

International Institute for Sustainable Laboratories

Literature Review of Current Building Performance Standards

As of September 2022

As the effects of climate change have become more evident, local and state governments have begun to set their own climate goals aimed at lowering energy consumption and greenhouse gas (GHG) emissions. With over 31 percent of overall GHG emissions in the United States deriving from buildings, policies aimed at this sector may facilitate a large fraction of the reductions needed for these local and state governments to reach their climate goals (EPA, 2022). One regulatory solution being used is the Building Performance Standard (BPS). The U.S. Environmental Protection Agency (EPA) defines a BPS as a policy that requires building owners to meet performance targets by actively improving their buildings over time (EPA, February 2021).

Beyond energy consumption and emissions reductions, BPSs have been found to be a policy tool that can help cities and states meet their community health and economic goals (IMT, 2020). While BPSs may help to significantly cut emissions from the building sector while providing other societal benefits, it is worth investigating their impact on each type of building they affect. The International Institute for Sustainable Laboratories (I²SL) recognizes that laboratory buildings are much more energy-intensive – and more diverse as a group – than most other types of commercial buildings (Thompson, August 2021). Therefore, depending on how the BPSs are constructed, it could be more difficult for laboratory owners to meet BPS requirements than for owners of offices and other commercial buildings.

The purpose of this review is to examine the current landscape of BPSs and what they mean for laboratory buildings in each jurisdiction. The review, and in particular the accompanying summary table, will equip laboratory owners to navigate the BPS of their jurisdiction. Furthermore, this document will prepare policymakers and laboratory owners to engage lab stakeholders in BPS creation and compliance.

Composition of Building Performance Standards

BPSs typically require the building owner to report the building's energy consumption or GHG emissions, depending on the goal of the policy. A common reporting tool used is EPA's ENERGY STAR® Portfolio Manager (ENERGY STAR-1). This tool is used in most jurisdictions to categorize building types, to set baseline and target energy or emissions metrics, and to track compliance. For certain building types, the tool provides a normalized 1-100 score based on the building's calculated energy efficiency, with 100 being the most efficient (ENERGY STAR-1). However, no ENERGY STAR score exists for lab buildings.

Jurisdictions with BPSs have thus far used either GHG emissions or energy consumption as their performance metric. In most instances, the BPS mandates either a reduction in energy use intensity (EUI) or in GHG emissions (EPA, February 2021) over a period of time; the time period varies between BPSs. Energy use intensity can be tracked using site EUI or source EUI; a weather normalized EUI (ENERGY STAR-1) is used in some cases. Some policies use percentage reduction targets, while others use absolute values of GHG or energy intensities.

The categorization of buildings' occupancy or use type also varies from policy to policy. Some jurisdictions opt to use the categorization used in ENERGY STAR Portfolio Manager, in which labs fall into a broad category named "Technology/Science." Other jurisdictions use a more granular classification, with a use category specific to labs.

Finally, BPS policies differ in the compliance mechanisms they offer. For example, a policy may provide alternative compliance pathways for building owners who meet certain criteria. There may also be exemptions for certain building types, or waivers for building owners who would face financial hardship.

Current Landscape

Within the United States, there are currently 10 locations that have mandated BPSs: Boston, Massachusetts; Chula Vista, California; the entire state of Colorado; Denver, Colorado; the entire state of Maryland; Montgomery County, Maryland; New York, New York; Saint Louis, Missouri; Washington state; and Washington, D.C. Some jurisdictions' rulemaking is still in progress, so some policy details have not yet been finalized.

It is worth noting that the landscape for BPSs is set to change. In January 2021, the Biden Administration announced the Building Performance Standards Coalition. This coalition is comprised of 33 state and local governments, with the goal of implementing BPSs by Earth Day 2024 (Schlegel, January 21, 2022). Additionally, The Biden Administration announced that the Council on Environmental Quality (CEQ), Department of Energy (DOE), General Service Administration (GSA), and EPA are working to develop a federal building performance standard to reach federal carbon emissions goals (White House, May 17, 2021).

1. Boston, Massachusetts

In 2013, Boston implemented the Building Emissions Reduction and Disclosure Ordinance, requiring the owner of a building greater than or equal to 35,000 square feet, or the owner of a building with 35 or more units, to report the energy and water consumption of their building. In 2021, Boston updated the Building Emissions Reduction and Disclosure Ordinance to include a BPS, requiring eligible building owners to reduce the GHG emission intensity of their building, measured in kilograms of carbon dioxide equivalent per square foot per year (kgCO₂e/SF/yr).

The buildings covered by this ordinance include: all municipal buildings; commercial or multifamily buildings over 20,000 square feet or with 15 or more residential units; or parcels which have multiple buildings that total at least 20,000 square feet. The ordinance mandates emissions standards that must be met annually, starting in 2025, with emissions reductions increasing at five-year intervals until 2050, at which point applicable buildings must have net-zero carbon emissions (Appendix A). Building owners not in compliance with the benchmarking or performance standard requirements are subject to an inquiry and daily fines for each day of non-compliance (BERDO, 2021; IMT, November 2021). Laboratories are categorized as "Technology/Science" under this ordinance (Appendix A). A laboratory must meet the mandated requirement unless a lab owner successfully applies for a financial hardship waiver. If the review board grants a financial hardship waiver to a lab owner, the laboratory will then have an alternative compliance pathway to follow (BERDO, 2021).

2. Chula Vista, California

In 2015, California passed an energy benchmarking requirement for buildings over 50,000 square feet. In 2021, Chula Vista built upon this benchmarking requirement by mandating a BPS through its Building Energy Saving Ordinance. Through this ordinance, owners of a commercial or multifamily property greater than or equal to 20,000 square feet must benchmark energy consumption and meet the required percent improvement target for its ENERGY STAR score or its weather normalized site EUI (kBtu/SF/yr.) (Appendix B, Appendix C). Every five years, building owners must show that their building has reached its designated improvement target, which is determined by the building's ENERGY STAR score or its site EUI. This improvement requirement takes the form of a percentage improvement in the building's ENERGY STAR score, or a percentage reduction in its site EUI if (as is the case for labs) the building does not qualify for an ENERGY STAR rating (Appendix B). An alternative compliance pathway requires building owners to meet minimum site EUI improvement requirements set below the building's baseline site EUI after 10 years if the building undergoes an audit and retrofit as mentioned in the mandate (Appendix C). Non-compliance with the Building Energy Saving Ordinance means the building owner is subject to a fine based on the building's square footage not to exceed \$2,500 "on a per-incident basis" (2021).

Laboratories are categorized as "Technology/Science" under this ordinance (Table 2). A laboratory will be exempt from the ordinance if it is a federal, state, or county building (Building Energy Saving Ordinance, 2021; IMT, November 2021). An exemption may be granted to a laboratory owner if the building meets the criteria to be deemed as in "financial distress." Generally, this would only apply to a building under the city's tax lien sale list, that is foreclosed, or is owned by a financial institution (Building Energy Saving Ordinance, 2021). Furthermore, the ordinance states that a building will be exempt from the requirements if has an ENERGY STAR score over 80, or if the building has been LEED certified for three of the past five years (2021). Laboratories will be unable to meet the ENERGY STAR score exemption as ENERGY STAR does not provide a score for labs.

3. State of Colorado

Colorado's House Bill 21-1286, Energy Performance for Buildings, was passed in 2021. The law mandates that buildings comprising a gross floor area of 50,000 square feet or more are to follow benchmarking and BPS requirements. The annual benchmarking requirement is set to start December 1, 2022. Specifics on the standards have yet to be determined. The Energy Performance for Buildings Act establishes a BPS task force to set standards that will satisfy a GHG reduction of seven percent by 2026 and 20 percent by 2030 from a 2021 baseline. The BPS task force will also propose standards by October 1, 2022, with final rule making to occur in May 2023. (Energy Performance for Buildings, 2021; IMT, November 2021).

Laboratories are categorized as "Technology/Science" under this law (Table 2). A laboratory will be exempted from the mandate if "more than half of the building's gross floor area is used for manufacturing, industrial, or agricultural purposes" (Energy Performance for Buildings, 2021).

4. Denver, Colorado

In 2021, the City Council of Denver passed the Energize Denver Ordinance. The ordinance mandates that the owners of commercial and multifamily buildings over 25,000 square feet benchmark the building's energy consumption and lower the weather-normalized site EUI to a standard based on the compliance year and building type (IMT, November 2021). To reach its GHG reduction from existing buildings goal of

100 percent from a 2005 baseline by 2040, Denver is targeting energy efficiency and increased building performance with its BPS (Energize Denver Ordinance, 2021).

To comply with the ordinance, covered buildings will need to reach a site EUI BPS in 2024, 2027, and 2030. The 2030 performance metric is dependent on the building type, while the 2024 and 2027 standards will be unique to the specific building based on its baseline site EUI (Energize Denver Ordinance, 2021; Hart, November 23, 2021). For example, a lab building will need to meet a site EUI of 153.9 kBtu/SF/yr by 2030, but will have unique performance metrics for the 2024 and 2027 interim deadlines based on its baseline site EUI. Baselines are set as the 2019 site EUI if it was reported, or an estimated baseline for buildings that have never had their data benchmarked. IMT has created an example of what this would look like for three office buildings with different baselines (Appendix D) (Hart, November 23, 2021). Failure to meet the statutory standards will result in \$0.70 penalty per each kBtu reduction the building owner fails to meet each year. Further noncompliance will result in the city putting a lien on the property until all debts have been paid (Energize Denver Ordinance, 2021).

Laboratories are categorized as “Laboratory” under this ordinance (Table 1). There do not appear to be any exemptions for buildings in the Laboratory category (Energize Denver Ordinance, 2021).

5. State of Maryland

The Climate Solutions Now Act was signed into law on April 8, 2022. The overarching goal of the act is “to reduce statewide greenhouse gas emissions through the use of various measures...” (Climate Solutions Now Act, 2022). Through this law, Maryland has instituted a building performance standard, which covers commercial, multifamily, and state-owned buildings with a gross floor area greater than or equal to 35,000 square feet (2022). Historical buildings, elementary and secondary schools, and manufacturing and agricultural buildings are exempt from this standard. By June 1, 2023, the Maryland Department of the Environment may implement special provisions to the regulation based on a building’s age, regional differences, and to account for the unique needs of laboratories (Climate Solutions Now Act, 2022).

The State of Maryland is the only jurisdiction that has a performance standard focused on direct GHG emissions (Scope 1). While “direct emissions” is not defined within the text of the legislation, EPA defines “direct emissions” as emissions occurring from sources that are controlled or owned by an organization (this excludes emissions sourced from electricity generation and transmission) (EPA, September 2021). The metrics an individual building will need to meet has yet to be released, but the standards shall be set to achieve a 20 percent reduction in net direct GHG emissions, from a 2025 baseline, for the average building of the specific building type. According to the legislation, building categorizations and the standards to reach this 20 percent reduction goal are to be set no later than June 1, 2023 (Climate Solutions Now Act, 2022). The benchmarking requirement of this legislation is set to begin in 2025, with buildings needing to meet their respective emissions standard by 2030 and 2035. The legislation also provides an additional compliance pathway via which a building owner will be allowed to pay a fee for the remaining amount of GHG emissions by which the building exceeds its target. The fee will be set no lower than the social cost of GHGs as set by EPA. (Climate Solutions Act Now, 2022).

6. Montgomery County, Maryland

In May 2022, Montgomery County passed Bill 16-21, which established the county’s building performance standards (*Environmental Sustainability - Building Energy Use Benchmarking and Performance Standards – Amendments, May 2022*). In acknowledgement of the large role buildings play in the county’s total GHG emissions, the performance standards were put in place to help meet the county’s goal of being carbon neutral by 2035 (Montgomery County Department of Environmental Protection, 2022).

Covered buildings have been split into five groups under this bill, each with an assigned compliance timeline. Under this bill, Group 1 contains “commercial buildings with a gross floor area that equals or exceeds 250,000 square feet;” Group 2 entails “commercial buildings with a gross floor area that exceeds 50,000 and less than 250,000 square feet;” Group 3 consists of “commercial buildings with a gross floor area that exceeds 25,000 and less than 50,000 square feet;” Group 4 is comprised of “multifamily residential or mixed-use covered building whose gross floor area equals or exceeds 250,000 square feet;” and Group 5 includes “multifamily buildings with a gross floor area that equals or exceeds 25,000 square feet but is less than 250,000 square feet” (May 2022). The compliance timeline for a building is determined by the groupings above. Group 1 and 2 will have an interim target in 2028 and a final target in 2033; Group 3 and 4 will have an interim target in 2030 and a final target in 2035; and Group 5 will have an interim target in 2031 and a final target in 2036 (Montgomery County Department of Environmental Protection, 2022). A laboratory building with more than 10 percent of its gross floor area being used for warehousing; self-storage; manufacturing and industrial purposes; transportation; communication; or utilities will be exempt from this regulation (*Environmental Sustainability - Building Energy Use Benchmarking and Performance Standards – Amendments, May 2022*).

The performance standards, which will use Site EUI as a metric, have yet to be determined. Furthermore, it is currently unknown how laboratories will be categorized under the standard, as the categorization of buildings by type has not been determined either. Like the ordinance passed in Denver, the final target will be based on building category, with the interim target for a building being based on that building’s baseline metric (Energize Denver Ordinance, 2021; Montgomery County Department of Environmental Protection, 2022).

Laboratories that are unable to meet the compliance requirements may be eligible for an alternative compliance pathway. By submitting a “Building Performance Improvement Plan” to the Montgomery County Building Performance Improvement Board, and successfully completing the action items of the plan on a prescribed timeline, a building can be deemed compliant with the regulation (Montgomery County Department of Environmental Protection, 2022).

7. New York, New York

Local Law 97 of the New York City Climate Mobilization Act of 2019 established the city’s BPS. The policy focuses on emissions reductions to help meet the city’s goal of becoming carbon neutral by 2050. The Climate Mobilization Act of 2019 also aims to reduce GHG emissions from buildings by 2030 (from a 2005 baseline). Commercial and multifamily buildings over 25,000 square feet are covered by this ordinance and must meet GHG intensity reduction requirements measured in tons of CO₂ equivalent per square foot (tCO₂e/SF).

Beginning in 2024, owners are required to reduce their buildings’ emissions to the predetermined limit. This limit is calculated by multiplying the building’s square footage by the emissions intensity limit assigned to the building’s occupancy group (Appendix E) (Climate Mobilization Act, 2019; IMT, June

2022). The energy intensity limits become more stringent for the 2030 – 2034 compliance cycle, and the limits for 2035 and beyond will be set in the future. Noncompliance with the ordinance will result in the building owner paying a penalty of \$268 multiplied by the total emissions (tCO₂e) above the building's calculated limit for the year. (Climate Mobilization Act, 2019).

Laboratories can be categorized under Occupancy Group B or F per Chapter 3 of the New York City's Building Code (2014). This categorization is determined by the primary usage of the laboratory. Occupancy Group B will be assigned to nonproduction laboratories, or labs used for research and testing. Occupancy Group F will be assigned to "moderate-hazard" or "low-hazard" production labs. "High-hazard" labs will be placed in Occupancy Group B or F based on which group the lab best resembles (New York City Building Code, 2014). Lab owners will need to investigate which occupancy group their buildings fall under to know which emissions intensity coefficient to use (Appendix E). A laboratory may be granted an alternative emissions limit by the city if capital improvement projects are needed; if the owner has tried to purchase carbon offsets, but the amount needed was not available; or if the owner has participated in utility incentive programs when possible (Climate Mobilization Act, 2019; IMT, June 2022).

8. Saint Louis, Missouri

To help reach the city's goal of reducing GHG emissions by 100 percent (from a 2005 baseline) by 2040, Saint Louis enacted the Building Energy Performance Standards Ordinance in 2020. The BPS of this ordinance is based on site EUI. The Building Energy Performance Standards Ordinance requires that all commercial, multifamily, institutional, and municipal buildings over 50,000 square feet meet the site EUI standard set by the Office of Building Performance.

The site EUI standard will be based on the building type and will be no lower than the 65th percentile EUI metric for that building type (Appendix F) (Building Energy Performance Standards, 2020; IMT, June 2022). The standard for a building type is localized (i.e. based on buildings in the city) if more than 10 instances of that building type exist within the city, and will be nationalized (based on site EUI values provided by ENERGY STAR) if the city contains fewer than 10 buildings of that type. Buildings that are subject to this ordinance will need to meet the determined site EUI requirement by 2024, and a new requirement will be set thereafter (Building Energy Performance Standards, 2020; IMT, June 2022).

Lab buildings are categorized as "Laboratory" under this ordinance (Appendix F). With 23 laboratories in Saint Louis, lab buildings will need to meet a localized standard site EUI of 219.2 kBtu/SF/year (Appendix F). Building owners who do not send in the benchmarking and building performance data within 60 days of the deadline will be assessed a fine of no more than \$500, or imprisonment of no more than 90 days, for each day that the building owner is in noncompliance with the ordinance (Building Energy Performance Standards, 2020).

The ordinance provides exemptions for buildings when compliance will create financial hardship or would not be in the interests of the public. Furthermore, exemptions are allowed for buildings that are primarily used for industrial reasons, or if the building is owned by the state or federal government. If a laboratory undergoes energy retrofits and achieves performance well beyond the mandated level, the Building Energy Improvement Board may deem the building to be in compliance for the next 15 years (Building Energy Performance Standards, 2020).

9. Washington State

Washington State passed a BPS, the Clean Buildings Act, in 2019. To meet the state’s energy efficiency and GHG emission reduction goals, the mandated BPS will focus on weather-normalized EUI reductions (The Clean Buildings Act, 2019). Tier 1 buildings (commercial buildings of over 50,000 square feet) are covered by this mandate and must comply with reporting and EUI requirements. Tier 2 buildings (commercial buildings between 20,000 and 50,000 SF; and multifamily buildings greater than 50,000 SF) have no performance target but must begin benchmarking their data by June 1, 2027 (Washington State Department of Commerce, n.d.). The weather-normalized EUI target for Tier 1 buildings is based on the ANSI/ASHRAE/IES Standard 100-2018, and must be “no greater than the average energy use intensity for the covered commercial building occupancy type” (The Clean Buildings Act, 2019; IMT, June 2022). Occupancy type is based on the ANSI/ASHRAE/IES Standard 100-2018 document (Washington State Department of Commerce, 2020).

The compliance date for this mandate is determined by the square footage of the building. For buildings greater than 220,000 square feet, the compliance deadline is June 1, 2026; for buildings greater than 90,000 square feet but less than 220,001 square feet, the compliance deadline is June 1, 2017; and for buildings greater than 50,000 square feet but less than 90,001 square feet, the compliance deadline is June 1, 2028. Failure to comply with the mandate will result in a penalty of no more than \$5,000 plus a fee for each day the building is noncompliant (The Clean Buildings Act, 2019).

Under this act, laboratories are categorized as “Technology/Science,” with a subcategory designation of “Laboratory” (Table 2). The performance target for labs will be dependent on the climate zone in which the lab resides. Labs in Climate Zone 4C will need to meet a site EUI of 237 kBtu/SF/yr, whereas labs in Climate Zone 5B will need to meet a site EUI of 249 kBtu/SF/yr. (Washington State Department of Commerce, March 2022). The Clean Buildings Act of 2019 allows exemptions for buildings that are under 50 percent occupancy, primarily used for industrial or agricultural purposes, or under financial hardship. Financial hardship is defined in the act as buildings under a tax lien, that are controlled by a financial institution, or that have “other conditions of financial hardship identified by the department rule” (The Clean Buildings Act, 2019). Furthermore, the act established that a building is exempt if the gross square footage, minus unconditioned and semi-conditioned spaces, falls below the 50,000 square feet requirement (2019).

Alternative compliance pathways exist under this regulation. The “Conditional Compliance” pathway is granted if the “verification requirements” will not be met by the compliance deadline (Washington State Department of Commerce, 2021). An investment-based path also exists for building owners. A building owner will need to have an ASHRAE Level II energy audit conducted and will need to implement all cost-effective energy efficiency measures (Washington State Department of Commerce, July 2021) in order to comply.

10. Washington, D.C.

In 2018, Washington D.C. passed the Clean Energy Omnibus Amendment Act. Based on goals of reducing GHG emissions 50 percent by 2032 and becoming carbon neutral by 2050, the District government established the Building Energy Performance Standards Program, under the 2018 Omnibus Amendment Act in 2019. The program aims to lower source EUI in buildings, with performance standards being set at the District median ENERGY STAR score for each building type (Appendix G) (Establishment of a Building Performance Standard Program, 2019). For buildings that do not receive an ENERGY STAR score, the city has established a source EUI target based on property type (Appendix G). Covered in this program are all

privately owned buildings over 50,000 square feet and District-owned buildings over 10,000 square feet beginning in 2021; all privately owned buildings over 25,000 square feet beginning in 2023; and all privately owned buildings over 10,000 square feet in 2026. Laboratory buildings are categorized as “Laboratory” under this ordinance (Appendix G).

To satisfy the BPS for Washington, D.C., a building owner may follow one of four compliance pathways: performance, standard, prescriptive, or an alternative pathway that meets or exceeds the energy savings achieved in the three other pathways. If following the standard pathway, laboratories will need to meet a source EUI of 318.2 kBtu/SF/year to satisfy the first compliance cycle’s standard target pathway. (Appendix G). A covered building is considered compliant with the mandate if it is below the source EUI performance standard, or above the ENERGY STAR score at the beginning of the compliance cycle (Establishment of a Building Performance Standard Program, 2019; IMT, June 2022). Subsequent standards will be set every seven years with the next standard being set in 2027. To satisfy the performance pathway requirement in the first compliance cycle, a building owner will need to reduce their building’s site EUI by 20 percent over the last two years of the compliance cycle. The performance standards for the next compliance cycle are to be determined during the year after the first compliance cycle ends (Establishment of a Building Performance Standard Program, 2019). To satisfy the requirements of the prescriptive pathway, a building owner will need to complete specific actions and requirements set by the Washington D.C. Department of Energy and Environment (DOEE). Building owners whose buildings do not comply with the BPS will face a financial penalty proportional to the building’s performance relative to its compliance target (Building Energy Performance Standards Compliance and Enforcement Guidebook for Compliance Cycle 1).

The ordinance permits that a building may be granted a three-year compliance extension by the Washington D.C. DOEE if the building owner can demonstrate good cause for a delay and submit an Extended Delay Milestone Plan (Building Energy Performance Standards Compliance and Enforcement Guidebook for Compliance Cycle 1).

How Laboratories Could Be Affected

Under the current BPSs enacted across the United States, laboratory buildings above a specific square footage are subject to performance targets in each jurisdiction. The performance metric type, the building categorization method, and alternative compliance mechanisms all play a role in determining how difficult it will be for a given lab building to comply with its applicable BPS.

First, whether the BPS is based on GHG metrics or energy metrics plays a key role in determining the steps that must be taken to comply with the standard (EPA 2021). From Table 1-1, five jurisdictions use EUI, two jurisdictions use GHG emissions intensity, and one jurisdiction has yet to define a performance metric. If a BPS is based on site EUI, a laboratory building that is predisposed to higher levels of energy consumption due to stringent functional requirements (e.g. high airflow required for occupant safety) may find compliance difficult. However, if a jurisdiction requires GHG emissions reduction, the building may be able to find other methods to lower its emissions while maintaining the energy intensity needed for safety and function. However, focusing on electrification and emissions offsets could result in missed opportunities to become more energy-efficient without sacrificing functional requirements (IMT, January 2021).

Table 1-1: Current BPS Performance Metrics

Performance Metric		Location(s)
Site Energy Use Intensity	5	Chula Vista, Denver, Montgomery County, St. Louis, State of Washington
Source Energy Use Intensity	1	Washington D.C.
Greenhouse Gas Emissions Intensity	2	Boston, New York City
Direct Greenhouse Gas Emissions	1	State of Maryland
To Be Determined	1	Colorado

Second, the building categorization plays an important role. For instance, most BPSs group buildings by occupancy type (Table 1-2). This can raise compliance issues if the buildings in a given occupancy type do not have similar energy intensity or GHG emission levels. For example, ENERGY STAR classifies laboratories in the occupancy group of “Technology/Science,” along with data centers and “Other” occupancy types (ENERGY STAR-3). If the BPS is based on the median or average energy intensity within that category, energy-intensive laboratory buildings could find compliance difficult.

Table 1-2: Current BPS Laboratory Classification

How a Laboratory Is Classified		Location(s)
Technology/Science	3	Boston, Chula Vista, Colorado
Laboratory	4	Denver, Saint Louis, State of Washington, Washington D.C.
Occupancy B or F	1	New York City
To Be Determined	2	State of Maryland, Montgomery County

Importantly, even grouping laboratory buildings in their own dedicated category may lead to inequitable results. The laboratory designation covers a broad range of buildings with diverse functional requirements and energy consumption needs (I2SL, 2020). Any assignment of a single EUI target for laboratory buildings will disadvantage those buildings with energy-intensive functional requirements such as protection from high-hazard materials or the use of particularly energy-intensive lab equipment.

Finally, the availability of alternative compliance pathways will play a significant role in the ease with which a laboratory can comply with a BPS. One alternative compliance pathway involves allowing the purchase of renewable energy certificates (RECs) or carbon offsets to lower a building’s GHG emissions. For example, Boston allows for the purchase of RECs to offset the GHG emissions associated with a building’s electricity consumption (Building Emissions Reduction and Disclosure Ordinance, 2021; IMT,

June 2022). This mechanism allows for a laboratory owner to comply with the ordinance without making significant changes to the facility's performance.

The achievement of a high ENERGY STAR score is used by Chula Vista as an alternative compliance pathway. ENERGY STAR scores take into account a selected set of building-specific functional requirements and as such they partially normalize for diversity within each applicable building category. No ENERGY STAR score is available for laboratories, but this type of score could be a particularly useful alternative compliance method for labs because of the problems (described above) posed by the large amount of diversity within the lab category.

Another alternative compliance pathway, mandated by Chula Vista, stipulates that building owners can opt to meet an audit requirement by the end of a compliance cycle, rather than the meet the performance standard (Building Energy Saving Ordinance, 2021). The building will still need to meet the performance standard for the next compliance period, but it will be a reduced standard in comparison to not satisfying the audit requirement (IMT, June 2022). The audit requirement is satisfied if the building owner has an audit performed by an approved auditor, and if retro-commissioning is performed following ASHRAE guidelines. This pathway could potentially be more cost-effective for a lab owner.

New York City provides the option for building owners to apply for alternative methods of compliance. This includes adjustments to the performance target, the ability to purchase RECs or carbon offsets, and "adjustments for special categories of buildings or for special use and occupancies" (Climate Mobilization Act, 2019). Such a mechanism could be beneficial for a laboratory owner if labs fall within the special categories of buildings.

Exemptions and Hardship Waivers

Of the 10 BPSs enacted within the United States, all jurisdictions offer either exemptions or hardship waivers (IMT, June 2022). These may serve as a mechanism to alleviate the burdens of the BPS for laboratory owners that qualify. Building type exemptions across the mandated BPSs include agricultural, manufacturing, industrial, religious, publicly owned, single-family, or newly constructed buildings (IMT, June 2022). Boston, Chula Vista, and Saint Louis provide an exemption for buildings that are financially distressed, or for buildings where compliance would not be in the public interest. (Building Emissions Reduction and Disclosure Ordinance, 2021; Building Energy Saving Ordinance, 2021; Building Energy Performance Standards, 2020). This mechanism could allow for an exemption for labs that will face high financial costs for compliance or where compliance would jeopardize a public service being provided by the lab. Many of the exemptions or hardship waivers will only be granted upon the submittal of an application, which will then be reviewed by a committee.

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Appendix A

Emission intensity standards for the Boston BPS

Building Use	Emission Intensity Standard (kgCO ₂ e/SF/year)					
	2025-2029	2030-2034	2035-2039	2040-2044	2045-2049	2050-
Assembly	7.8	4.6	3.3	2.1	1.1	0.0
College / University	10.2	5.3	3.8	2.5	1.2	0.0
Education	3.9	2.4	1.8	1.2	0.6	0.0
Food Sales and Services	17.4	10.9	8.0	5.4	2.7	0.0
Healthcare	15.4	10.0	7.4	4.9	2.4	0.0
Lodging	5.8	3.7	2.7	1.8	0.9	0.0
Manufacturing / Industrial	23.9	15.3	10.9	6.7	3.2	0.0
Multifamily Housing	4.1	2.4	1.8	1.1	0.6	0.0
Office	5.3	3.2	2.4	1.6	0.8	0.0
Retail	7.1	3.4	2.4	1.5	0.7	0.0
Services	7.5	4.5	3.3	2.2	1.1	0.0
Storage	5.4	2.8	1.8	1.0	0.4	0.0
Technology / Science	19.2	11.1	7.8	5.1	2.5	0.0

Source: City of Boston. <https://www.boston.gov/departments/environment/building-emissions-reduction-and-disclosure#emissions-standards>

Appendix B

Normal performance target for the Chula Vista BPS

Non-ENERGY STAR Qualified Building		ENERGY STAR Qualified Building	
Baseline Weather Normalized Site EUI (kBtu/SF/year)	Improvement Target	Baseline Energy Star Score	Improvement Target
80+	30%	0-45	30%
51-79	20%	46-65	20%
19-50	10%	66-79	10%
0-18	None	80+	None

Source: City of Chula Vista, California.
<https://www.chulavistaca.gov/home/showpublisheddocument/22730/637571124879800000>

Appendix C

Alternative performance target for the Chula Vista BPS

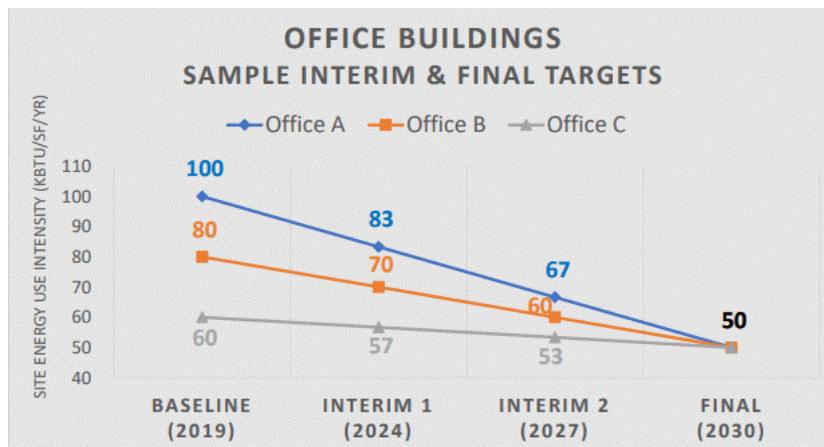
Non-ENERGY STAR Qualified Building		ENERGY STAR Qualified Building	
Baseline Weather Normalized Site EUI (kBtu/SF/year)	Improvement Target	Baseline Energy Star Score	Improvement Target
80+	15%	0-45	15%
51-79	10%	46-65	10%
19-50	None	66-79	None
0-18	None	80+	None

Source: City of Chula Vista, California.

<https://www.chulavistaca.gov/home/showpublisheddocument/22730/637571124879800000>

Appendix D

Example of the trajectory target setting approach used in Denver, Colorado



Source: Zachary Hart. <https://www.imt.org/denver-passes-building-performance-standard/#:~:text=Denver's%20Building%20Performance%20Standard%20and,type%20by%20the%20year%202030.>

Appendix E

Emission intensity standards for the New York City BPS

Occupancy Group	Emissions Intensity Standard (tCO ₂ e/SF/year)	
	2024-2029	2030-2034
A	0.01074	0.0042
B	0.00846	0.00453
E	0.00758	0.00344
I-4	0.00758	0.00344
I-1	0.01138	0.00598
F	0.00574	0.00167
B (non-production labs, ambulatory healthcare facilities, civic administration facilities)	0.02381	0.01193
F	0.02381	0.01193
I-2	0.02381	0.01193
I-3	0.02381	0.01193
M	0.01181	0.00403
R-1	0.00987	0.00526
R-2	0.00675	0.00407
S	0.00426	0.0011
U	0.00426	0.0011

Source: City of New York. https://www1.nyc.gov/assets/buildings/local_laws/ll97of2019.pdf

Appendix F

Energy intensity standards for Saint Louis, Missouri BPS

	Site EUI (kBtu/SF/year)
Building Use	2025
College/University	113.8
Dormitory	64.5
Education	80.1
Food Service	181.9
Grocery Store	256.5
Hospital	259.9
Hotel	89.4
K-12 School	63.5
Laboratory	219.2
Library	57
Manufacturing/Industrial	38.9
Multifamily Housing	42.5
Museum	118.4
Nonrefrigerated Warehouse	17.6
Office	71.7
Outpatient Healthcare	105.9
Public Assembly	77.3
Public Order & Safety	112.3
Refrigerated Warehouse	84.1
Religious Worship	63.4
Retail/Service	79.3
Senior Care/Residential Care	111.3
Strip Shopping Mall	101.1

Source: City of Saint Louis, Missouri. https://www.stlouis-mo.gov/government/departments/public-safety/building/building-energy-improvement-board/documents/upload/ApprovedBEPS_05-03-21.pdf

Appendix G

ENERGY STAR score and emissions intensity standards for the Washington, D.C. BPS

	Building Energy Performance Standard Period 1	
Building Use	Energy Star Score	Source EUI (kBtu/SF/year)
Adult Education		110.4
Ambulatory Surgical Center		426.9
Aquarium		240.2
Automobile Dealership		124.1
Bank Branch	71	153.7
Bar/Nightclub		297
Barracks	56	141.4
Bowling Alley		206.6
Casino		240.2
College/University		180.6
Convenience Store		592.6
Convention Center		192
Courthouse	71	153.7
Data Center	50	1.8 Total Energy kBtu/IT Energy kBtu
Distribution Center	19	103.7
Drinking Water Treatment & Distribution		5.9 kBtu/gallons/day
Enclosed Mall		170.7
Energy/Power Station		229.4
Fast Food Restaurant		886.4
Financial Office	71	153.7
Fire Station		185.5
Fitness Center/Health Club/Gym		206.6
Food Sales		592.6
Food Service		527.7
Hospital (General, Medical & Surgical)	50	426.9

Hotel	54	183.9
Ice/Curling Rink		206.6
Indoor Arena		240.2
K-12 School	36	139
Laboratory		318.2
Library		206.4
Lifestyle Center		228.8
Mailing Center/Post Office		242.6
Medical Office	62	172
Mixed Use Property		2294
Movie Theatre		240.2
Multifamily Housing	66	110.7
Museum		240.2
Non-Refrigerated Warehouse	19	103.7
Office	71	153.7
Other		229.4
Other - Education		110.4
Other - Entertainment/Public Assembly		240.2
Other - Lodging/Residential		143.6
Other - Mall		225.3
Other - Public Services		229.4
Other - Recreation		206.6
Other - Restaurant/Bar		573.7
Other - Services		242.6
Other - Specialty Hospital		426.9
Other - Stadium		240.2
Other - Technology Science		229.4
Other - Utility		229.4
Outpatient Rehabilitation Center		426.9
Performing Arts		240.2

Personal Services (Health/Beauty, Dry Cleaning, etc.)		242.6
Police Station		185.5
Pre-school/Daycare		131.5
Prison/Incarceration		156.4
Racetrack		240.2
Refrigerated Warehouse	19	235.6
Repair Service (Vehicle, Shoe, Locksmith, etc.)		242.6
Residence Hall/Dormitory	56	141.4
Residential Care Facility		213.2
Restaurant		573.7
Retail Store	64	401.2
Roller Rink		206.6
Self-Storage Facility		21.2
Senior Care Community	50	213.2
Social/Meeting Hall		192
Stadium (Closed)		240.2
Stadium (Open)		240.2
Strip Mall		228.8
Supermarket/Grocery Store	64	401.2
Swimming Pool		206.6
Transportation Terminal/Station		240.2
Urgent Care/Clinic/Other Outpatient		426.9
Veterinary Office		145.8
Vocational School		110.4
Wastewater Treatment Plant	50	7.5 kBtu/gallons/day
Wholesale Club/Supercenter	64	401.2
Worship Facility	17	140.3
Zoo		240.2

Source: City of Washington, D.C. <https://dc.beam-portal.org/helpdesk/kb/BEPS/58/>