# Addendum to Building Energy Codes for a Carbon Constrained Era: Regional Progress & Next Steps

## Table of Contents

## Executive Summary

The following report serves as an addendum to a previous report published by NEEP, titled Building Energy Codes for a Carbon Constrained Era: A Toolkit of Strategies and Examples (2017). This report provides regional progress updates on the innovative strategies and recommendations outlined in the previous report, with a focus on the advancement of zero energy buildings (ZEBs).[1]

The following addendum is presented in two sections. Section 1 will concentrate on the advancement of previous recommendations.

**Section 1: *Regional Progress Report***

- Objective 1: Advance Code Development to Zero Energy
- Objective 2: Improve Code Administration, Compliance, and Enforcement

Section 2 presents updated objectives and recommendations, considering current regional progress.

**Section 2: *Future Recommendations Toward ZEBs***

- Objective 1: Advance Code Development to Zero Energy
- Objective 2: Improve Code Administration, Compliance, and Enforcement
- Objective 3: Appliance Standards
- Objective 4: Support and Advance Workforce Development
- Objective 5: Equity Across Codes

[1] A zero energy building (ZEB) is a type of building that over the course of a year, generates enough renewable energy from on-site sources (such as solar panels or wind turbines) to fulfill its total energy needs. The primary objective of a ZEB is to attain "zero energy" consumption, meaning the building consumes no more energy from the grid than it produces. While the building remains connected to the grid to facilitate energy import or export as necessary, the ultimate aim is to achieve a net energy consumption of zero over the specified time frame. This approach ensures that the building operates self-sufficiently in terms of energy, and it can even contribute surplus energy back to the grid, making it a sustainable and environmentally friendly construction choice.

## Common Acronyms and Abbreviations

American National Standards Institute (ANSI)
American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
Authority Having Jurisdiction (AHJ)
Bipartisan Infrastructure Law (BIL)
Building Codes Assistance Project (BCAP)
Community Development Block Grant (CDBG)
Connecticut Weatherization Assistance Program (WAP)
Washington, District of Columbia (D.C.)
Electric Vehicle (EV)
Energy Efficiency Resource Standards (EERS)
Energy Rating Index (ERI)
Environmental Protection Agency (EPA)
Rhode Island Executive Climate Change Council (EC4)
Massachusetts Global Warming Solutions Act (GWSA)
Moderately Priced Dwelling Units (MPDUs)
Greenhouse Gas (GHG)
Heating, Ventilation, and Air Conditioning (HVAC)
Home Energy Rating System (HERS)
Inflation Reduction Act (IRA)
International Code Council (ICC)
International Energy Conservation Code (IECC)
International Green Construction Code (IgCC)
Low-Income Housing Tax Credit (LIHTC)
Massachusetts Department of Energy Resources (DOER)
Million Metric Tons (MMT)
The Modular Building Institute (MBI)
New Buildings Institute (NBI)
New York State Energy Research and Development Authority (NYSERDA)
Phius (formerly known as Passive House Institute U.S.)
Pacific Northwest National Laboratory (PNNL)
Passive House Institute (PHI)
Qualified Allocation Plan (QAP)
Regional Energy Efficiency Organizations (REEOs)
Remote Virtual Inspections (RVI)
Renewable Portfolio Standards (RPS)
Residential Energy Services Network (RESNET)
State Appliance Standards Database (SASD)
Technical Advisory Groups (TAGs)
The U.S. Department of Energy (DOE)
Third-Party Inspection Agencies (TPIA)
U.S. Dollars (USD)
Zero Energy Buildings (ZEB)
Zero Energy Ready Homes (ZERH)

## The Everlasting Built Environment

Operational carbon emissions from buildings, along with emissions stemming from building industry practices, account for approximately 38 percent of the world's total energy-related carbon emissions. Projections indicate that between 2017 and 2050, the expansion of the built environment in the United States will be nearly 20 times the current building stock of New York City. Buildings constructed between 2020 and 2050 will account for 30 percent of the nation's building stock (The Zero Carbon Consortium, 2020). While the United States has made progress in reducing operational emissions in recent years, significant changes are necessary to achieve zero emissions by 2050. The state of our built environment will have significant implications for the nation's future energy consumption, the health of the environment, and global climate change.

**DEFINITIONS**

**Built Environment:**
The built environment refers to various components of man-made infrastructure built to support human activity. The built environment encompasses physical factors such as building structures (e.g., residential, commercial, and public structures) and utility distribution systems.

**Building Industry:**
The building industry is characterized by various aspects influencing and relating to all building projects; this includes the development, installation, renovation, repair, and/or maintenance of buildings.

Buildings constructed between 2020 and 2050 will have long lifespans, spanning several decades or even over a century. Consequently, the choices made during their design, construction, and operation will have a significant impact on long-term energy usage, resource use, and the environment.

The period from now to 2050 presents a pivotal opportunity for states and jurisdictions to integrate innovative decarbonization strategies. Constructing buildings requires significant amounts of materials, water, and other resources. By prioritizing sustainable construction, there are opportunities to reduce embodied carbon, mitigate resource overconsumption, and minimize waste generation. Improved ventilation, electrical appliances, access to daylight, and sustainable materials enhance occupant health and well-being, creating healthier and more comfortable living and working environments in buildings constructed during this period.

Additionally, the construction of buildings between now and 2050 presents an opportunity for the investment and expansion of the zero energy building market, creating employment opportunities and driving green innovation. Considering the scale of the existing and future built environment, and its long-term impacts, the choices made today and, in the future, will shape various aspects of life and well-being for generations to come.

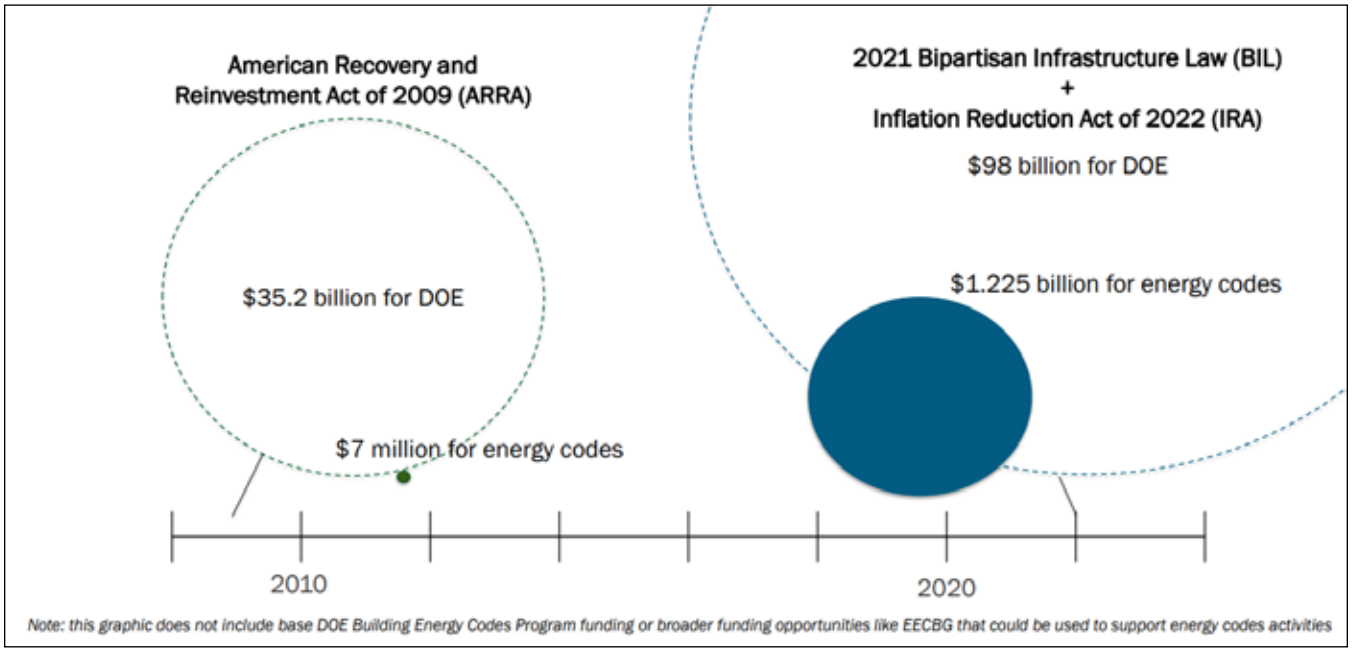
### *National and Regional Roles for Clean Energy Transitions and Decarbonization*

At the national level, federal investments in clean energy and building decarbonization strategies play a pivotal role in shaping domestic industrial policy by promoting the adoption and development of clean energy technologies. Notably, the Inflation Reduction Act (IRA) of 2022 represents the largest federal investment in

building decarbonization and clean energy in American history. The IRA allocates $1 billion in funding to the Department of Energy provide grants to states or units of local government. These grants are intended to facilitate the adoption of updated building energy codes, including the implementation of zero energy codes. As part of this legislation $330 million is allocated for the adoption of the most current building energy codes, specifically the 2021 International Energy Conservation Code (IECC) for residential structures and the ANSI/ASHRAE/IES Standard 90.1-2019 for commercial buildings, or other codes and standards that achieve similar or higher energy savings (Section 50131). Additionally, $670 million is designated for the implementation of a building energy code that aligns with or surpasses the zero energy provisions outlined in the 2021 IECC code or other codes and standards delivering equivalent or superior energy savings.

The Bipartisan Infrastructure Law, passed in November 2021, earmarked $62 billion for various infrastructure projects, including clean energy, building efficiency, transportation systems, broadband, and communications networks. As part of this legislation, $225 million is allocated specifically for the Building Codes Implementation for Efficiency and Resilience Program. This funding aims to support the creation of state or regional partnerships that provide training and materials to comply with updated building energy codes. Additionally, the plan includes measures to implement new codes, such as monitoring compliance[2] and collecting data on implementation efforts. The initiative also addresses implementation challenges in rural, suburban, and urban areas, with a focus on updating current energy codes.

**Figure 1:** ***New Federal Funding and Technical Assistance Opportunities for Building Energy Codes***




*Courtesy of U.S. Department of Energy*

[2] Compliance with building energy codes refers to adhering to regulations and standards that aim to improve the energy efficiency of buildings. It involves meeting or exceeding prescribed energy efficiency requirements during the design, construction, and operation of buildings.

Federal legislation, such as the IRA and BIL, have the potential to actively promote key industrial sectors within the building industry, potentially facilitating significant progress in decarbonization efforts. These sectors include renewable energy technologies such as photovoltaics (solar power) and wind power, power transmission and distribution systems, electric vehicles, ZEBs, and grid modernization through the implementation of advanced technologies like smart grids with a 5G backbone and advanced battery systems.

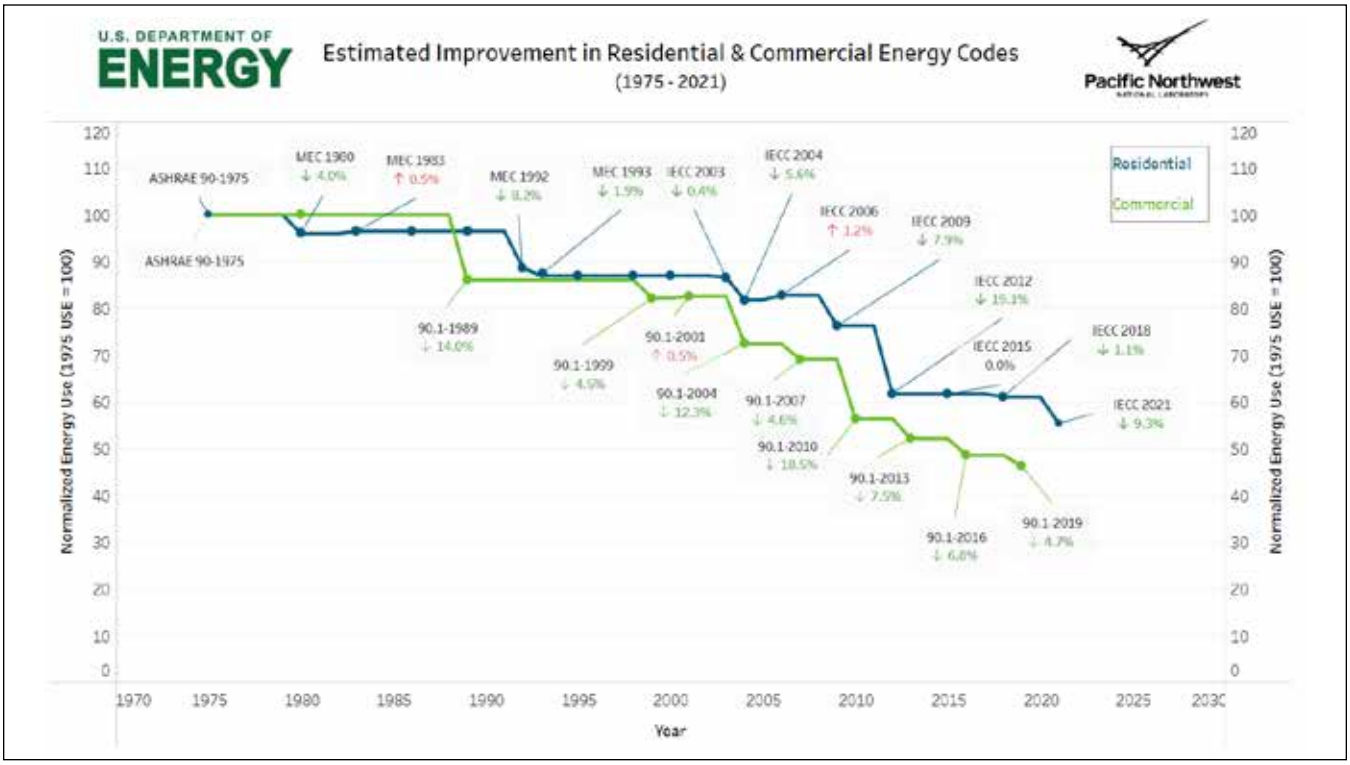
States and jurisdictions play a crucial role in developing comprehensive climate plans to achieve their decarbonization goals. The presence or absence of these plans significantly impact the potential for communities to achieve net zero or low carbon environments. In the Northeast and Mid-Atlantic region, states and communities have made significant commitments to carbon reduction targets spanning from 2030 to 2050. To effectively meet these targets, the region must prioritize the following objectives:

- Promote the development and adoption of advanced building energy codes that require all new buildings to be designed for achieving net zero[3] operational emissions by 2035
- Enhance the administration of building energy codes to ensure that the desired performance levels are effectively achieved
- Improve building code compliance and enforcement[4] by advancing the skills and training of the workforce
- Ensure equitable access to safe and resilient buildings for all communities, particularly historically underserved communities

[3] A net zero energy building (net zero) strives to generate an equal amount of energy to what it consumes within a defined timeframe, typically a year. The main distinction between ZEBs and net zero buildings lies in their emphasis on "net zero" energy consumption. This implies that the building remains connected to the grid and may import energy when demand is high or renewable energy generation is low. Conversely, it exports surplus energy to the grid during times when it produces more energy than it consumes. The ultimate objective is to achieve a balanced net energy consumption, where the total energy exports equal the total energy imports, resulting in an overall net energy consumption of zero.

[4] Building energy code enforcement refers to the implementation and oversight of regulations that ensure building projects adhere to prescribed energy efficiency requirements. It involves conducting inspections throughout the construction process to verify compliance with energy code standards.

**Figure 2***: Estimated Improvement in Residential and Commercial Energy Codes (1975-2021)*[5]




The U.S. Department of Energy (DOE) Building Energy Codes Program (BECP) tracks and analyzes data related to the adoption, compliance, and implementation of the latest model energy codes. The figure above demonstrates the estimated decrease in energy usage in residential and commercial building energy codes for each three-year cycle.

The Impacts of Model Building Energy Codes report by Pacific Northwest National Laboratory (PNNL) assesses the impact of building energy codes from 2010 to 2040; Figure 3 summarizes the findings for states[6] included in the analysis. The results include savings from electricity, natural gas, and fuel oil (residential only), and are reported separately for residential and commercial codes. The cumulative primary energy savings from 2010-2040 are 13.57 quads (1 quad = 1 quadrillion BTU), and energy codes are projected to save consumers $138 billion from 2010 to 2040, equivalent to a CO2 reduction of 900 million metric tons (MMT). These savings are approximately equal to the greenhouse gases emitted by 200 million gasoline-powered passenger vehicles driven for one year. The projected energy savings provided by updated building energy codes are sizeable. However,

[5] Pacific Northwest National Laboratory (PNNL). Energy Savings Analysis, 2024 Residential IECC Interim Progress Indicator. Available at: https://www.iccsafe.org/wp-content/uploads/2024-IECC-Interim-Residential-Progress-Indicator-to-ICC.pdf; PNNL. 2024. IECC Interim Energy Savings Analysis and Progress Indicator for Commercial Buildings. Available at: https://www.iccsafe.org/wp-content/uploads/2024-IECC_Commercial_Interim-Progress-Indicator-Results-11072022.pdf.

[6] The analysis excludes the following states due to the absence of a statewide code and the lack of enforcement of energy codes by jurisdictions within the state: Alaska, Hawaii, Kansas, Missouri, Mississippi (excluded only from residential calculations), North Dakota, and South Dakota.

states and jurisdictions must act intentionally through planning and policy to unlock the considerable additional energy savings potential from improved energy codes throughout the region.

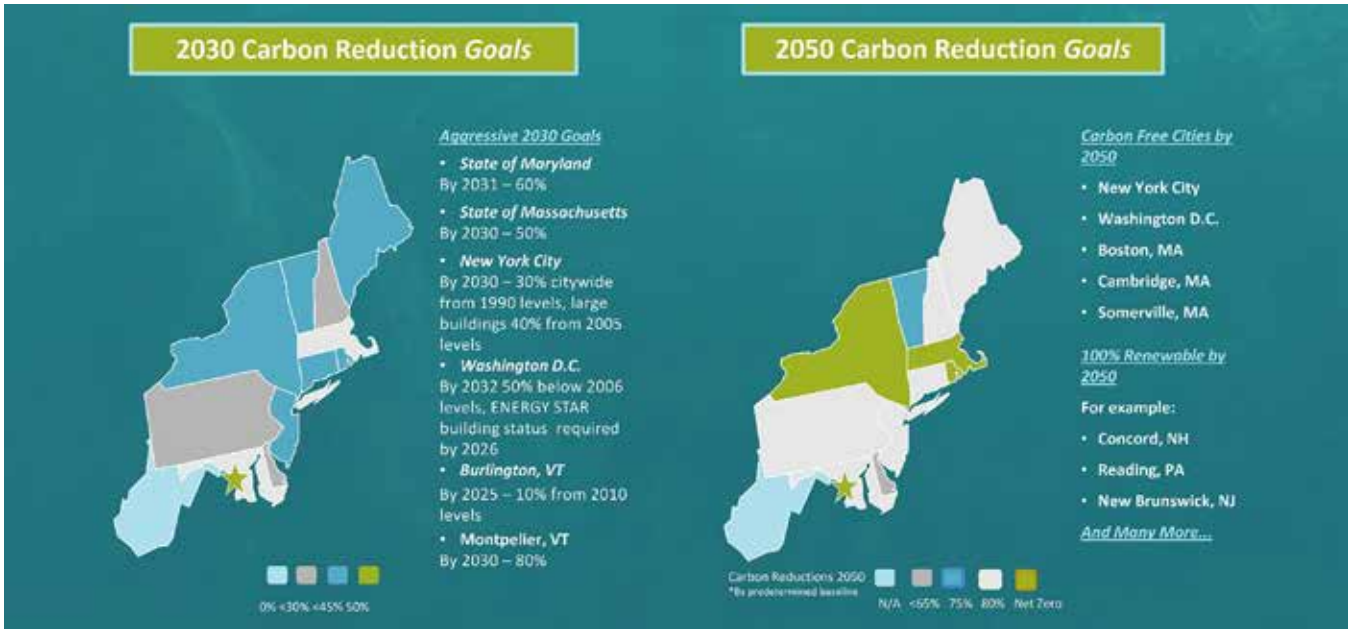
**Figure 3***: Summary of Impact of Energy Codes*

| SECTOR | ENERGY COST SAVINGS (2020 USD billion) | CO2 REDUCTION (MMT) |
|---|---|---|
| **COMMERCIAL** | | |
| Annual 2030 | 2.80 | 21.16 |
| Annual 2040 | 3.06 | 24.49 |
| Cumulative 2010-2030 | 34.27 | 246.73 |
| Cumulative 2010-2040 | 63.80 | 476.77 |
| **RESIDENTIAL** | | |
| Annual 2030 | 3.24 | 18.50 |
| Annual 2040 | 3.52 | 21.15 |
| Cumulative 2010-2030 | 40.59 | 224.69 |
| Cumulative 2010-2040 | 74.61 | 424.20 |
| **TOTAL** | | |
| Annual 2030 | 6.05 | 39.66 |
| Annual 2040 | 6.58 | 45.63 |
| Cumulative 2010-2030 | 74.86 | 471.42 |
| Cumulative 2010-2040 | 138.41 | 900.97 |

## Building Decarbonization: Current Trends in the Region

States and communities in the region have set historic carbon reduction goals and renewable energy targets. These goals will require the energy performance of newly constructed, existing, and/or renovated buildings to change dramatically. The image below includes decarbonization goals and renewable energy targets for each of the 12 states in the Northeast and Mid-Atlantic region and Washington, D.C. These commitments to carbon reduction are foundational to the advancement of state and jurisdictional climate plans.

**Figure 4:** ***Greenhouse Gas (GHG) Emission Reduction Targets for 2030 and 2050***




## Key Findings: Building Energy Code Updates

The NEEP region continues to lead the nation in the adoption of energy codes. As of January 2023, each state in the region, along with D.C., has either adopted or plans to adopt the International Energy Conservation Code (IECC)[7] of 2015, 2018, or 2021 for residential buildings and the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)[8] Standard 90.1-2019 for commercial buildings.

[7] IECC stands for the International Energy Conservation Code. It is a model code developed by the International Code Council (ICC) that provides minimum standards for energy efficiency in new construction and renovation projects. The IECC covers various aspects of building design, construction, and operation, including building envelope requirements, heating, ventilation, air conditioning (HVAC) systems, lighting, and the use of renewable energy sources. The code is regularly updated to incorporate advancements in energy-efficient technologies and practices, aiming to reduce energy consumption and promote sustainability in the built environment. The IECC serves as a reference for local and state jurisdictions in developing their own energy codes to regulate building energy efficiency within their respective areas.

[8] ASHRAE standards are guidelines developed by the American Society of Heating, Refrigerating and Air Conditioning Engineers. These standards provide technical requirements and recommendations for heating, ventilation, air-conditioning and refrigeration (HVAC&R systems), energy efficiency, indoor air quality, and more. They are widely used to ensure optimal performance and environmental conditions in buildings and aim to promote energy efficiency.

In the past year, West Virginia implemented the 2015 IECC, while New Hampshire adopted the 2018 IECC. New York and Rhode Island decided to bypass the 2021 IECC and instead plan to adopt the forthcoming 2024 IECC. New Jersey, Connecticut, Vermont, and Maryland have already adopted the 2021 IECC, while the remaining states in the region, along with D.C., are currently promulgating the 2021 IECC and ASHRAE 90.1-2019.

Since the previous report in 2017, the region has experienced positive trends in the adoption and administration processes of energy codes. However, there are still significant opportunities for states and jurisdictions to enhance the efficiency of and compliance with building energy codes.

**Figure 5: Current State Energy Code Adoption and Where They Are Headed**


*An asterisk (*) denotes states that are updating or developing stretch codes. The arrow depicts states adopting new codes. IECC shorthand is used to represent the level of efficiency of both the residential and commercial code currently being enforced in each state (even in states where the commercial chapter of the IECC is not an accepted compliance path).*

**Figure 6: Current Stretch Energy Codes in the Region**

| STATE | RESIDENTIAL | COMMERCIAL | NOTES |
|---|---|---|---|
| MA | HERS/ERI | Percent Better | Stretch, Muni Opt-In (all Electric-HERS 0) |
| NY | IECC | IECC/ASHRAE | Updating; ZE base 2026 |
| DC | All new construction electric | Appendix Z (zero energy) | Electrification measures in base code 2021, ZE base 2027 |
| VT | Point Based | Base code additional measures | EV Charging, Solar Ready, Air Sealing, Points, HERS; Embodied CArbon, ZE base 2030 |
| RI | DOE ZERH | IGCC | Updating – Zero Code Option |
| ME | IECC ZE Appendix | IECC ZE Appendix | 2021 IECC |
| MD | | IGCC | Statewide Stretch Zero/EIc Code |

## Best Practices Toward a ZEB Future

Buildings are significant contributors to global energy consumption and will continue to play a crucial role in the future. With the increasing number of buildings worldwide, there is a growing need to sustainably meet rising energy demands. Projections indicate that the global energy demand for buildings will increase by an additional 30 percent by 2035.

Although commendable progress has been achieved in developing and implementing more efficient building energy codes across the region, it is crucial for states and municipalities to prioritize the establishment and implementation of zero energy building codes to align with state climate goals. DOE and PNNL have conducted thorough analyses of current and projected efficiency and construction trends. Based on their findings, NEEP supports the following goals for the NEEP region:

**2030** → Leading states that have regularly adopted building energy codes and set policies with an eye towards zero energy are in the process of adopting IECC Zero energy base codes and/or IECC 2021 zero energy appendices.

**2035** → All new buildings will be designed to achieve zero energy.

**2050** → All existing buildings will have been retrofitted through programs or initiatives that address efficiency.

NEEP actively supports states and municipalities in developing comprehensive plans and policies to tackle energy efficiency in new and existing buildings. NEEP works toward policies that consider specific building types and sizes, promote equitable progress toward achieving deep energy retrofits, promote zero energy ready standards, and promote ZEB.

Achieving building decarbonization relies on the widespread adoption and strict compliance with increasingly efficient building energy codes. Specifically, building energy standards with clear pathways and provisions for ZEBs play a vital role. ZEBs are buildings that consume less energy than the renewable energy they generate on-site or obtain from off-site renewable sources.

To accelerate decarbonization, it is crucial that all new construction projects and major renovations[9] implement comprehensive measures to reduce carbon emissions and transition to sustainable and renewable energy sources. By employing advanced technologies, adopting innovative building design practices, and implementing efficient construction methods, it is possible to develop resilient structures that align with ZEB principles while remaining cost-competitive with conventional construction methods.

By embracing the concept of ZEBs and adhering to the associated standards, the building industry can make significant strides toward reducing carbon emissions and transitioning to a more sustainable future.

The Global **ZEB market** is anticipated to grow by over 12 percent between 2022 and 2028. In North America, the market will grow at a compounded annual growth rate (CAGR) of 38 percent, reaching $127 billion by 2035.[10] The growing ZEB market has played a crucial role in reducing the costs associated with energy-efficient technologies, particularly renewable energy sources like wind and solar. Broad and in-depth educational opportunities for design and construction professionals, state actors, homeowners, and other interested parties are necessary to accelerate ZEB growth to support building demands while simultaneously facilitating decarbonization goals. These educational initiatives will enhance understanding and knowledge of ZEBs, enabling their widespread adoption.

States and jurisdictions are encouraged to further develop building energy codes and policies to adequately advance widespread building industry understanding and application of ZEBs.

### ZEB MARKET

Components of the ZEB market in commercial and residential buildings:

**Lighting**: This component focuses on energy-efficient lighting solutions, such as LED technology, to reduce electricity consumption and promote sustainability.

**Heating, Ventilation, and Air Conditioning Systems (HVAC):** This component emphasizes the implementation of energy-efficient HVAC systems, including advanced controls and efficient equipment, to optimize heating and cooling requirements while minimizing energy waste.

**Walls and Roofs**: This component addresses the building envelope's insulation and design to enhance thermal performance, reduce heat loss or gain, and improve overall energy efficiency.

**Others**: This component encompasses additional aspects of zero energy building design and technologies, such as renewable energy systems (solar panels, wind turbines), energy efficient appliances, energy storage solutions, smart building automation, and energy management systems.

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[9] A major renovation (also referred to as a retrofit) refers to a substantial and comprehensive modification of an existing structure that exceeds routine maintenance or minor repairs. It encompasses a wide range of changes, upgrades, or improvements aimed at enhancing the building's functionality, aesthetics, sustainability, energy efficiency, and compliance with building codes and regulations.

[10] Business Research Insights. November 2023. Zero-Energy Building (ZEB) Market Size, Share, Growth, And Industry Analysis, By Type (Lighting, Walls & Roofs, HVAC Systems and Others), By Application (Commercial and Residential), Regional Insights, and Forecast From 2022 To 2030.

# SECTION 1: REGIONAL PROGRESS REPORT

In this section, we will explore the objectives outlined in NEEP's Building Energy Codes for a Carbon Constrained Era report (2017), hereafter referred to as the 2017 Carbon Constrained Era report, and its corresponding recommendations. Following the overview of each recommendation, we will provide updates on the progress made toward implementing these recommendations. This section will highlight advancements and developments related to each recommendation in the region. Additionally, we will introduce new concepts and best practices that have emerged since the report's publication.

The recommendations outlined in the 2017 report were formulated to facilitate carbon reduction and energy savings in new construction and existing buildings. The previous report provided cutting-edge strategic recommendations, accompanied by detailed explanations, best practices, and case studies. Its primary aim was to guide the region toward achieving ZEBs.

The recommendations from the 2017 report focused on two fundamental objectives:

**Objective 1: Advance Code Development to Zero Energy**
**Objective 2: Improve Code Administration, Compliance, and Enforcement**

## Objective 1: Advance Code Development to Zero Energy

Previous recommendations to advance code development toward ZEBs facilitate an incremental market transformation toward high performance buildings by prioritizing improved building energy codes. The 2017 Carbon Constrained Era report recommended the following to advance code development to reach zero energy:

- Establish a zero energy buildings code goal and a strategy that links to carbon reduction goals
- Update base state building energy codes without weakening amendments
- Implement stretch building energy codes

### Previous Recommendation #1: *Establish a Statewide Zero Energy Buildings Code Plan*

States and municipalities should establish statewide ZEB objectives to effectively fulfill their commitments to significant carbon reduction goals. The criteria proposed to achieve long-term carbon reduction goals encompass three key strategies:

- **Dramatically improve energy use efficiency:** This strategy involves implementing measures to enhance the overall efficiency of energy consumption across various sectors, thereby reducing energy waste and optimizing energy performance.
- **Decarbonize the electric grid through renewable power generation:** By transitioning to renewable energy sources for electricity generation, such as wind and solar power, the carbon intensity of the electric grid can be significantly reduced, leading to a cleaner and more sustainable energy supply.

- **Shift end-uses to electricity and utilize lower carbon fuels:** A key aspect of decarbonization involves transitioning as many end-uses as possible to electricity, leveraging its potential as a low carbon energy source. For remaining energy needs, the use of lower carbon fuels can help further minimize greenhouse gas emissions.

The adoption of increasingly efficient building energy codes plays a foundational role in decarbonizing the built environment. Upgrading and implementing updated codes facilitate the integration of energy efficiency programs, practices, and technologies. As mentioned above, many states in the NEEP region have adopted or are adopting the 2021 IECC, which is the latest version available at the time of publication.

In the U.S., the total percentage of electricity generated from renewable sources currently exceeds that of coal power plants; however, petroleum and natural gas remain the largest source of energy (Building Electrification Programs and Best Practices, ACEEE 2022). Renewable energy is anticipated to steadily grow in the coming years. Adding to this landscape, the concept of zero energy codes dovetails with policies like renewable portfolio standards (RPS) and energy efficiency resource standards (EERS). As states advance their climate ambitions, zero energy codes emerge as a pivotal strategy, working in harmony with other policies. These efforts collectively contribute to a comprehensive framework that not only emphasizes renewable energy sources but also underscores the importance of enhancing energy efficiency and reducing carbon emissions. Thirty-one states including D.C. set binding RPS (alternatively known as renewable energy standards, RES) in late 2021. RPS requires electricity suppliers to supply a set share of electricity from carbon-free renewable technologies. All states and municipalities within the NEEP region except West Virginia have established RPS. Similar to RPS, EERS also sets precise, long-term objectives for energy savings to align with state climate goals. EERS requires utilities or non-utility program administrators to achieve these targets by implementing energy efficiency programs for their customers. Depending on the state, the EERS can be applicable to electric utilities, natural gas utilities, or both, and its adoption can occur through legislation or regulation.

The International Code Council (ICC) has committed to develop a zero net energy model code by 2030. The release of the 2021 IECC signified a crucial step in the integration of zero energy principles into building regulations, as it introduced optional zero energy code appendices. The ASHRAE Board of Directors recently reiterated their objective to achieve net zero energy in new buildings by 2030, as outlined in the Building Decarbonization Position Document and the 2020 Vision Statement from 2008. In line with this commitment, ASHRAE aims to enhance the decarbonization elements within its standards, including Standard 90.1. This standard also aims to achieve net zero carbon and net zero energy by 2031.

NEEP conducted a study on energy code compliance attribution for National Grid, which explored how National Grid could claim savings for improving code compliance in newly constructed buildings through attribution programs in Massachusetts and Rhode Island. This study was based on NEEP's report Attributing Building Energy Code Savings to Energy Efficiency Programs.[11] The case study outlined how National Grid's program

[11] Attribution is defined as the determination of the amount of energy savings that should be credited to PA efforts in the code development, adoption, and compliance processes. Code compliance attribution programs often provide funding for education, training, and consensus building to increase the adoption of more progressive energy codes.

administrators (PAs) can be incentivized to support energy code compliance since building energy codes, when enforced and complied with, provide highly cost-effective energy savings opportunities for states and utilities.

## Previous Recommendation #2: *Update the State Building Energy Code Every Three to Five Years*

States are strongly advised to align their building energy codes with the most recent code cycles of the ICC and ASHRAE. Updating state building energy codes to reflect the latest editions of national model building energy codes, such as the 2021 IECC and ASHRAE 90.1-2019, can achieve significant energy and greenhouse gas emissions savings throughout the region. This practice ensures that building efficiency requirements are enhanced, leading to improved health, safety, and welfare of citizens. Both the ICC and ASHRAE standards undergo updates every three years, making it essential for states to stay current with the latest codes.

Key strategies for ensuring a continuously updated code referenced in the 2017 report include:

- Adopt the latest, most efficient national model energy code every three to five years
- Maintain a technical advisory committee to inform updates to the state building energy code
- Avoid state-specific code amendments that decrease the stringency and energy savings of the national model energy code

Most states within the NEEP region adhere to regulatory code update cycles of three years; however, some leading states adhere to more stringent update cycles, while other states have no regulatory code update requirements.

**Figure 7:** ***Code Update Cycles in the NEEP Region***

| STATE CODE DEPARTMENT | CODE UPDATE CYCLE |
|---|---|
| **CT**, Department of Administrative Services – Codes & Standards Committee | As State Building Inspector and the Codes and Standards Committee, from time to time, deem necessary or desirable (Chapter. 541.Sec. 29-252) |
| **DE**, Department of Natural Resources and Environmental Control – Division of Energy and Climate | Every three years (§7602) |
| **ME**, Department of Public Utilities - Bureau of Building Codes and Standards | Either the most recent edition or the edition previous to the most recent edition (Sec.§9722.6) |
| **MD**, Department of Labor, Licensing, and Regulation | After new editions of I-codes become available from ICC, the Department is required to adopt the new codes for the State within 18 months. |
| **MA**, Department of Public Safety – Board of Building Regulations and Standards | After new editions of I-codes become available from ICC, the Department is required to adopt the new codes for the State within 18 months. |

| | |
|---|---|
| **NH**, Department of Public Safety - Building Code Review Board | The board may recommend adoption of a newer version of a code that has been published for at least two years. (Sec. 155-A:10.IV(a)) |
| **NJ**, Department of Community Affairs – Division of Codes and Standards | Every three years |
| **NY**, Department of State – Division of Building Standards and Codes | Code can be revised at any time. The State Fire Prevention and Building Code Council meets at least four times a year to consider revisions to the code. |
| **PA**, Department of Labor and Industry – Review and Advisory Council (RAC) | Can adopt new code three years after its publication (Sec.2.b.3) |
| **RI**, State Building Office – Building Code Commission | The state building code standards committee shall revise the state energy conservation code to comply with this requirement within one year of any update to the International Energy Conservation Code. (§ 4.100.1.5-27.3-23.a.1)<br><br>Specific legislation for the 2024 IECC shall be adopted within three months of its release. (S0855A) |
| **VT**, Department of Public Service | The Commissioner shall ensure that appropriate revisions are made promptly after the issuance of updated standards for residential construction under the IECC. (VSA 30 § 51) |
| **D.C.**, Department of Consumer and Regulatory Affairs – Construction Codes Coordinating Board | Every three years (Chapter 14A. §6–1451.09.d.3) |
| **WV**, State Fire Commission | Any time |

## Suggested Statutory Language

Regional energy efficiency organizations (REEOs) can assist states and municipalities in drafting language for the continual adoption of codes. Here is a simple example of the suggested language:

"The authority having jurisdiction (AHJ) shall be required to consider for adoption, at least every three to five years, the latest edition of the International Energy Conservation Code (IECC), published by the International Code Council (ICC), that has received a positive determination from the U.S. Department of Energy, together with any other energy efficiency provisions and other related building codes that the AHJ concludes are warranted. The statute shall provide that no amendments to the energy conservation code or other building codes shall be adopted that will result in a net increase in energy consumption in buildings without sound, technical justification, and lifetime cost analysis data."

While many states and jurisdictions within the NEEP region have adopted the most recent building energy codes, it is common for opponents to these codes to propose weakening amendments or exemptions. These weakening amendments can arise due to political pressures or other factors. However, weakening amendments create gaps in efficiency, hindering the progress of states and jurisdictions in decarbonizing their building sectors. To address this issue, states and jurisdictions are increasingly prioritizing the adoption of unamended or strengthened energy codes to avoid the shortcomings associated with weakening provisions.

Additionally, the IRA funding for updated building codes as explained above (page 7) encourages the adoption of robust energy codes and incentivizes states and jurisdictions to make substantial progress in energy efficiency and decarbonization efforts.

NEEP is available to provide technical analysis and support to help states and jurisdictions achieve the energy savings of the 2021 IECC and/or ASHRAE 90.1-2019. NEEP also submits public comments to provide technical information regarding weakening amendments that may disqualify states and jurisdictions from IRA funds.

## Previous Recommendation #3: *Implement Stretch Building Energy Codes*

Since 2017, many states within the region have adopted stretch energy codes. These codes, which may be opted into by various jurisdictions in the state, go beyond the energy efficiency requirements of the current national model code and/or the adopted state base building energy code to incentivize high performance buildings and pave the way toward a zero energy built environment. A statewide stretch code should effectively:

- Provide a state-sanctioned building standard for local jurisdictions wishing to adopt a code beyond the baseline state energy code
- Provide architects, engineers, and other building and design professionals with appropriate references
- Synchronize criteria for ratepayer-funded energy efficiency, new construction, and renovations programs

### Stretch Energy Codes in the Region

States in the NEEP region, including D.C., Rhode Island, Maine, and New York, are currently updating their stretch codes. Connecticut is currently developing its stretch energy code. Figure 6 further details the residential and commercial stretch codes in the region.

## Objective 2: Improve Code Administration, Compliance, and Enforcement

Previous recommendations to achieve Objective 2: Improve Code Administration, Compliance, and Enforcement included:

- Expand energy code compliance infrastructure
- Implement electronic permit processing, plan review, inspection, and fee collection systems
- Quantify code compliance
- Allow utility program administrators to claim savings for energy code support activities
- Implement voluntary or mandatory building energy rating or transparency policies

### Previous Recommendation #1: *Expand Energy Code Compliance Infrastructure*

Improving the code enforcement[12] infrastructure is crucial for enhancing energy code compliance and facilitating measurable progress. By expanding the energy code compliance infrastructure, we can strengthen the administration of codes and further improve compliance. Previous recommendations for expanding the energy code compliance infrastructure encompassed the following:

- Utilizing third-party energy specialists to increase compliance
- Establishing an energy code compliance collaborative
- Developing robust training and certification requirements for code inspectors, plan reviewers, and building energy professionals

#### Establish an Energy Code Compliance Collaborative

An energy code compliance collaborative can help ease the burden on state energy offices by bringing together key stakeholders into a collaborative forum to support common interests around energy code adoption and compliance. In several states, collaboratives have already proven successful in creating an open dialogue for ideas and conversation concerning energy codes. The Building Codes Assistance Project (BCAP) and NEEP have helped several states in the Northeast and Mid-Atlantic form code collaboratives, tasked with addressing everything from general code adoption concerns to compliance issues.

#### Develop Robust Training and Certification Requirements for Code Inspectors, Plan Reviewers, and Building Industry Professionals

To expand code compliance infrastructure, municipalities must adequately train and certify building professionals and inspectors. Investments in statewide training programs and training materials allow for the necessary education and training of building professionals, including code officials, architects, engineers, and builders. Many states and municipalities mandate training to ensure compliance with best practices and enforcement of recent energy codes.

[12] Building energy code enforcement refers to the implementation and oversight of regulations that ensure building projects adhere to prescribed energy efficiency requirements. It involves conducting inspections throughout the construction process to verify compliance with energy code standards.

COMcheck software is an easy method for architects, builders, designers, and contractors to determine whether new commercial or high-rise residential buildings, additions, and alterations meet the requirements of the 2021 IECC. COMcheck provides state-specific codes in the NEEP region, including Vermont's code, the New York City Energy Conservation Code, and the New York Stretch Energy Code. COMcheck simplifies compliance for building officials, plan checkers, and inspectors by allowing them to quickly determine if a building project meets the code.

Similarly, REScheck software is a fast and straightforward way for builders, designers, and contractors to determine whether new homes, additions, and alterations meet the requirements of the IECC and state- or jurisdiction-specific energy codes, including the 2017 District of Columbia Energy Conservation Code, 2020 New York City code, and Vermont 2020 code. REScheck also simplifies compliance determinations for building officials, plan checkers, and inspectors by allowing them to quickly determine if a low-rise residence meets the code. In our 2017 report, we highlighted the importance of voluntary programs that promote efficient and sustainable building design. Recently, a notable program called the Residential Energy Services Network (RESNET) Carbon Rating Index has been developed.

## Previous Recommendation #2:
## *Implement Modern Permit Processing and Fee Collection Systems*

The previous recommendation to enhance permit processing and fee collection systems included implementing a fee-for-service structure to allocate dedicated funds for energy code plan review and inspections, as well as investing in information technology to streamline the building permit process.

In our previous report, we featured a case study of New York City's permit processing and fee system, which initially charged $220 per permit. However, in November 2021, the fees were updated to reflect higher costs for alterations to multifamily buildings and projects that change the certificate of occupancy. This adjustment allows the city to receive fair compensation for projects that require more time and effort during the review process, while also providing additional funds for energy code compliance and support.

Furthermore, the New York State Energy Research and Development Authority (NYSERDA) recently issued a request for qualifications to establish a pool of competent third-party support providers. These providers would assist jurisdictions with residential and commercial plan reviews and inspections. Although the program is not currently funded by the state, participating third parties could benefit from cost savings on advertising and client acquisition. To fund this program, as described in our previous report, a state could establish a fee-for-service structure where the fees collected from building permits contribute to funding the database and support services.

In 2020, the global coronavirus pandemic disrupted the normal operations of organizations, necessitating innovative solutions to overcome the challenges it presented. Government buildings suspended or reduced in-person operations, making it difficult to obtain construction permits. In response, several states and jurisdictions implemented temporary or permanent measures to streamline the building permit process. NEEP has developed a resource on online electronic permitting, which includes examples of these initiatives.

### ELECTRONIC PERMITTING REGIONAL OUTLOOK

**Washington, D.C.**

The District of Columbia implemented online permitting and plan review. D.C. has a comprehensive electronic permitting site. The Department of Consumer and Regulatory Affairs (DCRA) offers instant online permitting, called a post card permit, for simple or critical repairs up through certificate of occupancy. Plans, as well as all forms and fees, can be submitted online. A building owner can also apply online for third-party code inspection services from certified vendors. DCRA is currently working on offering online technical assistance for code compliance and green building.

**Maryland**

Maryland adopts statewide codes that then can be adopted by local jurisdictions. The state's web page directs users to each local jurisdiction, which in turn directs users to the specific permit applications. In some cases, such as in Baltimore, plans can be submitted online. In Montgomery County, permits can be accessed online and returned online, and the associated fees can be paid online.

**Rhode Island**

Rhode Island launched online permitting services for three entities: the state fire marshal, the state building commission, and the city of North Smithfield; nine other cities will be online this fall. The building commission and fire marshal offer permits for state-owned and operated buildings, and privately-owned buildings will obtain permits from the website of their respective city. Electronic libraries tracking permit records and building codes will be a valuable resource to the state and utilities and to subsequent building owners in estimating efficiency through codes.

## Previous Recommendation #3:
## *Measure Code Compliance Every Three to Five Years Between Code Updates*

Previous recommendations to measure code compliance every three to five years between code updates included:

- Conducting state code compliance baseline studies and gap analyses
- Reassessing code compliance every three to five years to identify opportunities to focus resources

### Conducting State Code Compliance Baseline Study and Gap Analysis

To improve energy efficiency within the built environment, states must conduct a baseline study to assess energy code compliance. Compliance studies allow policymakers and other stakeholders to identify specific gaps in code knowledge and implementation and additional opportunities to increase compliance.

The DOE has funded numerous field studies involving residential, multifamily, and commercial buildings to evaluate the energy and economic performance of model energy codes and standards. The Energy Efficiency Field Studies assess the energy savings associated with investments in code training and education programs. The study provides a comparison between the baseline assessments and post-study results to assess energy savings (the study phases are further discussed on page 36. The studies conclude that lack of adequate education and training of code officials results in decreased energy savings; likewise, use of training and education programs increased energy savings.

### Reassess Code Compliance Every Three to Five Years to Identify Opportunities to Focus Resources

Code compliance assessments should be performed in alignment with the three-to-five-year code update cycle. Regular code compliance assessment allows for:

- Focusing limited code compliance and enforcement resources into the areas of demonstrated need, thereby generating the largest possible "bang for the buck"
- Using data from actual homes in the next code update cycle (to either demonstrate industry mastery of a code provision that could be pushed further or difficulty in complying with a specific code provision that may be best left as is until compliance improves)
- Refining parameters used by utilities, state energy offices, and others in models used to forecast future load growth and determine the need to invest in additional energy generation capacity
- Modifying input assumptions in energy code savings attribution models in states that allow utilities to claim savings

## Previous Recommendation #4:
## *Allow Utility Program Administrators to Claim Savings for Energy Code Compliance Support Activities*

The 2017 Carbon Constrained Era report recommended that utility program administrators be allowed to attribute savings to their energy code compliance support activities. This recommendation was intended to motivate program administrators to actively contribute to code adoption and enhance compliance by engaging with code officials, builders, developers, contractors, architects, and the market. We explored strategies to collaborate with program administrators and public utility commissions in developing an attribution framework, and to implement and improve the program through compliance studies and code updates.

Since our initial report, NEEP has published a resource, Utilities and Energy Code Compliance, where we discussed opportunities and examples of utility support of code adoption and compliance initiatives. In 2019, TRC Advanced Energy conducted a study on behalf of the California investor-owned utilities to explore the development of an attribution model for energy savings. The study's objective was to create a model that could be implemented in California and other states, providing a broader application for measuring and attributing energy savings.

## Previous Recommendation #5:
## *Implement Voluntary or Mandatory Building Energy Rating or Transparency Policies*

The statewide adoption of increasingly efficient building energy codes directly impacts the construction practices of new buildings, as well as major renovations and additions to existing buildings; however, customers may remain unaware of the energy performance of their properties. Transparent building energy rating programs are essential for consumers to understand the performance levels of properties. Information made available through energy labeling programs increases the demand for energy efficiency within the market and further allows customers to make investments per recent building energy codes (Comparison Information in Energy Efficiency Labeling: Real Estate Listings). Energy labeling practices provide valuable information for real estate professionals, appraisers, contractors, and lenders, further encouraging increased efficiency retrofits and installations within buildings with low energy performance.

In the past few years, several states and jurisdictions in the NEEP region have deployed voluntary and mandatory energy labeling programs, including: Vermont; Maine; Massachusetts; Connecticut; Montgomery County, Maryland; and New York.

# SECTION 2: FUTURE RECOMMENDATIONS TOWARD ZERO ENERGY BUILDINGS

In Section 2, we will offer fresh recommendations in line with our previous objectives: advancing code development to zero energy and improving code administration, compliance, and enforcement. Additionally, we will introduce two new objectives: to support and advance workforce development, and to ensure equitable application across codes. These new objectives will be prioritized in the years ahead to guarantee an equitable and just transition away from fossil fuels.

## Objective 1: Advance Code Development to Zero Energy

### Recommendations:

1. Adopt building energy codes aiming to achieve zero energy buildings
2. Implement and expand new and existing stretch building energy codes
3. Update state building energy codes with strengthening provisions
4. Drive zero energy requirements in the national energy base code development process

One of the most critical strategies to achieving this objective is adopting building energy codes that aim to achieve ZEBs, which sets standards for the entire building industry to follow. Additionally, expanding existing stretch building energy codes and implementing new ones can help ensure that buildings are designed and constructed to be more energy-efficient.

Updating state-building energy codes with stronger provisions is another key strategy in advancing code development to zero energy. By doing so, state governments can set higher energy standards for buildings within their jurisdiction and encourage the building industry to adopt more sustainable practices. Moreover, driving zero energy requirements in the national energy base code development process can help ensure that building codes across the entire country are continually evolving to become more energy-efficient.

Overall, advancing code development to zero energy is critical in achieving a more sustainable and environmentally responsible future. By reducing energy consumption in buildings, we can decrease our carbon footprint and contribute to a healthier planet.

## Recommendation #1:
## *Adopt Building Energy Codes Aiming to Achieve Zero Energy Buildings*

The 2024 IECC Draft provides states and jurisdictions with requirements to achieve zero energy buildings.[13] The 2024 IECC Appendix CD: The 2030 Glide Path outlines a way to achieve zero energy commercial buildings by 2030. The building energy code update will include optional appendices to streamline building decarbonization. The New Buildings Institute (NBI) has readily available model code language as an overlay to the 2021 IECC requirements to decarbonize new and existing buildings. The Building Decarbonization Code focuses on new construction and is also compatible with ASHRAE 90.1; the overlay provides requirements for residential and commercial buildings. The code offers jurisdictions all-electric and mixed-fuel options. Similarly, the Existing Building Decarbonization Code covers both residential and commercial buildings offering both all-electric and mixed fuel pathways. This code advances the measures of efficiency for existing buildings by providing model code language for net zero retrofits.

The DOE ZERH Program and passive house certifications provided by the Passive House Institute (PHI) and by Phius (formerly Passive House Institute U.S.) are examples of advanced building energy standards that can inform states updating energy codes. Requirements can be incorporated into various components of the base energy code, and additionally offered as alternative compliance pathways to the base energy code.

### Zero Energy Ready Homes (ZERH)

The DOE ZERH Program builds upon existing programs and building energy code standards, such as the Environmental Protection Agency (EPA) Indoor AirPlus program and Energy STAR. The high-performance program requires high levels of efficiency that significantly decrease the home's operational energy use. ZERH are designed to be 40-50 percent more efficient than other newly constructed homes that adhere to less stringent building energy code requirements. Certified homes must be fully electric and utilize energy-efficient appliances like HVAC systems, ENERGY STAR-rated smart appliances and fixtures, and high-performance windows. ZERH are designed "ready" to become zero energy homes allowing homeowners the affordability and flexibility of attaining zero energy in the future. ZERH uniquely offers a renewable-ready design that allows renewable energy systems such as solar panels to be easily installed later.

As of January 31, 2023, over 10,000 homes have received a ZERH certification nationally. States within the NEEP region represent over 35 percent of certifications.

| | |
|---|---|
| **Connecticut:** | **485 homes** |
| **Maryland:** | **156 homes** |
| **Delaware:** | **674 homes** |
| **Massachusetts:** | **149 homes** |
| **Rhode Island:** | **38 homes** |
| **Maine:** | **34 homes** |
| **New Jersey:** | **1,260 homes** |
| **Pennsylvania:** | **1,024 homes** |
| **New York:** | **227 homes** |
| **Vermont:** | **85 homes** |
| **New Hampshire:** | **161 homes** |
| **District of Columbia:** | **4 homes** |

[13] The decarbonization glide path is a planned approach to significantly reduce carbon emissions over a set time frame. It involves a gradual shift toward cleaner and sustainable energy sources, technologies, and practices to achieve decarbonization objectives. June 19, 2023. Rossi, Michael.

### Passive House

Passive homes go beyond ZERH by significantly reducing building energy loads. The energy required to heat a passive home is significantly lower than buildings built to less stringent building energy standards. Phius provides climate and building-specific standards to guide the design and construction of passive buildings in North America. The two Phius certification paths, Phius CORE and Phius ZERO, can be applied to new construction, including homes, multifamily buildings, offices, schools, and other projects. Phius CORE REVIVE and Phius ZERO REVIVE apply to existing buildings. Phius projects draw upon ZERH certification requirements as well as other existing programs such as ENERGY STAR and EPA Indoor AirPlus. Phius ZERO projects go beyond Phius CORE by achieving operational carbon neutrality.

States within the NEEP region such as Connecticut, Massachusetts, New York, and Rhode Island, offer existing programs that provide financial incentives for certified PHI or Phius projects. Passive design standards are available as an alternative compliance pathway in the Massachusetts stretch code. This pathway is available for all types of commercial buildings and compliance requires Phius CORE 2021 or Phius ZERO 2021 certification. Alternatively, PHI certification is also available as an alternative compliance pathway. Maine is also currently considering both passive house design standards and DOE ZERH as alternative compliance pathways to their base code.

## *Key Findings: Policies Towards Zero Energy Buildings*

ZEB goals also rely on state policy that outlines decarbonization goals. This legislative language guides state and municipalities in taking the necessary steps when adopting and/or developing building energy codes.

- **Bill 13-22 Comprehensive Building Decarbonization**: Montgomery County in Maryland became the first jurisdiction in the state to pass building decarbonization legislation, Bill 13-22 Comprehensive Building Decarbonization, in late November 2022. The legislation requires the county to issue all electric building standards for new construction by December 31, 2026, priming building energy codes to standardize ZEB in the future and achieve zero GHG emission targets.
- **Council Bill 5-2023**: Climate advocates and residents of Howard County, Maryland, facilitated the legislation of Council Bill 5-2023. Council Bill 5 will require the county executive to identify recommendations necessary to enact all-electric building standards for all new construction, major renovations, and additions.
- **Delaware Code for Energy Conservation:** Delaware is working on a zero-energy-code-ready initiative per the governor's executive order. NEEP is actively advising New Castle County, Delaware, on becoming net zero ready by 2025 for residential buildings and 2030 for commercial buildings, and on other technical provisions using new building codes or ordinances.
- **NJ Zero Energy Buildings Roadmap:** NEEP works with the New Jersey Board of Public Utilities and Rutgers Center for Green Building to coordinate the NJ Zero Energy Buildings Roadmap initiative and is tasked with developing strategies and timelines for achieving building electrification.
- Act on Climate: In 2021, Rhode Island passed the Act on Climate bill, which mandates state carbon reduction goals by 2050. To enforce the net zero targets, in December 2022 the Executive Climate

Change Council (EC4) delivered an update to the 2016 Greenhouse Emissions Reduction Plan to the governor and General Assembly. The 2022 Climate Update includes building electrification and improved building energy code goals to be achieved by 2030. Additionally, the EC4 will release a Climate Strategy in 2025, the following strategy will update every few years and will plan to incrementally reduce to net zero by 2050.

- **Clean Energy D.C. Building Code Act of 2022:** Washington, D.C., has passed the Clean Energy D.C. Building Code Act of 2022. The legislation requires the mayor to issue final regulations by 2026 that require all new construction, major renovations, and additions to be constructed to a net zero energy standard.

## Recommendation #2:
## *Implement and Expand New and Existing Stretch Building Energy Codes*

To achieve greater energy efficiency, states and communities are encouraged to promulgate a voluntary or mandatory "stretch" or "reach" energy code to supplement or overlay their base code. A stretch code is more energy efficient than the state's base energy code. Implementation of a stretch energy code improves market capacities to design and construct buildings with advanced energy efficiency features to support ZEB strategies. The IRA provides federal funding to support state adoption of stretch energy codes geared toward zero energy buildings, including the 2021 IECC net zero appendices. The 2021 IECC Zero Energy appendix is available for both residential and commercial construction. The appendices provide model language to support states and jurisdictions advancing energy and climate goals.

Massachusetts was the first state in the region to adopt an above code stretch in 2009. Since then, the Stretch Energy Code has been significantly updated and sets the precedent for stretch energy codes in the region. The Massachusetts Department of Energy Resources (DOER) stretch code exceeds the requirements of the 2021 IECC, aiming to meet targets set by the Global Warming Solutions Act 2009 (GWSA). The GWSA sets the reduction target for Massachusetts at least 80 percent below the statewide 1990 GHG emission levels by 2050 and a reduction of at least 50 percent by 2030. The updated residential stretch code is effective as of January 1, 2023, and the updated commercial stretch code is effective as of July 2023. The state's Green Communities Division automatically enrolls participating municipalities in the updated stretch (nearly 300 communities are enrolled). Those not participating in the program are required to comply with the base energy code, which will be the 10$^{th}$ Edition of the Building Code (IECC 2021 with strengthening amendments). Additionally, the Massachusetts stretch codes include advanced construction practices such as energy recovery ventilation or heat recovery ventilation, and electric vehicle readiness.

The Massachusetts Opt-In Code, which is a voluntary energy code that is more stringent than the stretch code, requires passive house certifications for all large multifamily buildings over 12,000 square feet while including it as a pathway for all other types. We anticipate that more states will add above code measures such as passive house or Department of Energy Zero Energy Ready Homes (DOE ZERH) as options for code compliance soon, in part due to additional funding from the 45L Tax Credit of the IRA, which provides financial incentives for building above code requirements.

The Zero Energy Homes appendix for residential projects prioritizes energy efficiency alongside renewable energy usage. A building's ERI is measured to ensure the building scores are within the target range. Compliance with the ERI requirements varies based on a given climate zone. A home that meets the required ERI score ensures that the structure meets a high level of energy-efficiency performance. The energy needs of the home are met with on-site or off-site renewable energy generation. The commercial appendix, Zero Energy Commercial Building Provisions, sets carbon-neutral standards for commercial, institutional, and multifamily buildings; the commercial zero energy appendix also requires on-site or off-site renewable energy systems. The adoption of the zero energy appendices to base building energy codes or stretch energy building codes offers clarification and uniformity of zero energy standards amongst builders, contractors, product manufacturers, code officials, and other building professionals. The adoption of the appendix facilitates the transition of the local building industry toward zero energy buildings. In doing so, actors within the industry will be better prepared to expand local ZEB markets to achieve ZEB goals and economic growth. The International Green Construction Code (IgCC) and ASHRAE 90.1-2019 also provide advanced building guidelines to consider in the development of stretch informative appendices.

**International Green Construction Code (IgCC)**

The IgCC is a green overlay code to the ICC's suite of I-Codes, which focuses on a range of sustainability issues that lessen the impact of buildings on the environment. It applies to nonresidential buildings. Within the IgCC energy chapter, performance-based, outcome-based, and energy use intensity-based compliance paths are available. The 2021 IgCC was published in May 2021, and includes the ASHRAE 189.1 2020 Standard, Design of High-Performance Green Buildings Except Low-Rise Residential Buildings. The IgCC also includes provisions that allow for coordination with the IECC or ASHRAE Standard 90.1.

## Recommendation #3:
## *Update State Building Energy Codes with Strengthening Provisions*

Adopting the latest IECC and model energy codes comes with a host of advantages. Updated energy code standards increase energy efficiency requirements, offer more flexible pathways to compliance, and provide clear guidelines in various sections. Additionally, the ICC and other organizations involved in energy efficiency offer a variety of resources including free training and software to help with compliance and enforcement. Strengthening energy codes maximizes energy savings by reducing load demand for utilities and operational costs for owners. States and jurisdictions may consider strengthening measures when updating the building energy code including:

- **Electric Vehicle (EV) Ready:** Requirements for new buildings to be EV ready (infrastructure in place to support EV charging stations).
- **Heat Pumps:** Requiring the installation of heat pumps instead of conventional heating and cooling systems.

- **Home Energy Rating System (HERS)**: Incentives and rebates are offered to homeowners, builders, and developers who achieve lower HERS scores. Incorporating HERS into building energy codes promotes building electrification, like heat pump installation.
- **Renewable Energy:** Requiring renewable energy ready design for later installation of renewable energy.
- **Building Envelope Requirements:** Improving the building envelope, including insulation, air sealing, and exterior walls, roof, windows, and doors, to reduce energy consumption by reducing air leakage and minimizing thermal bridging, while incorporating appropriate ventilation.
- **Energy Efficient Appliances and Fixtures:** Requirements for all energy-efficient appliances rated by ENERGY STAR.

### Model Code Compliance Pathways

Model code compliance pathways develop flexible approaches for demonstrating compliance with the code (prescriptive options, outcome-based/performance-based codes). The 2021 IECC provides compliance pathways for residential and commercial buildings:

- The Prescriptive pathway is available for residential (R401.2.1) and commercial buildings (C401.2.1); this pathway involves following a predefined list of measures outlined in the code to meet compliance requirements. It lists specific measures that must be achieved to comply with the energy code.
- The Total Building Performance pathway for residential (R401.2.2) and commercial (C401.2.1) is found in Section R405 of the residential IECC and Section C407 of the commercial IECC. This pathway considers multiple aspects of the building, including the building envelope, mechanical systems, water heating, lighting, and additional efficiency requirements. It takes a comprehensive approach to evaluate the overall performance of the building and ensure energy code compliance.
- The Energy Rating Index Path (R401.2.3) is an alternative pathway to compliance outlined in Section R406 of the code. It involves using an energy rating index (ERI), such as the Home Energy Rating System (HERS) in accordance with RESNET/ANSI/ICC 301. This pathway allows for a comprehensive assessment of the building's energy performance, providing an index that indicates the energy efficiency level. Compliance can be achieved by meeting the specified requirements of the energy rating index.

#### *Alternative Compliance Paths Considered in the 2024 IECC*

The 2024 IECC draft, which is currently under development, includes prescriptive and performance-based pathways based on existing alternative compliance paths provided in the 2021 IECC. The Simulated Performance pathway for residential (R405) enhances the energy savings required beyond the reference design by crediting efficiency and duct location for HVAC systems and domestic hot water systems. The ERI pathway (R406) was adjusted to allow for more flexibility in compliance. ERI values were updated in consideration of the allowance of on-site renewable energy sources.

The HVAC Total System Performance Ratio (C409) section of the commercial code introduces a computer-based model that evaluates the overall performance of the HVAC system. Instead of analyzing individual components separately, this approach considers the entire system design, including equipment efficiency, insulation,

design loads, and other factors. By taking a holistic view, this method provides a better understanding of the effectiveness of the HVAC system and its potential for energy efficiency.

Both the residential and commercial sections of the 2024 IECC will implement a point-based credit system for additional efficiency measures. The updated code requires a specific number of energy efficiency "credits" for compliance. In the commercial section (C406), the updated version offers a wider range of eligible efficiency measures, allowing builders more flexibility and tradeoff options in their design choices. Similarly, the residential section (R408) provides building and design professionals with increased choice and flexibility in meeting code requirements. The potential efficiency measures include improvements in insulation, windows, HVAC systems, water heating, air sealing, ventilation, and ductwork options.

***Alternative Compliance Pathways in ASHRAE 90.1***

ASHRAE Standard 90.1-2019 for commercial buildings provides alternative compliance paths. Here are a few examples of alternative compliance paths available in ASHRAE 90.1-2019:

- **Performance Rating Method:** This path allows for a performance-based approach to compliance, where the energy performance of the building is evaluated and compared to a baseline reference building. The building must demonstrate that it performs equal to or better than the baseline in terms of energy consumption.
- **Energy Cost Budget Method:** This method sets a maximum allowable energy cost budget for the building, which is determined based on the building characteristics and occupancy. The building's design must ensure that the calculated energy costs do not exceed the allowable budget.
- **Appendix G Performance Rating Method:** This appendix provides a detailed methodology for evaluating the energy performance of buildings using computer simulation software. It allows for a more detailed and customized analysis of the building's energy performance compared to the baseline requirements.

For residential buildings, ASHRAE provides separate standards and guidelines. The most referenced standard for residential energy efficiency is ASHRAE Standard 90.2, which focuses on energy efficiency requirements for low-rise residential buildings. ASHRAE Standard 90.2 does not typically provide alternative compliance paths like those found in ASHRAE Standard 90.1.

## Model Code Language for Existing Buildings

Given that existing buildings represent the largest portion of the built environment, they contribute significantly to overall building activity within the industry. The prevalence of outdated technology and construction methods in existing buildings, compared to newer buildings constructed according to more recent energy codes, contributes to greenhouse gas emissions.

Chapter 5 of the IECC establishes standards for existing buildings to maintain or improve energy usage when buildings undergo renovations or alterations. The standards proposed in the Public Comment Draft #2 for the Residential 2024 IECC increase compliance stringency compared to the 2021 IECC. Additions and alterations to existing buildings must meet additional efficiency credit requirements outlined in Sections R502.2.5 (for additions) and R503.1.5 (for alterations).

NBI released the Building Decarbonization Code in August 2021 as an overlay to the 2021 code. Subsequently, in September 2022, NBI introduced the Existing Building Decarbonization Code to complement its decarbonization framework. The model language for existing buildings encompasses both residential and commercial construction and provides pathways for all-electric and mixed-fuel energy use.

## Recommendation #4:
## *Drive Zero Energy Requirements in the National Energy Base Code Development Process*

To drive efficiency in the national code development process, NEEP previously recommended the engagement of state employees with the ICC. By participating in the national model code update periods, states and jurisdictions can improve code administration and application, expanding code application to existing buildings and the adoption and compliance of the most recent national model codes.

The adoption process for the most recent national model code, the 2024 IECC, differs from previous iterations of the code development process. In 2021, the ICC Board of Directors voted to shift from a codes process to a standards process. Instead of ICC governmental members voting, Residential and Commercial Consensus Committees develop the content for inclusion in the 2024 IECC. These committees, which include industry experts and code officials from different sectors who follow American National Standards Institute (ANSI) development procedures and others outlined by the ICC, consider proposals received in an open call for 2024 IECC proposals.

To drive efficiency in the national model update process, NEEP recommends:

- Developing flexible approaches for demonstrating compliance with the code (prescriptive options, outcome-based/performance-based codes)
- Developing code change proposal(s) for the IEBC and IECC focused on increasing the usability of the codes for existing building energy use

The implementation of zero energy requirements in the national building energy base code requires a comprehensive approach that considers various aspects of building design and construction such as energy efficiency measures, education and training, renewable energy systems, and building materials. The IECC establishes an ambitious goal of achieving a ZEB base code by 2030, aligning with broader climate and energy policy objectives. The 2024 IECC Draft will provide states and jurisdictions with requirements to achieve zero energy buildings. The 2024 IECC will additionally offer decarbonization glide paths that achieve zero energy buildings by 2030. The 2024 building energy code will include optional appendices to streamline building decarbonization, such as:

## Residential[14]

- **Appendix RE, All-Electric Residential Buildings**, is an optional code that requires new residential construction to be all-electric with no use of combustion equipment.
- **Appendix RI, On-Site Renewable Energy Systems**, mandates the installation of on-site renewable energy systems, with a minimum capacity of 2 kW for single-family residences and townhouses, or 0.75 watts per square foot multiplied by the gross conditioned floor area for commercial properties. It offers additional instructions for the simulated building performance method found in Section R405 and necessitates that the Energy Rating Index (ERI) in Section R406 includes the energy generated from on-site power production.
- **Appendix RC, Zero Net Energy Residential Buildings**, provides provisions to achieve zero net energy consumption over a year. The provisions require buildings to meet a specific ERI threshold before renewable energy use and a score of 0 following the adjustment of energy source to renewable energy power.

## Commercial[15]

- **Appendix CC, Updated Provisions for Zero Energy Commercial Buildings**, originally introduced in the 2021 IECC, this appendix has undergone revisions to impose more rigorous requirements for renewable energy systems. The update includes an expanded table encompassing various building types. Moreover, the units of measurement have shifted from one thousand British thermal units (kBtu) to kilowatt hours (kWh).
- **Appendix CD, The 2030 Efficiency Path**, introduced in the 2024 IECC, this fresh appendix serves the purpose of progressively enhancing efficiency measures to assist states in achieving their emissions reduction objectives by 2030. It stipulates a 1.4-fold increase in efficiency credits compared to the prescriptive compliance standards. Additionally, it mandates a two percent reduction in the percentage of annual energy costs used in the standard reference design for total building performance compliance. Furthermore, it calls for the installation of extra on-site or off-site renewable electricity systems beyond the previous requirements for energy efficiency credits compliance.
- **Appendix CG, Guidelines for All-Electric Commercial Buildings**, this newly added appendix in the 2024 IECC provides guidance for both new and existing commercial buildings, facilitating their transition to an all-electric infrastructure.
- **Appendix CH, Preparing for Electric-Ready Commercial Buildings**, also introduced in the 2024 IECC, this appendix furnishes guidance for new and existing commercial structures to prepare for an electric-based setup.

[14] NEEP. What's in the Residential Draft of the 2024 IECC?, 2024.

[15] NEEP. What's in the Commercial Draft of the 2024 IECC?, 2024.

The 2024 IECC builds on the prior efficiency measures of the 2021 IECC, averaging an 8 percent increase in efficiency requirements per cycle since 2006, and a 40 percent increase in efficiency compared to 2006 standards. The IECC is regularly evaluated to ensure that every three-year code update cycle maintains relevance with the latest technologies and best practices that facilitate zero energy requirements, for example:

- Requiring and incentivizing the use of renewable energy systems, such as solar PV, wind, and geothermal energy.
- Incorporating grid-scale energy storage systems into building design to reduce peak demand and allow the use of intermittent renewable energy sources.
- Promoting sustainable building practices to reduce the carbon footprint of buildings, encouraging or requiring the use of low carbon building materials including recycled, natural, and locally sourced materials.
- Increasing stringency of minimum requirements for building envelope, lighting, heating, ventilation, and air conditioning systems to reduce energy waste.
- Including adequate sizing and maintenance requirements to prevent oversized equipment and underperforming systems.
- Considering water conservation requirements for low-flow fixtures and appliances, such as requiring EPA WaterSense labeled products.
- Including comprehensive decarbonization requirements for existing multifamily and commercial buildings.

Education and training for building professionals including engineers, architects, contractors, builders, and code officials is imperative to ensure that the skills and knowledge required to construct, design, maintain and assess zero energy buildings are prevalent amongst the new and existing building workforce. The Code Council plans to publish resources to provide communities with technical and policy resources alongside IECC updates. The resources will address various components of the code update including:

- Electric vehicle charging for all building types
- Electrification and decarbonization
- Zero energy and zero carbon
- Grid interactivity/efficiency
- Performance standards for existing buildings
- Enhancing energy savings through water efficiency and reuse
- Integration of on-site renewable energy generation and energy storage to realize greenhouse gas reduction and resilience goals

***Disclaimer*****:** *The information presented in this document is subject to change based on public comments and further committee updates. A final draft of the 2024 IECC is expected to be published in late 2023.*

## Objective 2: Improve Code Administration, Compliance, and Enforcement

### Recommendations:

1. Expand energy code compliance capacity
2. Support and advance use of electronic permit processing, plan review, inspection, and fee collection
3. Quantify code compliance
4. Allow utility program administrators to claim savings for energy support activities
5. Implement mandatory building energy rating or transparency policies

This objective aims to promote ZEBs through a suite of approaches that improve the functioning of infrastructure within state energy departments. To achieve this objective, several measures can be taken.

One approach is to expand the capacity for energy code compliance. This could involve expanding the resources available to building code officials and inspectors, such as providing additional training, hiring more staff, or implementing innovative methods to improve compliance monitoring such as circuit riders.[16] By doing so, code officials will be more likely to accurately enforce and assess building energy codes. Another strategy to advance the infrastructure for energy code compliance is to advance the use of digital technologies for permit processing, plan review, inspection, and fee collection. This could include electronic plan reviews, remote inspections, and online fee payments. By utilizing digital tools, the building permit process can be streamlined, making it more efficient for all parties involved.

To identify areas where improvements are needed, it is essential to quantify code compliance. This could be achieved by conducting audits, tracking compliance rates, and providing feedback to building owners and operators. By measuring and reporting compliance with energy codes, it is possible to identify areas where improvements are needed and ensure that energy codes are being followed. Incentivizing energy efficiency measures is another approach that can be taken to promote energy efficiency in buildings. One way to do this is to allow utility program administrators to claim savings resulting from their energy support activities. By incentivizing energy-efficient building upgrades and retrofits, building owners and operators will be more likely to invest in energy-saving measures.

Finally, implementing mandatory building energy rating or transparency policies could provide building owners and operators with information on their building's energy performance. Building energy ratings incentivize individuals to invest in energy-saving measures and promote energy efficiency in buildings. By requiring the disclosure of building energy performance through energy rating or transparency policies, building owners and operators will be more conscious of their building's energy usage, leading to increased energy efficiency in the building market. Additionally, providing incentives or financial support can further encourage building owners to adopt energy-saving measures and make improvements that contribute to overall energy efficiency.

[16] Circuit riders, in the context of building energy codes, are individuals or teams who provide technical assistance and support to jurisdictions, builders, contractors, and code officials to improve compliance with energy codes.

## Recommendation #1:
## *Expand Energy Code Compliance Capacity*

Energy code compliance is assessed by a project's ability to meet all applicable requirements specified in the building energy code. To expand the capacity for compliance, states and jurisdictions must identify existing barriers to compliance.

NEEP encourages states to conduct statewide compliance assessments to identify potential gaps and opportunities to improve compliance. Conducting compliance studies in coordination with energy code adoption cycles allows states to identify trends in code enforcement and address common areas of noncompliance.

Common areas of noncompliance may include:

- Whole building airtightness testing results
- Wall insulation
- Ceiling insulation
- Slab insulation
- Duct leakage[17]

Conducting compliance studies enables code departments to identify specific areas of low compliance and develop targeted interventions to address them. One example might include developing or improving workforce training programs to address shortcomings in enforcement. Additionally, code departments will be able to administer compliance support programs, such as energy code ambassadors, circuit riders, working groups, and other approaches that leverage established professional networks and organizations in the building community to bridge gaps in code compliance.

### Third-Party Inspection Agencies

A significant challenge to achieving compliance in code enforcement is the shortage of staff in code departments due to many longtime code inspectors retiring. A reduction in the number of personnel available for inspections, combined with a growing demand for inspections, has led to lower rates of inspection and an increased likelihood of errors in compliance assessments.

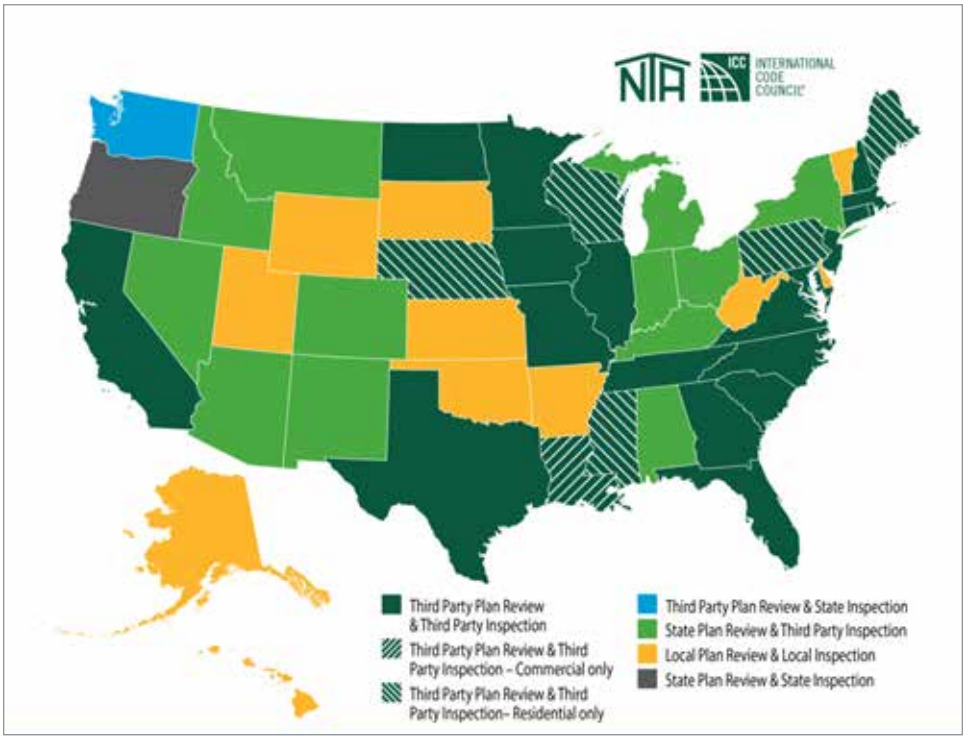
[17] Duct leakage refers to the unintended loss of conditioned air from HVAC ductwork. Building energy codes typically set limits on allowable duct leakage to improve energy efficiency, indoor comfort, and reduce energy waste. Effective duct sealing helps maintain indoor temperature, lowers energy consumption, and minimizes greenhouse gas emissions.

### THE CODE OFFICIAL SHIFT CHANGE

A 2014 National Institute of Building Sciences study found that over 80 percent of code officials expected to retire by 2029, and more than 30 percent planned to do so by 2019. Such a massive exodus of public safety professionals could have a particularly serious impact on smaller jurisdictions since more than half of the respondents worked in departments of nine or fewer employees. Rhode Island, the smallest state in the country, is already feeling the effects of this shortage, as a lack of new building officials has forced the state to share some code officials part-time across multiple towns. While the position of code official is one that will require some modernization to attract the next generation of code officials and meet the needs of future building departments, third-party energy specialists can help to stem the tide of code official retirement in the face of increasingly complex energy codes.

Third-party inspection agencies (TPIAs) are companies that provide inspection services subject to the oversight of the authority having jurisdiction (AHJ). TPIAs are especially valuable to states that may be experiencing limited resources, such as limited staff and the need to cover large geographic areas. While this addendum focuses on energy-related inspections, TPIAs can perform structural, mechanical, and fire protection inspections as well.

**Figure 8:** ***State Regulation of Third-Party Inspection, International Code Council, NTA*** *As of January 2022*




Under the discretion of the AHJs, TPIAs can conduct inspections at locations beyond the geographical area of the AHJ. Compliance is assessed in accordance with the building codes of the actual building site. Seventy-five percent of states require the use of third-party inspectors for some off-site construction projects. A third-party inspector can perform in-factory inspections of the fabricated components according to AHJ requirements. TPIAs are also required to verify Phius and ZERH projects.

### Technical Advisory Groups

NEEP facilitates technical advisory groups (TAGs) or collaboratives to maintain well-informed building energy code adoptions and updates. TAGs and collaboratives are comprised of design professionals, builders and contractors, code officials, state and local officials, and other key stakeholders. The TAG provides guidance on technical questions related to code adoption, efficiency, and compliance. NEEP currently facilitates and assists the following TAGs as they develop and advance code adoption:

- Massachusetts Net Zero Building Coalition
- Maine Energy Code Collaborative
- New Jersey Energy Code Collaborative
- Building Performance Standards Working Group (includes Boston, D.C., and NYC)
- Prefabricated Buildings and Remote Virtual Inspections TAG

## Recommendation #2:
## *Support and Advance Use of lectronic Permit Processing, Plan Review, Inspection, and Fee Collection*

By instituting virtual permitting and inspection processes, cities and states can support code compliance more effectively and efficiently.

The benefits of virtual permitting and inspections processes include:

- Reduced permitting time
- Improved customer service and staff efficiency
- Enhanced quality of service
- Operational savings
- Inter- and intradepartmental communication and management
- Coordination with private and public entities that provide construction services (utilities, alarm services, renewable providers)
- Electronic recordkeeping
- Transparency
- Efficient inspection scheduling
- Reliable fee collection
- Enhanced use of online compliance software

### Remote Virtual Inspections (RVI)

Remote Virtual Inspections (RVI) utilize technology to allow inspectors or certified TPIAs to conduct inspections while not being physically present at the inspection site. Inspectors attend the inspection remotely and instruct contractors/homeowners on how to deploy the technology so that the inspectors can observe the site. RVI also allow jurisdictions to encourage and monitor off-site construction practices, which can, in turn, cut costs to homeowners, builders, and jurisdictions using on-site construction and inspections.

The use of RVI allows jurisdictions to save time and money otherwise spent on in-person inspections, such as the costs, time, and energy use attributed to the transportation of inspectors to and from the building site. Builders also benefit from the time savings of RVI, because it facilitates coordination and allows for inspection of various areas in a building, such as wall cavities, before they are sealed off. RVI can streamline the scheduling process and help to avoid costly delays.

**RVI IN PRACTICE**

The City of North Las Vegas piloted its remote virtual inspection program in response to ongoing Covid-19 concerns, and modeled after a similar program in Tucson, AZ. In 12 weeks from March to June 2020, the city of North Las Vegas was able to perform 11,500 inspections and has since expanded its RVI program.

### Remotely

NEEP, ClearlyEnergy, and Signetron have developed a virtual audit tool, Remotely, in part supported by NYSERDA. Remotely is an iPhone app that uses augmented reality spatial measurements of windows and finished areas to collect residential energy audit data. Homeowners and energy professionals can generate a preliminary Home Energy Score and view personalized recommendations for home energy improvements.

## Recommendation #3: *Quantify Code Compliance*

Some of the primary challenges with code compliance evaluation studies are that they are state-specific, conducted infrequently, and intended to meet short-term needs. There is no uniform, consistently used design for compliance studies or the presentation of the data collected. Comparing compliance rates between states and longitudinally, over time, requires developing standard methods for collecting, analyzing, and reporting data. States and jurisdictions should also establish and maintain joint working groups between interested stakeholders to better quantify code compliance and additionally encourage improvements to code compliance. Regularly scheduled compliance studies are strongly encouraged to monitor changes in state code compliance over time, to reassess code enforcement efforts, and to gauge the effectiveness of implemented policies and programs.

The U.S. Department of Energy's Building Energy Codes Program (DOE BECP) conducted a study designed to identify energy savings. The Energy Efficiency Field Studies offer valuable research methods that can assist states in analyzing the impact of their residential and commercial building energy codes. The multistate field research study consists of three parts:

1. **Pre-Study:** A baseline field study to identify energy use in typical single-family residential buildings in each state and opportunities for improving energy efficiency.
2. **Education and Training:** Education, training, and outreach programs targeting compliance gaps identified in the baseline study.
3. **Post-Study:** A follow-up field study to identify the change in energy use following the application of education and training programs. These studies demonstrated that targeted workforce training significantly improves compliance. The DOE recommended that states that have not conducted a

baseline study do so and that states that have already completed a baseline study update their field studies every three to five years.

In 2023, NEEP received funding from the DOE through Section 40511 of the Bipartisan Infrastructure Law to conduct compliance studies and training in Pennsylvania and Delaware. With this funding, NEEP will update the initial DOE baseline study for Pennsylvania and set a new baseline for Delaware.

In addition to using the data collection methodology designed by the DOE, the project team will conduct an equity study and gather additional information to advance equitable distribution of resources. Partners will collect demographic information of project sites, including population density; community demographics; and code official, HERS/HES rater, and contractor demographics, while maintaining confidentiality. NEEP will use the data to develop cross-state outreach and a targeted training roadmap to increase energy efficiency implementation and code compliance.

Based on the data collected, NEEP will identify any geographic areas in which compliance is lacking, which will inform data-driven state-led outreach and training targeted to disadvantaged communities. NEEP anticipates this will lead to reduced energy burden, improving the health of building occupants and leading to greater resiliency within the community. The project team will also seek out minority-serving institutions, community colleges, and other community-based organizations to perform aspects of the studies, such as data collection. These organizations will provide paid internships to promote these groups' inclusion in the work and provide workforce exposure.

### Building Energy Analysis Manager (BEAM)

The Building Energy Analysis Manager (BEAM) is a database and communication platform for building energy data developed by NEEP and ClearlyEnergy. BEAM streamlines the administration of building policies such as benchmarking and building performance standards (BPS) by bundling automatic compliance tracking with integrated customer relationship management (CRM) and communication tools together.

BEAM expands on the Department of Energy's Standard Energy Efficiency Data (SEED) platform by adding the ability to automate compliance tracking for benchmarking and building performance standards. BEAM can integrate with ENERGY STAR Portfolio Manager and other energy reporting and audit tools like BuildingSync and Audit Template to automatically pull data into the database. Integrated communication tools allow program administrators to easily communicate with various groups of building owners and a Helpdesk facilitates engagement with the public. New functionality is being developed that will add forward looking energy/carbon modeling to help building owners plan out improvements to comply with building performance standards. Read more about BEAM on its website.

## Recommendation #4:
## *Allow Utility Program Administrators to Claim Savings for Energy Support Activities*

Utilities play a crucial role in enhancing code compliance and enforcement rates through their energy efficiency program portfolios. Utility program administrators (PAs) and other energy efficiency program administrators can work as partners to support building energy code adoption, compliance, and enforcement. Energy and cost savings can be directly attributed to utility-run programs, allowing utilities to meet performance incentives and energy-saving goals.

Some of the key questions in involving PAs in code support activities include:

- What energy-savings goals do PAs have?
- How are savings goals met?
- How are savings from energy codes tracked and measured?
- What incentives or other mechanisms are used to encourage PAs to achieve their savings goals?
- How can energy savings be used for activities supporting energy codes?

Through evaluation and program design, utility-run programs can work with states and local governments to incentivize electrification and other energy-efficiency measures.

Existing programs across the NEEP region are detailed in Utilities and Energy Code Compliance; the following resource offers insight on how states can align interests between utilities and energy codes and achieve substantial energy savings.

**Figure 9: Energy-Savings Programs in the NEEP Region**

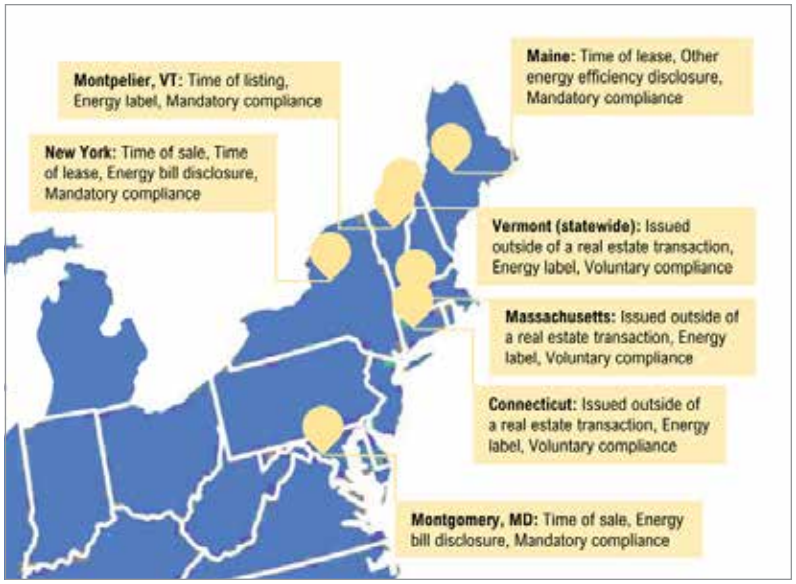
| | |
|---|---|
| CT | Energize Connecticut |
| D.C. | D.C. Sustainable Energy Utility |
| DE | Energize Delaware |
| MA | Mass Save |
| MD | EmPower Maryland |
| ME | Efficiency Maine |
| NH | NH Saves |

| | |
|---|---|
| NJ | Clean Energy Program |
| NY | NYSERDA |
| PA | Act 129 |
| RI | Rhode Island Energy: Energy Saving Programs |
| VT | Efficiency Vermont |
| WV | Appalachian Power: Take Charge West Virginia |

## Recommendation #5:
## I*mplement Mandatory Building Energy Rating or Transparency Policies*

States should introduce programs that utilize building energy ratings to provide necessary information on the market value of building energy efficiency. Eventually, voluntary programs must transition to mandatory energy labeling policies. Energy labeling programs and policies lead to higher market demand and potentially

higher value for buildings built in line with recent energy codes. Findings from a discrete choice experiment, Comparison Information in Energy Efficiency Labeling: Real Estate Listings, show that consumers are likely to choose more efficient options when presented with energy labeling information. The data reveals that homebuyers are willing to pay more for a home that features greater energy efficiency, as depicted by energy labels.



Home Energy Labeling, Naseo

### Home Energy Labeling Information eXchange (HELIX)

Home Energy Labeling Information eXchange (HELIX) facilitates energy data in a single portal available to NEEP's state partners. Historically the information has been made available through the real estate market through auto-population of home energy labels (e.g., DOE Home Energy Score, RESNET HERS) and solar PV data in Multiple Listing Services and other real estate portals, such as Trulia or Zillow. Since 2022, NEEP has been exploring expanded uses in program tracking and related areas.

States and cities can use HELIX to manage voluntary and mandatory home energy labeling programs. The Energy Estimator is a companion tool to HELIX, developed by NEEP and ClearlyEnergy. The Energy Estimator is an automated energy modeling (AEM) tool. The AEM tool overlays HELIX by incorporating energy labels, certifications, and solar PV data with information from publicly available tax assessor databases to generate a customizable home energy label. The tool provides a breakdown of annual energy costs for homeowners or energy professionals. They may use the tool to make cost estimates based on utility bill data and information on in-home assets through a virtual audit.

In Vermont, the city of Montpelier has implemented an energy labeling ordinance that utilizes Vermont Home Energy Profile (VHEP) supported by HELIX, requiring certain buildings to display energy labels that provide information on their energy efficiency performance. The tool is utilized to calculate and generate these labels, allowing building owners and occupants to easily understand and compare energy performance.

## Objective 3: Appliance Standards

Appliance standards are a powerful tool available to states in a carbon constrained era—and one that NEEP did not discuss in the 2017 report. There are federal minimum standards for energy and water efficiency for many appliances, and many NEEP states have stepped in to adopt their own standards where no federal standards exist. The intent of these standards is to produce monetary and energy savings on a wide range of common everyday use appliances, like water heaters, for residential and commercial building owners.

## Recommendation #1:
## *Prioritize and Promote the Adoption of Appliance Standards*

Several states in the NEEP region, including Massachusetts, Maine, Maryland, New Jersey, New York, Rhode Island, and Washington, D.C., have recently adopted new appliance standards or updated existing ones, and others, including Connecticut, New Hampshire, and Vermont have existing standards set prior to 2020. Appliance standards have been described as "the best energy and climate policy you've never heard of" because they are the second-best ranked energy-saving tool in the United States.

Appliance standards present a massive opportunity for carbon reduction because they are set behind the scenes and apply to only the worst performing products on the market. Their adoption benefits the public because they save homeowners money on their energy bills, and as more states adopt standards, they provide consistency for manufacturers. States that have adopted appliance standards can also develop and implement programs like existing energy code compliance attribution programs so that regulated utilities can receive credit for these energy savings as well. States without adopted standards can use the potential savings from appliance standards attribution programs to encourage future adoption.

According to the U.S. Department of Energy: "As a result of [appliance] standards, American consumers saved 63 billion USD on their utility bills in 2015 alone. By 2030, cumulative operating cost savings from all standards in effect since 1987 will reach nearly 2 trillion USD. Products covered by standards represent about 90% of home energy use, 60% of commercial building use, and 30% of industrial energy use."

NEEP manages the State Appliance Standards Database (SASD) and tracks which states in the region have policies relating to energy- and water-efficiency standards. SASD is a publicly accessible tool identifying certified products which meet efficiency standards for states. SASD is designed as a "one-stop shop" for state appliance standards and is an important tool to support compliance with state standards. With more than 40,000 products currently listed as compliant in these states, SASD has grown to be recognized across industries as *the location* for certification and compliance with state standards. As of August 2023, Massachusetts, New Jersey, New York, and Rhode Island have signed onto SASD and are currently listing products.

### EQUIPMENT EMISSION STANDARDS

Equipment Emission Standards mark a significant shift in the market for residential and commercial water heaters and furnaces relying on fossil fuels or methane combustion. These standards impose requirements for reducing air emissions, compelling manufacturers and users to adopt cleaner heating options. This regulation sets specific and mandatory deadlines, leveraging an established regulatory framework and transitioning environmental agencies from overseeing industries and power plants to regulating the manufacturers of pollutant-emitting appliances.

## Objective 4: Support and Advance Workforce Development

Objective 4 focuses on addressing the challenges stemming from a concurrent wave of retirements among experienced code officials and the growing demand for their services. To effectively tackle these challenges, states and jurisdictions should adopt comprehensive workforce development strategies. These strategies may encompass additional funding for training programs designed for code enforcement, targeting both new and seasoned code officials. Furthermore, forming new partnerships with organizations specializing in training and building science can aid in cultivating the requisite skills and knowledge. This approach ensures a well-prepared workforce capable of enforcing building codes and safeguarding building safety and sustainability.

In addition to training, it is crucial that states address the need to attract new candidates into the local energy-efficiency workforce. One effective approach involves establishing tailored and accessible career pathways and educational initiatives to enable individuals to acquire the skills required for this sector. This encompasses comprehensive training in critical areas such as energy-efficient design, thorough building performance evaluation, and additional sustainable building practices. States may need to provide additional supports, beyond technical training, to representatives from historically disadvantaged communities. This could encompass offering guidance in crafting resumes, enhancing financial literacy, preparing candidates for interviews, providing instruction for successful navigation of professional settings, guiding individuals in accessing available resources, and more.

Finally, it is important to support the transition of fossil fuel workers into alternative career paths in the clean energy sector. This could involve providing training programs that help these workers acquire the skills and knowledge needed to work in renewable energy industries, such as solar or wind energy.

Our current workforce will not be sufficient to achieve our energy and climate goals. States must address the need for more workers to effectively reach these objectives. By prioritizing equitable workforce development, recruiting new candidates into the energy-efficiency sector, and facilitating the transition of fossil fuel workers to renewable energy careers, we can build a skilled, diverse workforce that can address the challenges of the future.

### Recommendations:

1. Strengthen state and jurisdictional workforce resources by coordinating and aligning programs for a more effective code enforcement approach
2. Support a local community-based workforce through training, accessible career pathways, and inclusive training and education programs
3. Support the transition of workers from fossil fuel industries into renewable energy and building decarbonization sectors aligned with the economic shift toward clean energy practices

## Recommendation #1:
## *Strengthen State and Jurisdictional Workforce Resources by Coordinating and Aligning Programs for a More Effective Code Enforcement Approach*

Workforce development programs ensure the ability of building professionals to adequately assess code compliance. To understand the needs of the workforce, states must analyze the landscape of existing workforce resources, conduct surveys to understand workforce needs, and assess gaps in compliance. The Building Codes Assistance Program survey in 2018 found that while over 80 percent of code officials receive training at least once per year, all code officials reported the desire for additional educational opportunities. Recently code officials, contractors, and other building code professionals have expressed the desire for additional educational opportunities and support training in the use of compliance software to enforce current and future code updates.

States and jurisdictions should utilize existing educational and training resources. The ICC Major Jurisdictions Committee facilitates the compilation of lessons learned around the nation through the regular publication of the Best Practices Guide. Additionally, the ICC offers numerous resources and training free of cost via the ICC Training webpage.

### Total Building Performance (TBP)

NEEP, together with the Building Performance Institute (BPI), Energy Futures Group (EFG), and the Building Performance Association (BPA), is developing a nationally recognized certificate of knowledge to train and identify people who have a knowledge of multi-measure whole home retrofit projects. The Total Building Performance (TBP) certificate is for experienced and novice-level retrofit contractors. The BPI program prepares individuals for the management and execution of whole-building retrofits to maximize residential energy savings. Participants can access training materials at no cost from the NEEP website. After completing the TBP coursework, participants can obtain the TBP certificate upon successful completion of the course exam. The TBP certificate certifies that workers:

- Demonstrate proficiency in designing and building a decarbonization project
- Understand project financial analysis for a building decarbonization project
- Understand energy modeling, load calculations, and measure analysis for a building decarbonization project
- Understand building science and whole building concepts
- Understand project carbon impacts
- Identify electrification/decarbonization technologies
- Understand the post-retrofit process

Existing training and educational resources may be underutilized due to a lack of awareness and lack of access. Lack of access may be due to factors such as offering training during times and in locations that make it impossible for the target audience to participate. States should enhance their outreach and communication by developing collaborative partnerships with grassroots organizations to effectively address underutilization of existing training and educational resources. This collaborative approach also involves aligning programs and resources strategically to meet workforce needs.

States or jurisdictions should establish training committees that oversee the development and application of energy code training curriculum and programs to support code enforcement. The committees should include:

- A representative body including code officials, local inspectors, workforce representatives and other building professionals to support the internal and external goals of the committee
- The authority to develop, update, and maintain training materials and resources that best support workforce development and education
- Development of quarterly and annual plans to best support changes to building energy codes and efficiency measures
- Identification of the needs of the workforce through program development and implementation
- Strategies to increase the dissemination and accessibility of available resources

**Massachusetts Code Training Resources**

The stretch code update in Massachusetts is supported by the Mass Save® Energy Code Technical Support Program. The program sponsors free training on the updated stretch code, on the new residential stretch code, and existing buildings for code officials, builders, and architects.

The ICC Learning Center caters to various career paths and beginner and advanced levels of understanding and application. Certification of candidates who will perform commercial and residential plan review/inspections is available through the ICC's certification programs and testing.

Building departments, design professionals, builders, and other building professionals can take advantage of existing training tools. The Better Buildings Workforce Guidelines are national guidelines developed by the DOE, National Institute of Building Sciences, and industry stakeholders to provide high-quality and nationally recognized training and certification programs. Four commercial building workforce credentials for key energy-related jobs—building energy auditor, building commissioning professional, building operations professional, and energy managers—are available.

### Federal Funding

The IRA allocates $200 million administered by DOE to the Home Energy Efficiency Contractor Training Grant. The program provides funding to state energy offices for the implementation of contractor training programs. State energy offices may partner with a nonprofit organization to "provide training and education to contractors involved in the installation of home energy efficiency and electrification improvements." Grant funds may also be used to decrease costs associated with training and implement testing and certifications that complement contractor training programs. Funds are available until September 30th, 2031, and the application is currently open to states.

## Recommendation #2:
## *Support a Local Community-Based Workforce Through Training and Education Programs and Accessible Career Pathways*

States need to develop long-term solutions to expand the energy efficiency workforce if they are to meet their aggressive decarbonization goals. Access points to the energy efficiency sector, including pathways like entry-level roles and internships, are notably constrained. Additionally, these career trajectories are often specialized and not widely integrated into mainstream opportunities, resulting in limited accessibility for disadvantaged communities.

Historically, states and jurisdictions have employed a narrow approach to attract code officials. However, the pressing need to rapidly expand the code official workforce necessitates a shift away from relying solely on the existing, shrinking pool of professionals. To address this challenge, states and jurisdictions must invest in accessible career pathways that not only foster diversity but also offer entry points into essential career tracks. Focusing on diversity will address several critical issues—it will provide access to additional potential candidates in a tight market, and hiring code officials who more closely resemble the demographics of their communities may provide better access to buildings in areas that have historically suffered from low code compliance.

To address the lack of diversity prevalent within the existing energy efficiency workforce, states and jurisdictions must identify barriers and opportunities to expand a diverse workforce. Some key strategies states and jurisdictions should consider include:

- **Integrating code-specific curriculum** within K-12 school districts, such as, elective courses, dual enrollment options, STEM and STEAM programs, after-school programs, and additional programs, courses, or other opportunities that engage younger populations.
    - Partnering with nonprofits, universities, students, and other key stakeholders to develop and implement building energy curriculum in local community and public colleges. A comprehensive curriculum will effectively guide undergraduate students to post-graduate employment opportunities.
    - Promoting and expanding entry-level and internship positions.
    - Developing comprehensive educational programs and certifications that lead to entry-level positions. Educational pathways toward energy professions should cater to all legal age groups that meet a level of baseline requirements.
- **Developing accessible programs** across states or jurisdictions. Accessible programs will:
    - Invest in outreach to reach underserved communities and school districts.
    - Invest in supplementary funds and scholarships for interested participants to ease the participation of individuals as needed.
    - Allow for self-paced program completion and offer technical support and/or guidance through mentorship programs and other educational opportunities such as conferences, webinars, hands-on study and application, career day booths, presentations from local energy professionals.
    - Collaborate with local community centers, libraries, and other hubs used by the local community to develop and disseminate opportunities.

### Strategies to Promote Accessibility and Inclusivity in the Workforce

If states seek merely to provide technical training to expand the energy efficiency workforce, without providing additional supports for groups historically not represented in the field, they will fail on two fronts—they will not attract the large number of employees needed to support the sector, and the sector will not represent the diversity of the communities it serves. Some of the measures that states should consider in addition to technical training include:

- **Investing in wrap-around services,** which play a pivotal role in mitigating obstacles that extend beyond job requisites, such as addressing challenges related to childcare, securing a driver's license or transportation options, and ensuring stable housing.
- **Allocating funds for on-the-job training and certifications,** which serves to counterbalance the initial financial burdens associated with entering the field, while concurrently expanding opportunities for workers to transition into these roles. This financial support also facilitates the growth of small businesses by enabling them to enhance their workforce with well-trained professionals.
- **Collaborating with community organizations,** which serves as a strategic approach for program administrators to effectively promote these opportunities, orchestrate seamless coordination of programs and benefits from diverse sources, and provide avenues for mentorships and professional development within the field.
- **Establishing clearly delineated career pathways** with well-defined progression steps, which empowers trainees to seamlessly transition from entry-level positions to long-term careers in the energy-efficiency domain. Drawing inspiration from the Green Buildings Career Map can serve as a foundation for designing such pathways.
- **Enabling pathways for formerly incarcerated individuals** with a record of nonviolent criminal offenses to join the workforce, which can help fill gaps in the workforce and provide a path for rehabilitation.

The Office of Manufacturing and Energy Supply Chains and the Office of State and Community Engagement Programs of the DOE have announced the Industrial Assessment Center Program (IAC) Expansion & Building Training Assessment Center (BTAC) program funding opportunity. Applications are available for $45 million to $54 million to expand Industrial Assessment Centers (IACs) to trade schools, community colleges, and union training programs. Up to $9 million is available to develop a new Building Training Assessment Center (BTAC) Program. The IACs will focus on training the workforce into high-quality clean energy jobs, IACs will also provide hands-on support to small and medium manufacturers. The BTAC will allow students and trainees to conduct energy efficiency assessments and upgrades to improve building efficiency measures and performance of commercial and institutional buildings. The programs will provide services in historically underserved communities in accordance with the Justice40 Initiative. The Justice40 Initiative is a federal program designed to address disparities in disadvantaged communities by ensuring that 40 percent of the benefits from federal investments in clean energy and environmental programs are allocated to these communities. It aims to promote environmental justice and empower marginalized communities by directing resources toward their specific needs and challenges.

### ReMaine Clean Energy Internship Program

The ReMaine Clean Energy Internship Program provides an entry point to clean energy jobs throughout the state and focuses on diversity in the search for qualified participants. The program is led by NEEP and is funded by the Maine Governor's Energy Office; it includes several partners with roots in the community and expertise in recruiting diverse candidates, including "new Mainers" settling in the state from other countries. The program will support 32 interns across two cohorts and will subsidize 50 percent of wages from $18 to $22 an hour for a total of 240 hours.

The job types that the program aims to fill include:

- Weatherization technicians
- Heat pump installers
- Energy consultants
- Community solar positions
- Mechanical, electrical, and firmware engineers
- Energy policy analysts

## *Recommendation #3: Support the Transition of Workers from Fossil Fuel Industries into Renewable Energy and Building Decarbonization Sectors Aligned with the Economic Shift Toward Clean Energy Practices*

The United States Energy and Employment Report provides an overview of trends within the energy sector; employment in the U.S. energy sector in renewable energy and energy efficiency are areas of major job growth. In contrast, the fuel sector, specifically coal fuel and petroleum, has experienced a decrease from 2020-2021. Across all energy sectors, 10 percent of workers are represented by a union or project labor agreement, and 6 percent are represented in the private sector.

Labor unions, which have long represented low-income workers, are essential in supporting a just transition from careers in fossil fuel to clean energy. The future expansion of the net zero building market will further expand jobs in energy efficiency and renewable energy; consequently, jobs within the fossil fuel sector will be decreasingly in demand. Labor unions allow for opportunities for workers in the energy sector by providing support and representation for workers in the workplace. Labor unions often maintain training and apprenticeship programs that can serve as valuable resources for workforce development initiatives seeking to train the clean energy workforce. States and jurisdictions can collaborate with labor unions to tap into their established structures and networks, facilitating the development of effective workforce programs. This approach requires intentional strategies for retraining and recruiting individuals within the energy sector.

Moreover, it is essential for states and jurisdictions to establish and ensure equitable access to a robust education and training infrastructure that supports the growth of the clean energy sector. This includes developing programs that equip individuals with the necessary skills and knowledge to pursue and excel in clean

energy careers while addressing any existing disparities in access to education and training opportunities. To accomplish this, states can leverage existing economic development programs such as the Appalachian Regional Commission's (ARC) Partnerships for Opportunity and Workforce Economic Revitalization (POWER) Initiative or the Economic Development Administration's (EDA) Assistance to Coal Communities (ACC) program.

## Objective 5: Equity Across Codes

Objective 5 aims to promote equity across building codes by ensuring that all communities, regardless of income or socio-economic status, have access to safe, secure, and energy-efficient housing.[18] It is essential for state energy offices to actively engage with community members in a meaningful way regarding energy-efficiency planning and application. This could include organizing workshops to educate community members about the benefits of energy efficiency and how to apply these principles in their own homes. Such engagement enables community members to make informed decisions about their energy usage and comprehend the impacts of energy efficiency. Furthermore, states should actively involve community members in the development of policies and programs to advance building decarbonization goals equitably and address the energy burden.

Finally, it is crucial for policymakers and state energy offices to consider the effects of code inequity, particularly on underserved and energy-burdened communities. This entails conducting a thorough analysis of how building codes and standards affect different communities and taking steps to rectify any existing inequities. Promoting equity across building codes is paramount to ensuring that all communities have access to safe, secure, and energy-efficient housing.

### Recommendations:

1. Expand access to energy-efficient housing for low-income communities through state and federal programs
2. Meaningfully engage community members around energy-efficiency planning and application
3. Consider the impacts of code inequity, particularly on underserved and energy burdened communities

### Recommendation #1:
### *Expand Access to Energy-Efficient Housing for Low-Income Communities Through State and Federal Programs*

States can expand access to resilient housing for low-income communities through a combination of different strategies and programs, including:

- **Weatherization Programs**: These programs aim to help low-income households reduce their energy bills by improving the home's energy efficiency. Weatherization measures include insulation, air leakage

[18] "Equity is the fair distribution of benefits and burdens from energy production and consumption. It differs from equality because it accounts for context and historical causes of current inequalities. In practice, equity ensures everyone is given equal opportunity to thrive, which may mean that resources are divided and shared unequally." NEEP. Centering Equity with Metrics, p. 2. 2022.

sealing, and heating and cooling system upgrades. These programs may be funded by federal and state grants, utility programs, and nonprofit organizations.

- **Connecticut Weatherization Assistance Program (WAP):** The WAP aids low-income individuals in reducing energy costs and fuel consumption by enhancing home energy efficiency. This includes conducting energy audits to identify necessary weatherization improvements like heating system maintenance, air sealing, insulation, and safety inspections. The program covers expenses for energy-saving enhancements for households with incomes up to 60 percent of the state median income.

- **Provide Targeted Tax Incentives and Credits for Affordable Housing**: Encourage developers and investors to construct energy-efficient and resilient housing in underserved communities by offering tax incentives.
  - **Qualified Allocation Plan (QAP)**: A QAP is a document used by state housing finance agencies to allocate low-income housing tax credits to developers. The QAP can be directed to prioritize energy-efficient housing projects and encourage developers to incorporate green building practices into the design and construction of projects.
  - **Low-Income Housing Tax Credit (LIHTC)**: LIHTC is a federal program that incentivizes developers and investors to create affordable housing for low-income individuals and families. It provides tax credits to finance the construction or rehabilitation of housing units, ensuring affordability and economic diversity within communities. LIHTC can be leveraged to promote resilient housing by incorporating disaster-resistant features, energy efficiency, and sustainability measures in these affordable housing developments.
  - **Community Development Block Grant (CDBG):** The CDBG, a longstanding initiative under the U.S. Department of Housing and Urban Development, allocates financial resources to support community development efforts at the local level. Its primary objective is to facilitate development of affordable housing, initiatives aimed at poverty alleviation, and the development of essential infrastructure. In this context, CDBG plays a significant role in expanding access to energy-efficient homes for low-income communities, as it aligns with the broader mission of enhancing the living conditions and socio-economic well-being of these underserved populations.

- **Implement Inclusionary Zoning Regulations** that require developers to include affordable housing units within new projects and/or make contributions to a housing trust fund as a requirement.
  - **Moderately Priced Dwelling Units (MPDUs):** The MPDU program in Montgomery County, Maryland, requires that developers allocate approximately 15 percent of the units in their new projects for households earning less than two-thirds of the local area's median income.

- **IRA Provisions**: The IRA includes $4.3 billion in direct consumer rebates for whole-home upgrades that deliver 20 percent to 35 percent energy savings in homes. Low- and middle-income (LMI) households (earning at or below 80 percent of the local median income) can receive rebates ranging from $4,000 to $8,000 per household for efficiency improvements.

- Affordable housing buildings that undergo whole-building retrofits targeting water and energy efficiency and climate resilience may receive up to $1 billion in upgrades such as water and energy efficiency and climate resilience.
- The IRA is providing $145 million in federal funds to connect tribal communities to the grid and upgrade tribal homes to zero emission energy systems.

A comprehensive and coordinated approach that expands on these strategies and programs can help expand access to resilient and energy-efficient housing for low-income communities.

## Recommendation #2:
## *Meaningfully Engage Community Members Around Energy-Efficiency Development and Application*

Actively seeking out and including the voices of historically marginalized community members during the planning stages is integral to an inclusive approach. States and jurisdictions should avoid inadvertently excluding communities from participating in code development. Common barriers include limited outreach and communication, or publication of English-only resources, leaving community members unaware of opportunities for public participation and input. Scarce resources and tight timelines restrict involvement, particularly for marginalized groups such as language-isolated, low-income, and communities with high proportions of people of color or environmental justice (EJ) designations. Moreover, a lack of transparent decision-making and feedback mechanisms deters community engagement, leaving community members feeling unheard and excluded. States must consistently identify and address these barriers to promote equity in code development processes. Collaborating with local community organizations to engage community members can amplify the effectiveness of outreach efforts. These organizations possess valuable insights into the unique needs and concerns of the community, and their involvement can ensure that information about energy efficiency is conveyed in ways that are culturally appropriate and engaging. Furthermore, actively incorporating community feedback into the planning process is a core component of equitable engagement. Community meetings, surveys, and other forms of outreach should be tailored to engage diverse communities and successfully provide channels through which community concerns and ideas can be heard and integrated into energy efficiency plans.

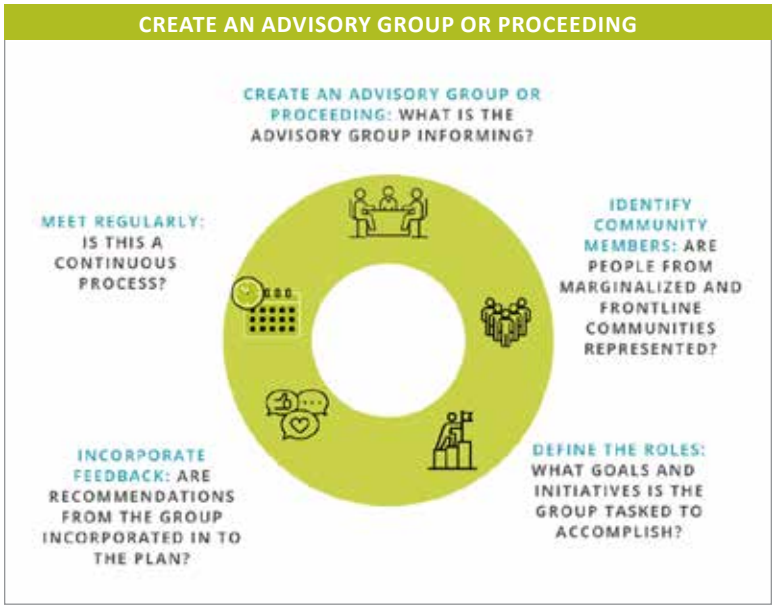
### Spectrum of Community Engagement to Ownership

The Spectrum of Community Engagement to Ownership, developed by Rosa Gonzalez, underscores the significance of community empowerment in shaping the energy landscape. The spectrum outlines a continuum of community engagement, from ignoring the needs of the community to deferring to those needs, and highlights activities that typically characterize each stage toward ownership.

As communities move along the spectrum, they transition from being mere recipients of energy policies, subject to the established energy landscape, to becoming active participants and co-creators of energy solutions and decisions, shaping the energy landscape. This transition allows for the resulting codes to not only meet technical necessities but to also embody the various viewpoints and goals of those they directly impact.

### Equity Advisory Groups

Equity advisory groups can be valuable resources in creating a process for meaningful stakeholder engagement. These groups are decision-making entities composed of representatives from marginalized and underserved communities. They play a pivotal role in assisting policymakers and program administrators to understand and integrate equity metrics vital to communities historically marginalized or excluded. They serve as deliberate platforms where communities actively participate and collaborate to champion equitable energy efficiency policies and initiatives.




### Community Action Planning for Energy Efficiency (CAPEE)

The Community Action Planning for Energy Efficiency (CAPEE) tool is a resource designed to assist organizations and communities in climate mitigation and energy efficiency planning. The CAPEE tool includes a module that supports the facilitation of meaningful community engagement around climate and energy issues. The module provides guidance to organizations on identifying accessible methods of community engagement including communication strategies, marketing, and programming events to maximize outreach and visibility. The module aims to promote an inclusive decision-making process that involves all members of the community, particularly those from underserved and marginalized populations. Centering equity throughout the engagement process ensures that all voices are heard when shaping the future of climate and energy initiatives.

## Recommendation #3:
## *Consider Impacts of Code Inequity, Particularly on Underserved and/or Energy-Burdened Communities*

Inequitable application of building energy codes disproportionately affects marginalized communities, subjecting them to unsafe and hazardous living conditions, inflating utility bills, and adding other hardships. Inequitable enforcement can compound systemic inequity, given that people of color often experience lower-quality living conditions due to a combination of historical discrimination, economic disparities, biased housing practices, environmental injustices, and unequal investment, for instance:

**Historical Discrimination**: In the United States, historically, people of color have endured systemic discrimination, including racial segregation, redlining, and biased housing policies. These practices forced minority communities into areas with restricted access to resources and quality housing.

**Socio-economic Disparities**: People of color in the United States frequently confront economic disparities, marked by lower income and limited access to education and employment opportunities. These disparities can pose challenges when it comes to affording secure and resilient housing. According to the report Racial Inequality in the United States by the U.S. Department of the Treasury, there is ample evidence of racial disparities in income and economic opportunities. For instance, the report highlights that Black and Hispanic households tend to have lower income levels compared to White households, and they face higher unemployment rates.19 These earnings differences have changed little since 1970 and are one of the primary contributors to the persistence of the racial wealth gap.

Moreover, disparities in rural areas, such as limited economic opportunities and the delayed adoption of updated building energy codes, result in less energy-efficient housing stock, which can perpetuate housing-related inequalities.

**Discriminatory Practices**: Discriminatory practices in housing markets, such as racial steering, biased lending like redlining and predatory loans, and landlord discrimination, severely restrict the housing options available to people of color and expose them to substandard living conditions. A notable investigation by Newsday from 2016 to 2018 delved into Long Island's real estate market, engaging 25 testers who interacted with 93 real estate agents from 12 major firms responsible for over half of the area's property sales. This investigation revealed alarming disparities, with Black testers experiencing differential treatment in 49 percent of cases, Hispanic testers in 39 percent, and Asian testers in 19 percent. Moreover, these discriminatory lending practices can indirectly steer marginalized communities into neighborhoods with older, less energy-efficient housing stock due to historical neglect and disinvestment, contributing to increased energy consumption and environmental impact in already disadvantaged communities.

**Environmental Injustice:** Discriminatory laws and policies have for decades located polluting industries near low-income communities of color, often resulting in subsidized and affordable housing near hazardous Superfund sites.20 In 2022, statistics revealed that Black Americans were 75 percent more likely to reside near waste-producing facilities or within fenceline communities21 than the average American. This longstanding pattern of environmental discrimination has led to increased exposure to health hazards and diminished living conditions for these communities (Housing Matters, 2022).

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[19] Black and Hispanic individuals in the United States continue to experience significantly lower income levels compared to White and Asian individuals. In 2020, the median household income for Black and Hispanic workers was approximately $46,000 and $55,500, respectively, while White and Asian households had median incomes of $75,000 and $95,000. These earnings differences have changed little since 1970 and are one of the primary contributors to the persistence of the racial wealth gap. U.S. Department of Treasury. Racial Inequality in the United States. July 2022.

[20] Superfund sites are specific locations in the United States that have been officially recognized as heavily polluted with hazardous substances. The federal government has designated these sites for cleanup and environmental restoration efforts under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It's crucial to understand that Superfund sites carry substantial health and environmental hazards due to the presence of harmful chemicals and pollutants. These areas are typically linked to previous industrial or commercial activities that have left behind dangerous waste materials. "U.S. Department of Housing and Urban Development (HUD) owns, operates, or subsidizes 18,158 properties located within one mile of Superfund sites. The majority of HUD tenants are households of color." Taylor, Amaya. 2022. "Millions of Americans Live Near Toxic Waste Sites: How Does This Affect Their Health?" Housing Matters.

[21] Fenceline communities are situated in close proximity to industrial facilities, refineries, power plants, and other sources of pollution. This proximity exposes residents to higher levels of air and water pollution, as well as potential health risks associated with toxic emissions. Climate Reality Project. "Frontline and Fenceline Communities."

Due to systemic inequity in housing for certain populations, improvements in building energy codes are likely to benefit those of higher socio-economic status, who do not live in low-income housing. Low-income housing may consist of existing buildings that meet lower standards of building efficiency, health, and resiliency due to their age. This disparity in housing quality affects marginalized communities, particularly people of color, who have historically faced systemic discrimination, socio-economic disparities, biased housing practices, and environmental injustices. Building energy code inequity can impact various groups:

- **Low-income Communities**: Low-income individuals may dwell in older homes and/or rental properties that do not conform to current building energy codes. Consequently, low-income communities may encounter inequitable utility rate design decisions[22] and a diminished level of comfort within their living environments. Financial constraints faced by low-income homeowners prevent necessary building improvements and can complicate compliance with the latest building energy codes.
- **Rural Communities**: In rural areas, there tends to be a greater prevalence of older residential structures predating the establishment of contemporary energy-efficiency benchmarks. Consequently, individuals residing in these rural areas may encounter disparities in energy code compliance, irrespective of their income status. These discrepancies can result from the outdated construction practices employed in these older homes, leading to suboptimal energy performance and associated challenges.
- **Renters**: Tenants frequently possess limited influence over the energy-efficiency attributes of their leased dwelling units. Key determinants such as landlord choices, the age of the property, and the specifics outlined in rental agreements can collectively prevent renters from accessing the benefits of new, more stringent energy codes. Renters consequently often face living in non-code-compliant homes. It is important that states and jurisdictions provide incentives that prevent a landlord from passing on the cost of energy-efficiency improvements to renters.
- **Elderly and Vulnerable Populations**: Elders who opt to age in place may live in older, outdated structures that have not kept up with current energy standards. Others may face similar challenges to those outlined for renters, above. These communities may already be more vulnerable than the population at large to the health and safety risks resulting from compliance with outdated building energy codes.
- **Nonprofit and Community Facilities**, which include institutions like schools, community centers, or religious organizations, have often been subject to disparities in energy code compliance.

Due to discriminatory practices and policies in the past and current underinvestment, marginalized communities, particularly those comprised of people of color, are often relegated to areas with limited access to resources and quality housing. As a result, many nonprofit and community facilities serving these communities may be in older, underinvested neighborhoods with buildings that do not meet modern energy-efficiency standards.

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[22] Utility rate design decisions, typically established by regulatory authorities, can exacerbate inequities. Fixed charges, for instance, impose a uniform fee on all customers regardless of their energy usage, disproportionately burdening those with lower incomes. Similarly, time-of-use rates and residential demand charges, which impose higher costs during specific periods or based on demand, can prove challenging for households that lack flexibility in their energy consumption patterns.

Wealthier individuals who have access to newer construction and can benefit from updated building energy codes are more likely to enjoy better living conditions with improved energy efficiency, comfort, and overall safety. Meanwhile, marginalized communities subject to built environments often lacking proper insulation, modern HVAC systems, and energy-efficient features, are subject to inflated utility bills, hazardous living conditions, structures that are less resilient to the impacts of climate change, and increased exposure to health hazards.

Addressing these disparities in building energy codes and in enforcement can help reduce the inequalities in housing quality and energy efficiency, ultimately benefiting marginalized communities who have historically been disadvantaged in housing-related matters.

### Energy Equity Impact Analysis

State energy offices must recognize that their residents are not equally equipped to benefit from newly adopted energy codes without further intervention on their part. To prioritize equity, state energy offices must acknowledge and rectify initial disparities. This entails recognizing past injustices, involving the voices of those most impacted by historical decisions, and proactively ensuring that the advantages of building decarbonization and development are accessible to all residents. To drive change, policymakers should revise their approach to program design and implementation and work toward eliminating institutional biases. Restorative justice and transformative justice both provide useful frameworks through which policymakers can begin to address institutional biases.

Restorative justice centers the questions of "What harm has been done to the community or individual(s), who or what is responsible, and in what way can the responsible party repair the harm done?" Restorative justice focuses on identifying the harm and requiring accountability that restores trust to those harmed. Transformative justice delves further into the identified harm by understanding its root causes and the systemic and social structures that contribute or perpetuate said harm. Transformative justice goes beyond restorative justice by centering the needs of the community by addressing the root causes of harm to enable systemic change and prevent future harm.

The Moriah Group Equity Impact Analysis fact sheet offers explicit guidelines that incorporate principles from both restorative justice and transformative justice. These guidelines might provide a useful framework to state energy offices in centering equity.

The guidelines are designed to comprehensively address issues related to racial equity[23] and disparities. Step 1 involves understanding the issues by examining racial/ethnic groups in the affected area to identify whether

[23] Racial equity is the condition that will be achieved when one's racial identity no longer statistically predicts how one fares. To achieve racial equity, we must address both the root causes of inequities and their manifestations. This includes eliminating policies, practices, attitudes, and cultural messages that reinforce differential outcomes by race. Racial Equity Tools. Racial Equity Tools Glossary.

disproportionality[24] indicates a racial or ethnic disparity[25] in the policy or service. This includes analyzing the racial and ethnic composition of the general population, the inherent risk or need of demographic groups for the program or service, and the racial and ethnic composition of program participants. Step 2 delves into the causes of disparities by identifying root causes and factors contributing to or perpetuating these inequities. It also involves consulting with affected communities for insights and context. Step 3 focuses on the purpose and impact of the policy, defining intended outcomes and assessing effects on people of color while considering community involvement. Step 4 addresses the practical aspects of policy implementation, considering strategies, risks, feasibility, and available resources. Lastly, Step 5 emphasizes accountability and evaluation, ensuring transparency, stakeholder involvement, and ongoing data collection for policy effectiveness assessment. These steps collectively provide a framework for addressing racial equity and disparities within policies and programs.

This equity-focused approach requires acknowledging past injustices, involving marginalized communities, and proactively ensuring that the benefits of building decarbonization and development reach all residents. Restorative and transformative justice approaches provide frameworks to address harm, accountability, and systemic change effectively. The Moriah Group Equity Impact Analysis offers practical guidelines that incorporate these principles. These guidelines could provide a useful framework to state officials in their quest to address energy inequity, as they offer a holistic approach to address existing disparities and to ensure that their policies contribute to a more equitable and sustainable future for all communities, regardless of their historical disadvantages.

## Conclusion

There has been noteworthy progress in advancing energy codes since our initial Building Energy Codes for a Carbon Constrained Era report was published in 2017. This new addendum highlights the opportunities presented to states through the BIL and IRA, which provide an unprecedented level of federal funding for energy code compliance and adoption. This report plays a crucial role in supporting states and jurisdictions in their efforts toward decarbonizing their built environment, and it equips them with updates on regional progress, best practices, and actionable objectives and recommendations.

Section 1 of this report provides a brief progress update on the advancement of our previous objectives and recommendations. This section highlights which states have adopted or updated their base and stretch codes and discusses innovative ways to increase code compliance and enforcement.

In Section 2, we provide new recommendations that align with our previous objectives and add three: appliance standards, supporting and advancing workforce development, and equitable application across codes. These new objectives need to be prioritized in the years ahead if we want to ensure an equitable and just transition away from fossil fuels. The new objectives highlight important aspects of advancing energy codes that will be a key

[24] Disproportionality is "when the share of a racial/ethnic group in a program or service is high or low relative to the share of the group's representation in the general population."Moriah Group. DISPARITY VS. DISPROPORTIONALITY. Racial Equity in Advocacy, Fact Sheet #4.

[25] Disparity is a situation where, despite all factors being equal, including need, eligibility, and preferences, one group consistently experiences worse outcomes or treatment compared to another group.

part of the conversation moving forward.

## *Key Findings*

### Base Code

States in the NEEP region lead the way in implementing the latest model energy codes as the base code. Most states in the region have adopted or are in the process of adopting the 2021 IECC for residential and/or commercial, or ASHRAE 90.1-2019 for commercial.

- 2021 IECC (as of the publication date of this resource): Connecticut, Maryland, and New Jersey
- In process: 2024 IECC (not yet published): New York, Rhode Island
- 2021 IECC: District of Columbia, Delaware, Massachusetts, Maine, Pennsylvania, Vermont
- 2018 IECC: New Hampshire
- 2015 IECC: West Virginia

### Stretch Code

The following NEEP states/jurisdictions have based stretch codes on the 2021 IECC, International Green Construction Code (IgCC), U.S. DOE Zero Energy Ready Home (ZERH), Passive House, Home Energy Rating System (HERS), and other standards:

- District of Columbia, Maryland, Massachusetts, Maine, New York, Rhode Island, Vermont
- In process: Connecticut

### Zero Energy Code

Jurisdictions within the NEEP region have been exploring ways to incorporate zero energy.

- The District of Columbia's net zero pathway is Appendix Z, part of the 2017 D.C. Construction Code. Legislation passed unanimously by the D.C. Council in July 2022 requires that by 2026, all new buildings and substantial renovations in D.C. must be net zero.
- Massachusetts has included residential and commercial zero energy pathways in the Municipal Opt-in Specialized Stretch Energy Code. These pathways require either a Phius ZERO certification or a maximum value under the Home Energy Rating System (HERS) Index. The pathways under the Specialized code are designed to ensure new construction that is consistent with a net-zero Massachusetts economy in 2050.
- Delaware is working on a zero-energy-code-ready initiative per the governor's executive order. NEEP is actively advising New Castle County, Delaware, on becoming net zero ready by 2025 for residential buildings and 2030 for commercial buildings, and on other technical provisions using new building codes or ordinances.
- In New Jersey, NEEP works with the NJ Board of Public Utilities and Rutgers Center for Green Building to coordinate the NJ Zero Energy Buildings Roadmap initiative and is tasked with developing strategies and timelines for achieving building electrification.

Our hope is that this addendum will create a path forward with a new set of goals to work toward in our efforts

to decarbonize our built environment. The next 10 years will be a critical time to mitigate the worst impacts of climate change, and buildings present a massive opportunity for emissions reductions. Energy codes can spark immediate change by advancing energy efficiency, while also saving money and protecting the health and safety of building occupants. Looking ahead, we anticipate that more states and jurisdictions will adopt net zero energy codes and will be prepared for this transition by exceeding the goals outlined in this report.