Aligning Building Performance Standards and Energy Codes

Introduction

Building performance standards (BPS) and building energy codes are two important strategies to decarbonize the built environment. While energy codes primarily address newly constructed buildings and, to a limited extent, existing buildings undergoing major upgrades such as additions and alternations, BPS specifically target existing buildings by setting emissions reductions goals that decrease over time.

NEEP has previously outlined the challenges of aligning these policies in our 2022 report The Nexus of Energy Codes and Building Performance Standards, but since its publication, more attention has been given to how jurisdictions can strategically develop complementary energy codes and building performance standards. For example, in May 2023 the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) published a BPS Technical Resource Guide that places considerable weight on how metrics for BPS and codes can be designed to achieve similar goals and avoid competing priorities.

Although energy codes and BPS serve slightly different functions, they can complement each other to jointly achieve decarbonization goals. Energy code provisions that are designed to prepare buildings for a BPS can help avoid major costly retrofits. This resource explores how several jurisdictions have successfully aligned their energy code updates with building performance standards, looking at both existing and new buildings. It will also discuss innovative approaches that can better align energy codes and BPS, including lessons learned from a conversation with Colorado's Energy Office.

How to Incorporate BPS into Energy Codes for Existing Buildings

Several jurisdictions have incorporated provisions intended to support BPS for existing buildings into their energy code.

In **Seattle, Washington**, an amendment[1] to the commercial energy code requires building owners to replace any heating, ventilation, and air-conditioning (HVAC) system needing replacement with a system that is "*not provided by electric resistance or fossil fuel combustion appliances*".[2] There is a similar code amendment[3] for water heating systems that "*shall be provided by an electric air-source heat pump water heating system*".[4] These amendments provide a great opportunity to support Seattle's BPS by requiring owners to decarbonize their

[1] Section C503.4.6 of Seattle's Amendment to the 2018 Energy Code

[2] This language is taken from Section C403.1.4 of the 2021 Washington State Energy Code, which is referenced in Section C503.4.6 of Seattle's Energy Code Amendment

[3] Section C503.5 of Seattle's Amendment to the 2018 Energy Code

[4] This language is taken from Section C404.2.1 of the 2021 Washington State Energy Code, where C404 is referenced in Section C503.5 of Seattle's Energy Code Amendment

space and water heating equipment when upgrading their systems, which will help achieve the city's emissions reductions targets outlined in the BPS.

Denver, Colorado also has provisions in its energy code relating to HVAC and water heating system replacements. The 2022 Denver Energy Code has provisions[5] requiring that when building owners replace a gas furnace, the new system must either meet a threshold of limited nitrogen emissions or must have an Annual Fuel Utilization Intensity (AFUE) of 90 percent or better, which would improve the efficiency when compared to an existing system. In addition, when replacing a gas furnace or gas water heater, the Denver code requires[6] either that the owner test the gas pipes to minimize gas leaks or develop an "Electrification Retrofit Feasibility Report". Although these provisions do not directly require electrification, they do promote efficient use of gas equipment, and help determine if the project can feasibly become all electric in the future.

The **New Buildings Institute's (NBI) Existing Building Decarbonization Code** gives examples of model code language that can incorporate a jurisdiction's BPS into the energy code itself.[7] Embedding the BPS into the energy code aligns the goals of both tools and can ensure that decisions on improvements to both are well coordinated rather than occurring independently.

How to Incorporate BPS into Energy Codes for New Buildings

Although the examples to this point emphasize existing building provisions, energy codes can also help prepare new buildings for the future development of a BPS. One example is in the 2021 International Energy Conservation Code (IECC), which contains "benchmarking ready" provisions for buildings over 25,000 square feet.[8] These provisions help commercial buildings prepare to monitor and record energy data, so that tracking metrics is dramatically less burdensome when a BPS is adopted. This provision has been updated in the 2024 IECC draft[9] which requires buildings over 10,000 square feet[10] to comply. Adding provisions that prepare jurisdictions for a BPS into the national model energy code will allow buildings currently under construction to avoid future costly retrofits. States and municipalities should prioritize updating their energy code to the latest national model code to prepare new buildings for a BPS, and new model codes should add more BPS-ready provisions to support the emissions reductions goals of jurisdictions across the country.

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[5] Section C503.3.2 of the 2022 Denver Energy Code

[6] The requirements are outlined in Section C503.3.3 for space heating, and in Section C503.4.1 for water heating of the 2022 Denver Energy Code

[7] The NBI model code language is outlined in Section C502.1.2, C503.1.4, and R503.1.4 of the NBI Existing Building Decarbonization Code

[8] Section C405.12 of the 2021 IECC

[9] The 2024 IECC is still under development and provisions are subject to change. The information in this document is from the 2024 IECC Commercial Public Comment Draft #2 Update from July 6, 2023

[10] Section C405.13 of 2024 IECC Public Comment Draft #2

Lessons Learned from Colorado

NEEP recently met with Adam Berry, Senior Program Manager for Building Codes from Colorado's Energy Office (CEO). Adam shared that considerable time could have been saved if the team working on BPS and the team working on energy codes had coordinated at the outset. While setting the BPS targets, the CEO sought to account for future building stock growth. To do so required the CEO to factor building and energy codes into the decision-making process. By estimating the impact of future energy code savings, targets for the BPS would have been easier to set. Colorado determined the energy code savings using a report by the Pacific Northwest National Laboratory (PNNL), who estimate the improvement of the energy code between model code updates. Although it was challenging to align BPS and Codes,[11] by looking at the bigger picture and setting long-term targets without diving into specific energy code details, the CEO was able to set complementary targets for their BPS that aligned with the projected energy code savings of the 2021 IECC. He also emphasized the importance of metric alignment, and making sure that the metrics used in Codes and BPS are similar. Codes historically have used Energy Use Intensity (EUI) to measure savings, while BPS often use the percentage of greenhouse gas emissions reductions. EUI does not account for all emissions, which leaves out important considerations like embodied carbon. Using similar metrics can present opportunities to better align goals.

Innovative Approaches to Align Codes and BPS

Using published sources to set targets presents another opportunity to align codes and BPS.[12] ASHRAE Standard 100-2018 provides a list of energy efficiency measures designed to improve building performance that can help existing buildings meet energy targets set by a BPS. Energy Star also develops National Median EUIs, which can be used as a baseline to compare future building emissions reductions goals to the energy use of different building types.

Outcome-based energy codes are a strategy for code compliance that look at a building's actual energy use as a metric, rather than a traditional prescriptive or performance approach. Outcome-based codes are enforced by creating a designated energy budget for a building. This budget would be set based on building type or application.[13] Bringing attention to how buildings operate rather than just considering their design and construction provides jurisdictions with better data about actual building performance, extends code enforcement past the occupancy permit date, and allows for adjustable targets for energy use that can decrease over time.[14]

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[11] As described by Adam's colleague Crystal Egelkamp in a May 2023 Presentation at the Department of Energy National Energy Codes Conference on Slide 44: https://www.energycodes.gov/sites/default/files/2023-05/2023_NECC_BPS_and_Codes.pdf

[12] https://www.energycodes.gov/sites/default/files/2023-05/2023_NECC_BPS_Panel.pdf

[13] https://lightingcontrolsassociation.org/2021/07/23/outcome-based-the-future-of-energy-codes/

[14] https://newbuildings.org/code_policy/outcome-based-energy-codes/

In October 2017, the National Institute of Building Sciences in partnership with NBI developed guidance for implementing an outcome-based compliance path in energy codes. This guidance could be used as a framework for future model codes, and serve as a guide for communities seeking to adopt outcome-based codes. This strategy for code enforcement would align with BPS by setting the same goals and targets based on actual emissions reductions and energy use of a building, and would operate concurrently rather than having code enforcement end and BPS compliance begin. Boulder, Colorado has a climate commitment to "design and adopt net zero energy, outcome verified codes for all building types by 2031", and its current 2020 Energy Code has a measured performance outcome, where "*projects may demonstrate compliance with this code by documenting that the building has achieved the EUI performance*" for that specific building type "*based on metered energy use after occupancy*".[15]

Conclusion

Energy codes and BPS can work together to achieve building decarbonization goals. Energy codes can include provisions for both new and existing buildings that assist with achieving the targets set by a BPS. The examples provided for Seattle and Denver outline best practices for existing buildings to reduce emissions, while Boulder demonstrates opportunities to use outcome-based codes to strategically align energy codes and BPS. The Colorado Energy Office example shows that metrics also need to be aligned, and that coordination between offices is critical when setting targets. National model codes can also do more to align BPS and codes, by adding provisions that prepare future existing buildings for upgrades ahead of time, before a BPS is implemented. These examples can be replicated across the NEEP region to drive further energy savings.

[15] Section C407.3.3 of the 2020 City of Boulder Colorado Energy Conservation Code

The Building Energy Analysis Manager (BEAM) Tool for Outcome Based Codes

The Building Energy Analysis Manager (BEAM) tool is a database and CRM platform for the management of building energy policies. BEAM is primarily used to facilitate the implementation of benchmarking and building performance standards which both involve gathering actual energy consumption data in existing buildings. BEAM could also be used by a jurisdiction managing an outcome-based code (OBC) because, similar to a BPS program, an OBC also relies on actual energy use data. Furthermore, OBCs may use the same metric as a BPS which is often kBTu per square foot, also known as Energy Use Intensity (EUI). Because OBCs rely on actual energy usage data, compliance with the code must happen after the building is constructed and occupied. The New Building Institute (NBI) recommends that buildings owners be given at least 24 months to present code officials with 12 months of utility bills that demonstrate adequate building performance. After this two-year period the building may be subject to city or state's building performance standards. For jurisdictions considering an OBC for new buildings and/or a BPS for existing buildings, BEAM could be a valuable tool to manage compliance with both

BEAM is designed to allow jurisdictions to re-create the parameters of a building energy policy such as a BPS or an OBC in the software including thresholds, energy budgets, exemptions, cycles, and compliance with multiple metrics. Integrated communication tools allow a jurisdiction to easily identify building segments to communicate with, either individually or in large email blasts. The BEAM database allows for easy sorting of buildings based on characteristics such as size (i.e. square footage) and type (i.e. municipal, commercial, etc.), or performance (i.e. GHG emissions, ENERGY STAR Score, energy use, etc.) to identify groups of similar buildings or outliers. This functionality could help a jurisdiction set OBC energy budgets for new buildings as well as track for code compliance. ENERGY STAR Portfolio Manager is an effective tool for building owners to report energy data which can be automatically imported into BEAM for compliance tracking and/or analysis to determine the appropriate energy budget for an OBC.

While commercial building owners are increasingly prepared to benchmark their energy usage, benchmarking would be a new endeavor for smaller residential buildings. For BEAM to be useful for OBC in the residential space, a jurisdiction would need to adopt a reporting platform for single family and small multifamily buildings that BEAM could integrate with.

Examples of Outcome-Based Codes

Seattle, Washington: Seattle was the first jurisdiction in the country to pilot outcome-based codes beginning with three pilot projects in the late 2000's. The resulting projects used 31-48 percent less energy than the modeled references. The 2015 Seattle Energy Code contains a voluntary OBC pathway.[16]

Washington State: The 2018 Washington State Energy Code introduced an OBC to provide building designers more flexibility. It was adopted from the 2015 Seattle Energy Code. The new compliance pathway requires each building to operate within a pre-determined EUI budget. This path limits the building enclosure's total heat loss coefficient (UA) to be no more than 20 percent higher than the level stated in the prescriptive code. To ensure compliance the building owner must submit one year of energy data within the first three years after occupancy and every five years after.[17]

Boulder, Colorado: Boulder has a climate commitment to "design and adopt net zero energy, outcome verified codes for all building types by 2031", and its current 2020 Energy Code has a measured performance outcome, where "projects may demonstrate compliance with this code by documenting that the building has achieved the EUI performance" for that specific building type *"based on metered energy use after occupancy".*[18]

[16] Driving Innovation, Rewarding Performance: Seattle's Next Generation Energy Codes and Utility Incentives (aceee.org)

[17] 2021 Update: Understanding the 2018 Washington State Energy Code and Seattle Energy Code Changes - Blog - RDH Building Science

[18] Section C407.3.3 of the 2020 City of Boulder Colorado Energy Conservation Code