## Title

Evaluation of U.S. Building Energy Benchmarking and Transparency Programs: Attributes, Impacts, and Best Practices



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# Evaluation of U.S. Building Energy Benchmarking and Transparency Programs: Attributes, Impacts, and Best Practices

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# Disclaimer

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# Acronyms and Abbreviations

| | |
|---|---|
| B&T | Benchmarking and transparency |
| DOE | U.S. Department of Energy |
| EPA | U.S. Environmental Protection Agency |
| EPBD | Energy Performance of Buildings Directive |
| EPC | Energy performance certificate |
| EU | European Union |
| EUI | Energy Use Intensity |
| FTE | Full time equivalent |
| IMT | Institute for Market Transformation |
| LEED | Leadership in Energy and Environmental Design |
| RFF | Resources for the Future |
| SFE | San Francisco Environment |

# Executive Summary

In the last decade, a new policy area has emerged to boost energy efficiency in buildings that focuses on the simple action of measuring energy use as compared to buildings of similar type and size, and making that data publicly available. These efforts, referred to as benchmarking and transparency (B&T) policies, seek to unlock new energy efficiency opportunities in the country's existing buildings by promoting data-driven decision making, and creating stronger market signals. Using data collected from B&T policies, building owners, managers, and operators can identify opportunities to cost-effectively reduce wasted energy and water. Local and state governments can use the data to help achieve economic goals such as increasing local jobs and creating higher property values, or inform energy efficiency programs funded by the public or utility customers.

As of December 2016, 24 U.S. jurisdictions have adopted B&T policies that require reporting of energy consumption for privately-owned commercial or multifamily buildings, or both. These policies continue to gain popularity and are being adopted at a rapid pace across the country by local and state governments.

Some B&T policies are accompanied by requirements under complementary policies, such as energy audits and retro-commissioning. Both energy audits and retro-commissioning, similar to data from B&T policies, identify opportunities for improving building energy performance through equipment and system upgrades, or through maintenance, reprogramming, and other process improvements.

## Purpose of the report

The Energy Efficiency Improvement Act of 2015 requires the U.S. Department of Energy to provide Congress with an overview of policy and implementation attributes of B&T policies in the nation, and a study to summarize known performance impacts of state and local energy B&T policies on privately owned buildings.[1]

This report focuses on the 24 state and local jurisdictions that (as of December 31, 2016) require owners of privately owned commercial buildings, multifamily buildings, or both to comply with a B&T policy.[2] Thirteen other jurisdictions require that only publicly owned buildings must comply with a B&T policy.[3]

[1] Energy Efficiency Improvement Act of 2015, 42 USC 17063 (b).

[2] Atlanta, GA; Austin, TX; Berkeley, CA; Boston, MA; Boulder, CO; Cambridge, MA; Chicago, IL; Denver, CO; Evanston, IL; Kansas City, MO; Los Angeles, CA; Minneapolis, MN; Montgomery County, MD; New York City, NY; Orlando, FL; Philadelphia, PA; Pittsburgh, PA; Portland, ME; Portland, OR; San Francisco, CA; Seattle, WA; Washington, D.C.; and the states of California and Washington.

[3] Alabama; Cook County, IL; Delaware; Hawaii; Michigan; Minnesota; New York; Ohio; Oklahoma; Oregon; Salt Lake City; Utah; and West Chester, PA.

## Overview of the report

This report provides a summary of U.S. B&T policy design and implementation characteristics, including:

- Building types and sizes
- Phased implementation
- Data submission and requirements
- Exemptions, enforcement, penalties, and compliance
- Market education and outreach
- Data quality assurance
- Compliance help centers
- Cost of policy implementation and enforcement
- Utility data access and privacy
- Complementary policies associated with B&T policies
- International experiences

The report then summarizes reported results and impacts from jurisdictions with B&T policies and discusses opportunities for increasing the efficacy of B&T policies, as well as suggested areas for further research.

## Summary of report findings

The fast pace at which new B&T policies are being adopted indicates significant city and state interest in them. As of December 2016, ten of the twenty-five most populated U.S. cities have B&T policies. Best practices from more experienced jurisdictions are being documented and replicated. Among the elements jurisdictions identify as helping ensure B&T policy success are educating and conducting outreach to the affected building sectors prior to policy compliance requirements, using help desks to aid in compliance, requiring utilities to provide building owners and authorized representatives access to whole-building energy data, and providing downloadable spreadsheets and online visualization tools.

The U.S. Environmental Protection Agency's (EPA's) ENERGY STAR® Portfolio Manager® tool also aids jurisdictions in B&T policy success by bringing consistency to the user experience of building owners and managers required to comply with B&T policies. ENERGY STAR resources bring training and implementation costs down, and Portfolio Manager web services provide a cost-free application program interface for utilities to import and benchmark their customers' data, further reducing the burden of compliance.

This report also identifies a number of ways to improve B&T policy implementation and performance. These include the following:

- Two opportunities could allow for a faster transfer of high quality information from the jurisdictions to market actors that can use the information: 1) improving the accuracy and

granularity of data reported for B&T policy compliance and 2) publishing annual B&T reports with consistent summary statistics and performance metrics.
- Continuing and expanding impact evaluation of a wide range of performance metrics, as well as process evaluation, will provide timely feedback to B&T policy developers and implementing agencies that can use the information to improve policy efficacy.
- Providing a range of support services at the local level can help building owners comply with B&T requirements and use benchmarking information to improve their facilities. At the state level, agencies may be able to play an increasing role as a resource provider for local jurisdictions adopting and implementing B&T policies (e.g., working with utilities on improving building energy data access).

B&T policies are enabling strategies that rely on identifying and using data on energy and other resource consumption in buildings to support improvements in energy efficiency and related impacts, such as reduction in water consumption and air pollution. These strategies themselves do not improve energy efficiency or reduce water consumption and pollution. Instead, they address barriers to achieving these goals, primarily the lack of information on potential opportunities and benefits of reducing energy waste in buildings.

B&T policies, and the data they offer, are intended to positively support the way real estate and efficiency markets interact — how manufacturers, distributors, retailers, consumers, and others buy and sell energy-related products and services. Evaluation of the success of B&T policies should focus on whether the policies induce changes in market adoption of energy technologies and practices, as well as changes in energy use. Unfortunately, there are few published studies that focus on this broader market impact's connection with B&T policies. Evaluating such indicators, using experience gained from related fields, is one of this report's recommendations.

However, we are gaining insight into the energy impacts associated with state and local B&T policies. All but one of the B&T policy evaluation studies reviewed for this report indicate some reduction (from 1.6 to 14 percent) in energy use, energy costs, or energy intensity over the two- to four-year period of the analyses.[4] More specifically, most of the studies reviewed for this report indicate 3 to 8 percent reductions in gross energy consumption or energy use intensity over a two- to four-year period of B&T policy implementation. This energy savings range is generally consistent with the impacts reported from evaluations of benchmarking policies in general (e.g., policies that do not necessarily include mandatory reporting.)[5] Also, two additional evaluation studies indicate that there is a causal relationship between B&T policies and energy savings or energy cost savings.

These documented impacts should be reviewed with some caution. While consistently showing energy savings benefits associated with B&T policies, all of the evaluation study indications of savings should

[4] For comparison, the U.S. Energy Information Administration's 2017 reference case projects that U.S. total energy consumption increases by a total of only about 5 percent between 2016 and 2040. Annual Energy Outlook 2017 with projections to 2050, U.S. Energy Information Administration, January 5, 2017, http://www.eia.gov/outlooks/aeo/.

[5] Such as analyses prepared by the U.S. Environmental Protection Agency (EPA ENERGY STAR Portfolio Manager Data Trends), multifamily benchmarking program in Minnesota, voluntary benchmarking programs in Washington, D.C., and other countries.

be considered preliminary. This is because of the limited period of analyses and inconsistencies among analysis methods for the various studies. Future, more rigorous analyses may provide data and conclusions that confirm, or do not confirm, these initial findings and provide greater specificity on the range of energy impacts and any causal relationships.

There are a number of non-energy benefits that are logically connected with B&T policies, for building owners and occupants, utility systems, and society. These may include water use and water treatment savings, increased property values, improved productivity of building tenants, reduced greenhouse gases and other air pollution, and local economic development (direct, indirect, and induced job growth). To date there has only been one comprehensive study of some of these potential impacts, for New York City—and it showed positive non-energy impacts with respect to job growth and reduced greenhouse gas emissions. Analyses by other jurisdictions will provide additional data on the non-energy benefits of B&T policies.

A nationally standardized method for data collection, reporting, and evaluation of B&T policies—developed with an advisory group of state and local jurisdictions, energy efficiency and evaluation experts, building owner and real estate associations, and other stakeholders—could improve the consistency and quality of B&T impact studies, providing policymakers and others with a more complete understanding of the present and future impacts of these policies.

# 1 Introduction

## 1.1 Background on U.S. building energy benchmarking and transparency policies and complementary policies

For about a decade, state and local governments have explored policy options that would better leverage building energy use data as a way to identify opportunities for reduction of energy waste and to achieve economic, sustainability, and pollution reduction goals. As of December 31, 2016, 24 U.S. jurisdictions had adopted what are known as benchmarking and transparency (B&T) policies that require reporting and disclosure of energy consumption for privately owned commercial or multifamily buildings, or both.

Benchmarking policies require that energy use and other relevant data for buildings of a certain type and size be measured and reported annually. Building owners or managers provide the data to the designated state or local government jurisdiction, typically the state energy office or city sustainability office. Most jurisdictions that require benchmarking also include transparency, referring to requirements that a subset of the reported data be made publicly available. Together, benchmarking and transparency policies are intended to support energy efficiency activity by raising awareness of building energy consumption, helping to identify opportunities for energy efficiency upgrades, and spurring private sector investment to finance solutions.

Some B&T policies are accompanied by requirements for additional, complementary actions, such as building energy audits and retro-commissioning. Energy audits, conducted by certified technicians, identify opportunities and make recommendations for improving building performance through efficient equipment and system upgrades. Retro-commissioning is a closely related process that identifies opportunities for improving the efficiency of a building's existing mechanical, lighting, and control systems through maintenance, reprogramming, and other process improvements.[6]

State and local governments adopt B&T policies as a tool to identify opportunities for reduction of energy waste and to achieve economic, sustainability, and pollution reduction goals. As of December 2016, 24 U.S. jurisdictions had adopted B&T policies that require privately owned commercial or multifamily buildings, or both, to report energy consumption.

## 1.2 Types of studies and reports to date

A variety of reports and studies on B&T policies in the U.S. and abroad are available. From a national perspective, some reports discuss B&T policy design and impacts.[7] Others focus on specific components of B&T policies, such as impact evaluations, stakeholder support functions (help desks), effective

[6] Palmer and Walls (2015a).
[7] See Dillingham and Badoian-Kriticos (2016); Hart (2015); Palmer and Wells (2015a); Palmer and Wells (2015b).

communication of B&T policies, and best practices for using utility data for B&T policy compliance.[8] Some jurisdictions publish annual B&T reports and infographics.[9] The frequency and content of these reports vary widely by jurisdiction. Some jurisdictions provide online platforms with building energy data available for download.[10]

## 1.3 Report organization

This report is organized as follows:

- Chapter 2 discusses data sources and research approach.
- Chapter 3 summarizes existing U.S. benchmarking and transparency policies as of December 31, 2016.
- Chapter 4 summarizes impacts of the ordinances in a number of jurisdictions.
- Chapter 5 evaluates the national impact of benchmarking and transparency policies to date.
- Chapter 6 discusses opportunities to improve the ability of policies to effectively achieve their intended outcomes.

[8] See Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015a); Krukowski and Keicher (2012); Zullo et al. (2016); Freeh (2016); SEE Action (2013); DOE (2016a); and DOE (2016b).

[9] See City of Boston (2015); City of Cambridge (2016); City of Chicago (2015); City of Minneapolis (2016); City of New York (2016); City of Philadelphia (2016); City of Portland (2016); SF Environment (2015); and Seattle Office of Sustainability and Environment (2015).

[10] See The City of Philadelphia, Mayor's Office of Sustainability. 2015 Building Energy Benchmarking. http://visualization.phillybuildingbenchmarking.com/#/; NYC Mayor's Office of Sustainability. Data Disclosure & Reports. http://www.nyc.gov/html/gbee/html/plan/ll84_scores.shtml; Minneapolis Health Department. Energy Benchmarking Results for Public and Large Commercial Buildings http://www.minneapolismn.gov/environment/energy/benchmarking; DC.gov Department of Energy & Environment. 2015 Building Benchmarking Dataset. https://doee.dc.gov/node/1203042; Chicago Data Portal. Chicago Energy Benchmarking - 2015 Data Reported in 2016. https://data.cityofchicago.org/Environment-Sustainable-Development/Chicago-Energy-Benchmarking-2015-Data-Reported-in-/ebtp-548e; Greenovate Boston. 2015 and 2016 Reported Energy and Water Metrics. http://berdo.greenovateboston.org/#Data.

# 2 Approach

## 2.1 Data sources

This report relies on the following data sources:

- Interviews with staff from 13 jurisdictions that have implemented B&T policies for at least three years:[11] Austin, TX; Boston, MA; Cambridge, MA; Chicago, IL; Minneapolis, MN;[12] Montgomery County, MD; New York, NY; Philadelphia, PA; San Francisco, CA; Seattle, WA; Washington, D.C; and the states of California and Washington
- Annual reports from jurisdictions that provide compiled information from the ENERGY STAR Portfolio Manager
- Reported U.S. EPA Portfolio Manager inputs
- Third-party evaluations of B&T policies
- Reports by entities such as the U.S. Department of Energy (DOE), the Institute for Market Transformation (IMT), and Resources for the Future (RFF) that cover topics such as lessons learned on policy structure, help desks, guidance for utilities and local governments, impact evaluation, and data sharing

## 2.2 Method

Lawrence Berkeley National Laboratory (Berkeley Lab) developed a standard set of interview questions in consultation with the U.S. Department of Energy and conducted 60-minute interviews with the 13 jurisdictions referenced in Section 2.1. Berkeley Lab also interviewed consultants and organizations with expertise in B&T policies and conducted a literature review, including reports prepared by or for jurisdictions with B&T policies.

Our meta-analysis of B&T policy impacts relies on the energy and non-energy impacts reported by jurisdictions and a limited number of impact evaluations available. Existing data were compiled into a table summarizing the measured impacts of B&T policies to date.

While B&T policies themselves do not directly result in energy and non-energy impacts, they enable such impacts through implementation of supporting policies and dissemination of information which supports market transformation. Thus, we identified four categories of performance metrics to assess the impacts of B&T policies: two for long-term sustained energy and non-energy impacts, one for market transformation indicators, and one for implementation milestones. We did not conduct original impact evaluations to quantify values for each of these performance metrics.

In Chapter 4, we present a summary of how the enabling effects of B&T policies are defined through logic models and how effects (impacts, indicators, and milestones) are evaluated and determined. Also

[11] The U.S. Department of Energy contacted four additional jurisdictions, which declined to be interviewed. In total, 24 jurisdictions have adopted B&T policies for privately owned commercial or multifamily buildings as of December 31, 2016.
[12] Minneapolis released its 2015 B&T data after the cut-off date for new data for this report. City of Minneapolis (2017).

included is a summary of the limited amount of data and quantified performance metrics for the 28 jurisdictions with B&T policies as of December 2016. Chapter 5 presents the conclusions that can be drawn from these limited data through meta-analysis.

# 3 Summary of Existing Building Energy Benchmarking and Transparency Policies

The Energy Efficiency Improvement Act of 2015 requires an overview of key B&T policy and implementation attributes and a study to summarize known performance impacts of state and local energy B&T policies on privately owned buildings (Energy Efficiency Improvement Act of 2015, 42 USC 17063 (b)).

This report focuses on the 24 state and local jurisdictions, where more than 65 million Americans live,[13] that require owners of privately owned commercial buildings, multifamily buildings, or both to comply with a B&T policy.[14] Thirteen other jurisdictions require that only publicly owned buildings must comply with a B&T policy.[15] The number of B&T policies are growing quickly. In 2016 alone, seven cities passed benchmarking ordinances.[16]

The following key policy designs and implementation attributes are summarized in this chapter:

- Building types and sizes
- Phased implementation
- Data submission and requirements
- Exemptions, enforcement, penalties, and compliance
- Transparency approaches
- Market education and outreach
- Data quality assurance Cost of policy implementation and enforcement
- Compliance help centers
- Utility data access and privacy
- Complementary policies
- International experiences

## 3.1 Building types and sizes covered by benchmarking and transparency policies

*Building Types – Commercial and Multifamily*

Sixteen of the 24 B&T policies apply to both private commercial and multifamily buildings.[17] Seven of these policies apply only to commercial buildings (Boulder; Minneapolis; Montgomery County MD;

[13] U.S. Census Bureau, https://www.census.gov/

[14] Atlanta, GA; Austin, TX; Berkeley, CA; Boston, MA; Boulder, CO; Cambridge, MA; Chicago, IL; Denver, CO; Evanston, IL; Kansas City, MO; Los Angeles, CA; Minneapolis, MN; Montgomery County, MD; New York City, NY; Orlando, FL; Philadelphia, PA; Pittsburgh, PA; Portland, ME; Portland, OR; San Francisco, CA; Seattle, WA; Washington, D.C.; and the states of California and Washington.

[15] Alabama; Cook County, IL; Delaware; Hawaii; Michigan; Minnesota; New York; Ohio; Oklahoma; Oregon; Salt Lake City; Utah; and West Chester, PA.

[16] Denver, CO; Evanston, IL; Los Angeles, CA; Montgomery County, MD; Orlando, FL; Pittsburgh, PA; and Portland, ME.

[17] Atlanta; Austin; Berkeley; Boston; California; Cambridge; Chicago; Denver; Evanston, IL; Kansas City; Los Angeles; New York City; Orlando; Philadelphia; Portland, ME; Seattle, and Washington, D.C.

Pittsburg; Portland, OR; San Francisco; and Washington State). Most jurisdictions do not provide data on the portion of covered floor area that applies to commercial versus multifamily property. Office buildings are typically the largest portion of total square footage that must comply with the policy, but the limited data available indicates that multifamily properties can comprise a significant portion of the total square footage that must comply with the policy. For example, in New York City, of the 2.06 billion square feet ($ft^2$) covered by the policy, 1.31 billion (64 percent) is in multifamily buildings and 745 million (36 percent) is in commercial buildings.

Multifamily buildings are increasingly being included in B&T policies. Five of the six policies passed during the fourth quarter of 2016[18] require multifamily buildings to comply with the B&T policy (see Table A-1 in Appendix A). In addition, several of the jurisdictions interviewed for this report are in the process of expanding, or are considering expanding, their B&T policy to include multifamily properties. For example, the Philadelphia city council voted to add large residential buildings (50,000 $ft^2$ and larger) to the policy in 2015, citing interest in equity and quality of life issues, in addition to energy cost savings for tenants. Staff from Minneapolis and San Francisco also reported that these cities are considering adding multifamily. The San Francisco Department of the Environment identified that more than two-thirds of the city's housing units are in buildings with five or more units, and recommended that the city expand the B&T policy to cover those properties.[19]

*Building Sizes*

Benchmarking and transparency policies vary widely in terms of the sizes of buildings that must comply. For example, Austin's B&T policy covers the greatest range of sizes for commercial and multifamily buildings: commercial buildings 10,000 $ft^2$ and larger and multifamily units with five or more units. Most of the policies cover commercial and multifamily buildings greater than 50,000 $ft^2$, while some set the threshold for compliance at 25,000 $ft^2$ (see Table A-1).

Market size, and level of building owner sophistication for each size category of buildings, are factors that help jurisdictions determine the appropriate building size thresholds for their policy.[20] The lower the threshold size for compliance, the more buildings will be required to participate. Thus, in determining the size thresholds for the policy, jurisdictions weigh potential trade-offs: more buildings mean more city resources are needed for data collection and verification, outreach, help center support, and enforcement.

New York City will expand its coverage to buildings 25,000 $ft^2$ or higher, requiring buildings to comply starting in 2018, which will capture an additional 10,000 properties, though the increase in covered square footage will be relatively small. Staff from the City of Austin reported that when they reduced the original threshold from 75,000 $ft^2$ to 35,000 $ft^2$ and then down again to 10,000 $ft^2$, they discovered that each building size strata had a different owner profile. Owners of smaller buildings typically had much less time and resources to devote to energy management than owners of larger buildings. These

[18] Denver, CO; Evanston, IL; Los Angeles, CA; Orlando, FL; and Portland, ME.
[19] SF Environment (2015).
[20] Dillingham and Badoian-Kritocs (2016).

different strata would likely benefit from different types and levels of effort for outreach and technical support.

## 3.2 Phased implementation

Phased implementation of B&T policies is a common practice.[21] All jurisdictions included in this report, with the exception of California (which has not yet passed regulations on its B&T policy),[22] began to implement their B&T policies by requiring government buildings, the largest privately owned buildings, or both to report their compliance metrics first. Jurisdictions typically roll out new phases annually, adding another building type or size category for each phase.

The phase-in time varies widely among jurisdictions. For example, Minneapolis implemented its B&T policy in two phases: commercial buildings 100,000 $ft^2$ and above (compliance required by June 1, 2014) and commercial buildings 50,000 $ft^2$ and above (compliance required by June 1, 2015). Chicago phased its requirements in over three years, starting with commercial buildings over 250,000 $ft^2$ in year one, commercial buildings over 50,000 $ft^2$, and residential buildings over 250,000 $ft^2$ in year two, and residential buildings over 50,000 $ft^2$ in year three.

Phased implementation is useful, providing the opportunity for government to lead by example and model compliance for other building owners and managers.[23] The process also allowed cities to ramp up capabilities over time, testing and improving the implementation process before rolling out to a larger number of buildings. Jurisdictions interviewed by Berkeley Lab also reported that allowing buildings to phase in helped to achieve building owner and manager support for the policy.

## 3.3 Data submission and requirements

All B&T policies reviewed for this report require submission of building energy metrics and other data for compliance. Exact data requirements vary across jurisdictions, but a common requirement for nearly all of the jurisdictions is to report the building's ENERGY STAR score. In addition, most of the jurisdictions with annual or periodic compliance require owners to populate their data in the U.S. EPA ENERGY STAR Portfolio Manager online tool (Figure 1).

[21] O'Keeffe et al. (2015).
[22] The California Energy Commission is tasked with creating regulations for a statewide energy benchmarking disclosure. See http://www.energy.ca.gov/benchmarking/documents/.
[23] Dillingham and Badoian-Kriticos (2016).

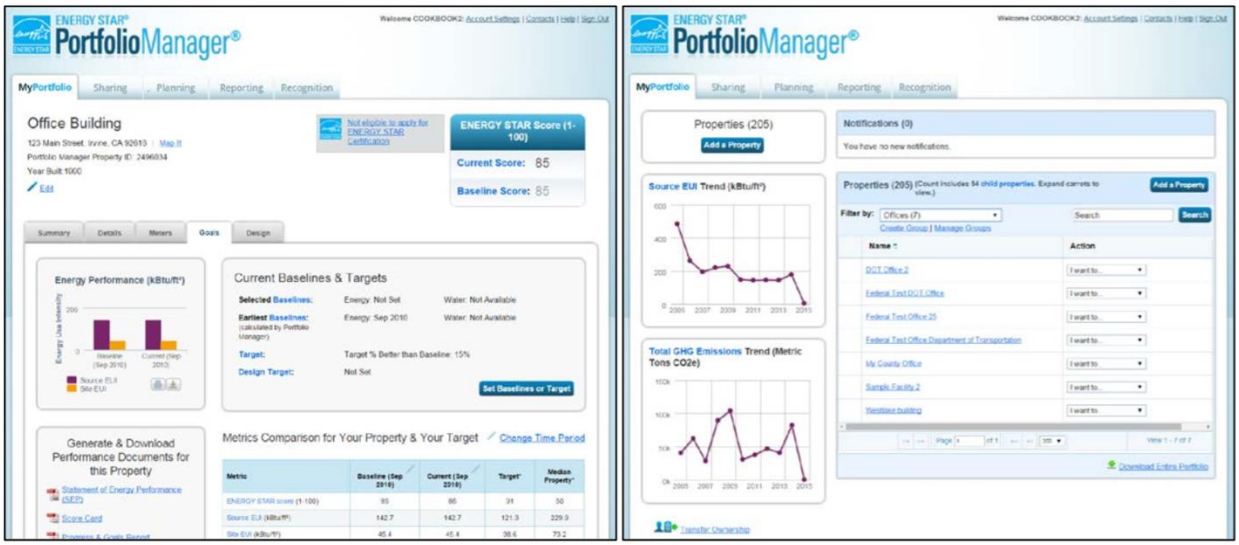


**Figure 1. Sample of Portfolio Manager Views**[24]

The EPA, through the ENERGY STAR program, offers the Portfolio Manager benchmarking tool which enables building owners to assess and manage the energy and water performance of any building. Users enter utility consumption data, cost information, and operational details and Portfolio Manager produces more than 100 energy, water, financial, and greenhouse gas (GHG) emission performance metrics. The EPA recently added waste and materials tracking to the Portfolio Manager.

By benchmarking in Portfolio Manager, many building types can also receive a 1–100 ENERGY STAR score. This score compares a building's energy performance to similar buildings nationwide. A score of 50 represents median energy performance, while a score of 75 means your building performs better than 75 percent of all similar buildings nationwide—and may be eligible for ENERGY STAR certification.

Most B&T policies require that building owners enter their building data into Portfolio Manager because: (1) it is a federal government-backed software tool that is offered for no cost, along with cost-free training resources and technical assistance, (2) Portfolio Manager is used by about 50 percent of the U.S. commercial building market, (3) utilities can use Portfolio Manager web services to send electronic energy use data directly into customer Portfolio Manager accounts upon request, and (4) the Portfolio Manager tool offers features that improve data quality and streamline electronic reporting.

Jurisdictions interviewed by Berkeley Lab identified that Portfolio Manager provides standard data fields and standardized analysis methods to assess the building's energy, water, and emission impacts using widely accepted weather and occupancy data variables. Portfolio Manager is also in compliance with the U.S. government's Federal Information Security Management Act requirements for security and has been granted full authorization to operate. The system has been categorized as "Low Impact"

[24] See the Portfolio Manager website at http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager.

in accordance with Federal Information Processing Standards 199.[25] ENERGY STAR infrastructure follows the most current government guidance and standards by the National Institute of Standards and Technology to ensure that the system is properly secured. The security controls in place cover operational, management, and technical types of controls. The Portfolio Manager tool also has protections in place that go beyond the "Low Impact" requirements, such as access control, configuration management, patch management, physical and environmental protection, and system and information integrity. Data security issues are discussed further in Section 3.10 of this report.

Portfolio Manager may pre-populate some of a building's data fields with default values,[26] to enable building owners who do not have all of the exact values or property use details to generate an initial ENERGY STAR score. However, building owners and managers are encouraged to ultimately obtain and enter actual values for the property. Most jurisdictions currently accept a property as compliant with the B&T policy whether the owner entered actual data or used the Portfolio Manager default values. Some jurisdictions' staff interviewed for this report suggest that one future improvement to B&T policies would be to clearly flag where default values have been used or even allow enforcement for noncompliance when building owners use the Portfolio Manager default values.

Data requirements for B&T compliance varies across jurisdictions. In addition to some variation in the types of data required for compliance, there is also variation in the amount of data that are publicly disclosed. In Los Angeles and San Francisco, the B&T policy explicitly states that the implementing authority will only provide a limited summary of the data submitted. Also, some jurisdictions will not publicly disclose certain information. For example, in Chicago, if 10 percent of a building's floor space is used as a data center, television studio, or trading floor, the city will not share the information publicly.

## 3.4 Exemptions, enforcement, penalties, and compliance

*Exemptions*

Many B&T policies allow for exemptions from compliance. However, the number and type of exemptions vary widely among the jurisdictions. Common exemptions include new buildings (less than two years old), buildings primarily used for manufacturing or industrial purposes, buildings that have not been occupied for an entire year, buildings that have been documented to be efficient or high performance (e.g., ENERGY STAR- or LEED-certified), and buildings where compliance with the B&T policy would cause financial hardship or distress, or is not in the public interest. Seventeen of the 24 jurisdictions provide for one or more exemptions to compliance with the B&T policy (see Table A-2 in Appendix A). To qualify for an exemption, the building owner or manager typically must complete an exemption application process.

[25] Federal Information Processing Standards 199 are the Standards for Security Categorization of Federal Information and Information Systems. For more information see http://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.199.pdf.

[26] Portfolio Manager default values are derived from the sample population of buildings the subject property is being scored against.

*Enforcement*

Jurisdictions use a variety of administrative structures for enforcement of B&T policies (see Appendix A, Table A-3).

*Penalties*

Nineteen jurisdictions have the option to assess financial penalties for noncompliance. Minneapolis may revoke the building registration. Pittsburgh and Orlando may publicly list that a property is required to benchmark but is noncompliant. Denver is not required to use financial penalties. Washington State does not have any penalty for noncompliance in their statutory guidance. Table A-3 lists penalties for each jurisdiction, which range from daily fines to annual fines.

Not all jurisdictions with the authority to issue fines have done so. For example, Cambridge has the authority to enforce the ordinance, but with a 90 to 95 percent compliance rate, has not needed to levy fines to achieve high compliance performance. The San Francisco Department of the Environment has levied no fines to date. Instead, it focuses its enforcement efforts on educational efforts, as lack of compliance can often be due to challenges acquiring the building data rather than recalcitrance.

Washington, D.C., staff report that a warning can help nudge owners into compliance with the B&T policy. The city also issued 200 fines (a $1,000 flat fee) in 2015 and expects it will have issued about the same number in 2016. Building owners can discuss a settlement to reduce the fine, but the city has sometimes required that the owner comply first, before discussing a fine reduction. Until the owner reports benchmarking data, the property remains out of compliance and can be fined again.

*Compliance*

Ten of the 24 jurisdictions reviewed (Boston; Cambridge; Chicago; Minneapolis; New York City; Philadelphia; Portland, OR; San Francisco; Seattle; and Washington, D.C.) include, in their annual reports, compliance rates for mandatory reporting of energy and other data for buildings covered by their B&T ordinances. For those cities, the overall compliance rate ranges from 73 to 99 percent, with most in the upper half of that range—a very high compliance level. These cities generally report higher compliance rates for larger buildings and lower rates for smaller ones. The compliance rates also tend to increase over time as building owners learn more about the programs and outreach and training programs proliferate.

**What Is Compliance?**

The definition of compliance varies from one jurisdiction to another in terms of how B&T policies are implemented. The following is an example summary from Minneapolis (City of Minneapolis 2016).

*Buildings comply with the benchmarking ordinance by submitting either an approved exemption or data submission. Buildings must pass basic data quality standards. Buildings that pass basic data checks are deemed compliant. Submissions that fail these checks are deemed partially compliant and are not included in report analysis. Buildings not in compliance by year two receive citations and fines.*

Table 1 shows overall compliance rates for the ten jurisdictions that report annual compliance rates, as well as other indicators of compliance included in their most recent annual reports.

**Table 1. Benchmarking and Transparency Policy Compliance Rates[27]**

| City | Most Recent Year Overall Compliance Rate (by number of properties) | Other Indicators (e.g., compliance rates by ft²) |
|---|---|---|
| **Boston** | 2013: 73% | • Overall compliance by ft²: 84%<br>• Compliance rate for buildings over 700,000 ft²: 97%<br>• Compliance rate 600,001 – 700,000 ft²: 89%<br>• Compliance rate 500,001 – 600,000 ft²: 100%<br>• Compliance rate 300,001 – 500,000 ft²: 82%<br>• Compliance rate for buildings between 50,000 and 300,000 ft²: 66% |
| **Cambridge** | 2014: 95%<br>2015: 91%[28] | N/A |
| **Chicago** | 2015: 80% | • Overall compliance by ft²: 91%<br>• Compliance rate for buildings at or over 250,000 ft²: 95%<br>• Compliance rate for buildings between 50,000 and 250,000 ft²: 65%<br>*Note: Year-to-year overall compliance rate has declined, as smaller residential properties are now required to report.* |
| **Minneapolis** | 2014: 91% | • Compliance rate for buildings over 100,000 ft²: 100%<br>• Improvement from 75% compliance rate for all buildings in 2013 |
| **New York** | 2013: 87% | • Improvement from 75% to 84% compliance in prior years<br>• Highest compliance rates in multifamily housing and office buildings |
| **Philadelphia** | 2014: 91% | • Similar to compliance rate of 90% in 2013 and 86% in 2012 |
| **Portland, OR** | 2015: 82% | N/A |
| **San Francisco** | N/A | • Reported value in 2014 by ft²: 72%<br>• Reported compliance rates in 2010–2013 by ft²: 81% to 83% for buildings over 50,000 ft²<br>• In California, utilities and regulators had previously interpreted state laws as requiring consent of all separately metered tenants before an owner can obtain energy use information, creating a barrier to compliance reporting. However, AB 802 (Williams, Chapter 590, Statutes of 2015) makes whole-building energy use data available to building owners, their agents, and operators upon request. |
| **Seattle** | 2013: 99%<br>2014: 99%<br>2015: 99% | • Improvement from 93% compliance in 2012<br>• Benchmarked buildings energy consumption decreased by 2.7% |
| **Washington, D.C.** | 2014: 89% | • N/A |

Jurisdictions reported that building owners experienced a range of barriers to compliance. For example, Austin and Boston city staff noted that, compared to larger building owners, owners of smaller buildings (10,000–30,000 ft²) are typically less familiar with energy management practices, have fewer staff, financial resources and time, and may be uncomfortable using the Internet. Overall, based on

[27] As reported by 10 cities for the most recent year data are available.
[28] Personal correspondence with John Bolduc, City of Cambridge.

review of relevant literature and interviews conducted by Berkeley Lab, the major compliance barriers for the owners and operators of buildings include the following:

- Lack of capacity, knowledge, or basic understanding of energy use and related building data and metrics—particularly for smaller building owners
- Malfunctioning meters in smaller or older buildings, which can make benchmarking more challenging
- Difficulty obtaining whole-building energy consumption data from the utility or from tenants
- Difficulty ensuring that all meters representing whole-building energy use are entered in Portfolio Manager
- Challenges using Portfolio Manager, especially for owners or managers who are not technology-savvy

In addition, jurisdictions face their own barriers with regards to supporting compliance, including challenges delivering notifications to building owners and managers and making sure they understood the policy provisions. Those challenges included the following:

- Difficulty getting the correct contact information for the current owner
- Difficulty identifying the correct person at the facility to receive the compliance notice
- Absentee owners
- Validating that correct information has been provided
- Owners or managers who did not speak English

Most of the local jurisdictions provide technical assistance and education services to help building owners overcome compliance barriers. Topics covered by these services include compliance requirements, how to request an exemption, basics of energy accounting, and how to obtain data and use Portfolio Manager. However, some barriers, such as making sure all of a building's meters are accounted for and their data are entered in Portfolio Manager, may require more intensive one-on-one technical assistance, cooperation with the servicing utility(ies), and in some jurisdictions (e.g., California), approval from tenants to access data from separate meters if there are less than three customers in a non-residential building.

Some jurisdictions have been testing different messaging and approaches to facilitate compliance. Chicago established a Behavioral Design team, which included a behavioral science consulting firm, to improve the compliance messaging. The team tested different versions of the compliance notices sent out to building owners to determine which were most effective in encouraging compliance. The team also determined that a streamlined compliance checklist which encouraged people to make their own task plan improved compliance, as compared to the prior, longer, more complex checklist.[29] Also, as described in Section 3.9, nearly all of the jurisdictions have established help centers to support building

[29] City of Chicago (2016).

owners and operators with ordinance compliance. In interviews with Berkeley Lab, jurisdictions reported that the help centers have been vital for achieving high compliance rates.

## 3.5 Transparency approaches

Disclosure of building energy data is an important component of transparency and market transformation.[30] It makes key information about buildings transparent to building owners, managers, tenants, and the market at large and is the first step toward identifying energy efficiency opportunities. There are two primary types of transparency requirements among the B&T ordinances. The more common type is an annual or periodic requirement to report compliance data to an implementing authority, which then makes key data publicly accessible. The less common type requires disclosing a building's energy use information to potential or current building renters or owners at the time of sale or lease (see text box).

**Two Transparency Approaches, Two Levels of Impact**

Two approaches are used to define transparency requirements. These approaches differ in terms of timing and number of people who can potentially benefit from the information. The more common approach requires the building owner to provide compliance data to an implementing authority periodically, annually or by a specified deadline. The authority then makes the building's energy data accessible to the general public via downloadable spreadsheets, through online visualization tools such as interactive maps or benchmarking tools, or both (see Figure 2 for an example of Chicago's building energy mapping tool). The other approach, called *transactional transparency,* requires a building owner to disclose the building's energy use information only at the time of sale or lease to the parties involved in the sale or rental transaction.

Washington State is the only jurisdiction that requires time of sale transparency with no other form of public transparency. Among the disadvantages of this approach: (1) there is no requirement to disclose information to the state, and thus the state cannot track the number of transactions or how many building owners are compliant, and (2) transparency is required only at time of sale or lease contract signing, which is too late in the real estate transaction process to influence the transaction.

In California, the Assembly Bill (AB) 1103 transactional transparency law has been replaced by AB 802, which will enable the California Energy Commission to implement annual benchmarking requirements statewide and publicly disclose the information.

A few jurisdictions, (Seattle, Austin, and Berkeley), require such transactional transparency. They also provide a limited subset of the data to the general public. Washington State is the only jurisdiction that requires transparency at the time a building is sold or rented, but provides no other form of public transparency. Transparency requirements for compliance vary by jurisdiction (see Table A-1).

The approach to disclosing data also varies by the types of data disclosed and format of transparency. In terms of providing benchmarking data to building owners, some of the jurisdictions deliver peer comparison information to the building owner in the form of a report card or scorecard, or a

[30] Market transformation for energy efficiency is "the strategic process of intervening in a market to create lasting change in market behavior by removing identified barriers or exploiting opportunities to accelerate the adoption of all cost-effective energy efficiency as a matter of standard practice." Northwest Energy Efficiency Alliance: https://neea.org/docs/default-source/marketing-tookits/neea_definition_of_markettransformation.pdf?sfvrsn=2

personalized dashboard. Seattle's scorecard, called the Energy Performance Profile, has evolved over the past several years to include more analysis and metrics, recommended improvements, and an estimate of the potential cost savings of the improvements (Figure 3).

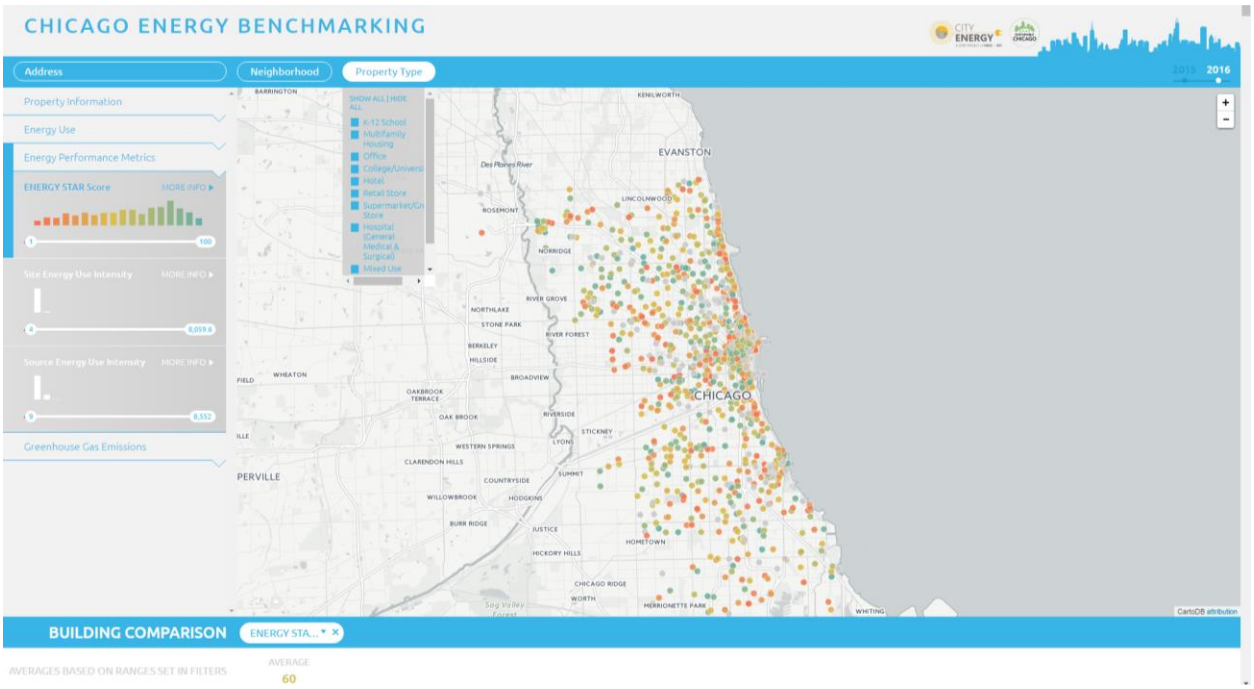


**Figure 2. Chicago Building Energy Benchmarking Online Visualization Tool**

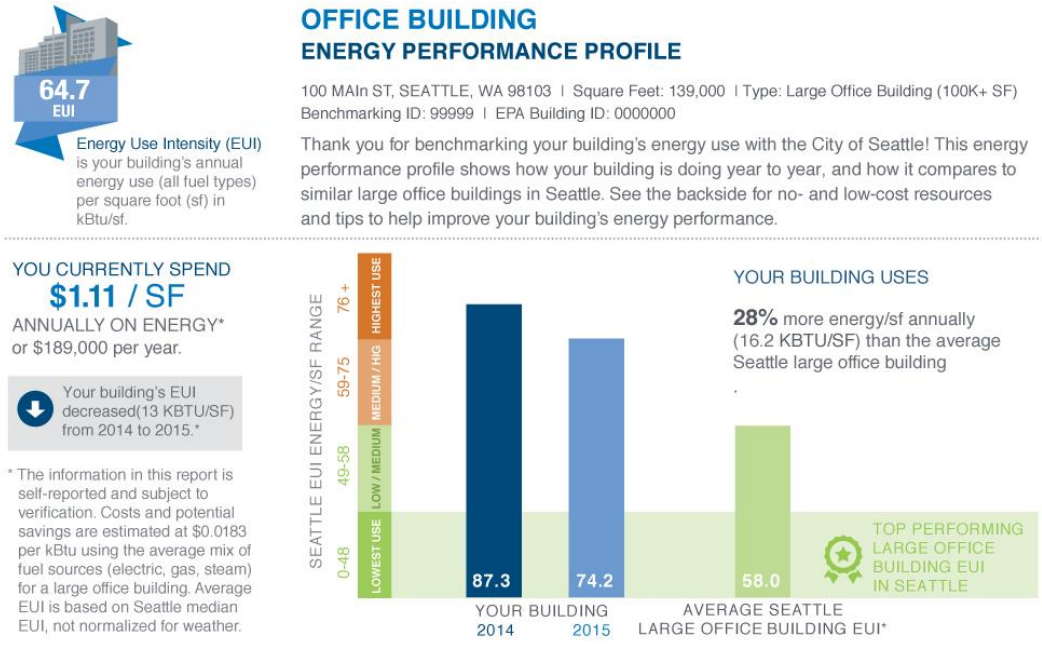


**Figure 3. An Example of Seattle's Energy Performance Profile**

An increasing number of jurisdictions are providing both downloadable spreadsheets of data for the covered properties and online visualization map tools. Chicago's online interactive data map, like others, allows any member of the public to learn about building energy use data, ENERGY STAR scores, and other information by building type and neighborhood (see Figure 2).

Most of the jurisdictions also provide the data in spreadsheet format, either as an interactive tool, such as Seattle's data portal (see Figure 4), or in downloadable spreadsheet format such as the one Philadelphia provides, which lists each covered building, its compliance status, ENERGY STAR score, and reported energy use data, among other information.

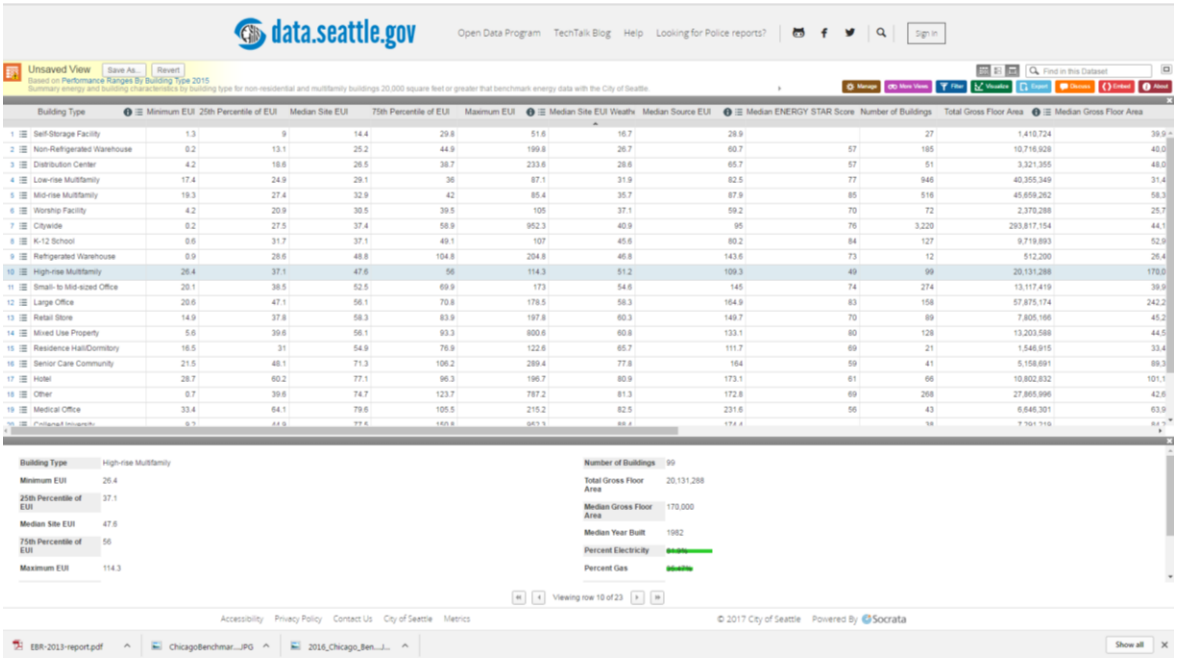


**Figure 4. Seattle's Building Benchmarking Data Portal**

Several interviewed jurisdictions (Austin; Washington D.C.; New York; San Francisco), indicated that the impact of their policies could be increased by disclosing the benchmarking information to the real estate market at large—specifically by transferring the data to the CoStar Group™ commercial property real estate database (see text box).

**Transparency in the real estate market for accurate property valuation**

A number of efforts are underway across the United States to make data about efficient buildings visible to the real estate market (e.g., real estate agents, buyers, lenders, appraisers), to accurately value high-performance properties. For proper real estate valuation, energy efficiency information must be provided as part of the marketing of the property—in particular, making sure the energy-related information is included in the databases that display properties for sale. In the single-family homes market, stakeholders have made significant strides in getting regional multiple listing services to include performance information in a home's ENERGY STAR certification. In 2016, the CoStar Group™ partnered with DOE to expand the visibility of energy-efficient commercial buildings in the United States and promote the range of benefits of energy efficiency for building owners and occupants. The CoStar Group provides extensive national databases of commercial and apartment buildings and their attributes to commercial real estate professionals, investors, and building owners, as well as to business and residential renters. The disclosure of commercial and apartment building energy performance is intended to inform property purchase and rental decisions, and enable building owners and investors to better understand their market. The CoStar Group and DOE have agreed to jointly support the following initiatives:

- Display building energy information, such as energy use intensity and ENERGY STAR score, in the CoStar Group's online property databases
- Perform new, cutting-edge research to evaluate the impact of energy efficiency and sustainability on real estate valuation, building operating income and expenses, tenant health, comfort, productivity, and other topics
- Promote DOE's Better Buildings efforts and the solutions of market-leading Better Buildings partners

*See: CoStar Group (2016), DOE (2016c), Houston et al. (2016), and Stuart (2015).*

## 3.6 Market education and outreach

In this report, market education and outreach for B&T policies is divided into three categories:

1. education and outreach to stakeholders for policy development and support;
2. education and outreach to building owners and managers regarding the policy and compliance requirements; and
3. use of the B&T data as a tool for market transformation.

The first two categories are discussed in this section. Chapters 4 and 5 discuss the use of B&T data as a tool for market transformation.

For policy development and support, Table 2 shows the themes that emerged from Berkeley Lab's interviews and literature review. Themes include engaging stakeholders early, using existing infrastructure (e.g., climate action plan groups) to vet the B&T policy, and use of public meetings and industry groups.

To ensure that building owners and managers are aware of the B&T policy and how to comply, all of the local jurisdictions sent initial notification of the policy by mail and email to building owners, and followed up on non-respondents and bounce-backs in an effort to make sure the right person received

the notices. Jurisdictions then conducted a variety of education and outreach efforts to train and support users (see Table 2).

**Table 2. Market Education and Outreach Approaches Identified in Interviews and Literature Review**

| Type of Market Education and Outreach | Education and Outreach Approaches |
|---|---|
| **Policy development and support** | • **Engage key stakeholders early**. Several jurisdictions identified this approach as critical to a successful B&T policy. In particular, engaging electric and gas utilities early was important for understanding their customer data privacy concerns and expertise in releasing energy usage data. For example, Montgomery County created a stakeholder group including industry groups, building owners, real estate companies, energy service contractors, sustainability nonprofits, utilities, and other stakeholders early in the policy development process to create a forum for concerns and ideas.<br>• **Use existing working groups**—for example, related to environmental issues—as a sounding board to develop and refine the B&T policy.[31]<br>• **Use public meetings** to demonstrate transparency and discuss policy concepts. Public meetings were facilitated by city staff, or by third parties as in Chicago[32] and Atlanta.[33]<br>• **Engage industry groups**. New York City conducted market education through property owner representative organizations—for example, the Real Estate Board of New York, which represents a majority of the buildings covered by the policy. |
| **Educating building owners about the policy requirements and providing guidance on benchmarking** | • **Partner with the utility for trainings.** In San Francisco, Pacific Gas & Electric (PG&E) offers hands-on benchmarking training classes and free online training modules. For trainings conducted by the city, the PG&E videos provide local policy-specific information about San Francisco's requirements.<br>• **Establish online forums**. Montgomery County's B&T regulatory department created an online benchmarking forum and Google group where people can ask questions of each other, to encourage compliance and enable building owners and managers to help each other.<br>• **Create effective online "how-to" guides.** In one example, Philadelphia designed its outreach and education structure to be able to function well despite its limited staff resources. The city developed very easy-to-use "how to" guides based on other cities' successful models, to minimize the need for extensive help desk and training services. All of the jurisdictions offer some form of implementation and help guides on their benchmarking websites.<br>• **Institute a variety of education and outreach efforts.** Examples include webinar and in-person trainings, online training documents and videos, and outreach to industry partners (e.g., building owner management associations and local and regional real estate associations). |

[31] Dillingham and Badoian-Kriticos (2016).
[32] Dillingham and Badoian-Kriticos (2016).
[33] Dillingham and Badoian-Kriticos (2016).

| Type of Market Education and Outreach | Education and Outreach Approaches |
|---|---|
| | • **Provide recognition.** Washington, D.C., has given awards to building owners with the highest ENERGY STAR score, which has generated some friendly competitiveness to take the top spot.<br>• **Create partnerships.** Chicago built a network of more than 80 partners, including nonprofit organizations, to conduct a wide range of outreach efforts and, in some cases, to take on portions of the implementation (e.g., Elevate Energy administers the compliance help center).<br>• **Leverage academic institutions.** Boston, Cambridge, New York City, and Washington, D.C., engaged university research teams to conduct analysis of the building data for reporting. Other cities, such as Seattle and Chicago partnered with local nonprofits or consultants for similar analyses.<br>• **Disclose information to building owners via report cards**. Seattle, Philadelphia, and Chicago distribute personalized building performance report cards, or performance profiles that include building energy data and benchmarking information as well as local efficiency resources and compliance information.[34] |

## 3.7 Data quality assurance

For benchmarking data to support the jurisdiction's policy objectives, users of the data must have reasonable confidence in its reliability. Several reports have highlighted concerns with the quality of data submitted for compliance with B&T ordinances.[35] In addition, jurisdictions interviewed by Berkeley

**Bringing Data Quality Assurance to Scale**

Cities deal with massive amounts of data for a large number of buildings. Increasingly, they need complex analysis tools to identify data issues. Several cities (e.g., Cambridge, Boston, and New York) partnered with academic research institutions to analyze the data to improve quality assurance and reporting.

To develop more efficient means of conducting quality checks on large amounts of data, Washington, D.C., worked with New York University to develop a new data quality rating algorithm called the Data Integrity and Quality (DataIQ) score. The approach employs machine learning to rank the reliability of reported building data and provides a tool to predict future quality and consistency problems. *See: Kontokotsa et al. (2016).*

**Improving Multifamily Data**

Washington, D.C., faced issues with some owners of multifamily buildings who thought they were submitting whole-building data when their submissions captured only part of each building's energy use. In an interview with Berkeley Lab, staff reported that for many building owners, tenant electricity use was "out of sight, out of mind." To address this issue, in 2016 the jurisdiction added an extra step to its benchmarking verification and compliance check process. The new step requires owners of multifamily buildings with ENERGY STAR scores of more than 95, or electricity use constituting less than 15 percent of total reported site energy use, to confirm whether they did in fact submit whole-building data. (These thresholds were set based on internal analysis of 2014 data.) Buildings that do not submit full building data receive notices of violation.

[34] Freeh (2016).
[35] Kontokotsa et al. (2016); Palmer and Walls (2015b); U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. "Benchmarking Data Cleansing: A Rite of Passage Along the Benchmarking Journey," https://energy.gov/eere/slsc/downloads/benchmarking-data-cleansing-rite-passage-along-benchmarking-journey

Lab cited a number of common challenges with the data submitted by building owners, including: (1) incomplete data, (2) inaccurate building square footage,[36] (3) inaccurate building type and space use attributes, (4) not entering all of the energy meters for the building, and (5) accuracy of energy use from non-utility sources, such as delivered fuel oil. Relatively simple omissions, such as not entering meter data for the full year, can result in "fatal" errors—i.e., a building record that cannot produce key metrics such as energy use intensity (EUI).[37]

Cities can readily minimize these errors. In Washington, D.C., 25 percent of initial transparency reports contained relatively simple user errors, but the city reduced that rate to 3 percent through compliance assistance and enforcement.[38]

**Data Quality Issues**

As with any other data collection process, the data collected for B&T policies involve opportunities for introduction of systematic and random errors. Interviews of B&T policy implementers indicate that these data validity issues are a challenge. Some cities (e.g., as reported by Chicago and New York) have some form of data scrubbing, as well guidance materials, to help building owners and operators to report underlying data reliably. However, it is inevitable that some errors will enter the data process as long as most data are self-reported and the input data used for benchmarking are also used for other, often more pressing, uses from a building owner's perspective, with different definitions of the input categories than may be used for energy benchmarking. Thus, when reviewing reported and analyzed data in this chapter, caution should be used with respect to the validity of data and analysis that underlie the reported metrics.

Random errors can be as basic as data entry mistakes or simple mathematical mistakes. Neither is unique to B&T policy compliance reporting. The greater concern may be data validity associated with systematic errors. This can usually be tied to issues with a lack of consistent definitions for key data inputs. Even for information as basic as square footage, building use, and occupancy rates, a range of possible definitions and sources of such data can lead to inconsistencies. For example, when providing square footage data, a building owner may provide data from an assessor's or other property tax database, permit data, or the building owner's own records (or estimates)—all of which can use different definitions or represent different years' data. Occupancy categories are also a source of challenge, particularly for buildings with multiple uses, such as one that has conventional offices, a retail store, and residential tenants. Occupancy is another metric that can affect energy use but also can be hard to define—for example, whether it is based on number of actual occupants or percentage of floor space that is rented.

All of the jurisdictions employ some level of data quality verification. At minimum, most review the submitted data for "flags" in Portfolio Manager, which indicate missing data or a value that is outside the normal range for the data type. Chicago, Evanston, Montgomery County, and Orlando all require a certified professional (e.g., professional engineer, architect, or holder of a jurisdiction-recognized training credential) to verify that the building owner or manager's data are accurate.

[36] Building square footage provided in county tax records can often be wrong, or the building owner may not understand what spaces in the building are to be included in the gross square footage.
[37] *Energy use intensity* is the amount of energy consumed per square foot of floor area.
[38] Kontokotsa et al. (2016).

## 3.8 Costs of policy implementation and enforcement

This section provides approximate cost and staffing estimates for implementing and enforcing B&T policies. All of the cities interviewed by LBNL reported the need for more staff or resources at certain times (e.g., during initial implementation and during "high traffic" times when compliance deadlines approached) and fewer resources during other times. Some jurisdictions relied largely upon in-house staff for most activities, particularly jurisdictions with a smaller number of buildings under the policy, while others engaged a combination of in-house staff and consultants or other partner organizations. See Table 3 for examples of B&T policy implementation and enforcement activities.

**Table 3. Examples of Benchmarking and Transparency Implementation and Enforcement Activities**

| Activity Area | Activity Details |
|---|---|
| **Program design** | Establish a compliance process, an infrastructure, and partnerships with utilities for data access. |
| **Owner notification** | Send initial mailings to notify building owners and managers of policy provisions and compliance deadlines; follow-up on bounced communications to identify the correct building owner and facility contact person. |
| **Website development** | Develop a website that includes ordinance information and compliance requirements, step-by-step instructions, help resources, and links to Portfolio Manager and utility websites for accessing data. |
| **Marketing, education, and training** | Conduct outreach through industry and community groups, in-person presentations, webinars, printed and online materials, on-demand videos, and other resources. |
| **Help center services** | Provide support by mail and phone to help building owners with compliance. |
| **Enforcement** | Communicate to noncompliant owners, offer technical support, and issue fines. |
| **Analysis and reporting** | Analyze submitted data for release to the public and building owners and write program reports. |
| **Visualization tools** | Develop various transparency tools, such as a website dashboard and mapping tool and owner "report cards." |

We asked jurisdictions to provide estimates of staffing and other costs necessary to implement the policy. Most jurisdictions provided some level of information. Table 4 presents ranges of jurisdictions' estimates of full-time equivalent (FTE) staffing needs for some of the key implementation and enforcement activities. Higher-range values generally represent policies that cover more buildings, and lower values represent policies that cover fewer buildings.

**Table 4. Ranges of Staffing Needs for Key Benchmarking and Transparency Policy Implementation Activities Reported by Jurisdictions**

| Activity | FTE during startup and first year | Post-startup annual FTE |
|---|---|---|
| **Conducting building inventory (3 months)** | 1.5 | N/A |
| **Help center services** | 1 to 2 | 0.5 to 2 |
| **Enforcement** | 0 to 1 | 0.8 to 1 |
| **All activities covered by in-house staff (including jurisdictions that did not provide breakdowns of above activities)** | 1.5 to 4.25 | <1 to 4 |

Some jurisdictions provided cost information but were not able to estimate the value of services provided by other city departments (e.g., information technology or geographic information system), utilities, or partner organizations. Thus, the cost estimate ranges represent only costs to the ordinance's authorizing department and known costs for consultants and outsourced services, and generally exclude costs that might be incurred by other departments of the city or partner organizations.

**The SEED Platform™**

The Standard Energy Efficiency Data (SEED) Platform™ is a tool created by the U.S. Department of Energy, Institute for Market Transformation, Berkeley Lab, and the National Renewable Energy Laboratory to "manage portfolio scale building performance data from a variety of sources." The key audiences for this tool are city, county, and state governments that are implementing a program that manages building performance data. One of the goals of the tool is to save public agencies time and money by reducing the administrative effort required to implement their building performance programs.

*See https://energy.gov/eere/buildings/standard-energy-efficiency-data-platform*

During B&T policy startup, and first year, jurisdictions estimated costs of $300,000 to $1,200,000. After startup, jurisdictions estimated annual cost to be between $150,000 and $800,000. This cost range is not surprising, given the wide range of building sizes, number of buildings covered, and potential additional actions required such as an energy audit or retro commissioning. We found a generally positive correlation between staffing demands to implement a policy and number of buildings or square footage covered.

One jurisdiction also provided an estimate of $60,000 for software development and customization. In some cases, jurisdictions incurred other costs, such as those associated with establishing data reporting systems. Montgomery County reported that the cost for their utility operations to implement new utility bill software, which enabled utilities to make energy use and billing data available to all customers, was approximately $100,000 for initial implementation and $40,000 annually to process all building's billing data. However, the system covers all utility customers; the portion that applies to buildings covered by the benchmarking policy was estimated to be $10,000 for startup and $1,000 annually for billing processing.

## 3.9 Compliance help centers

Jurisdictions provide technical assistance to aid building owners or managers in complying with B&T policies by providing help centers. Help centers respond to inquiries by email and phone. They may also provide training and develop help documentation. Recent studies have found that help centers are important for enabling compliance.[39] Seattle attributes its particularly high compliance rate (99 percent in 2013–2015) in large part to its Benchmarking Help Desk. All 10 of the cities interviewed by LBNL offer help center services, and all reported that these services were vital for enabling building owners to provide better quality and more complete data and meet compliance. Neither of the interviewed states (California and Washington) provide compliance help centers.

Help centers are staffed and funded in a variety of ways. For example, Philadelphia uses only in-house staff to provide support. San Francisco also relies on in-house staff, but PG&E also offers compliance

[39] Krukowski and Keicher (2012); Slobe and Heller (2014); Freeh (2016).

help desk services. In contrast, Chicago has partnered with the nonprofit organization Elevate Energy to manage the help center, and Portland partnered with Energy Trust of Oregon and Northwest Energy Efficiency Alliance to implement the city's Energy Reporting Help Desk. Table 5 provides examples of jurisdictions' help center staffing approaches and activity statistics.

**Table 5. Help Center Staffing and Activity (where available)**

| Jurisdiction | Staffing | Activity |
|---|---|---|
| **Boston** | In-house and interns: during peak hours between 1.5 and 2 full time equivalent (FTE); other times <1 FTE | 2016 reporting year: 284 unique individuals, 217 emails, 216 phone calls; most common topics: (1) getting started; (2) Portfolio Manager; (3) exemptions; (4) obtaining utility data; (5) submission process. |
| **Cambridge** | Primarily an external consultant with oversight and some supplemental assistance from in-house staffing | Data unavailable |
| **Chicago** | Nonprofit partner, Elevate Energy, runs the help center; 1.5 FTE, including preparing activity and compliance reports | Fielded more than 10,000 phone calls in 2014–16, and 4,600 interactions (email, phone) in 2016 alone (see Figure 5) |
| **Montgomery County** | In-house staff (0.5–0.75 FTE). Montgomery County staff offer monthly office hours to help with questions about the benchmarking law at the County Department of Environmental Protection, but reported in interviews with Berkeley Lab that a staffed help center could make policy more effective | Data unavailable |
| **New York City** | In-house staff help center; 2 FTE | Fielded nearly 1,000 calls and emails in 2016 |
| **Philadelphia** | In-house staff; no breakout provided for help desk; the city has worked to develop materials that minimize the need for help desk services | Fielded 978 phone calls and 2,393 emails from 2013–2015[40] |
| **San Francisco** | In-house staff; no breakout provided for help desk; PG&E also staffs a help desk that focuses on data access | Data unavailable |
| **Seattle** | Outsourced help desk services; 1.5 FTE | In 2013, the help desk responded to 9,695 calls and email; 64% of the owners or managers required to report received assistance. The City of Seattle has indicated that the help desk has continued to provide support through 2016.[41] |
| **Washington, D.C.** | One full-time staff, and 1 to 2 half-time interns or contractors during the reporting season | In 2013 and 2014, the first two years of reporting, the help center assisted over 70% of buildings with reporting. In 2015, the help center fielded over 2,000 calls and emails. |

Chicago, one of the few jurisdictions that reports help center activity in its ordinance reports, conducted over 4,600 interactions (via email, phone, and in person) in 2016 (see Figure 5). The city expects the number of help inquires to decline as benchmarking increasingly becomes business as usual.[42]

[40] Freeh (2016).
[41] Personal correspondence with Rebecca Baker, City of Seattle.
[42] City of Chicago (2016).

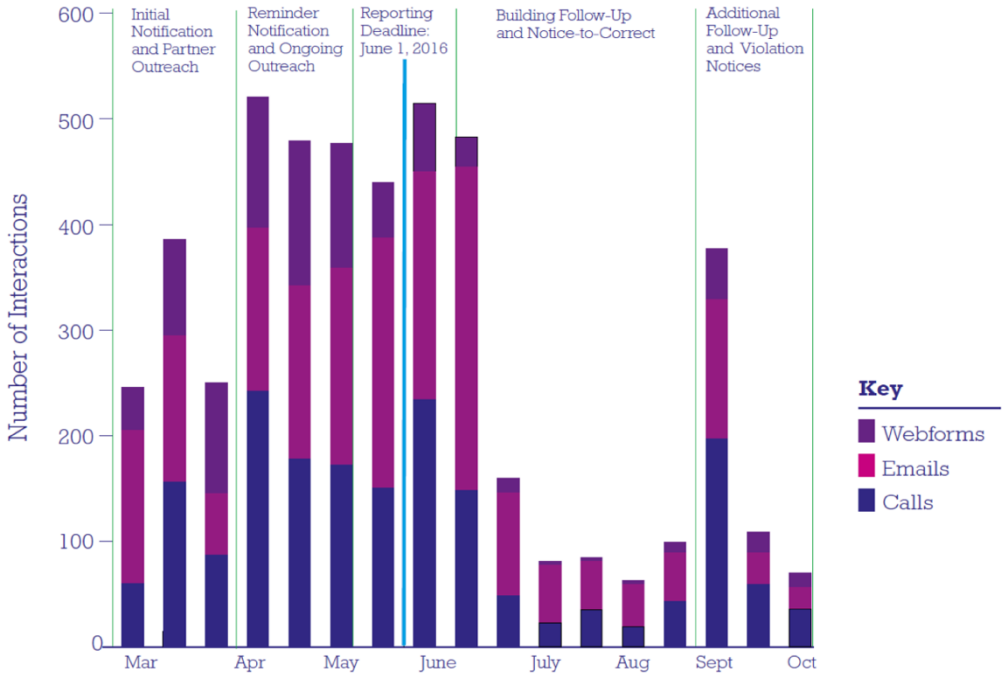


**Figure 5. Chicago 2016 Benchmarking Help Center Interactions[43]**

## 3.10 Utility data access and privacy

Commercial and multifamily building owners and authorized representatives must compile energy data for an entire building, including all individually metered units, in order to benchmark their buildings. However, utilities generally will not release energy data from tenants' individual-metered accounts without customer consent, due to confidentiality concerns. Obtaining consent from multiple tenants can pose significant data collection challenges for building owners. As an alternative solution, utilities can release aggregate whole-building energy data to building owners to facilitate benchmarking.

When providing whole-building aggregated data, a utility aggregates meter-level energy usage information for all accounts associated with a property and provides the aggregated total energy consumption to the property owner. The utility does not require consent from individually metered customers within the building if the number of aggregated accounts exceeds certain thresholds established by the utility. For buildings that have fewer individual accounts than the threshold level, building owners must obtain tenant permission for the utility to release the energy usage data.

Aggregating data at the building level involves several considerations related to privacy. In particular, aggregate data for buildings with only a small number of meters may not fully conceal usage patterns of any individual customer, particularly if there is a dominant energy user within a given building. This is less of an issue as the number of meters in a building increases, and it becomes increasingly difficult to identify the usage associated with a specific meter.

[43] City of Chicago (2016).

Researchers have shown that above five meters, there is a declining likelihood that any one meter's energy usage will approximate the average consumption of a building as a whole.[44] In practice, as Table 6 shows, most utilities that have established a minimum meter threshold for aggregated data collection have settled on a number of meters between two and five. Some utilities have also specified that no single meter should account for more than a given percentage (e.g., 50 percent) of the building's usage, to further ensure that collection of whole-building data does not too closely reflect the energy usage of any one individually metered customer.

**Table 6. Aggregation Thresholds in Various Jurisdictions[45]**

| Utility Company (Service Territory) | Aggregation Thresholds (no. of meters/% of building's usage) |
|---|---|
| **Austin Energy** (Texas) | 4/80% |
| **Baltimore Gas & Electric** (Maryland) | 5 |
| **California** – all utilities | Non-residential buildings: 3*<br>Residential buildings: 5 |
| **Clark Public Utilities** (Washington) | 2 |
| **Commonwealth Edison** (Illinois) | 4 |
| **Consolidated Edison** (New York City) | 2 |
| **Eversource** (Boston and Cambridge, MA) | 4/50% |
| **National Grid** (New York City) | 4/50% |
| **Pacific Power** (Oregon) | 5 |
| **Peoples Gas** (Illinois) | 5 |
| **Pepco** (Washington D.C.) | 5 |
| **PSEG Long Island** (New York City) | 2 |
| **Puget Sound Energy** (Washington) | 5 |
| **Rocky Mountain Power** (Utah) | 5 |
| **Seattle City Light** (Washington) | 2 |
| **Xcel Energy** (Minnesota and Colorado) | 4/50% |
| **Washington Gas** (Maryland and Washington D.C.) | 5 |

*For non-residential buildings with less than three accounts, the utility is required to provide whole-building data with customer permission.

The ENERGY STAR Portfolio Manager tool also helps jurisdictions bring consistency to the user experience of building owners and managers required to comply with B&T policies. ENERGY STAR resources keep training and implementation costs down, and Portfolio Manager web services provide a cost-free application program interface that utilities can use to import their customers' data, further reducing the burden of compliance.

[44] See U.S. Department of Energy. Better Buildings. *Best Practices for Providing Whole-Building Energy Data: A Guide for Utilities Energy Data Accelerator.* January 2016. https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Best%20Practices%20for%20Providing%20Whole-Building%20Energy%20Data%20-%20Guide%20for%20Utilities.pdf and U.S. Department of Energy. Better Buildings. Briefing Document: Statistical Analysis of Data Access and Privacy. No date. https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Briefing Document - Statistical Analysis of Data Access and Privacy.pdf

[45] For a more complete list, see "Utilities Providing Energy Data for Benchmarking in ENERGY STAR Portfolio Manager," https://www.energystar.gov/sites/default/files/tools/Web_Services_Fact_Sheet_08302016_508.pdf. See also this interactive map of utilities providing energy data for benchmarking: https://www.energystar.gov/buildings/owners_and_managers/existing_buildings/use_portfolio_manager/find_utilities_provide_data_benchmarking.

Table 16, Table 17, and Appendix B provide additional guidance on best practices regarding the aggregation and release of energy data for commercial and multifamily properties. Topics include authorizations via leasing documents, mapping energy meters to buildings, opt-out practices, missing data for individual meters, delivered fuels, and legal limitations to data use.

## 3.11 Complementary policies

Ten jurisdictions couple their B&T policy with complementary policies, such as building energy audits and retro-commissioning requirements (see Table A-4). Energy audits, conducted by certified technicians, identify opportunities and make recommendations for improving building performance through efficient equipment and system upgrades. Retro-commissioning is a closely related process that identifies opportunities for improving the efficiency of a building's existing mechanical, lighting, and control systems through maintenance, reprogramming, and other process improvements.[46] Eight of the jurisdictions (Atlanta, Austin,[47] Berkeley, Boston, Boulder, Cambridge, New York, and San Francisco) require that building owners or managers submit audit data, or confirm that an audit has occurred as part of their B&T policy compliance. Boulder, Los Angeles, Seattle, and New York City require all buildings to undergo retro-commissioning.[48] San Francisco requires building owners or managers to provide a summary of all retro-commissioning and retrofit measures that can be implemented with a simple payback of three years or less, and Orlando requires an audit or retro-commissioning if a building receives an ENERGY STAR score of less than 50.

Jurisdictions use the audit information in several ways. In the interview with Berkeley Lab, New York City staff reported that they are combining benchmarking scores and audit information to calculate how much money the building could save by implementing efficiency measures. San Francisco uses the audit data to identify high-opportunity buildings and reach out to owners to discuss the opportunities and offer technical assistance with implementing efficiency upgrades.

A few of the jurisdictions encourage building owners who are benchmarking their buildings also to take advantage of ratepayer-funded energy efficiency retrofit programs and incentives. For example, Chicago's web page with benchmarking instructions and guidance materials provides links to utility programs that provide incentives and technical support for implementing energy efficiency projects. New York City offers a Retrofit Accelerator program, which provides advisors who can help building owners comply with the benchmarking and other city requirements and make decisions about energy efficiency improvements.

[46] Palmer and Walls (2015b).
[47] Austin requires owners of residential buildings to conduct an audit every 10 years. Owners of commercial buildings are not required to conduct an audit.
[48] Palmer and Walls (2015b); buildingrating.org.

## 3.12 International experiences

International B&T efforts largely center on building energy rating schemes and associated building labeling policies and programs. The European Union (EU) first launched its Energy Performance of Buildings Directive in 2002, ramping up to full compliance for all member states by 2006. The directive provided for the establishment of building energy rating schemes and associated energy performance certificate (EPC) labels for residential, private commercial, and public buildings. A number of non-EU countries have developed their own energy rating or labeling schemes as well. Rating schemes vary by jurisdiction, and for a number of reasons, such as variation in building stock and climate, and the ability of the government to mandate regulations.[49]

Rating and labeling policies vary in regard to three key program components:

1. Which buildings are targeted (e.g., new versus existing, residential vs. commercial)
2. Key requirements (mandatory versus voluntary, timing of the transparency)
3. Type of rating (e.g., asset-based versus operational)

Several international rating and labeling schemes (such as those in Australia, France, and Germany) have similar key provisions as the B&T policies in the United States—the policy is mandatory, uses an operational rating scheme, and covers private commercial or multifamily buildings. Table 7 provides examples of building rating schemes implemented by countries that are members of the International Partnership for Energy Efficiency Cooperation (IPEEC).

*Disclosure and Transparency*

The Energy Performance Certificate (EPC) is the key disclosure and transparency vehicle for the Energy Performance of Buildings Directive (EPBD). The EPC provides information about a building's energy performance to potential tenants and buyers. The EPC is intended to spur demand for better-performing buildings or rental units, in turn increasing market values and influencing building owners to renovate their properties. The directive requires EU member states to ensure that building owners provide EPCs to prospective tenants or buyers as part of the property transaction process. The EPCs must be produced when a covered building is constructed, sold, or rented, and must contain key information, such as an energy efficiency rating and comparison to peer properties.[50] The directive also requires countries to maintain an EPC database. Some countries, such as Ireland, have developed data visualization tools much like those in the United States to disclose the information to the general public, rather than just to participants in the sale or lease transactions. Others—e.g., Germany and Austria—have stronger privacy concerns and only allow data access to officials directly involved and occasionally for research purposes. The EPBD requires the EPC to be physically displayed in a prominent, visible location on large buildings that are frequently visited by the public. This requirement applies both to public buildings larger than 250 square meters and to any building larger than 500 square meters. European Union member states have implemented the display requirement differently. For example,

[49] IPEEC (2014).
[50] BPIE (2014).

Greece, Ireland, and the United Kingdom have implemented a simplified approach that requires all large buildings, whether public or private, greater than 250 square meters to display the EPC.[51,52]

**Table 7. Examples of IPEEC Member Building Rating Schemes[53]**

| Country | Scheme Name | Mandatory? | Asset-based | Operational | Private Commercial | Multifamily |
|---|---|---|---|---|---|---|
| **Australia** | Commercial Building Disclosure | Y | | X | X | |
| **Brazil** | PGE Edifica | | X | | X | X |
| **Canada** | ENERGY STAR | | X | X | X | |
| | Realpac Energy Benchmarking Program | | | X | X | |
| **China** | China 3 Star Building Energy Efficiency Evaluation | | X | X | X | X |
| **EU** | Energy Performance Certificates (EPCs) | Y* | X | X | X | X |
| **France** | Diagnostic de Performance Energetique | Y | X | X | X | X |
| **Germany** | Energieausweis | Y | X | X | X | X |
| **India** | Star Rating for Buildings | | | X | X | |
| **Italy** | Certificazione Energetica | Y | X | | X | X |
| **Japan** | CASBEE | | X | X | X | X |
| **Russia** | Energy Passports | | X | | X | X |
| **South Korea** | Certificate of Building Energy Efficiency | | X | X | X | X |
| **United Kingdom** | EPCs | Y | X | | X | X |
| **U.S.** | ENERGY STAR (national) | | | X | X | X |
| | Commercial Building Energy Asset Score[54] | | X | | X | X |
| | ENERGY STAR (local ordinances) | Y | | X | X | X |

*In some EU member states the EPC is implemented as a voluntary program.

*Impact Studies*

Policymakers and jurisdictions implementing these policies in the United States and abroad have a strong interest in understanding the extent to which B&T policies lead to reduced energy use. However, research on international energy rating and transparency schemes has focused almost exclusively on

[51] ICF International (2015).

[52] Gov. UK (2017). SEAI (2017).

[53] Hinge et. al. (2014); IPEEC (2014).

[54] U.S. DOE. Building Energy Asset Score. https://energy.gov/eere/buildings/building-energy-asset-score

the impacts on property resale and rental prices. Few, if any, have attempted to quantify energy savings impacts.

Nearly all international studies of B&T policies have focused on the residential sector.[55] Only a few studies have examined the international private commercial building market, but researchers have found evidence that buildings with efficiency labels garner higher rents than those that do not.[56] A larger number of studies of the U.S. commercial buildings sector have reported that in most cases, building performance labels (e.g., ENERGY STAR or LEED) correlate to higher sale and rental prices.[57]

*Insights from the International Experience*

Based on lessons learned during the first phase of implementation, the EU recast the Energy Performance of Buildings Directive and updated its provisions in 2010, and again in 2016, to make the policy more effective. The updates required member states to establish two new provisions: (1) penalties for noncompliance and (2) an independent system of control over the certificates and compliance.[58] The EPBD has worked to balance the need for a cost-effective scheme (for example, through use of default values, similar to those in the ENERGY STAR Portfolio Manager) with the need for accurate and reliable data that generates trust in the rating scheme.[59]

While research to date on international B&T policies has not focused on determining whether they have led to reduced energy consumption, studies of program outcomes provide useful insights for U.S. policymakers. See Table 8 for a summary of findings and opportunities for international energy rating and labeling schemes.[60]

**Table 8. Opportunities from Studies of International Energy Rating and Transparency Policies**

| Opportunities | Details |
|---|---|
| Create an integrated policy framework | Building rating and labeling policies have the greatest impact when implemented as part of a coordinated energy efficiency policy framework, including financial incentives, code enforcement, and robust outreach. |
| Include recommendations in the rating or label | Providing recommendations for efficiency improvements in the rating appears to improve policy effectiveness and move building owners to make improvements. |
| Implement oversight and enforcement | There is little information on compliance in EU countries where the EPC is voluntary. Programs should track compliance and assess penalties for noncompliance. In addition, there may be helpful ways to combine carrots and sticks to encourage compliance—e.g., high-performing properties can be allowed less frequent compliance rounds. |
| Conduct a quality assessment | At minimum, jurisdictions need to implement spot-checking and analysis of data submitted by building owners to identify outliers. Missing and erroneous data should be considered noncompliance. |

[55] See, for example, Fuerst et al. (2013) and European Commission (DG Energy) (2013).
[56] Kok and Jennen (2012); Chegut et al. (2011).
[57] Eichholtz et al. (2010); Fuerst and McAllister (2011).
[58] IPEEC (2014).
[59] Concerted Action (2015).
[60] Concerted Action (2015); IPEEC (2014).

| Opportunities | Details |
|---|---|
| Make reporting clear and actionable | The reporting tool(s)—e.g., the EPC—should be designed to be clear, intuitive, and easy for the recipient to use for comparisons. It should also provide tangible, action-oriented recommendations for efficiency improvements. |
| Require reporting at the appropriate time | For transactional transparency policies, information must be disclosed to decision-makers early enough in the transactional process to inform the decision-making process. For example, the information provided in the EPC should be disclosed in all marketing and advertisement materials for the available property. |
| Conduct broad outreach | The jurisdiction should conduct broad outreach to all stakeholders and link the policy requirements to other resources such as energy efficiency incentives. |
| Maintain a centralized data collection effort and make the data available | Jurisdictions should develop a robust data collection and database system and make the data available as widely as possible to transaction participants, as well as to researchers, policymakers, and the general public—for example, by enabling data to be downloaded and by providing online visualization tools. |
| Conduct policy assessments | Jurisdictions should periodically assess whether the policy objectives are being met by reviewing such metrics as compliance rates and whether market participants are changing their behavior (implementing efficiency). |
| Support more research | To date there has been limited data and analysis on the links between rating and labeling programs and demonstrated energy savings. More work is needed to develop robust methodologies and analysis. |

# 4 Benchmarking and Transparency Policy Impacts

Benchmarking and transparency policies are enabling strategies that rely on market transformation to support improvements in energy efficiency and related environmental impacts, such as reduction in water consumption and air pollution. These policies themselves do not improve energy efficiency or reduce water consumption and pollution. Instead, they address barriers to achieving these goals; primarily the lack of information on potential opportunities and benefits of reducing energy waste in buildings.

Benchmarking information enables building owners, managers, operators, engineers, and contractors to determine which buildings have the most opportunities for cost-effective energy-saving investments. B&T policy goals are incorporation of energy (as well as water and pollution) performance information into building owner decision-making and, by extension, achieving energy savings and non-energy benefits. The information can also inform policy and program development by providing building energy data to policymakers and administrators of energy efficiency programs funded by utility customers.

Benchmarking and transparency policies remove key energy efficiency implementation barriers[61] by providing tools for understanding and measuring progress, which indirectly results in energy savings, with a specific focus on the following:

- Raising the knowledge base of building owners about energy usage in their property(ies), thereby enabling enhancement of building energy performance
- Providing market transparency on energy efficiency to tenants, investors, and underwriters in real estate market transactions
- Providing market data to allow for enhanced deployment of efficiency efforts on the part of the relevant agencies[62]

An analogy for B&T policies are information labels on food products that compare their nutritional content to an established benchmark. In this case, the primary goal is healthier people. The nutritional information does not directly result in healthier people or healthier eating habits, but provides the information that allows people to make their own eating habit choices.

This chapter provides background and information on the enabling role of B&T policies and the range of B&T policy performance metrics that can be assessed:

- B&T policies in the context of market transformation basics (Section 4.1)
- B&T policy logic models that show how such policies can result in energy and non-energy benefits (Section 4.2)

[61] *Barriers* are defined as "factors that inhibit both the efficient use of energy and/or proactive market actor activities to saving energy." Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015a).
[62] Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015a). Page v.

- Performance metrics that are used to assess B&T policies and how the metrics are evaluated (Section 4.3)
- Methods used for quantifying and evaluating B&T performance metrics (Section 4.4)
- Available data on B&T policy performance metrics (Section 4.5)

Appendix C provides additional, more detailed information on B&T metric categories. Appendix D and Appendix E provide examples of B&T impacts reported for several jurisdictions. Appendix F presents the results of a study on the impact of efficiency on property (building) values to illustrate a potential non-energy impact of B&T policies.

The information in this chapter and the referenced appendices support the limited conclusions that can be drawn about overall energy impacts of existing U.S. benchmarking and transparency policies, as presented in Chapter 5. Chapter 6 uses information in this chapter to present best practices in evaluation and metrics.

## 4.1 Benchmarking and transparency policies support energy efficiency

Benchmarking and transparency policies provide data that can unlock energy efficiency's potential.

**What Is Market Transformation?**

For energy efficiency, *market transformation* can be defined as "the strategic process of intervening in a market to create lasting change in market behavior by removing identified barriers or exploiting opportunities to accelerate the adoption of all cost-effective energy efficiency as a matter of standard practice."* Market transformation is intended to positively influence the way efficiency markets operate—how manufacturers, distributors, retailers, consumers, and others sell and buy energy-related products and services. This implies that market transformation can indirectly result in incremental energy savings. In contrast, "resource acquisition" programs achieve benefits (e.g., energy savings) through specific, direct actions such as efficient equipment installation.

**Northwest Energy Efficiency Alliance, https://neea.org/docs/default-source/marketing-tookits/neea_definition_of_markettransformation.pdf?sfvrsn=2*

B&T policies develop a strong market for building energy efficiency by raising building owners' awareness of efficiency opportunities, which may result in behavior and operational changes that create low-cost reductions in energy consumption. These policies also make building performance more visible in the marketplace, thus empowering consumers to more easily understand how buildings are performing and reward owners of efficient buildings. These effects are referred to as market transformation.

Market transformation metrics relating to building efficiency and related fields have been identified and evaluated for many years.[63] Evaluation of market transformation activities focuses on the mechanisms

[63] For example, see the market research and evaluation publications list, starting with 1997 publications, at Northwest Energy Efficiency Alliance, http://neea.org/resource-center/market-research-and-evaluation-reports?sort=PublicationDate+ASC.

through which changes in market adoption of energy technologies and practices, as well as energy use, are induced by, in this case, B&T policies. Attention is focused on indicators (or performance metrics) of market transformation through market tracking. For example, a market transformation evaluation might first report changes in the number of energy audits being conducted in buildings subject to a B&T ordinance, or sales patterns and valuations for efficient versus less efficient buildings, as an indication of program progress in meeting the policy goal.[64] Figure 6 presents a heuristic presentation of the standard technology adoption "S-curve," which is indicative of the market transformation progression expected for efficiency actions that are influenced by enabling policies such as B&T.


**Figure 6. Technology Adoption "S" Curve**

Berkeley Lab interviews with staff in jurisdictions implementing B&T policies indicate that tracking market data to document progress across a full range of market transformation indicators would be beneficial–particularly for assessing how B&T policies are supporting changes in the energy marketplace, how implementation of the policies can be more effective, and how the policies support local economic development. However, jurisdictions are only tracking building-specific data such as energy consumption and building square footage, which can be used to calculate changes in energy use and energy use intensity. At this time, they do not track market indicators in any systematic or comprehensive manner.

## 4.2 Logic models

Best practices in the evaluation of B&T policies start with understanding the logic and strategies for encouraging incorporation of energy (as well as water consumption and pollution) performance information into building owner decision-making and, by extension, transforming markets and yielding energy savings and non-energy benefits. The logic and strategies are incorporated into tools known as *logic models.* Understanding the logic behind B&T policies' enabling and market transformation roles is important for establishing appropriate B&T performance metrics (see Section 4.3). Impact evaluations

[64] Schiller (2012).

also use the logic model information, as well as collected data and analyses, to assess a variety of metrics that determine the performance of the policies and provide any recommendations for B&T policy modifications or improvements.

Figure 7 is an example of a B&T logic model. The approach for reaching the overall goal of B&T policies is to encourage the development of a strong market for building efficiency that has measurable outcomes, such as the following:[65]

**Logic Models**

Logic modeling is a thought process that efficiency program managers and evaluators use to develop a plausible and sensible model of how a program will work under defined conditions to solve identified problems. The logic model can be the basis for presenting a convincing story of the program's expected performance–telling stakeholders and others the problems the program focuses on, how the program will address the problems, and what outcomes and metrics can be used to assess success.

*Source: [http://energy.gov/eere/analysis/program-evaluation-program-logic](http://energy.gov/eere/analysis/program-evaluation-program-logic)*

- Building owners' paying attention to energy efficiency, resulting in behavioral and operational changes that bring immediate and low-cost reductions in energy consumption.
- Utilities, and other administrators of utility-customer funded efficiency programs, targeting their customers that would benefit most from their efficiency programs, thereby increasing the cost-effectiveness of the utility's efficiency investments.
- Policymakers crafting more effective methods to address their jurisdictions' most inefficient buildings.
- Making building performance more visible in the marketplace, thus empowering consumers to more easily understand how buildings are performing and rewarding owners of efficient buildings by supporting the real estate market to value efficient buildings.[66]
- By making benchmarking information transparent, prospective real estate investors and tenants can include energy performance and expected utility costs in their decision-making processes when evaluating buildings and leased spaces. This may provide an incentive to building owners to improve the performance of their buildings, as energy efficiency becomes another value differentiator when competing for buyers and tenants.

[65] Hart (2015) and Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015a).

[66] By making benchmarking information transparent, prospective real estate investors and tenants can include energy performance and expected utility costs in their decision-making processes when evaluating buildings and leased spaces. This may provide an incentive to building owners to improve the performance of their buildings, as energy efficiency becomes another value differentiator when competing for buyers and tenants.

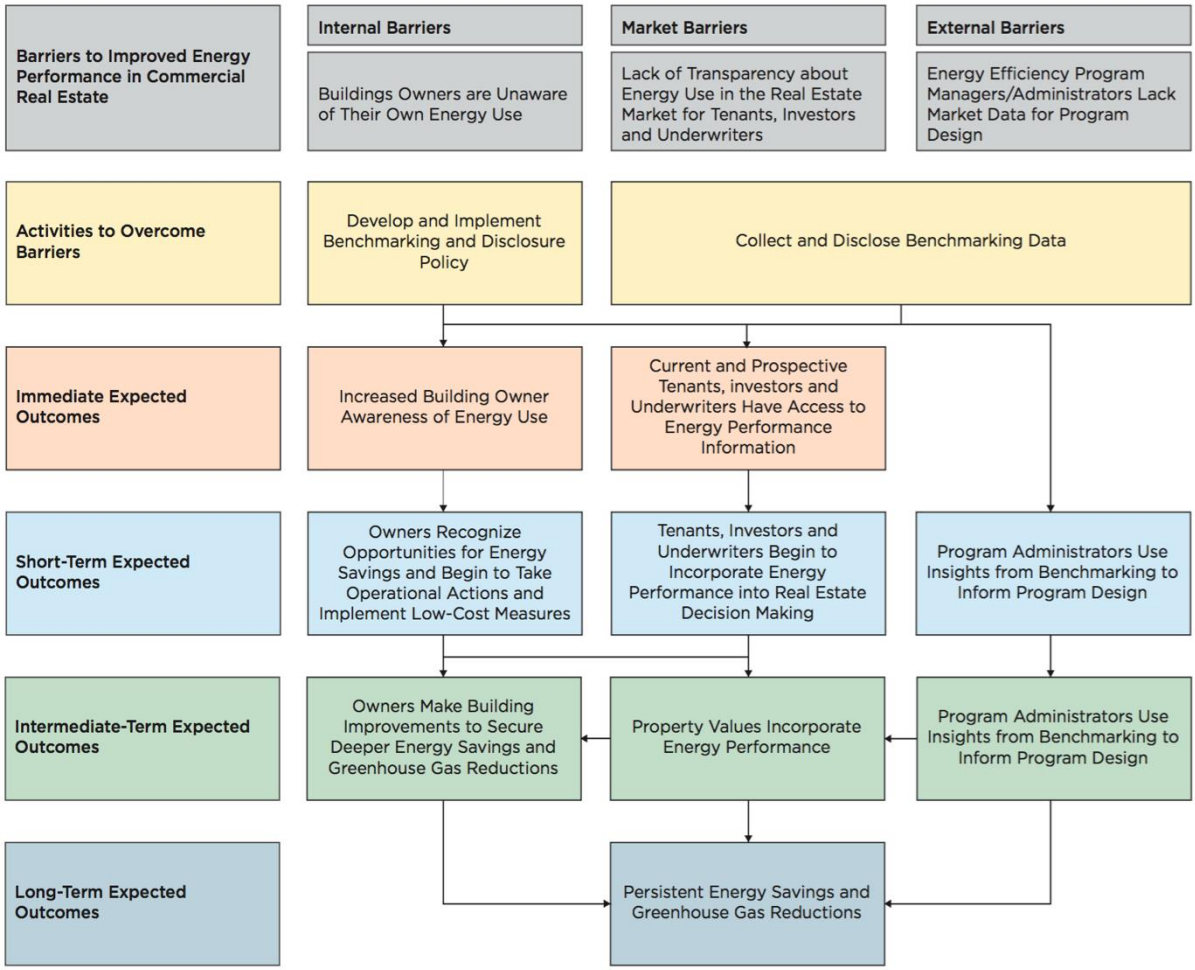


**Figure 7. Illustrative Benchmarking and Transparency Policy Logic Model Diagram**[67]

## 4.3 Performance metrics

To determine the impact of B&T policies, evaluators must identify specific measurable performance metrics, whether interim or long-term.

[67] Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015a). Page 6.

Interim performance metrics are associated with actions and measurable outcomes that support or lead to the long-term energy and non-energy impacts. These interim metrics include meeting B&T policy (ordinance) implementation milestones (e.g., regulatory text development and approval, reporting system in place) and reaching defined market transformation achievements. Ordinance implementation metrics are straightforward and are based on common, well-established program or project tracking indicators, such as a schedule for roll-out of ordinance documents and compliance rates for those subject to an ordinance. As mentioned above, there are also well established metrics for market transformation, such as indicators of energy use awareness among building owners and operators, contractors' use of benchmarking information to expand their business offerings, and overall consumer awareness and demand for benchmarking information and efficient buildings. While straightforward in concept, in practice, market transformation metrics are not commonly reported or even tracked by jurisdictions with B&T policies.

**Performance Metrics and Key Indicators**

For purposes of this report, a *performance metric* is defined as a quantifiable measure that is used to track and assess a specific objective, such as energy savings. Another term often used interchangeably with metrics is *key performance indicator* (KPI). However, KPIs are usually only associated with the most important metrics or objectives. This chapter discusses a range of performance metrics that each jurisdiction may use to determine its B&T policy KPIs, such as energy savings, air pollutant reductions, and economic development.

Long-term performance metrics of B&T policies are associated with energy and non-energy impacts.[68] The goal of most B&T policies is the voluntary achievement of cost-effective energy efficiency investments, resulting in buildings that provide benefits for building owners and occupants, utility systems, and society.[69] Thus, such metrics include energy and water use reductions and cost savings, as well as impacts than can result from such savings. These may include increased property values, improved productivity of building tenants, reduced greenhouse gases and other air pollution, and local economic development (direct, indirect, and induced job growth).

Long-term energy performance metrics such as annual energy savings are well defined and are commonly assessed and reported for a wide range of efficiency policies, regulations, and programs. Similarly, non-energy impacts over the long term also have readily identifiable metrics that are associated with most energy efficiency activities (e.g., emissions reductions, property value increases, and jobs). However, most of these metrics are not as commonly quantified or reported, probably because of the resources required to determine values for these metrics. Even so, two non-energy impact metrics are found in some jurisdictions' B&T reports: (1) emissions reductions, calculated simply by multiplying energy savings by an average emissions factor (e.g., pounds of GHG emissions per kilowatt-hour [kWh] of energy savings) and (2) water savings, based on reported changes in building water consumption.

[68] These energy and non-energy impacts are called *long-term* because of the interest in them being ongoing, sustained impacts, not necessarily because they take a long time to occur.

[69] This statement in consistent with the goals established for B&T policies in Atlanta, Boston, California, Chicago, Denver, Evanston, Kansas City, Los Angeles, Minneapolis, Montgomery County, New York City, Orlando, Philadelphia, Portland, San Francisco, Seattle, and Washington D.C.

Table 9 presents a summary of performance metrics associated with B&T policies categorized as energy impacts, non-energy impacts, market transformation metrics, and interim implementation milestones. These are presented in the approximate order of their importance, as first indicators of energy and non-energy impacts and interim market transformation and implementation progress. A more detailed version of this table is in Appendix C.

**Table 9. Benchmarking and Transparency Policy Metrics Summary**

| Metric Category | Example Metrics (common to all energy efficiency programs) | Example Metrics, Indicators, and Benefits Specific to B&T Policies | Notes |
|---|---|---|---|
| **Energy Impacts**<br>**As used in common practice, *energy impacts* are defined as those directly associated with reductions in energy consumption, demand, or both.** | • Gross energy savings<br>• Net energy savings | • Energy use intensity<br>• Normalized energy use intensity<br>• ENERGY STAR Score | • Savings can be defined as source- or site-level values.<br>• See definitions below for net and gross impacts in the text box in Section 4.4.1 |
| **Non-Energy Impacts**[70]<br>***Non-energy impacts* are the wide variety of positive and negative effects beyond energy savings that are delivered to utilities, participants, and society as a consequence of delivering energy efficiency programs and measures.** | • Decrease in energy (water) costs<br>• Increased property values<br>• Higher rents and better retention for commercial properties (landlord benefit) | • Understanding of the building's energy use<br>• Metrics to rank the building against others in a portfolio, allowing prioritization of energy efficiency investments | • Benefits accrue to participants |
| | • Avoided transmission and distribution costs<br>• Energy price and reliability effects | • Use of benchmarking data to make utility efficiency programs more effective | • Benefits accrue to utility system |
| | • Jobs<br>• Local economic development | • Indicators that enable state and local governments to better understand building stocks in their jurisdictions | • Benefits accrue to society |
| **Market Transformation/Adoption**<br>***Market transformation* is a reduction in market barriers resulting from a market intervention, as evidenced by a set of market effects that is likely to last after the intervention has been withdrawn, reduced, or changed.** | • Supply chain adoption and growth<br>• Higher consumer awareness and confidence | • Increased awareness of energy use by building owners and increased market actor awareness of energy<br>• Increased energy awareness by occupants/users (e.g., store customers) | |

[70] Skumatz (1997); Skumatz (2015). Non-energy impacts can be categorized as those accruing to utilities (energy providers), society as a whole, and to individual participants.

| Metric Category | Example Metrics (common to all energy efficiency programs) | Example Metrics, Indicators, and Benefits Specific to B&T Policies | Notes |
|---|---|---|---|
| **Interim Performance/Milestones** **Interim performance and milestone indicators are indicators associated with the implementation of and compliance with B&T policies.** | • Workforce education and training metrics<br>• Marketing and outreach metrics | • Compliance rates – number and square footage of benchmarked/labeled buildings | |

## 4.4 Quantification and evaluation methods

An important challenge to estimating the impacts of B&T policies is that energy savings and non-energy impacts resulting from efficiency actions cannot be directly measured. For example, for a B&T policy, the true impacts of energy savings are the difference between the amount of energy that building owners or managers use relative to the amount of energy they would have otherwise used (the baseline) had they not been subject to the policy during the same time period. This baseline is called the *counterfactual scenario.* In practice, we can never observe how much energy the participants would have used had they not been in the program, because at any given time a participant must either be in the program or not. See Figure 8 for an illustration of this concept.

**The Counterfactual Scenario**

Energy savings and other impacts of efficiency actions are estimated to varying degrees of accuracy by comparing the situation (e.g., energy consumption) after a measure is implemented (the reporting period) to what is assumed to have been the situation in the absence of the program (the "counterfactual" scenario, also known as the baseline). Energy impacts are determined by comparing the baseline and reporting period energy use, while controlling (adjusting) for factors unrelated to energy efficiency actions, such as weather and building occupancy. These adjustments are a major part of the evaluation process.

Defining the counterfactual scenario represents the fundamental challenge to documenting the impacts of efficiency actions in general, and B&T policies specifically. This challenge is met with impact evaluations using measured energy (and water, emissions, etc.) consumption—but, the savings themselves will always be estimates.[71]

[71] Schiller (2012).

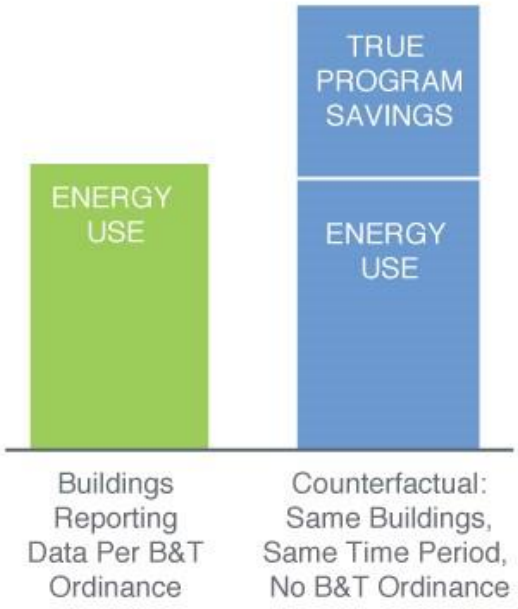


**Figure 8. True Program Savings: The Counterfactual for a Benchmarking and Transparency Policy**

Most impact assessments of B&T policies establish a counterfactual by assuming that the prior year's/years' resource consumption is the baseline. This approach is known as *pre/post comparisons,* and it creates the need for corrections for factors that influence energy use (or water use or emissions), other than the B&T policy, between the baseline year(s) and the program year(s). Typically, these corrections are made for weather differences and perhaps changes in building occupancy. However, other factors that are not easily assessed or routinely considered, such as energy prices, economic downturns or upturns, changes in building use, and influence of other efficiency programs can also have significant impacts.

Thus, simple pre/post comparisons may not provide as reliable an analysis as control group-based methods. Control group approaches measure the difference between the energy use (or water use, etc.) of buildings participating in a B&T program (the "treatment group") and that of a similar comparison group of non-participating buildings (the "control group") during the same time period.[72] The challenge with such approaches for evaluating B&T policies is to define and gather data for a control group of buildings.

Understanding the counterfactual and the need for estimating a baseline leads to the definition of the principle energy-saving impact metrics used in the efficiency industry: gross energy savings impacts and net energy savings impacts (see text box "Gross and Net Impact Definitions"). The DOE's Uniform Methods Project provides definitions of the components of net savings metrics that are widely accepted by the industry (see text box "Net to Gross Factors for Energy Savings").[73]

[72] Schiller (2012).

[73] Violette and Rathbun (2014).

### 4.4.1 Assessing gross and net energy, water, and emissions impacts

**Gross and Net Impact Definitions**

**Gross Impacts:** The change in buildings' energy usage over time inclusive of actions taken to improve their Portfolio Manager scores or reduce energy consumption, as well as their participation in other energy-efficiency activities or programs.
**Net Impacts:** The subset of measured gross energy changes attributable to the B&T policy. That is, savings after taking into account natural market forces and the impacts from other local, state, federal, and utility energy-efficiency program and tax credit initiatives.

*Source: Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015b).*

**Net to Gross Factors for Energy Savings**

The following factors are used to determine net savings versus gross energy savings:

- *Free riders* are program participants who would have implemented a program measure or practice (e.g., reduced energy consumption) in the absence of the B&T policy.
- *Spillover* refers to additional impacts due to the B&T policy's influences beyond those directly associated with participation. There are generally two types of spillover: participant and non-participant.
- *Market effects* refer to a change in the structure of a market or the behavior of participants in a market that is reflective of an increase in the adoption of energy efficiency products, services, or practices and is causally related to market intervention(s). This is a primary intended outcome of B&T policies.

*Source: Violette and Rathbun (2014)*

All energy, water, and emissions impacts reported by jurisdictions with B&T policies are gross impacts. Most impact assessments of B&T policies establish a counterfactual by assuming that the prior year's/years' resource consumption is the baseline. Thus, period-to-period (e.g., year-to-year) data that directly indicate changes in energy, water, and avoided emissions are what are typically used to indicate the gross impacts of B&T policies. However, even for gross impact assessments, routine adjustments must be made for factors that are clearly quantifiable and for which data are available.

For efficiency evaluation in general, gross savings are almost always adjusted for changes in weather from a baseline period to a reporting period.[74] Adjustments also may be made for building occupancy.[75] As discussed earlier in this report, most jurisdictions use Portfolio Manager as the impact evaluation tool to assess the energy, water, and emission impacts, and Portfolio Manager has the capability to adjust savings using weather and occupancy data.

Thus, preferably this comparison would be normalized to other independent variables that also can affect energy use, such as weather and building occupancy rates. However, not all jurisdictions present weather-

[74] *Reporting period* is the time (usually one or more years) that the B&T policy is in place and for which an impact is to be assessed. *Baseline period* is the year(s) prior to the reporting period. Weather adjustments are usually made by increasing or decreasing the baseline energy consumption to account for differences in average ambient temperatures between the baseline and reporting periods.
[75] Portfolio Manager defines *building occupancy* as the percentage of a property's gross floor area that is occupied and operational. This information is not always available. With Portfolio Manager, gross metrics are the standard output based on comparing prior year and current year energy consumption (or water use or emissions) with adjustments to account for changes in weather from one year to the next.

normalized energy consumption data in their reports, and none of them appears to provide occupancy-normalized data.

While total energy use (and water use and emissions) are informative, intensities (e.g., energy use per square foot) tend to be better indicators of changes from year to year, rather than simply measuring total changes in consumption or emissions. Total consumption in a jurisdiction is also affected by the number of buildings reporting data and building square footage that is occupied and space conditioned (see text box "Calculating Energy Use Intensity").

**Calculating Energy Use Intensity**

The following formula compares energy (or water or emissions intensities) from year to year:

*(total energy consumption/total square footage) all reporting buildings with both energy and ft² data, year x*

*minus*

*(total energy consumption/total square footage) all reporting buildings with both energy and ft² data, year x+1 (or 2,*

The objective for determining net impacts is to quantify values of performance metrics, both energy and non-energy impacts, that can be attributed to the B&T policy—for example, to quantify the causal relationship between a B&T policy and energy savings. The factors most often associated with the difference between gross and net savings are free riders, spillover, and market effects (see text box, "Net to Gross Factors for Energy Savings"). However, attribution can also be affected by a range of other factors, such as non-B&T regulations and policies, changes in energy prices, and economic upturns or downturns. Establishing net impacts, market transformation, and broader non-energy impacts is more difficult than assessing gross impacts. Only two published, third-party impact evaluations of B&T policies have attempted to assess net impacts (see Chapter 5).

Several methods can be used to assess net impacts:[76]

- Control methods with randomized control trial and quasi-experimental designs
- Survey-based approaches
- Common-practice baseline approaches
- Market sales data analyses
- Top-down evaluations (or macroeconomic models)
- Structured expert judgment approaches
- Deemed or stipulated net to gross ratios
- Historical tracing (or case study) method

In practice, evaluators use a variety of methods, some of which address free ridership, spillover, or both (e.g., self-report surveys); others focus on market effects (e.g., structured judgment approaches or historical tracing), while other studies have used control group-based methods. The methods most commonly employed for energy efficiency policies and programs in general when net savings are assessed are survey-based approaches and structured expert judgment approaches. However, comparison group methods were used for the two published, third-party impact evaluations of B&T

[76] Violette and Rathbun (2014).

policies that assessed net impacts (see Chapter 5). As mentioned above, these control group methods are usually seen as more reliable than the other methods listed above

### 4.4.2 Assessing market transformation and other non-energy impacts

Market transformation occurs over time, making impacts and indicators difficult to quantify and attribute to B&T policies versus other influences. Thus, assessing the early progress of market transformation efforts typically relies upon observing qualitative changes in market structure or market actor behavior as evidence that the eventual, intended energy savings outcomes are likely to take place. Survey-based and structured expert judgment approaches are most commonly used to evaluate the impacts of market transformation. However, for B&T policies, Berkeley Lab was only able to find two studies that reported on market transformation indicators, both for New York City (see Section 4.5.1).

While energy, water, and emissions impacts typically are assessed quantitatively, any other non-energy impacts typically evaluated are assessed only qualitatively, whether for B&T policies specifically or for other types of efficiency-related policies. However, with high interest in economic development impacts for all types of public policies, there are some quantitative assessments of job impacts.

In terms of job development impacts, Berkeley Lab found a single study—a third-party impact assessment of New York City's B&T policy. The B&T evaluation used two analytical approaches to determine job growth:[77]

- *Input-output modeling:* "….to view job creation: through the labor required to benchmark properties each year, and through estimated economic activity resulting from energy-efficiency improvements"
- *Job-multipliers:* "The studies' job creation multipliers predict the number of jobs that result from the energy-efficiency expenditure activities, and include three types of job creation:[78]
    - Direct Jobs: Jobs generated from a change in spending patterns resulting from an expenditure or effort (e.g., construction jobs for an energy-efficiency retrofit project or operations and maintenance jobs directed toward efficiency improvements)
    - Indirect Jobs: Jobs generated in the supply chain and supporting industries of an industry that is directly impacted by an expenditure or effort (e.g., the production components in efficiency related mechanical equipment or trucking of materials)
    - Induced Jobs: Jobs generated by the spending of received income resulting from direct and indirect job creation in the affected region (e.g., workers added in the direct and indirect job categories spend money in the economy on housing, retail goods and services, healthcare, food, etc.)"

[77] Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015b).

[78] An American Council for an Energy-Efficient Economy paper further details these types of job creation from increased energy efficiency: http://www.aceee.org/files/pdf/white-paper/energy-efficiency-job-creation.pdf.

Figure 9 shows the three types of job creation assessed in the New York City impact evaluation. The evaluation used an input-output model to calculate jobs from three activities: operations and maintenance improvements, capital upgrades, and energy savings. Appendix D includes the results for the 2010 to 2013 period with other summary impacts for New York City.

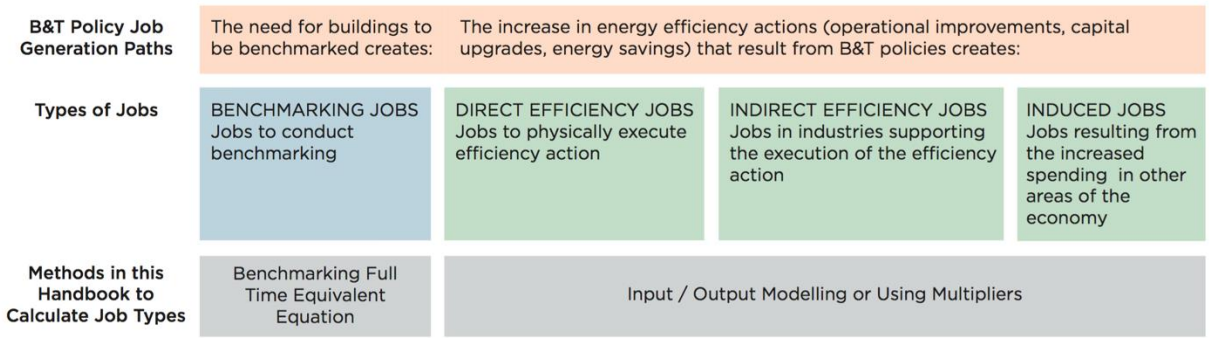


**Figure 9. Job Creation Categories for Benchmarking and Transparency Policies[79]**

## 4.5 Available data for jurisdiction-specific reported benchmarking and transparency metrics

Assessing performance metrics requires longitudinal data—data that track the same type of information on the same subjects at multiple points in time. Benchmarking and transparency policies are still nascent, and the availability of reported data from B&T policies reflects this.

Table 11 at the end of this chapter summarizes the data available for the 24 jurisdictions with B&T policies. For the 24 jurisdictions, the most commonly reported information is:

- Address and property type (23 jurisdictions)[80]
- ENERGY STAR score (23 jurisdictions)[81]
- Building square footage (22 jurisdictions)[82]
- Site energy use intensity (thousand British thermal units [kBtu]/ft$^2$) (20 jurisdictions)[83]
- GHG emissions (metric tons of carbon dioxide equivalent [$CO_{2(e)}$]) (18 jurisdictions)[84]
- Weather-normalized site EUI (kBtu/ft$^2$) (11 jurisdictions)
- Water use or water intensity (11 jurisdictions)
- Source energy use intensity and weather-normalized source energy use intensity (kBtu/ft$^2$) (10 jurisdictions)
- Electricity (kWh) and natural gas (kBtu) consumption (8 jurisdictions)

[79] Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015b).
[80] Denver does not explicitly state that the address and property type must be reported.
[81] Pittsburgh does not explicitly state that the ENERGY STAR score must be reported.
[82] Denver and Austin do not explicitly require building square footage to be reported.
[83] Berkeley, Boulder, Cambridge, and Kansas City do not explicitly require site EUI to be reported.
[84] Austin, Berkeley, Boulder, Cambridge, Pittsburgh, and Washington State do not explicitly require GHG emissions to be reported.

Ten of the B&T policies reviewed for this report either do not have any data to report[85] or do not have public data for privately owned buildings (Boulder, Montgomery County, and Washington State). Two cities have publicly accessible data for one year (Cambridge and Portland, OR), and the remaining nine jurisdictions have published more than one year of B&T data for privately owned buildings (some of which is weather normalized):

- Four cities (Boston, Chicago, Minneapolis, and Philadelphia) have two years of data.
- Five cities (Austin; Washington, D.C.; New York City; San Francisco; and Seattle) have three or four years of data.[86]

Ten jurisdictions (Boston; Cambridge; Chicago; Minneapolis; New York City; Philadelphia; Portland, OR; San Francisco; Seattle, and Washington, D.C.) have published at least one report using these data to describe the characteristics of private-sector buildings. This information can be used to understand the scale of opportunities available in existing private-sector building stock in these cities and to benchmark their buildings against each other and against national averages. However, the data alone do not indicate performance metrics regarding the impacts of the B&T policies, such as how much energy was saved, how much emissions were reduced, or how much property values have increased.

Section 4.3 defined four categories of performance metrics: energy impacts, non-energy impacts, market transformation, and interim B&T policy implementation milestones. The availability of such data is very limited, and independently determining performance metrics is beyond this study's scope. The appendices include excerpts from some of the published B&T reports for energy and non-energy impacts (Appendix D), implementation milestones (Appendix E), and efficiency and property values (Appendix F). Appendix E also provides representative indicators on cities' outreach activities in support of the B&T policies and current-year summary performance indicators for buildings with reported data.

While very little information is available on market transformation-related indicators, Section 4.5.1 provides an example of what such data could look like based on two studies of the market effects of New York City's B&T ordinances. Sections 4.5.2 and 4.5.3 describe the availability of energy and non-energy metrics data and implementation milestone data availability, respectively. These data are available for more cities.

### 4.5.1 Available market transformation performance metrics data and results

None of the jurisdictions has reported market transformation data as such. Reporting such metrics requires market data collection and market actor interviews, which is beyond the building-specific data collection and analyses currently conducted by the jurisdictions. However, two analyses by third parties of market transformation metrics have been completed for New York City.

[85] Atlanta; Berkeley; California; Denver; Evanston; Kansas City; Los Angeles; Orlando; Pittsburgh; Portland, ME.
[86] Seattle provided its 2015 B&T data after the cut-off date for new data for this report. See https://data.seattle.gov/dataset/Performance-Ranges-By-Building-Type-2015/pqdh-4i9k.

The first report was based on a survey conducted in spring 2016, of 151 New York City facility managers of buildings 50,000 square feet and larger in New York City, by a third-party vendor working for National Electrical Manufacturers Association (NEMA).[87] With increased building operator energy awareness, followed by energy efficiency implementation actions, as key market transformation metrics, the report had these important findings:[88]

- "Of those surveyed, 77% reported that they had changed how they operated their facility as a result of [New York's Benchmarking and Transparency Ordinance] Local Law 84 (LL84), including training building operation staff, stopping simultaneous heating and cooling, calibrating building systems, educating building occupants, and more."[89]
- "Seventy-five percent reported that they had made capital investments in new equipment to improve the efficiency of their building. The most frequent upgrade was lighting, followed by heating systems, lighting controls, energy management systems, cooling equipment, plug load management, daylighting upgrades, and building envelope investments."[90]
- "The most common reasons why facility managers reported that they made efficiency improvements were to save money/reduce costs (79%), to help the environment (50%), or to follow best practices (48%)."[91]

Figure 10 is an infographic with the results of the survey.

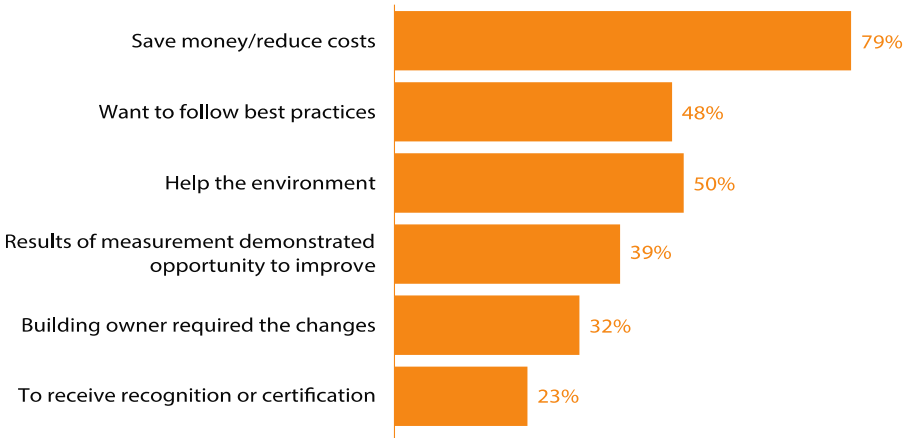


**Figure 10. New York City Facility Managers' Energy Efficiency Improvements Decision Ranking**[92]

The NEMA study concluded:

> "By demonstrating that New York City's energy benchmarking and transparency ordinance is motivating actions and investments to save energy, this survey adds to the mounting evidence

[87] NEMA (2017).
[88] NEMA (2016). Page 2.
[89] NEMA (2017). Page 6.
[90] NEMA (2017). Page 7.
[91] NEMA (2017). Page 7.
[92] NEMA (2017). Page 7.

that policies like LL84 should be adopted by communities as a way to spur energy savings in buildings and support local construction and manufacturing jobs." [93]

The second report was prepared in 2015 for DOE and is a broad impact evaluation of New York City's B&T policy,[94] which had several findings concerning energy (see Chapter 5), emissions, job impacts (See Appendix D), and market transformation indicators. The report provided initial New York City market transformation indicators organized around the following three key barriers that the B&T policy addresses:[95]

- Lack of awareness by building owner of own energy use
- Lack of transparency about energy use in the real estate market for tenants, investors, and underwriters
- Energy-efficiency program managers and administrators lack of market data for program design

The authors of the report used eight interviews with market actors to collect evidence, or note the lack of evidence, on the presence of these indicators. Table 10 summarizes the results of the interviews and subsequent analysis. The report noted that it "is too soon in the implementation process to make generalizations about changes in market actor behavior, or to directly attribute to the policy the increased amounts of energy and non-energy benefits found to exist in this study."[96]

**Table 10. 2015 Immediate and Short-Term Indicators for New York City[97]**

| Outcome | Market Transformation Indicator | Market Transformation Present? |
|---|---|---|
| **Immediate** | | |
| Increased building owner awareness of energy use | Building owners are aware of annual energy spent per building or leased space for all fuels. | Yes |
| **Short Term** | | |
| Owners recognize opportunities for energy savings and begin to take operational actions and implement low-cost measures. | Building owners can identify specific energy savings opportunities in their own buildings. | Yes, but not necessarily due to policy |
| | Building owners can describe implementation of specific low-cost measures within their own buildings. | Yes, but not necessarily due to policy |

[93] NEMA (2017). Page 8.

[94] Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015b).

[95] Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015b).

[96] Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015b).Page i.

[97] Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015b).

| Outcome | Market Transformation Indicator | Market Transformation Present? |
|---|---|---|
| **Immediate** | | |
| Tenants, investors, and underwriters begin to incorporate energy performance into real estate decision-making. | Tenants are increasingly aware of benchmarking information, and their understanding of this information increases over time. | Yes |
| | Investors and underwriters are increasingly aware of benchmarking and transparency information. | Yes |
| Program administrators use insights from benchmarking to inform program design. | Energy-efficiency program administrators begin to include benchmarking and transparency information to their new program design. | Yes |

### 4.5.2 Available energy and non-energy performance metrics data

Theoretically, energy and non-energy impact metrics associated with buildings covered by B&T policies—on a gross and net basis—can be calculated using the data provided in publicly available spreadsheets. However, analysis of these data would require substantial analytical resources and additional data for the following reasons:

- The anticipated changes in annual energy and non-energy indicators are expected to be small, on the order of a few percent.[98] Thus, even small data errors or failure to correct for weather normalization can cause significant inaccuracies and bias in the results.
- Quality of the reported data would require a significant verification effort. For example, in the 2016 Chicago report, 9 percent of energy values for buildings were estimated, 31 percent of values were "default," and 4 percent of values were "temporary."[99] New York's most recent annual report also indicated significant percentages of reported data were not useable.[100]
- A proper analysis requires a methodology that includes data scrubbing and matching of buildings that provided data for more than one year, and excluding those that only reported partial data or data for just one year.[101] Such a methodology is described in Chicago's 2016 benchmarking report.[102]
- Analysis of the data provided would indicate gross impacts, not necessarily impacts attributable to the jurisdiction's B&T policies. Such analyses would require use of the net impact methods described above and the collection of control group data, as well as data on other influences on energy and non-energy impacts.

[98] See reported values in Table 12.
[99] City of Chicago (2016).
[100] City of New York (2016).
[101] For example, the New York City annual report for 2013 indicated that analysis of emission and energy use impacts included only buildings that reported greenhouse gas emissions or weather-normalized source energy use data in all four benchmarked years. That represents only about one-third of all benchmarked properties reporting in 2014 using 2013 use data. The report also notes that reported results do not account for the energy use and emissions reductions caused by Hurricane Sandy. City of New York (2016).
[102] City of Chicago (2016).

For this report, we rely on the energy performance metrics reported by others, as summarized in Chapter 5, for energy impact analyses results. As Table 11 shows, only six of the cities (and none of the states) with B&T policies have themselves calculated and publicly reported either energy or non-energy impacts.

- Chicago, New York, Philadelphia, and San Francisco have summary reports that indicate both energy and non-energy performance metrics over two or more years.
- Minneapolis reports a few energy metrics for a two-year period (first and second year of data availability).
- Seattle provided some preliminary indication of changes in energy use.

In addition to these self-reporting cities, a four-city analysis of net energy cost impacts covered Austin, TX, New York City, San Francisco, and Seattle. There are also two, third-party studies of the impacts of New York City's ordinance. In total, some form of energy impact data has been reported for eight cities, including the seven mentioned above, plus some data are available for Washington, D.C.[103]

With respect to studies of benchmarking efforts in general, several studies indicate positive energy savings. For example:

- A report indicating energy and environmental performance metrics for a subset of Washington, D.C., office properties for which the property owners submitted data on a voluntary basis.[104]
- A report indicating the water and energy savings associated with a Minnesota benchmarking program for 500+ multifamily buildings.[105]
- An EPA technical brief with analysis of buildings benchmarking consistently from 2008 through 2011 via Portfolio Manager.[106]

The findings from these three reports are briefly described in Table 12 in Chapter 5.

### 4.5.3 Available B&T policy implementation milestones data

Jurisdictions with B&T policies are reporting status of implementation milestones for compliance rates (see Section 3.4 for more detail) and, in some cases, indicators of the amount of outreach and training conducted by jurisdictions or other organizations (see Table 11). Outreach includes activities such as maintaining a help desk, and the related metrics reported might include how many calls the help desk received. Training is typically for building owners and operators to help them with gathering the data needed for compliance reporting and the use of Portfolio Manager. Training might also include support to contractors and others for helping the building owners and operators reduce energy, water, or emissions footprints. Outreach information data were reported for Boston, Cambridge, Chicago,

[103] The report was for a subset of buildings in Washington, D.C., that were part of a voluntary reporting program. Urban Land Institute (2014a and 2014b).
[104] The report was for a subset of buildings in Washington, D.C., that were part of a voluntary reporting program. Urban Land Institute (2014a and 2014b).
[105] Bright Power (2015).
[106] EPA (2012).

Minneapolis, San Francisco, and Seattle.[107] Seattle also had a third-party process evaluation of its help desk function. Appendix D includes the primary findings from the Seattle process evaluation reports with other interim implementation milestones data for the jurisdictions where the information is available.

[107] New York's most recent report (*New York City's Energy and Water Use 2013 Report* [City of New York 2016]) indicated it has launched outreach efforts, but did not provide data on these efforts. The report also refers to a retrofit accelerator program, the NYC Retrofit Accelerator (see https://retrofitaccelerator.cityofnewyork.us).

**Table 11. Metrics Data Availability for 24 Jurisdictions with Benchmarking and Transparency Policies**

| Jurisdiction | Jurisdiction Annual Report(s) | Third-Party Report(s) Available | Data for Privately Owned Buildings Available for at Least One Year | Data for Privately Owned Buildings Available for Multiple Years | Energy Impacts Metrics Data Available | Non-Energy Impacts Metrics Data Available | Market Transformation Metrics Data Available | Interim Implement-ation Milestone Data Available |
|---|---|---|---|---|---|---|---|---|
| **Atlanta** | No | No | No | No | No | No | No | No |
| **Austin** | No | Included in third-party evaluation of four cities[108] | Yes | 2013–2015 | Yes | No | No | No |
| **Berkeley** | No | No | No | No | No | No | No | No |
| **Boston** | Program year 2013 | No | Yes | 2014 and 2015, not weather-normalized | No | No | No | Yes |
| **Boulder** | No | No | No | No | No | No | No | No |
| **California** | No | No | No | No | No | No | No | No |
| **Cambridge** | Program year 2014 | 2016 ACEEE Summer Study paper [109] | Yes | No | No | No | No | Yes |
| **Chicago** | Program years 2015 and 2016 | No | Yes | 2014 and 2015, weather-normalized | Yes | Yes | No | Yes |
| **Denver** | No | No | No | No | No | No | No | No |
| **Evanston, IL** | No | No | No | No | No | No | No | No |
| **Kansas City, MO** | No | No | No | No | No | No | No | No |
| **Los Angeles** | No | No | No | No | No | No | No | No |

[108] Palmer and Walls (2015b).

[109] The ACEEE paper addresses process and outreach options in multiple jurisdictions with B&T policies. Schulte et al. (2016).

| Jurisdiction | Jurisdiction Annual Report(s) | Third-Party Report(s) Available | Data for Privately Owned Buildings Available for at Least One Year | Data for Privately Owned Buildings Available for Multiple Years | Energy Impacts Metrics Data Available | Non-Energy Impacts Metrics Data Available | Market Transformation Metrics Data Available | Interim Implement-ation Milestone Data Available |
|---|---|---|---|---|---|---|---|---|
| **Minneapolis** | Program years 2012, 2013, and 2014 | No | Yes | 2014 and 2015, weather-normalized | Yes | No | No | Yes |
| **Montgomery County, MD** | No | No | No | No | No | No | No | No |
| **New York City** | Program year 2013 | Several third-party evaluations (see Chapter 5) | Yes | 2012–2015, weather-normalized | Yes | Yes | Yes | Yes |
| **Orlando** | No | No | No | No | No | No | No | No |
| **Philadelphia** | Program years 2013 and 2014 | No | Yes | 2013 and 2014, not weather-normalized | Yes | Yes | No | Yes |
| **Pittsburgh** | No | No | No | No | No | No | No | No |
| **Portland, ME** | No | No | No | No | No | No | No | No |
| **Portland, OR** | Program year 2015 | 2016 ACEEE Summer Study Paper [110] | Yes | No | No | No | No | Yes |
| **San Francisco** | Performance report for 2010–2014 | Included in third-party evaluation of four cities | Yes | 2011–2015, weather-normalized | Yes | Yes | No | Yes |
| **Seattle** | Program Years 2011–2013 | Process evaluation[111] and included in third-party evaluation of four cities | Yes | 2011–2013; 2015 available online | Limited | No | No | Yes |
| **Washington, D.C.** | Program years 2013–2014 | 2012 Office Building Performance Report[112] | Yes | 2011-2015, weather-normalized | Partial | Partial | No | No |
| **Washington State** | No | No | No | No | No | No | No | No |
| **Total** | 10 | 7 | 11 | 9 | 8 | 5 | 1 | 9 |

[110] Schulte et al. (2016).
[111] Slobe and Heller (2014).
[112] The report was for a subset of buildings in Washington, D.C., that were part of a voluntary reporting program. Metro Washington, D.C. (2014).

# 5 National Indications of the Energy Impacts of Benchmarking and Transparency Policies

Chapter 4 discussed the availability of performance metrics for jurisdictions with B&T policies, noting that there is a limited amount of such data. In particular, there is a lack of data on non-energy impacts and market transformation indicators. As a result of this limitation, gross energy savings are the only performance metrics from which conclusions can be drawn at this time. This chapter provides summary data for gross energy savings for six jurisdictions and net energy savings results from two, third-party studies of B&T policies (for New York City, Austin, New York, San Francisco, and Seattle).

Other parts of this document present individual examples of reported performance metric data:

- Section 3.4 provides information on compliance rates for nine cities that have reported this information.
- Section 4.5.1 describes some market transformation indicators as reported for New York City (the only city with such indicators reported, in this case by a third-party).
- Appendix D has energy and non-energy metrics examples for seven jurisdictions.
- Appendix E has interim implementation milestone examples for nine jurisdictions.
- Appendix F has an example of property valuation impacts associated with efficient buildings (which can be associated with B&T policies).

There are no national, comprehensive impact evaluations of B&T policy impacts. Performing such impact analyses was outside the scope of this study and may be difficult to perform at this time given the lack of data available for many of the jurisdictions with B&T policies (see Chapter 4). Additional useful data may become available in the future as jurisdictions gather more years of data and more reliable data as their data collection and cleaning processes improve. The new data can be used to generate more robust indications of the attributable energy and non-energy performance of B&T policies for individual jurisdictions and collectively. Further, if jurisdictions or third parties more systematically collect market transformation indicators, analyses of how markets are reacting to the B&T policies can be assessed. All such information can indicate how B&T policies are performing and may also indicate areas for improved efficacy of implementation (see identified opportunities listed in Chapter 6).

## 5.1 Energy impact data

Quantifiable energy impacts (e.g., energy savings) are the most clearly identifiable objective of B&T policies and are the metric most often reported when there are data to support such quantification. As Table 12 shows, six cities (Chicago, Minneapolis, New York City, Philadelphia, San Francisco, and Seattle) have their own B&T evaluation reports with indications of gross energy savings and three third-party comprehensive analyses indicate net energy (or energy cost) impacts for three of these cities (New York, San Francisco, and Seattle) as well as one additional city (Austin). Thus, a total of seven cities have B&T policy energy impact evaluations. Air emissions reductions are reported for a few cities in their

annual reports (see Table 12 and Appendix D).[113] In addition, some cities report average changes in ENERGY STAR scores for the reporting buildings.[114]

Table 12 lists the geographic coverage of reports with energy ex-post impact evaluation results and provides a summary of their findings with respect to energy impacts.[115] It is a simplistic summary because there are nuances to each reported value, such as whether the data that form the basis for reported energy savings are all the buildings reporting data or a subset of such buildings, whether the data were weather-corrected, how many years of data were used, whether the data indicate energy use changes in total or per square foot, and whether the indicated values are net or gross. Thus, it is not practical to directly compare the results from one analysis to another, and the assumable reliability of the indicated values likely varies.

## 5.2 Energy impact findings

Determining energy impacts addresses two primary questions:

1. Are buildings subject to B&T policy requirements consuming less energy, or are they less energy-intensive (using less energy on a per square footage basis[116]) after implementation of the B&T policy?
2. Can any observed changes in energy use or intensity be attributed to the B&T policy (i.e., is there sufficient evidence of causation between B&T polices and energy impacts)?

Regarding the first question, the impact evaluation reporting to date combined with the logic models for B&T policies (see Chapter 4) indicate it is reasonable to hypothesize that buildings participating in B&T policy-based reporting efforts have reduced their energy use and energy use intensity. This finding is a reasonable hypothesis, rather than a specific conclusion, because most B&T policies are in the early stages of implementation. Only eight of the 24 jurisdictions with B&T policies have any impact metrics reported at all, and the impacts reported to date are based on limited periods of B&T policy implementation, if not limited data in general for subsets of reporting buildings.

Regarding the second question, two studies to date indicate that there is a causal relationship between B&T policies and energy savings, or at least energy cost savings. However, for reasons similar to those above related to not drawing conclusions prematurely, these indications should be considered

[113] Table 12 summarizes emissions reductions for these cities, where available. There are few data and a lack of documentation on how values were calculated.

[114] The 1 to 100 ENERGY STAR score is a screening tool that helps assess how a building is performing with respect to energy use. A score of 50 is the median. The higher the score, the better the building is performing. A score of 75 or higher means it's a top performer and may be eligible for ENERGY STAR certification. The score adjusts for climate and business activity. See https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager/interpret-your-results/what.

[115] The information in the chapter is based on ex-post evaluations of benchmarking and B&T policies. It does not include ex-ante estimate of potential benefits. Such studies have been conducted by the Institute for Market Transformation—e.g., see Burr et al. 2012.

[116] Energy intensity could be assessed on the basis of energy use per occupant, level of activity in a building, or other metric that might be used as a unit of measure of interest. However, in all cases the Energy Use Intensity (EUI) value calculated for B&T policies and commercial buildings in general is energy use per square foot of building.

preliminary. Future analyses may provide data and conclusions that confirm, or do not confirm, these hypotheses and provide greater specificity on the range of energy impacts. Following are the bases for these findings.

All the evaluation reports described in Table 12 except one, indicate some reduction in energy use (from 1.6 to 14 percent reduction), energy costs, or energy intensity, over the two- to four-year period of the analyses.[117] The one evaluation report (Minneapolis) that indicated an increase in energy use (approximately a 2 percent increase in EUI from 2013 to 2014) also indicated that the period covered was very early in the implementation of the B&T ordinance and perhaps too soon for building owners and operators to have responded to the B&T information.[118] Overall, most of the reports listed in Table 12 indicate 3 to 8 percent reductions in gross energy consumption or EUI, over a two- to four-year period of B&T policy implementation.

This range of 3 to 8 percent is also generally consistent with the impacts reported in reports by EPA,[119] Minnesota, and Washington, D.C. (see Table 12), as well as in one international program evaluation[120] of benchmarked buildings, all of which were not necessarily covered by a B&T requirement. Although not a direct indication of B&T policy performance, these reports point toward savings as a major outcome of B&T policies. However, these reports include both voluntary and mandatory reporting populations. These populations would be expected to be different, with voluntary program participants likely having a self-selection bias towards energy efficiency and reductions in energy use. *Also, apart from two of the studies shown in Table 12, these conclusions are based on average energy use over time, meaning that these are correlations and not necessarily causally attributable results.*

Thus, regarding the second question of whether energy impacts can be attributed to B&T policies, two studies (included in Table 12) indicate that the answer is that there is a causal relationship between B&T polices and energy impacts. One of those studies was a rigorous analysis of impacts attributable to B&T policies published by Resources for the Future (RFF), which evaluated impacts of B&T regulations

[117] For comparison, the U.S. Energy Information Administration's 2017 reference case projects that U.S. total energy consumption increases by a total of only 5 percent between 2016 and 2040. See EIA 2017.

[118] In a report released after the cut-off date for new data for this report, Minneapolis reported a decrease in weather-normalized energy use intensity from 2014 to 2015 of slightly more than 2 percent for private buildings. City of Minneapolis (2017).

[119] EPA ENERGY STAR Portfolio Manager Data Trends.

[120] Urban Land Institute, Greenprint Performance Report, Volume 7. http://uli.org/research/centers-initiatives/greenprint-center/greenprint-performance-report/.

- "This report is based on analysis of data Greenprint and its members collected on 5,414 properties across 123 million square meters (1.32 billion square feet) of building area in 39 countries."
- "Greenpoint members collectively use the Greenprint Environmental Management Platform to track, report, benchmark, and analyze energy, emissions, water, and waste performance for properties, funds, and portfolios."
- "For those buildings participating in Greenprint since its inception in 2009, energy consumption decreased by 13.7 percent, greenhouse gas emissions by 16.5 percent, and water use by 10.9 percent."
- "From 2014 to 2015, same-building energy consumption decreased by 3.4 percent, greenhouse gas emissions by 3.9 percent, and water use by 4.8 percent."
- "In six U.S. cities, buildings participating in Greenprint significantly outperformed the portfolio average, achieving reductions of 5 percent, 6 percent, or even 10 percent between 2014 and 2015."

in Austin, New York, San Francisco, and Seattle.[121] Their control-group based regression analyses, which controlled for several factors, addressed reductions in quarterly utility expenditures (bills). Changes in utility expenditures are not necessarily the same as a reduction in energy consumption. The RFF study focused on utility expenditures because that is the data the researchers had available to build control groups for their analyses.

The RFF study concluded the following:[122]

> We find that disclosure laws have had a negative effect on utility expenditures. In our central specification, which includes a large set of buildings in cities across the country as controls, average utility expenditures per square foot are approximately 3 percent lower in buildings covered by the laws. The finding is fairly robust to alternative specifications and samples of control buildings, though the precision of the estimates varies. When we limit the sample of control buildings to those in cities that either have adopted disclosure laws after the time period of our study or are actively considering such laws, we continue to find a negative effect of the laws, but it is statistically insignificant.

The study further notes that RFF:[123]

> … find[s] a similarly sized percentage impact in New York and San Francisco, a much larger impact in Seattle, and no statistically significant effect in Austin. Seattle's larger impact is due to low average utility expenditures in buildings there, which in turn appears to be due, at least in part, to relatively low electricity prices. Austin's negligible impact is probably due to the small treatment sample size there, as the city's law was the most recent to go into effect among the four cities.

The RFF study's estimates are a measure of the difference in average utility expenditures (per square foot) over roughly the first quarter of 2012 to the third quarter of 2013. The findings essentially indicate that average utility bills in the four early-adopter cities would have been about 3 percent higher without the B&T ordinances. Because the benchmarking policies that were analyzed were fairly new during the data collection period, and there were a limited number of "post disclosure requirement" observations, this is a short-run response indication. One might expect the size of the impact to grow over time once property owners have an opportunity to make investments, but whether this is the case remains an open question to be investigated. The authors of the RFF report have now obtained several additional quarters of data and are in the process of updating the analysis to go through the end of 2015. This could allow RFF to add more city policies and to have more observations for programs that have been in effect for a while.[124]

[121] Palmer and Walls 2015b.

[122] Palmer and Walls 2015b. Page 3.

[123] Palmer and Walls 2015b. Page 6.

[124] Communications with Karen Palmer and Margaret Walls, RFF, between January 30 and February 9, 2017.

The other net impact analysis, which addressed energy use intensity for New York City, was published by researchers at Massachusetts Institute of Technology (MIT) and University of Pennsylvania.[125] They identified treatment and control groups both before and after the B&T policies took effect and measured outcomes for each group and time, using a difference-in-differences causal study design to estimate effects using an econometric regression approach. The results indicated that: [126]

> … in comparison with the control group and before the policies were implemented in 2011, the total disclosure policy can be credited with a 6% reduction in building energy use intensity (EUI) three years later and a 14% reduction in EUI four years later; the disclosure of ENERGY STAR scores decreased building EUI by 9% three years later and 13% four years later. The two sets of independent findings are a consequence of the policy design and different control groups.

and

> Since this effect only appears in 2013 and 2014, energy saving related to benchmarking policies appears to be only significant after three years of policy implementation. This interpretation is reasonable, as time is required for building owners and potential tenants/buyers to understand the building energy information and to incorporate it into their decision-making process.

[125] Meng et al. 2016.

[126] Meng et al. 2016. Pages 9-1, 9-7, and 9-8.

**Table 12. Summary of Impact Data Available from Benchmarking and Transparency Evaluations**

| Jurisdiction | Report | Period of Time Covered by Reported Impacts | Energy Savings | Weather-Normalized? | Net or Gross | Total Energy Savings or EUI (energy use per square foot) | Notes |
|---|---|---|---|---|---|---|---|
| **Evaluations of B&T Polices and Ordinances** | | | | | | | |
| Chicago | Chicago 2016 Annual Report (City of Chicago 2016) | 2013–2015 | Cumulative 1.6% decrease over three years (212 buildings analyzed in 2015) Cumulative 4% decrease over three years (200 buildings analyzed in 2016) | Yes | Gross | Total Energy | Also indicated ENERGY STAR ratings improvements over the same time period |
| Minneapolis | Minneapolis 2014 Annual Report (City of Minneapolis 2016) | 2013–2014 | Approximately 2% increase in EUI from 2013 to 2014 | Yes | Gross | EUI | Report indicated that the private sector reporting was new. "Since the reporting date lags the performance year, building owners and managers had little opportunity to react to the benchmarking results and improve performance." |
| New York City | NYC 2013 Annual Report (City of New York 2016) | 2010–2013 | Cumulative 6% reduction over three years | Yes | Gross | Total Energy Use | Also indicated that emissions were reduced over same time period by 8% |
| | MIT/University of PA Study (Meng et al. 2016) | 2011–2014 | Cumulative 14% reduction over four years | Yes | Net | EUI | Also indicated an initial three-year reduction of 6% |
| | DOE Report (Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015b). | 2010–2013 | Cumulative 5.7% reduction over four years | Yes | Gross | Total Energy Use | Also indicted a cumulative GHG percentage reduction of 9.9% between 2010 through 2013 |

| Jurisdiction | Report | Period of Time Covered by Reported Impacts | Energy Savings | Weather-Normalized? | Net or Gross | Total Energy Savings or EUI (energy use per square foot) | Notes |
|---|---|---|---|---|---|---|---|
| **Evaluations of B&T Polices and Ordinances** | | | | | | | |
| Philadelphia | Philadelphia 2014 Annual Report (City of Philadelphia 2016) | 2012–2014 | "Raw energy usage increased in 2014, but when normalized for weather, building performance improved between 2013 and 2014." | NA | NA | NA | Indicated a 7% reduction in carbon emissions from large buildings |
| San Francisco | San Francisco Annual Report (SFE 2015) | 2010–2014 | Cumulative 7.9% reduction | NA | Gross | Total | Indicated value for "…cohort of 176 properties that have benchmarked energy use consistently over the past five years." Report also indicated a 16.9% reduction in energy-related emissions for 2010–2014 for the same 176 properties. |
| Seattle | Seattle 2015 Annual Report (2013 data) (Seattle Office of Sustainability 2015) | 2012–2013 | Decrease of 0.6% (2012–2013) Decrease of 2.7% (2014–2015)[127] | NA | Gross | Total | "2012 was the first year that the ordinance included buildings 20,000 to 50,000 $ft^2$ and therefore (a) 2013 was the first year that year-to-year comparisons were made, (b) a measured change between 2012 and 2013 is not necessarily indicative of a trend." |

[127] Seattle.com. Greenspace Blog. Seattle's Buildings Are Using Less Energy. November 4, 2016. http://greenspace.seattle.gov/2016/11/seattles-buildings-are-using-less-energy/#sthash.ZTk4RrsG.dr2e7DZP.dpbs; Seattle Energy Benchmarking Attains 99% Compliance. July 29. 2016. http://greenspace.seattle.gov/?s=benchmarking#sthash.XFOW2dQF.EgjqAcbH.dpbs

| Jurisdiction | Report | Period of Time Covered by Reported Impacts | Energy Savings | Weather-Normalized? | Net or Gross | Total Energy Savings or EUI (energy use per square foot) | Notes |
|---|---|---|---|---|---|---|---|
| **Evaluations of B&T Polices and Ordinances** | | | | | | | |
| Austin, New York, San Francisco, and Seattle | Resources for the Future 2015 Report (Palmer and Walls 2015b) | Post early 2012 when the first program took effect through 3rd quarter of 2013 | About 3% reduction in quarterly utility expenditures | Yes | Net | Total Energy Costs | Savings estimates are a measure of the difference in average utility expenditures (per square foot) over roughly the 1st quarter of 2012 through the 3rd quarter of 2013 due to the benchmarking laws. |
| **Example Evaluations of Benchmarking (not specifically for buildings subject to a B&T policy or ordinance)** | | | | | | | |
| Washington, D.C. | 2014, GreenPrint Performance report of buildings with voluntary reported data (Urban Land Institute 2014a and 2014b) | 2009–2012 | Cumulative 5.8% reduction | NA | Gross | Total | Also indicated reduced $CO_{2(e)}$ emissions reduction of 5.2% over same period |
| National | U.S. EPA Portfolio Manager Data Trends 2012 Technical Brief - analysis of buildings that have benchmarked via Portfolio Manager (EPA 2012) | 2008–2012 | Average annual energy (source) savings is 2.4%, with a total savings of 7.0% | Yes | Gross | EUI | Analysis represents buildings benchmarking consistently from 2008 through 2011 via Portfolio Manager |
| Minnesota Non-Residential Buildings | EnergyScoreCards Minnesota (Bright Power 2015) | 2012–2015 | About 5% reduction in site energy use over two years | Yes | Net | EUI | Also indicated a 30% reduction in water use |

# 6 Best Practices for Benchmarking and Transparency Policy Design, Implementation, and Research

This chapter addresses practices associated with B&T policy design and implementation, B&T performance metrics, and accessing building energy and water consumption data from utilities. The chapter concludes by identifying opportunities for future implementation of B&T policy design as well as research topics.

## 6.1 Benchmarking and transparency policy design and implementation

Table 13 and Table 14 summarize current practices for various components of B&T policy design and implementation, as discussed in Chapter 3, and indicate some potential opportunities to improve the effectiveness of B&T policies. These identified opportunities are based on published reviews of B&T policies, including identification of effective strategies, interviews with staff implementing B&T policies (as described in Chapter 2), and conclusions reached by this report's authors.

**Table 13. Current Practices and Opportunities for Benchmarking and Transparency Policy Design**

| Policy Characteristic | Current Practices | Opportunities |
|---|---|---|
| **Criteria for selection of building sizes and types** | Jurisdictions have made limited efforts to quantitatively assess the impact of including or excluding buildings based on their sizes (floor area) and types. | • Review criteria and experience of other jurisdictions for possible applicability.<br>• Evaluate the jurisdiction's building stock to determine the appropriate threshold for building sizes and uses that achieve the greatest impact at the least cost for both building owners and the jurisdiction.<br>• Assess reported data by building size categories and types to better understand the impacts each has on performance metrics. Use the data to assess which buildings should be covered. |
| **Phased implementation for different categories of buildings** | Most jurisdictions use phased implementation, requiring government buildings, larger buildings, or both to comply with the policy first. | • Lead by example by requiring publicly owned buildings to comply with B&T policies prior to privately owned buildings to develop tested implementation strategies and garner support for the policy. |
| **Exemptions to reporting B&T data** | Jurisdictions provide limited information regarding the basis for their exemptions. Table A-2 shows common exemptions. Few, if any, jurisdictions have quantified the impact of exemptions. | • Collect data (e.g., energy use, building types, ownership structures) on quantity and types of buildings exempt from the B&T policy to help inform opportunities to include those buildings in the policy in the future or confirm the validity of these exemptions. |
| **Complementary policies** | Ten jurisdictions have audit or retro-commissioning requirements that complement their B&T policy (see Table A-4). | • Consider coupling B&T reporting with energy and water audits to identify cost-effective opportunities for reducing energy and water usage in buildings covered under the B&T policy. Similarly, consider connecting retro-commissioning programs with buildings with high energy use intensities.<br>• Partner with utilities and other program administrators to reduce energy and water waste in buildings.<br>• Provide direct links from B&T policy websites to websites with information on utility energy audit and incentive programs. |

**Table 14. Current Practices and Opportunities for Benchmarking and Transparency Policy Implementation**

| Implementation Approach | Current Practices | Opportunities |
|---|---|---|
| **Market education and outreach to stakeholders for policy development and support** | Jurisdictions use a variety of strategies to gain support for B&T policy development and support. Table 2 provides detailed information on current market education and outreach practices. | • Document and publicize benefits of B&T policies for building owners, utilities, and the general public.<br>• Engage key stakeholders early in the policy development process using existing stakeholder infrastructures.<br>• Develop partnerships with nonprofit organizations, industry groups, and utilities that can realize benefits from B&T policies and aid in education and outreach.<br>• Solicit support from influential building owners and operators to assist in education and outreach.<br>• Elicit support from real estate agents that can use B&T data to support policy education. |
| **Market education for compliance with B&T policies** | Jurisdictions use a variety of strategies to encourage and educate building owners and managers on policy compliance. Jurisdictions that report compliance have high compliance rates, ranging from 73% to 99%. However, most jurisdictions do not report compliance rates. Table 1 and Table A-3 provide detailed information on compliance rates. | • Work with utilities to develop solutions for the release of aggregate data to building owners to facilitate benchmarking (see Table 6 and Table 16).<br>• Partner with electric and gas utilities and industry groups to aid in information dissemination.<br>• Create user-friendly, online resources such as "how-to" guides and online forums that provide building owners with answers to common questions about compliance.<br>• Use webinars, in-person trainings, and online training documents and videos to aid with compliance education.<br>• Establish help centers with jurisdiction staff, contractors, or local trade association volunteers.<br>• Provide additional support at designated periods in the B&T policy implementation—e.g., during initial implementation and during "high traffic" times when compliance deadlines approach. |
| **Enforcement of B&T policies** | Jurisdictions have limited experience with enforcing B&T policies to date. Table A-3 shows enforcement entities and penalties for noncompliance. | • Provide adequate funding and training for enforcement.<br>• Measure compliance every year by building type and size category.<br>• Collect data on barriers to compliance and develop a range of strategies to address the barriers (e.g., educational efforts).<br>• Leverage authority to reduce fines by requiring that the owner come into compliance before discussing fine reduction. |
| **Ensuring high quality data are being reported** | The level of data validation and scrubbing varies significantly across jurisdictions with B&T policies. Several reports have highlighted concerns with the quality of data that are provided in compliance reports. Jurisdictions interviewed by Berkeley Lab cited a number of common challenges to receiving accurate data from building owners and managers. | • Develop data quality criteria and systems to check reasonableness of data, such the data verification requirements used in Chicago, Evanston, Montgomery County, and Orlando.<br>• Use resources such as the DOE Standard Energy Efficiency Database (SEED) Platform and Building Energy Data Exchange Specifications (BEDES), and use the features in Portfolio Manager that improve data quality.<br>• Consider identifying where Portfolio Manager default values have been used and allowing enforcement for noncompliance when building owners use the default values. |

| Implementation Approach | Current Practices | Opportunities |
|---|---|---|
| **Transparency of B&T information** | Few jurisdictions have published reports summarizing the information collected from their B&T databases. A subset of those reports provides statistics useful for understanding the profiles of reported buildings, performance metrics, or opportunities to reduce energy and water waste. Only some jurisdictions have made their collected building data available on public websites, and often the data are not easily accessible for analysis. | • Provide annual B&T reports with summary statistics of data, performance metrics, and identified areas of opportunity for improvements in the jurisdiction's building stock.<br>• Provide reported data that do not contain confidential information on publicly accessible websites in a manner that allows for analysis.<br>• Transfer the benchmarking data into the CoStar database.<br>• Consider the following ways to improve the presentation of disclosed information:<br>  ○ Additional channels for public transparency, such as live presentations, dashboards, and maps<br>  ○ Recognition approaches for building owners that comply and awards for high-performing buildings with low energy use intensity<br>  ○ Report cards or building energy performance profiles that include building energy data as well as local efficiency resources and compliance information[128] |

## 6.2 Performance metrics

Benchmarking and transparency policies appear to result in a wide range of benefits, perhaps foremost energy and water savings. However, many other benefits are not currently quantified. These benefits could be assessed, reported, and used to better understand the impacts of B&T policies. Several of the jurisdictions Berkeley Lab interviewed were interested in assessing a wider range of performance metrics, if they had funding or staff to do so. They recognize the importance of metrics for assessing current and projected future progress in improving the efficiency of building energy and water use, reducing environmental impacts, identifying opportunities for improving policy performance through modifications, and providing the public with information about the impacts of B&T polices.

A nationally standardized method for data collection, reporting, and evaluation of B&T policies, developed with an advisory group of state and local jurisdictions, energy efficiency and evaluation experts, building owner and real estate associations, and other stakeholders could improve the consistency and quality of B&T impact studies, providing policymakers and others with a more complete understanding of the present and future impacts of these policies.

Table 15 summarizes current practices and provides opportunities associated with the four categories of performance metrics identified in Chapter 4.

[128] Freeh (2016).

**Table 15. Current Practices and Opportunities for Benchmarking and Transparency Performance Metrics**

| Performance Metric | Current Practices | Opportunities |
|---|---|---|
| **Energy impacts** | The most common statistics that jurisdictions report are current year total energy consumption and energy use intensity. Only a subset of jurisdictions reports on changes in energy consumption over the period of time for which B&T policies have been in place. | • Continue to publicly report energy consumption data:<br>  ○ Provide total energy use data in addition to energy use intensity data<br>  ○ Include subcategories such as by end-use (e.g., offices, retail, schools) and size (e.g., 20,000–50,000 $ft^2$, 50,000–100,000 $ft^2$, and >100,000 $ft^2$), as well as benchmarks for comparing values<br>  ○ Use logic models to identify and assess performance metrics<br>• Report energy performance metrics indicating changes in energy use over time:<br>  ○ Gross data on annual basis<br>  ○ Net data indicating attribution on a multiple-year cycle using the best available data and techniques for assessing attribution<br>  ○ Data by subcategories of buildings<br>• Implement data quality control and data scrubbing protocols.<br>• Use evaluations to identify opportunities for improved implementation and performance of B&T policies. |
| **Non-energy impacts** | Few jurisdictions have reported emissions or water use data. At least one third-party study evaluated employment impacts. | • Report broader impacts of B&T policies related to benefits to building owners and occupants/users, utility systems, local communities, and society.<br>• Quantify and publicize impacts such as local economic development through job growth, property value increases, and reduced air pollution. |
| **Market transformation** | At this time, jurisdictions are not tracking market indicators. | • Track market transformation metrics such as:<br>  ○ Changes in awareness of energy and water consumption, opportunities for reducing energy and water consumption and costs, and changes in marketplace supply chains to meet demand for implementing waste-reducing opportunities<br>  ○ Changes in property valuations, changes in the energy efficiency services and products markets (and associated local jobs), and awareness and attitudes towards efficiency resulting from B&T policies<br>  ○ Rates of utility customer enrollment in available energy efficiency incentive and rebate programs<br>• Differentiate market transformation assessments between changes in market indicators that are attributable to B&T policies and those attributable to other causes, such as changes in overall economic conditions or energy prices.<br>• Use results of market transformation assessments to fine tune program implementation and report broader economic impacts of B&T policies |
| **Interim milestones** | Few jurisdictions track, analyze, and publicly report implementation of their B&T policies, including compliance metrics (see Table 12). | • Continue to track interim and milestone metrics, such as compliance rates and number and effectiveness of outreach and training efforts, as a mechanism for identifying opportunities to improve performance of B&T policies. |

## 6.3 Access to utility data

Jurisdictions establishing new B&T policies may wish to consider five key factors as they work with utilities to release aggregate energy usage data for commercial and multifamily buildings: (1) level of data (e.g., meter-level, building level), (2) time interval of data, (3) recipient of data, (4) type of data, and (5) intended use of data, shown in Table 16.

**Table 16. Utility Data Access Key Factors**

| Factor | Options | Best Practices for B&T Policies for Commercial and Multifamily Buildings |
|---|---|---|
| **1. Level of Data** | Device-level, meter-level, building-level, census block, community-wide | Building level |
| **2. Time Interval of Data** | Real-time, 15-minute, daily, monthly, yearly | Monthly |
| **3. Recipient of Data** | Building owners, operators, governments, academics, vendors, and service providers | Building owners and authorized representatives |
| **4. Type of Data** | Energy (electric, natural gas, oil, propane, biomass) and water | Energy and water |
| **5. Intended Use of Data** | Energy efficiency, community planning, academic research, meeting local environmental goals, marketing by providers of efficiency products and services, benchmarking | Benchmarking, that can then be used as the basis for enrollment in energy efficiency programs, community planning, research, and meeting local environmental goals |

Limiting utility releases to whole-building, monthly data should in most cases provide sufficient information for benchmarking purposes while maintaining the privacy of individually metered customers. Providing this level of aggregated data only to building owners and their authorized representatives with assurances that is will be used only for benchmarking purposes protects the privacy of tenants.

Energy data access in the context of commercial and multifamily B&T policies requires consideration of a range of factors. Jurisdictions may wish to consider a number of best practices with regard to data collection and customer privacy when establishing a B&T initiative, including:

- Establishing aggregation thresholds
- Encouraging authorization through leasing documents of release of energy usage data
- Mapping meter data to buildings
- Allowing tenants and owners to opt out of public release of data if publishing that data would reveal trade secrets or create security risks
- Establishing methods of filling in missing data
- Determining methods for collecting data on delivered fuels (e.g., oil, propane)
- Establishing limitations on data usage

Table 17 summarizes opportunities in each of these areas. Section 3.10 and Appendix B include a more robust discussion of best practices for utility data access.

**Table 17. Opportunities for Benchmarking and Transparency Utility Data Access**

| Issue | Opportunities |
|---|---|
| **Whole-building aggregation** | • Establish "aggregation thresholds" of between two and five utility accounts, above which authorization is not required for each individually metered customer.<br>• Consider a cap on the percentage of total energy used by a single account.<br>• Require authorization from individually metered customers to release energy data if the minimum threshold is not met. |
| **Authorization via leasing documents** | • Allow tenants to authorize the release of energy data through their leasing contract documents to avoid requiring additional authorization in the future for benchmarking purposes. |
| **Mapping energy meters to buildings** | • Match meter data to actual physical building usage.<br>• Design customer information systems to address meter mapping issues, and seek to minimize customer workload and user error. |
| **Opting out** | • Allow tenants and owners to opt out of publicly releasing data, if publishing the data would reveal trade secrets or create security risks. |
| **Missing data** | • Establish a methodology for filling in data from missing units. |
| **Energy and water** | • Support data access and benchmarking of both energy and water |
| **Delivered fuels** | • Coordinate with local delivered-fuel trade associations to establish workable data access provisions for delivered fuels. |
| **Limiting data usage** | • Restrict re-dissemination of aggregated data by building owners for uses other than benchmarking and facilitating participation in energy efficiency programs in order to further protect tenant privacy. |

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# Appendix A. Benchmarking and Transparency Summary Tables

**Table A-1. Comparison of U.S. Energy Benchmarking and Transparency Policies for Commercial and Multifamily Buildings[129]**

| Jurisdiction | Public Data | Policy Impact | | | Buildings Included | Policy Schedule | | Additional Elements |
|---|---|---|---|---|---|---|---|---|
| | Released | # of Buildings | Square footage (million) | Energy Savings | Types and Sizes | Reporting to Gov't | Reporting to Public | Water tracking |
| **Atlanta** | — | 2,900 | 402 | — | **Com & MF ≥50k**<br>*Com & MF ≥25k* | **Aug 1, 2015**<br>*Jun 1, 2017* | (if ENERGY STAR >55)<br>*Jan 2017*<br>*Sept 2017* | Yes |
| **Austin** | — | 2,800 | 113 | — | **Com ≥10k**<br>**MF ≥5 units** | **Jun 1, Annual** | **Time of transaction** | — |
| **Berkeley** | — | 257 | 13.7 | — | *Com & MF ≥50k*<br>*Com & MF ≥25k* | **> April 2017**<br>*> April 2018* | - | Yes |
| **Boston** | Yes | 1,600 | 250 | — | **Com ≥50k**<br>**MF ≥50k/50 units**<br>**Com ≥35kMF**<br>*≥35k/35 units* | **Sep 15, 2014**<br>**May 15, 2015**<br>**May 15, 2016,**<br>*May 15, 2017* | **Oct 1, 2015**<br>**Oct 1, 2015**<br>**Oct 1, 2016**<br>*Oct 1, 2017* | Yes |
| **Boulder** | — | 475 | 26 | — | **Com ≥50k**<br>**New Com ≥10k**<br>*Com ≥30k*<br>*Com ≥20k* | **Aug 1, 2016**<br>**Aug 1, 2016**<br>*Jun 1, 2018*<br>*Jun 1, 2020* | *Before Jun 1, 2019*<br>*Before Jun 1, 2019*<br>*Before Jun 1, 2021*<br>*Before Jun 1, 2023* | — |
| **California[130]** | — | 20,573 | 2,400 | — | Com >50k<br>MF >50k | *June 1, 2018*<br>*June 1, 2019* | *TBD, 2019*<br>*TBD, 2020* | — |
| **Cambridge** | — | 1,100 | 78 | — | **Com ≥50k**<br>**MF ≥ 50 units**<br>**Com ≥25k** | **May 1, 2015**<br>**May 1, 2015**<br>**May 1, 2016**<br>*Sept 1, 2017* | **Sept 1, 2016**<br>**Sept 1, 2016** | Yes |
| **Chicago** | Yes | 3,500 | 900 | 1.9% (2015-2016) | **Com ≥250k**<br>**MF ≥250k**<br>**Com ≥50k**<br>**MF ≥50k** | **Jun 1, 2014**<br>**Jun 1, 2015**<br>**Jun 1, 2015**<br>**Jun 1, 2016** | **Dec 2015**<br>**Jun 1, 2016**<br>**June 1, 2016**<br>*Before Jun 1, 2017* | — |
| **Denver** | — | 3,000 | 360 | — | *Com & MF ≥50k*<br>*Com & MF ≥25k* | *Jun 1, 2017*<br>*Jun 1, 2018* | *TBD* | — |

Note: Bold font indicates building sizes and types required to comply as of December 31, 2016. Italic font indicates building sizes and types required to comply at a future date.

[129] Adapted from IMT (2016).

[130] This represents California's proposed regulations, which are not yet finalized.

| Jurisdiction | Public Data | Policy Impact | | | Buildings Included | Policy Schedule | | Additional Elements |
|---|---|---|---|---|---|---|---|---|
| | **Released** | **# of Buildings** | **Square footage (million)** | **Energy Savings** | **Types & Sizes** | **Reporting to Gov't** | **Reporting to Public** | **Water tracking** |
| **Evanston, IL** | — | 557 | 45.6 | — | *Com & MF ≥100k*<br>*Com & MF ≥50k*<br>*Com & MF ≥20k* | *Jun 30, 2017*<br>*Jun 30, 2018*<br>*Jun 30, 2019* | *TBD* | — |
| **Kansas City, MO** | — | ~1,500 | ~400 | — | *Com & MF ≥100k*<br>*Com & MF ≥50k* | **May 1, 2017**<br>*May 1, 2018* | *Sept 1, 2018*<br>*Sept 1, 2019* | — |
| **Los Angeles** | — | 14,000 | 900 | — | *Com & MF ≥100k*<br>*Com & MF ≥50k*<br>*Com & MF ≥20k* | *Jul 1, 2017*<br>*Apr 1, 2018*<br>*Apr 1, 2019* | *TBD* | — |
| **New York City** | Yes | 33,147 | 2,800 | 6%–14% (2010 - 2014) | **Com & MF ≥50k**<br>*Com & MF ≥25k* | **May 1, Annual**<br>*Anticipated 2018* | **Sept 1, Annual**<br>*Anticipated before 2018* | Yes |
| **Orlando** | — | 826 | 125.6 | — | *Com & MF ≥50k* | *May 1, 2018* | — | — |
| **Philadelphia** | Yes | 2,900 | 390 | — | **Com ≥50k**<br>**MF ≥50k** | **Jun 30, Annual**<br>**Jun 30, 2016** | **Before Jun 30, Annual**<br>*Before Jun 20, 2017* | 91% (2013) |
| **Pittsburgh** | — | 861 | 164 | — | *Com ≥50k* | *June 1, 2018* | *Before Jun 1, Annual* | — |
| **Portland, ME** | — | 284 | — | — | *Com ≥20k*<br>*MF ≥50 units* | **May 1, 2018** | *Sept 1, 2019* | — |
| **Portland, OR** | — | 1,024 | 87 | — | **Com ≥50k**<br>*Com ≥20k* | **Apr 22, 2016**<br>**Apr 22, 2017** | *Oct 1, 2017*<br>*Oct 1, 2018* | — |
| **San Francisco** | Yes | 2,312 | 203 | 7.9% (2010 – 2014) | **Com ≥10k** | **Apr 1, Annual** | **Before Apr 1, Annual** | — |
| **Seattle** | Yes | 3,347[131] | 269[132] | 2.7% (2014 – 2015) | **Com & MF ≥20k** | **Apr 1, Annual** | **Before Dec 31, Annual** | — |
| **Washington, D.C.** | Yes | 2,000 | 357 | 9% (2010 – 2013) | **Com ≥50k**<br>**MF ≥50k** | **Apr 1, Annual** | **Annually before April 1** | Yes |
| **Washington State** | — | 4,600 | 247 | — | **Com ≥10k** | **None** | **Time of transaction** | — |

Note: Bold font indicates building sizes and types required to comply as of December 31, 2016. Italic font indicates building sizes and types required to comply at a future date.

[131] Personal correspondence with Rebecca Baker, City of Seattle.

[132] Personal correspondence with Rebecca Baker, City of Seattle.

**Table A-2. Exemptions from U.S. Benchmarking and Transparency Policies**

| Jurisdiction | Exemption |
|---|---|
| **Atlanta** | • Buildings with more than 50% residential tenants where the utility does not provide data aggregation and the owner does not have access to master meters for the building<br>• Buildings with more than 50% hotel or motel tenants where the utility does not provide data aggregation and the owner does not have access to master meters for the building<br>• Financial hardship<br>• Unoccupied buildings<br>• Residential buildings where the owner is not responsible for operations and the utility does not provide data aggregation, and the owner does not have access to master meters for the building |
| **Austin** | • Performance exemption for multifamily properties if the building owner completed comprehensive duct remediation work on the facility though participation in an Austin Electric Utility rebate program no more than 10 years before the otherwise applicable audit deadline<br>• Performance exemption for multifamily properties if HVAC equipment was replaced through an Austin Electric Utility rebate program in all units of the facility no more than 10 years before the otherwise applicable audit deadline<br>• Performance exemption for multifamily properties if HVAC equipment was replaced with equipment meeting the requirements for an Austin Electric utility rebate program, though not participating in the program, in all units of the facility no more than 10 years before the otherwise applicable audit deadline |
| **Berkeley** | • Buildings with less than 25,000 $ft^2$ must be in compliance at time of sale, or within 12 months when a lender acquired title, or by the dates specified. The requirement at sale may be transferred to the buyer and deferred 12 months under certain provisions.<br>• Performance Exemption: certification of high performance, completion of a multi-measure energy project, newly built or renovated within prior 10 years |
| **Boston** | • No exemptions listed in the ordinance<br>• Performance exemption: ENERGY STAR rating of 75 or above, LEED certification, pattern of significant improvement, inclusion in comprehensive energy management plan |
| **Boulder** | • Building owners may request exemptions for conducting an equivalent energy assessment within 10 years of the first deadline, subject to City Manager approval.<br>• Performance exemption: ENERGY STAR Certification; LEED O+M; pattern of significant improvement in efficiency or greenhouse gas emissions |
| **Cambridge** | • New properties with less than 12 months of usage statistics begin reporting the following year. |
| **Chicago** | • Requirements do not apply to any building with more than 10% occupancy use classified as Class D open air assembly units, Class G industrial units, Class H storage units, Class I hazardous use units, or Class J miscellaneous buildings and structures, as defined by Chapter 13-56.<br>• The building is presently experiencing qualifying financial distress.<br>• The building or areas of the building subject to the requirements have been less than 50% occupied during the calendar year for which benchmarking is required.<br>• New construction when the certificate of occupancy was issued less than two years prior to the applicable benchmarking deadlines.<br>• The city will not publicly share data for buildings that contain a data center, television studio, or trading floor that together exceed 10% of gross area. |

| Jurisdiction | Exemption |
|---|---|
| **Kansas City, MO** | • The property does not have a certificate of occupancy or temporary certificate of occupancy for all 12 months of the calendar year being benchmarked<br>• A demolition permit has been issued during the prior calendar year, provided that demolition work has commenced, energy-related systems have been compromised, and legal occupancy is no longer possible prior to May 1 for the applicable year<br>• The covered property has average physical occupancy of less than 50% through the calendar year for which benchmarking is required<br>• The director determines that, due to special circumstances unique to the applicant's facility and not based on a condition caused by actions of the applicant, strict compliance with the provision of the ordinance would cause undue hardship or would not be in the public interest<br>• The property is primarily used for manufacturing or other industrial purposes for which benchmarking results would not meaningfully reflect covered property energy use characteristics due to the intensive use of process energy<br>The owner is unable to benchmark due to the failure of either a utility or a tenant (or both) to report the information necessary for the owner to complete any benchmarking submittal requirement |
| **Los Angeles** | • The building did not have a Certificate of Occupancy or Temporary Certificate of Occupancy for the entire calendar year required to be benchmarked<br>• The entire building was not occupied, due to renovation, for the entire calendar year required to be benchmarked<br>• The demolition permit for the entire building has been issued and demolition work has commenced on or before the date the benchmarking report is due for that calendar year<br>• The building did not receive energy or water services for the entire calendar year required to be benchmarked<br>• There are several exemptions from participation in the energy and water audits or retro-commissioning requirements |
| **Minneapolis** | • The building is experiencing qualifying financial distress in that the building is the subject of a qualified tax lien sale or public auction due to property tax arrearages, the building is controlled by a court-appointed receiver based on financial distress, the building is owned by a financial institution through default by the borrower, the building has been acquired by a deed in lieu of foreclosure, or the building has a senior mortgage which is subject to a notice of default<br>• The building or areas of the building subject to the requirements have been less than 50% occupied during the calendar year for which benchmarking is required<br>• The building is new construction and the certificate of occupancy was issued less than two years prior to the applicable benchmarking deadline established |
| **Montgomery County, MD** | • Any building where more than 10% is used for public assembly in a building without walls; warehousing; self-storage; or a use classified as manufacturing and industrial, transportation, communications, or utilities<br>• Buildings in financial distress (i.e., bankruptcy, building in tax sale)<br>• Buildings with average occupancy of less than 50% during the calendar year being benchmarked<br>• A building that is new construction and received its certificate of occupancy during the current calendar year for which benchmarking is required<br>• A building that has been demolished during the calendar year being benchmarked |

| Jurisdiction | Exemption |
|---|---|
| **New York City** | • Energy efficiency report exemption: One to three family dwellings that are not condos, or one to three family condos that are three stories or less<br>• Energy audit exemption: ENERGY STAR Certification for 2 of 3 preceding years; LEED for Existing Building certification within four years; buildings without central cooling or chilled water systems that complete simple retrofits[133]<br>• Retro-commissioning exemption: the building earned both LEED Existing Building: Operations and Maintenance (EBOM) points for existing building commissioning or was certified under the LEED for Existing Buildings within two years |
| **Orlando** | • Buildings that do not have a certificate of occupancy for the full calendar year being benchmarked<br>• Buildings issued a full demolition permit in prior year, with demolition work commenced, including compromised energy-related systems and where occupancy is not possible prior to May 1 of the benchmarking year<br>• Buildings without utility service<br>• When the director determines that strict compliance with the ordinance would cause undue hardship or would not be in the public interest<br>• Property that is considered industry, manufacturing, or is part of a theme park<br>• Privately owned property that is used substantially for telecommunication infrastructure<br>• Privately owned property with more than three meters where the utility does not provide whole-building data aggregation services and the owner does not have access to a master meter |
| **Philadelphia** | • Buildings where in any calendar year more than 50% of the indoor floor space is unoccupied for more than 180 days in total<br>• Buildings where benchmarking or transparency would cause exceptional hardship or would not be in the public interest<br>• Buildings used primarily for manufacturing or other industrial purposes for which benchmarking results would not meaningfully reflect building energy use characteristics due to the intensive use of process energy. “Process energy” refers to energy used in the actual manufacturing, production, or processing of a good, commodity, or other material. |
| **Pittsburgh** | • Buildings that do not have a certificate of occupancy or temporary certificate of occupancy for all 12 months of the calendar year being benchmarked<br>• A demolition permit has been issued for the Covered Building during the calendar year being benchmarked, provided that demolition work has commenced, energy-related systems have been compromised, and legal occupancy is no longer possible prior to June 1 for the applicable year<br>• Buildings with an average physical occupancy of less than 50% throughout the calendar year for which benchmarking is required<br>• Due to special circumstances that are unique to the building, and not based on a condition caused by actions of the owner, applicant, or operator, that strict compliance with provisions would cause undue hardship or would not be in the public interest<br>• The building is used primarily for manufacturing or other industrial purposes for which benchmarking results would not meaningfully reflect the Covered Building’s energy use characteristics due to the intensive use of process energy.<br>• The building owner is unable to benchmark due to the failure of either a utility or a tenant (or both) to provide the information necessary for the owner to complete any benchmarking submittal requirement. |

[133] Buildings must complete six of seven “simple retrofits” which are: individual heating controls, common area and exterior lighting in compliance with the New York City Energy Conservation Code, low flow fixtures, insulated pipes, insulated hot water tanks, front-loading washing machines, and cool roofs.

| Jurisdiction | Exemption |
|---|---|
| **San Francisco** | • Benchmarking exceptions:<br>  ○ New buildings with Certificate of Occupancy from the Department of Building Inspection dated less than two years prior to benchmarking due date<br>  ○ Unoccupied buildings that have less than one full-time equivalent occupant for previous calendar year<br>  ○ There are also exceptions for energy audit requirements. |
| **Seattle** | • Buildings used primarily for manufacturing or industrial purposes are exempt from benchmarking requirements |
| **Washington D.C.** | • The building was vacant for the entire year, with less than one average employee/occupant/resident over the year<br>• If the building was newly built and received its Temporary or Permanent Certificate of Occupancy in the year being reported<br>• A demolition permit has been issued during the prior calendar year<br>• If the building gross floor area is under the 50,000 square foot threshold once parking areas are removed from the total<br>• If the "building" is actually several separate buildings, each of which is smaller than the reporting threshold, and all buildings that are separately metered for all energy sources<br>• If a building owner believes reporting or disclosure would harm national security or the public interest, they may apply for an exemption. |

**Table A-3. Benchmarking and Transparency Enforcement, Penalties, and Compliance Rates by Jurisdiction[134]**

| Jurisdiction | Enforcement Entity | Penalty for Noncompliance | Compliance Rate by # of Buildings | Compliance by % of Square Footage |
|---|---|---|---|---|
| **Atlanta** | Mayor's Office of Sustainability | Building owners are subject to written notice for the first violation and a fine of $1,000 if 30 days late with compliance, plus an additional $1,000 every year thereafter. | N/A | N/A |
| **Austin** | Director of the Austin electric utility | Building owners are subject to a fine of up to $500 for noncompliance. A fine up to $2,000 may be assessed for intentional noncompliance. | N/A | N/A |
| **Berkeley** | Director of Planning and Community Development | The City Council sets fees, and the Director of Planning and Community Development is in charge of enforcement. Written violation notices are issued if a building owner is in violation of code. | N/A | N/A |
| **Boston** | Air Pollution Control Commission | Building owners are subject to a fine of $75 to $200 per day. The maximum annual fine is $3,000. Non-residential tenants may be fined up to $35 per day for failing to supply building owners with energy data. Residential tenants are not fined. | 73% (2014) | 84% (2014) |
| **Boulder** | City Manager | The city manager issues a warning first. Violations not corrected within 14 days may be penalized at $0.0025 per square foot, not to exceed $1,000 per day. | N/A | N/A |
| **California** | California Energy Commission | $500–$3,000 per day the violation exists. | N/A | N/A |
| **Cambridge** | Community Development Department | The first violation results in a warning. Subsequent violations result in a fine of $300 per day. | 95% (2015) | 93.5% (2014) |
| **Chicago** | Commissioner of Business Affair and Consumer Protection | Building owners are subject to a fine of up to $100 for the first violation and additional fines up to $25 per day. | 84% (2014) | 92% (2014) |
| **Denver** | Department of Environmental Health for the City | The manager of the Department of Environmental Health may enforce the regulations adopted by the Board of Environmental Health for the City. | N/A | N/A |
| **Evanston, IL** | City Manager | Each month a building is in noncompliance, the responsible entity may be fined $100. | N/A | N/A |
| **Kansas City, MO** | City Manager | A written warning is provided for the first failure to comply. A fine of up to $500 may be issued if compliance is not met within 60 days of the warning. The city may take legal action in court for noncompliance. | N/A | N/A |
| **Los Angeles** | Department of Buildings and Safety | No explicit enforcement language is provided in the ordinance. Building owners that fail to comply with the ordinance are subject to a $202 noncompliance fee. | N/A | N/A |

[134] Compliance rate by number of buildings and compliance rate by square footage are taken from IMT. See wwww.buildingrating.org.

| Jurisdiction | Enforcement Entity | Penalty for Noncompliance | Compliance Rate by # of Buildings | Compliance by % of Square Footage |
|---|---|---|---|---|
| **Minneapolis** | Health Department Environmental Services | A warning notice is mailed to the building owner, indicating 45 days to comply or else face a penalty. Failure to comply with penalties may result in a suspension of a commercial building registration or business license. | 91% (2013) | N/A |
| **Montgomery County, MD** | Department of Environmental Protection | Noncompliance is a Class A County violation, which carries an initial offense fine of $500 and $750 for repeat offenses for civil penalties. Criminal penalties are $1,000, 6 months in jail, or both. | N/A | N/A |
| **New York City** | Department of Buildings | Building owners or managers that miss the May 1 benchmarking deadline may be fined $500. They may be fined an additional $500 for each subsequent quarter failing to benchmark (maximum of $2,000). | 87% (2013) | N/A |
| **Orlando** | Office of Sustainability & Energy | Properties that are required to benchmark and do not meet the requirements are publicly posted on the city's website as not participating. | N/A | N/A |
| **Philadelphia** | Office of Sustainability | The city may issue a $300 fine for failure to comply within 30 days of the compliance date, plus $100 for every additional day. | 91% (2013) | 91% (2013) |
| **Pittsburgh** | Department of Innovation and Performance | Covered buildings that do not participate are listed on a publicly accessible website as "eligible and non-participating." | N/A | N/A |
| **Portland, ME** | City Manager or Energy and Sustainability Coordinator | The City Manager may issue a written warning for the first violation and a $50 per day fine for subsequent or ongoing violations. | N/A | N/A |
| **Portland, OR** | Bureau of Planning and Sustainability | The Director may issue a fine for the first violation and assess penalties of up to $500 for every 90-day period that the building is in violation of the policy. | N/A | N/A |
| **San Francisco** | Department of Environment | The Director issues written warnings to building owners in violation of the benchmarking or audit requirements and may assess a fine of $50 per day for buildings less than 49,000 $ft^2$, and $100 per day for buildings 50,000 $ft^2$ or larger. The maximum fine is for 25 days in one year. | N/A | 82% (2013) |
| **Seattle** | Director of the Seattle Office of Sustainability and Environment | Failure to submit an accurate annual benchmarking report to the City of Seattle will result in assessed penalties that accrue quarterly, starting 90 days after the reporting deadlines for each year of required building energy data. Building owners that do not comply with the policy will be sent a Notice of Violation with an assessed penalty amount. If a building owner does not correct the violation within the next quarter, the penalty increases through a quarterly accruing fine. Quarterly penalty amounts are based on building size:<br>**50,000 $ft^2$ or greater** non-residential and multifamily buildings = $1,000 per quarter<br>Total annual penalty of $4,000 per reporting year.<br>**20,000 to 49,999 $ft^2$** non-residential and multifamily buildings = $500 per quarter<br>Total annual penalty of $2,000 per reporting year. | 99% (2013)<br>99% (2014)<br>99% (2015) | 99% (2013) |

| Jurisdiction | Enforcement Entity | Penalty for Noncompliance | Compliance Rate by # of Buildings | Compliance by % of Square Footage |
|---|---|---|---|---|
| **Washington D.C.** | District Department of the Environment | Fines of up to $100 per day may be assessed. | 89% (2014) | N/A |
| **Washington State** | Department of Community, Trade, and Economic Development | No penalties have been established to date. | N/A | N/A |

**Table A-4. Complementary Policies: Building Energy Audit or Retro-commissioning[135]**

| Jurisdiction | Complementary Policy Description |
|---|---|
| **Atlanta** | Audits are required for all buildings that are covered by the B&T policy. The following circumstances provide exemptions from the audit requirement:<br>• The building has received an ENERGY STAR certification two of the preceding three years<br>• There is no ENERGY STAR rating for the building type, and a design professional submits documentation that the building is 25% or more efficient than an average building of its type<br>• The building ENERGY STAR score improved 15% or the weather-normalized source energy use intensity has been reduced by 15% within five years prior to the audit<br>• The building has achieved or maintained LEED status for Existing Buildings for two of the preceding three years |
| **Austin** | Residential building owners must conduct an audit every 10 years. Multifamily buildings that use more than 150% of the average multifamily building consumption per square foot must take action within 18 months to reduce the building energy consumption 110% of the average. |
| **Berkeley** | All buildings will be (or are) required to conduct an energy audit within a specified time period or at the point of building sale. Owners of large buildings over 25,000 $ft^2$ must conduct an energy audit every five years, owners of medium buildings between 5,000 and 24,999 $ft^2$must conduct an audit every eight years, and owners of small buildings must conduct an audit every five years. |
| **Boston** | Building owners who must comply with the B&T policy must complete an energy assessment or action every five years. An energy assessment is an ASHRAE Level 2 audit or an alternative assessment that is approved by the Commission. An energy action is an energy efficiency, district steam, or renewable energy project (or any combination thereof) that reduces the annual energy use intensity by at least 15% cumulatively over five years, or improves the building's ENERGY STAR rating by 15 points cumulatively over five years. The building owner must submit an Energy Action report to the Commission to document the energy actions taken. |
| **Boulder** | Building owners that are subject to the B&T ordinance must conduct an energy assessment within three years of their first reporting requirement, and at least once every 10 years thereafter. The building owner must submit the energy assessment to the city manager for compliance. Buildings less than 50,000 $ft^2$ must conduct an ASHRAE Level 1 Energy Assessment, and buildings greater than 50,000 $ft^2$ must conduct an ASHRAE Level 2 Energy Assessment. There are performance exemptions for the energy assessment (e.g., ENERGY STAR certification, LEED Building Operations and Maintenance certificates, pattern of significant and consistent improvements in energy efficiency or greenhouse gases).<br><br>In addition, within five years of a building owner's first reporting requirement, and every 10 years after, the building owner must conduct retro-commissioning and provide the city manager with a copy of the retro-commissioning report and any actions taken. Within two years of submittal of the retro-commissioning report, the owner must implement measures that have a payback of two years or less. There are also performance exemptions, similar to the audit exemptions, for the retro-commissioning requirement. |
| **Los Angeles** | Any building that is subject to the B&T ordinance must conduct an energy audit and retro-commissioning of the building base systems. Energy audits must meet or exceed ASHRAE Level 2 audits. Retro-commissioning is performed in accordance with ASHRAE Guideline 2.0 *Commissioning Process for Existing Systems and Assemblies.* The building owner must keep a report of the energy audit and retro-commissioning reports. There are performance exemptions for the audit and retro-commissioning (e.g., ENERGY STAR certification). |
| **New York City** | New York City's B&T policy does not require energy audits and retro-commissioning, but Local Law 87, a companion law, does. Buildings over 25,000 $ft^2$ must conduct periodic audits and retro-commissioning measures and submit the reports to the city every 10 years. |
| **Orlando** | Beginning in December 2020, buildings that receive an ENERGY STAR score of less than 50, or the equivalent energy use intensity, must perform an energy audit or retro-commissioning by May 2025. |
| **San Francisco** | All non-residential building owners must file a confirmation that an energy efficiency audit has been performed and provide a summary of all retro-commissioning and retrofit measures that are available to the building owner with a simple payback of three years or less, the estimated cost of the identified measures, and the estimated savings from the measures. |

[135] Information in table compiled from IMT (2015) and B&T ordinances and regulations. See Appendix F.

| Jurisdiction | Complementary Policy Description |
|---|---|
| **Seattle** | Beginning in 2018, non-residential buildings 200,000 $ft^2$ or larger must conduct a "tune-up." This includes (a) an inspection of building systems to identify operational or maintenance issues, (b) corrective actions to operational and maintenance issues identified in the inspection, and (c) a report to the Seattle Office of Sustainability and Environment summarizing issues identified and actions taken. The requirement phases in, and by 2021, buildings 50,000 $ft^2$ or larger will be required to comply. |
| **Washington State** | State agencies must conduct energy audits, to the extent that specific appropriations are provided to those agencies. If a building scores lower that 75 on a national energy performance rating system, the building is not available for lease renewal without energy upgrades. |

# Appendix B. Utility Data Access

## Whole-Building Aggregation

The most common utility-led solution to supporting benchmarking while protecting customer confidentiality is whole-building data aggregation. Using this approach, a utility aggregates meter-level energy usage information for all accounts associated with a property and provides the aggregated total energy consumption to the property owner. The utility does not require consent from utility customers within the building if the aggregated accounts exceed certain thresholds.

In establishing a method for collecting aggregated building data, a key issue for jurisdictions to consider is the minimum number of individual utility accounts that must be present in a building to allow for aggregate building-level data collection without specific authorization from individually metered customers. The greater the number of meters, the less likely it is that aggregated data reveal the energy usage patterns of any one customer. However, the higher the number of required meters, the lower the percentage of buildings for which energy usage data can be collected without specific authorization from individually metered customers. Thus, in establishing a minimum meter threshold, jurisdictions must seek to find a balance between customer privacy and ease of data collection.

## Authorizations via Leasing Documents

Beyond establishing aggregation thresholds, certain additional best practices can further simplify the process of data collection. For example, in some jurisdictions, if tenants already have agreed to share energy usage with building owners per the terms of their lease contract, the utility recognizes these lease agreements and does not require further authorization.[136] This practice may help streamline the participation of buildings that do not meet aggregation thresholds by avoiding the need to separately solicit authorizations from all individually metered tenants.

## Mapping Energy Meters to Buildings

Many commercial and multifamily buildings have numerous energy meters serving different areas of the building, including tenant spaces. Utilities that provide whole-building energy consumption data to building owners must first be able to link those meters (or in some cases, the customer accounts) to each building. Although this may seem straightforward, in reality it is a challenge. Many utility customer information systems—the systems utilities use to bill customers—are not designed to track energy consumption at the building level and may not be able to "map" individual meters to specific structures. Additionally, the addresses used by utilities to associate meters with buildings (known as *service addresses*) often differ from the physical street address for a building. This issue has presented a significant barrier for many utilities considering whole-building data access.

Utilities that have mapped meters to buildings used several methods discussed in Section 3.10.

[136] This practice is growing within the real estate industry. See www.greenleaselibrary.com.

The exact process used by a utility will depend on the capabilities of their existing customer information and metering systems. To reduce the practical challenges of mapping usage data to buildings, utilities should ensure meter mapping is addressed early in system design when implementing new customer information systems.

### Opting Out

Some jurisdictions include an appeals process whereby tenants and building owners can assert that publishing their benchmarking data would create security risks or reveal trade secrets and will consider granting waivers in these circumstances. If tenants are able to show that these concerns are warranted, they can opt out of having their data included for benchmarking purposes.

### Missing Units

In some cases, buildings may be missing data for individual meters. Opting out is one example of such a scenario. In other cases, owners may be unable to obtain data for individual tenants due to buildings falling under the aggregation threshold. In cases of missing data, jurisdictions may establish processes for filling in missing data using pre-established proxy methods. For example, in Orlando, building owners are required to use Portfolio Manager default values in cases in which they are unable to obtain data from individual tenants.[137]

### Delivered Fuels

While electric and gas utilities, which serve most buildings nationwide, are relatively accustomed to complying with regulatory requirements such as benchmarking provisions, significant numbers of buildings in certain jurisdictions make use of fuel oil, propane, and wood provided by unregulated suppliers. These "delivered fuel" vendors may not be set up to respond to benchmarking data requests. In addition, as they are generally unregulated, they are not accustomed to complying with requirements regarding how to treat their customers' information. Similar to regulated utilities, fuel dealers generally will not release this information without a customer's authorization. Nonetheless, in order to benchmark a building using these delivered fuels, it is necessary to obtain all of that the energy data for the entire building.

Jurisdictions in which delivered fuels are present should work with their local delivered fuels industry to explain benchmarking initiatives and negotiate workable arrangements for receiving energy data. Trade associations representing local fuel dealer industries may be helpful in facilitating these discussions.

### Limiting Data Usage

In concert with whole-building data aggregation, utilities can require building owners to agree to legal terms of use that restrict the re-dissemination of aggregated whole-building data for uses other than benchmarking and facilitation with energy efficiency program participation. Such terms of use can be written to only allow the sharing of aggregated data with property managers or designated vendors, to

[137] Orlando, Florida, Ordinance No. 2016-64.

the extent that they are identified and authorized as “owners’ agents” that will be involved in the benchmarking process and any follow-on energy efficiency upgrades. However, it can also be valuable to allow sharing of data for public purposes such as program review, evaluation, design, and community planning. Jurisdictions should consider all uses carefully and balance public purpose interests and privacy concerns.

# Appendix C. Detailed Table of Benchmarking and Transparency Policy Metrics

Table C-1 is a more detailed version of a similar table in Chapter 4 (Table 9).

**Table C-1. Detailed Benchmarking and Transparency Metrics**

| Metric Category | Example Metrics (common to all energy efficiency programs) | Example Metrics, Indicators, and Benefits Specific to B&T Policies | Notes |
|---|---|---|---|
| **Energy Impacts**<br>**As used in common practice, *energy impacts* are defined as those directly associated with reductions in energy consumption, demand, or both.** | • Gross energy savings<br>• Net energy savings<br>• Gross demand savings<br>• Net demand savings | • Energy use intensity<br>• Normalized energy use intensity | • Savings can be defined as source or site level values.<br>• See definitions below for net and gross impacts in text box in Section 4.4.1. |
| **Non-Energy Impacts**[138]<br>***Non-energy impacts* are the wide variety of positive and negative effects beyond energy savings that are delivered to utilities, participants, and society as a consequence of delivering energy efficiency programs and measures.** | • Decrease in energy (water) costs<br>• Increased property values<br>• Improved comfort/indoor air quality<br>• Reduced equipment operations and maintenance (O&M) costs because of more efficient, robust systems (although more complex systems could require more maintenance)<br>• Improved operational control<br>• Higher rents and better retention for commercial properties (landlord benefit)<br>• Superior comfort and better health and well-being, translating into higher productivity and lower absenteeism (tenant/occupant benefit)<br>• Reduced water consumption | • Understanding of the building's energy use<br>• Metrics to rank the building against others in a portfolio, allowing prioritization of energy efficiency investments<br>• Better understanding of how the buildings' energy performance compares to competitors<br>• Basis of an energy management plan to drive continuous performance improvement<br>• For high performers, evidence of the building's additional value | • Benefits accrue to participants |
| | • Avoided transmission and distribution costs<br>• Energy price and reliability effects | • Use of benchmarking data to make utility efficiency programs more effective | • Benefits accrue to utility system |

[138] Skumatz (1997); Skumatz (2015). Non-energy impacts can be categorized as those accruing to utilities (energy providers), society as a whole, and to individual participants.

| Metric Category | Example Metrics (common to all energy efficiency programs) | Example Metrics, Indicators, and Benefits Specific to B&T Policies | Notes |
|---|---|---|---|
| **Non-Energy Impacts**[139]<br>***Non-energy impacts* are the wide variety of positive and negative effects beyond energy savings that are delivered to utilities, participants, and society as a consequence of delivering energy efficiency programs and measures.** | • Jobs<br>• Local economic development | • Indicators that enable state and local governments to better understand building stocks in their jurisdictions<br>• Indicators that enable policymakers to understand which buildings are most inefficient and design more effective methods of addressing them.[140]<br>• Number of instances where benchmarking data have been cited/used to inform policy decisions. | • Benefits accrue to society |
| **Market Transformation/Adoption**<br>***Market transformation* is a reduction in market barriers resulting from a market intervention, as evidenced by a set of market effects that is likely to last after the intervention has been withdrawn, reduced, or changed.** | • Normalized, total market unit energy consumption reductions<br>• Supply chain adoption and growth (including reduced cost of energy-efficient products and energy efficiency services, Increased availability and purchase activity for energy-efficient products and energy efficiency services, and reduced time for sales/installation).<br>• Higher consumer awareness and confidence | • Increased awareness of energy use by building owners and increased market actor awareness of energy[141]<br>• Increased energy awareness by occupants/users (e.g., store customers)<br>• Short-term outcomes focus on the initial effects and on early energy savings<br>• Intermediate outcomes focus on continued enhancement of building energy performance and on intended change to market structure or market actor behavior in support of the policy goals<br>• Long-term outcomes are the intended market effects that follow the erosion or elimination of all barriers to the B&T policy's goals<br>• Cost of B&T policy implementation reduced<br>• Increased adoption of B&T policies in other jurisdictions | |

[139] Skumatz (1997); Skumatz (2015). Non-energy impacts can be categorized as those accruing to utilities (energy providers), society as a whole, and to individual participants.
[140] The first and second bullets are from *The Benefits of Benchmarking Building Performance*. IMT (2015).
[141] The second through fifth bullets are from *Benchmarking & Transparency Policy and Program Impact Evaluation Handbook.* (Navigant Consulting and Steven Winter Associates 2015a).

| Metric Category | Example Metrics (common to all energy efficiency programs) | Example Metrics, Indicators, and Benefits Specific to B&T Policies | Notes |
|---|---|---|---|
| **Interim Performance/Milestones**<br>**Interim performance and milestone indicators are indicators associated with the implementation of and compliance with B&T policies.** | • Initiation of program implementation policies and expenditures<br>• Number of participants (consumers/building owners, vendors, contractors, architects/engineers)<br>• Consumer awareness and support<br>• Workforce education and training metrics<br>• Marketing and outreach metrics<br>• Completion of evaluations | • Compliance rates - number and square footage of benchmarked/labeled buildings[142]<br>• Improved efficiency for heating, ventilating and air-conditioning systems and domestic water heating<br>• Improved lighting system efficiency<br>• Improved plug load efficiency<br>• Improved building shell performance | |

[142] Bullets in this box were informed by City of New York (2016).

# Appendix D. Energy and Non-Energy Performance Metrics: Example Data Reported by Jurisdictions with Benchmarking and Transparency Policies

This appendix provides summary information and excerpts indicating examples of recent reporting of energy and non-energy impacts associated with B&T policies and ordinances. The six cities from which examples are cited have publicly available energy-related data for more than one year and self-reported energy and non-energy impacts or trends that a third-party used to conduct impact evaluation. Also provided is information from a study of voluntary reporting for a subset of buildings in Washington, D.C. While nine cities have at least two years of energy-related data publicly available for the reporting private-sector buildings, three (Austin, Boston, and Washington, D.C.) do not have analyses of these data to show trends in energy use, energy use intensities, emissions, etc.

## D.1 Chicago

- The report, City of Chicago Energy Benchmarking Report 2016, covering data for program year 2015, summarizes the city's Energy Benchmarking Ordinance policy energy impacts with the following gross impact indicators:
- "With three years of results, energy benchmarking reports are now indicating that regular tracking and reporting have a significant impact on supporting energy management."
- "Under the three-year phase-in period of Chicago Energy Benchmarking, commercial and institutional properties that are 250,000 $ft^2$ or greater have now been required to benchmark for three years in a row, from 2014–2016. […] [I]n 2015, an analysis of 212 property reports indicated a 1.6% decrease in weather normalized site energy use. […] [I]n 2016, data from a slightly smaller subset, a group of 200 properties, shows a 4.0% decrease in weather normalized site energy use over three years (from calendar year 2013 to calendar year 2015 …). At the same time, the properties' ENERGY STAR scores increased by 6.6% from a median score of 76 to a median score of 81.22. These energy savings equate to a reduction of 187,576 metric tons of GHG emissions, as well as an estimated cost savings of $11.6 million per year."

Figure D-1 shows these reduction trends.

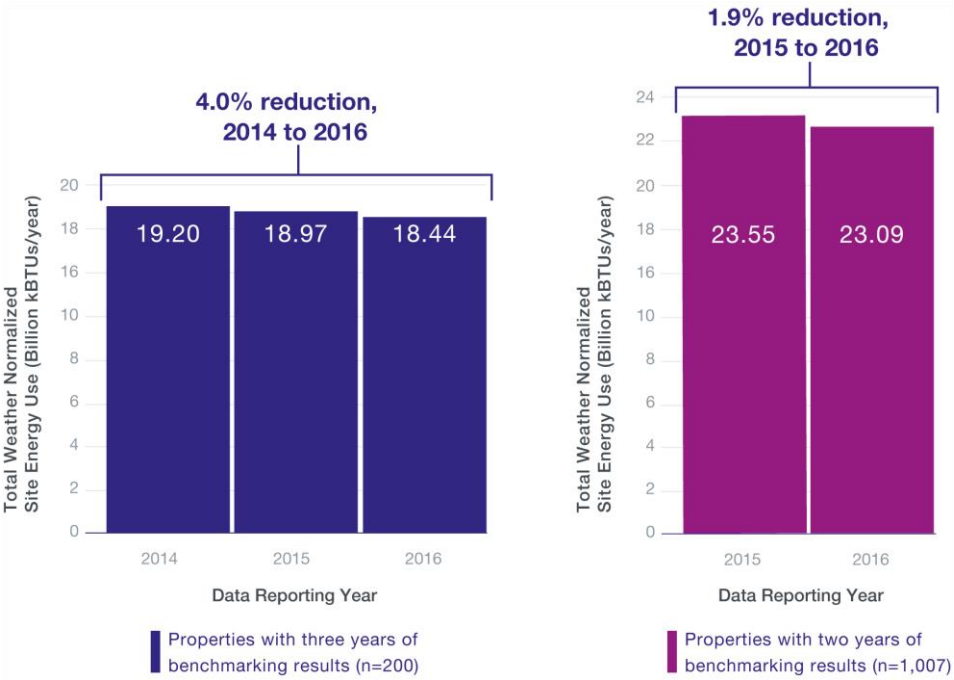



**Figure D-1. Chicago Energy Reduction Trends: Buildings With 2 or 3 Years of Benchmarking Results[143]**

## D.2 Minneapolis

Minneapolis's February 2016 benchmarking report (for the 2014 reporting year) noted these impacts:[144]

- "Private commercial buildings greater than 100,000 $ft^2$ have now reported for two years, thereby providing a first opportunity to explore the performance trends of the largest private buildings in Minneapolis. Median ENERGY STAR scores dipped slightly from 82 to 80, while median site EUI and weather-normalized site EUIs rose from 89 to 91 and 86 to 88 kBtu/ $ft^2$ respectively. Overall, trend line analysis of weather normalized EUI indicates steady performance from 2013 to 2014, thereby providing a consistent baseline before the effect of performance transparency is underway."
- "Since the reporting date lags the performance year, building owners and managers had little opportunity to react to the benchmarking results and improve performance in calendar year 2014. In addition, since disclosure did not begin until August 2015, building owners had not yet experienced the full roll-out of the benchmarking policy. The full market cycle of understanding benchmarking results and then planning, making decisions, and investing in efficiency projects will require time."

[143] City of Chicago (2016).

[144] City of Minneapolis (2016).

## D.3 New York

New York City's August 2016 benchmarking report (for the 2013 reporting year) states the following impacts:[145]

> "The data the City collects show that the carbon emissions and energy use of benchmarked buildings have decreased over time. Between 2010 and 2013, emissions from 3,000 consistently benchmarked properties dropped by 8 percent, while energy use decreased by 6 percent."

Figure D-2 illustrates these impacts.

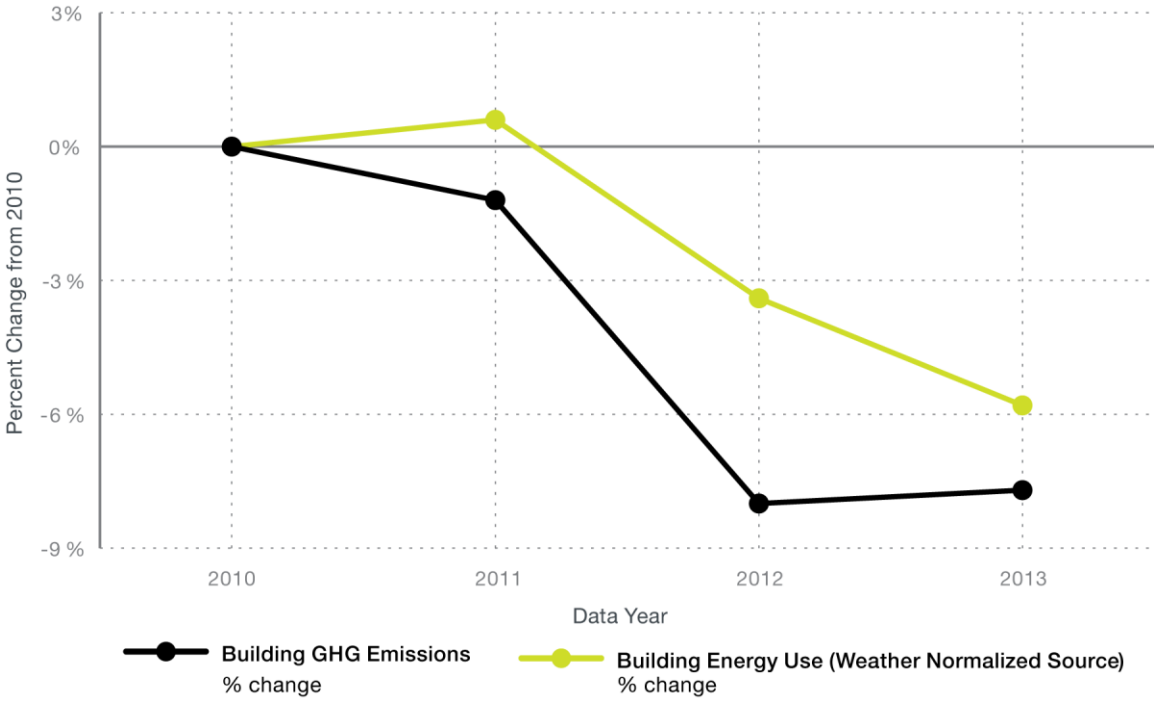



**Figure D-2. New York City Buildings Consistently Benchmarked Under Local Law 84**[146]

New York City's B&T ordinance has also been the subject of several independent studies. The following are energy and non-energy impact findings from two of these studies:

- ***Measuring Energy Savings from Benchmarking Policies in New York City.***[147] This report addressed causation and indicated the following:
  - "By identifying treatment and control groups within each stage of implementation, and then applying a novel difference-in-differences strategy, we can causally attribute

[145] City of New York (2016).

[146] City of New York (2016). "The data displayed here represent only properties that have reported greenhouse gas emissions or weather normalized source energy use data in all four benchmarked years. They represent approximately one-third of all benchmarked properties reporting in 2014 on 2013 use data. These are some of the largest buildings in New York City and they have never been out of compliance with LL84. This result does not account for the energy use and emissions reductions caused by Hurricane Sandy. Emissions calculations use EPA coefficients, not NYC-specific coefficients."

[147] Meng et al. (2016). Page 9-4.

observed declines in energy consumption to specific owner behaviors and policy mechanisms. Our analysis indicates that in comparison with the control group and before the policies were implemented in 2011, the total disclosure policy can be credited with a 6% reduction in building energy use intensity (EUI) three years later and a 14% reduction in EUI four years later; the disclosure of ENERGY STAR scores decreased building EUI by 9% three years later and 13% four years later. The two sets of independent findings are a consequence of the policy design and different control groups."

- **New York City Benchmarking and Transparency Policy Impact Evaluation Report.**[148] This report provided several findings concerning energy, emissions, and job impacts:
    - "The City saw a cumulative energy savings of 5.7% during the first four years of the policy from 2010 through 2013. This resulted in total dollar savings of $267,492,147."
    - "The percentage savings steadily increased between 2010 and 2013. The percentage savings between 2010 and 2011 was 0.3%, as compared to 3.7% between 2011 and 2012 and 4.4% between 2012 and 2013. Although this evaluation cannot necessarily attribute these energy savings to LL84, these early results are consistent with the notion that energy savings will occur even in the early stages of policy adoption."
    - "The City saw a cumulative GHG percentage reduction of 9.9% between 2010 through 2013. GHG reductions were small between 2010 and 2011, but much larger in the 2011–2012 and 2012–2013 periods."
    - "Estimated labor/job increases from benchmarking activities in the City were: 2010, 13 full-time equivalent (FTE) jobs; 2011, 35 FTE jobs; 2012, 40 FTE jobs; and 2013, 39 FTE jobs created from LL84."
    - "An input-output (I-O) analysis estimates direct, indirect, and induced job creation from the labor required to achieve energy savings in buildings through operations and maintenance (O&M) upgrades and capital improvements. 3,132 direct jobs were calculated from the energy savings between 2010, the first reported year of data, and 2013." See Table D-1.

However, the report noted that "is too soon in the implementation process to make generalizations about changes in market actor behavior, or to directly attribute to the policy the increased amounts of energy and non-energy benefits found to exist in this study."

**Table D-1. New York City: Total Number of Estimated Jobs Created, Using Input-Output Modeling[149]**

| Calculation | Calculated Jobs 2010–2011 | Calculated Jobs 2011–2012 | Calculated Jobs 2012–2013 | Total 2010–2013 |
|---|---|---|---|---|
| **Input-Output Modeling Direct Jobs** | 382 | 1,456 | 1,294 | 3,132 |
| **Input-Output Modeling Indirect Jobs** | 290 | 1,098 | 988 | 2,377 |
| **Input-Output Modeling Induced Jobs** | 269 | 1,021 | 912 | 2,202 |
| **Total** | 941 | 3,576 | 3,195 | 7,711 |

[148] Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015b).

[149] Navigant Consulting Inc. and Steven Winters and Associates, Inc. (2015b).

## D.4 Philadelphia

In its *2016 Energy Benchmarking Report* (for the 2014 program year), Philadelphia indicated the following about changes in energy consumption, greenhouse gas emissions, and ENERGY STAR scores:[150]

- "Philadelphia buildings earning an ENERGY STAR score … received a median of 59 in 2014 …. This is down from a score of 63 in 2013."
- "From 2012 to 2014 the median ENERGY STAR score of eligible buildings reporting all three years decreased, but still remains nine points above the national median of 50. There has been a steady increase of the number of properties receiving scores, possibly indicating higher quality reporting by building owners and property managers."
- "Raw energy usage increased in 2014, but when normalized for weather, building performance improved between 2013 and 2014."
- "There was a seven percent reduction in carbon emissions from large buildings."

## D.5 San Francisco

The report, *San Francisco Existing Commercial Buildings Performance Report 2010–2014*,[151] provides information on B&T policy compliance and current year energy indicators related to the city's benchmarking ordinance, as well as energy and emissions trends. Among the reported energy use metrics is a comparison of annual energy consumption with market indicators, as a way to indicate an implied decoupling of economic growth from energy consumption increases:

> "The San Francisco market has experienced significant economic expansion while simultaneously reducing primary energy use and emissions. From 2009 to 2013, the gross domestic product (GDP) of the San Francisco metropolitan statistical area (MSA) increased 19 percent. Within San Francisco, commercial real estate value increased by nearly 80 percent, the total number employed increased 11 percent, and energy use in commercial buildings declined 2 percent" (see Figure D-4).

[150] City of Philadelphia (2016).

[151] SFE (2015).

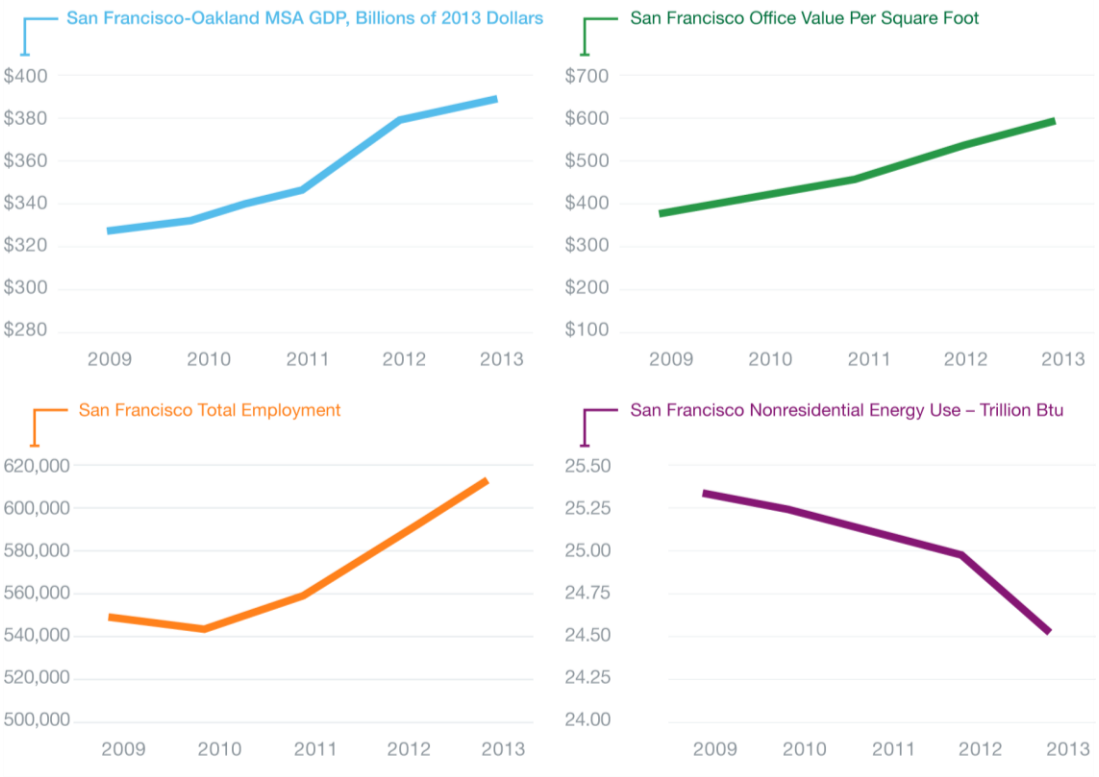



**Figure D-3. San Francisco Energy Use and Economic Growth 2009–2013**[152]

San Francisco is unique in being able to report five years of impacts for consistently complying properties. The following figures (Figure D-4, Figure D-5, and Figure D-6) show changes in energy use, energy use intensity (by property type), and emissions, respectively, for these properties, providing a like-for-like[153] comparison. The following are summary points from the report:

- "The cohort of 176 properties that have benchmarked energy use consistently over the past five years demonstrated regular year-over-year savings with a 7.9% overall reduction …."
- "As additional office properties have joined the program over the years, median site energy use intensity (EUI) for the cohort of all benchmarked buildings has decreased. Hotel, retail, and warehouse properties, however, do not show a clear trend in EUI. This could be attributable to the increasing number of high-energy-intensity properties reporting in those sectors, and to changes in consumption due to increasing activity at the properties—i.e., more retail shoppers and more hotel guests…."

[152] SFE (2015).

[153] A *like-for-like comparison* is defined in report as "a year-over-year comparison of properties that have complete data available for each year in the analysis."

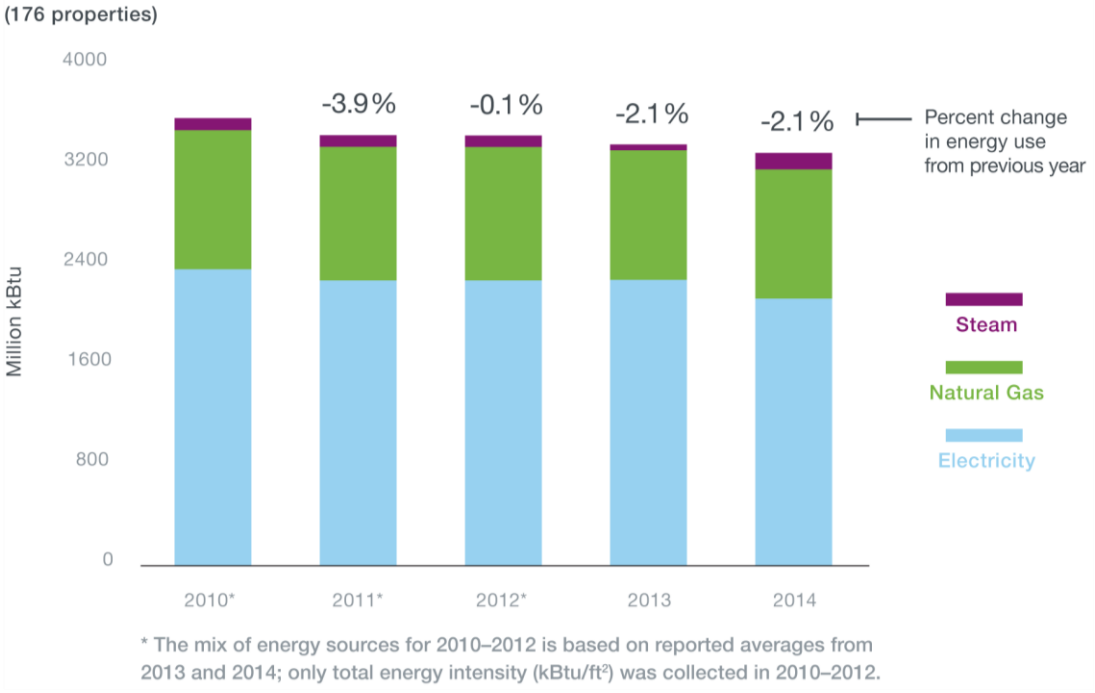



**Figure D-4. San Francisco Energy Consumption Trend for Consistently Reporting Buildings: 2010–2014[154]**

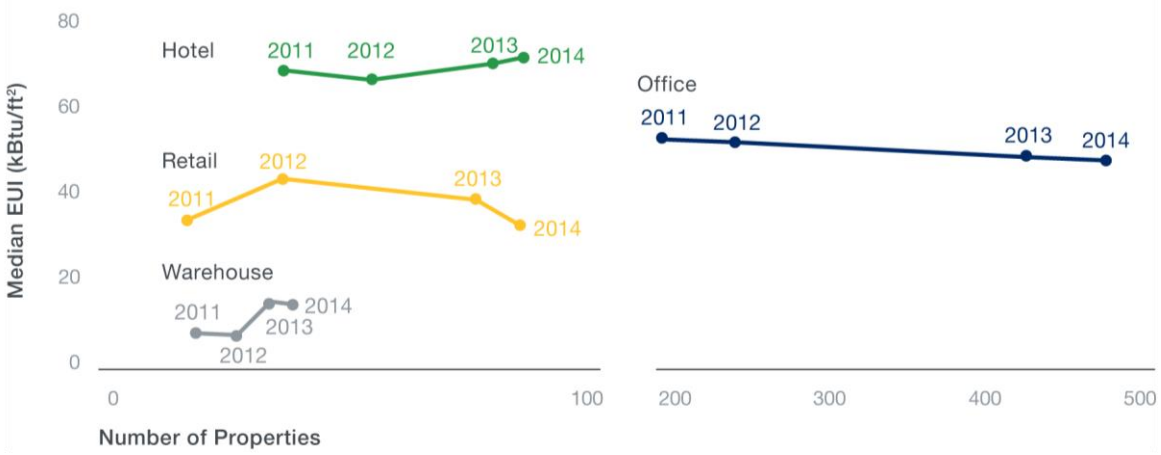



**Figure D-5. San Francisco Energy Use Intensity (EUI) Trends for Consistently Reporting Buildings, by Property Type: 2010–2014[155]**

[154] SFE (2015).

[155] SFE (2015).

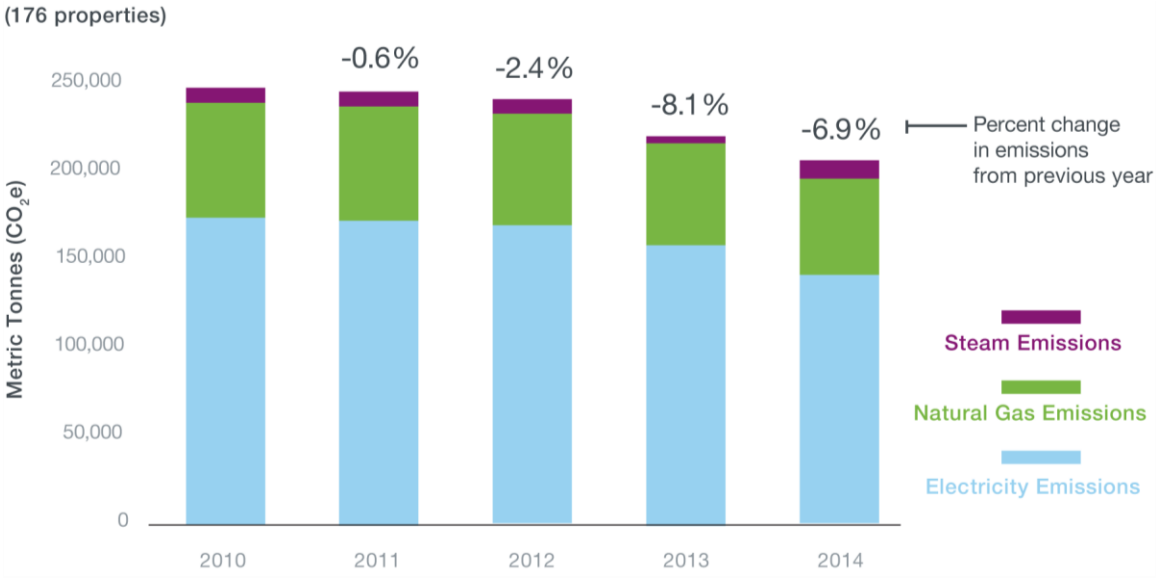



**Figure D-6. San Francisco Emissions Trends for Consistently Reporting Buildings: 2010–2014**[156]

## D.6 Seattle

In its 2015 report, *Seattle Building Energy Benchmarking Analysis Report 2013 Data*, the city summarized several current-year metrics with some indication of changes in energy use. For example, "Preliminary analysis … suggests that year-to-year building energy performance is stable or trending positively, with an overall decrease of 0.6% in total energy use from 2012 to 2013."[157] The report noted that 2012 was the first year the ordinance included buildings 20,000 to 50,000 ft$^2$. Therefore, 2013 was the first time that year-to-year comparisons were made. Further, a measured change between 2012 and 2013 is not necessarily indicative of a trend. Trends require several years of data for confirmation.

## D.7 Washington, D.C.

In a third-party report published in 2014, analysis was conducted for Washington, D.C., of multiple-year environmental performance for a subset of office properties using data *submitted on a voluntary basis by the asset owners*.[158] Thus, participants in this study are not expected to be representative of the general population in terms of interest in benchmarking, and the study could have a self-selection bias toward building owners with an interest in reducing energy and emissions profiles of their properties.

While not necessarily representative of participants in a mandatory reporting system, the report presents the following results:

- "On a year-over-year basis between 2009 and 2012, the metro Washington … portfolio of 113 like-for-like buildings decreased energy consumption by 5.8 percent (124 million kBtu)

[156] SFE (2015).
[157] City of Seattle (2015).
[158] Metro Washington, D.C. (2014).

and reduced carbon emissions by 5.2 percent (13.8 thousand metric tons $CO_2e$). The carbon reduction is equivalent to planting over 358,000 trees."

- "The average ENERGY STAR® score increased by 11 percent during this period, from 73 to 81."

# Appendix E. Implementation Milestones and Current Year Energy, Water, and Emissions Data

Ten cities have prepared annual reports that provide interim performance metrics—information on how B&T policies are being implemented and some indication of the compliance rate. Some of these reports also include other objective and subjective indicators associated with implementation, such as outreach efforts. The reports also typically include a snapshot of energy and non-energy data for buildings subject to the B&T ordinance, most typically average energy use intensity indicators (EUIs, such as site energy use per square foot). These snapshots of data, while not indicative of the impacts of B&T policies, provide information that is useful for other purposes, such as targeting energy services.

Thus, while these annual reports provide valuable information about building stock, they do not provide an indication of energy or non-energy impacts—unless they provide comparative analysis of the reporting buildings over multiple years, preferably more than two.[159]

Following are examples of some of the interim performance metrics included in the nine cities' annual reports.

## E.1 Boston

*Energy and Water Use In Boston's Large Buildings, 2013*[160] provides information on compliance, current year energy and non-energy indicators, and outreach indicators for the city. The following are examples of the information provided on these topics.

*Boston compliance results for 2013 reporting year:*

- "…. all non-residential buildings over 50,000 square feet were required to report their energy and water usage for calendar year 2013; in addition, any set of non-residential buildings on one tax parcel totaling over 100,000 square feet was required to report. This included buildings in the office, real estate, non-profit, education, health-care, and industrial sectors."
- "A total of 819 buildings, encompassing 175 million square feet, reported…562—or 71 percent—of the 790 parcels required to report submitted their energy reports (as of February 6, 2015). Because many parcels have multiple buildings, the parcels that reported encompass 718 (or 73 percent) of the 984 buildings required to comply. These 718 buildings represent more than 84 percent of the total square footage covered by parcels required to report."
- "In general, larger properties had higher rates of reporting than smaller ones. …. properties over 700,000 square feet had a compliance rate of 97 percent, and the next two smaller size categories had compliance rates of 100 percent and 89 percent, respectively. For

[159] See Chapter 5 and Appendix D for jurisdictions where such multi-year information is available.

[160] City of Boston (2015).

parcels between 50,000 and 300,000 square feet, on the other hand, 66 percent of properties complied, and the smallest size category in that group, 50,000 to 100,000 square feet, had a compliance rate of only 61 percent. Parcels between 50,000 and 300,000 square feet made up three-quarters of the properties required to report in 2014 and approximately 43 percent of the square footage required to report."

*Boston energy and non-energy indicators for 2014 reporting year:*

Figure E-1 illustrates 2013 building energy use intensity of the buildings that reported data.

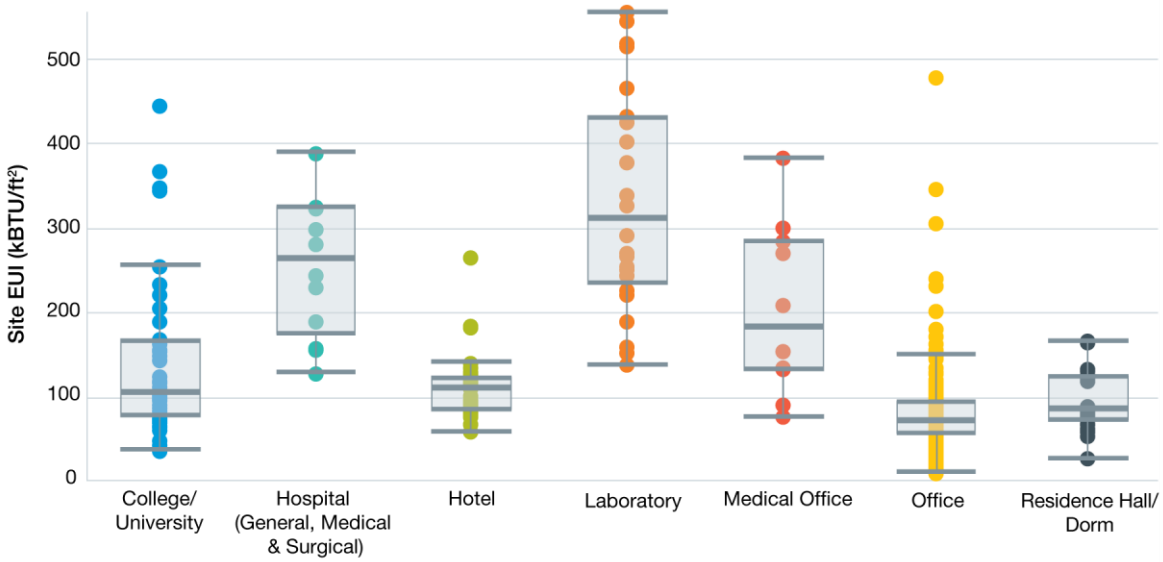



**Figure E-1. Boston 2013 Site Energy Use Intensity (EUI) by Property Type (kBtu per ft²)**[161]

*Boston outreach indicators for 2014 reporting year:*

- "2014 was the first year of required reporting for private-sector buildings. Coordinating with utility and institutional partners, the City began extensive outreach in January with a mailing to all large buildings, informing them of the reporting requirements and the resources available on the City's website. The City also posted online a list of buildings required to report."
- "The City, utilities, and EPA's Region 1 office in Boston also held six in-person informational sessions to train property managers on how to comply with the ordinance."
- "The City sent several reminder mailings over the spring and summer to building owners and property management firms. By the September 15 deadline, buildings had received five mailings—letters and postcards—with information on the available resources."
- "Building owners found the utility [whole-building data] services to be very valuable,

[161] City of Boston (2015). "In this figure, each dot represents an individual property. The solid bars in the center of the boxes are the median, and the top and bottom of the boxes are the 25 percent quartile and 75 percent quartile. The outlying whiskers mark the nearest data point within 1.5 the interquartile range (IQR) of the quartile value; points outside these whiskers are typically considered outliers."

providing them with information on building-level energy use for the first time. Utilities reported being able to turn around most requests within one business day, with over 800 requests for electricity or gas data. Established points-of-contact at each utility allowed constituent questions to be easily referred to the right person."

- "The informational sessions provided jointly by the City, utilities, and EPA were attended by approximately 240 property managers and owners, allowing them to understand the process and get their questions answered. Property managers also heavily utilized the guidance provided by the City: the Energy Reporting How-To Guide was downloaded or viewed approximately 1,400 times in 2014, and many said they used it step-by-step to comply with the ordinance. EPA also provided support to many buildings through its helpdesk email, and EPA's Region 1 staff in Boston provided one-on-one help to approximately 25 property managers."

## E.2 Cambridge

Figure E-2 is from the report prepared by the City of Cambridge, *2015 Building Energy & Water Use Report*.[162] It indicates compliance results for program year 2014 and energy and water indicators for the 2014 reporting year.

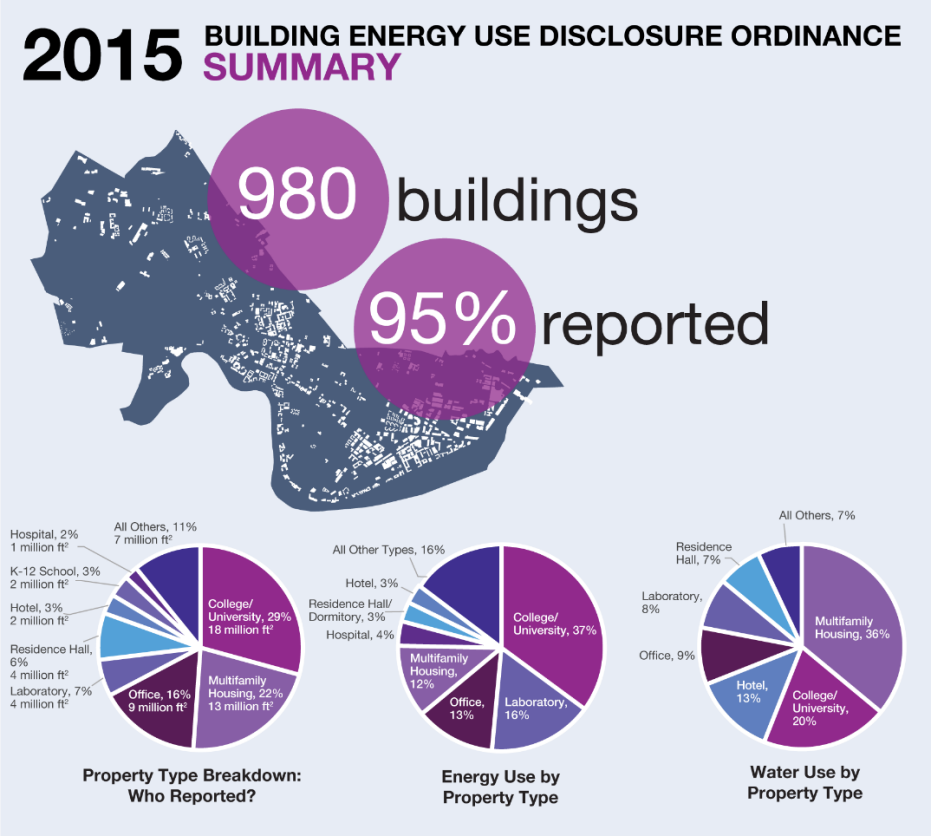



**Figure E-2. Cambridge 2014 Building Energy Use Disclosure Summary[163]**

[162] City of Cambridge (2016).

[163] See "95% of Buildings Report in First Year of Energy Benchmarking Ordinance." http://www.cambridgema.gov/CDD/News/2016/5/BEUDO.aspx.

A third-party paper discussed one aspect of the Cambridge outreach efforts, as implemented by Eversource, which provides electric and gas service to the commercial and residential customers of Cambridge:[164]

> "Eversource collaborated with the City of Cambridge during the development of its Ordinance and continued support during the first year of Cambridge BEUDO Reporting in 2015. Eversource provided support in three distinct ways: (1) staff resources were dedicated to working with Cambridge and its customers; (2) a web portal was developed to facilitate customer download of whole-building energy data needed for benchmarking; and (3) Eversource staff helped respond to inquiries received directly from customers, as well as from the Cambridge Helpdesk…."

## E.3 Chicago

*City of Chicago Energy Benchmarking Report 2016*[165] covers data for program year 2015. The city summarized the reach of its B&T policy, compliance, outreach indicators, and current year energy and non-energy (GHG emissions) indicators. Following are examples of the information the report provides.

*Chicago compliance results for the 2016 reporting year:*

"In 2016, 2,695 properties spanning nearly three-fourths of a billion square feet tracked and reported energy use, a 45% increase from 2015, and a 7-fold increase from 2014.

- There is at least one reporting property in each of Chicago's neighborhoods, and 87% of neighborhoods have five or more reporting properties.
- Over 3,500 properties are now included in the policy's coverage.
- Reporting properties represent 23% of citywide energy use.
- Compliance continued at a high rate, with a reporting rate of 91% by floor area and 80% by number of properties."

*Chicago outreach indicators for 2016 reporting year:*

In terms of outreach and support indictors, the 2016 report also indicated:

- "The Chicago Energy Benchmarking Help Center has now facilitated more than 10,000 phone calls and emails since 2014, an enormous level of support to the local real estate community."
- "Local volunteers have provided more than 40 trainings and drop-in help sessions."
- "100 properties spanning over 12 million square feet including nonprofit organizations, houses of worship, and affordable housing properties have received pro-bono assistance for energy benchmarking and data verification."

The 2016 Chicago report also indicated that the City and its outreach partners tested various communications to improve messaging, indicating value of tracking metrics such as compliance and various outreach mechanism. The report further indicated that, "In 2016, the Behavioral Design Team found that a streamlined checklist encouraging people to make their own task plan helped improve

[164] Schulte et al. (2016).
[165] City of Chicago (2016).

compliance by 4.5 percent, as opposed to a longer, more complex checklist. This difference was statistically significant at the building level, but not statistically significant when clustered at the building owner/manager level."

Chicago also is tracking outreach and communication metrics to understand performance and find opportunities for improvement. For example, the city's 2016 report provides the following statistics:

- "10,845 interactions from 2014–2016 (phone calls, emails, and webforms)"
- "Average 2016 call time: 6 minutes, 19 seconds"
- "Average 2016 caller wait time: 28 seconds"
- "Total 2016 phone support: 182 hours, 34 minutes"
- "Total 2016 estimated email and webform support: 502 hours, 25 minutes"

*Chicago energy and non-energy indicators for the 2015 reporting year:*

Figure E-3 and Figure E-4 illustrate the types of building information provided under Chicago's B&T ordinance.

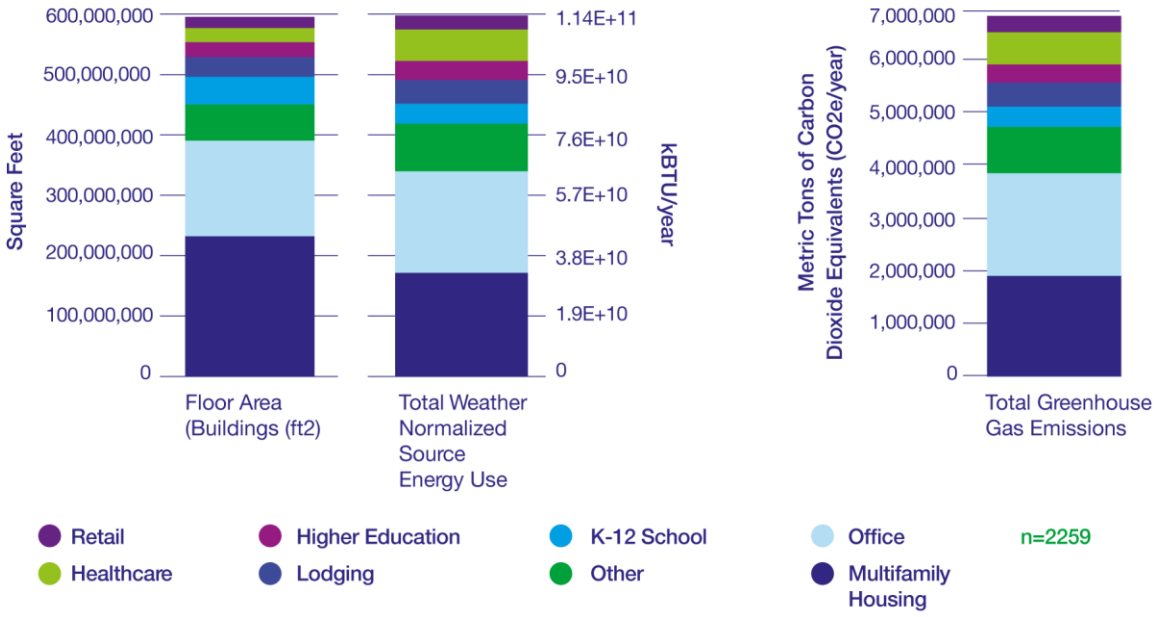



**Figure E-3. Chicago 2015 Floor Area, Total Energy Use, and Total Greenhouse Gas Emissions by Building Sector[166]**

[166] City of Chicago (2016).

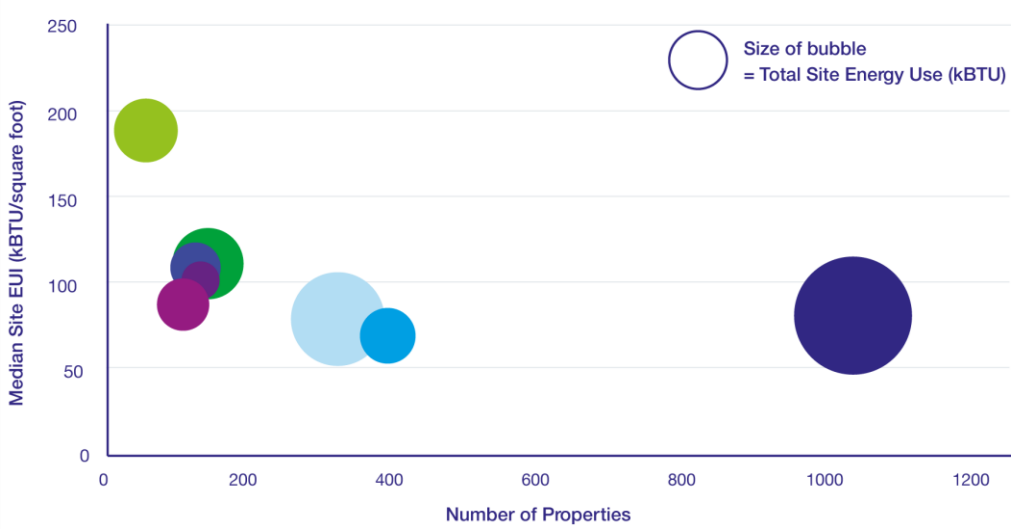



**Figure E-4. Chicago 2015 Median Site EUI and Total Site Energy Use by Number of Properties**[167]

## E.4 Minneapolis

The following information is from the city's *2014 Energy Benchmarking Report.*[168]

*Minneapolis compliance and data quality results for the 2014 reporting year:*

- "Training and outreach strategies were effective as the private building response rate reached 90% by the 2015 disclosure deadline of August 31. Responses for the largest private buildings (100,000+ $ft^2$) reached 100% by the end of 2015."
- "… [D]ata quality improved by 16% in the largest private buildings as benchmarking staff established and promoted clear energy use thresholds to determine compliance. This helped the percentage of compliant buildings jump from 75% in 2013 to 91% in 2014. Data quality was also high for first-time reporting buildings as 84% of buildings sized between 50,000 and 100,000 $ft^2$ had sufficient data quality to be compliant."

Figure E-5 shows compliance rates for various building types for Minneapolis in 2014.

[167] City of Chicago (2016).

[168] City of Minneapolis (2016).

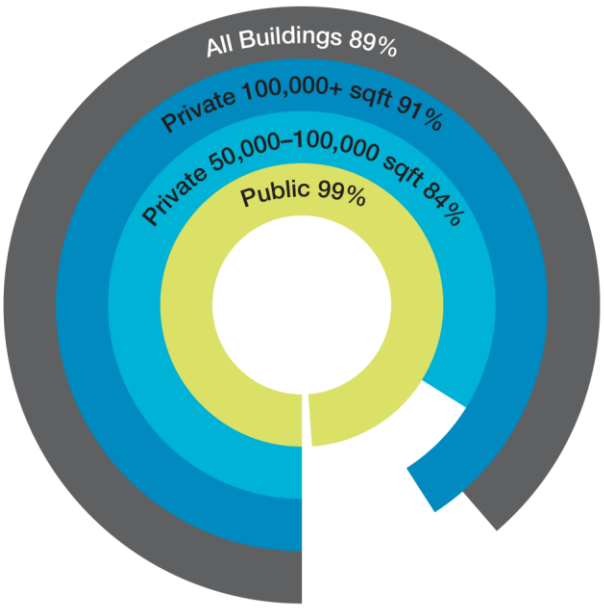



**Figure E-5. Minneapolis 2014 Percent of Compliant Submissions by Building Category**

*Minneapolis outreach indicators for the 2014 reporting year:*

- "… [T]he benchmarking program team strove to improve participation and data quality by streamlining communication, expanding outreach modes, and simplifying the helpline process. More specifically, attention was directed to enhance websites, develop newsletters and scorecards, publish data quality standards, and provide online meeting screen sharing to augment helpline assistance."
- "Building owners received three mailed notices in the first half of 2015, informing them of the June 1st reporting deadline as well as directing them to training resources. In addition, the outreach team developed news material for community distribution and worked with Minneapolis Building Operators and Managers Association […] and other neighborhood business associations to include announcements in their communications."
- "The team conducted two 2-hour in-depth training workshops in the months prior to the deadline, offered online user guides, and operated a helpline for email and phone questions."

*Minneapolis energy indicators for the 2014 reporting year:*

Figure E-6 illustrates 2014 energy use intensity for buildings reporting under Minneapolis' B&T ordinance, one of many ways the city's annual report displays energy indicators for the B&T ordinance.

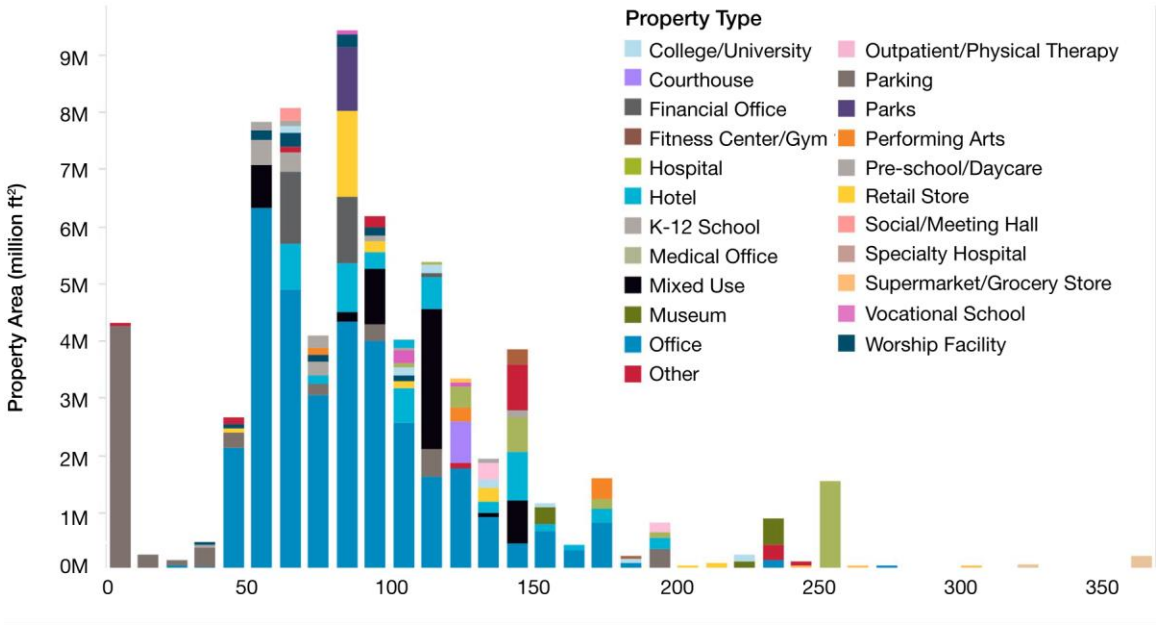



**Figure E-6. Minneapolis 2014 Cumulative Property Type Area by Energy Use Intensity (kBtu/ft²): 258 Private Buildings**[169]

## E.5 New York City

*New York City's Energy and Water Use 2013 Report*[170] provides information on the city's building stock, compliance rates, building energy and non-energy metrics, data validity, and energy efficiency opportunities.

*New York City compliance rates and data quality indicators for the 2013 reporting year:*

According to the report, the overall reporting compliance rate for 2013 was 87 percent (for data reported in 2014). This was an improvement from prior year reported compliance rates of 75 to 84 percent. The report indicated that the improvement could be due to building owners and data consultants becoming more familiar with benchmarking requirements. Figure E-7 provides compliance rates from 2011 through 2014 by property type.

[169] City of Minneapolis (2016).
[170] City of New York (2016).

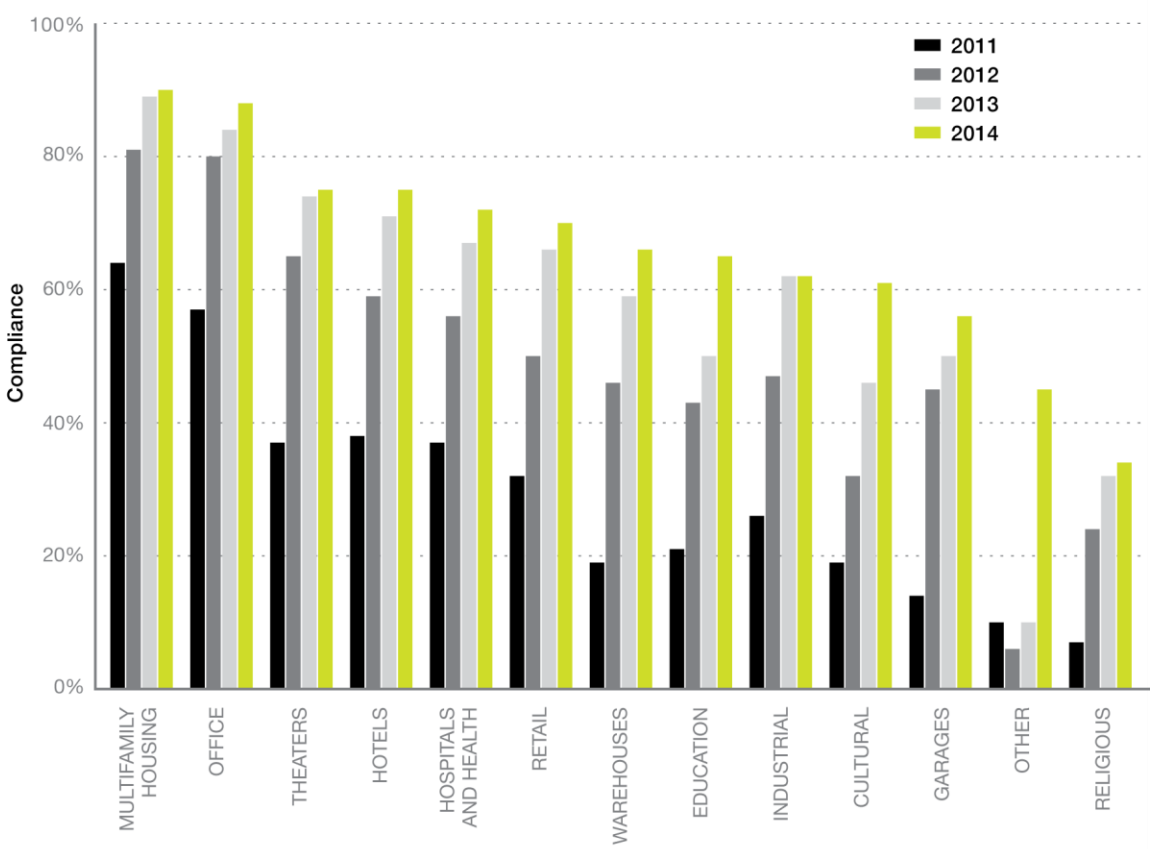



**Figure E-7. New York City LL84 Compliance by Property Type Over Time**[171]

The New York City report also discussed efforts underway to address data accuracy. Figure E-8 shows reporting compliance rates compared to percentage of reporting buildings with useable energy data. A majority, but not all, of the buildings provide useful data.

[171] City of New York (2016).

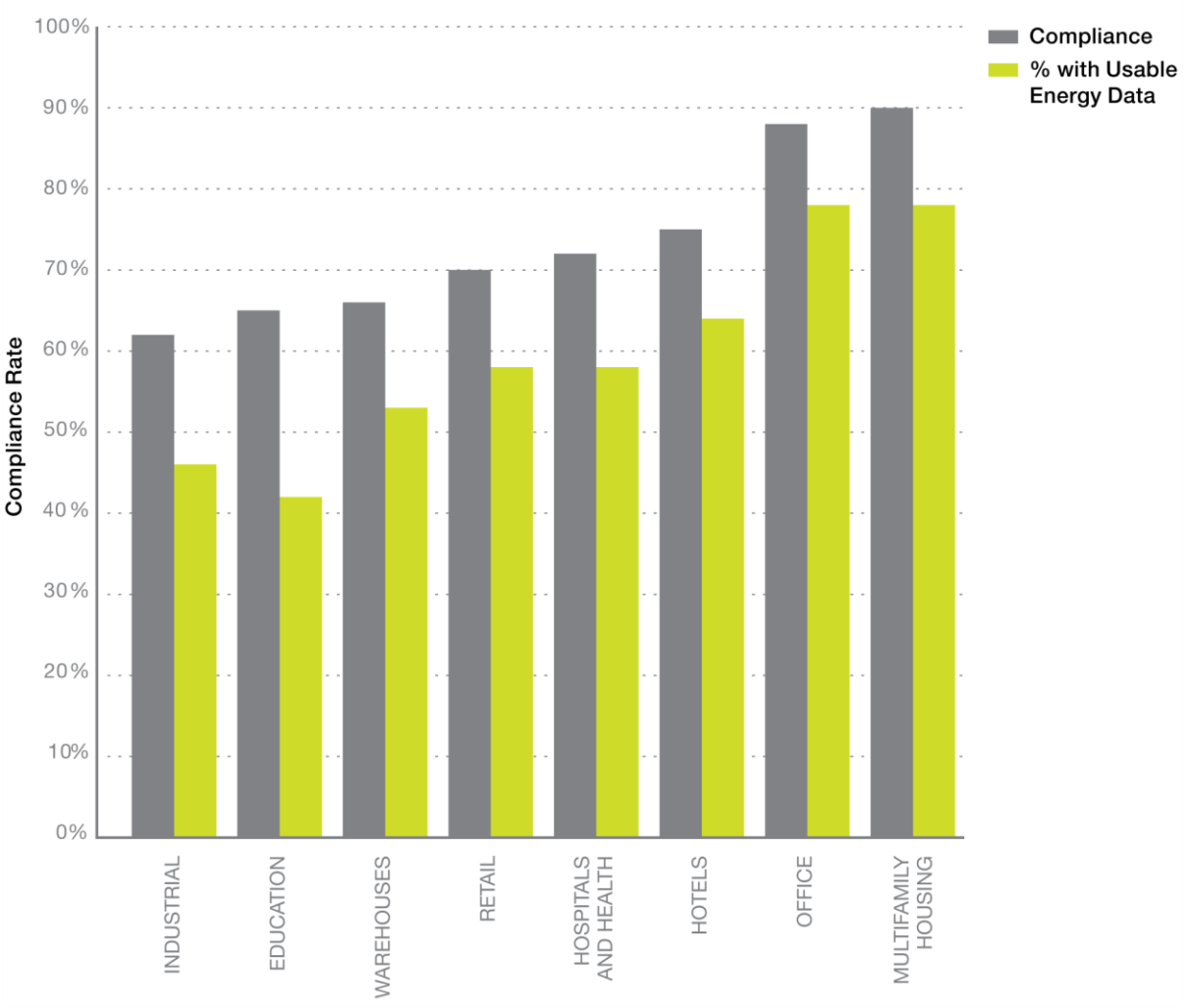



**Figure E-8. New York City LL84 Compliance Compared to Validity of Energy Data**[172]

*New York City energy and non-energy indicators for the 2013 reporting year:*

The New York City report includes extensive information on energy consumption and intensity data for 2013. Figure E-9 is one example of the data provided and analyzed in the report. Benchmarked multifamily buildings consume the most energy overall, while benchmarked supermarkets use the most energy per square foot.

[172] City of New York (2016).

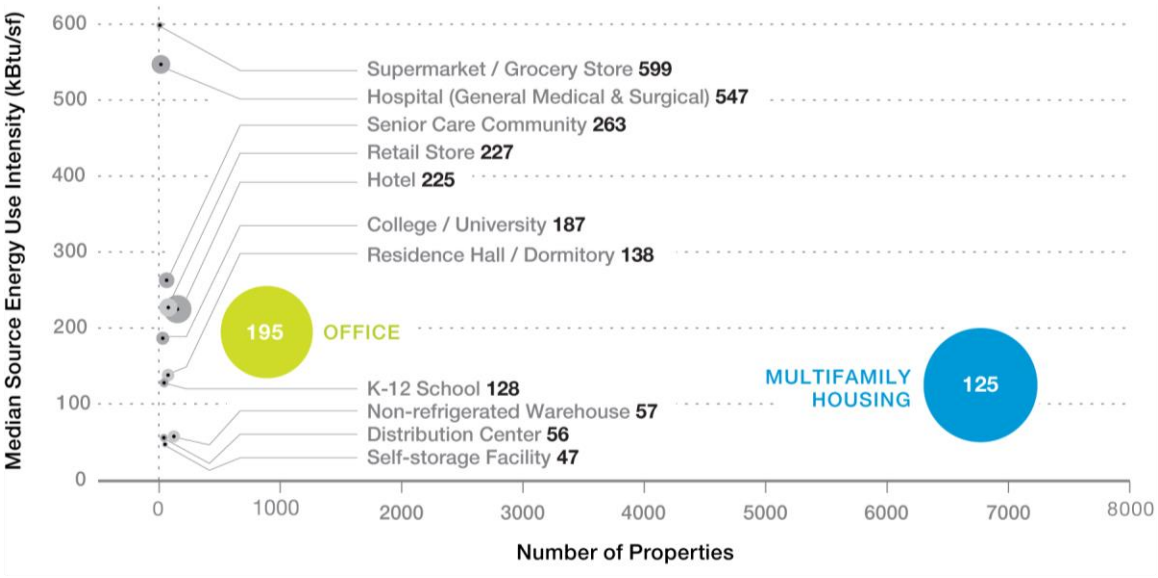



**Figure E-9. New York City Median Energy Use Intensity by Property Type (LL84 data).**
Note: Area of circle is proportional to energy consumed.

## E.6 Philadelphia

In its *2016 Energy Benchmarking Report*, the city of Philadelphia indicated a 91 percent compliance rate for buildings for the 2014 program year.[173] This is similar to the 90 percent compliance rate reported for the 2013 program year and 86 percent for 2012, the first year of the Philadelphia B&T program.[174]

## E.7 Portland, Oregon

*2015 Building Energy Performance Reporting Results*[175] (for program year 2015) indicates that Portland received 340 submittals out of 413 commercial buildings that were expected to report—a compliance rate of 82 percent.[176] Another report describes outreach efforts to support the Portland benchmarking ordinance by the Energy Trust of Oregon, a third-party administer of energy efficiency programs funded by utility customers.[177] Efforts included supporting city training and outreach in part by designing incentive programs, such as retro-commissioning, that build on or integrate with Portland's benchmarking requirements.

[173] City of Philadelphia (2016).
[174] City of Philadelphia (2016).
[175] City of Portland (2016).
[176] City of Portland (2016).
[177] Schulte et al. (2016).

## E.8 San Francisco

*San Francisco Existing Commercial Buildings Performance Report 2010–2014*[178] provides information on compliance and current year energy indicators, as well as energy and emissions trends. The San Francisco ordinance also has an energy audit requirements for buildings over 10,000 $ft^2$. Following are examples of information the report provides on these topics.

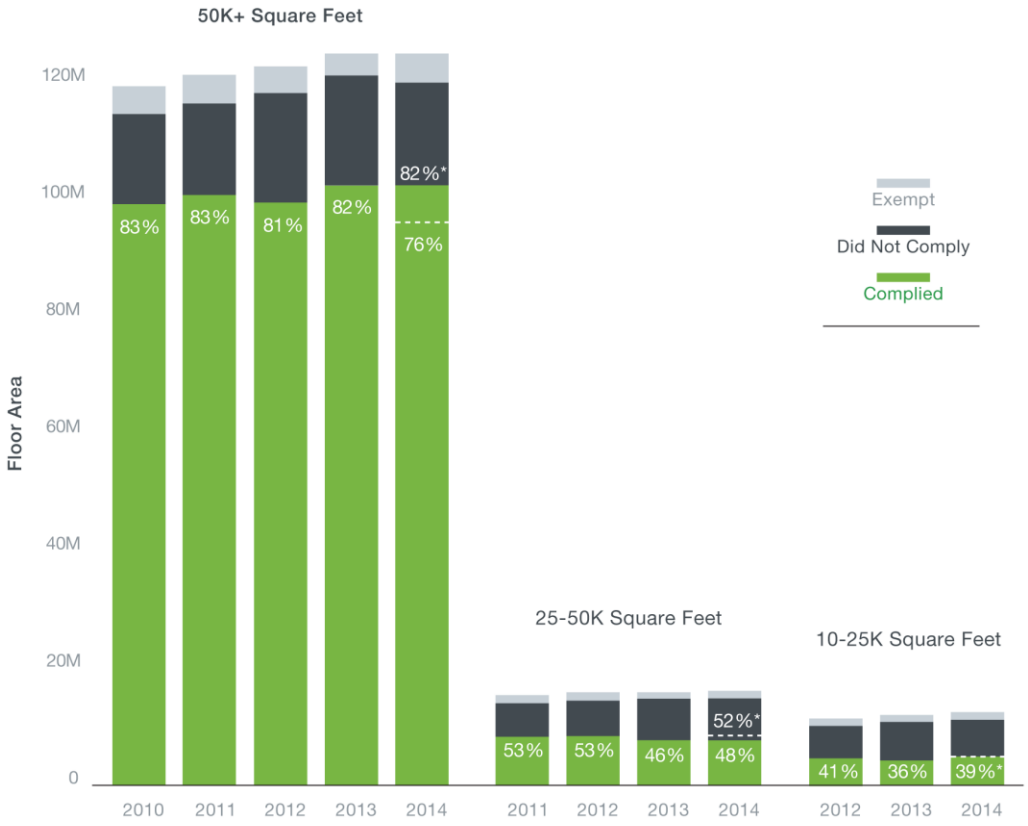
*San Francisco compliance rates:*

The report provides data on compliance rates for each year in total and for three categories of buildings, organized by large, medium, and small footprints. * The San Francisco report was prepared while data from 2014 was still being collected. Numbers below the dotted lines represent the compliance figures at the point the report was published and numbers above the line represent a compliance projection based on prior city experience.
Figure E-10 from the report indicates these compliance rates. The report notes that, compared to other cities with B&T policies, the San Francisco compliance rate is relatively low. For example, for 2014 (as of the date of the report), "benchmark reports have been accepted for 72 percent of floor area, and compliance is anticipated to reach 82 percent by year-end."

The report explains this relatively low compliance rate as follows:

> "Unlike other US cities that adopted benchmarking policies before 2015, in California, utilities and regulators have interpreted state laws as requiring consent of all separately metered tenants before an owner can obtain energy use information, and in San Francisco, 48 percent of buildings affected by the ordinance have two or more energy meters Because owners can have legitimate difficulty obtaining the data essential to compliance, [San Francisco] has not yet issued fines for late benchmark reports, and instead provides technical assistance, written notifications, and public censure in the form of display of noncompliance on the city's open data portal (DataSF.org)."

[178] SFE (2015).




* The San Francisco report was prepared while data from 2014 was still being collected. Numbers below the dotted lines represent the compliance figures at the point the report was published and numbers above the line represent a compliance projection based on prior city experience.

**Figure E-10. San Francisco Annual Compliance Rates (by Floor Area)[179]**

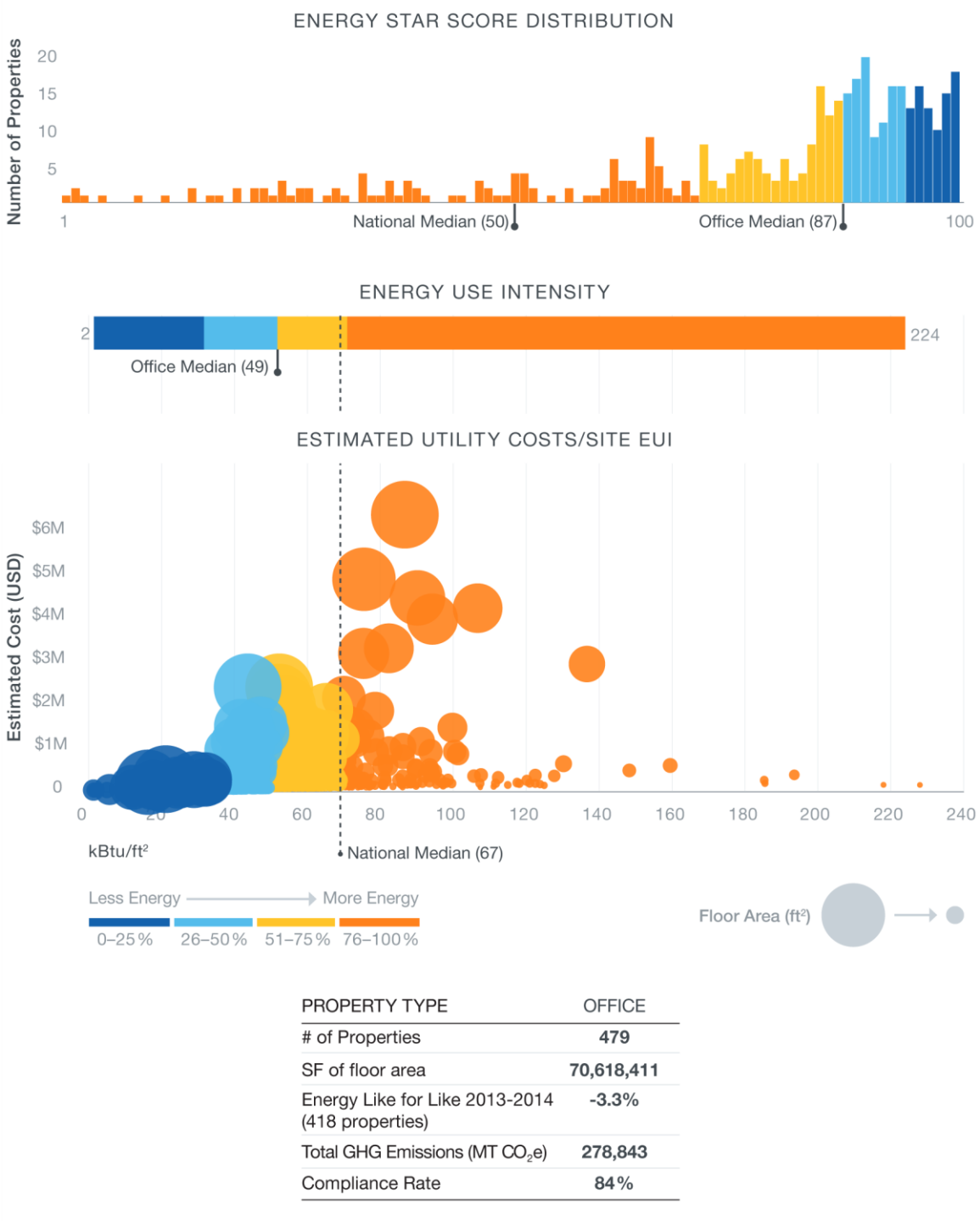
*San Francisco outreach:*

The report states that the city provided more than 90 training sessions and operated a help desk.

*San Francisco current-year energy indicators:*

The report provides energy metrics for offices, hotels, retail, warehouses, and arts and culture facilities. Figure E-11 is an example graphic for office buildings.

[179] SFE (2015).




| PROPERTY TYPE | OFFICE |
|---|---|
| # of Properties | **479** |
| SF of floor area | **70,618,411** |
| Energy Like for Like 2013-2014 (418 properties) | **-3.3%** |
| Total GHG Emissions (MT $CO_2e$) | **278,843** |
| Compliance Rate | **84%** |

**Figure E-11. San Francisco 2014 Benchmarking Results for Office Buildings[180]**

[180] SFE (2015).

*San Francisco audit results:*

The San Francisco ordinance requires that affected buildings have a qualified professional assess energy efficiency opportunities in the entire facility, including leased space, every five years. The report indicated that as of 2014, 79 percent of affected floor area in San Francisco had undergone an audit in the past five years or earned operational certifications to comply with the audit requirements. The report states:

> "In the 817 buildings assessed by September 2015, more than $60.6 million in cost-effective energy efficiency investment opportunities were identified by the auditors, which were estimated to yield $25 million in annual savings and capture $170 million in net present value over the lifetime of the projects. If implemented, these projects would cut annual electricity consumption by 150 GWh and save 1.4 million therms of natural gas per year, with a portfolio-wide payback of three years."

Figure E-12 illustrates the value of the energy-savings opportunities identified by the audits.

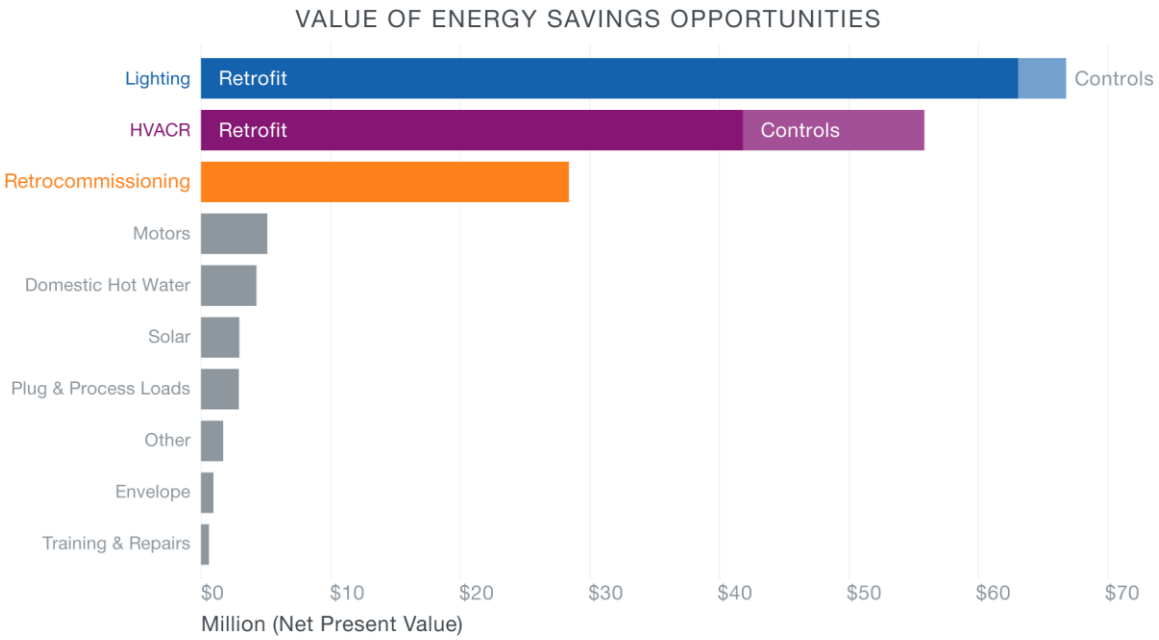



**Figure E-12. San Francisco Value of Energy-Savings Opportunities[181]**

[181] SFE (2015).

## E.9 Seattle

The 2015 *Seattle Building Energy Benchmarking Analysis Report: 2013 Data* summarizes several metrics related to current year (2013) building energy performance data as well as several relating to outreach and compliance.[182]

With respect to compliance, the report indicated, "As of December 2014, 99% of these buildings had 2013 energy performance data reported by a manager, owner or vendor to the City. This represents 99.4% of the total square footage subject to the requirement. The 2012 calendar year was the first year that all buildings 20,000 square feet or larger were required to report data. The overall compliance rate of 99% in 2013 improved over the already high rate of 93% in 2012, due largely to higher reporting by non-residential buildings."

Seattle also reported several support and outreach efforts including staffing a help desk, conducting workshops,[183] and piloting benchmarking performance profiles for the office building sector, providing feedback to owners and managers on how their property compared to similar buildings locally and nationally. Figure E-13 presents a snapshot of the city's outreach efforts for the program year. The report also includes a section on data accuracy, with information on the city's data quality assessment results.

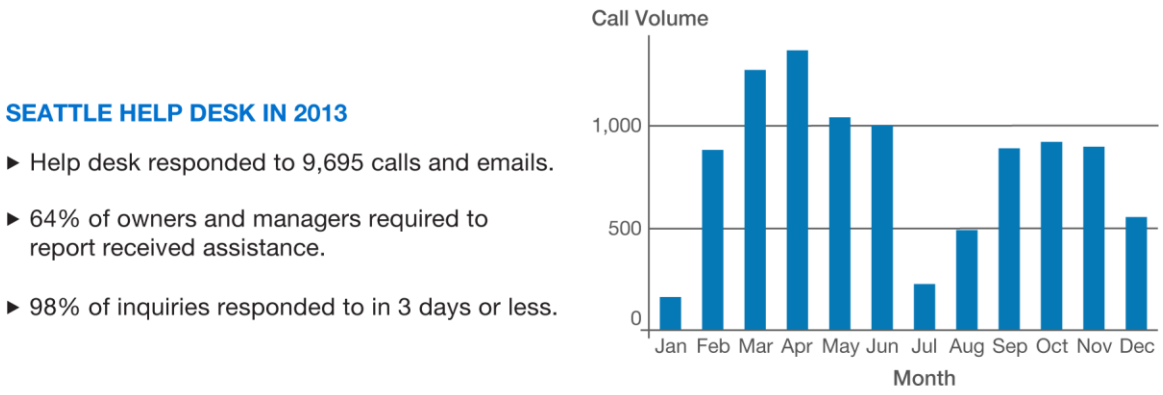



**Figure E-13. Seattle Help Desk 2013 Call Volume[184]**

The 2015 Seattle report also indicated a wide range of indicators and metrics on the characteristics of the buildings that reported under the ordinance and energy use consumption and intensity (EUIs) of those buildings. Figure E-14 is an example of the EUI data reported for the year 2013.

[182] City of Seattle (2015).

[183] "Throughout 2013, 142 owners or their representatives registered for Seattle Benchmarking training workshops and 34 attended in-person help sessions."

[184] City of Seattle (2015).

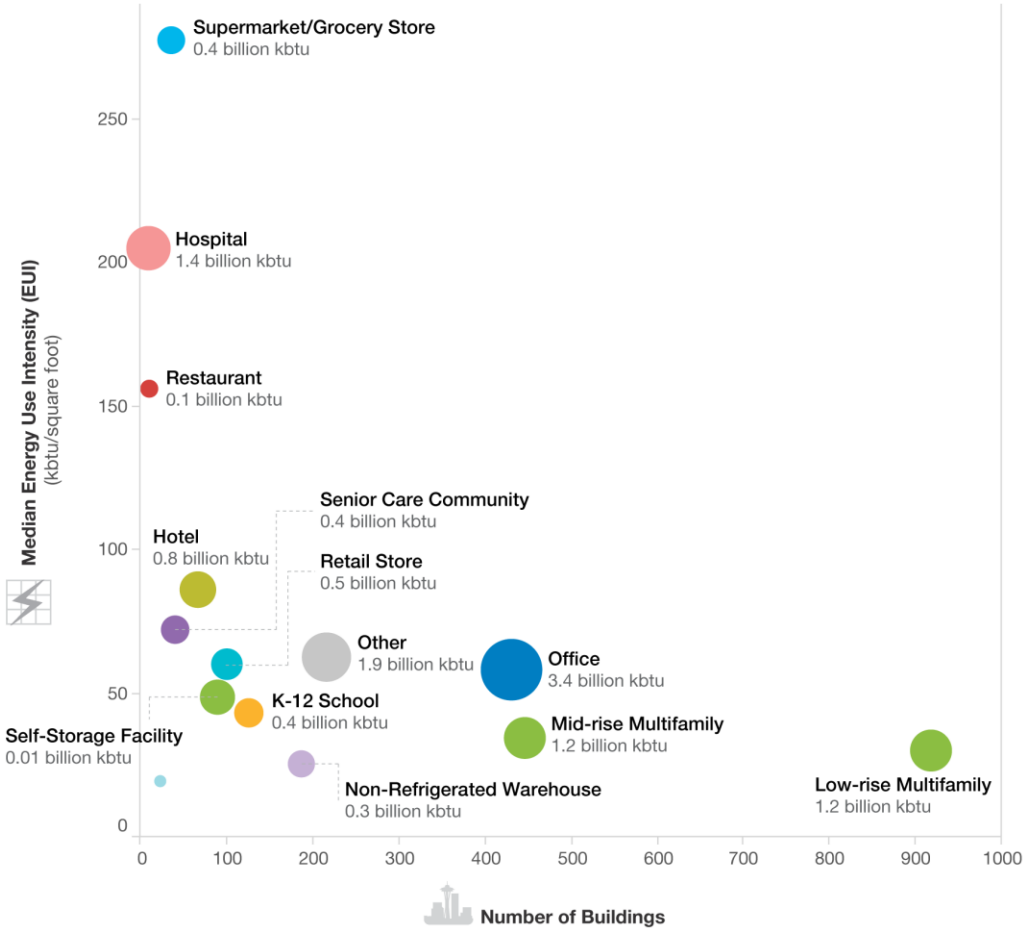



**Figure E-14. Seattle Median 2013 Site Energy Use Intensity by Number of Buildings**[185]

A third-party evaluation of Seattle's technical support functions for its benchmarking ordinance reported the following findings, among others:[186]

- Help desk staff were successful in responding quickly and efficiently to owner/manager inquiries. The vast majority of inquiries (83 percent, n = 7,062) were responded to the same day, and nearly all (98 percent, n = 7,961) were responded to in three days or less. Out of the 2,451 buildings that the help desk served in 2013, the vast majority (84 percent, n = 2,051) had 1–5 contacts with help desk staff, over two-thirds (69 percent, n = 1,682) had 1–3 contacts, and about one-third (35 percent, n = 872) had just one contact.
- Seattle's robust benchmarking help desk resulted in the highest compliance rates in the nation. The capacity of the help desk allowed building owners and managers seeking assistance to receive timely responses and ongoing tailored support to ensure compliance with the

[185] City of Seattle (2015).

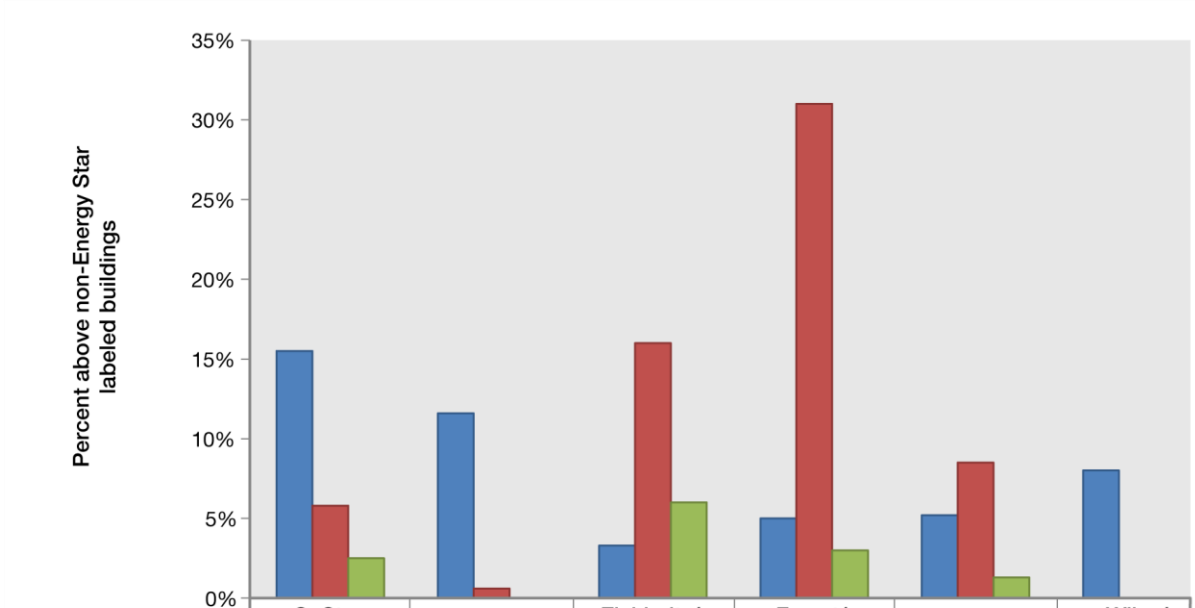
[186] Slobe and Heller (2014). Pages 2, 3, and 4.

ordinance. Proactive outreach and education contributed to the high compliance rate, especially among owners that had not heard of the ordinance.

- Help desk staff and web services were instrumental in helping owners complete the benchmarking process and ensuring data accuracy.
- Seattle's one-stop-shop model of technical support streamlined the benchmarking process for owners/managers and helped local utilities and EPA improve systems and customer service.

# Appendix F. Property Value Impacts of Energy Efficiency

How energy efficiency affects property value is a keen area of interest. One study compiled results from multiple reports and presented findings on rent, sale, and occupancy premiums for high-efficiency commercial buildings to indicate their market value in multiple jurisdictions (see Figure F-1). While these increases in market value cannot be directly attributed to B&T policies, the findings are consistent with B&T policy logic models: B&T policies enable implementation of energy efficiency, which in turn increases the market value of commercial buildings.




| | CoStar Group/USD | CBRE/USD | Eichholtz/ Kok/Quigley | Fuerst/ McCallister | Pivo/Fisher | Wiley/ Johnson |
|---|---|---|---|---|---|---|
| Rental Rate Premium | 16% | 12% | 3% | 5% | 5% | 8% |
| Sale Price Premium | 6% | 1% | 16% | 31% | 9% | 0% |
| Occupancy Premium | 3% | 0% | 6% | 3% | 1% | 0% |

**Figure F-1. Studies Evaluating the Added Market Value of ENERGY STAR-Labeled Buildings**[187]

[187] A Better City and Meister Consultants Group, Inc. (2012).

# Appendix G. Benchmarking and Transparency Codes and Regulations

Austin City Code, Title 6 Chapter 6-7, Energy Conservation.
https://austinenergy.com/wps/wcm/connect/c8814cf7-e1a4-4d6f-8257-88445444f40c/ECADChap6-7EnergyConservation.pdf?MOD=AJPERES&projectid=f69bb082-7be9-483d-b966-924149d4e013

California Assembly Bill 802.
https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB802

City of Atlanta Municipal Code, Part III, Part 8, Chapter 2.
https://www.municode.com/library/ga/atlanta/codes/code_of_ordinances?nodeId=PTIIICOORANDECO_PT8COHUDE_CH2BURE

City of Berkeley Municipal Code, Chapter 19.81.
http://www.ci.berkeley.ca.us/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/Regulations_current.pdf

City of Boston Code, Ordinances, Chapter VII, Section 7-2.2 (j).
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