US EPA ARCHIVE DOCUMENT

4.3 Building Codes for Energy Efficiency

Policy Description and Objective

Summary

Building energy codes require new construction and major renovations in existing buildings to meet minimum energy efficiency requirements. Well-designed and enforced codes can institute construction practices that reduce building life-cycle costs and occupants' total housing or commercial costs. Building energy code requirements can also help reduce peak energy demand, as well as greenhouse gas (GHG) emissions and other air pollutants. Recognizing these benefits, a majority of states have adopted building energy codes for residential and commercial buildings.

Building energy codes improve energy efficiency in new building construction and major renovations by setting thermal performance standards for building envelope components and efficiency criteria for building systems and equipment. Developed at the national level through model code and standards processes, energy codes are typically adopted at the state level and enforced by code officials at the local level.

Broadly speaking, building codes include an array of specifications and standards that address safety and functionality. In 1978, California became the first state to include energy requirements in its code. As of March 1 2015, 40 states plus Washington, D.C., have state-level residential building energy codes equal to or better than the 2006 International Energy Conservation Code (IECC), and 41 states plus D.C. have state-level commercial building energy codes equal to or better than ASHRAE 90.1-2004 (BCAP 2015a).

To be successful with codes, state and local governments have found they must ensure that the most efficient model energy codes are adopted and that compliance is rigorous. States and localities are taking steps in this direction by adopting updated versions of energy codes and are improving compliance by monitoring, evaluating, and enforcing their codes. States and localities without building energy codes can leverage these existing best practices when adopting energy codes in their jurisdictions.

The potential energy savings from further state action can be significant. If the most recent commercial and residential model energy codes—i.e., the 2012 IECC—are adopted, states can reduce their energy usage by 30 percent compared to the 2006 IECC (DOE 2013). If states comply with existing codes, the projected national savings from bringing a year's worth of new residential and commercial construction in the U.S. up to full compliance is 2.8–7.9 quadrillion British thermal units annually, or $63–$174 million in annual energy cost savings (IMT 2013).

Why Building Energy Codes Matter

Incorporating efficiency at the time of construction is typically the most cost-effective way to improve building energy performance. However, market barriers result in underinvestment, leading to "lost opportunities" in inefficient structures that are expensive or impractical to improve later in the building life cycle. Two such barriers are:

- *Split incentives*. Whereas builders are motivated to minimize capital costs, homeowners and building tenants are motivated to minimize total occupancy costs, including energy bills. When builders invest in energy efficiency, the benefits in lower energy bills flow to occupants and not to them.
- *Customer preferences*. Most home purchase decisions and feature choices are driven by non-energy factors. In selecting optional features for the home, buyers often focus on amenities like kitchen upgrades, extra bathrooms, and new flooring. Efficiency competes with these priorities.

In the face of multiple barriers, energy codes can ensure that new buildings achieve a basic level of energy efficiency performance that is cost-effective and delivers related benefits.

Objective

Building energy codes establish legal requirements for a minimum level of energy efficiency for residential and commercial buildings.

US EPA ARCHIVE DOCUMENT

Benefits

State and local governments see a range of benefits from building codes, including lower energy use, reduced energy costs, reduced pollutant emissions, stronger local economies, improved energy resource reliability and improved health. For example, the U.S. Department of Energy (DOE) estimates that upgrading from the 2006 to the 2012 IECC would reduce the energy costs to the homeowner by an average of 32.1 percent (DOE 2012).

The DOE analysis also estimates that cumulative energy savings from 1992–2012 were approximately 4.2 quads and cost savings to consumers have been more than $44 billion. These savings resulted primarily from DOE-supported activities that help upgrade model energy codes; accelerate their adoption by states and localities; and improve code compliance via software tools, training, and technical support. At an estimated 20-year federal budget cost of some $110 million, energy codes have realized more than $400 in cost savings for each DOE program dollar spent (DOE 2014).

Looking forward, the estimated cumulative benefits from DOE program support total nearly 46 quads of full-fuel-cycle energy—or 44 quads of primary energy—through 2040, equivalent to almost an entire year's worth of current U.S. residential and commercial primary energy consumption. These energy savings correspond with consumer dollar savings of up to $230 billion on utility bills through 2040. In terms of emission prevention benefits, annual carbon savings are estimated at 36 million tons through 2012, with expected cumulative savings through 2040 of 3,478 million tons (DOE 2014f).

Building energy codes can also strengthen state and local economies by increasing investment in energy-efficient capital equipment and increasing employment for technical experts, duct and air leakage professionals, quality control assessors, building and system commissioning agents, energy auditors, and compliance officers (DOE 2014f).

Other key benefits of building energy codes include improved regional energy reliability and energy self-reliance. Codes reduce energy usage and therefore decrease peak loads, which increases grid reliability. They also help reduce our nation's dependency on foreign energy sources (DOE 2014f).

States and municipalities may also see benefits from building energy codes ability to reduce energy use and reduce pollutants. Energy-efficient buildings reduce GHG emissions and other air pollution and thus lower the risk of related health issues (DOE 2014f). In addition to improved outdoor air quality, building energy codes help improve indoor air quality—which can be more polluted than outdoor air—by reducing particulate matter, radon, carbon monoxide and other harmful pollutants (CPSC 2014).

States with Building Energy Codes

Because new construction is a key driver of energy demand growth in the buildings sector, states often use energy codes as a key energy and environmental strategy. Some states and utilities are promoting "beyond code" building programs to achieve additional cost-effective energy efficiency.

For residential buildings, as of March 2015, 40 states plus Washington, D.C., use a version of the 2006 IECC or better building energy code. Eleven of these states (plus D.C.) are using the 2012 IECC version that DOE has determined would improve the energy efficiency of residential buildings by approximately 30 percent compared to the 2006 IECC. Only 10 states have not adopted a statewide code, although many jurisdictions in these states have adopted the 2009 IECC (BCAP 2015a).

For commercial buildings, as of June 2014, 41 states plus Washington, D.C., use a version of ASHRAE 90.1-2004 or a more stringent building energy code. Seventeen of these states (plus D.C.) are using the ASHRAE 90.1-2010 version that DOE has determined would improve energy efficiency in commercial buildings compared to ASHRAE 90.1-2004. Nine states have not adopted commercial building codes, although many jurisdictions within these states have adopted ASHRAE 90.1-2010 (BCAP 2015a).

Residential and Commercial Building Energy Codes

The energy code that applies to most *residential* buildings is the applicable version of the IECC, which supersedes the Model Energy Code. The 2012 IECC is the most recent version for which DOE has issued a positive determination. However, different versions of the IECC have been adopted by states, creating a patchwork of residential codes across the country. The federal Energy Conservation and Production Act (ECPA) was amended in 1992 to require states to review and adopt the most recent model code, or submit to the Secretary of Energy its reasons for not doing so.

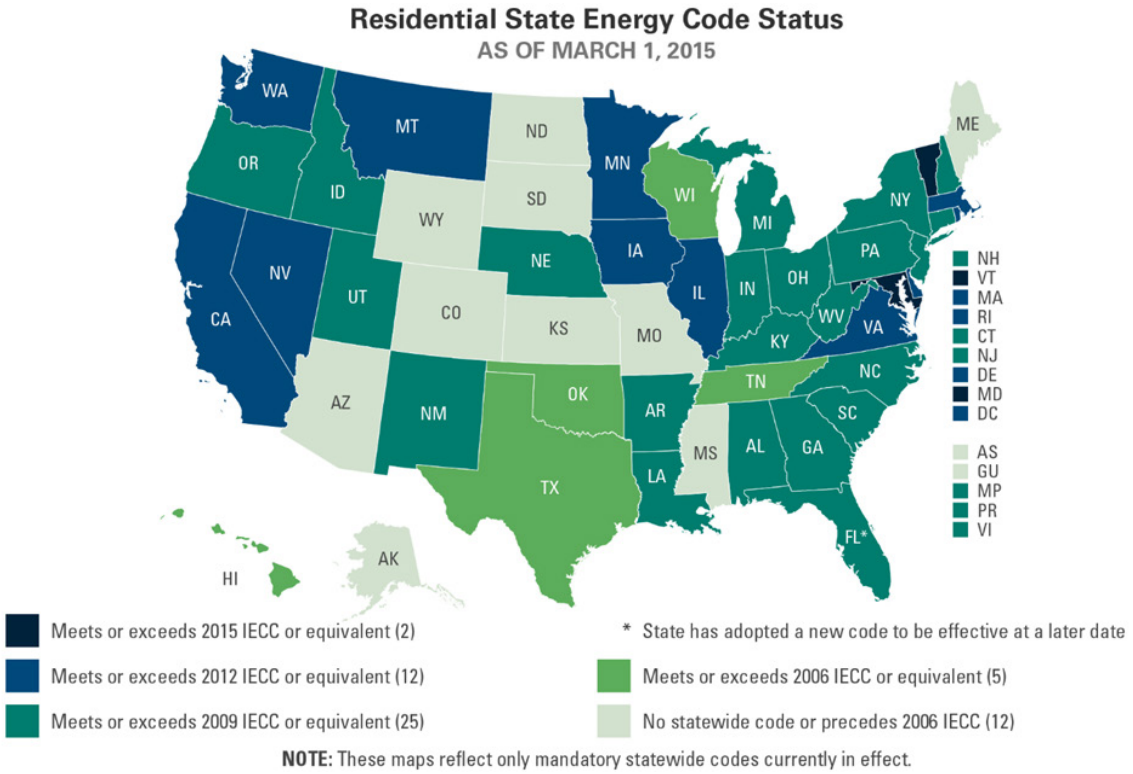
Most *commercial* building energy codes are based on ANSI/ASHRAE/IES Standard 90.1, jointly developed through the American National Standards Institute, ASHRAE, and the Illuminating Engineering Society, and commonly referred to as ASHRAE 90.1. ECPA requires states to adopt the most recent version of ASHRAE Standard 90.1 for which DOE has made a positive determination for energy savings, currently 90.1-2013. The IECC also contains prescriptive and performance commercial building provisions. By referencing Standard 90.1 for commercial buildings, IECC offers designers alternate compliance paths.

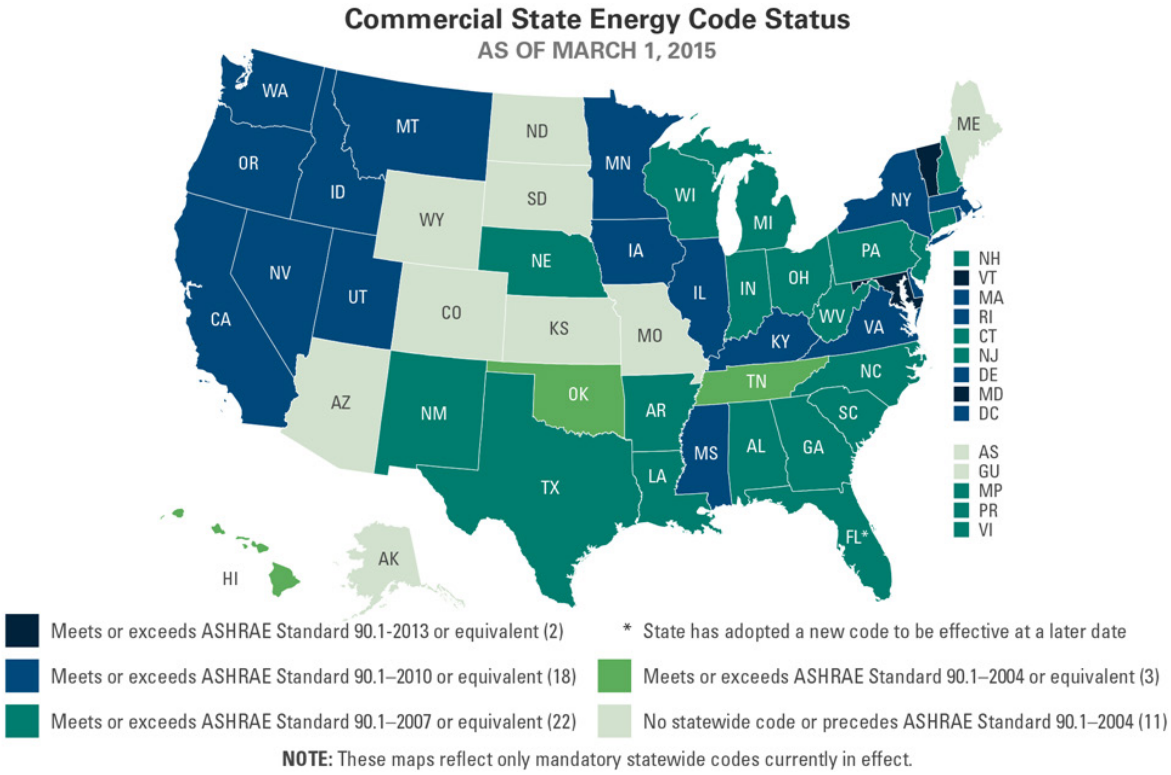
State and local experience has shown that a code must be properly implemented, evaluated, and enforced after being adopted to achieve energy savings. In states where these components are missing, compliance rates can fall short. But recent studies, including a 2011 Illinois study (IEE 2011) and a 2013 Minnesota study, show that improved enforcement is leading to increased compliance—more than 80 percent compliance in the new homes and new commercial building markets (BCAP 2015b). Leading states are not only monitoring and evaluating their energy codes, but also using the findings from these analyses to take corrective action.

Most states and municipalities periodically update their building energy codes to ensure that they incorporate improvements in technology and design that offer increased energy efficiency and cost-effectiveness. Code reviews are often triggered by DOE's Congressionally mandated determination as to whether each new code version saves energy relative to the previous version (ASHRAE 90.1 or IECC). For residential codes, federal law requires states to consider adoption of each new IECC version for which DOE issues a positive determination.

US EPA ARCHIVE DOCUMENT

Figure 4.3.1: States with Residential and Commercial Building Energy Codes





Source: BCAP 2015a

Establishing Effective Building Energy Codes

When adopting, implementing, enforcing, or updating energy codes, states identify key participants, review code implementation costs, analyze building life-cycle costs, determine a timeframe for action, and evaluate interactions with federal and state policies.

Participants

- *Government officials*. Some states and local jurisdiction government officials have been active participants in updating the national model energy codes. State and local governments are the front-line actors in code implementation and enforcement (DOE 2005). States and local jurisdictions often modify the national model codes during the state/local adoption process to account for their specific needs and opportunities.

  In national model code development processes conducted by the International Code Council (ICC) and ASHRAE, federal government officials from DOE and many other stakeholders participate in the multi-year code development cycles. Each time a new version of the IECC or ASHRAE 90.1 is issued, DOE makes a determination on whether the new version saves energy compared to the previous version. If DOE makes a positive determination on a new residential code, federal law gives states 2 years to consider adopting it. If they elect not to adopt the code, state officials are required to submit their reasoning to the U.S. Secretary of Energy. State adoption of the ASHRAE 90.1 commercial building energy code, by contrast, is not optional. If DOE makes a positive determination on a new commercial building energy code, states are required to update their current code with either the applicable ASHRAE 90.1 version or an equally stringent code within 2 years. DOE also provides technical assistance to states to support building code adoption and implementation. More information is available at http://www.energycodes.gov.

- *Code development organizations.* The ICC, ASHRAE, and the National Fire Protection Association (NFPA) develop model energy codes and standards. The ICC develops the IECC for residential and commercial buildings, while ASHRAE maintains the 90.1 standards for commercial buildings and 90.2 for residential buildings. Both ICC and NFPA provide a reference to ASHRAE Standard 90.1 as an alternate compliance path for commercial buildings. The ICC also provides training and technical support to code officials to assist with interpretation and implementation of codes.

- *Nongovernmental organizations (NGOs).* NGOs support building energy code adoption and implementation by fostering peer exchange, serving as information sources, and providing expert assistance. For example, the Building Codes Assistance Project (BCAP) offers tailored technical assistance to states and municipalities. In states seeking to adopt the IECC or ASHRAE 90.1, BCAP provides services such as educational support and implementation assistance for code officials and legislators. BCAP was founded as a joint initiative of the Alliance to Save Energy, the American Council for an Energy-Efficient Economy, and the Natural Resources Defense Council. Other active NGOs in the building codes arena include the regional energy efficiency organizations (comprising six regional groups), the New Buildings Institute (NBI), and the Institute for Market Transformation (IMT).

- *Utilities and utility regulators.* Utilities and regulators can also be key participants in improving building energy code implementation and compliance (EPA 2009). IMT, the Institute for Electric Efficiency, and the Northeast Energy Efficiency Partnership list five recommended roles for utilities: 1) advancing measurement and translation of baseline compliance levels to target education and training efforts, 2) developing a mechanism for evaluating and attributing the energy savings impacts, 3) promoting the inclusion of energy codes into integrated resource planning, 4) securing regulatory approval for expenditures on code activities, and 5) advancing knowledge on the interaction of codes with existing energy efficiency programs (Stellberg et al. 2012).

US EPA ARCHIVE DOCUMENT

- *Builders, developers, and building owners.* Builders, developers, owners, and managers are becoming more involved with the development of the national model energy codes as they are responsible for implementing provisions in the code. States and municipalities are also finding that active collaboration with these groups improves understanding, creates buy-in, and can lead to greater levels of compliance.
- *Industry professionals.* Building scientists, manufacturer representatives, and other industry experts are involved in the code development and implementation process to ensure that the code language and requirements are in coordination with available technologies and building science. The Residential Energy Services Network (RESNET) promotes codes by fostering national markets for home energy rating systems, accrediting home energy raters and providers, promoting residential energy efficiency financing products, and conducting educational programs. To encourage consistency across rating systems, the organization works to harmonize its standards with the IECC.

Building Life-Cycle Costs

Incorporating efficiency into building design and construction is more cost-effective than trying to upgrade efficiency after the building is in operation. Decisions made during design and construction often cannot be remedied later or can only be improved at significant cost. Moreover, because building components and systems can last 15, 20, 50 years, or longer, inefficient technologies can waste energy for decades until a replacement or upgrade occurs.

For example, a recent study estimated that upgrading the energy efficiency of a typical new home in Arizona from the 2006 IECC would save homeowners an average of $3,245 over 30 years with the 2009 IECC and $6,550 over 30 years with the 2012 IECC (DOE 2012). The cost to install the measures in the 2012 IECC, including improved ducts, air sealing, and insulation, makes it very difficult to upgrade after the home construction is complete.

Code Implementation Costs

National code development processes can spare a state the full cost of developing its own codes. While ICC, ASHRAE, and NFPA offer model energy codes that can be adopted in their entirety, it is common for states to initiate an adoption and modification process that amends the model codes to reflect state-specific considerations. However, some states (e.g., California) and municipalities maintain their own code development processes. State and local governments can also lower development, adoption, and enforcement costs by taking advantage of resources offered by DOE.

When adopting a model code, some states provide resources to municipalities to support implementation and enforcement. In some cases local funds are available to help code officials and builders understand and comply with the code's requirements. However, even when such resources are available, localities are finding that staff resources for code enforcement are often stretched thin. To overcome this barrier, some local governments collaborate with state officials, utilities, or third-party technical experts such as energy raters to help meet resource and assistance needs.

Timing and Duration

States are finding that a periodic review of energy code requirements helps ensure that new efficiency opportunities are realized in their jurisdictions. States often conduct their code reviews following national-level model codes updates or the issuance of a DOE determination. Other states call for updates on their own regular schedules. For example, some states take action if the code is more than 5 years old, if there is no evidence of consistent enforcement, or if there is no state energy code.

When DOE makes a positive determination on a new version of a model code, states are required by federal law to complete an adoption consideration process within 2 years. State adoption is not required for the IECC residential building energy code (though states choosing not to update their codes must publicly submit their reasoning to DOE), which has recently been updated and is released every 3 years (e.g., 2009, 2012, 2015). State adoption is mandatory for the ASHRAE 90.1 commercial building energy code, which has recently been updated and is also on a 3-year cycle (e.g., 2007, 2010, 2013).

State experience with the review and update process demonstrates that it is important to anticipate and plan for the education and training needs of code officials, builders, contractors, and other affected parties. Each participant requires time to understand new requirements. Code changes also affect product manufacturers and suppliers, who need lead-time to clear current inventories and ensure that compliant products are available when the revised code takes effect.

Best Practices for Developing and Adopting Building Codes

- *Do your homework.* Evaluate current building energy code laws and options for implementation and enforcement. If there is no state energy code, if it is more than 5 years old, or if there is no evidence of consistent enforcement, it may be time to act:
  - Analyze the benefits and costs of code adoption and implementation.
  - Talk with key stakeholders, including local officials and builders, to gauge their perspectives.
  - Assess resources for training and technical support for code officials, builders, designers, and installers.
  - Contact suppliers about availability of products.
- *Get outside help.* Tap building expertise and other resources from organizations such as DOE's Pacific Northwest National Laboratory, BCAP, Regional Energy Efficiency Organizations (REEOs), state energy offices, the National Association of State Energy Officials (NASEO), and the NBI. Resources might include quantitative assessments of potential benefits, baseline building practice studies, legislative and regulatory assessments, training, and technical assistance for builders and code officials.
- *Create a stakeholder process.* Involve key stakeholders early and regularly. Include them in reviews of studies, proposed regulations, and other aspects of the process. This process increases the chances of code adoption and minimizes enforcement problems.

Interaction with Federal Programs

State and local governments are finding that voluntary programs such as ENERGY STAR can advance building performance beyond code minimum requirements and can field test potential design and building practices that can become future energy code requirements. ENERGY STAR-certified new homes are designed and built to standards well above code and market performance levels, and have undergone inspections, testing, and verification to ensure strict requirements are met.

In some states, ENERGY STAR certification may be recognized under certain conditions as “deemed to comply” with energy codes, helping state and local governments address the technical and resource issues they face in code implementation. This can be especially helpful where utilities fund such voluntary programs. Specific state and local conditions should be carefully reviewed when considering options of this type.

US EPA ARCHIVE DOCUMENT

Interaction with State Policies

State and local policy-makers are leveraging other state clean energy policies to support building energy codes. For example, some states are using public benefits funds to support code implementation and enforcement. The New York State Energy Research and Development Authority is committed to ensuring that at least 90 percent of residential and commercial buildings comply with the 2010 Energy Conservation Code of New York State by 2017 through its Energy Codes Training and Support Initiative to transition to a more energy-efficient built environment (NYSERDA 2014).

Some state and local governments are investigating the extent to which building codes can be incorporated into their air quality planning processes. Codes improve air quality by reducing energy consumption in buildings, thereby lowering direct fuel use and electricity generation and the resulting pollution from power plants. Some jurisdictions have examined the role of energy codes in State Implementation Plans for regulated air pollutants. S.B.5 in Texas is an example of legislation mandating building energy efficiency for the purpose of improving the state's ozone air quality through the state's Health and Safety Code (SECO 2010). As states explore their options for developing plans under the proposed EPA Clean Power rule, energy codes are garnering focus as part of the rule's allowed use of energy efficiency in compliance.

Program Implementation and Evaluation

Implementation

States and municipalities are finding innovative ways to implement building codes.

These efforts are needed to address the following commonly encountered barriers to implementation:

- *Building industry technology advancement is slow*. While there are fewer than a dozen U.S. manufacturers of automobiles, home appliances, and light bulbs, there are thousands of home building companies in the United States, even with substantial consolidation in the wake of recent construction downturn. In contrast to highly automated sectors of the U.S. economy, the building sector remains largely a local craft industry dependent on onsite crews and subcontractors integrating hundreds of components from various manufacturers. While some advanced building systems, including those used by modular home builders, are beginning to shift the industry, this barrier still requires training and education services to address such issues.
- *Energy codes can be complex and difficult to understand*. Responding to feedback from code officials and industry groups, code-development organizations have worked to simplify new versions

Best Practices for Energy Code Implementation

States and municipalities have identified the following best practices for energy code implementation:

- Educate and train key audiences:
- Build strong working relationships with local building officials, homebuilders, designers, building supply companies, and contractors for insulation, heating, and cooling equipment.
- Hold regular education and training sessions before and after the effective date of the new energy code requirements. Maintain an ongoing relationship with homebuilders and building officials associations, even between code change cycles. This encourages both understanding and trust and is an opportunity to share concerns.
- Provide the right resources, including:
  - An overview of energy code requirements, opportunities, and related costs and benefits.
  - Basic building science concepts. Practical compliance aids can range from laminated information cards for simple prescriptive methods to software packages for performance-based codes.
  - Information on how to inspect plans and site features for compliance.
  - Whom to contact and resources for more information and technical assistance.
- Provide budget and staff for the program. Assign staff personnel with appropriate training and experience to support the code adoption and implementation processes. Give them enough of a budget to do the necessary homework, involve stakeholders, and support implementation.

of the ASHRAE 90.1 and IECC model codes. Some states have had success with simplified prescriptive codes, as in Oregon and Washington, written in plain English with easy-to-read tables and other user-friendly features. Code officials are also pursuing a range of best practices (see text box, "Best Practices for Energy Code Implementation") that minimize the additional education and time requirements imposed on code officials.

- *Many states do not have the resources to monitor, evaluate, and enforce their energy codes*. Many jurisdictions do not have staff dedicated to training, technical assistance, or enforcement, and thus do not pursue monitoring and evaluation. As a result, self-enforcement of building energy code provisions is the norm in many states. New York accomplishes this by requiring a licensed design professional to complete an official form attesting to code compliance. In the face of resource shortages, other states rely on self-enforcement mechanisms such as home energy rating systems and the ENERGY STAR program.

Evaluation

State and municipal experience demonstrates that evaluating energy savings, conducting compliance surveys, and assessing the process by which program information is distributed are key elements of a successful building energy code. Evaluation of energy and peak demand savings data helps ensure that requirements are followed and that stated goals are achieved. Code officials use information about the "co-benefits" of energy savings (e.g., financial savings and reductions in air pollution), implementation levels, and code awareness to evaluate progress, suggest strategies for improvement, and enhance overall program effectiveness. Another major benefit of compliance evaluation is the identification of code provisions that show the greatest energy savings impacts, as well as low compliance, or reveal significant market confusion. Revealing such issues can help code officials develop targeted corrective actions for training and enforcement.

Similarly, states are conducting studies of prospective energy savings from codes prior to adoption and implementation. Measuring the range of potential benefits, energy, economic, and environmental, can build the case for energy codes by assessing both positive and negative costs. If results show promise, studies of prospective benefits can also broaden stakeholder support for energy codes.

Texas Energy Code Evaluation

In Texas, the South-central Partnership for Energy Efficiency as a Resource developed a *2014 Energy Code Adoption Report* (SPEER 2014) that identifies the code adoption status of 217 cities and describes enforcement and adoption activities. Key findings include:

- In 2013, just over half of the jurisdictions required certification of their enforcement staff.
- Conversations with building industry leaders indicated that the industry tends to support the "leveling of the [playing] field" to the extent that codes can help eliminate low-cost, low-efficiency, low-quality construction that undercuts mainstream builders' market prices and reputations. These discussions indicate support for adoption and enforcement of the current (2009) state energy code.
- Through 2013, 20 cities in Texas had adopted the 2012 IECC energy codes or stronger amendments. This number had almost tripled by 2014.

State and local officials are finding value from the following kinds of evaluation tools:

- *Energy savings evaluation*. Even though theoretical energy savings from building codes can be estimated with computer software, it is important to evaluate whether codes are actually saving energy and meeting goals. Information from energy savings evaluations can indicate if certain portions of the code perform better than others or if overall savings are meeting expectations. With this insight, states can focus their implementation and enforcement efforts on addressing priority concerns. For example, a 2002 study in Fort Collins, Colorado, found that measured energy savings from a code change in 1996 were approximately half of pre-implementation estimates. By conducting a code evaluation, the city was able to identify problem areas and focus its resources accordingly (City of Fort Collins 2002). In the context of

US EPA ARCHIVE DOCUMENT

EPA's proposed Clean Power Plan, state plans that include codes need to consider best practices for energy savings evaluation.

- *Compliance surveys*. While there are few comprehensive code compliance studies, DOE has created a series of compliance evaluation tools that can be used to determine whether buildings are being built in compliance with code. Another purpose of compliance studies is to assess the overall state of building technology and practice. Results might show, for example, that certain beyond-code energy features are gaining wide acceptance in the market. In states and municipalities where data exist, they frequently indicate compliance rates between 40 and 60 percent, although much lower levels of performance have been documented (NEEP 2009). Because the methodologies used in compliance studies can vary significantly, DOE's evaluation tools can help provide greater consistency in assessing compliance rates. Regardless of which methods are used, the gap between targeted and measured compliance highlights the challenges state and local governments face in reaching compliance goals and puts a premium on innovation and effort aimed at forging new compliance strategies.
- *Process evaluation.* State programs that offer technical assistance and related services benefit from a process evaluation to assess and suggest improvements to these offerings. These evaluations look less at what is being built than at the ways information is delivered to key stakeholders such as builders and code officials. Improving service delivery can help improve code compliance and overall stakeholder acceptance of the code. Process evaluation is also used to determine the effectiveness of a state's enforcement efforts.

State Examples

The following states have implemented successful building code programs using varying approaches.

California

California's Title 24 standards for residential and commercial buildings constitute a mandatory, statewide building energy code that is more efficient than the 2012 IECC and ASHRAE 90.1-2010. California's building energy code differs from other state codes in that it impacts the process of building design and construction verification more thoroughly. For building designs, all building plans must be reviewed for energy code compliance prior to the release of building permits. For construction verification, California requires energy inspections (envelope, infiltration) and has unique inspection certificates that are required for insulation and mechanical equipment and devices that fall under the Building Energy Efficiency Standards.

Website: http://www.energy.ca.gov/title24/

Massachusetts

The first state to adopt an above-code appendix to its state building energy code, Massachusetts implemented a version of the 2009 IECC that was designed to achieve 20 percent greater savings than the base 2009 IECC. By the end of 2012, 122 communities in Massachusetts adopted the voluntary stretch code—an impressive rate of participation for voluntary code. The Massachusetts state government has since adopted the 2012 IECC and ASHRAE 90.1-2010 building energy codes, with an effective date of July 1, 2014. As a result, DOE estimates, the state will save $144 million annually by 2030.

Website: http://www.mass.gov/eea/energy-utilities-clean-tech/energy-efficiency/policies-regs-for-ee/building-energy-codes.html

Texas

Texas, a state with a "home rule" constitution, passed legislation in 2001 requiring local governments to follow a single statewide building energy code.

While Texas has not adopted the 2012 IECC or ASHRAE 90.1-2013, numerous municipalities in the state have moved forward with more progressive building energy codes than are recommended by the state. Notably, the city of Houston has adopted a stretch code for residential buildings equivalent to 10 percent above the 2009 IECC. It is estimated that 2012 IECC and ASHRAE 90.1-2010 adoption in Texas would save close to $1 billion annually by 2030.

Website: http://seco.cpa.state.tx.us/tbec/

Arizona

Arizona is another home rule state, where energy codes are adopted and enforced at the local level. As such, several communities, including Pima County, Peoria, and Phoenix, have emerged as local leaders in building code adoption. These jurisdictions now have codes based on the 2012 IECC. The successful experience of these municipalities has encouraged other local governments in Arizona to consider adopting an energy code. However, despite the continued success, only half of the cities researched by the Phoenix Chapter's Technical Committee have adopted energy codes. It is estimated that adopting the 2012 IECC and ASHRAE 90.1-2010 energy codes statewide could save Arizona about $270 million annually by 2030.

Website: http://www.azenergy.gov/government/state+energy+codes.aspx

Illinois

Illinois is notable as a state that adopted the 2012 IECC on January 1, 2013, and has set up an aggressive system for implementing future updates to energy building codes. A provision in past legislation to adopt 2009 IECC and ASHRAE 90.1-2007 directed the state's Capital Development Board to adopt subsequent versions of the IECC within 9 months of publication. DOE expects Illinois' energy cost savings to reach $270 million annually by 2030.

Website: http://www.illinois.gov/dceo/whyillinois/KeyIndustries/Energy/Pages/IECC.aspx

US EPA ARCHIVE DOCUMENT

What States Can Do

States with energy codes can consider updates and improvements to the implementation process to increase energy efficiency. States with no energy code in place can examine the costs and benefits of implementing a code and consider initiating a code adoption process.

Action Steps for States

States that already have an energy code can:

- Implement a rigorous enforcement program that ensures that local building code departments have proper training and resources, including adequate staff coverage.
- Review the version of the document currently in force. If it is more than 5 years old, consider an updated version. The latest available IECC code is the 2015 version, and the most recent ASHRAE Standard 90.1 is the 2013 version.
- Conduct analysis on the effect of potential code updates on energy and cost savings for building owners, on the effect on energy generation and distribution, and on GHG emissions and other criteria air pollutant levels. Balance these benefits against any added construction costs.
- Initiate a stakeholder process to review the data, obtain participant input, and decide whether to adopt a new code.
- If a new version of the energy code is adopted, initiate administrative and educational processes. Implementation tools and other resources are available at no charge from DOE.
- If a state-specific energy code training program exists, review it and consider an update that describes new codes not currently covered.

A state that does not have an energy code can:

- Review available model codes and standards and learn about other states' experiences. Conduct research and analysis to determine which model codes best match the needs of the area under consideration.
- Establish a construction market baseline against which to assess the benefits of an energy code. This may require a field survey of homebuilders, suppliers, and contractors, including onsite inspections and interviews.
- Conduct an analysis of the effect of the new code on energy and cost savings for building owners, power system reliability, and reduced GHG emissions and other criteria air pollutants. Balance these benefits against any added construction codes.
- Initiate a stakeholder process to review the data, obtain stakeholder input, and decide whether to adopt the energy code under consideration.
- After a decision to adopt an energy code, initiate administrative and educational processes, as appropriate.
- Develop a code implementation process that includes training and technical assistance. Reach out to affected industries and audiences across the state. Tap federal, NGO, and industry sources for expertise and resources to support these efforts.

Information Resources

Resources for Building Code Information

Title/Description	URL Address
ASHRAE. ASHRAE provides technical standards, publications, education, and hosting for industry events.	http://www.ashrae.org
BCAP. A nonprofit organization, BCAP is dedicated to helping states adopt and implement up-to-date building energy codes.	http://energycodesocean.org
DOE Building Energy Codes Program. Program provides compliance tools, technical assistance, and other code information and support.	http://www.energycodes.gov
DOE. Building energy code determinations issues by the U.S. Department of Energy.	http://www.energycodes.gov/determinations
ICC. The ICC provides code documents, technical assistance, training, and other services, including the IECC residential code.	http://www.iccsafe.org
ICC Code Library. Online library for each of the ICC model codes.	http://publicecodes.cyberregs.com/icod/
ICC State Codes. Online library of code language for various states that have IECC-based building code language.	http://publicecodes.cyberregs.com/st/
Midwest Energy Efficiency Alliance (MEEA). MEEA works on code development and adoption in the Midwest states.	http://www.mwalliance.org/policy/building-energy-codes
NASEO. The association of state energy offices.	http://www.naseo.org/building-energy-codes
NBI. A nonprofit organization, NBI develops leading-edge commercial building standards and related research and technical information.	http://www.newbuildings.org
Northeast Energy Efficiency Partnerships (NEEP). NEEP works on code development and adoption in the Northeast states.	http://www.neep.org/initiatives/energy-efficient-buildings/building-energy-codes
Northwest Energy Efficiency Alliance (NEEA). NEEA works on code development and adoption in the Pacific Northwest states.	http://neea.org/initiatives/codes-standards/codes
RESNET. RESNET accredits home energy rating organizations and provides a variety of technical information on home energy ratings and home energy performance.	http://www.resnet.us
Southwest Energy Efficiency Project (SWEEP). SWEEP works on code development and adoption in the Southwest region and Rocky Mountain states.	http://www.swenergy.org/programs/buildings/codes/index.html
South-central Partnership for Energy Efficiency as a Resource (SPEER). SPEER works to accelerate the adoption of energy codes in Texas and Oklahoma.	http://eepartnership.org/energy-codes-2/

US EPA ARCHIVE DOCUMENT

Compliance and Analytical Tools

Title/Description	URL Address
DOE Building Energy Software Tools Directory. This is the DOE directory of building energy analysis tools available from numerous organizations.	http://www.eere.energy.gov/buildings/tools_directory/
DOE COMcheck and REScheck. DOE-developed tools that offer an easy way to check whether building designs meet energy code requirements.	https://www.energycodes.gov/compliance/tools
DOE Compliance Evaluation Tools. DOE-developed tools to help states and jurisdictions measure and report their rate of compliance.	https://www.energycodes.gov/compliance/evaluation
DOE EnergyPlus. This public-domain software is a whole-building energy simulation program that engineers, architects, and researchers use to model energy and water use in buildings.	http://www.eere.energy.gov/buildings/energyplus/
ENERGY STAR Portfolio Manager. This tool allows users to track energy use of a portfolio of existing buildings online. It includes functions for benchmarking, managing a single building or group of buildings, assessing investment priorities, and verifying building performance.	https://portfoliomanager.energystar.gov/
ENERGY STAR Target Finder. This tool rates the energy performance of a new building design using information about energy use per square foot derived from building design simulation tools. EPA's energy performance rating system uses a 1 to 100 scale, where an ENERGY STAR target rating is 75 or higher.	http://www.energystar.gov/buildings/tools-and-resources/target-finder https://portfoliomanager.energystar.gov/pm/targetFinder
NEEA Energy Code Compliance Studies. These studies document energy code compliance results in the Pacific Northwest states.	http://neea.org/initiatives/codes-standards/codes

References

Title/Description	URL Address
BCAP. 2015a. Code Status: Commercial Adoption and Residential Adoption Maps. Building Codes Assistance Project. Accessed on April 2, 2015.	http://energycodesocean.org/code-status
BCAP. 2015b. State Compliance Studies. Building Codes Assistance Project. Accessed on April 2, 2015.	http://energycodesocean.org/state-compliance-studies
CPSC. 2014. The Inside Story: A Guide to Indoor Air Quality. Consumer Product Safety Commission.	http://www.cpsc.gov/en/Safety-Education/Safety-Guides/Home/The-Inside-Story-A-Guide-to-Indoor-Air-Quality/
DOE. 2010. Measuring State Energy Code Compliance. U.S. Department of Energy, Building Technology Program.	http://www.energycodes.gov/sites/default/files/documents/MeasuringStateCompliance.pdf
DOE. 2012a. Arizona Energy and Cost Savings for New Single- and Multifamily Homes: 2009 and 2012 IECC as Compared to 2006 IECC. U.S. Department of Energy, Building Technology Program.	http://www.energycodes.gov/sites/default/files/documents/ArizonaResidentialCostEffectiveness.pdf
DOE. 2012b. National Energy and Cost Savings for New Single- and Multifamily Homes: A Comparison of the 2006, 2009, and 2012 Editions of the IECC. U.S. Department of Energy, Building Technology Program.	http://energy.maryland.gov/codes/documents/NationalResidentialCostEffectiveness.pdf

Title/Description	URL Address
DOE. 2013. Overview of the 2012 IECC and DOE's Involvement. U.S. Department of Energy.	http://energy.gov/sites/prod/files/2013/12/f6/iecc_overview.pdf
DOE. 2014. Building Energy Codes Program: National Benefits Assessment, 1992–2040. U.S. Department of Energy.	https://www.energycodes.gov/sites/default/files/documents/BenefitsReport_Final_March20142.pdf
EPA. 2009. Energy Efficiency Program Administrators and Building Energy Codes. U.S. Environmental Protection Agency.	http://www.epa.gov/cleanenergy/documents/suca/codes.pdf
IEE. 2011. Assessment of Electricity Savings in the U.S. Achievable Through New Appliance/Equipment Efficiency Standards and Building Efficiency Codes (2010–2025). Institute for Electric Efficiency, The Edison Foundation.	http://www.edisonfoundation.net/iei/Documents/IEE_CodesandStandardsAssessment_2010-2025_UPDATE.pdf
IMT. 2013. Assessment of Energy Efficiency Achievable from Improved Compliance with U.S. Building Energy Codes: 2013–2030. Institute for Market Transformation.	http://www.imt.org/resources/detail/assessment-of-energy-efficiency-achievable-from-improved-compliance-with-u
NEEP. 2009. Model Progressive Building Energy Codes Policy for Northeast States. Northeast Energy Efficiency Partnership.	http://thehill.com/sites/default/files/neep_building_energy_codes_policy_march%202009_0.pdf
NYSERDA. 2014. Energy Code Training and Support Services. New York State Energy Research and Development Authority.	https://www.nyserda.ny.gov/All-Programs/Programs/Energy-Code-Training
SECO. 2010. Texas Energy Code Rulemaking Process. State Energy Conservation Office.	http://catee.tamu.edu/wp-content/uploads/2012/07/100824-CATEE_-_Lopez_-_Texas_Energy_Codes_Rulemaking_Process.pdf
SPEER. 2014. 2014 Energy Code Adoption Report. South-central Partnership for Energy Efficiency as a Resource.	http://eepartnership.org/2014/08/20/texas-energy-code-compliance-collaborative-releases-2014-energy-code-adoption-report/
Stellberg, S., A. Cooper, C. Sarno, and D. Lis. 2012. Role for Utilities in Enhancing Building Energy Code Compliance. Institute for Market Transformation, Institute for Electric Efficiency, and Northeast Energy Efficiency Partnership.	http://www.aceee.org/files/proceedings/2012/data/papers/0193-000174.pdf

US EPA ARCHIVE DOCUMENT