



ENERGY STAR Score for Senior Living Communities in the United States

OVERVIEW

The ENERGY STAR Score for Senior Living Communities applies to buildings that house and provide care and assistance for elderly residents. 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 senior living communities applies to buildings that house and provide care and assistance for elderly residents. The score applies to an entire senior living community whether it is a single building or a campus of buildings.
- **Reference Data.** The analysis for senior living communities is based on data from an industry survey conducted by the Assisted Living Federation of America, American Association of Homes and Services for the Aging, the American Health Care Association, and the National Center on Assisted Living.
- **Adjustments for Weather and Business Activity.** The analysis includes adjustments for:
 - Number of Units
 - Resident Capacity
 - Number of Workers
 - Number of Personal Computers
 - Number of Commercial Refrigeration Units
 - Number of Commercial Washing Machine Units
 - Number of Residential Washing Machine Units
 - Number of Electronic Lifts
 - 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 senior living communities was released in March 2011.

This document presents details on the development of the 1 - 100 ENERGY STAR score for senior living communities. 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 senior living communities:

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REFERENCE DATA & FILTERS

For the ENERGY STAR score for senior living communities, the reference data used to establish the peer building population in the United States is based on a survey conducted by the Assisted Living Federation of America (ALFA), American Association of Homes and Services for the Aging (AAHSA), the American Health Care Association (AHCA), and the National Center on Assisted Living (NCAL).

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 senior living communities, 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 553 properties.

Figure 1 – Summary of Filters for the ENERGY STAR Score for Senior Living Communities

Condition for Including an Observation in the Analysis	Rationale	Number Remaining
Must have complete data for energy use and operating characteristics	EPA Program Filter – Complete data is necessary for analysis	658
Combined total of assisted living (with or without dementia care) and skilled nursing facility (with or without dementia care) units must be more than 50% of the units	Building Type Filter – In order to be defined as senior living, more than 50% of the units must be devoted to assisted living (with or without dementia care) or to skilled nursing (with or without dementia care)	599
If parking energy is reported with metered data, the size of all parking structures (completely enclosed and partially enclosed parking) cannot exceed building size.	Building Type Filter – If the combined square foot of parking structures exceeds the size of the senior living building then the overall structure is classified as parking, not senior living. This is a standard policy in Portfolio Manager	593
If parking energy is reported with metered data, EPA’s Estimated Parking Adjustment must be less than 50% of the actual source energy.	Analytical Filter – In order to perform an analysis of the building (not the parking), EPA estimates the energy use of the parking area. ¹ If this estimation is 50% or more the actual source energy, it is determined that there is too much variability/error in the energy use.	589
Must have Source EUI ² greater than 10 kBtu/ft ² and not more than 650 kBtu/ft ²	Analytical Filter – Values determined to be data entry errors or statistical outliers.	579

¹ For more information on the methodology used for estimation, refer to the standard Portfolio Manager technical description for Parking, available at: www.energystar.gov/ScoreDetails.

² Source EUI refers to Source EUI_Adjusted (i.e. after parking and pool energy estimates have been removed to isolate the Senior Living EUI).

Condition for Including an Observation in the Analysis	Rationale	Number Remaining
Must have square foot per unit greater than 50 but less than 5,000	Analytical Filter – Values determined to be data entry errors or statistical outliers.	573
Must have greater than 0.2 and less than 30 residents per 1,000 square foot	Analytical Filter – Values determined to be data entry errors or statistical outliers.	571
Must have less than or equal to 1.0 commercial refrigeration units per 1,000 square foot	Analytical Filter – Values determined to be data entry errors or statistical outliers.	570
Must have less than or equal to 2.7 electronic lifts per 1,000 square foot	Analytical Filter – Values determined to be data entry errors or statistical outliers.	569
Must have Percent Resident Capacity less than or equal to 100%	Analytical Limitation – Values determined to be data entry errors or statistical outliers.	557
Must not be less than 50% cooled and less than 50% heated.	Analytical Limitation – Values determined to be data entry errors or statistical outliers.	553

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 senior living communities, 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 senior living community in one building), it is also eligible for a score.

Survey Weights

The senior living survey data represented data from a total of 110 companies. Within this group, there were four companies that provided a large number of responses (over 50 each). These four companies accounted for 426 of the 658 complete observations. Given the high representation of these companies, the survey is better viewed as a survey of *companies* rather than a survey of *buildings* in the national population. That is, rather than being a simple

random sample from the entire population, it is regarded as a stratified random sample, with five groups: each of the four major companies and a fifth group of all other companies. In order to properly account for this stratification, survey sample weights were constructed to reflect the probability of being selected within each of these five groups. Within each group, the weight of an individual observation was computed as:

$$\text{Observation Weight} = \text{Total Size of Population in Group} / \text{Number of Responses in Group}$$

The Total Size of Population in Group was obtained through market research on the companies and available census data. The Number of Responses in Group was counted from the complete set of 658 observations in the survey.

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 units, 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 senior living communities.

Dependent Variable

The dependent variable is what we try to predict with the regression equation. For the senior living 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 senior living communities.

Independent Variables

The reference survey collects numerous property operating characteristics that were identified as potentially important for senior living communities. Based on a review of the available variables in the data, in accordance with the criteria for inclusion in Portfolio Manager,³ Figure 2 summarizes the variables were analyzed.

³ For a complete explanation of these criteria, refer to our Technical Reference for the ENERGY STAR Score, at www.energystar.gov/ENERGYSTARScore.

Figure 2 – Summary of Variables Analyzed in Regression Equations

Overall descriptors of the community	Variables for type of senior living
Building Square Footage	Community type (Single Building / Campus / Part of Building / Other)
Total Number of Units	Primary Use (Independent Living / Assisted Living / Skinned Nursing Facility / Dementia Care)
Total Resident Capacity	Percent of Units designated as Skilled Nursing
Average Number of Residents	Percent of Units designated as Assisted Living
Average Units Size (Square foot per unit)	Percent of Units designated as Assisted Living/Dementia Care
Percentage of Resident Capacity (Average Number of Residents/Total Resident Capacity)	Percent of Units designated as Skilled Nursing/Dementia Care
Variables describing operation and equipment	Variables for type of senior living
Number of Main Shift Staff	Percent of Units designated as Independent Living (Apartment)
Number of computers	Percent of Units designated as Independent Living (Single Family)
Number of elevators	Percent of Units designated as Other
Number of electronic lifts	Variables for type of senior living
Number of Walk-in commercial refrigeration units	Community type (Single Building / Campus / Part of Building / Other)
Number of Open commercial refrigeration units	Primary Use (Independent Living / Assisted Living / Skinned Nursing Facility / Dementia Care)
Number of Closed commercial refrigeration units	Percent of Units designated as Skilled Nursing
Sum of all commercial type refrigeration units	Percent of Units designated as Assisted Living
Number of Residential refrigeration units	Percent of Units designated as Assisted Living/Dementia Care
Number of Residential washers	Percent of Units designated as Skilled Nursing/Dementia Care
Number of Commercial washers	Percent of Units designated as Independent Living (Apartment)
Number of Residential dryers	Percent of Units designated as Independent Living (Single Family)
Number of Commercial dryers	Percent of Units designated as Other
Variables describing heating and cooling	Percent of Units defined as Senior Living (Assisted Living / Assisted Living with Dementia Care / Skilled Nursing Facility / Skilled Nursing Facility with Dementia Care) ⁴
Percent Central/Residential Heat	Variables describing amenities offered
Percent Central/Residential Cool	Coffee Shop/Bistro (yes or no)
Heating Degree Days (Base 65)	Commercial kitchen (yes or no)
Cooling Degree Days (Base 65)	Auxiliary Kitchen (yes or no)
	Fitness Center (yes or no)
	Beauty salon (yes or no)
	Pharmacy (yes or no)
	TV/Entertainment Room (yes or no)
	Individually controlled thermostats (yes or no)
	Number of Spas/Whirlpools

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

⁴ Note that Independent Living is not considered a type of Senior Living

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 units per 1,000 square feet
- Percent resident capacity
- Number of electronic lifts per 1,000 square feet
- Number of workers per 1,000 square feet
- Number of personal computers per 1,000 square feet
- Number of commercial refrigeration units per 1,000 square feet
- Number of commercial washing machine units per 1,000 square feet
- Number of residential washing machine units per 1,000 square feet
- Cooling degree days times Percent cooled
- Heating degree days times Percent heated

These variables are used together to compute the predicted source EUI for senior living communities. 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.

Residential Washer Analysis

The regression analysis shows that facilities with higher density of residential washing machines (more residential washers on a per square foot basis) have higher source EUI values on average. This relationship between source EUI and the residential washer density was only observed up to a certain density of washing machines. Therefore, the regression adjustment on residential washer density within the model is applied over that range, and capped at a maximum adjustment at the value of 0.16 washers per 1,000 square feet. That is, the residential washer density adjustment in the regression equation for a building whose actual density is greater 0.16 will be identical to the adjustment for a building with a density of 0.16.

Testing

Finally, we test the regression equation using actual senior living communities that have been entered in Portfolio Manager. This provides another set of buildings to examine in addition to the industry survey 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, percent occupied, equipment density, 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 553 observations. The dependent variable is source EUI. Each independent variable is centered relative to the mean value, presented in **Figure 3**. The final equation⁵ 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 (a p-level of less than 0.05 indicates 95% confidence), with the exception of the Heating Degree Days x Percent Heated variable, which has a p-level just above 0.05 (0.0527).

The regression equation has a coefficient of determination (R^2) value of 0.4417, indicating that this equation explains 44.17% of the variance in source EUI for senior living communities. 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 energy⁶ demonstrates that the equation actually explains 79.47% of the variation of source energy of senior living communities. 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)	219.4	10.43	567.0
Number of Units per 1,000 ft ²	1.582	0.3481	4.526
Percent Resident Capacity	87.61	24.51	100.0
Number of Electronic lifts per 1,000 ft ²	0.06915	0.0000	0.3580
Number of Workers per 1,000 ft ²	0.9370	0.1205	3.761
Number of Computers per 1,000 ft ²	0.3636	0.01961	1.566
Number of Commercial Refrigeration units per 1,000 ft ²	0.09045	0.0	0.3624
Number of Commercial Washing Machine units per 1,000 ft ²	0.04317	0.0	0.1426
Number of Residential Washing Machine units per 1,000 ft ²	0.05842	0.0	2.308
Cooling Degree Days x Percent Cooled	1,184	0.0	3,862
Heating Degree Days x Percent Heated	4,524	257.0	9,752

⁵ The lookup table and model coefficients were adjusted in 2018 to account for updated ratios used in Portfolio Manager to convert site energy to source energy. The new source-site ratios were applied to the underlying dataset, resulting in changes to the model coefficients, lookup table, and R^2 value.

⁶ 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 4 - Final Regression Results

Summary				
Dependent Variable	Source Energy Intensity (kBtu/ft ²)			
Number of Observations in Analysis	553			
R ² value	0.4417			
Adjusted R ² value	0.4314			
F Statistic	42.89			
Significance (p-level)	<0.0001			
	Unstandardized Coefficients	Standard Error	T value	Significance (p-level)
Constant	219.4	2.915	75.26	<0.0001
C_Number of Units per 1,000 ft ²	17.43	5.901	2.953	0.0033
C_Percent Resident Capacity	0.7962	0.2752	2.894	0.0040
C_Number of Electronic lifts per 1,000 ft ²	253.9	47.07	5.393	<0.0001
C_Number of Workers per 1,000 ft ²	30.36	8.989	3.377	0.0008
C_Number of Computers per 1,000 ft ²	75.03	19.61	3.826	0.0001
C_Number of Commercial Refrigeration units per 1,000 ft ²	224.0	52.50	4.267	<0.0001
C_Number of Commercial Washing Machine units per 1,000 ft ²	334.9	117.3	2.854	0.0045
C_Number of Residential Washing Machine units per 1,000 ft ²	207.6	37.30	5.565	<0.0001
C_Cooling Degree Days x Percent Cooled	0.01456	0.006875	2.118	0.0346
C_Heating Degree Days x Percent Heated	0.005431	0.002797	1.942	0.0527

Notes:

- The regression is a weighted ordinary least squares regression, weighted by the Survey Weights (refer to Survey Weights Section).
- The prefix "C_" on each variable indicates that it is centered. The centered variable is equal to the difference between the actual value and the observed mean. The observed mean values are presented in **Figure 3**.
- Commercial Refrigeration units include open, closed, and walk-in units.

ENERGY STAR SCORE LOOKUP TABLE

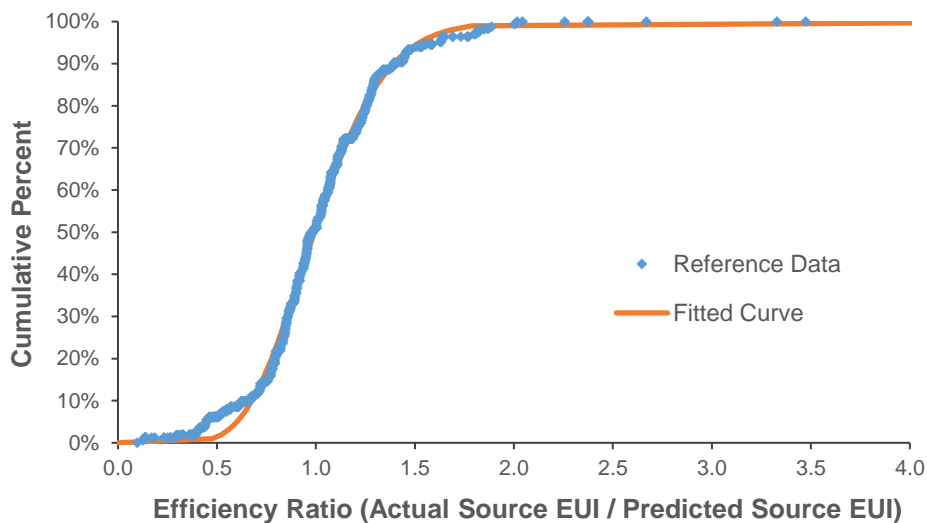
The final regression equation (presented in **Figure 4**) yields a prediction of source EUI based on a building's operating characteristics. Some buildings in the reference data sample use more energy than predicted by the regression equation, while others use less. The *actual* source EUI of each reference data observation is divided by its *predicted* source EUI to calculate an energy efficiency ratio:

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

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 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 12.97 and a scale parameter (beta) of 0.07847. For this fit, the sum of the squared error is 0.2360.

Figure 5 – Distribution for Senior Living



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 Senior Care Communities

ENERGY STAR Score	Cumulative Percent	Energy Efficiency Ratio		ENERGY STAR Score	Cumulative Percent	Energy Efficiency Ratio	
		> =	<			>=	<
100	0%	0.0000	0.4770	50	50%	0.9917	0.9987
99	1%	0.4770	0.5244	49	51%	0.9987	1.0057
98	2%	0.5244	0.5561	48	52%	1.0057	1.0128
97	3%	0.5561	0.5809	47	53%	1.0128	1.0199
96	4%	0.5809	0.6016	46	54%	1.0199	1.0271
95	5%	0.6016	0.6196	45	55%	1.0271	1.0343
94	6%	0.6196	0.6357	44	56%	1.0343	1.0416
93	7%	0.6357	0.6504	43	57%	1.0416	1.0490
92	8%	0.6504	0.6639	42	58%	1.0490	1.0564
91	9%	0.6639	0.6765	41	59%	1.0564	1.0639
90	10%	0.6765	0.6884	40	60%	1.0639	1.0715
89	11%	0.6884	0.6997	39	61%	1.0715	1.0792
88	12%	0.6997	0.7104	38	62%	1.0792	1.0870
87	13%	0.7104	0.7207	37	63%	1.0870	1.0949
86	14%	0.7207	0.7306	36	64%	1.0949	1.1029
85	15%	0.7306	0.7401	35	65%	1.1029	1.1110
84	16%	0.7401	0.7493	34	66%	1.1110	1.1193
83	17%	0.7493	0.7583	33	67%	1.1193	1.1277
82	18%	0.7583	0.7670	32	68%	1.1277	1.1362
81	19%	0.7670	0.7756	31	69%	1.1362	1.1450
80	20%	0.7756	0.7839	30	70%	1.1450	1.1539
79	21%	0.7839	0.7921	29	71%	1.1539	1.1629
78	22%	0.7921	0.8001	28	72%	1.1629	1.1722
77	23%	0.8001	0.8079	27	73%	1.1722	1.1818
76	24%	0.8079	0.8157	26	74%	1.1818	1.1915
75	25%	0.8157	0.8233	25	75%	1.1915	1.2016
74	26%	0.8233	0.8308	24	76%	1.2016	1.2119
73	27%	0.8308	0.8382	23	77%	1.2119	1.2225
72	28%	0.8382	0.8456	22	78%	1.2225	1.2335
71	29%	0.8456	0.8528	21	79%	1.2335	1.2448
70	30%	0.8528	0.8600	20	80%	1.2448	1.2566
69	31%	0.8600	0.8672	19	81%	1.2566	1.2688
68	32%	0.8672	0.8743	18	82%	1.2688	1.2816
67	33%	0.8743	0.8813	17	83%	1.2816	1.2949
66	34%	0.8813	0.8883	16	84%	1.2949	1.3089
65	35%	0.8883	0.8953	15	85%	1.3089	1.3236
64	36%	0.8953	0.9022	14	86%	1.3236	1.3392
63	37%	0.9022	0.9091	13	87%	1.3392	1.3558
62	38%	0.9091	0.9160	12	88%	1.3558	1.3735
61	39%	0.9160	0.9229	11	89%	1.3735	1.3925
60	40%	0.9229	0.9297	10	90%	1.3925	1.4133
59	41%	0.9297	0.9366	9	91%	1.4133	1.4360
58	42%	0.9366	0.9434	8	92%	1.4360	1.4612
57	43%	0.9434	0.9503	7	93%	1.4612	1.4898
56	44%	0.9503	0.9572	6	94%	1.4898	1.5228
55	45%	0.9572	0.9640	5	95%	1.5228	1.5621
54	46%	0.9640	0.9709	4	96%	1.5621	1.6114
53	47%	0.9709	0.9778	3	97%	1.6114	1.6784
52	48%	0.9778	0.9848	2	98%	1.6784	1.7876
51	49%	0.9848	0.9917	1	99%	1.7876	>1.7876

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 senior living communities:

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, units, etc.) and use details describing building activity (workers, etc.)

Energy Data	Value
Electricity	3,070,000 kWh
Natural gas	166,000 therms

Property Use Details	Value
Gross floor area (ft ²)	220,000
Average number of residents	480
Total resident capacity	525
Number of Units	310
Number of electronic lifts	14
Workers on the main shift ⁷	260
Number of computers	85
Number of commercial refrigeration units	25
Number of commercial washing machines	15
Number of residential washing machines	11
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)	4,200
CDD (provided by Portfolio Manager, based on Zip code)	1,300

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	3,070,000 kWh	3.412	10,474,840	2.80	29,329,552
Natural gas	166,000 therms	100	16,600,000	1.05	17,430,000
Total Source Energy (kBtu)					46,759,552
Actual Source EUI (kBtu/ft²)					212.5

⁷ 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	--	--	--	219.4	219.4
Number of Units per 1000 ft ²	1.409	1.582	-0.1730	17.43	-3.015
Percent Resident Capacity	91.43	87.61	3.820	0.7962	3.041
Number of Electronic Lifts per 1000 ft ²	0.06364	0.06915	-0.005510	253.9	-1.399
Number of Workers per 1000 ft ²	1.182	0.9370	0.2450	30.36	7.438
Number of Computers per 1000 ft ²	0.3864	0.3636	0.02280	75.03	1.711
Commercial Refrigeration Units per 1000 ft ²	0.1136	0.09045	0.02315	224.0	5.186
Commercial Washing Machines per 1000 ft ²	0.06818	0.04317	0.02501	334.9	8.376
Min(Residential Washing Machines per 1000 ft ² , 0.16)	0.05	0.05842	-0.008420	207.6	-1.748
CDD x Percent Cooled	1,300	1,184	116.0	0.01456	1.689
HDD x Percent Heated	4,200	4,524	-324.0	0.005431	-1.760
Predicted Source EUI (kBtu/ft²)					238.9

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 = 212.5 / 238.9 = 0.8895

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 0.8895 is greater than or equal to 0.8883 and less than 0.8953.
- **The ENERGY STAR score is 65.**

