



BUILDING PERFORMANCE STANDARDS

An Overview for Developing and Implementing
a Building Performance Standard

NORESCO
AN OPTERRA COMPANY

**SUSTAINABILITY
SERVICES**

How to Use this Guide

This guide provides a high-level overview for those considering a building performance standard (BPS) for their jurisdiction. The guide is presented as six parts:

1. Foundational questions

The guide begins with questions to help you gain insights and establish a good working foundation for your BPS journey.

2. Community impact considerations

A BPS has the potential for broad community impact when implemented. Engaging with community members and gathering stakeholder feedback are critical early steps to proactively develop and design a BPS to serve the community and achieve goals.

3. Defining the scope

The guide outlines methods and steps for defining the scope of a BPS. Scope considerations typically include building types and sizes covered and which metric, or metrics, to use for tracking performance.





4. Establishing Targets and Timeline

The guide outlines methods and steps for establishing the performance targets of the BPS and the timeline for achieving these targets. Establishing these targets with the overall goals in mind ensures alignment with long-term sustainability objectives.

5. Developing the Compliance Framework

The guide lists topics for inclusion when developing a BPS compliance framework. This includes compliance support offered for building owners.

6. Implementation

The guide outlines three key areas of BPS implementation and actions needed within each. The implementation will employ the compliance framework for success of the BPS.



Getting Started with BPS

Taking the time to define your goals will help you better determine where your BPS should focus and what metrics to use. Spend some time to think through and write down your overarching goals. These goals are likely related to achieving certain energy or environmental improvements.

Have climate and energy goals already been set within your jurisdiction or department? Are they based on goals set at a higher-level organization, such as city-wide climate action plans or state-level requirements? How do existing buildings fit within your goals?

Stakeholder input is critical

Providing opportunities for participation in the development of your BPS can help ensure greater participation and compliance. Actively engaging stakeholders, including building owners, building occupants, building and HVAC contractors, utilities, inspectors, code officials, city staff, and sustainability consultants gives you valuable input from many perspectives and can shape better policy for your BPS. Prioritize inclusion when

forming stakeholder groups to ensure you include interested community members. As the community stakeholders participate, they may feel a sense of ownership with the BPS and not only be more likely to comply, but also to encourage others to comply.

Foundational questions

Consider these questions to help you gain insights and establish a good working foundation for your BPS journey.

What are your objectives?

Your objectives will flow from your overarching goals. It is common to have multiple objectives, and making an early list helps guide your policy decisions down the road. Some common objectives for developing a BPS are:

- **Climate targets (energy/greenhouse gases/carbon reductions)**
- **Building electrification**
- **Resiliency**
- **Resource equity**
- **Workforce activation and growth**

When do you aim to achieve your objectives?

Once you've outlined your objectives, set a timeline for when you will achieve them. For example, your objective may be reducing greenhouse gas (GHG) emissions by a certain percentage by 2050. The timeline for achieving your objectives will influence the design of your BPS and when targets must be met.

Do you have building benchmarking in place?

If you already have a building energy and/or water benchmarking policy in place, it can provide valuable information to design your building performance standard. Building data from benchmark reporting can be analyzed to determine metrics for your policy and to understand the population of buildings and how the policy may impact them.

What are your peers doing?

Gather information about what other communities like yours are doing. Several cities, and some states, have a BPS in place

and many others are developing them. If there is a state-level BPS, it is valuable for you to know those requirements to ensure your BPS is compliant. Understanding what surrounding jurisdictions are doing is also valuable to shaping your BPS. Aligning your BPS with surrounding jurisdictions will provide consistency and can make it easier for building owners with properties in multiple jurisdictions to comply.

This map provides a good snapshot of current BPS activity in the U.S., as summarized by the Pacific Northwest National Laboratory's Building Energy Codes Program: [Click here](#)

What do your new construction energy codes require?

Alignment of new construction energy codes and your building performance standard helps you plan for long term success. Evaluating how code compliant buildings will perform against your BPS can ensure that new buildings will be able to comply without needing further upgrades.

What communities will be impacted?

Engage with communities, including building owners, building occupants, and building contractors to understand how the BPS may impact them. Equity considerations are especially important when designing your BPS because BPS ordinances have potential to impact many disadvantaged and under-resourced communities, positively and negatively.

A BPS may also have different impacts for different building sectors; commercial impacts will be different than residential. Similarly, if specific upgrades are required by a BPS, different system upgrades may have greater impacts than others, such as electrifying heating equipment versus changing lighting to LED.



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Community Impact

Community impacts from a BPS cannot all be anticipated by your jurisdiction. Sharing the planned BPS with community stakeholders and asking for their feedback will prove invaluable to understanding and anticipating both positive and negative impacts. Deep listening prepares you to reinforce positive impacts and take steps to mitigate or offset negative impacts. Engaging with your community stakeholders requires a planned and deliberate effort to be most successful. Below are suggested actions and areas for consideration when engaging with your community stakeholders:

Support framework

Rather than going to your community with a blank page, outline a support framework for under-resourced communities and stakeholders and share it with them for feedback. You are more likely to receive effective input if you ask for feedback on a proposed framework than if you ask stakeholders to generate the framework for you.

Listening sessions

Various listening sessions with different mixes of community stakeholders can be beneficial. This requires more effort but can also provide more candid and insightful feedback. Consider holding sessions with individual groups of stakeholders and sessions with multiple stakeholder groups combined.

Equity considerations

Equity considerations may not simply be the same starting point for all. Some disproportionately impacted communities or stakeholders may require additional support and resources beyond others to enable successful compliance with the BPS. This additional support may not just be funding to purchase or install technologies/systems needed to improve a building's energy performance. Many existing buildings will have other deficiencies or limitations that need to be addressed before installing or upgrading systems. Such deficiencies may include electrical capacity or service upgrades, structural repairs or reinforcement, and latent hazards that can be disturbed during construction. Remedying these deficiencies

may exceed the cost of the actual energy efficiency upgrades themselves.

Workforce

BPS policies will likely impact the local workforce in both positive and negative ways. Beyond listening sessions to understand impacts, consider resources to help transition those workers who are negatively impacted and to help build capacity for under-resourced services. For example, building electrification policies may negatively impact plumbers due to reduction in natural gas plumbing needs while also producing a greater need for electricians. Developing programs to provide training for plumbers to transition to electricians can help address both needs.

Funding solutions

Putting together a list of funding resources from federal, state, local and utilities can greatly help building owners who will need to make upgrades to comply with the BPS. Consider if there are new programs or resources that can be made available to help with BPS compliance and discuss these ideas with other potential program sponsors.

Defining the Scope

Which metric(s)?

Your main objectives should help you determine which metric, or metrics, to use for your BPS. For example, if your objective is improving building energy efficiency, a single metric, such as EUI, may be all you need. If you want to achieve both building energy efficiency and building electrification, you may also track the electrification ratio to show progress in both areas. You should also consider if you are focused only on energy or carbon, or if you also want to track water use and efficiency. Below is a list of metrics commonly considered when implementing a BPS.

- **Energy use intensity (EUI)**
- **ENERGY STAR score**
- **Greenhouse gas intensity (GHGI)**
- **Electrification ratio**
- **Renewable energy utilization**
- **Grid factors**
- **Water use intensity**



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Which buildings?

You can analyze your existing building population and determine which building types and sizes have the most impact toward your main objectives. Another key consideration is what, if any, exceptions or variances your BPS will permit. These can be based on financial considerations or other factors like historical preservation requirements. Community impacts should also contribute to your decisions for which buildings are covered or any allowable variances.

- **Community impacts**
- **Minimum building size (floor area)**
- **Building types**
 - Commercial
 - Residential
 - Municipal
 - Industrial
- **Exceptions or variances**
 - Historic preservation
 - Process driven
 - Federal buildings
 - State buildings

Targets and Timeline

Set targets

Analyzing your existing building population can also help you determine the targets that will help achieve your main objectives. Setting detailed targets specific to individual building characteristics allows good understanding of which building types perform well or not, but also requires more effort to analyze and enforce. There may also be specific building types or circumstances that warrant variances or exceptions to the targets. Balancing level of detail and level of effort is an important decision in BPS development. Community impacts should also contribute to your decisions for establishing targets and to consideration for any variances or exceptions to these targets.

- **Community impacts**
- **Top down or bottom up method**
 - Top down – work backward from final target(s)
 - Bottom up – work forward from current building stock energy/water use
- **Level of detail/granularity**
 - Building specific
 - Building type specific
 - Singular target
- **Reduction from baseline or achieve raw metric (e.g., EUI)**

Set timeline

You can evaluate different target/timeline scenarios to determine the best combination to meet your objectives. Setting interim targets can help building owners phase any needed upgrades (and cost). Recalculating performance targets at each timeline interval can help you adjust future targets if performance of the BPS is not on track. However, multiple interim targets that are recalculated can make it difficult for building owners to understand what is needed to comply and establish longer-term plans to meet targets. Recalculating targets also requires more effort than static targets. Community impacts should also contribute to your decisions for the timeline of the BPS.

- **Community impacts**
- **Interim targets or only final target**
 - Align interim targets with code cycles?
- **Fixed target(s) or recalculate target(s) each interval**
- **Phased approach**
- **Allowances or variances in timeline**



Compliance

Support offered

Define a scope of support services offered to building owners who must comply with the BPS. Providing support services can increase levels of compliance and assist those building owners who may lack resources.

Methods

Define methods, or paths, for compliance with the BPS. Consider alternative compliance paths that will help achieve your goals. For example, accepting certain third-party building certifications may be an acceptable alternative method of compliance to achieving a specific EUI.

Timeline

Like the timeline for BPS targets, establish a timeline for compliance with these targets. You may elect to have grace periods for previously compliant buildings or offer windows of time for correction and re-reporting a building's performance.





Community impacts

Through community engagement and feedback, seek to understand the potential cost of compliance to various community members and look for disparity among groups. Taking steps to address disparities from BPS compliance during policy development can avoid potentially unforeseen inequities.

Costs

Consider the costs for the compliance program. Costs for administering the program may include purchasing or developing tracking software, hiring field inspectors or analysis staff. As previously mentioned, building owners will face costs to bring buildings into compliance.

Penalties

Determine what type, if any, penalties are consequences of non-compliance. This includes the frequency and amount of penalties, especially for sustained non-compliance.



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Implementation

Once your BPS is in place, then begins the work to collect and analyze building data to determine compliance as well as effectiveness of the BPS. Plan your data sources and reporting system to handle the type and amount of data you expect from buildings in the BPS and then build a system for quality checks to ensure accurate data. When accurate data is coming in reliably, it will be time to analyze the results for each building individually and as a group. You will follow the compliance framework for individual buildings and can offer building owners support to help them succeed with compliance. Broader analyses of reporting rates, compliance rates, and the metrics will help you understand how the program is working and what your progress is toward your objectives. Depending on the results you may increase support to building owners.

Data collection

- **Accurate building owner info**
- **Reporting system**
- **Quality checks**

Data analysis

- **Reporting rates**
- **Compliance rates**
- **Progress toward goals**

Community support

- **Technical support**
- **Funding support**
- **Equity framework**

Technical Analysis Services

Development of a BPS involves multiple decision points that can be intimidating to navigate. Many of these decisions can be informed from available building data but may still require technical analyses that are complex and intensive. Resources exist to help you with these analyses for data-driven policy. The U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) both offer free resources for BPS development and implementation. These resources provide information and guidance for:

- **Building stock analyses**
- **Target-setting and trajectories**
- **Energy efficiency/electrification technology prioritization and packaging**
- **Cost-effectiveness analyses**
- **Implementation and compliance support resources/tools**

You can find more information on DOE support, tools and resources at:

energycodes.gov/BPS

You can find the EPA development toolkit at their website, here:

[EPA Benchmarking & BPS Policy Toolkit](#)

NORESCO encourages you to take full advantage of the available resources for your BPS. Navigating these tools can sometimes feel overwhelming, but NORESO can provide expert guidance to help streamline the process.

Whether it's navigating the documents and guidance offered by the U.S. Department of Energy (DOE) and Environmental Protection Agency (EPA) or evaluating software platforms for building energy benchmarking and BPS compliance, NORESO's approach ensures informed decision-making that maximizes efficiency and impact.

Additionally, we offer a collaborative service to work directly with your staff, collecting and analyzing building data to support successful implementation.

Our team can also support your staff to coordinate outreach and engagement with your building owners to both increase compliance with your BPS and guide building owners on the path to successfully meet targets and timelines. Support can range from organizing and hosting educational and "how-to" events about your BPS to identifying and training contractor networks to support building energy upgrades.



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Data-Driven Policy Analysis

NORESCO offers services to support your jurisdiction with building data analysis to inform the development of your BPS. Data-driven methods for BPS development can use building data (where available), building energy models, or a combination of both. Using data-driven methods gives firm information to support your policy and the reasoning behind your metrics and timelines.

To get started, NORESCO goes through a few simple steps that determine the best analysis method for your BPS development.

- **List specific policy questions to answer**
- **Determine analysis method**
- **Perform modeling**
 - Identify different building categories
 - Evaluate energy/water use distributions
- **Summarize results for policy makers**







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Analysis Methods

Data-driven methods for Building Performance Standards (BPS) development can utilize existing building data, building energy models, or a combination of both.

Empirical models, which use existing building data, are typically developed when benchmarking data is available from an existing benchmarking policy. The advantage of this approach is that the data comes from your actual building stock. However, there can be challenges with the completeness of this data, although national building databases may be used to supplement your benchmarking data. Empirical methods evaluate at a whole building level and do not assess individual measures or strategies, e.g., space heating electrification.

Building energy models are generally used when there is no data available for your existing building stock. As with any model, assumptions will need to be made, and the results will be an estimation of your actual building stock. However, building energy models allow you to evaluate the impacts of individual measures or strategies for achieving your goals. Models

can be developed to represent each of the various building types within your building stock, or prototype building energy models developed by the DOE can be used. Developing representative models requires more time but may provide a closer representation of your buildings. Prototype models are readily available and can reduce the modeling effort.

Empirical Methods

- **Data availability**
- **Data quality**
- **Whole-building analyses**
- **Actual building stock**

Building Energy Modeling Methods

- **Representative Building Energy Models**
 - System level analyses
 - Assumptions
 - Simulated performance
 - Represent building stock
- **Prototype Building Energy Models**
 - Simplified or prepped models
 - Building type analyses
 - Hypothetical building

Applicability of Analysis Methods

The table below comes from the [ASHRAE Building Performance Standards Technical Resource Guide](#) and outlines the areas of strength for each of the data-driven analysis methods. This table can help you determine which method is best suited for your BPS development based on your goals, your timeline and information you have available.

Policy Design Consideration	Empirical Models	Building Energy Models	Prototype Building Energy Models
Current energy/emissions of the building stock	High/Medium	High/Low	N/A
Selection of BPS metrics and targets and impacts on the building stock over time	High/Medium	High/Low	N/A
Impact of electrification and a changing grid	High/Medium	High	N/A
Alignment with energy codes for new and existing buildings	Low	High	High
Normalizing building-level targets for operating conditions	High/N/A	High	High
Types and levels of energy efficiency/electrification retrofits needed to meet BPS targets	Medium/N/A	High	High
Cost-effectiveness of building retrofits to meet BPS targets	N/A	High	High
Impacts of alternative compliance paths	N/A	High	Medium

ASHRAE Building Performance Standards – A Technical Resource Guide, Table 5.2



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Process: Empirical Method

NORESCO develops empirical models using existing building data to support effective BPS implementation. This process begins with collecting available benchmarking data, which is then analyzed and categorized for further evaluation.

Using these insights, we simulate the projected impacts of a BPS on overall energy and water consumption, evaluating various target options, timelines, and strategies to quantify expected reductions.

Through an iterative approach, NORESO identifies the optimal combination of parameters to ensure the BPS is both effective and aligned with your desired goals.

1. Collect and clean data

2. Parse categories

3. Evaluate distributions

4. Select parameter (e.g., performance target, cycle period)

5. Compute population energy use

- Consider dynamic factors (compliance rates, system efficiencies, emissions factors)

6. Evaluate if results meet objective

- Consider compliance amplitudes and timing

7. Record results

8. Iterate for considered parameters

9. Select optimal combination of parameters

Process: Representative Building Energy Model Method

NORESCO develops representative building energy models based on your existing building stock. We perform a building stock analysis to determine the different building types and their quantities within your jurisdiction. We then develop representative models for each category based on the nominal characteristics of buildings in the category.

Once the models are developed, the process is similar to the iterative process used with empirical data models. However, building energy models allow for evaluation at a building system level, meaning that you can analyze the impact from specific measures, such as space heating electrification using heat pumps. The representative building energy models are then used to simulate impacts on the overall energy/water use from implementation of a BPS. We evaluate impacts from various options for targets, timelines, etc. to determine the reductions in energy/water use expected from your BPS. We perform an iterative analysis to identify the optimal combination of parameters for your BPS that will help achieve your goals.

- 1. Collect and clean data**
- 2. Develop and document energy model inputs**
- 3. Develop and run energy models**
- 4. Calibrate energy models**
- 5. Select parameters**
(e.g., performance target, cycle period)
- 6. Run energy model parametric calculations**
- 7. Evaluate results**
- 8. Apply building results to larger population**
- 9. Evaluate if results meet objective**
 - Consider compliance amplitudes and timing
- 10. Record results**
- 11. Iterate for considered parameters**
- 12. Select optimal combination of parameters**



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Process: Prototype Building Energy Model Method

NORESCO leverages prototype building energy models developed by the U.S. Department of Energy (DOE) to represent your existing building stock. Through a building stock analysis, we assess the different building types and their quantities within your jurisdiction, selecting appropriate prototype models for each category.

This approach streamlines the process compared to developing fully representative building energy models, though prototype models may not always be exact reflections of your actual buildings.

Once the models are established, we apply the same iterative process used with representative models—analyzing various parameters to identify the optimal combination for your BPS. Our goal is to ensure your BPS is tailored to maximize efficiency and help you achieve your desired outcomes.

- 1. Determine prototype model to use**
- 2. Establish represented building types**
- 3. Document prototype model inputs**
- 4. Verify prototype model**
- 5. Select parameters**
(e.g., performance target, cycle period)
- 6. Run energy model parametric calculations**
- 7. Evaluate results**
- 8. Apply building results to larger population**
- 9. Evaluate if results meet objective**
 - Consider compliance amplitudes and timing
- 10. Record results**
- 11. Iterate for considered parameters**
- 12. Select optimal combination of parameters**

*Pictured on this page:
Pierce Boston Luxury Apartments
Boston, MA
LEED Silver
Photo Credit: Jeremy Bittermann*



ABOUT NORESCO

NORESCO, a part of Carrier Global Corporation, helps clients adapt to and mitigate the impacts of climate change by decarbonizing, modernizing and electrifying their building stock to be more sustainable and resilient.

NORESKO influences many levels of the built environment — from optimizing new and existing buildings, to improving regional utility programs, to developing national energy codes and standards. To date, NORESKO has guaranteed more than \$5 billion in energy and operating cost savings while reducing customer CO₂ emissions by more than 25 million metric tons – the equivalent to planting 1.4 million acres of forest. We offer services for new and existing buildings including:

Energy and Efficiency Consulting

- Energy Savings Performance Contracts
- Decarbonization Assessments and GHG Benchmarking
- Decarbonization Roadmaps and Existing Building Policies
- Energy Procurement Consulting
- Renewable Energy Consulting
- Retrofit Implementation

Sustainability Consulting

- Green Building Certification and Wellness Consulting
- Energy and Daylight Modeling
- Lifecycle Assessment Modeling
- Energy and Sustainability Master Planning

Building Performance

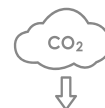
- Building Performance and Indoor Air Quality Testing
- New Building Commissioning and Retro-Commissioning
- Building Enclosure Commissioning
- Testing, Adjusting and Balancing



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50 billion
gallons of
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