Moving Energy Codes Forward: A Guide for Cities and States

nbi new buildings institute

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INTRODUCTION

Residential and commercial buildings accounted for over 2,000 Million Metric Tons (MMT) of carbon equivalent emissions[1] and 40% of the total energy consumed in the United States in 2016.[2] New construction and major renovations in buildings have a long-term impact on emissions as many of the features incorporated at time of construction will impact energy consumption for decades.

In cities, the building sector is a major contributor to carbon emissions. Some jurisdictions may have climate policies and climate action plans that set targets and lay out an action plan for improvement on the path to zero carbon emissions. Other jurisdictions, like states and cities, may not have explicit climate goals, but they have an interest in improving building performance and reducing energy costs for their constituents.

Moving Energy Codes Forward: A Guide for Cities and States explains how energy codes can be a critical part of carbon reduction strategies and outlines steps to achieve significant code improvements. It links jurisdictions to leading design measures and new technologies which may be adopted as a stretch code, incorporated into incentive programs or policy initiatives, and eventually integrated in local and national code advancement efforts. It also offers guidance, resources and examples of advanced code adoption based on experiences in other communities.

Although local jurisdictions are unique in needs and specific implementation approaches, this guide provides a practical framework for implementing advanced codes and policies.

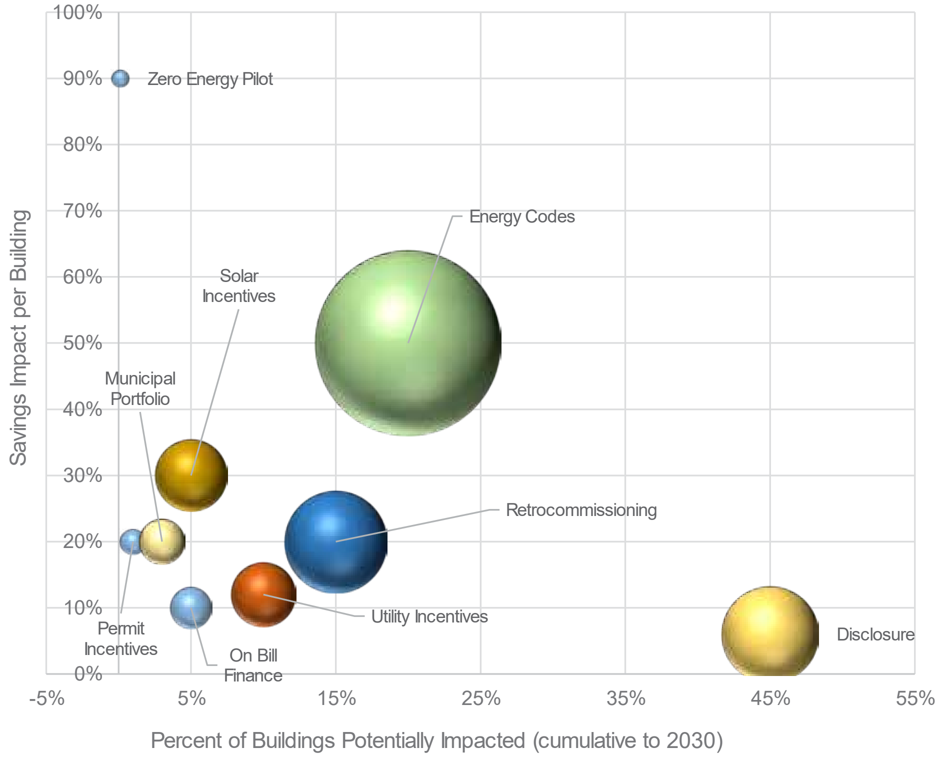
1 https://www.epa.gov/sites/production/files/2018-01/documents/2018_executive_summary.pdf
2 https://www.eia.gov/tools/faqs/faq.php?id=86&t=1

WHY ADVANCED ENERGY CODES?

Energy code advancements are an important tool to guide improvements in the energy performance of the building stock and deliver carbon emission savings as seen in the illustrative example in Figure 1. However, many jurisdictions have realized that current energy codes are not delivering sufficient levels of energy performance in buildings. Advanced local code amendments, stretch codes and policies can provide a series of additional building performance strategies.

Advanced energy codes are an important tool to improve building performance and deliver carbon emission reductions.

Figure 1: Illustrative Example of the Impact of Building Energy Policies



Base, Stretch and Green Codes

National Model Base Codes

National model energy codes set minimum levels of efficiency for building design and construction. ASHRAE 90.1 and the International Energy Conservation Code (IECC) – and several versions of each - are available for local adoption (See Table 1). Jurisdictions adopt a particular version of a base code and they may adopt the IECC for residential and ASHRAE for commercial, or they may cross reference both.

Local Base Energy Codes

Most energy codes are adopted at the state or local level. Many states adopt national base codes with limited local amendments which can increase or decrease the energy efficiency. Local codes with more local amendments that increase the energy efficiency are generally referred to as "advanced" codes in this document. Progressive jurisdictions like California, Washington State and Seattle, WA. have developed and adopted their own advanced energy codes to ensure that they are compatible with their local energy and carbon reduction goals. "Home rule" states such as Arizona and Wyoming do not have state-wide energy codes. In those states, the local municipality may adopt any energy code that they deem to be acceptable for their building stock.

Stretch Codes

Stretch codes (also known as "reach" and "step" codes) offer an early preview of the "next" code, paving the way for future adoption. They lay a foundation for market transformation, establishing a continuous code advancement cycle, creating certainty, and increasing awareness for the market. They promote advanced technologies and are designed so that efficiency increases between the base and stretch code are achievable for users of the code.

A stretch code might be unique to a jurisdiction or it may be a more recent version of the national base code or standard. Enforceable (i.e. mandatory) stretch code language is essentially a more aggressive local base energy code which overlays the local code and applies additional requirements on the same energy feature. In some instances, states develop a state-wide stretch code that local jurisdictions may adopt. When they do, the stretch code becomes the local base code in that jurisdiction. Voluntary stretch codes are not enforceable though they can be referenced in policy and/or incentive programs.

Green Codes

Like stretch codes, green codes go beyond minimum requirements. In addition to energy, they cover water and resource efficiency aspects of green building construction. Two common base green codes are ASHRAE 189.1 and the International Green Conservation Code (IgCC) which are consolidating.

Table 1: National Base Codes and Standards

	International Energy Conservation Code	ASHRAE Standard
Commercial Energy Codes and Standards	2018 IECC (references ASHRAE 90.1-2016)	90.1-2016
	2015 IECC (references ASHRAE 90.1-2013)	90.1-2013
	2012 IECC (references ASHRAE 90.1-2010)	90.1-2010
Residential Energy Codes and Standards	2018 IECC	90.2-2007R
	2015 IECC	
	2012 IECC	

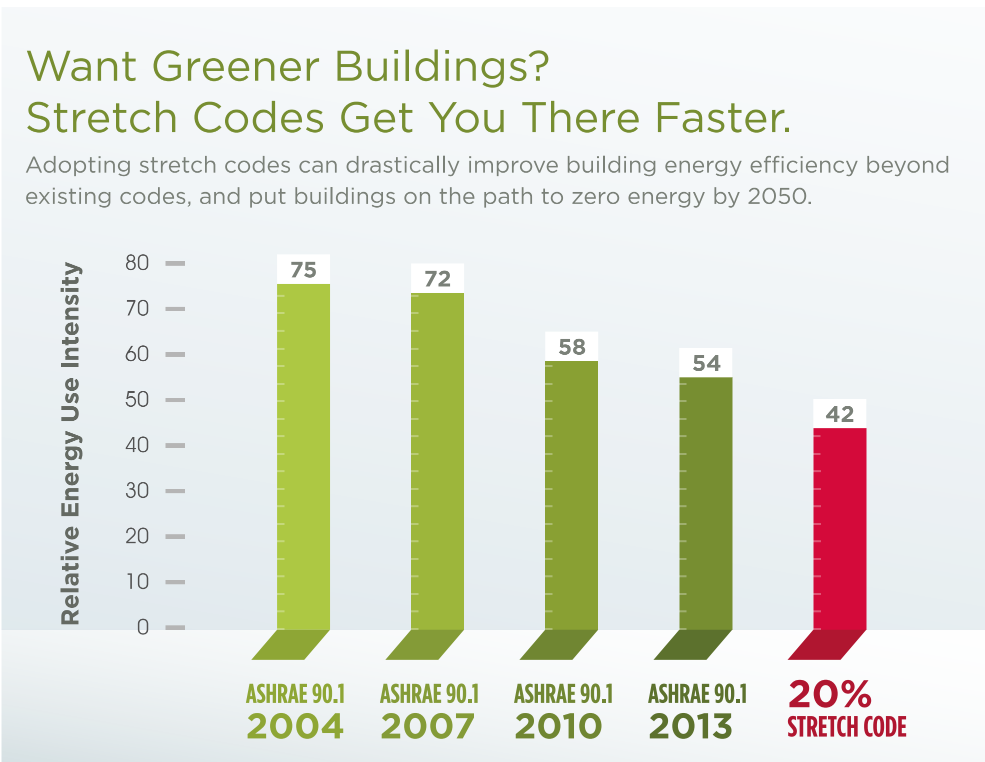
Benefits of Stretch Codes

Stretch codes have benefits and advantages in addition to carbon and energy reductions. They result in buildings that cost less to own, are more comfortable to occupy and are more resilient during power outages.

Importantly, stretch codes familiarize a large share of market actors with advanced technologies. Experience with the new requirements can increase stakeholder support for future code advancements, as demonstrated by the 2012 International Energy Conservation Code improvements that were largely based on the Massachusetts Green Communities stretch code. Stretch codes also ease the transition to the new code when adopted. This creates consistency which supports code usability and can improve compliance once the new local code passes.

More advanced technologies in stretch codes also provide tremendous confidence and motivation to manufacturers. They provide visibility and insight into future regulations, increase lead time for manufacturers to scale up production, and motivate competitors to ensure they can match with comparable products.

Figure 2: Progression of Stretch Codes



CODE ADOPTION AND IMPLEMENTATION PROCESS

Each jurisdiction has a unique code and policy context that impacts code adoption.

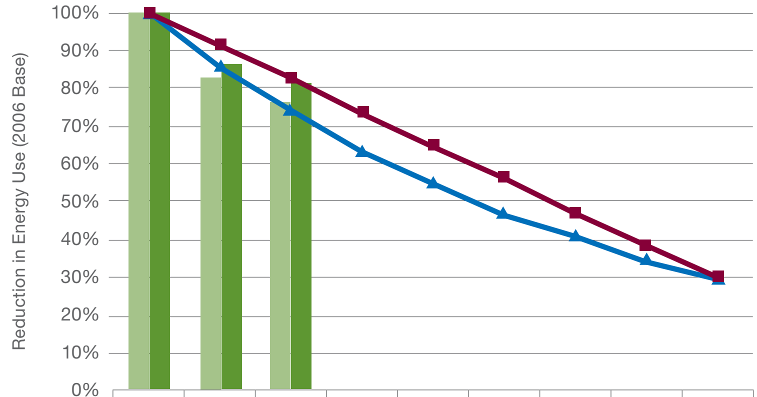
Energy codes are adopted at the state or local level and are sometimes part of a broader set of building codes adoption (e.g. adoption of an updated energy, building and mechanical code). At the state level, the adoption process can occur directly by legislative action, or through regulatory agencies authorized by the legislative body.

- **Legislative Action.** Once proposed, energy code legislation may travel a path of hearings, public commentary, and following revisions. This process typically culminates with the approval of a voting body of authority, and the signature of the governor, mayor, or applicable elected official.
- **Regulatory Action.** The legislative process can also empower agencies of the executive branch of government to promulgate building energy codes. When adoption occurs through this process, states and local governments often appoint an advisory body comprised of affected industry representatives, including individuals from the design, construction, and enforcement communities. This group typically reviews the code requirements, and considers the impacts of the specific provisions. Final recommendations of the group then proceed through a public review process, and may eventually return to the legislature for confirmation prior to becoming law. This regulatory process is sometimes preferred by local stakeholders, as it can allow for increased consideration with respect to local preferences.

Code improvements occur in incremental steps and code roadmaps identify the order and priority needed to lay the groundwork for subsequent code improvements on the path to zero. Roadmaps provide specific code performance goals for new residential and commercial buildings in order to meet overall policy objectives. They also identify the mechanisms and cycles by which code provisions can evolve over time and multiple code cycles. Stretch codes can be an important part of the overall framework to promote more efficient construction practices and set the stage for adopting more efficient base energy codes.

Figure 3: Incremental Code Improvement Compared to Targets

The Washington State Energy Code (WSEC) goal is to achieve a 70 percent reduction in annual new building energy consumption compared to the 2006 state energy code by 2030 (i.e. 70 x 30) for commercial and residential buildings.



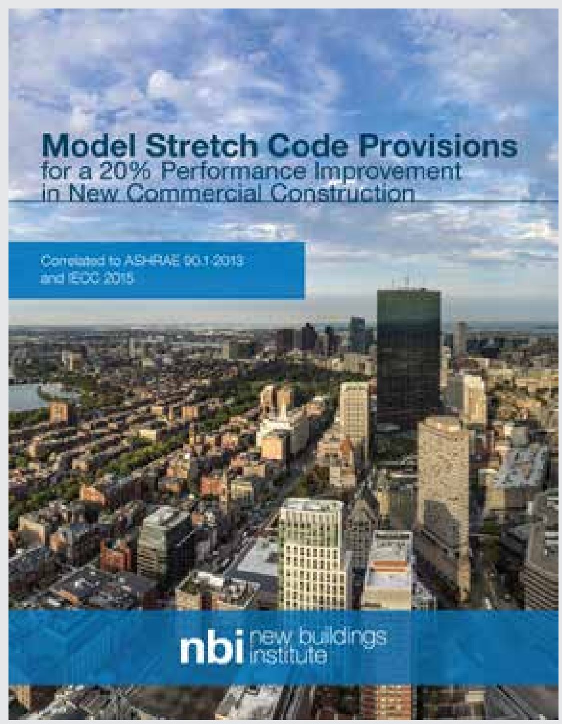
	2006	2009	2012	2015	2018	2021	2024	2027	2030
Residential	100%	82.7%	76.1%						
Commercial	100%	86.8%	82.0%						
Target: 8.75% savings compared to the 2006 WSEC	100%	91%	83%	74%	65%	56%	48%	39%	30%
Target: 14% savings compared to each previous code	100%	86%	74%	64%	55%	47%	41%	35%	30%

Stretch Code Adoption

Some states have passed legislation that does not allow for municipalities to adopt stretch codes. For example, Idaho House Bill 547 does not allow municipalities to adopt an energy code more stringent than the state adopted code.

Jurisdictions that are not able to adopt codes beyond state code minimums may be able to adopt other policies to achieve the same result. They might choose to lead by example by adopting policies that impact their own building stock. They might use stretch codes provisions to allow zoning changes, fee rebates, or Floor Area Ratio bonuses. Financial incentive alignment, either with utility programs or other public financing mechanisms, have also been used. These approaches are discussed in the Advancing Energy Codes Through Policies and Incentives section later in this document.

Mandatory stretch codes are carefully coordinated with the local code in effect and offer regionally appropriate solutions. Customizing a general stretch code framework of measures into enforceable code language readily adoptable by local governments can be an involved process. Jurisdictions must have the authority and must follow a carefully defined process as locally defined when pursuing advanced codes. In California, the process includes rulemaking documents, public involvement and comment periods, hearings, meetings and other actions.[3]



NBI has developed model stretch code provisions referenced in the Resources section that saves approximately 20% over ASHRAE 90.1-2013 or the 2015 IECC.

3 https://www.documents.dgs.ca.gov/bsc/GuidesAndHelpDocs/2016GuideToTitle24-v01.24.2018.pdf

Table 2: Energy Savings Analysis of the Proposed NYStretch-Energy Code 2018

Building Type	Prototype	Construction Weight (%)	Site Energy [kBtu/ft²/yr]		% Energy Savings
			90.1-2013	NYStretch	NYStretch vs. 90.1-2013
Office	Large office	10.1%	60.91	57.25	6.0%
Retail	Standalone retail	16.9%	49.23	41.86	15.0%
Education	Secondary school	11.4%	39.87	32.73	17.9%
Lodging	Large hotel	9.0%	87.68	69.84	20.3%
Apartment	20-story apartment	25.3%	53.04	36.57	31.0%
	10-story apartment	27.6%	51.35	35.04	31.8%
Weighted Average (across all climate zones in NY)		**100.0**	**54.51**	**41.81**	**23.3%**

Stakeholder engagement is critical in the stretch code adoption process. Key stakeholders often participate in advisory group meetings to advise the development of the stretch code. These stakeholders include code officials, housing agencies, elected officials and their staff, local building owners, designers, contractors, utilities and energy efficiency organizations. Stakeholders review, comment and suggest modifications to proposed code language, sometimes even before it goes out for official public comment. It may be helpful to separate residential and commercial stakeholders during this process.

Jurisdictions, Regional Energy Efficiency Organizations (REEOs), and other organizations can be advocates in the code advancement process. These "code champions" can be quite influential so ensuring they are familiar with the process and when decisions will be made is important. At the beginning of the process, staff of jurisdictions with an interest in carbon emission reductions should ensure that code officials are aware of policy priorities that can be incorporated into code. Clarity and ease of enforcement are typically key drivers of code officials, so it is wise to communicate in these terms to gain support. Stakeholders can also submit their own code proposals for consideration in the process, comment on other proposals and participate throughout the public adoption and implementation adoption process.

Energy modeling analysis results can be helpful to have during an adoption process in order to estimate code stringency and energy savings. Measures and packages of measures are typically modeled for a variety of building types in a particular climate zone to quantify estimated energy savings. NBI has energy modeling results for measures in the 20% model stretch code provisions which may be helpful to jurisdiction staff or code advocates in this process. For example, Pacific Northwest National Labs modeled the 16 key proposed measures for Stretch Code development sponsored by NYSERDA in New York as seen in Table 2 above.

Stretch codes need to find a balance between energy savings, cost and achievability. Cost studies done to estimate the incremental cost of stretch code measures over the base code are another important part of the stretch code adoption process. For example, the City of Santa Monica in California conducted a cost effectiveness study to support the development of their zero energy residential code.[4]

4 https://www.smgov.net/uploadedFiles/Departments/OSE/Categories/Green_Building/2016_SantaMonicaReachCodeCostEffectiveness_Final.pdf

In some instances, stretch codes developed at the state level go through a local process before being adopted and becoming mandatory in a particular jurisdiction. States can support this process with a toolkit and informational materials to support adoption. A toolkit might include the specific amendments and language that overlays the stretch code on the base code, template ordinances and resolutions that can be used at the local level. Informational materials could be fact sheets that explain the benefits of the stretch code and webinars to familiarize local stakeholders on the components of the new stretch code.

New York has worked to develop a state-wide stretch code available for adoption by cities through a local process.

Mandatory stretch codes must have specific enacting language in order to be enforceable. Adoption requires careful coordination with legal counsel familiar with state and city requirements. Code updates must follow the appropriate local process and reduce conflict with other laws and requirements. While each community is different, many resources have already been developed to support this process including template administrative procedures, sample resolutions and ordinances can be customized, reducing some of the administrative burden on local jurisdictions.

Base energy codes are typically updated on a three-year cycle. Stretch codes are best developed at the same time as the base energy code is under review and consideration at the state or local level. This allows the stretch code to be developed around the base energy code and account for any amendments to the base energy code. Stretch codes should always consider relevant updates to the health/life safety codes during the development process.

Implementation of Advanced Local Base Codes

Details of the adoption process vary considerably from state-to-state, depending on whether the energy code is adopted via legislation or regulation, and by a state or local government. Often during the adoption process, stakeholders can propose advanced code amendments to improve efficiency. Jurisdiction staff can engage in this process to help ensure that advanced codes are in place to assist in achieving carbon emission reduction goals. Documentation to support code amendments varies by state but often includes the description of the approach, estimated energy savings and cost information.

The adoption process generally includes the following steps:

- A proposal is initiated through legislation, or by a regulatory agency with the authority to promulgate the code. Interested or affected parties also may initiate proposals. An advisory body typically is convened and will recommend a new code or revisions to an existing code. Examples of typical initiators may include a State Energy Office, State Appointed Energy Code Council, Local Building Officials, Mayor, or City Council.
- The proposal undergoes a public review, as defined by the legislative or regulatory process under which the stretch code is being considered. Public review options may include publishing a notice in key publications, filing notices of intent, or holding public hearings. Interested and affected parties are invited to submit written or oral comments.
- The results of the review process are incorporated into the proposal and the final legislation or regulation is prepared for approval.
- The approving authority reviews the legislation or regulation. Revisions may be submitted to the designated authority for final approval or for filing.
- After being filed or approved, the code is scheduled to become effective on a specified date. The delay creates a grace period allowing affected stakeholders to become familiar with any new requirements. The period between adoption and effective date typically varies from 30 days to six months.

Implementation of Stretch Codes

Stretch codes are an overlay on current code requirements. This means that the measures will align with current code scope and limitations, and primarily impact building components that are currently regulated by municipal building departments. Current stretch codes focus on prescriptive strategies that are most familiar to the building, design and enforcement industry. For example, the 2018 IECC for commercial buildings requires that the building envelope meet an air leakage rate of 0.40 CFM/ft^2 of envelope area. A stretch code might increase the efficiency of the building envelope by requiring an air leakage rate of 0.25 CFM/ft^2 of envelope area.

Residential stretch codes are typically structured to overlay on the Home Energy Rating System (HERS) based approach in the IECC and to require a lower HERS score. The HERS based option provides flexibility to the building designer and builder to achieve the HERS score by using high efficiency heating, cooling and water heating systems, a more efficient building envelope and efficient appliances.

Commercial building stretch codes might offer prescriptive and/or whole building performance options. A prescriptive option includes provisions that address increased efficiencies for the building envelope, lighting, HVAC, water heating and plug load and equipment.

Code Outreach and Education

Once adopted, outreach and education is critical for successful implementation of the advanced energy code and/or stretch code. This helps to ensure high levels of code compliance so that energy use and carbon emission reductions are realized.

Stakeholders involved in the building design, construction and enforcement must have a thorough understanding of the advanced code provisions. Training should be deployed well before the advanced local code, stretch code or stretch policies go into effect. Training available after the effective date is helpful to address any questions or issues that arise once the building, design and enforcement industry start to implement the code. Ongoing training should be planned to address personnel turnover in the industry, new interpretations to code provisions, new information on effective design practices, etc.

Code training is most effective when designed around the information needs for particular target audiences, including:

- **Building Design and Engineering.** These audiences will need to understand the base and stretch code requirements, how the new requirements will impact their typical design practices, strategies for meeting the requirements and how to document that they have met the requirements.
- **Manufacturers / Product Suppliers.** Energy efficient material suppliers will need to understand the requirements for the base and stretch code as they relate to the materials and levels of efficiency that they will be asked to supply (e.g. continuous insulation for wall systems and low U-factor fenestration).
- **Enforcement Personnel.** Understanding the base and stretch code requirements is critical for two primary reasons 1) they are responsible for enforcing the code at plan review and inspection and 2) they often play a role in the education process by answering questions from designers, buildings, manufacturers, etc., on the codes. Their primary interests, in addition understanding the code requirements, is what documentation and information on the plan set should be reviewed to ensure compliance and what to review at the construction site to verify that the installed energy efficiency feature complies with the base and stretch codes.

Technical assistance is an important and often overlooked element of implementing energy codes. Questions, comments and code issues typically surface once the code is enforced. Assistance in the format of a technical assistance “hotline” (ability to email questions or call a code expert appointed by those responsible for implementing the code) is important for code implementation.

zEPI: A NEW METRIC FOR TRACKING ENERGY CODES DRIVING TOWARD ZERO

The Zero Energy Performance Index (zEPI) provides a scale for measuring energy performance. zEPI sets a constant goal of zero and shifts the conversation from percent better than code to percent from zero, representing a fundamental shift in how the market considers energy performance.

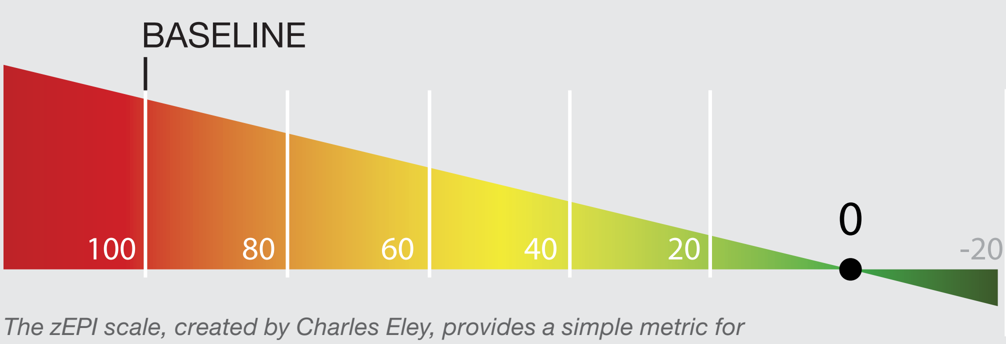
The zEPI scale can easily compare between different code levels, climate zones, and building types. Fixing the baseline to the Commercial Buildings Energy Consumption Survey 2003 performance levels (where zEPI equals 100) and the goal to net zero (where zEPI equals 0) creates a linear scale which can be used to track progress towards zero.

A scoring approach developed by New Buildings Institute (NBI) uses zEPI to develop a common baseline against which the energy performance of code-compliant buildings can be compared across states and cities, and to the national model codes. This *zEPI Jurisdictional Score* calculates scores for entire states or cities based on their adopted energy policy, taking into account statewide energy codes and local stretch codes.

With a metric that gives a clear vision to zero energy, tracking the zEPI rankings of energy model code and jurisdictional adoption provides straightforward feedback to policymakers and code stakeholders on progression toward a low-carbon future.

The zEPI jurisdictional score is an important first step to understand where code stringency currently stands. To find out a score for a city or a state, contact kevin@newbuildings.org.

Zero Energy Performance Index (zEPI) Scale



The zEPI scale, created by Charles Eley, provides a simple metric for measuring building energy performance on the path to zero. Graphic from Architecture 2030's Zero Tool (www.zerotool.org).

ADVANCING ENERGY CODES THROUGH POLICIES AND INCENTIVES

Jurisdictions can use policies to lead by example and pave the way for future code advancement.

Jurisdictions that do not have authority to establish a mandatory stretch code frequently tie advanced energy code measures code to meeting other policy mandates of a jurisdiction. This has a similar effect of increasing familiarity with advanced measures which can pave the way for future code advancement and improve code compliance once passed. Here are some examples of other policy mechanisms that have been tied to required energy advancements:

- **Up-zoning and Floor Area Ratio (FAR) Bonuses.** Up-zoning and FAR bonuses are regulatory levers that allow for higher value zoning or additional density for projects that comply with advanced stretch code measures. An example of up-zoning is allowing for different zoning that supports a more valuable use (for example, industrial to residential). FAR limits the gross floor area of the building for a given building lot size. Municipalities can increase the FAR for buildings that build to a stretch code. Arlington County, Virginia provides bonus density increases for commercial building projects based on the level of LEED achieved.[5] The same could be true for certain levels of energy performance. Table 3 provides an example of how density credits are allocated in Arlington.

Table 3: Arlington County Floor Area Ratio (FAR) Credits

New development project teams may request additional bonus density and/or height in exchange for green building certification as outlined below.

LEED version 4	Office or Residential*	Two Arlington Priority Credits	Total Bonus FAR Available
Silver	0.25 FAR	+ 0.05 FAR	0.30
Gold	0.35 FAR	+ 0.05 FAR	0.40
Platinum	0.50 FAR	+ 0.05 FAR	0.55

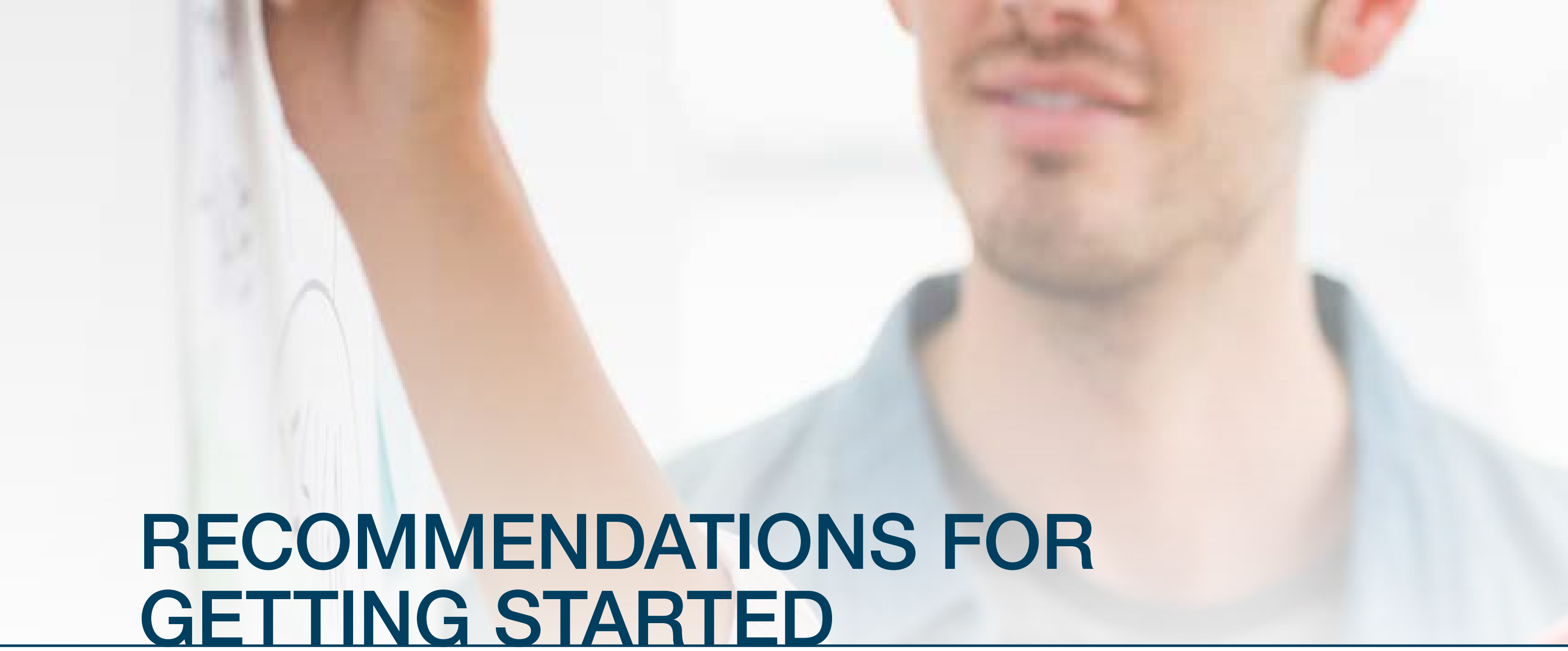
**Minimum Program Requirements include ENERGY STAR certification for commercial office, ten years of energy reporting, and ENERGY STAR lighting and appliances for multifamily.*

5 https://environment.arlingtonva.us/energy/green-building/green-building-bonus-density-program/

- **Tax Incentives.** Tax incentives are an effective way to mobilize investments in a community. They can be coupled with requirements to comply with advanced energy code measures or stretch code provisions.
- **Permit Fee Rebates.** A percent of permit fees can be rebated at the successful completion of the building or for granting a building permit for a project that meets advanced code requirements. For example, the City of Anaheim offers up to $500 reimbursement for customers who install Level 2 (240-Volt) plug-in electric vehicle chargers at their residences or businesses.[6]
- **Public Building Requirements.** Municipalities can lead-by-example, requiring that city owned buildings constructed, renovated, or maintained with city funds or using bonding capacity, be designed to meet stretch code requirements. The City of Denver requires that new city building projects (new construction and major renovation) over 5,000 square feet, funded after March 11, 2013, achieve LEED Gold Certification, with the goal of achieving LEED Platinum where economically feasible. All General Fund agencies must implement LEED EB: O+M best practices.
- **Local Development Commission Funded Projects.** The local development commission can set minimum conditions that projects must meet stretch code requirements to qualify for funding. The Portland Housing Bureau (PHB) has adopted the Affordable Housing Green Building Policy with the goal of achieving net zero energy for PHB funded buildings by or before the year 2050. The policy requires that projects receiving at least 10% of the total project funding from PHB or that are owned and by PHB, receive third party Certification from either LEED or Earth Advantage.[7] The policy also requires that the project conduct a solar study and, if feasible, the project must either be solar ready or include a solar system in the design.
- **Affordable Housing Programs Using Public Funding.** Housing projects funded by public funding can be required to comply with stretch codes. Funding from the Department of Housing and Urban Development (HUD) can have criteria placed on them from state agencies that are managing the funds. The state of Washington used a portion of the HUD funds from the Housing Trust Fund, a HUD-sponsored program, to fund their $1.9 million Ultra-High Energy Efficiency Demonstration Program that focuses on net zero energy projects for affordable housing.[8]
- **Utility Incentive Programs.** Like the local code and policy context varies from state to state, utility regulations also vary from state to state. In most states, when a measure is required by code, whether it is from an advanced local code or mandatory stretch code, utilities may be precluded from providing financial incentives by state regulators. However, there are examples where regulators think of the local community as being the "voluntary" actor which allows energy efficiency programs to continue incentivizing advanced measures, even if they are required. This is true in the British Columbia "step" code and was true in the Green Communities program in Massachusetts.

In the case of voluntary stretch codes, residential and commercial buildings can leverage utility incentive programs to offset the first cost of construction. For example, when stretch code requirements are consistent with utility rebate programs for Energy Star-rated appliances, the local utility may provide a rebate for the Energy Star appliances, offsetting first costs and ongoing costs.

6 https://www.anaheim.net/3312/Public-EV-Charger-Rebate
7 https://www.portlandoregon.gov/phb/article/662764
8 http://www.commerce.wa.gov/wp-content/uploads/2015/12/hfu-ultra-efficiency-funding-plan-2015.pdf



RECOMMENDATIONS FOR GETTING STARTED

The process for developing and adopting advanced energy codes will vary based on state and local municipality requirements.

Several resources can assist jurisdictions as they move through the process of adopting a stretch or advanced base code. General steps are summarized here.

1 Establish energy and carbon goals.

States and municipalities that are successful at adopting and implementing stretch codes often have well established energy goals that serve as the driving force behind adoption.

2 Contact supporting organizations.

Stretch codes have been developed for use in states and jurisdictions are included as case studies and in the Resources section of this guide. Existing stretch code provisions can be either adopted in their entirety or amended to better fit the state or jurisdiction. Organizations that have developed stretch codes can also serve as a guide through the development and adoption process. Supporting organizations can also be of assistance on developing a roadmap for meeting the established energy and carbon goals.

3 Assess currently adopted energy code.

Jurisdictions should adopt the most aggressive base code if they have an older version of a national base code, especially if the state or municipalities have adopted a code older than the 2015 IECC / ASHRAE 90.1-2013. Stretch codes overlay the base code and are designed to provide increased efficiencies over the efficiency measures that currently in the code. NBI's 20% Stretch Code provisions support the 2015 IECC / ASHRAE 90.1-2013 national base codes.

4 Gain support for advanced or stretch code.

Gaining support from those who could be affected by the code is quite valuable in ensuring success. Discuss with code officials, affordable housing advocates, and all other parties within the jurisdiction that will be impacted by the advanced or stretch code. The Building Official, or authority having jurisdiction, and other offices within the state or municipality should be consulted. The authority having jurisdiction may also be responsible for guiding the stretch code review and adoption process within the municipality.

5 Determine the legal authority and timing to adopt a stretch code.

In-house council can best verify whether the jurisdiction has the legal authority to adopt a stretch code at the state or municipal level. If no legal authority exists, the jurisdiction can adopt a voluntary stretch code and offer incentives for compliance with the code or the code can be offered by the utility.

6 Convene stakeholder committee to provide feedback.

Convening a stakeholder committee is critical for gaining acceptance for stretch code adoption and to ensure that the adopted code reflects current design, construction, and enforcement practice and that the material suppliers can provide the levels of efficiencies for the features that are included in the code. Select and convene committee of interested and affected industry parties that will be impacted by the adoption of the stretch code.

7 Implement the formal adoption process to adopt the stretch code.

Formal adoption of the stretch code is dictated by the state or local adoption code adoption process. Adoption of voluntary stretch codes will either at the municipal or state level will be handled differently.

8 Deploy training and education to industry stakeholders.

Training development and implementation will be necessary following the formal adoption of the stretch code and through the effective date of enforcement. Training will need to be provided to all stakeholders involved in the design, build, enforcement and material supplier industry. Technical assistance is critical for the effective implementation of the code.

9 Effective date of enforcement for the stretch code.

All projects that are submitted for permit on, or after the effective date, will need to comply with the stretch code. At this time training will have been implemented and any materials supporting the implementation of the code will need to be completed. Also, a feedback loop should be implemented that will include an assessment of compliance with the stretch code to identify issues that will need to be addressed in future versions of the code.

CASE STUDIES AND RESOURCES

Case Studies

New York Stretch Code. NYSERDA drafted NYStretch Code-Energy 2015 as a locally adoptable stretch energy code to reduce the environmental impact of building energy use so the state can meet its 40 X 30 and 80 X 50 carbon reduction goals. The stretch code is readily adoptable as a "More Restrictive Local Standard" with minimal changes required by local governments. It includes enforceable language coordinated with the New York State Uniform and Energy Codes. The proposed code was studied to confirm that it is cost-effective, regionally appropriate and lowers energy use and greenhouse gas emissions associated with new buildings. The NYStretch Code-Energy is about a cycle ahead of the current New York State Energy Code in its requirements. https://www.nyserda.ny.gov/All-Programs/Programs/Energy-Code-Training/NYStretch-Code-Energy-2015

Vermont Stretch Code. The Vermont Department of Public Service (PSD) adopted a stretch code for residential buildings and commercial buildings to achieve greater energy savings than the baseline residential building energy standard (RBES), as authorized in Act 89 of 2013. Both residential and commercial stretch codes were based on the 2015 International Energy Conservation Code. The stretch code went into effect on December 1, 2015. Buildings complying with the stretch code are considered "deemed to comply" with the energy conservation criterion of Act 250. The stretch code requires a higher level of thermal energy efficiency, a blower door test to verify the air leakage rates, and electric vehicle support for multifamily developments of 10 or more dwelling units. The stretch code also requires meeting a lower Energy Rating Index for residential projects than required to comply with the base energy code. http://publicservice.vermont.gov/energy_efficiency/code_update

Boulder Code. The City of Boulder, Colorado has set goals of achieving 80 percent reduction by 2050 (80x50), reaching net zero energy construction through building and energy codes by 2031, as well as achieving 100 percent renewable electricity, economic vitality and community resilience. To help reach these goals, Boulder has adopted the 2017 City of Boulder Energy Conservation Code (COBECC) that prescribes advanced energy efficiency and conservation standards for new buildings and for additions and alterations to existing building. For commercial projects, energy requirements are 30 percent more efficient than 2012 IECC/ASHRAE 90.1-2010 in addition to efficiency measures for residential buildings that result in significant energy efficiency. Boulder is also encouraging policies that will move the community towards local, distributed and renewable energy systems (for both buildings and transportation). https://bouldercolorado.gov/plan-develop/energy-conservation-codes

Washington, DC Green Construction Code. The District of Columbia has adopted the IECC and the District of Columbia Green Construction Code (GCC) as part of the Sustainable DC Plan, making the District of Columbia a nationwide leader in sustainability. These codes incorporate many local sustainable, energy- and water-efficient building best practices as mandatory requirements. The codes also extend the green building practices legislated by the District of Columbia Green Building Act of 2006 (GBA). The Green Building Act (GBA) (§ 6-1451.01 - § 6-1451.11) establishes high-performance green building standards for public and private construction projects. If a project falls within the scope of the GBA, and associated regulations, compliance with the GBA will also satisfy compliance with the 2013 Green Construction Code. https://static1.squarespace.com/

California CALGreen. CALGreen was the first-in-the-nation mandatory green building standard developed in 2007 in an effort to meet the goals of California's landmark initiative AB 32. CALGreen was developed to reduce GHG from buildings, promote environmentally responsible, cost-effective, healthier places to live and work, reduce energy and water consumption and respond to the environmental directives of the administration.

The establishment of the CALGreen Code was an important step toward more efficient and responsible building design. The California Air Resources Board estimated that the mandatory provisions in CALGreen reduce greenhouse gas emissions by three million metric tons by the year 2020. https://www.documents.dgs.ca.gov/bsc/CALGreen/CALGreen-Guide-2016-FINAL.pdf and https://codes.iccsafe.org/public/document/details/toc/657

British Columbia Step Code. The BC Energy Step Code is a voluntary provincial standard enacted in April 2017 that provides an incremental and consistent approach to achieving more energy-efficient buildings that go beyond the requirements of the base BC Building Code. It does so by establishing a series of measurable, performance-based energy-efficiency requirements for construction that builders can choose to build to, and communities may voluntarily choose to adopt in bylaws and policies. https://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/energy-efficiency/energy-step-code

The City of Vancouver, British Columbia. The City of Vancouver has adopted a series of code and zoning policy upgrades to achieve energy savings and decarbonization. The city's new Green Buildings Policy for Rezoning applies to density upgrade requests in the downtown core, and requires the adoption of a series of 'stretch code' strategies for approval of density upgrades. The requirements align with the third tier of the BC Step Code, but are enforced as a zoning requirement by the city as they move toward the broader step code requirements. A key feature of the requirements is that projects must comply with limits on Thermal Demand Intensity (TEDI) which effectively limits the overall allowed capacity of mechanical systems. In order for the projects to succeed, they must deliver a building envelope efficient enough that the building can be heated and cooled by the amount of system capacity allowed to be installed. These requirements closely parallel the approach taken by the Passive House program to deliver high performance building envelopes. http://vancouver.ca/home-property-development/zero-emissions-buildings.aspx

Resources

National Base Energy Code Resources

International Code Council (ICC)
ICC promulgates the ICC IECC for both residential and commercial buildings through their government consensus process. The 2015 and 2018 IECC are found at www.iccsafe.org. ICC also provides full support for the energy codes through training, education, supporting publications and code interpretations.

American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
ASHRAE promulgates the ANSI/ASHRAE/IES Standard 90.1-2013 and 2016 through their consensus process. These standards are found at www.ashrae.org. ASHRAE also provides full support for the energy code through training, education, supporting publications and code interpretations.

Energy Code Support Services

The U.S. Department of Energy Building Energy Codes Program
The Building Energy Codes Program (BECP) mission is to support building energy code development, adoption, implementation and enforcement processes to achieve the maximum practicable, cost-effective improvements in energy efficiency while providing safe, healthy buildings for occupants. The BECP provides several free resources to support their goals including training and education and support materials, technical assistance and REScheck and COMcheck code compliance software. (https://www.energycodes.gov/).

Building Codes Assistance Project (BCAP)
BCAP provides energy code advocacy, research and analysis, technical support, training, and code status tracking. BCAP provides a range of services to federal, state and local governments, foundations, private organizations and other nonprofits to help support energy codes. (http://bcapcodes.org/)

Additional Resources for Advanced Energy and Stretch Codes

New Buildings Institute (NBI)
NBI's Continuous Code and Policy Innovation program provides information and services regarding the development, adoption and implementation of advanced base and stretch codes. As a leading authority in stretch code development and base code advancement in the United States, NBI has developed advanced code measures and educational materials on stretch codes, advanced code measures and zero energy codes. NBI also lead the effort to rewrite the 2012 IECC commercial resulting in a 20% increase in efficiency. https://newbuildings.org/code_policy/utility-programs-stretch-codes/

- **Model stretch code provisions for a 20% performance improvement in new commercial construction.** This summary document describes a set of code strategies that represent a 20% performance improvement for commercial buildings over the ASHRAE 90.1-2013 code baseline and approximately similar savings over the IECC 2015 baseline. https://newbuildings.org/resource/model-stretch-code-provisions-20-percent/
- **Zero Net Energy Policies.** Policies and programs can dramatically change the landscape for Zero Net Energy (ZNE) buildings that produce as much energy as they consume over the course of a year. Policies and programs can foster burgeoning market interest and grow that interest through leadership, direct support, and the reduction of risks and uncertainties. NBI has developed the following set of action paths for jurisdictions to support a long term commitment to Zero Net Energy (ZNE) Buildings. By assessing progress and capability for each of these key action paths, jurisdictions can systematically plan to make progress towards their carbon emission reduction goals. https://newbuildings.org/code_policy/zero-net-energy-policies/
- **Implementing an Outcome-Based Compliance Path In Energy Codes: Guidance For Cities.** Adjustments and modifications to the built environment provide significant opportunities for meeting energy reduction goals and objectives,

since buildings comprise 40% of our nation's primary energy consumption. This document provides jurisdictions with a new approach to shift their focus towards actual, measurable energy results and provides guidance for incorporating an outcome-based compliance path into current energy codes. The guide includes draft regulatory language as a framework around which jurisdictions can begin to align their energy goals through their building codes. https://newbuildings.org/resource/implementing-outcome-based-compliance/

- **Zero Energy Policy Resources.** NBI has assembled best practice examples on how to successfully implement policy to achieve zero energy goals. This resources hub includes goals, policies, programs, and case studies from a variety of states, cities and school districts across North America. https://gettingtozeroforum.org/policy-resources/ (Click Codes and Stretch Codes at the top of the page)

Regional Energy Efficiency Organizations (REEOS)

The REEOS operate on the ground in 46 states and are on the front line of the energy code adoption, implementation and evaluation process. They work through funded partnerships with the U.S. DOE to help state and local governments increase and coordinate energy efficiency and market transformation efforts in the U.S. The REEOs are made up of the following organizations:

- Midwest Energy Efficiency Alliance (Midwest States) - http://www.mwalliance.org/
- Northeast Energy Efficiency Partnership (Northeast States) - http://www.neep.org/
- Northwest Energy Efficiency Alliance (Pacific Northwest States) – http://neea.org/
- South Central Partnership for Energy Efficiency as a Resource (Texas and Oklahoma) - https://eepartnership.org/
- Southeast Energy Efficiency Alliance (Southeast States) - http://seealliance.org/
- Southwest Energy Efficiency Partnership (Southwest States) - http://www.swenergy.org/

Building Energy Magazine Article

For decades, local energy codes have defined the least efficient structure that could be legally built. Although codes have become stricter, they still fall short of industry experts' recommendations toward zero-net energy. For projects that cannot offset energy use on site, the goal should be creating standards for ultra-low energy homes and commercial spaces on par with ZNE. http://www.nxtbook.com/naylor/ENEB/ENEB0118/index.php#/40

ACEEE's Local Policy Tracker and State Energy Efficiency Scorecard

The American Council for an Energy Efficient Economy maintains a comprehensive local policy tracker. ACEEE also ranks states based on six categories including utility programs, transportation, building energy codes, combined heat and power, state initiative and appliance standards. Starting in 2018, the scorecard will incorporate zEPI Jurisdictional Scores. http://aceee.org/state-policy/scorecard

zEPI Factsheet

This factsheet outlines the methodology to calculate zEPI jurisdictional scores included in the ACEEE Scorecards. https://newbuildings.org/wp-content/uploads/2015/12/JurisdictionalScoreMethodologyFactsheet_2017.pdf

Zero Code from Architecture 2030. This document describes a policy approach to require the adoption of renewable energy to projects to offset design energy use to achieve zero net energy. Using a prescriptive code baseline of ASHRAE 90.1-2016, the Zero Code describes anticipated energy use for a range of project types based on national modeling analysis. The document provides a calculation protocol to account for the adoption of on and off-site renewables to offset anticipated (design) energy use of the project. For projects using a modeled performance pathway, additional percentage reductions in regulated energy use below 90.1-2016 must be demonstrated to meet the requirements of the Zero Code. This calculation determines the amount of renewable energy required for projects following this protocol.
https://zero-code.org/

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New Buildings Institute (NBI) is a nonprofit organization driving better energy performance in buildings. We work collaboratively with industry market players—governments, utilities, energy efficiency advocates, and building professionals—to promote advanced design practices, innovative technologies, public policies, and programs that improve energy efficiency. We also develop and offer guidance and tools to support the design and construction of energy efficient buildings.

Throughout its 20-year history, NBI has become a trusted and independent resource helping to drive buildings that are better for people and the environment.