Energy Code Triggers for Existing Buildings

Introduction

As states advance their commitments to building decarbonization and electrification, it is important to reevaluate our perception of existing buildings and their corresponding energy consumption. Building energy codes can be used as regulatory instruments that define the minimum standards and prerequisites for achieving energy efficiency in new building design, construction, and operation. This, in turn, can lead to reduced energy consumption, resulting in lower operational costs for building occupants and owners.[1] Beyond financial benefits, the overarching goal of energy codes is to enhance indoor health and safety, prioritizing the well-being of individuals and communities.

The benefits of energy codes apply predominantly to new construction. Existing buildings, many of which were constructed[2] before the building energy code was introduced in 1975,[3] often lack adequate insulation, and in many cases rely on inefficient insulation materials such as newspapers. This lack of adequate insulation makes energy efficiency enhancements a pressing challenge. Additions, alterations, and repairs may trigger localized improvements in the building energy code, while unaltered portions of the building are not subject to the same energy code compliance requirements.[4] Although these triggers offer opportunities for gradual enhancements, they fall short of addressing the full potential of energy efficiency retrofits for existing buildings. A comprehensive retrofit strategy that goes beyond these triggers, encompassing deep retrofits and addressing the building as a whole system, can unlock the full potential for energy savings in existing buildings.

This brief presents several potential avenues to stimulate increased retrofit activity in existing buildings, thereby fostering greater energy savings. The resource can be a valuable tool to state energy offices and utilities looking to explore additional retrofit triggers to improve existing buildings. This exploration serves as a starting point for further dialogue on encouraging and supporting comprehensive retrofits to enhance energy efficiency. While recognizing the importance of energy efficiency enhancements, it is critical to acknowledge that retrofit projects may incur higher costs and cost-effective solutions should be considered, especially for low-income communities.

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[1] U.S. Department of Energy, Saving Energy and Money with Building Energy Codes in the United States, Published December 2016. Available at https://www.energy.gov/eere/buildings/articles/building-energy-codes-fact-sheet#:~:text=Building%20energy%20codes%20have%20a,by%20U.S.%20homes%20and%20businesses.

[2] As of 2021, the largest share of the housing stock in the United States was constructed between 1975 and 1979. See more at: https://www.statista.com/statistics/377830/number-of-houses-built-usa/.

[3] See, History of Model Energy Code Improvements: https://public.tableau.com/app/profile/doebecp/viz/HistoricalModelEnergyCodeImprovement/CombinedHistoricalCodeImprovement_1.

[4] See, 2021 International Energy Conservation Code (IECC), Section R503.1 *"Alterations to any building or structure shall comply with the requirements of the code for new construction, without requiring the unaltered portions of the existing building or building system to comply with this code."*

Exploring Triggers for Enhanced Efficiency in Existing Buildings

Model Code Provisions for Building Alterations

Energy codes traditionally incorporate mandatory prescriptive measures that can be used to demonstrate compliance, along with performance-based compliance options. The 2021 International Energy Conservation Code (IECC) introduced additional efficiency measures, with a stipulation that one such measure must be selected to fulfill an additional efficiency requirement. Chapter 5 of the 2024 IECC draft[5] requires existing buildings to maintain or improve energy usage when undergoing renovations or alterations. In this context, repair includes actions like reconstruction, replacement, or renewal aimed at maintaining the building or addressing damage, while addition refers to expanding the floor area, number of stories, or height of a building or structure. Alteration involves the construction or renovation of an existing structure that goes beyond mere repair or addition. The standards proposed in Public Draft #2 for the Residential 2024 IECC increase compliance stringency compared to the 2021 IECC. Additions and alterations to existing buildings must meet a certain number of additional efficiency credits as required by sections R502.2.5 (for additions) and R503.1.5 (for alterations). Section R408.2 of the 2024 IECC draft, which contains the table of additional efficiency credits for existing buildings, has undergone considerable revisions to reflect the new point-based credit system for efficiency measures. These measures give construction, design professionals, and homeowners greater compliance alternatives. Potential efficiency methods include enhanced envelope performance, more efficient heating, ventilation, and air conditioning (HVAC), reduced energy use water heating, more efficient duct systems, improved air sealing, and efficient ventilation.

Model Code Provision for Home Energy Rating System Use for Major Alterations, Additions, or Change of Use

The Energy Rating Index (ERI) performance path6 provides homeowners with different performance options to demonstrate compliance with energy codes. It presents a significant shift in how homeowners can approach energy efficiency compliance. Massachusetts introduced the ERI performance path into the Residential Stretch Code, selecting the Home Energy Rating System (HERS), developed by the Residential Energy Services Network (RESNET), as a standard for assessing energy performance. The Residential Stretch Code mandates specific requirements for certain home additions and alterations. Notably, it requires that change-of-use renovations, additions exceeding 1,000 square feet or surpassing 100 percent of the conditioned floor area of the existing home, and well as alterations over 1,000 square feet exceeding 100 percent of the conditioned floor area or 50 percent of the total building area, must meet a designated HERS Index Score.7 Future stretch code updates have the potential to gradually lower the HERS requirements for existing buildings, ultimately leading to substantial energy savings in retrofit projects. Massachusetts's adoption of this path within the Residential Stretch Code serves as a model that other jurisdictions can follow.

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5 This section refers to the 2024 IECC Residential Public Comment Draft #2. The draft is not final and is subject to change.

6 See, 2021 IECC, R406.

7 See, 225 CMR 22: Massachusetts Residential Stretch Energy Code and Municipal Opt-In Specialized Code 2023, Table 405.6.

NBI Existing Building Decarbonization Code

New Buildings Institute (NBI) published the Existing Building Decarbonization Code, which builds upon its predecessor and serves as an essential tool for jurisdictions seeking to increase energy efficiency within existing buildings. This model language includes both residential and commercial buildings and lays out a strategic roadmap that pairs key decarbonization opportunities, such as occupancy changes, additions, and alterations, with efficiency measures and energy use pathways. The trigger events identified in the model language serve as key moments in the lifecycle of existing buildings, signaling the ideal times to implement decarbonization measures. For instance, when it comes to roof replacement projects, the code seizes this opportunity by requiring the simultaneous installation of onsite renewable energy systems, such as photovoltaic arrays.[8] Additionally, the code identifies various building lifecycle events that can prompt the integration of electric vehicle charging infrastructure[9] and the inclusion of battery storage technologies.[10] Jurisdictions seeking to incorporate additional energy savings and energy efficiency measures for existing buildings into their energy codes should consider adopting the model code language provided by NBI.

Additional Approaches and Triggers to Increase Energy Efficiency in Existing Buildings

When adopting new codes, building energy code officials do not have to rely upon conventional approaches. They should explore additional approaches and triggers to target the unaltered portions of buildings that currently do not have to comply with energy codes and achieve much greater savings.

1. Public Awareness and Education

One of the first steps towards promoting energy efficiency in existing buildings is to raise public awareness and outline the benefits of retrofitting. Public perception and understanding play a critical role in driving change. Conducting outreach programs, workshops, and informational campaigns, can empower building owners and occupants with knowledge about the advantages of energy-efficient retrofits, and prompt them to take proactive steps to improve the energy performance of their properties.

2. Pilot Projects

Pilot projects[11] involving retrofits in older buildings can be instrumental in showcasing the benefits and feasibility of energy-efficient retrofits. These projects can serve as tangible examples, offering insights into how retrofits can be successfully implemented. National Grid has undertaken a pilot project to illustrate the potential of energy efficiency improvements in existing buildings. The pilot project encompasses multiple sites, allowing for a diverse range of building types, sizes, and conditions to be examined. The National Grid project uses robust

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[8] See, C503.5.5 and R503.5.5 at New Buildings Institute's (NBI) Existing Building Decarbonization Code, Version 1.0, September 2022.

[9] See, C502.5.4, C503.5.6, R502.5.1, R503.5.3 at New Buildings Institute's (NBI) Existing Building Decarbonization Code, Version 1.0, September 2022.

[10] See, C503.5.4, R502.5.3, R503.5.1 at New Buildings Institute's (NBI) Existing Building Decarbonization Code, Version 1.0, September 2022.

[11] Pilot project is a small-scale effort designed to manage the risk and identify any deficiencies before substantial resources are committed.

performance monitoring and data collection to assess the effectiveness of the retrofits. Benefits achieved through these projects included improved comfort, superior water management, elimination of ice dams, passive survivability, and aesthetic improvements.

3. Incentive Tiers

Creating a tiered incentive system can offer a structured approach to encourage energy efficiency retrofits. Offering varying levels of incentives based on the depth and impact of retrofits can motivate building owners to pursue more comprehensive and ambitious projects. Higher incentives could be provided for deep retrofits that address the entire building system, while lower tiers could incentivize incremental improvements. This tiered approach ensures that a wide range of building owners, including those with limited resources, can participate in energy efficiency initiatives.

Program providers can provide additional guidance to customers, advising them to prioritize improvements that offer the fastest return on investment and/or to begin with energy efficiency improvements before electrification, aligning the retrofit process with what is most efficient and beneficial for the customer. Building on the concept of tiered incentives, it's crucial to recognize the significance of existing incentive programs that are already paving the way for energy-efficient retrofits. Initiatives such as the Weatherization Assistance Program and the Mass Save Energy Efficiency Renovations and Additions Program are examples of how incentives can stimulate retrofits. Massachusetts residents looking to undertake renovations and additions to their single-family or multi-family homes can find valuable incentives through the Mass Save Energy Efficiency Renovations and Additions program. Additionally, the Weatherization Assistance Program, a federally supported initiative, plays a crucial role in reducing energy costs for low-income households, offering incentives and financial assistance to eligible homeowners to implement weatherization and energy-efficient retrofit measures.

4. Incremental Compliance/BPS (Building Performance Standards)

Implementing incremental compliance standards or building performance standards can establish a gradual pathway to energy efficiency improvements for the building as a whole. Instead of waiting for major renovations or trigger events, building owners can be required to make incremental upgrades over time. For instance, building owners will meet specific energy performance benchmarks within a predefined timeframe. These standards can be designed to steadily increase energy efficiency requirements, ensuring that existing buildings continually progress towards optimal performance.

5. Additional Trigger Events

In addition to traditional trigger events like alterations and repairs, a broader range of events should be considered to prompt energy efficiency retrofits. Non-construction events, such as property sales, refinancing, or changes in occupancy, can be leveraged as opportunities to encourage retrofits. By requiring energy efficiency assessments or upgrades during these events, energy performance can remain a priority throughout the building's lifecycle.

6. Rebuilding after Extreme Weather Events

Extreme weather events, such as fires or floods, often necessitate rebuilding or extensive repairs. These events present a unique opportunity to incorporate energy-efficient features and technologies into the reconstruction process. Some jurisdictions have taken proactive steps by offering incentives not only for those directly affected by the disaster but also for property owners with homes vulnerable to future extreme weather events. For instance, in South Carolina, homeowners can take advantage of tax credits for retrofitting their homes to be more disaster-resistant, especially to hurricanes, rising floodwaters, and other catastrophic windstorm events.

Given the high insurance rates due to climate-related risks, it is imperative for states to explore strategies for reducing insurance costs and simultaneously encourage homeowners to undertake retrofit measures for enhancing resilience. Several states, including South Carolina, North Carolina, Alabama, and Louisiana, require insurance companies to offer discounts to customers who make their homes more resilient through retrofit projects, therefore mitigating risks associated with extreme weather.[12] This approach aligns with broader efforts to promote retrofits of existing buildings and disaster preparedness.

Addressing Challenges

Enhancing energy efficiency in existing buildings will reduce operational costs for building occupants and owners, and it can play a vital role in mitigating climate change by decreasing carbon emissions. However, making existing buildings more energy efficient presents unique challenges to understand, explore, and actively address.

Financial Constraints

Retrofits aimed at enhancing energy efficiency in existing buildings often come with a substantial price tag. The upfront costs associated with comprehensive retrofits often deter building owners from making these investments despite the fact that the long-term return on investment often outweighs initial costs. To mitigate this challenge, various strategies can be employed. Government incentives, rebates, and tax credits can significantly reduce the initial financial burden, making retrofits more financially feasible. The federal government has taken steps to alleviate the financial burden of energy-efficient retrofits by providing funding through initiatives like the Weatherization Assistance Program. Energy service companies (ESCOs) can engage in performance contracts that will guarantee energy savings, allowing large building owners to fund retrofits through subsequent energy cost reductions. Additionally, facilitating access to favorable financing options, such as low-interest loans or innovative financing mechanisms, can alleviate the financial strain on building owners, encouraging them to undertake energy efficiency projects. Green banks, dedicated to advancing clean energy initiatives, can play an important role in providing financial support and guidance to building owners embarking on energy efficiency projects in existing buildings. In New York City, the Resilient Retrofit 1% Loan Program stands

[12] Personal Insurance & Risk Management, New incentives to storm-proof your house. Available at: https://tooleinsurance.com/personal-insurane-risk-management/new-incentives-to-storm-proof-your-house/.

as a great example of structuring a loan program to offer additional assistance for home retrofits, with its initial focus on flood-prone areas. Programs such as this have the potential for expansion beyond flood-prone regions and to promote energy–efficiency retrofits across a broader spectrum of buildings.

Lack of Technical Expertise

Another obstacle to effective energy-efficient retrofits in existing buildings is the lack of technical expertise. Building owners and operators without the necessary knowledge and guidance may find themselves struggling with the complexities of planning and executing retrofit projects, or potentially making decisions that could lead to ineffective or costly outcomes. Often, building owners may prioritize specific upgrades like heat pumps or new windows, overlooking other essential measures like insulation and air sealing. To address this challenge, building owners can seek partnerships with energy auditors, architects, engineers, and consultants who specialize in energy-efficient retrofits. These experts can provide invaluable guidance throughout the retrofit process, ensuring that projects are planned to achieve maximum energy savings and are sequenced effectively.

Moreover, government agencies and non-profit organizations can establish technical assistance programs, offering building owners access to experts, training, and resources to bridge the knowledge gap. The New York City Accelerator program is a good example of how a government initiative can offer valuable assistance to building owners and managers seeking support for their retrofit projects. Some of the assistance that this program provides includes expert guidance, matching homeowners with service providers, and financing opportunities. While the program may have limitations for individual residential owners, it serves as a noteworthy example of how similar initiatives can be developed to provide comprehensive guidance and expertise to a wide range of building stakeholders. Government agencies and non-profit organizations can also facilitate the development and growth of a qualified retrofit workforce to understand and better advise customers on the sequencing of their projects. NEEP's Total Energy Pathways (TEP) Workforce online resource center and the Total Building Performance (TBP) Certificate of Knowledge provide examples of such efforts.

Resistance to Change

Resistance to change is a natural human tendency that can present a significant hurdle in retrofitting existing buildings for energy efficiency. This resistance is prevalent not only among building occupants and owners who may resist disruptive construction processes or changes in their familiar environments, but also within the construction trades, where the status quo is often seen as less expensive and less risky. Construction workers are understandably cautious about adopting new methods, especially when they have a history of successful projects using traditional approaches. Addressing the perceived risks associated with energy efficiency initiatives is critical. These risks can include concerns about increased costs, potential disruption, and project delays. For instance, undertaking energy efficiency measures may extend the project timeline, leading to lost rent revenue or additional expenses related to staff time and the learning curve associated with new technologies and techniques. This resistance is particularly noteworthy in low-income communities where financial constraints and historic disparities can increase skepticism towards change.

Overcoming this resistance requires a combination of effective communication and engagement. Clear and transparent communication about the benefits of retrofits, including improved comfort, indoor air quality, and potential energy cost savings, can help mitigate or even eliminate concerns and increase the support for retrofits. Additionally, engaging directly with residents through community meetings, workshops, and grassroots initiatives can foster trust and address their unique concerns more effectively. Listening to their needs and tailoring retrofit solutions to align with their priorities is essential. When it comes to construction professionals, it is essential to provide them with comprehensive training and resources to build their confidence in implementing energy-efficient practices, showcasing the potential long-term savings, and emphasizing how these changes can enhance their reputation and competitiveness in the industry.

Deterrence Due to Stricter Requirements

While stricter energy codes and standards promise to encourage more energy savings and enhance energy efficiency, they also present a paradoxical challenge. On one hand, they can push the boundaries of energy efficiency, raising the bar for building performance. However, on the other hand, they can potentially deter building owners from initiating retrofits at all, especially when the prospect of complying with these more demanding standards seems intimidating and more costly. This challenge highlights the importance of engaging in meaningful discussions with the communities that these decisions may impact. It requires a careful balance between more ambitious energy codes and ensuring that building owners do not become discouraged from initiating retrofits. These discussions should focus on addressing concerns, providing clarity on compliance requirements, and exploring mechanisms that gradually expand energy efficiency standards for existing buildings without overwhelming building owners.

Conclusion

As states strive to reduce carbon emissions and decarbonize the building sector, it becomes imperative to explore strategies and trigger events that can drive energy efficiency retrofits in existing buildings. National model energy code provisions offer a structured framework for enhancing energy efficiency during renovations and alterations, presenting valuable tools that states can adopt and replicate. Diverse approaches and triggers, ranging from public education to financial incentives and building performance standards, hold the potential to empower increased energy efficiency and cost savings throughout a building's lifecycle.

Furthermore, addressing the associated challenges is crucial for realizing the benefits of energy-efficient retrofits and making meaningful progress in building decarbonization. Financial constraints often act as deterrents to comprehensive retrofits, but strategic measures such as government incentives, technical assistance, and favorable financing options can alleviate these burdens. The intention for stricter energy code requirements for existing buildings can present complex challenges, demanding thoughtful dialogue with affected communities to find the balance between ambition and feasibility. As states navigate these challenges, it is vital to remember that energy-efficient retrofits play a critical role in combating climate change through the reduction of carbon emissions and hold the potential to reduce operational costs for building occupants and owners, making homes more comfortable.