

# Reconstructing Building Codes for Greater Energy Efficiency

***To move towards an energy-saving future, governments are adopting new and strengthening existing building codes, hoping others will follow their lead.***

[Linda Baker](#) | May 2011

In Oklahoma, the governor's mansion is powered by a wind turbine. In Chicago, City Hall keeps its workers summer-cool with a sod-garden roof. In Colorado, the state capitol provides legislators with heat and light from solar panels. These are some of the glamour projects states and localities have built to harvest energy savings and encourage other property owners to go forth and do likewise.

But these high-profile projects are just part of what states and localities are doing to chart a path toward a low-energy future. The bigger thrust comes from a more mundane approach: reconfiguring building codes. Over the past few years, an increasing number of jurisdictions have done one of two things: They've adopted the Leadership in Energy & Environmental Design (LEED) green building standard, mostly for public buildings, or they have strengthened requirements detailing what materials and construction techniques new buildings should be using to conserve energy, primarily through systems for heating, cooling, insulation and lighting. Many places have done both.

A handful of pioneers has taken code-improvement projects a step further by turning to performance-based codes -- focusing on the ends rather than prescribing the means. "We are at the beginning of a dynamic shift in which the focus is on efficiency results," says Jim Hunt, chief of Boston's Environmental and Energy Services, "not technologies installed."

There's a reason why state and local environmental experts are setting their sights on construction codes. Energy experts see them as the next means to achieving higher levels of efficiency -- in part because buildings are a huge energy drain. Energy use in buildings accounts for close to 70 percent of electricity consumption and 40 percent of all greenhouse gas emissions in the United States. Energy efficiency in buildings is also considered the "least expensive carbon abatement," says Jim Edelson, senior project manager for the New Buildings Institute, a nonprofit group that works on model building codes.

The movement toward energy-wise code modification began -- where else? -- in California. In 1978, the state adopted Title 24, a set of high-efficiency standards dictating energy-saving requirements for walls, roofs, windows, insulation, heating, water heating, lighting, and ventilating and air conditioning systems. Some 30 years later, the results are impressive. Along with mandates for energy-efficient appliances, the Title 24 standards have saved Californians more than \$56 billion in electrical and natural gas expenses, according to the California Energy Commission. Although per capita electricity use in the U.S. has increased by nearly 50 percent since the mid-1970s, California has essentially maintained its per capita electricity use.

"Here's an example where policy really does work," says Matthew Tyler, an engineer with an energy-conservation firm.

Since then, a number of other states have taken aggressive approaches to developing low-energy building codes. Last year, this effort to create, through regulation, more environmentally friendly buildings took a quantum leap. The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) and the International Code Council (ICC) -- the two organizations charged with developing the nation's model energy codes -- released groundbreaking new versions of those standards. States typically use the model codes, which are updated every three years, as the basis for their own building regulations that cover private and public developments.

Known as the ASHRAE 2010 Standard 90.1 and the International Energy Conservation Code (IECC) 2012, the latest standards are about 30 percent more efficient than earlier versions -- and represent the largest single

increase in the history of the energy codes. Among the major changes to the code were lighting that shuts off automatically in commercial buildings; minimum energy performance standards for heating systems in computer rooms; and more efficient water-cooled air conditioners. "It's a significant improvement," says Edelson.

Energy codes are evolving in other ways -- most notably by including other environmentally friendly green building features such as recycling and water use. In 2010, for example, ASHRAE, the ICC and several other organizations jointly released a draft of the first International Green Construction Code. Meanwhile, California became the first in the country to adopt a statewide green building code, CalGreen.

But even as energy codes advance, the nation's approach to building regulations has its limits, because states can choose to adopt any version of the model codes -- or not adopt any code at all. The result is "a quilt of code adoption across the country," says Lane Burt, director of technical policy at the U.S. Green Building Council (USGBC). "It's an energy policy problem. We don't have a coherent national policy in terms of code."

To help rectify the situation -- and promote building efficiency nationwide -- the Department of Energy in 2009 stipulated that any state receiving funding from the Recovery Act's State Energy Program had to meet the 2009 IECC standard for residential buildings and ASHRAE Standard 90.1-2007 for commercial buildings.

According to Jen Stutsman, an energy department spokesperson, those efforts are bearing fruit. Over the past two years, 50 percent of states and territories have adopted these codes, she says. By contrast, in 2008, only 18 percent of states had updated their residential codes and 12 percent had implemented or upgraded their commercial codes.

Despite the progress, evidence suggests that not all states plan to comply with the conditions imposed by the Recovery Act, which distributed \$3 billion to state energy offices to improve energy efficiency. To qualify for the funds, states were supposed to provide assurances that they would update their energy codes to meet an earlier version of ASHRAE or the IECC. Some states -- Wyoming and Arizona, for example -- have chosen not to play.

Where a handful of states are dragging their feet, at least two -- Massachusetts and Oregon -- are forging ahead with innovative approaches. They have adopted add-ons to their basic codes, which together function like a LEED code in that they are voluntary but designed to push the market forward. Unlike LEED, however, they are promoted by states, not a separate, environmental organization such as the USGBC.

Known as "reach" or "stretch" codes, the regulations drafted by these two states do more than raise the bar for efficiency. They also expand the purview of conventional building regulations, which typically dictate materials and construction methods but don't necessarily measure the amount of energy the building actually uses. The new trend is to do just that -- either by modeling energy performance to ensure energy savings or by testing the systems post construction to make sure they are really working.

In 2009, Massachusetts became the first state in the country to adopt a stretch code -- an optional set of building efficiency standards that is about 20 percent more efficient than the state's base mandatory code. The voluntary code is part of a larger effort to meet the goals of the Massachusetts Clean Energy and Climate Plan, which mandates a 25 percent reduction in greenhouse gas emissions below 1990 levels by 2020. About 8 percent of those reductions will come from building efficiency strategies, says Mark Sylvia, commissioner of the state Department of Energy Resources.

The stretch code includes efficiency standards for measures such as window performance, lighting controls and mechanical equipment efficiency. It also marks a "philosophical difference" from the regular standard by emphasizing performance and real-world testing, says Ian Finlayson, a senior climate policy analyst with the Massachusetts Executive Office of Energy and Environmental Affairs. For example, homes built to the stretch code must attain a minimum score by the Home Energy Rating System (HERS), a system that quantifies energy performance based on a set standard. So far, 53 local jurisdictions have adopted the stretch code, including Boston.

In Oregon, policymakers updated the state's energy efficiency code this year to require a 15 percent reduction in energy use for commercial structures and a 10 percent reduction for homes. An optional but even more stringent set of efficiency standards -- the "reach code" -- will go into effect later this year and improve that standard by an additional 20 percent.

The voluntary standard will include features such as energy modeling of large commercial buildings, renewable energy-ready infrastructure -- to make installations of solar and wind technologies easier and cheaper -- and elements from the ICC's new model green building code, such as water conservation and gray water standards. "The reach code is being developed as a test bed for new technologies," says Andrea Fogue, green building services manager with the Building Code Division of Oregon's Department of Consumer Services. "We want to see what the market is capable of."

But that's not all. Fogue reports that by 2030, policymakers will require "net zero" energy use in all structures.

The Oregon and Massachusetts stretch and reach codes incorporate elements of the 2012 IECC, which is about 5 percent more efficient than the 2008 version of California's Title 24, according to the New Buildings Institute's Edelson. Then there is CalGreen, an overlay on Title 24 that is expected to reduce greenhouse gas emissions by about 3 million metric tons by 2020, according to Dave Walls, executive director of the California Building Standards Commission.

Despite the flurry of activity, there's a long road ahead for energy-efficient building codes. The challenges start with states like Wyoming that have not adopted a statewide energy code and don't plan to -- despite receiving \$20 million in stimulus funding for energy efficiency. In lieu of regulation, the state "is committed to education at the local level to encourage responsible action," says Shannon Stanfill, manager of the Wyoming Business Council's State Energy Office.

There are also misunderstandings about the role codes play in moving the building industry forward. As a minimum standard, codes "define the worst building you can legally build," says engineer Matthew Tyler. Moreover, strengthening building standards is an ongoing and dynamic process. "What's legal today cannot be built three years from now," Tyler says.

Think tanks such as the New Buildings Institute continue to push the boundaries of performance-based energy codes toward what Edelson describes as "outcomes-based" standards, in which the amount of energy a building consumes is regulated over time. One idea, he says, is "to come back 18 months after the building is occupied and measure if the building is really performing at a higher efficiency level." Although the new codes begin to phase in this kind of approach, various challenges remain, such as defining what constitutes energy performance data -- and accounting for variables such as tenant behavior, weather and operating hours.

Local jurisdictions are also moving ahead. To help align building regulations with outcomes-based approaches, several cities -- including New York, Seattle and Washington, D.C. -- have implemented requirements that commercial properties must disclose information related to energy performance. California and Washington also have also passed such mandatory reporting laws.

As these initiatives move forward, building efficiency experts say it's important to understand the interplay between voluntary, market-based, green-rating systems and regulatory mechanisms such as building codes. That is, as elements first promoted in certification programs such as LEED become part of a mandatory baseline code, organizations such as the USGBC are then free to pioneer new innovations, which in turn become part of code. And now innovations by select cities and states are adding to that dynamic. "The code is the minimum standard," Finlayson says. "We are raising the floor, while the voluntary programs are raising the ceiling."

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