

BUILDING ENERGY USE INTENSITY (EUI)

Concepts & Applications

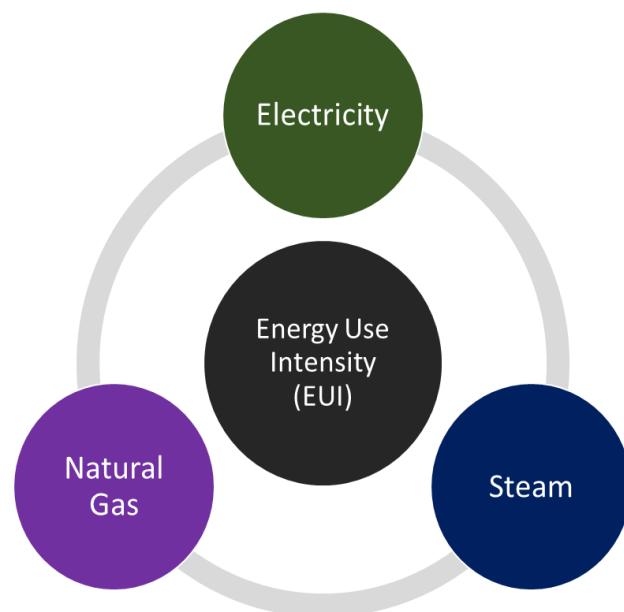
BuildingsOne | January 9, 2019



Energy Use Intensity (EUI) represents a building's total energy consumption in British Thermal Units (Btu's) per square feet per year. The EUI process promotes comparison of energy use - **benchmarking** - against comparable building use categories in the subject facility's regional and national database.

Building energy consumption and water use benchmarking has been a mandatory requirement in over 18 cities and/or states for several years, including the following locations: Atlanta, GA, Chicago, IL, New York, NY, Philadelphia, PA, San Francisco, CA, Seattle, WA, and Washington, DC. Building owner-operators should expect to see a continuation of compulsory facility energy reporting across the commercial real estate sector. Facilities energy reporting is standardized and administered through U.S. Environmental Protection Agency's (EPA) **Energy Star Portfolio Manager** program. The collation of facility energy data, and subsequent benchmarking and reporting of buildings' energy consumption, across a geographical region, is referred to as an **Energy Use Index (EUI)**.

“In benchmarking multiple facilities' energy consumption on a total energy basis, the Energy Use Index (EUI) process must incorporate conversion of site-use energy from its respective energy units of measure to a common energy unit measure - BTU's”.



BUILDING ENERGY USE INTENSITY (EUI)

Concepts & Applications



Electricity - 1 KWH (kilowatt hour)



Natural Gas - 1 CF (cubic foot) Natural Gas



Natural Gas - 1 Therm (1 therm = 100 cu ft)



#2 Fuel Oil - 1 Gallon



Steam - 1 pound (low pressure steam)



Steam - Mlbs (1,000 lbs low pressure steam)



The most common building energy end-use sources, including their Btu conversion rates, are outlined to the left.

The three (3) largest commercial building energy use-sources:

- Electricity - 61%
- Natural Gas - 32%
- District Steam - 5%

EPA Energy Star Portfolio Manager program includes conversion rates that automatically calculate common energy sources to Btu's.

EPA's Energy Star Portfolio Manager program facilitates energy reporting and rating of buildings, based on their use-category, against a common benchmark. The commercial real estate manager's subject building can receive a peer group rating compared to same-use buildings. A rating of 0 to 100 is derived based on the subject building's total annual energy consumption. A 75% rating indicates the subject building performed better than 75% of similar buildings nationwide. This EPA Energy Star rating system is accepted and incorporated into the U.S Green Building Council (USGBC) Leadership in Energy & Environmental Design (LEED) rating system.

BUILDING ENERGY USE INTENSITY (EUI)

Concepts & Applications

Tens of thousands of U.S. commercial buildings' energy consumption data, entered into the EPA Energy Star Portfolio Manager program is periodically surveyed on a national basis. National average EUI information is assembled by the Building Owners and Managers Association (BOMA) into a **Commercial Building Energy Consumption Survey (CBECS)**. A CBECS report was assembled and posted on U.S. Energy Information's website in 1999, 2003, and 2012 - <https://www.eia.gov/>

The 2012 CBECS report is the most recent survey available to commercial real estate owners and operators. Energy data provided in 2018 will be collated and reported later in 2019 resulting in the 2018 Commercial Building Energy Consumption Survey. In addition to overall energy indexing - national median energy intensity within each property type - benchmarking against building size, age, types of building systems, and specific energy sources, is also detailed in the CBECS report.



The CBECS Report benchmarks building energy use across 9 locations within 4 geographical regions - Northeast, Midwest, South, & West. The locations and regions are aligned with the reporting framework utilized by the U.S. Census Bureau.

The average **Energy Use Index (EUI)** in the 2012 CBECS Report - Commercial Buildings Office Category was 77,800 Btu's/SF/year. The average **Water Use Intensity Index** in the 2012 CBECS Report - Commercial Buildings Office Category was 15 gallons per SF per year.

BUILDING ENERGY USE INTENSITY (EUI)

Concepts & Applications



Building Energy Use Intensity (EUI) Calculation

400,000 SF Office Building

Annual Energy Consumption

Electricity - 7 million KWH

$7,000,000 \text{ KWH} \times 3,412 \text{ Btu's/KWH} = 23,884,000,000 \text{ Btu's}$
 $23,884,000,000 \text{ Btu's} / 400,000 \text{ SF} = \mathbf{59,710 \text{ Btu's/SF (EUI)}}$

Natural Gas - 20,000,000 cubic feet

$20,000,000 \text{ CF} \times 1,000 \text{ Btu's/CF} = 20,000,000,000 \text{ Btu's}$
 $20,000,000,000 \text{ Btu's} / 400,000 \text{ SF} = \mathbf{50,000 \text{ Btu's/SF (EUI)}}$

Building Energy Use Intensity (EUI)

$59,710 \text{ (electricity)} + 50,000 \text{ (natural gas)} = \mathbf{109,710 \text{ Btu's/SF}}$

Building Energy Cost Index (ECI) Calculation

400,000 SF Office Building

Annual Energy Cost

Electricity - 7 million KWH

$7,000,000 \text{ KWH} \times \$0.10/\text{KWH} = \$700,000$
 $\$700,000 / 400,000 \text{ SF} = \mathbf{\$1.75/\text{SF}}$

Natural Gas - 20,000,000 cubic feet

$20,000,000 \text{ CF} / 1,000 = 20,000 \text{ MCF (thousand cu ft)}$
 $20,000 \text{ MCF} \times \$8.00/\text{MCF} = \$160,000$
 $\$160,000 / 400,000 = \mathbf{\$.40/\text{SF}}$

Total Building Energy Cost Index (ECI)

$\$1.75 + \$.40 = \mathbf{\$2.15/\text{SF}}$

