Beyond EUI: Intuitive Metrics for Building Performance Management

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ABSTRACT

Energy Use Intensity (EUI), measured in British thermal units per gross square foot per year (BTU/GSF), remains the dominant metric for evaluating commercial building energy performance. EUI provides a convenient measure; however, in isolation, it offers limited insight on efficiency dynamics across diverse portfolios.

This paper introduces and evaluates alternative quantitative metrics derived from EUI to aid utilities analysts. Using a public dataset of federal building utility data, the analysis applies established and novel analytical techniques in an integrated framework to develop a suite of complementary performance indicators. Most methods require only basic algebra and public data, allowing practitioners to enhance internal benchmarking with minimal technical overhead. Because these metrics are derived from standard monthly invoices (consumption and cost data that building owners already receive) they offer a low-cost first step for identifying performance issues without committing to more costly consulting services, submetering, or commercial energy management software.

Initial analysis indicates that richer quantitative measures, presented in a clear and intuitive format, can reveal patterns that inform operational decisions, benchmarking, and retrofit prioritization. Compared with traditional EUI, these indicators more effectively explain variations in cost, highlight actionable opportunities, and communicate performance to non-technical stakeholders, while also advancing resiliency and affordability objectives.

In an era of steep energy price inflation, commercial facility and portfolio managers face growing pressure to curb rising costs through improved efficiency. By framing building performance through a more diverse analytical lens, this work offers energy professionals and policymakers practical tools to manage energy more effectively.

Introduction

Tracking and analyzing energy and water usage is an invaluable exercise for commercial real estate (CRE) organizations. The most basic energy and water usage metrics, presented elegantly and in the correct context, provide fundamental insights. This analysis presents a small set of derived metrics and display techniques designed to give portfolio managers, facility analysts, and policymakers a more actionable picture of building performance.

Motivation

CRE in the U.S. faces several challenges. Rising operating costs (utilities, operations and maintenance, and cleaning) are combining with lower occupancy rates to create difficult conditions for the industry (Kastle Systems 2026). The vast majority of markets, as measured by

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the Atlanta Federal Reserve's "Commercial Real Estate Market Index" (CREMI), are significantly weaker than their long-term averages (Federal Reserve Bank of Atlanta 2026).

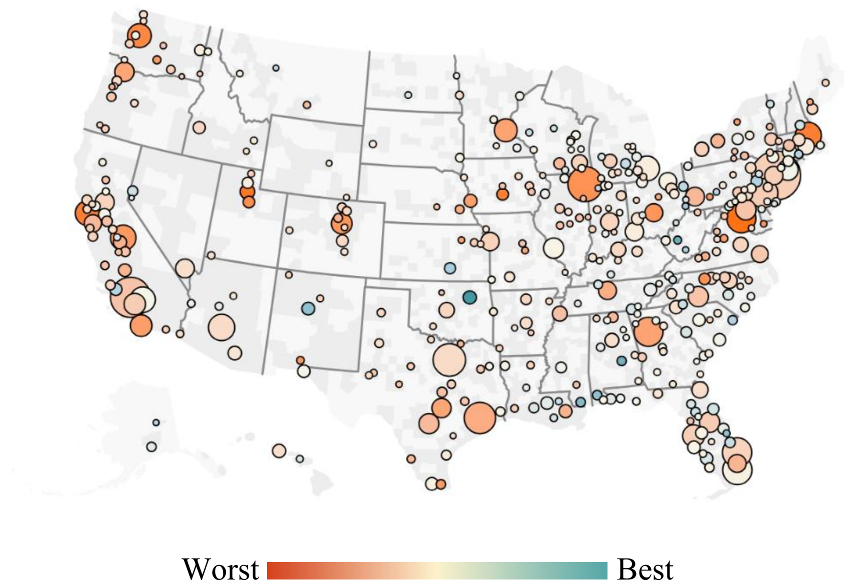

Figure 1: CREMI Index Relative to Long-Term Average, Q3 2025
Source: Federal Reserve Bank of Atlanta 2026

CRE organizations, therefore, must operate at peak efficiencies and with lowest operating costs to maintain a level of profitability. Of the major categories of operating expenses (janitorial, operations and maintenance, and utilities), utilities expenses represent the largest value share (BOMA 2024). And, while costs can be controlled in other ways[2], improving facility efficiency through analysis and benchmarking is an important way to control costs and cost growth. Furthermore, efficiency is interconnected with operations and maintenance programs, air quality, cleanliness, and other fundamental programs in a well-functioning CRE organization (OGP 2026).

Many CRE organizations, particularly those managing smaller portfolios or operating with constrained capital budgets, face a difficult tradeoff when seeking to improve energy and water performance: submetering, building automation systems, and commercial energy management platforms can provide granular, system-level insight, but they require meaningful upfront investment in hardware, software licensing, and ongoing administration.

The metrics presented here offer a lower-cost first step. Because they derive from data already collected through standard monthly billing that every owner receives, they let an organization extract diagnostic value before committing to costlier infrastructure. An owner can use them to identify which buildings, systems, or seasons warrant investigation, then target submetering or upgrades toward those opportunities, rather than deploying investments uniformly without prior evidence of value.

[2] Demand Response and energy supply contracting are often used to control commercial and industrial utilities costs.

Energy Usage Intensity and its Counterparts

Site[3] Energy Use Intensity[4], sometimes referred to as Energy Use Index, is the foundation of most CRE energy usage analysis. Its analogs, Water Use Intensity and Utility Cost Intensity, are similarly useful in operating cost analysis. Each one is simply calculated by dividing the annual quantity, either total consumed British Thermal Units of energy (BTU), total gallons of domestic water usage (Gal.), or total utility costs ($) by the gross square foot of the facility.

Table 1: Core Intensity Metrics by Category

Category	Common Name(s)	Acronym(s)	Calculation
Energy	Energy Use Intensity, Energy Use Index, BTU per Gross Square Foot	EUI, BTU/GSF	$\frac{\sum_{trailing\ 12-Mo.} BTU}{GSF}$
Water	Water Use Intensity, Water Use Index, Gallons per Gross Square Foot	WUI, Gal./GSF	$\frac{\sum_{trailing\ 12-Mo.} Gallon}{GSF}$
Utility Cost	Utility Cost Intensity, Utility Cost Index, Utility Costs per Gross Square Foot	UCI, $/GSF	$\frac{\sum_{trailing\ 12-Mo.} Utility\ \$}{GSF}$
Energy Prices	Energy Price Intensity, Energy Price Index, Energy Rate, Energy Cost per Million BTU	EPI, $/mmBTU	$\frac{\sum_{trailing\ 12-Mo.} Energy\ \$}{\sum_{trailing\ 12-Mo.} mmBTU}$
Water Prices	Water Price Intensity, Water Price Index, Water Rate, Water Cost per kGallon	WPI, $/kGallon	$\frac{\sum_{trailing\ 12-Mo.} Water\ \$}{\sum_{trailing\ 12-Mo.} kGal.}$

GSF is a standard value for facility size normalization, but analysts may decide to use other normalization factors. For example, BTU per rentable square foot may serve as another relevant benchmarking metric. For organizations with diverse geographic territories, normalizing utility costs with other dollar-based quantities may be more appropriate. For example, Utility Cost per Dollar of Revenue may serve as a better utility cost normalization factor across facilities in both high and low-cost cities. Another consideration is the treatment of facilities with dynamic GSF. Analysts might assume that GSF is static, but a building might construct an addition or demolish an unusable wing. In that case, calculating the annualized BTU/GSF is slightly different: instead of summing the trailing 12-months BTU and dividing by GSF, the calculation should be the trailing 12-month sum of the BTU per GSF.

EUI History & Review

Federal authority for energy data collection traces back to the 1970s energy crises. The Federal Energy Administration Act of 1974 (P.L. 93-275) directed the government to collect and disseminate nationwide energy data, with authority later expanded under the Department of

[3] This paper focuses on site energy, or energy delivered to the building regardless of sources. Source energy, while important, is detached from everyday experiences of property managers, engineers, and other key support staff.

[4] Not to be confused with *economic* energy use intensity, or energy usage per unit of gross domestic product.

Energy Organization Act of 1977 (P.L. 95-91), which established the EIA as the agency responsible for national energy statistics. These statutes provided the legal basis for datasets such as the Commercial Buildings Energy Consumption Survey and contributed to the broader adoption of metrics like EUI.

More recently, tools such as the EPA's Energy Star Portfolio Manager have let owners track and benchmark energy and water use. The tool's standardized 0-100 score relies heavily on EUI internally. The Energy Policy Act of 2005 (EPAct 2005) and the Energy Independence and Security Act of 2007 (EISA 2007) established EUI-based performance targets for federal buildings. EPAct 2005 required agencies to reduce EUI relative to a 2003 baseline; EISA 2007 expanded this to a 30% reduction by 2015.

Common Energy Analytic Shortfalls

"Off the shelf" commercial energy management platforms such as IBM Envizi ESG Suite provide dashboards, reports, benchmarking, utility account management support and other services. Performance dashboards, in particular, are a focal point of their product pages (IBM 2026). While these products are highly sophisticated and capable of handling large portfolios, hierarchies, categorical information, and utility interfaces, the analytic dashboards emphasize descriptive reporting (e.g., monthly totals) more than diagnostic indicators that directly support operational decision-making.

For example, public examples of monthly consumption dashboards offer descriptive reporting rather than diagnostic analysis. Energy, water, and utility cost analysis is inherently seasonal, and simply showing monthly consumption provides little diagnostic or analytic value. Requiring users to mentally aggregate seasonal patterns defeats the purpose of energy analysis. More analytically informative indicators such as trailing 12-month performance EUI, weather normalized EUI, moving average convergences, etc. are rarely presented directly. As a result, facility managers may have access to extensive data yet limited insight into the operational drivers of energy consumption.

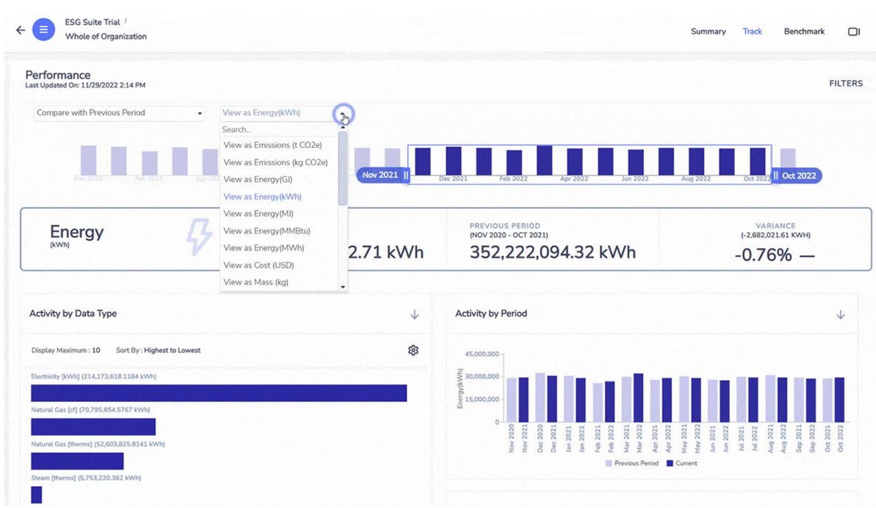

Figure 2: Envizi Product Dashboard
Source: https://www.ibm.com/products/envizi/resources

Furthermore, basic data visualization best practices would discourage displaying a single, large number with multiple decimal places, such as 352,222,094.32 kWh. This display conveys minimal insight and imposes unnecessary cognitive load on the user (Cole 2015). Representing the same quantity in a rounded, human-readable format, e.g., 352.2 M kWh, communicates scale clearly while avoiding false precision. In the context of facility management, O&M staff may keep daily or weekly logs of electricity consumption; therefore, a more appropriate measurement for them might be a trailing 12-month kWh per day.

Data

Data Sources

The U.S. General Services Administration (GSA) plays a central role in the CRE market through its Public Buildings Service (PBS), which manages one of the largest civilian real estate portfolios in the world, comprising hundreds of millions of square feet across federally owned and leased facilities (GSA, PBS 2026). PBS publishes data from its Energy Usage Analysis System (EUAS), including detailed utility consumption for federally managed buildings, distributed through Data.gov to support research, benchmarking, and transparency. EUAS tracks electricity, natural gas, oil, chilled water, steam, and renewable energy (GSA n.d.).

Statewide degree day data was obtained from NOAA, which provides climate datasets including temperature, precipitation, and degree days (NCEI 2025). More localized degree day data existed within PBS records but did not span the full utility time series.

Data Scope

The dataset provided includes over 800,000 rows of monthly utility data spanning from as early as 1973 to as recently as 2019. Individual buildings are identified via a code numbering system using state letters, four numbers, followed by two letters (IL0123ZZ). The fields include:

- BLDGNUM (building number)
- FYR (fiscal year: YYYY)
- FMONTH (fiscal month: MM)
- GOALTRACKED (goal tracked: Y/N)
- BLDCAT (a code that corresponds to goal tracked: A,B,C,D,I)
- GROSSSQFT (gross square feet)
- KWHRAMT (electricity: kilowatt hours)
- KWHRCOST (electricity: cost)
- Additional fields in the same format for other utility types: steam, gas, chilled water, domestic water
- CDD (cooling degree days)
- HDD (heating degree days)

Data Processing

The datasets were generally well organized and clean, suggesting careful maintenance by PBS staff. From the initial dataset of over 800,000 rows, the values for years 2005 through 2019 were retained. Further filters were applied to remove the buildings that did not retain the goal tracked "Y" category. Category "A" was the most common categorical designation, and it was assumed that "A" represented the most common building. Additionally, this categorical combination represented the largest average building across the observation periods. Therefore, the final analysis only retained "A" category buildings from fiscal years 2005 – 2019.[5] After this filtering, the valid remaining data reduced to under 7,000 "BLDGNUM", "YEAR" pairs. Each utility type field was then converted into its corresponding Energy Star BTU value (EPA 2015).

Table 2: BTU Conversion Factors

Utility Type	Common Unit	Abbreviation	Multiplier for BTU
Electricity	Kilowatt Hour	kWh	3,412
Natural Gas	Cubic Feet	CF	1,026
District Steam	Thousand Pounds	MLB	1,000
District Chilled Water	Ton-Hours	TH	12,000

Source: Energy Star

Metrics & Benchmarking Techniques

Basic EUI Metrics & Context

A meaningful display of EUI-derived metrics includes the following:

1. EUI value (BTU/GSF or kBTU/GSF);
2. Percent change from a consistent interval (one year ago, three years ago, or a relevant baseline period);
3. Longer term, seasonally adjusted trend (trailing 12-month annualized BTU/GSF);
4. Context or comparison against a measure of central tendency (average, median, Energy Star listed average, CBECS average, etc.).

Figure 3 examines PBS facility "IL0303ZZ", an 828,102 GSF building in Illinois. Based on calculated BTU/GSF, long-term trends, and relevant comparison values, this building had strong energy usage performance throughout the 2005 – 2019 study period. Energy usage consistently decreased, year-over-year, and its usage was 41% lower than the 2018 CBECS EUI benchmark for office buildings in the upper Midwest (EIA 2022).

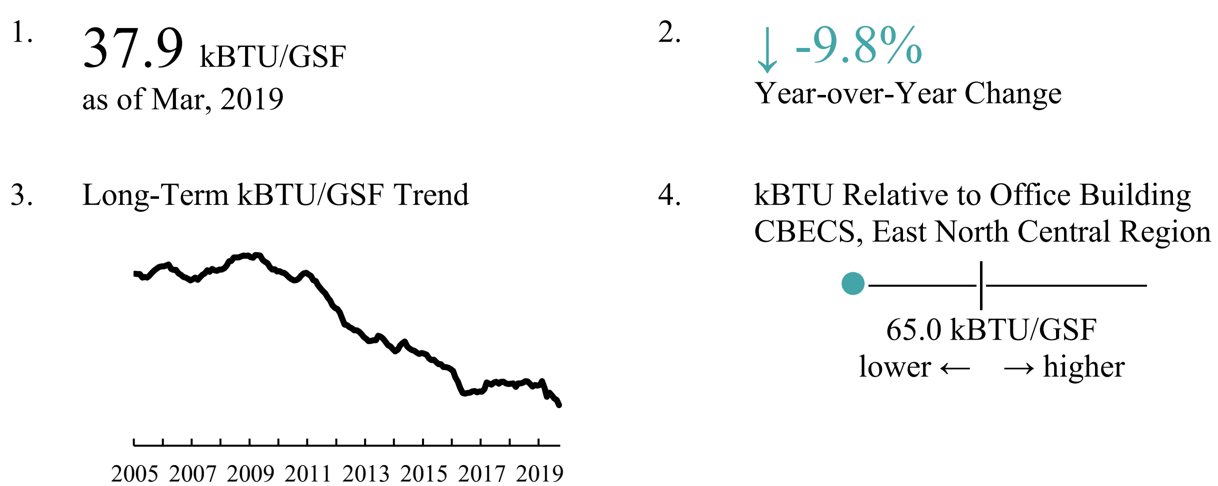

Figure 3: Four Recommended EUI Display Components for IL0303ZZ

[5] Fiscal years for the federal government run from October – September. E.g. October, FY2009 equals October CY2008.

Figure 4 examines PBS facility “IL0222ZZ”, a 19,559 GSF building in Illinois. Based on calculated BTU/GSF, long-term trends, and relevant comparison values, this building struggled with energy performance throughout the 2005 – 2019 study period. Energy usage alternated between years of reductions and increases. Its usage in 2019 was 13% higher than the 2018 CBECS EUI benchmark for office buildings in the upper Midwest.

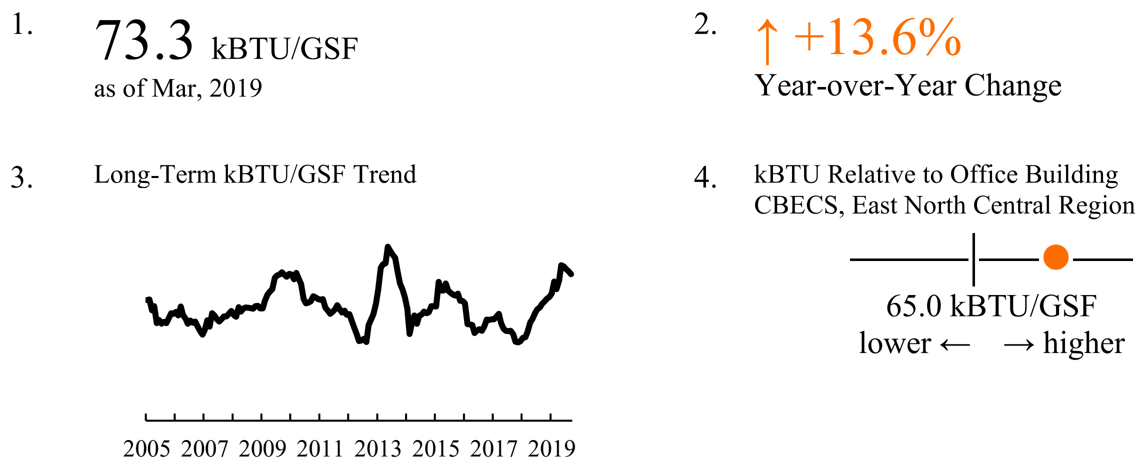

Figure 4: Four Recommended EUI Display Components for IL0222ZZ

Integrated EUI Trend Display

While the four components described above each convey a distinct piece of information, presenting them separately requires the reader to mentally assemble a complete picture of facility performance. A more effective approach consolidates the four elements into a single, compact display that communicates current performance, recent trajectory, historical context, and benchmark comparison in one view.

Figure 5 presents such a display for PBS facility "IL0303ZZ." The current trailing 12-month BTU/GSF value and its year-over-year change are presented together as a headline figure, directly above the long-term trend line, allowing the reader to immediately situate the current value within its historical trajectory rather than interpreting it in isolation. The relative benchmark comparison (positioned in the upper right) provides external context without requiring a separate figure or table.

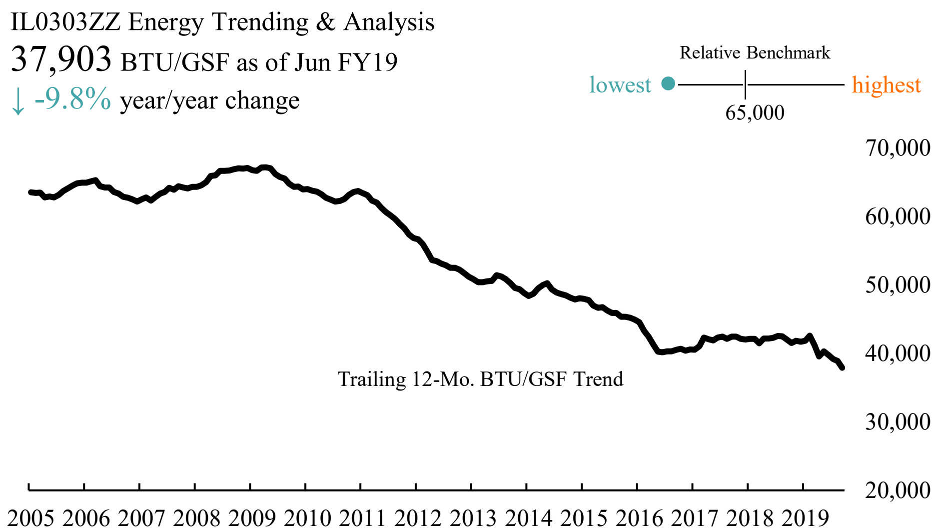

Figure 5: Consolidated EUI Metric View

This consolidated format offers several advantages over the four-panel presentation. First, it reduces the cognitive burden on the reader by eliminating the need to cross-reference separate panels; the headline value, trend, and context are read as a single coherent narrative rather than four independent data points. Second, it more closely mirrors the analytical workflow of a facility manager or analyst, who typically wants to know simultaneously "where are we now," "how did we get here," and "how does this compare." Third, the format scales well to portfolio-level reporting, where a single, compact visual template can be applied consistently across many buildings, supporting rapid comparison and prioritization.

The integrated display does not introduce new analytical content beyond the four components already discussed; rather, it demonstrates that thoughtful visual consolidation, informed by basic data visualization principles, can meaningfully increase the interpretive value of existing metrics without additional computational complexity (Few 2013).

Percentile-based banding.

Figure 6 presents an alternative approach: rather than a single point-in-time benchmark, the facility's trailing 12-month BTU/GSF trend is overlaid on shaded percentile bands (20th–40th to represent very efficient range, 40th–60th to represent the average or typical range, 60th–80th to represent the inefficient range) computed from a peer set at each point in time. This provides constant, near-real-time context. The reader can see the facility's relative standing evolve continuously, rather than only at the most recent observation. In Figure 6, the building moves from being a relatively average performer (yellow band) briefly into the 60th–80th percentile band (reddish). From then on, the building consistently drops through the typical (yellow) range into the high-performance 20th–40th band (greenish) by the end of the period. A single point context comparison would not reveal this trajectory and performance evolution.

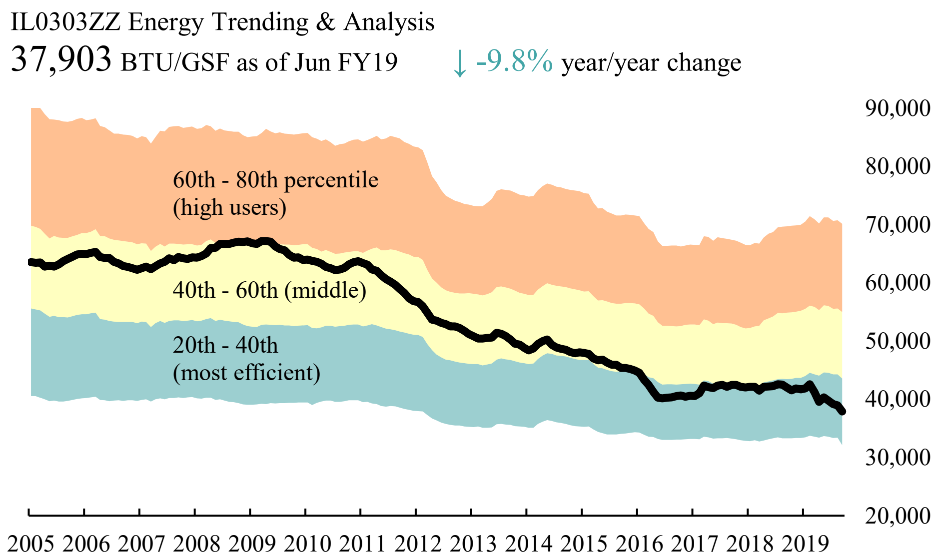

Figure 6: Consolidated EUI Metric View with Percentile Banding

This added value comes at a cost. Constructing rolling percentile bands requires a sufficiently large, consistently defined peer group at every point along the time axis. This is feasible for a portfolio the size of GSA's federal buildings, but likely impractical for an individual facility manager or smaller organization lacking enough comparable buildings, particularly once the peer group is further filtered by climate, building type, or size.

The display, while intuitive, is also harder to interpret than the four-component format, requiring the reader to understand both what a percentile band represents and how to read a trend line moving through shifting bands. The bands are also sensitive to changes in the underlying peer group's composition over time, which can shift the bands for reasons unrelated to genuine changes in peer performance. For most facility managers and smaller portfolios, the simpler four-component display remains more practical, even at the cost of the continuous context this approach provides.

Advanced EUI Metrics & Context

Degree-day-normalized EUI (BTU/GSF per TDD).

More advanced EUI based metrics can reveal deeper insight into facility performance. Weather plays a large role in energy usage patterns, and fluctuations in weather conditions can account for large portions of variability (Jarzomski 2026). Weather, measured in degree days, offers a particularly useful way of further normalizing energy usage. Analysts often perform regression analysis of consumption against a temperature measure (e.g. average outdoor temperature); however, by annualizing total degree days (TDD or heating degree days (HDD) + cooling degree days (CDD)), it allows for a secondary normalization factor which is more useful for longer-term performance trending and direct comparisons between different facilities.

$$BTU\ /\ GSF_{TDD} = \frac{\left(\frac{\sum_{trailing\ 12-Mo.} BTU}{GSF}\right)}{\sum_{trailing\ 12-Mo.} TDD}$$

This is particularly useful, as it can be used to compare facilities across more diverse climates, unlike EUI. In the previous example from PBS building IL0222ZZ, patterns and correlations between the weather conditions and energy (BTU/GSF) emerge.

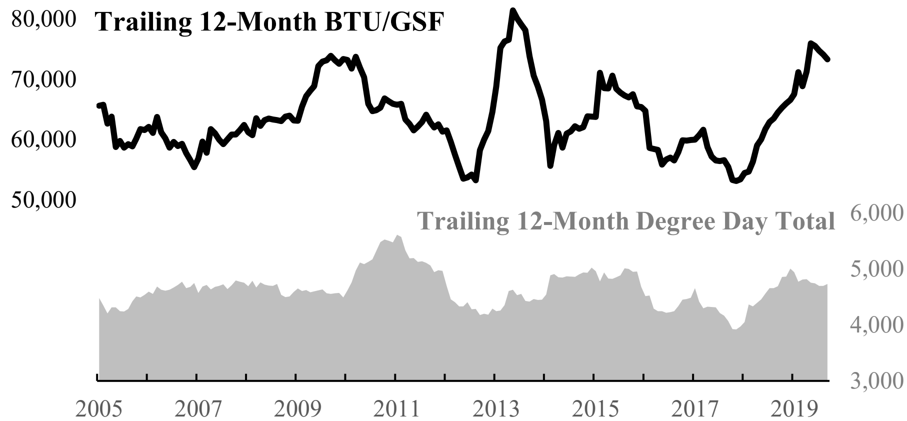

Figure 7: IL0222ZZ BTU/GSF and Trailing-12 Month Degree Day

For example, notice BTU/GSF increases drastically in late 2012 while TDD increases slightly. This may indicate operational problems or equipment failures. Alternatively, more data might reveal major changes in occupancy or data quality problems. In the period after 2015, BTU/GSF and TDD are more tightly correlated and rise and fall together which might indicate energy usage is actually becoming more responsive to weather conditions. IN1703ZZ, a large facility in Indiana, exhibited significant energy reductions, as measured by BTU/GSF per TDD.

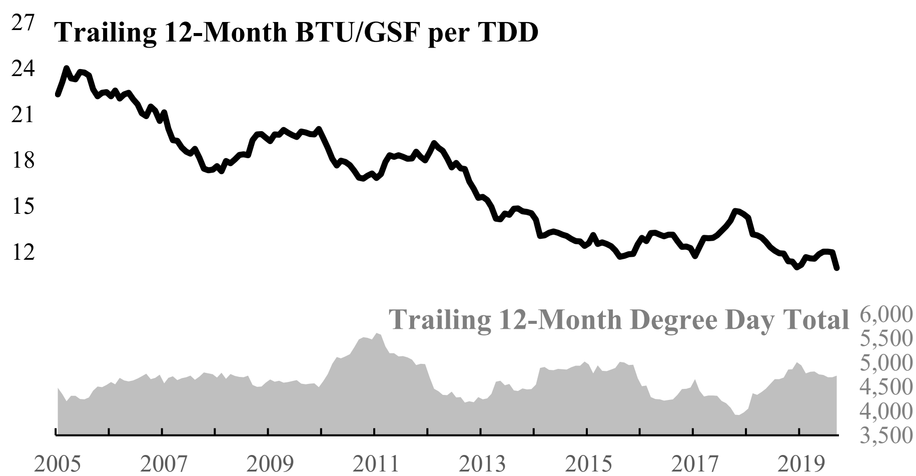

Figure 8: IN1703ZZ BTU/GSF per TDD

Seasonally decomposed EUI.

As discussed, energy and water usage are highly seasonal. In a typical building, there is a larger peak monthly energy usage in winter months (typically January or February) and a smaller peak in summer months (typically July or August). The lowest monthly usage typically occurs in

September or October. For Southern states, April and May were the minimum energy usage months most frequently.

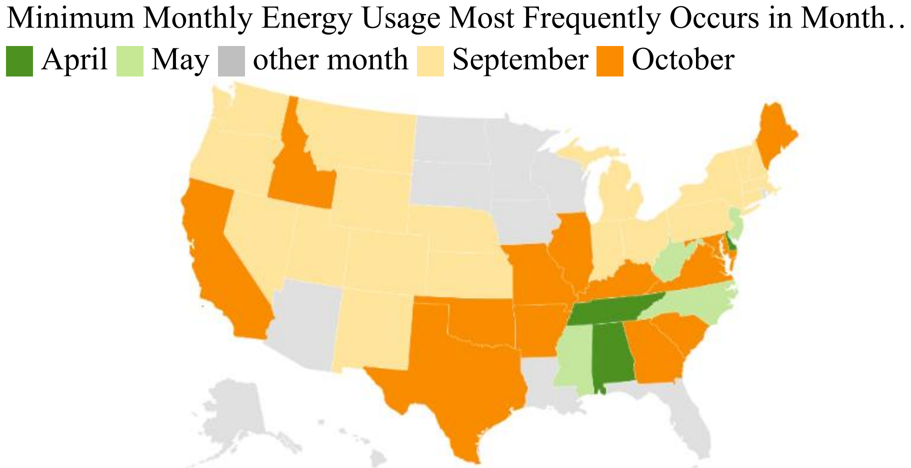

Figure 9: Most Frequent Month for Minimum Energy Use (2010 – 2016)

Non-seasonal energy components typically include lighting, domestic water pumping, domestic water heating, ventilation, air distribution, and plug loads, as well as 24/7 space conditioning operations for data centers or laboratories. *Seasonal* energy usage includes space heating, chilled water and air conditioning, and dehumidification. Note that for some facilities, the addition of solar power may push the minimum energy usage to new, lower levels in the summer rather than the spring and fall "shoulder seasons". By recognizing these seasonal differences and defining the lowest monthly usage as the non-seasonal energy component, an analyst may readily isolate the seasonal component of energy usage and apply trend analysis to each separately.

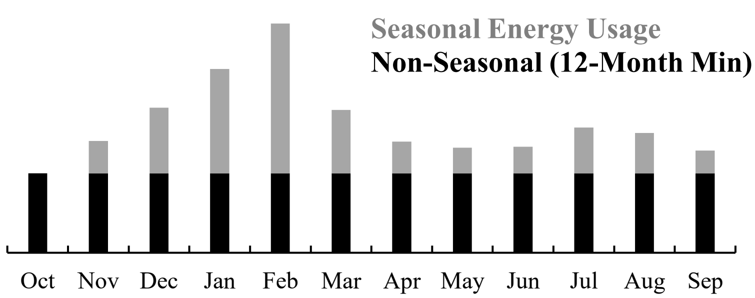

Figure 10: Non-Seasonal and Seasonal BTU/GSF Decomposition

This decomposition is formalized as follows. The non-seasonal component is defined as the minimum trailing 12-month monthly BTU/GSF value, annualized. The seasonal component is then the residual: the difference between total BTU/GSF and the non-seasonal floor:

$$BTU/GSF_{Non-Seasonal} = \min_{Trailing\ 12-Mo.}(BTU/GSF) \times 12$$

$$BTU/GSF_{Seasonal} = (BTU/GSF) - (BTU/GSF_{Non-Seasonal})$$

By defining BTU/GSF in this manner, trends may be observed that are otherwise hidden within broader, aggregated energy usage figures. For example, Figure 11 examines KY0006ZZ, a smaller Kentucky building.

The seasonal decomposition process reveals two components moving in markedly different directions. Non-seasonal BTU/GSF (black) rises in discrete steps (which is a natural consequence of being defined as a rolling 12-month minimum) and climbs from roughly 26,000 in 2005 to about 42,000 by 2019. Seasonal BTU/GSF (gray), by contrast, shows no comparable trend, and if anything declines modestly in later years.

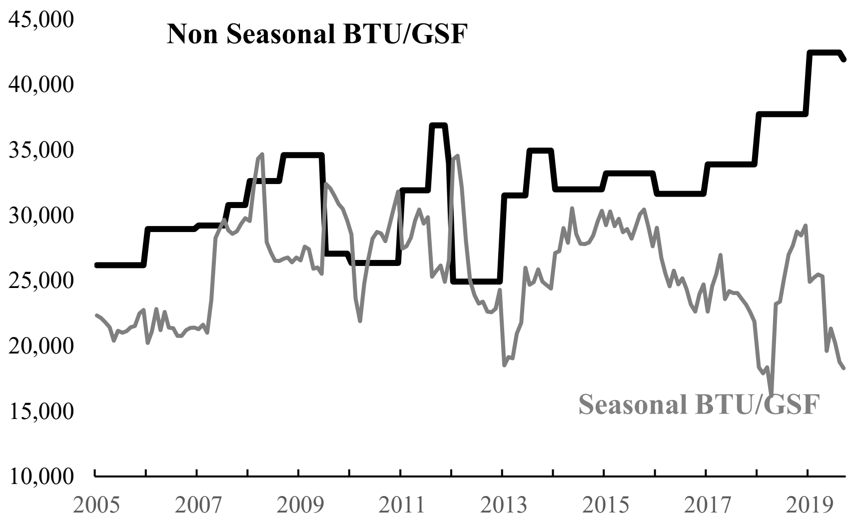

Figure 11: Non-Seasonal and Seasonal Trailing 12-Month BTU/GSF Decomposition

This divergence is analytically meaningful. Since non-seasonal usage is attributed to relatively constant loads (lighting, plug loads, ventilation) while seasonal usage reflects weather-driven loads (heating, cooling), a rising non-seasonal floor alongside flat seasonal usage suggests the building's base load, not its weather sensitivity, is driving overall energy growth. This points toward plug loads, equipment additions, or occupancy/schedule changes as likely causes, rather than envelope or HVAC efficiency issues. Notably, an aggregate BTU/GSF trend alone would likely understate this finding, since the rising non-seasonal component and declining seasonal component partially offset each other. The decomposition reveals a base-load trend that would otherwise stay hidden.

Moving average convergence/divergence (BTU/GSF trend acceleration).

While trailing twelve-month BTU/GSF removes seasonal variation, the resulting series may still obscure whether a facility's energy performance is improving, deteriorating, or merely fluctuating around a stable long-term level. Borrowing a technique common in technical market analysis, this study applies a moving average convergence/divergence (MACD) framework to the trailing-12 BTU/GSF series in order to isolate the *rate of change* of energy performance, rather than its level alone. Two moving averages of differing window length are computed from the trailing-12 BTU/GSF series: a twelve-month average, reflecting short-term performance, and a thirty-six-month average, reflecting longer-term performance:

$$MA12_{BTU/GSF} = \frac{1}{12}\sum_{i=0}^{11}\left(\frac{\sum_{trailing\ 12-Mo.} BTU}{GSF}\right)_{t-i}$$

$$MA36_{BTU/GSF} = \frac{1}{36}\sum_{i=0}^{35}\left(\frac{\sum_{trailing\ 12-Mo.} BTU}{GSF}\right)_{t-i}$$

The divergence between these two averages, normalized by the current trailing-12 BTU/GSF value, yields a dimensionless indicator expressed as a percentage:

$$MACD_{BTU/GSF} = \frac{(MA12^{BTU/GSF} - MA36^{BTU/GSF})}{\sum_{trailing\ 12-Mo.}^{BTU}/GSF}$$

A positive value indicates that short-term energy intensity is running above its longer-term trend and performance is deteriorating relative to recent history. A negative value indicates the converse. Because the indicator is normalized by the current BTU/GSF level, it remains comparable across facilities of differing size and baseline efficiency, a property not shared by the underlying moving averages themselves.

Figure 12 applies this technique to CA0154ZZ, a large building in California. Two extended periods of negative divergence, spanning roughly 2007–2011 and 2014–2019, correspond to sustained reductions in energy intensity, while a brief return to positive divergence near 2012–2013 suggests a temporary stall or reversal in those gains before the longer downward trend resumed. Unlike the trailing-12 BTU/GSF series alone, which only confirms a trend after it has persisted for a full annual cycle, the convergence/divergence indicator offers an earlier signal of inflection, making it potentially useful for flagging emerging operational issues or confirming the durability of efficiency gains following a retrofit or capital improvement.

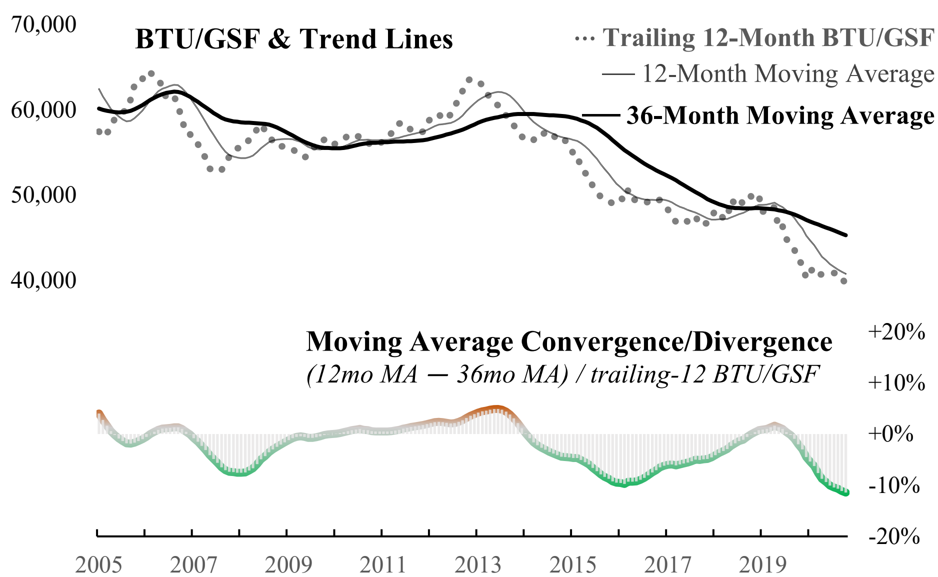

Figure 12: BTU/GSF with Trend Lines (Moving Averages) & MACD Oscillator

Application to Water and Utilities Cost Metrics

The trailing 12-month aggregation, moving average, and seasonal decomposition methods developed above apply directly to Water Use Intensity (WUI) and Utility Cost Intensity (UCI), with minor adjustments for each.

WUI is well suited to seasonal decomposition. Unlike energy, which peaks in winter, water use peaks in summer, driven by cooling tower makeup water and irrigation. The same framework isolates the non-seasonal load (plumbing, base operations) from the seasonal load (cooling towers, irrigation). Since these reflect different capital decisions, isolating the seasonal component lets an analyst better evaluate water-saving investments such as cooling tower controls or irrigation scheduling, which would otherwise be obscured in an aggregate trend.

UCI introduces a complication absent elsewhere: its dollar-denominated numerator is subject to inflation over multi-year horizons. A raw UCI trend across 2005–2019 would conflate real consumption changes with price inflation, requiring deflation to a constant base year before interpretation. An alternative is replacing GSF in the denominator with a facility's functional replacement value, provided it moves with the same market pressures as utility costs (e.g., property value, net operating income, revenue). This normalizes against a dynamic economic quantity rather than a fixed physical one, offering a more stable basis for long-term trending, though it depends on the quality of that denominator data.

Limitations

The analysis relies on a subset of public federal building data, so findings may not generalize to other markets or facility types. The paper also does not document how missing or anomalous readings were handled; a single bad month can distort trailing 12-month trends for up to a year. More fundamentally, these metrics are built from standard billing data without submetering access. This is the source of their value, but also its limit: they can flag that a problem likely exists and offer a coarse sense of where to look, but cannot identify the specific mechanism without operational knowledge or a follow-up walkthrough. They are a first-pass diagnostic layer, not a substitute for system-level investigation.

Similarly, flagged patterns, such as the late-2012 spike in IL0222ZZ, cannot be distinguished from occupancy or metering issues using billing data alone; these metrics generate hypotheses, not conclusions. The seasonal decomposition's reliance on a single lowest monthly value makes it sensitive to anomalies, and TDD normalization assumes a stable weather-usage relationship that may not hold as buildings change over time. Finally, the MACD technique, adapted from financial analysis, has not been independently validated for energy data; all techniques here are descriptive rather than statistical, so patterns should be treated as hypothesis-generating, not confirmatory.

Conclusion

Energy Use Intensity remains the dominant metric for evaluating energy performance in commercial buildings, largely because of its simplicity and its ability to normalize energy consumption across facilities of different sizes. As demonstrated in this analysis, EUI alone provides a limited perspective on building performance, but EUI can be transformed into highly valuable metrics with simple algebra.

Using publicly available data from GSA's PBS utility dataset, this study illustrates how several complementary metrics can significantly enhance the interpretive value of traditional energy benchmarking. Techniques such as trailing twelve-month EUI trends, degree-day normalized energy intensity, and seasonal decomposition provide clearer insight into operational patterns, weather sensitivity, and underlying base loads within buildings. These approaches require only modest analytical complexity yet reveal information that is often obscured in conventional monthly consumption charts or static dashboard displays.

The findings also highlight an important gap between the volume of energy data available to building managers and the analytical clarity provided by many commercial energy management platforms. While modern systems effectively aggregate and organize large datasets, their visualizations frequently emphasize descriptive reporting rather than diagnostic insight. More intuitive metrics and clearer data presentation can substantially improve the ability of facility managers, engineers, and portfolio analysts to identify inefficiencies, prioritize retrofits, and communicate performance outcomes to non-technical stakeholders.

Ultimately, effective energy management depends not only on collecting accurate consumption data but also on presenting that information in ways that align with human decision-making processes. By supplementing conventional EUI reporting with simple but analytically richer indicators, organizations can transform routine utility data into actionable intelligence. These methods provide a practical framework for improving building performance management and offer a foundation for further research into intuitive metrics for large commercial real estate portfolios.

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AI-Assisted Tools Disclosure

AI-assisted tools used: ChatGPT; Claude (Anthropic)
Used for: editing, consolidating author's text to meet length requirements, identifying formatting inconsistencies with formatting guidelines, creating citations, validating use of mathematical notation
Extent: light editing, phrasing, AI-driven feedback
Human review: The author reviewed and verified all content, calculations, and citations.