ENERGY STAR® Portfolio Manager® Technical Reference

ENERGY STAR Score for Hospitals in Canada

OVERVIEW

The ENERGY STAR Score for Hospitals in Canada applies to general medical hospitals, including critical access hospitals and children's hospitals. 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. A statistical analysis of the peer building population is performed to identify the aspects of building activity that are significant drivers of energy use and then to normalize for those factors. The result of this analysis is an equation that predicts 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 hospitals applies to general medical hospitals, including critical access hospitals and children's hospitals. The ENERGY STAR score applies to an entire hospital, whether it is a single building or a campus of buildings. Individual buildings that are part of larger hospital campuses cannot receive their own score.
- **Reference data.** The analysis for hospitals in Canada is based on data from the Survey on Commercial and Institutional Energy Use (SCIEU), which was commissioned by Natural Resources Canada (NRCan) and carried out by Statistics Canada, and represents consumption year 2009.
- **Adjustments for weather and business activity.** The analysis includes adjustments for:
  - Building size
  - Licensed hospital bed capacity
  - Number of workers on the main shift
  - Presence of on-site laundry facility
  - Weather and climate (using heating and cooling degree days, retrieved based on postal code)
  - Percent of the building/campus that is heated and cooled
- **Release date.** This is the first release of the ENERGY STAR score for hospitals in Canada.

This document presents details on the development of the 1 – 100 ENERGY STAR score for hospital 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 http://www.energystar.gov/ENERGYSTARScore. The subsequent sections of this document offer specific details on the development of the ENERGY STAR score for hospitals.

REFERENCE DATA & FILTERS

The ENERGY STAR score for hospitals in Canada applies to facilities that provide acute care services intended to treat patients for short periods (average less than 25 days) for any brief but severe medical condition, including emergency medical care, physicians' services, diagnostic care, ambulatory care and surgical care. It does not apply to outpatient hospitals, physical therapy or urgent care clinics, nursing or residential care facilities, medical offices, or veterinary hospitals. The reference data used to establish the peer building population is based on data from the Survey on Commercial and Institutional Energy Use (SCIEU), which was commissioned by Natural Resources Canada and carried out by Statistics Canada in late 2010 and early 2011. The consumption data for the survey was from the calendar year 2009. The raw collected data file for this survey is not publically available, but a report providing summary results is available on Natural Resources Canada's website at http://oee.nrcan.gc.ca/publications/statistics/scieu09/scieu_e.pdf.

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 hospitals and the rationale behind the filter. After all filters are applied, the remaining data set has 150 observations. Due to the confidentiality of the survey data, we are not able to identify the number of cases after each filter.

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

Condition for Including an Observation in the Analysis	Rationale
Defined as category 7 in SCIEU – Hospital Building	The SCIEU survey covered the commercial and institutional sector and included buildings of all types. For this model, only the observations identified as main activity being hospitals are used.
Building must be at least 70% Hospital	Building Type Filter – Definition of a hospital
Must have electric energy data	Program Filter – Basic requirement to be considered a functioning hospital is that it requires electrical consumption. Electricity can be grid-purchased or produced on site.
Must be at least 100 m^2	Program Filter – Since hospitals below 100 m^2 are uncommon, NRCan opted to select this cut-off as a program decision.
Must have 75% of the area that is heated	Program Filter – Basic requirement to be a functioning hospital.
Must operate at least 30 hours per week	Program Filter – Basic requirement to be considered as full time operation.
Must have at least 1 worker	Program Filter – Basic requirement for a functioning hospital. It must be occupied.
Must have at least 1 computer	Program Filter – Basic requirement for a functioning hospital. It must have at least one computer.
Must operate 12 months per year	Program Filter – Basic requirement to be considered as full time operation.
Must have at least 1 hospital bed	Program Filter – Basic requirement for a functioning hospital. It must have the ability to receive patients.
Must not use any "other" fuels for which the consumption is not reported	Data Limitation Filter – No data collected on this consumption. The survey asked if additional energy consumption occurred in the building that was not reported. In those occurrences, the cases were removed from the analysis.

Condition for Including an Observation in the Analysis	Rationale
Must be built in 2008 or earlier	Data Limitation Filter – The survey reported the consumption for calendar year 2009. Therefore, if the building was being built in 2009, a full year of consumption data would not be available.
Must have source EUI that is greater than 0.5 and less than 7 GJ/m^2	Analytical Filter – Values determined to be outliers based on analysis of the data. Outliers are typically clearly outside normal operating parameters for a building of this type.
Must have a worker density (Workers per 100 m^2) that is greater than or equal to 0.25 and less than or equal to 5	Analytical Filter – Values determined to be outliers based on analysis of the data. Outliers are typically clearly outside normal operating parameters for a building of this type.
Must have a hospital bed density (beds per 100m^2) that is less than or equal to 2.5	Analytical Filter – Values determined to be outliers based on analysis of the data. Outliers are typically clearly outside normal operating parameters for a building of this type.
Must have a worker-to-bed density (workers per bed) that is less than or equal to 15	Analytical Filter – Values determined to be outliers based on analysis of the data. Outliers are typically clearly outside normal operating parameters for a building of this type.

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 available during the analysis, 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 has a different behaviour from the rest of the properties (e.g., office buildings smaller than 465 m^2 do not behave the same way as larger buildings), in which case an Analytical Filter is 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. The ENERGY STAR score applies to an entire hospital, whether it is a single building or a campus of buildings. Hospitals may have multiple buildings that are all integral to the primary activity. One building might be a cancer center, another, an emergency center. It is in the nature of hospitals to be spread amongst multiple buildings for various reasons, such as disease prevention. In this case, the campus can get an ENERGY STAR score as long as the energy for all the buildings is metered and reported. For cases where all the activities are contained within one building, that hospital building can get an ENERGY STAR score.

VARIABLES ANALYZED

To normalize for differences in business activity, we performed 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, was analyzed using a weighted ordinary least squares regression, which evaluated energy use relative to business activity (e.g. number of beds, number of workers, and climate). This linear regression yielded 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 hospitals.

Dependent Variable

The dependent variable is what we try to predict with the regression equation. For the hospital 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, including all buildings. The regression analyzes the key drivers of source EUI – those factors that explain the variation in source energy use per square meter in hospitals. The unit for source EUI in the Canadian model is the Gigajoule per Square Meter (GJ/m^2)

Independent Variables

The SCIEU data contains numerous building property operation questions that NRCan identified as potentially important for hospitals. Based on a review of the available variables in the SCIEU data, in accordance with the criteria for inclusion,[1] NRCan initially analyzed the following variables in the regression analysis:

- Gross building area (m^2)
- Heating degree days (HDD)
- Cooling degree days (CDD)
- Average outdoor temperature (°C)
- Percentage of floor space that is heated
- Percentage of floor space that is cooled
- Presence of commercial food preparation area (y/n)
- Floor space dedicated to commercial cooking area
- Presence of an indoor pool (y/n)
- Number of floors
- Number of elevators
- Number of escalators
- Weekly hours of operation
- Months in operation in 2009
- Number of workers during the main shift
- Number of computers and computer servers
- Number of vending machines
- Floor space that is interior parking
- Floor space that is heated interior parking

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

- Presence of associated exterior parking (y/n)
- Number representing the hospital bed capacity
- Number of medical diagnosis machines including MRI machines *refer to additional note below
- Presence of laundry facility (y/n)
- Presence of trauma center (y/n)

NRCan and EPA performed extensive review on all of these operational characteristics. In addition to reviewing each characteristic individually, characteristics were reviewed in combination with each other (e.g., Heating Degree Days times Percent Heated). As part of the analysis, some variables were reformatted to reflect the physical relationships of building components. For example, the number of workers on the main shift can be evaluated in a density format. The number of workers *per square meter* (as opposed to the gross number of workers) could be expected to be correlated with the energy use per square meter. Also, based on analytical results and residual plots, variables were 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 explained the greatest amount of variance in the dependent variable: source EUI.

The final regression equation includes the following variables:

- Number of workers per $100m^2$ during main shift
- Building floor area
- Number of workers per hospital bed during main shift
- Presence of a laundry facility
- Percent of the building that is heated times heating degree days (%heated x HDD)
- Percent of the building that is cooled times the natural logarithm of cooling degree days plus 50 (%cooled x LN(CDD+50))

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

Imaging Machines and Trauma Centers

The analysis for magnetic resonance imaging (MRI) machines posed a challenge during the development of the model due to the wording of the question in the survey. The question in the survey asked for the number of medical diagnosis machines, and there was no question devoted exclusively to the number of MRI machines. The analysis showed that some respondents likely only included MRI machines while others included other equipment. NRCan analysed the data and removed observations with clear outliers, which were likely due to the situation mentioned above. However, even with those observations removed, the MRI variable was still not found to have a statistically significant correlation with Source EUI.

In order to reinforce the analysis, NRCan did some additional testing with actual Portfolio Manager data, which asked specifically for the number of MRI machines. We looked at the number of MRI machines in those observations and also calculated the MRI machine density (#of MRIs/$100m^2$). In both the Portfolio Manager data and the survey data, the hospitals with MRI machines did not have a higher Source EUI, nor did they receive a different calculated performance score. Therefore, the variable for the number of MRI machines is not included in the model.

An analysis of whether the presence of a trauma center had an impact on energy consumption was also performed. The result of the analysis did not show a significant correlation between the source EUI of the hospital and whether it had a trauma center. Therefore, a variable identifying the presence of a trauma center was not included in the final model.

Climate (HDD and CDD)

The analysis looked at the Heating Degree Days (HDD), the Cooling Degree Days (CDD) and the average outdoor temperature. There was a strong correlation between the energy intensity of the building and the variable of percent heated multiplied by the HDD. This variable is included in the model.

With regards to the CDD variables; an in-depth analysis demonstrated that the CDD variable that came out consistently significant was the percent cooled multiplied by the natural logarithm of (CDD+50). The decision to add 50 to the CDD value was required in order to properly score hospitals that were air conditioned but located in lower CDD climates. We hypothesize that while the relationship may follow a logarithmic pattern in general, it does not extend to a limit of negative infinity at zero CDD, as some hospitals still require cooling in situations where there is no CDD at reference 18°C. Therefore, the added "50" degree days moves the adjustment up to better fit the shape in the data.

The weather data for the Canadian model was taken from the US National Climatic Data Center sources, which are the same sources used by EPA for U.S. buildings and is the source of weather data for Portfolio Manager.

Property Floor Area

Several variables that were related to the size of the building were identified for analysis. They included the area and the natural logarithm of area. The variable that was consistently significant was area, and this variable was always significant on its own. However, it was also noticed that larger buildings did not behave the same way as smaller ones. After testing various thresholds, it was determined that the source EUI patterns no longer changed with size for buildings over 100,000 m^2. Therefore, the maximum adjustment for the building area term is at 100,000m^2. Buildings over this threshold will get the same adjustment as buildings that have an area of 100,000 m^2.

Testing

Finally, NRCan further analyzed the regression equation using actual hospital data that has been entered in Portfolio Manager. This provided another set of buildings to examine, in addition to the SCIEU data, to see the average ENERGY STAR scores and distributions, and to assess the impacts and adjustments. While Portfolio Manager did not capture some of the new variables required in the Canadian scale, and default values were used in their place, this analysis provided a second level of verification to ensure that there was a good distribution of scores.

It is important to reiterate that the final regression equation is based on the nationally representative reference data, not on 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 150 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 their respective significance levels.

The regression equation has a coefficient of determination (R^2) value of 0.351, indicating that this equation explains 35.1% of the variance in source EUI for hospital buildings. Because the final equation is structured with energy per unit area as the dependent variable, the explanatory power of the area is not included in the R^2 value, and thus this value appears artificially low. Re-computing the R^2 value in units of source energy[2] demonstrates that the equation actually explains 87.4% of the variation in total source energy of hospitals. 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 meter (GJ/m^2)	3.322	1.170	6.279
Number of workers per 100m^2 during main shift	1.417	0.2782	3.824
Number of workers per hospital bed	2.726	0.2000	12.38
Presence of a laundry facility (y/n)	N/A	0.000	1.000
Building floor area	19,004	1,073	194,623
Percent heated times heating degree days	4,787	2,608	7,323
Percent cooled times natural logarithm of cooling degree days+50 [%cooled x LN(CDD+50)]	4.03	0.000	6.109

[2] 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 (GJ/m²)			
Number of observations in analysis	150			
R^2 value	0.3513			
F statistic	12.91			
Significance (p-level)	0.0000			
	Unstandardized Coefficients	Standard Error	T value	Significance (p-level)
Constant	2.984	0.1622	18.40	<0.0001
C_Number of workers per 100m² during main shift	0.6092	0.12696	4.800	<0.0001
C_Number of workers per hospital bed	-0.0984	0.04408	-2.232	0.0272
C_Presence of a laundry facility	0.4596	0.1924	2.388	0.0182
C_Building floor area	0.0000093598	0.0000034	2.755	0.0066
C_Percent heated times heating degree days	0.00047986	0.00008009	5.992	<0.0001
C_Percent cooled times natural logarithm of cooling degree days+50	0.2775	0.06298	4.406	<0.0001

- *Notes:*
- *The regression is a weighted ordinary least squares regression, weighted by the SCIEU variable "WTBS."*
- *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.*
- *The Area variable is limited at a maximum value of 100,000 m² for calculation of the predicted EUI*
- *The heating degree days and cooling degree days are sourced from the U.S. National Climatic Data Center*

ENERGY STAR SCORE LOOKUP TABLE

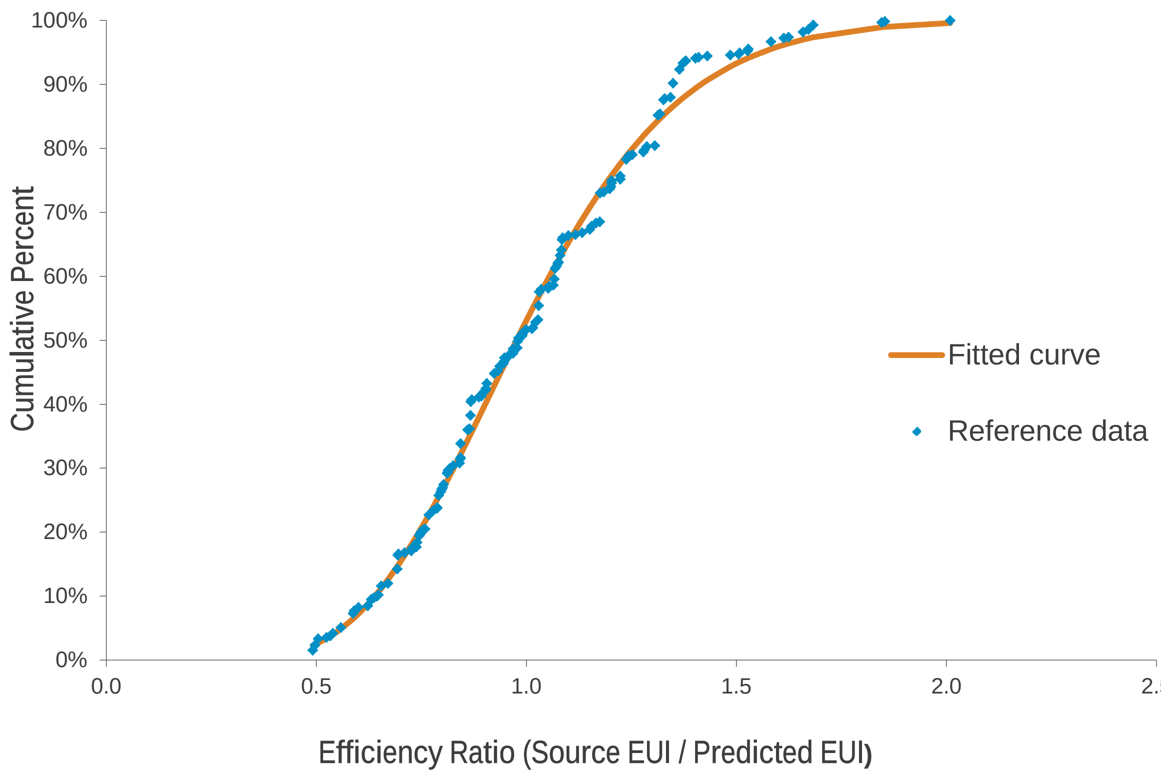
The final regression equation (presented in *Figure 3*) yields a prediction of source EUI based on a building's operating characteristics. Some buildings in the SCIEU data sample use more energy than predicted by the regression equation, while others use less. The *actual* source EUI of each reference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

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

An efficiency ratio lower than one 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 10.75198 and a scale parameter (beta) of 0.09370. For this fit, the sum of the squared error is 0.05577.

Figure 4 – Distribution for Hospitals



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% corresponds to the ratio for a score of 75; only 25% of the population has a ratio this small or smaller. The complete score lookup table is presented in *Figure 5*.

Figure 5 – ENERGY STAR Score Lookup Table for Hospital

ENERGY STAR Score	Cumulative Percent	Energy Efficiency Ratio		ENERGY STAR Score	Cumulative Percent	Energy Efficiency Ratio	
		> =	<			>=	<
100	0%	0.0000	0.4320	50	50%	0.9764	0.9840
99	1%	0.4320	0.4806	49	51%	0.9840	0.9916
98	2%	0.4806	0.5134	48	52%	0.9916	0.9993
97	3%	0.5134	0.5391	47	53%	0.9993	1.0070
96	4%	0.5391	0.5606	46	54%	1.0070	1.0148
95	5%	0.5606	0.5794	45	55%	1.0148	1.0226
94	6%	0.5794	0.5963	44	56%	1.0226	1.0306
93	7%	0.5963	0.6117	43	57%	1.0306	1.0386
92	8%	0.6117	0.6259	42	58%	1.0386	1.0467
91	9%	0.6259	0.6392	41	59%	1.0467	1.0548
90	10%	0.6392	0.6517	40	60%	1.0548	1.0631
89	11%	0.6517	0.6636	39	61%	1.0631	1.0715
88	12%	0.6636	0.6749	38	62%	1.0715	1.0800
87	13%	0.6749	0.6858	37	63%	1.0800	1.0886
86	14%	0.6858	0.6963	36	64%	1.0886	1.0973
85	15%	0.6963	0.7064	35	65%	1.0973	1.1062
84	16%	0.7064	0.7162	34	66%	1.1062	1.1152
83	17%	0.7162	0.7257	33	67%	1.1152	1.1244
82	18%	0.7257	0.7350	32	68%	1.1244	1.1337
81	19%	0.7350	0.7441	31	69%	1.1337	1.1433
80	20%	0.7441	0.7530	30	70%	1.1433	1.1530
79	21%	0.7530	0.7617	29	71%	1.1530	1.1630
78	22%	0.7617	0.7702	28	72%	1.1630	1.1731
77	23%	0.7702	0.7786	27	73%	1.1731	1.1836
76	24%	0.7786	0.7868	26	74%	1.1836	1.1943
75	25%	0.7868	0.7950	25	75%	1.1943	1.2053
74	26%	0.7950	0.8030	24	76%	1.2053	1.2166
73	27%	0.8030	0.8110	23	77%	1.2166	1.2283
72	28%	0.8110	0.8189	22	78%	1.2283	1.2403
71	29%	0.8189	0.8267	21	79%	1.2403	1.2528
70	30%	0.8267	0.8344	20	80%	1.2528	1.2658
69	31%	0.8344	0.8420	19	81%	1.2658	1.2792
68	32%	0.8420	0.8497	18	82%	1.2792	1.2933
67	33%	0.8497	0.8572	17	83%	1.2933	1.3080
66	34%	0.8572	0.8647	16	84%	1.3080	1.3234
65	35%	0.8647	0.8722	15	85%	1.3234	1.3396
64	36%	0.8722	0.8797	14	86%	1.3396	1.3568
63	37%	0.8797	0.8871	13	87%	1.3568	1.3751
62	38%	0.8871	0.8946	12	88%	1.3751	1.3947
61	39%	0.8946	0.9020	11	89%	1.3947	1.4158
60	40%	0.9020	0.9094	10	90%	1.4158	1.4387
59	41%	0.9094	0.9168	9	91%	1.4387	1.4639
58	42%	0.9168	0.9242	8	92%	1.4639	1.4919
57	43%	0.9242	0.9316	7	93%	1.4919	1.5236
56	44%	0.9316	0.9390	6	94%	1.5236	1.5602
55	45%	0.9390	0.9464	5	95%	1.5602	1.6040
54	46%	0.9464	0.9539	4	96%	1.6040	1.6590
53	47%	0.9539	0.9613	3	97%	1.6590	1.7338
52	48%	0.9613	0.9689	2	98%	1.7338	1.8560
51	49%	0.9689	0.9764	1	99%	1.8560	>1.8560

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 Hospitals.

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	10,000,000 kWh
Natural gas	1,200,000 m^3

Property Use Details	Value
Gross floor area (m^2)	50,000
Weekly operating hours	168
Workers on main shift[3]	300
Licensed bed capacity	200
Presence of a laundry facility	Yes
Percent heated	100%
Percent cooled	100%
HDD (provided by Portfolio Manager, based on postal code)	4000
CDD (provided by Portfolio Manager, based on postal code)	100

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 GJ Multiplier	Site GJ	Source Multiplier	Source GJ
Electricity	10,000,000 kWh	0.0036	36,000	2.05	73,800
Natural gas	1,200,000 m3	0.03843	46,116	1.02	47,038
			Total Source Energy (GJ)		120,838
			Source EUI (GJ/m^2)		2.4168

[3] This represents typical peak staffing level during the main shift. For example, in a hospital, if there are two daily 12-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 logarithm 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 Hospital regression equation to obtain a predicted source EUI.

Computing Predicted Source EUI

Variable	Actual Building Value	Reference Centering Value	Building Centered Variable	Coefficient	Coefficient x Centered Variable
Constant	-	-	-	2.98431	2.984
Number of workers per $100m^2$ during main shift	0.600	1.42	-0.820	0.60922	-0.4996
Number of workers per hospital bed	1.50	2.73	-1.230	-0.09839	0.121
Presence of a laundry facility (Yes=1, No=0)	1	N/A	1	0.45958	0.460
Building floor area	50,000	19,004	30,996	9.36E-06	0.290
Percent heated times heating degree days	4,000	4,787	-787	4.80E-04	-0.378
Percent cooled times natural logarithm of cooling degree days+50	5.011	4.03	0.981	0.2775	0.272
				Predicted Source EUI (GJ/m^2)	3.2494

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 = 2.4168 / 3.2494 = 0.7438

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 0.7438 is less than 0.7441 (requirement for 81) but greater than 0.7350 (requirement for 82).
- *The ENERGY STAR score is 81.*