How to Design and Implement an Equitable Building Performance Standard: Lessons from the Building Performance Standards Technical Assistance Network

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ABSTRACT

States and local governments seek to accomplish the intersecting goals of reducing greenhouse gas emissions, improving building operations, and bettering the daily lives of their communities. Building Performance Standards (BPS) have emerged as a critical policy lever to reach these intertwined climate and societal goals. These policies, if shaped and implemented well, have the chance to not only help reach our nation's climate, energy, and livability goals, but to do so with the active participation of those traditionally excluded from policy processes. This nascent policy movement provides jurisdictions across the country the opportunity to shape these policies from the outset to deliver comfort, health, and safety in our built environment for all.

The US Department of Energy in partnership with our National Laboratories have been providing technical assistance for jurisdictions interested in, adopting, and implementing Building Performance Standards. Through this work, the BPS Technical Assistance Network (TA Network) has tracked and documented the innovative and equitable approaches to BPS across the country. The TA Network has crafted foundational technical analysis, such as building stock and emissions impacts, equity prioritization and peak load impacts, and aggregated cost benefit analysis. And by combining powerful technical analysis with dissemination of best practices resources to support equitable implementation, the TA Network provides jurisdictions with the tools and support necessary to embark on their ambitious policy goals.

Introduction

The United States stands poised to fundamentally reshape the built environment through effective and unprecedented policies such as Building Performance Standards. Building Performance Standards (BPS) build upon the legacy of existing energy efficiency and climate activities by accelerating the speed and impact of emissions reduction activities. BPS are designed to reduce energy and emissions in existing buildings by mandating owners meet performance targets, or alternatively agreed-upon energy reduction goals, over a set time period. As a still-nascent policy movement, BPS present a distinct opportunity for state and local policy makers to embed equitable processes and outcomes into the policy design and implementation process from the outset.

States and local jurisdictions across the U.S. are leading the way in establishing policies that are both scientifically robust in their emissions reduction goals and designed to ensure a broad set of their communities will benefit from improved conditions where those buildings are included in policy requirements. These subnational governments strive for innovative and equitable policies designed to both reduce emissions and improve the lives of those who work, live, and play in their communities.

The authors plan to detail the creative and leading ways jurisdictions shape their Building Performance Standards at every step of the policy creation and implementation stage, including how jurisdictions co-envision their policies with key stakeholders to ensure equitable processes and outcomes for everyone impacted. The paper will highlight critical lessons learned and policy approaches to aid future policymaking and implementation efforts. Finally, the authors will showcase cutting-edge technical analysis and public sector data tools that support this moment of holistic policy creation and equitable implementation.

Building Performance Standards Overview

Policy Drivers

As our world faces the threat of climate change, we contend with increased energy demand, more extreme weather, and aging infrastructure (IPCC 2022). Compounding that, the US has begun to confront the legacy of racial and economic inequality embedded in our built environment (Clarke et. al 2023). In response to these twin challenges, the US and many subnational jurisdictions have established parallel climate and equity goals across economic sectors. Actors across the country are prioritizing an invigorated commitment to ensuring the known benefits of energy efficiency and climate adaptation reach all members of our community. Beyond benefits, jurisdictions aim to set up guardrails against the known inequities present in historical and existing building energy policy implementation. And while policy creation and implementation activities are daunting at this scale, the entities working to make BPS a reality see the chance to combine the best parts of existing building energy policy with full awareness of seemingly entrenched inequalities to achieve higher-performing, safer, more comfortable built spaces for all.

BPS policies present a shift in market activities from voluntary and discrete approaches toward energy efficiency such as energy audits, annual energy benchmarking, and individual measure replacements. This shift now requires building owners to transition to a continuous operational approach of their assets toward active management and lifetime performance, all with a long-term goal of reduced energy use or reduced or zero emissions (depending on the policy). And while building energy codes have contributed considerable gains in energy efficiency and performance for new construction and major renovations, buildings built today will still be here for decades to come (The White House 2022). With BPS, policymakers are seeking a similar regulatory approach to accelerate energy and emissions reduction activities in existing buildings to ensure energy and climate goals are fulfilled.

Policy Components and Current Landscape

No BPS are perfectly alike across the adopted policies in the United States. However, there are overall goals and key components critical to understand BPS policies. Jurisdictions adopt a set of performance targets based on overarching climate and energy goals with which buildings included in the policy must comply. Jurisdictions legislate which building types and sizes are mandated to comply and what the timeline of compliance will be. Larger commercial and multifamily buildings are typically selected as the focus of BPS given their outsized impact on energy use and emissions for many jurisdictions; in New York City for example, buildings overall make up over two thirds of the city’s emissions, and only two percent of those buildings emit almost half of that total (City of New York, 2024). Policies include one or more metrics that determine how buildings will confirm compliance with the performance targets, usually site EUI or GHGI. To account for the variety of existing building circumstances – whether physical condition, financial ability, or other factors - BPS also include various flexible pathways to meet the policy goals known as alternative compliance pathways (ACP) (ASHRAE & US DOE 2023).

Although BPS are an emerging policy mechanism in the United States, the rates of interest and adoption have demonstrated great progress and momentum in a short time. Since Washington, D.C. and New York City first passed regulations in 2018 and 2019, respectively, jurisdictions across the country have swiftly followed in expressing interest in, and adoption of, BPS. President Biden launched the National BPS Coalition (Coalition) with 33 states and local governments committed to passing a BPS by Earth Day 2024 as well as the lead-by-example Federal BPS (White House) in 2022. Since then, we've witnessed more than 16 state and local legislatures adopt policies and more than 45 jurisdictions now committed to the Coalition, as of this publication. More than 25 percent of the nation's commercial, multifamily, and federal buildings are now included in a region with an adopted BPS policy or a publicly committed jurisdiction (White House 2022).

Federal Support for Building Performance Standards

Given the complexity and scale of BPS policies, jurisdictions may not have internal resources and staff expertise to support the technical aspects of adoption and implementation. The US Department of Energy (DOE), in collaboration with the US Environmental Protection Agency (EPA), Pacific Northwest National Laboratory (PNNL), Lawrence Berkeley National Laboratory (LBNL), and the National Renewable Energy Laboratory (NREL), provides technical assistance to these state and local governments in pursuit of technically sound and realistically implementable BPS policies.

DOE and EPA have established the BPS Technical Assistance Network (TA Network) to provide this technical assistance at no cost for jurisdictions interested in, adopting, and implementing BPS and similar building intervention policies. The TA Network leverages expertise and technical capabilities from DOE, EPA, PNNL, LBNL, and NREL to support the myriad technical and implementation requirements of standing up a BPS program. Through this work with jurisdictions, the TA Network has developed resources around best practices in BPS adoption and implementation from leading jurisdictions to share with interested parties.

In addition to direct technical assistance and best practices resources, the TA Network disseminates education and resources for broader audiences around BPS. Most importantly, the TA Network offers jurisdictions convening opportunities to share expertise and challenges across a variety of topics important to BPS. Using best practices and lessons learned from the TA Network engagement with jurisdictions, this paper will provide an overview of the BPS policy movement across the country. The authors will dive into specific subtopics critical to equitable BPS design and implementation, and showcase leading jurisdictions in these areas.

Technical Analysis for Policymaking

Technical analysis is at the heart of BPS design and adoption processes. It is important for jurisdictions and other stakeholders involved in the design process to have a full understanding of baseline building stock conditions and projections of impacts on various key elements. What follows is a set of case studies detailing important analyses where the TA Network has provided support.

Building Stock and Impact Analysis

Jurisdictions cannot change what they cannot measure. Thus, the first step in any BPS journey is to understand the existing building stock and the impacts of various policy decisions on that stock. The City of Chicago is considering a BPS to help meet their city-wide greenhouse gas (GHG) emissions reductions goals. LBNL performed a building stock analysis on their benchmarking data to help understand which buildings (i.e., sizes and property types) use the most energy and cause the most emissions, and therefore which buildings can have the most influence on the city's goals.

Considering the characteristics of Chicago's building stock (and the emissions profile of the electric grid serving its buildings), the TA Network analyzed several potential BPS implementation scenarios and modeled the impact of each scenario on the city's GHG and emissions over the lifespan of the BPS. We considered different target metrics (i.e., direct emissions vs. site energy use intensity [Site EUI]), more and less aggressive final targets, and intermediate targets that are specific to individual buildings vs. specific to all buildings of each type.

For each target setting scenario, we modeled how building owners would comply with the proposed BPS, first via energy efficiency measures and later, as targets become more stringent over time, electrification of natural gas-fueled space- and water-heating systems. We used the resulting energy and emissions impacts to help the City of Chicago understand the tradeoffs between different BPS implementations and to select the BPS that meets their goals. We found that setting direct emissions and site EUI targets at the 50th percentile of their initial values (per property type) would result in a 40% reduction in GHG emissions by 2040, and that setting the targets to the 25th percentile would result in a 64% reduction. Compared to individual intermediate targets for each building, setting the same intermediate targets for all buildings of the same property type would reduce emissions more quickly (i.e., a 20% reduction by 2030, rather than 16%), but would require more savings from buildings that are initially further from their targets than their peers. Setting only direct emissions targets would result in 65% emissions savings and an 8% increase in electricity use by 2040, but setting site EUI targets in addition would keep electricity use level (avoiding potential issues with electric grid capacity) while achieving the same emissions savings.

Equity Analysis

Policy design is a critical lever for ensuring the equitable implementation of BPS. Jurisdictions who center equity in their policymaking ensure that the intended benefits of BPS reach all parts of the community where the policy is enacted. Benefits can be understood as direct or indirect investments and positive project outcomes (Young, Mallory, and McCarthy 2021). Some examples of positive project outcomes and investments in BPS include reduced utility bill costs, energy audits and building upgrades, healthier indoor environmental quality (IEQ). We will analyze how equity portfolio prioritization (EPP) methods - helping jurisdictions to prioritize their building stock by the most resource-constrained and disadvantaged owners and occupants - are key to BPS policy design, and how EPP ensures the benefits of BPS flow to the buildings and communities which need them most. EPP can help prioritize the buildings which need the most support for successful compliance. However, this is merely the first step in ensuring equitable outcomes and tracking that can occur within a jurisdiction. The burden of financing building upgrades in the prioritized properties remains a critical barrier to the realized benefits of BPS policies.

The State of Colorado’s BPS requires that building over 50,000 square feet report building energy and water use to meet emission reduction goals (CEO 2024). Although Aurora, Colorado does not currently have a BPS policy, buildings over 50,000 square feet in Aurora will need to comply with the State’s policy. Aurora is the most ethnically diverse city in Colorado, and thus an important location to investigate the equity considerations for Colorado's BPS. NREL found that 386 properties in Aurora must comply with Colorado's BPS, and of these 386 properties, 210 of the buildings are located in disadvantaged community (DAC) census tracts per the White House's Climate Economic Justice Screening Tool (CEJST) (Council on Environmental Quality, 2022). Furthermore, the majority of these properties' primary use type as defined by the State of Colorado are commercial. DOE funded NREL to collaborate with local and state partners in Colorado to investigate equity considerations in the commercial building stock and create replicable methodologies for EPP. EPP methodologies and data are designed to integrate into a platform where jurisdictions are managing their BPS program and building data to filter, track, and prioritize properties.

The NREL research team performed analysis of the commercial building stock, integrated commercial building equity considerations into the analysis, and performed stakeholder engagement across Aurora to analyze commercial buildings and create replicable EPP methodologies. Through the stock analysis NREL identified common commercial building property types, tenant industry types, and commercial building equity characteristics (lease type, lease duration, building age) in CEJST DAC and non-DAC communities. We then analyzed the poorest condition buildings (as defined by a commercial real estate database) by the same characteristics and determined Aurora-wide qualities of under-resourced properties. Under-resourced properties, here, is meant to include the poorest condition buildings and buildings which reside in CEJST DAC census tracts. By comparing the properties in CEJST DAC and poorest conditions we were able to test the efficacy of only leveraging CEJST location-based equity prioritization of commercial buildings. In Aurora, it was determined that 30% of the poorest condition commercial buildings were not located within CEJST DAC census tracts (Langlois-Romero, et al 2024). In order for jurisdictions to identify the 30% of properties which may need additional BPS resources and programming, alternative EPP methods are needed. NREL compared common characteristics between the poorest conditions buildings and the buildings which are located within CEJST DACs and determined a common set of property types, tenant industries, and commercial building equity considerations. The additional commercial building equity considerations identified through the stock analysis were property vintage, tenant information, rent costs, operating expenses, and leasing information (Langlois-Romero, et al 2024). This information will be included at the building or census tract level for each property in the covered buildings list (CBL) and used to filter or label on the central database for program management.

When developing equitable policies, it is critical for jurisdictions to consider the community's perspectives when prioritizing building upgrades. As part of this research, NREL sought to contextualize the stock analysis through robust community engagement where survey analysis and mixed methods research identified community-prioritized properties, community-prioritized industries, and prioritized commercial building community services. Research participants (property owners, business owners, and community members in Aurora) identified these characteristics and the research team merged these findings with the stock analysis to include equity stock analysis and community perspectives in the EPP. The overlapping prioritized property types, industry, types, commercial building community services, and commercial building equity characteristics are tagged at the property level for Colorado or Aurora to leverage for policy design and programming decision making in the future. With this community-validated data, Colorado and Aurora can now target resources and outreach to the most resource-constrained and community-important buildings to support BPS compliance.

Additionally, EPP informs variables which can be used for tracking and measuring the equitable implementation of BPS over time. Integrating EPP information into the CBL ensures that equity is effectively included in the day-to-day management and program evaluation of BPS.

Cost Analysis

Given the regulatory nature of BPS, costs associated with owner compliance are top of mind for many jurisdictions and stakeholders. The State of Colorado requested support from the TA Network to understand the costs associated with owner compliance of their BPS, and in particular to understand in aggregate the aforementioned challenges that under-resourced buildings may face. The aggregate cost analysis performed will help Colorado understand the potential impacts on their building owners and occupants and be able to tailor supportive resources and financing accordingly. To develop this analysis, capital and operational improvement costs were developed in three different categories: 1) energy efficiency measures (EEMs) (e.g. lighting measures, envelope measures, HVAC and hot water measures, etc.) 2) electrification of gas equipment, and 3) like-for-like replacement of gas equipment. With Colorado's goal of zero emissions, the primary focus of cost research was estimating costs that reduce energy consumption and electrify combustion space heating, water heating, food service and laundry equipment. Electric EEM costs and associated savings were developed using measure level engineering analyses from available literature and developing a "cost curve" with gradually increasing investment costs with increasing savings. That is, the cost per British thermal unit (Btu) of savings increases with deeper levels of savings.

Gas savings were limited to a single retro-commissioning and operational measure cost since they may be useful in meeting an intermediate target but would not be part of the final improvements needed to achieve zero emissions targets in Colorado. Electrification costs were the most difficult to develop because they are specific to the types of equipment and purpose of both removed and new equipment. Given the lack of data available for Colorado-specific costs, PNNL approximated from pilot investigations of electrification costs in other jurisdictions and adjusted using regional construction cost multipliers. Gas equipment replacements were not included as actual measures, but rather as the basis for calculating the incremental cost of electrification at the end of equipment useful life.

To date, jurisdiction level cost research has been sufficient to support successful adoption of state and local BPS. However, uniform methods and tools, supported by broader, comprehensive underlying data would both streamline and improve economic analysis to support adoption. The generalized costs for EEMs and electrification can be combined with an estimated building inventory to estimate the overall cost incurred across a selected population of buildings. In practice, some buildings will incur much greater costs to comply, and these higher costs may not always be due to higher consumption and emissions. Moving forward, PNNL will expand the cost data so that more granular analyses can be completed for jurisdictions and stakeholders.

Building off PNNL's cost curve analysis, LBNL conducted a building stock and impact analysis for Colorado and expanded upon these analyses to include the costs to building owners using the cost estimates provided by PNNL. A previous study performed by Group14 on behalf of Colorado resulted in site EUI and greenhouse gas intensity (GHGI) targets for 2026 and 2030, as well as future projections of electric grid emissions factors and electricity and natural gas use rates. LBNL modeled how building owners would behave in two potential scenarios: 1) a baseline scenario in which buildings have no performance targets, but must replace gas systems at the end of their natural life, and 2) a BPS scenario in which buildings are subject to EUI and

GHGI targets, and must meet either target, or at least a specified reduction (13% by 2026, 29% by 2030) (CEO 2024).

In the baseline scenario, buildings pay to replace gas systems at end of useful life. In the BPS scenario, buildings use efficiency and electrification to meet their target at the lowest cost, depending on their fuel mix, end-use profile, and the costs of efficiency measures or electrification. In the baseline scenario, site energy use reduces 3% by 2050, but emissions reduce 75% (due to the electric grid getting substantially cleaner over time), while owners in aggregate spend $5.56 billion on equipment replacement and $54.7 billion on energy costs. In the BPS scenario, energy use reduces 29% and emissions reduce 87%, while buildings spend $7.21 billion on efficiency and electrification and $45.5 billion on energy costs. Thus, we found the BPS scenario to provide a net savings of $7.55 billion over the baseline scenario (corresponding to an average of $5.34/sqft savings), with 68% of buildings with net savings, 3% breaking even, and 29% with net costs. While there are costs associated with BPS for building owners, this cost analysis for Colorado demonstrates the real positive implications of improved performance through savings on energy costs with a relatively minimal increase in aggregate retrofit costs.

Peak Load Analysis

One of the major concerns related to BPS implementation, particularly for policies that focus on driving electrification in moderate-to-cold climates, is the impact of increased electrification on the peak demand of the electric grid. The State of Maryland's proposed state-wide BPS policy considers both electrification and energy efficiency (EE) as performance metrics, thereby creating an opportunity to analyze how much electrification targets could impact peak demand, and how parallel EE targets could mitigate those impacts. LBNL employed a building stock modeling approach to estimate the impact of Maryland's direct emission targets and site EUI targets for buildings on peak demand in terms of magnitude and seasonal shifts. DOE prototype building models were utilized for creating representative baseline building stock (Goel et al. 2014). A total of 16 prototype models covering five building types—warehouses, office, multifamily, lodging, and retail, different vintages and floor area sizes were selected for analysis. The selected prototype models represent 87% of Maryland's building stock subject to BPS. These models were calibrated against the site EUIs and electric use ratios (electricity to site energy use) sampled from EPA's dataset for the year 2019 to create a baseline building stock. Two scenarios, Scenario A Electrification only and Scenario B Electrification + EE were developed for representing fully electrified building stock for the year 2040. Scenario A included measures related to electrification of heating, cooking and laundry such as air-source or water source heat pumps, heat pump water heaters, electric dryers, and electric stoves. Scenario B, in addition to the electrification measures considered in Scenario A, included measures related to envelope efficiency (such as high-performance windows, roof insulation), widening thermostat setpoints, occupancy sensor for lighting controls, and LED upgrades. Distinct electrification and EE packages were developed for each of the 16 models based on the building type, existing systems.

EnergyPlus version 22.2.0 was used to run annual energy simulations of the Maryland building stock under three situations- Baseline, Scenario A and Scenario B. Figure 1 illustrates the hourly load profile for the two-week period of peak demand for the three simulation runs. As compared to the baseline, both scenarios A and B indicate a shift from summer to winter peak electricity demand as well as a higher magnitude of peak demand that is majorly attributed to space heating electrification. For Scenario A (Electrification only), there is an estimated increase of 24% in peak electricity demand, whereas Scenario B (Electrification + EE) not only helps in mitigating electrification-induced peaks but also leads to a marginal decrease (6%) in peak demand. The results indicate that integrating EE with electrification targets could reduce over 30% of peak demand with the largest potential in offices and hotels. Table 1 presents the estimated savings for total site energy and electricity under the two scenarios. In terms of site energy savings, Scenario A yielded an estimated 10% savings while under Scenario B, threefold savings were estimated (31%). However, the electricity demand witnessed a 15% increase under Scenario A due to electrification only measures while under Scenario B, a 12% decrease/savings were estimated attributing to the energy efficiency measures. These quantitative insights on the potential of EE in mitigating peak demand and reducing site energy use helped the jurisdiction to strongly consider parallel EUI targets within the proposed BPS policy. Additionally, these results, when bifurcated into different building types, can help in developing targeted policies - such as focusing on offices and hotels that have the largest potential for peak demand reductions. It is important to note that the analysis assumes that all the buildings meet site EUI compliance and there exist appropriate financing mechanisms for implementing electrification and efficiency measures.

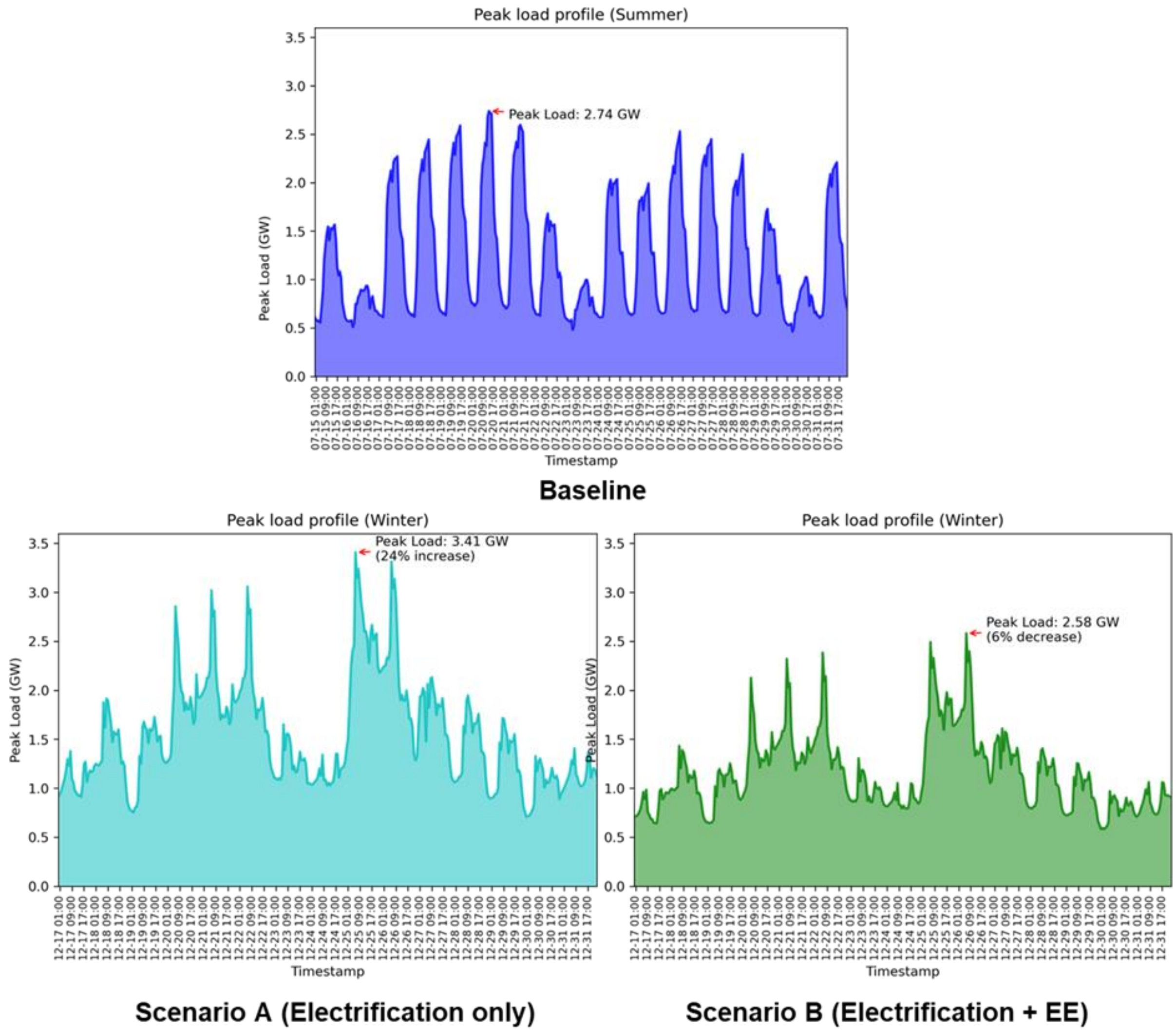

Figure 1: Estimated peak demand impacts of Maryland building stock under scenarios A and B

Table 1. Estimated energy savings of Maryland building stock under scenarios A and B

Scenario	Total site energy savings*	Electricity savings*
Scenario A (Electrification Only)	10%	-15%
Scenario B (Electrification +EE)	31%	12%

**Savings with respect to baseline. Negative values indicate an increase in energy/electricity demand w.r.t baseline.*

Stakeholder Engagement and Policy Process

Similar to equitable and technically sound policy design approaches, stakeholder engagement plays a vital role in ensuring the benefits of BPS are shared equitably across the community. Stakeholder engagement is imbued at each phase in the timeline of BPS from planning to adoption and implementation; exacerbated by the fact that there is no one-size-fits-all BPS, it takes time to build a rapport with affected communities, and each jurisdiction must pursue approaches that work for their community (Nadel 2020).

Once a jurisdiction decides to pursue a BPS policy, broad stakeholder engagement is needed to build a coalition of local community members who will support the development of the policy and provide meaningful feedback to ensure its success. These stakeholders often include building owners, portfolio managers, utilities, building occupants, jurisdiction officials across departments, building data analysts, special interest groups, local community-based organizations, and community members (USDOE Better Buildings, Pless). The process of stakeholder engagement begins with the recognition that broad community engagement is an opportunity for jurisdictions to build trust and relationships for future policy development and success down the line. Furthermore, stakeholder engagement should be understood as a mechanism for sharing responsibilities between community partners and an opportunity for co-creation practices.

The coalition-building phase, initially, can be built on existing jurisdiction-wide initiatives such as Climate Action Plans which may be coordinated with other jurisdiction department efforts to maintain alignment across policies. It is often critical to identify key players and actors during this initial phase to begin shaping policy priorities. For example, Denver, Colorado hired an equity administrator to facilitate stakeholder engagement with communities whose voices are often not included in the policy making process. This dedicated staff and financial investment led to the creation of Equity Priority Buildings (EPB). EPBs are defined equally by seven critical methods which address factors such as residential affordability, socioeconomic factors, historical redlining, corporate social responsibility, industry type, and buildings of significance to the community (Denver 2024). Significance to the community was determined through community engagement methods such as public meetings and community surveying. Denver's EPB methodology is not only valuable because of the engagement with community, but also because it provides the city with a trackable methodology for ensuring benefits of BPS are experienced equitably across the city.

Many local policies that are enacted undergo a rule-making phase. This is another opportunity to work even closer with stakeholders to finalize the roll out plan for BPS. During the rule-making phase, the same stakeholders should be engaged; however, there might be additional members added based on the particular BPS ordinance. For example, if the ordinance is focused on GHG emissions or auditing requirements, then additional data analysts or mechanical electrical and plumbing (MEP) firms should be leveraged. While engaging stakeholders in the beginning takes time, this dedicated effort increases the success of the program by building long-term understanding and shared goals across communities. And as previously discussed in the example of Denver's EPB, increased investment in time and staffing upfront ensures that Denver does not need to go back and play catch-up to create equity programming after the fact.

After rule making is publicly reviewed and approved by the originating committee, the process of implementation starts, which will be discussed in the next section. However, it is important to consider that elements of stakeholder engagement are present throughout the implementation of a BPS and to facilitate continual program evaluation and co-creation of policies with the community. Stakeholder engagement is an activity without a clear end because the nature of stakeholder engagement in BPS also encompasses supporting property owners with compliance and continued outreach to new property owners as the building thresholds of a BPS policy reduce over time.

Building Performance Standard Administration and Implementation

Proper administration and implementation of the BPS policy is integral to achieving climate and human goals. To support jurisdictions in their BPS planning and execution, DOE has produced resources including “Implementation and Administration of Building Performance Standards” (EERE 2023) which guides jurisdictions in varying stages of their BPS process. Early consideration of administration and implementation needs can open doors to opportunities like increased support for covered buildings, efficient use of resources, and effective hiring decisions.

Jurisdictions that have adopted a BPS have many considerations and decisions ahead of them. Most of these fit into one of three buckets: 1) Start-up responsibilities, 2) ongoing responsibilities, and 3) staffing. Start-up responsibilities refer to tasks that likely need to be done once, at the beginning of the implementation process. This can be creating a CBL, coordinating with building data entities like utilities, benchmarking departments, and tax assessment departments, and establishing a stakeholder advisory board. Ongoing responsibilities are those that are done on a regular, recurring basis like maintaining the compliance web portal, supporting building owner access to resources, handling inbound questions, and validating building performance submissions. And lastly, staffing includes tasks related to building out a jurisdiction’s BPS team including estimating how many full-time employees (FTE’s) are needed, determining role responsibilities, writing role descriptions, and hiring.

For ongoing responsibilities, it is particularly critical that staff time and resources be used efficiently to reduce a jurisdiction’s, and building owner’s, administrative burden in all parts of compliance. The more efficient the program administration, the more time staff have to ensure building owners and operators get appropriate outreach and resources for compliance. Denver, Colorado considered administration and implementation early and were able to focus their staff time and attention on establishing a list of equity priority buildings within their CBL. As mentioned above, this group of buildings serve communities that are vulnerable to effects of climate change and, through this program, are eligible to receive free compliance assistance, applications for target adjustments, and applications for timeline adjustments that better align with refinancing or capital cycles. By allocating staffing and resources with intention to support building owners, Denver has been able to provide much-needed outreach and support for compliance.

Washington State is another example of how thoughtful policy design can lead to a more equitable use of resources. Washington State designed an early compliance program wherein half of the funding is distributed on the basis of first come, first serve and the other half goes toward buildings and/or owners that meet certain equity criteria. The equity criteria range from affordable multifamily housing, buildings in rural communities, buildings in communities with the highest risk score on Department of Health’s environmental health disparities map, and buildings with the highest energy use. Successful implementation of equity mechanisms like this require oversight, administration, and resources within the state's BPS team so it is critical to plan ahead.

Software tools can also aid in equitable policy administration to help with time and cost efficiencies. DOE offers free, public software to assist jurisdictions in standardizing BPS data collection, managing the volume and complexity of BPS, and automating time-intensive manual processes. For efficient data sharing and standardization, DOE has a unique building identifier (UBID) generating tool for each building from geospatial data and use of UBID allows property-specific data to be cross-referenced and clearly matched across datasets and tracking systems. Audit Template is a web-based interface for collecting and reporting of building asset data, including information on building systems and energy efficiency measures, and potential savings. Standardized and centralized data collection through Audit Template allows for data sharing across platforms to maximize the benefit of the collected data for all actors and allows for data persistency and transparency in the event of staff turnover. The Standard Energy Efficiency Database (SEED) platform is a central database for all BPS data, receiving, merging, and sending data seamlessly from Audit Template, UBID, EPA's ENERGY STAR Portfolio Manager, public dashboards, customer relationship managers, and other 3rd party platforms. SEED automates spreadsheet-based workflows to simplify data management and can improve data quality and reduce staff time spent managing programs by over 25% (Mims et al. 2017). SEED can track basic BPS compliance with building-by-building dual-metric performance goals. A jurisdiction can use SEED to send automated emails to building owners to communicate data quality issues or compliance status. If a jurisdiction requires more complex compliance tracking (e.g., alternative pathways, milestone tracking), then other solutions might be required either built upon SEED or otherwise.

Building Performance Standards and Energy Codes

BPS policies are a mechanism that help bridge the gap between new and existing building performance by requiring newly constructed buildings to meet the requirements of the BPS in addition to complying with the applicable energy code. However, given the differences in scope and compliance approaches between BPS policies and energy codes it is possible that without special consideration some new buildings may have challenges in complying with the BPS. Jurisdictions interested in BPS do need to consider the interaction between this policy and building energy codes to avoid unnecessary burdens on building owners and occupants.

Reno, Nevada expressed interest in examining how their existing energy code would align with a future BPS. To support this request, PNNL reviewed the two policies and determined there were important misalignments between the two. Since their creation in the mid-1970s, building energy codes have played an increasingly important role in regulating the energy use of new construction and renovation projects. The national average building energy use in national model energy codes - the International Energy Conservation Code (IECC) for residential buildings and ASHRAE Standard 90.1 for commercial buildings – has been consistently decreasing from the first code in 1975 to the present (DOE BECP 2022). Energy codes have been able to achieve performance improvements by regulating the building's systems, components, and controls to ensure that they are configured to operate efficiently once the building is occupied. In contrast, BPS policies such as in Reno focus on whole building performance, including other building energy end uses such as miscellaneous equipment and plug loads, which are not within the scope of energy codes.

In addition to differences of scope, BPS and energy codes differed in terms of the compliance pathways that each type of policy allows. Common codes compliance options include a prescriptive path that involves meeting component-level efficiency requirements; a whole building performance path that uses building energy simulation to compare the proposed design with a simulated baseline building; and a system performance path that provides a simpler alternative to the whole building performance path and focuses on system-level (HVAC, lighting, envelope, etc.) performance. The variety of compliance options provided in codes can result in a wide range of performance outcomes for similar buildings complying with the same code. In research completed previously and for Reno, PNNL found that using building energy simulation have shown that different combinations of prescriptively compliant design parameters can result in significant variation in building performance (Rosenberg et al., 2015; Curtz et al., 2024, unpublished).

To support jurisdictions in aligning their BPS and energy code policies, resources such as the Energy Codes Building Performance Standards Brochure (EERE 2023) and the BPS and Energy Code Alignment Technical Brief (Karpman et al., 2024 unpublished) outline strategies policymakers and building practitioners can implement when considering compliance with both types of policies. Key strategies include:

1. For policymakers: Understand new building performance to assess how buildings under different code levels might perform under a BPS. Adjust the policies as needed based on the results and consider creating alternative compliance pathways for new buildings in transition from construction to BPS compliance. From the energy code perspective, policymakers can also consider providing compliance pathways targeted at achieving desired performance outcomes, such as performance-based compliance or specific prescriptive options.
2. For practitioners: Learn about local BPS requirements and leverage the potential of predictive energy modeling to understand future building performance and potential compliance with the BPS.

Complementary Policies and Activities

While jurisdictions focus on the core policy design and administration elements of their BPS, complementary activities are just as important in ensuring building owners can successfully comply with the requirements and building occupants can feel the benefits of improved performance. In addition to establishing policy flexibility through ACPs, jurisdictions need to consider the various financial, programmatic, and educational resources available in their region to support buildings faced with limited capital or lacking technical expertise in meeting these goals. Activities such as utility incentive programs, resource or innovation hubs, financing access such as green banks, and other supports can turn theoretical policy goals into achievable performance outcomes.

Washington DC's Affordable Housing Retrofit Accelerator

The District of Columbia Department of Energy and Environment (DC DOEE) has crafted a creative and effective approach to ensuring an equitable implementation of their BPS policy: The Affordable Housing Retrofit Accelerator (AHRA). The program is centered around ensuring access to energy efficiency upgrades for affordable multifamily buildings.

The AHRA is administered in partnership with the DC DOEE, District of Columbia Sustainable Energy Utility (DCSEU), and DC Green Bank and is designed to help qualified affordable multifamily and other under-resourced buildings:

- Meet the DC Building Performance Energy Standards (BEPS)
- Preserve affordability
- Cut energy costs, run their building more efficiently, and reduce greenhouse gas emissions
- Increase quality of life for residents
- Provide financial and technical resources to improve existing building energy efficiency
- Help building owners comply with BEPS

The program has shown great promise thanks to structures established such as stakeholder engagement, technical assistance to building owners, and multi-year financial support planning to span fiscal years. As of November 2023, the Affordable Housing Retrofit Accelerator achieved 71 audit enrollments, approved 61 audits, held over 50 meetings with building owners, processed 37 successful bids for work, and had 28 pending/executed agreements to retrofit these properties. Innovative partnerships between jurisdictions and regional programming such as DC DOEE, DCSEU, and DC Green Bank demonstrate a commitment to equitable and achievable BPS implementation.

Washington State's Operations and Maintenance Plans

Washington state's BPS, the Clean Buildings Performance Standard (CBPS), uses ASHRAE Standard 100-2018 – Energy Efficiency in Existing Buildings (Standard 100) as its base and requires each building to submit an operations and maintenance (O&M) plan when complying with the CBPS. The required O&M plans build on the requirements of Standard 100 and are intended to help ensure that the building energy-using systems optimize their energy efficiency throughout their service life. Washington State is in the process of developing resources for building owners to use when developing O&M plans for CBPS compliance, and in coordination with PNNL, is leveraging existing guidance from the Federal Energy Management Program (FEMP) as well as other O&M best practices.

Future of Building Performance Standards Technical Assistance

The examples we provided are only a few of the many innovative approaches jurisdictions are taking to ensure their BPS policies effect real change and improve building conditions in communities across the country. The TA Network continues to build upon existing tools and expand the resources, technical expertise, and implementation support for jurisdictions across the country ready to adopt and implement equitable BPS. As BPS move from a theoretical policy movement to concrete implementation, these policies hold the opportunity to radically reshape building performance and our experiences in buildings across the country. This vision will only be achieved through thoughtful, community-oriented, and scientifically realistic policy adoption and implementation.

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