum of the squared error is 0.04987.

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	0.0996
99	1%	0.0996	0.1374
98	2%	0.1374	0.1665
97	3%	0.1665	0.1915
96	4%	0.1915	0.2138
95	5%	0.2138	0.2342
94	6%	0.2342	0.2534
93	7%	0.2534	0.2715
92	8%	0.2715	0.2888
91	9%	0.2888	0.3054
90	10%	0.3054	0.3215
89	11%	0.3215	0.3371
88	12%	0.3371	0.3523
87	13%	0.3523	0.3672
86	14%	0.3672	0.3818
85	15%	0.3818	0.3961
84	16%	0.3961	0.4102
83	17%	0.4102	0.4242
82	18%	0.4242	0.4380
81	19%	0.4380	0.4516
80	20%	0.4516	0.4652
79	21%	0.4652	0.4786
78	22%	0.4786	0.4920
77	23%	0.4920	0.5053
76	24%	0.5053	0.5185
75	25%	0.5185	0.5317
74	26%	0.5317	0.5449
73	27%	0.5449	0.5580
72	28%	0.5580	0.5711
71	29%	0.5711	0.5843
70	30%	0.5843	0.5974
69	31%	0.5974	0.6105
68	32%	0.6105	0.6237
67	33%	0.6237	0.6369
66	34%	0.6369	0.6502
65	35%	0.6502	0.6635
64	36%	0.6635	0.6769
63	37%	0.6769	0.6903
62	38%	0.6903	0.7038
61	39%	0.7038	0.7174
60	40%	0.7174	0.7310
59	41%	0.7310	0.7448
58	42%	0.7448	0.7587
57	43%	0.7587	0.7727
56	44%	0.7727	0.7868
55	45%	0.7868	0.8010
54	46%	0.8010	0.8154
53	47%	0.8154	0.8299
52	48%	0.8299	0.8445
51	49%	0.8445	0.8594

ENERGY STAR Score	Cumulative Percent	Energy Efficiency Ratio >=	Energy Efficiency Ratio <
50	50%	0.8594	0.8744
49	51%	0.8744	0.8896
48	52%	0.8896	0.9050
47	53%	0.9050	0.9206
46	54%	0.9206	0.9364
45	55%	0.9364	0.9525
44	56%	0.9525	0.9688
43	57%	0.9688	0.9853
42	58%	0.9853	1.0021
41	59%	1.0021	1.0193
40	60%	1.0193	1.0367
39	61%	1.0367	1.0545
38	62%	1.0545	1.0726
37	63%	1.0726	1.0911
36	64%	1.0911	1.1099
35	65%	1.1099	1.1292
34	66%	1.1292	1.1489
33	67%	1.1489	1.1691
32	68%	1.1691	1.1898
31	69%	1.1898	1.2111
30	70%	1.2111	1.2329
29	71%	1.2329	1.2553
28	72%	1.2553	1.2784
27	73%	1.2784	1.3022
26	74%	1.3022	1.3268
25	75%	1.3268	1.3522
24	76%	1.3522	1.3786
23	77%	1.3786	1.4059
22	78%	1.4059	1.4343
21	79%	1.4343	1.4639
20	80%	1.4639	1.4948
19	81%	1.4948	1.5272
18	82%	1.5272	1.5612
17	83%	1.5612	1.5970
16	84%	1.5970	1.6349
15	85%	1.6349	1.6751
14	86%	1.6751	1.7179
13	87%	1.7179	1.7639
12	88%	1.7639	1.8135
11	89%	1.8135	1.8674
10	90%	1.8674	1.9265
9	91%	1.9265	1.9921
8	92%	1.9921	2.0658
7	93%	2.0658	2.1501
6	94%	2.1501	2.2488
5	95%	2.2488	2.3683
4	96%	2.3683	2.5205
3	97%	2.5205	2.7320
2	98%	2.7320	3.0868
1	99%	3.0868	> 3.0868

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[4]	90
Percent of the building used for cold storage	10%
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	2.80	8,120,560
Natural gas	35,000 therms	100	3,500,000	1.05	3,675,000
				Total Source Energy (kBtu)	11,795,560
				Actual Source EUI (kBtu/ft²)	**94.4**

[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	--	--	--	69.62	69.62
Weekly Operating Hours	60.00	59.25	0.75	0.1943	0.1457
Number of Workers per 1,000 ft^2	0.7200	0.8502	-0.1302	25.83	-3.363
Percent Cold Storage	0.1000	0.007669	0.09233	239.3	22.09
Percent Heated x HDD	5,806	1,602	4,204	0.009370	39.39
(Percent Cooled + Percent Cold Storage) x CDD	402.9	552.1	-149.2	0.01209	-1.804
			Predicted Source EUI (kBtu/ft^2)		**126.1**

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 = 94.4 / 126.1 = 0.7486

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 0.7486 is greater than 0.7448 and less than 0.7587
- ***The ENERGY STAR score is 58***