Making Residential Energy Codes More Effective: Building Science, Beyond Code Programs, and Effective Implementation Strategies

Mark Halverson, Pacific Northwest National Laboratory
Jeffrey Johnson, New Buildings Institute
David Weitz, Massachusetts Board of Building Regulations & Standards
Ronald Majette, U.S. Department of Energy
Mark LaLiberte, ShelterSource

ABSTRACT

The energy-efficient design and construction of new residential buildings is a vital part of an effective energy, economic, and environmental strategy. Through effective design and construction of new houses, less energy is used, thereby reducing energy expenditures and environmental pollutants. Houses with lower peak demand also require smaller generation and distribution capacities. Because the marketplace does not uniformly secure energy-efficient design and construction on its own, minimum requirements have been established through the use of energy standards and codes.

To be most effective at improving the energy efficiency of buildings, energy codes need to be successfully implemented and enforced. They also need to be viewed in light of sound building science practices and a systems approach to construction. In addition, it should be recognized that they are a minimum requirement. Code implementation programs and efficient building programs can be coupled, resulting in improved building efficiency, and possibly an improved code.

In this paper, we look at some of the issues facing residential energy codes and also at some of the opportunities for improving these codes. We also discuss effective implementation strategies, for no code, no matter how good, can save energy without implementation.

This paper is the printed companion to a Roundtable discussion of the same topic. The Roundtable discussion will present additional material.

Challenges for Residential Energy Codes

Residential energy codes have been one of the foundations of energy efficiency for over a quarter of a century. These codes provide the minimum level of efficiency for homes, thereby defining the "most inefficient home that can be built by law." Two key features of energy codes are encapsulated in the quote above. First, energy codes do not typically define particularly high levels of energy efficiency. Second, energy codes are written to be mandatory requirements – law. These two features are intimately related; the main reason codes do not require high levels of energy efficiency is that they are written to apply to all homes, from the proverbial tar paper shack to Bill Gate's multi-million dollar mansion on Lake Washington. Getting all stakeholders to agree on what should be required by law for all homes is not an easy task.

Energy codes evolve over time and are progressively redefined. Reaping new energy savings therefore has become an increasing challenge as the low-lying efficiency opportunities are captured (e.g. better windows, more insulation, higher HVAC efficiency, better duct sealing, infiltration reduction). Also, as codes address more complex homes and efficiency technologies, prescriptive requirements become difficult to craft, which leads codes to increasingly rely on performance methodologies. Unfortunately, any attempt to craft an energy code that addresses all possible home types and compliance approaches while also making incremental improvements in energy efficiency tends to lead to a large and complicated document. Thus, there is an inherent tension between the desire to craft a more technically sophisticated energy code and the desire to keep it simple.

Another similar tension is between the goals of simplicity and flexibility. Current model codes allow multiple compliance paths that offer different results for meeting the same standard. For instance the International Energy Conservation Code (IECC) offers four different approaches in Chapter 5 in addition to separate approaches in Chapters 4 and 6 of the same document. Codes also contain both mandatory requirements that must be met no matter which path is chosen (infiltration reduction, proper installation of materials, duct sealing,) and flexible requirements where the builder is faced with the multiple choices discussed above (window performance, insulation levels, HVAC efficiency.)

Another key issue of residential energy codes is that they are intended for the use of two primary and distinct groups: homebuilders and code officials. Many homes are built by small businesses that struggle to deliver a competitive product in today's housing market. Homebuilders are very concerned with first costs of their homes, and the general impact of energy codes is to require something "more, better, or different." More insulation, better windows, higher-efficiency equipment, and new ways of constructing homes are all items that are seen as additional costs that the market doesn't generally demand or reward.

Code officials, on the other hand, are responsible for ensuring the safety of homeowners by ensuring that houses are reasonably safe from fire, structural damage, water damage, tornados, hurricanes, and a whole host of other disasters and problems. Energy codes, as a general rule, are not as high on the priority list of a code official as traditional life/safety code issues. While an inefficient home may cost the homeowner higher fuel bills and lead to some increased level of environmental degradation, this does not compare with the possibility of life and property loss in a fire due to fire code violations.

Another of today's challenges in residential energy codes is related to how building materials and practices over the past 50 years have been modified. Homebuilders have been utilizing much the same construction techniques for the past half-century, but have been incorporating new materials and systems into their houses to satisfy the code. It is important for builders and code officials to understand the dynamics of how buildings react to increased insulation, tighter windows, and improved air sealing and construction practices. The science of building construction must play an increasing role in construction and code enforcement.

It is also important to remember that the adoption of even the most stringent energy code does not in and of itself lead to energy savings. Outreach and education are needed to notify the construction and enforcement communities about the existence of a new code and to introduce its details to these normally conservative groups.

Having identified a number of features and issues of residential energy codes, this paper will now examine the relationship of above-code programs, building science, and implementation partnerships with energy codes. *The remainder of the paper provides a brief* *history of residential energy codes, followed by sections devoted to the principal topics that will be discussed in more detail in the Roundtable discussion.*

A Brief History of Residential Energy Codes

The idea of energy codes in the United States emerged from the first energy crisis in the mid-1970s. Before this time, homes were built with little or no formal energy regulation. Homes may have been structurally sound, fire-resistant, and reasonably comfortable, but "energy efficient" was not a descriptor usually applied to any home. At that time, it wasn't an issue for most homebuyers and builders. Then the year 1973 arrived, and with it, the so-called Arab Oil Embargo. Oil became scarcer, long lines formed at gas stations around the country, and energy suddenly became a prime consideration in the world of home construction.

The first national energy design standard was the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90-75. (ASHRAE, 1975) The "90" comes from ASHRAE's Standing Standards Project Committee (SSPC) 90, ASHRAE's committee on building energy conservation. The "75" denotes the year of publication. ASHRAE SSPC 90 took as their scope the energy efficient design of all buildings, including residential, commercial, and industrial facilities. In what was a foreshadowing of things to come, the technical content of Standard 90-75 was very quickly recast into code format as the Model Code for Energy Conservation (MCEC) in New Building Construction (CABO 1977). This issue of standards (documents written as professional guidance to architects, designers, and builders) versus codes (documents written to be enforced as law by code officials) continues to this day. The MCEC was adopted by several states.

In the interest of updating their standards periodically, ASHRAE produced a new document, ASHRAE/IES Standard 90-1980. This document was actually comprised of 3 parts, with part A containing the energy requirements for all buildings. Thus, the document is commonly referred to as ASHRAE 90A-1980. A co-sponsor, the Illuminating Engineering Society (IES), joined ASHRAE in this document. A new codified version of this standard emerged in due time as well. The Council of American Building Officials (CABO) Model Energy Code (MEC) was first published in 1982 and quickly became the basis of many state codes. This code was updated on a 3-year cycle until the International Codes Council (ICC) International Energy Conservation Code (IECC) replaced it in 1998.

Meanwhile, ASHRAE continued its efforts to update the residential standards with the splitting of its "90" committee into the "90.2" committee (for residential buildings) (and "90.1" for commercial buildings) and the creation of ASHRAE Standard 90.2-1993. Standard 90.2 has most recently been proposed for adoption as the residential energy code portion of the new National Fire Protection Association (NFPA) building code, NFPA 5000 (scheduled for release in August 2002).

From a technical standpoint, there have been a number of changes in residential energy codes over the years. Requirements have become incrementally more stringent for many homes, additional compliance paths have been added to allow builders a simpler (but slightly more stringent) approach, software compliance alternatives have been developed, and much more attention has been paid to cooling issues in recent years. For example, residential requirements for windows did not include Solar Heat Gain Coefficient (SHGC) requirements until the 1998 printing of the IECC.

Today, there are two main national model energy codes under more or less continuous development:1) the ICC's IECC and related International Residential Code (IRC) (ICC 2000a, ICC 2000b), and 2) ASHRAE's Standard 90.2-1993 (ASHRAE 1993). At the state level, there are numerous state codes based loosely on the same body of knowledge as the national codes but modified and refined for use in specific states. California, Florida, Washington, and Oregon all offer reasonably unique state residential energy codes. Many other states take the IECC and/or IRC and modify it slightly for their own use. States like Massachusetts, Texas, and New York are examples of this approach.

Above-Code Residential Programs

There is a subset of builders who become sufficiently motivated to build homes that perform better than code in so-called "above-code" programs. The objective of many above-code programs is to not just do "more of the same" (more insulation, better windows, higher efficiency equipment) but also to do "different things" (better construction techniques, consideration of air and moisture leakage – in other words, to consider building science in design and construction.)

There are a number of above-code residential programs in the United States. These programs include the various Home Energy Rating System (HERS) programs that exist in a number of states, the Environmental Protection Agency's (EPA) ENERGY STAR program, and Department of Energy's (DOE) Building America program. All of these programs attempt to produce homes that are better than code, either on a component or whole building level. All of them have one very major difference from energy codes. Above-code programs are typically voluntary as opposed to the mandatory energy codes. As such, different market actors tend to take advantage of above-code programs.

Above-code programs are also addressing newer techniques of construction by incorporating building science into program design and training. Above-code programs such as Building America provide education in an effort to get their builders to understand building science in the hopes that this will overcome initial resistance to changing their standard practices. Other above-code programs, such as ENERGY STAR, focus on promotion of higher levels of energy through building performance analysis. HERS programs utilize independent, third party ratings of home performance to establish a rating or label for the home. In general, these rating and labeling systems focus on the quality, comfort, and energy efficiency of the home, which ties back into the building science aspect.

The relationship between energy codes and these above-code programs is complicated. Energy codes provide the basis for many of the targets of these programs (for example, ENERGY STAR's target of 30% more energy efficiency or Building America's target of 30% to 50% less energy used). In turn, the above-code programs provide a target for code development. Some states have drawn a direct link by incorporating HERS within their code as a compliance path.

One infrequently realized interaction between codes and above-code programs is that codes can and do periodically "catch up" to the above-code programs, requiring that above-code programs increase their requirements even further. While examples of this involving national model codes are rare due to the broad scope of these codes, examples at the state level are more common. Anecdotal information from the states indicates that there are problems in parts of California with code requirements catching up to ENERGY STAR. There is also some evidence that it is possible to build a home in Southern Texas that meets ENERGY STAR requirements but does not meet the requirements of the 2000 IECC.

Another aspect of above-code programs that hinders their acceptance as mandatory is cost, especially those that involve some sort of third party verification of the home's performance. These programs require the participation of an independent agent who must be paid by the homebuyer, homebuilder, or some government or utility agency. Various innovative attempts have been made to offset this cost (government subsidies, reduced mortgage rates) but it is still an issue with homebuyers and homebuilders.

Energy Codes and Market Transformation

The relationship between energy codes and above code programs is two-fold. First, above code programs serve as a reservoir of new ideas and new levels of performance for energy codes. As new ideas are incorporated into above-code programs and become more commonplace, the chance of getting these ideas incorporated into the minimum code increases. Second, the code can provide an increasing "floor" for energy efficiency that inspires the above-code programs to increase efficiency even more. Both these interactions are examples of energy codes as market transformation devices.

As with any market, the new construction market has a wide range of participants. In theory, energy codes can shift the average demand for efficiency of the market by eliminating the option of building to an efficiency level lower than that mandated by the code. This effect can produce significant savings even when the code minimum is set at the market "average" efficiency level.

Energy codes and above-code programs can be thought of as having a push/pull relationship on construction, with codes trying to "push" requirements up for the low-end of homes and above-code programs trying to "pull" up requirements for higher-end homes. Evidence from numerous code evaluations suggests that energy codes have transformed markets in three ways:

1. In areas where codes are well enforced, the stock of poor performing buildings has been reduced to a minimum.
2. In areas where utility incentive programs are successful, the overall efficiency of a typical building exceeds code.
3. Codes have brought more efficiency technologies into widespread use in the market (e.g., vinyl window frames, condensing furnaces.)

Building Science Aspects of Residential Energy Codes

House building practices over the past 50 years have been a mix of conservative adherence to old ways, and the introduction of new materials and practices. Engineered lumber products, housewrap, insulation, vapor barriers, forced air heating and cooling: all these have become standard practice. This introduction of new systems into traditional building construction means and methods sometimes leads to unforeseen problems in house operation that the codes have not always adequately addressed. As our knowledge and understanding of building science increases, it becomes clearer that the energy codes and other slow-changing building codes lag behind and can impede the construction of houses that are both energy efficient and structurally and environmentally sound.

There are numerous examples of this. Homebuilders put much more insulation into the houses they build today than they did 50 years ago. This in itself improves energy efficiency by creating greater temperature differences between indoors and outdoors. But it also means that the temperature of external sheathing in cold climates has dropped compared to the 1950s, thereby making structures more prone to moisture accumulation within wall systems and attics. The nearly universal use of air conditioning has had a similar effect on the interior surface of walls (particularly in warm humid climates) where drywall temperature falls below the dew point of outside summer air. Codes have driven these higher insulation levels but have been slow to recognize the way in which such changes to building elements may create new problems. Similarly, the model energy codes address basements by requiring insulation of either foundation walls or basement ceilings. In New England (and in many other locations) most builders opt to leave basements unconditioned, and to insulate the ceiling. This drives basement temperatures down and again increases the potential for moisture accumulation and the associated problems of mold and mildew.

The City of Seattle recently discovered over $60 million in high-rise residential construction defects resulting from maintaining old practices and using new efficiency technologies (increased insulation and vapor barriers). Building officials became aware of mold problems in homes in Idaho and have a renewed interest in building science to make sure that the homes they inspect are healthy. Builders in California are active in promoting quality assurance programs to avoid litigation. These quality assurance programs also promote energy efficiency.

Homes have become less drafty over the past 50 years because of new materials that have become industry standards. Sheet goods like plywood and OSB have replaced board sheathing, housewrap is almost universal, and windows are much tighter. These industry changes have led to automatic tightening of new houses, even before builders might pay any special attention to air sealing measures like caulks or foams. As above, these changes have produced more efficient houses. But over the same period we have tended to install more, and more powerful, fan systems that place new homes under negative pressure. Several exhaust fans (clothes dryers, down-draft and restaurant-style kitchen range hoods, bath fans) and typically leaky HVAC ductwork go into today's homes but, with rare exceptions in codes, there is no recognition of how these powerful systems can affect naturally drafting combustion equipment like most furnaces and water heaters. Codes continue to allow 12th century technologies (i.e. fireplaces) into 21st century homes without clear guidance on how they interact with 20th century equipment and materials. Homeowners commonly complain that it is hard to start and/or maintain a fire without cracking a window open, or that powerful kitchen exhaust fans backdraft a fireplace in an adjacent room. Also, as a fire dies down it burns less hot, making it harder still to draft properly while at the same time burning less completely and creating more-noxious by-products.

Today's tighter homes also interact with modern fan-forced heating and cooling systems. Pressure imbalances created by poorly designed and installed duct systems not only increase energy use, but can also make occupants uncomfortable and can lead to moisture accumulation or dangerous venting conditions. Although the model energy codes do discuss duct sealing, they do not address duct design to the degree of requiring adequate multiple returns or pressure relief transfers across rooms.

Residential energy codes are just beginning to be reviewed and revised to resolve some of these building science issues. One aspect of this solution is that it goes beyond just energy and deals with structural integrity, the use of new materials and practices, and affects the entire building code. For example, unventilated crawlspaces have recently been adopted into the International Residential Code. This is significant because it allows for more intelligent house design. The intent of ventilating crawlspaces is to disperse moisture that may collect there. In fact, the vents actually serve to allow moisture into the crawlspace in many humid climates. This interaction of energy efficiency with residential construction is challenging the efficiency community to develop good building science solutions that provide simple options to address the complex nature of moisture, heat, and ventilation in new buildings.

In addition to these disconnects between energy code minimum requirements and building science, the life/safety building codes sometimes act as a roadblock to new construction techniques based on an advanced knowledge. There is even occasional conflict between the energy and life/safety regulations. Some examples of this kind of "code collision" include: vapor barriers (should they be required or not? do they work in practice?), optimized framing that uses less wood (it may be more energy efficient, but does the code official know that it meets structural requirements?), and combination space and water heating equipment (does the local plumbing code prohibit such installations?)

Perhaps a more important issue is that buildings are becoming tight and well insulated enough that moisture and air quality problems that were uncommon 50 years ago are becoming more frequent today. While in many ways buildings have been getting much more efficient, there is a real concern that this has made other aspects of the building worse at the same time.

In summary, while knowledge of building science can obviously lead to “better” buildings, incorporating that knowledge into residential energy codes may require major additions to (or subtractions from) the current list of code requirements. Writers of energy codes must try to focus on the truly important issues in the hopes that code officials will take the time to understand and enforce them, and that homebuilders will understand the necessity for these requirements.

Residential Energy Code Partnerships that Work

This section addresses the simple fact that energy codes by themselves do not save any energy whatsoever. A national model energy code doesn’t mean a thing unless it is adopted in a state or local jurisdiction. And just adopting an energy code doesn’t save energy either. A whole host of enforcement, training, and support issues need to be addressed before better, more efficient buildings result from a new code. Partnerships, between the groups that develop codes and the states that adopt them, between the makers of support materials and users of those materials, between the builders and code officials, and between product suppliers and builders are all vital. No single organization can make better homes by itself. The Commonwealth of Massachusetts provides an interesting case study of how code adoption, implementation, and training can go hand-in-hand.

Massachusetts adopted a slighted modified version of the 1995 CABO Model Energy Code for low-rise residential new construction in 1997, and it took effect in March 1998. The delay was specifically to allow for an outreach and training program so that homebuilders, code officials, designers, and others in the industry could get up to speed on its requirements. With funding from the US Department of Energy (DOE) and the state's gas and electric utilities, the state building code agency (the Board of Building Regulations and Standards - BBRS) was able to notify the construction and enforcement communities of the upcoming new code, and offer extensive training throughout the state. This training took place in the six months prior to code implementation, and for 16 months afterward, reaching over 7500 people.

BBRS conducted an evaluation in 2001 to determine the effect that the new code had on houses throughout the state (XENERGY 2001). A representative random sample was selected from new houses that were built after the code took effect. Table 1 summarizes the rates of compliance with the new code.

Table 1. Massachusetts Compliance Rates

Characteristic	% Compliance
Overall thermal elements (i.e.- insulation & windows)	46
Properly installed air leakage reduction measures	17
Heating equipment properly sized	19
Cooling equipment properly sized	90+
Adequately sealed duct systems	19
Adequately insulated ducts	76
Adequately insulated hydronic pipes	68
Vapor barrier installed	69

Despite these generally low compliance numbers, energy savings were significant. The average new home used 6% less energy for air conditioning, and 23% less energy for heating than its 1995 counterpart. The annual statewide fuel and emissions savings, based on a US Census data estimate of 14,400 new housing units per year, are shown in Table 2.

Table 2. Massachusetts Annual Statewide Fuel and Emissions Savings

Fuel/Emissions	Annual Reduction
Natural gas	2 million therms
Heating oil	960,000 gallons
Electricity	1.4 million kWh
CO_2	26,600 tons
Sox	30.4 tons
NOx	24.5 tons

Using 2001 fuel costs, these reductions amount to over $3.3 million in annual savings when compared to a 1995 utility baseline study. These savings were achieved by overall improvement in the new houses, again despite poor compliance with the code, as summarized below in Table 3.

Table 3. Massachusetts Overall Improvement in New Houses

Construction Element	1995 Level	2000 Level	% Improvement
Wall insulation R-Value	13.6	14.1	3.7%
Attic insulation R-Value	30.9	31.5	1.9%
Floor insulation R-Value	17.6	18.6	5.7%
Window U-Factor	0.50	0.41	18.0%
Heating equipment AFUE	83.0	85.6	3.1%
Cooling equipment SEER	10.3	10.2	-1.0%
Building leakage "natural" ACH	0.54	0.34	37.0%

Results of the study are available at www.state.ma.us/bbrs/residential_evaulation.htm

Energy Code Simplicity versus Efficiency

There is also considerable evidence that the complexity of the energy code has a direct impact on the overall efficiency of the homes built to its' requirements. Specifically, it appears that simple codes are more successful in achieving the full energy savings potential of the energy code than complicated codes. The reason for this is straightforward. Local enforcement is funded by state, county and city revenue. Permit fees typically go into the general fund and the city manager or council authorize building department budgets. There is generally a lack of reconciliation between building department revenue receipts and staffing levels. Therefore, if permit activity increases, existing staff usually have to pick up the slack. As inspections and plan review activities increase, the scope of the review decreases proportionally. Items like energy are usually cut from the review and inspection, as they are not considered vital to the health and safety of the residents.

This creates a tension between efficiency community desires to increase the scope and stringency of energy codes, and local resources to enforce them. While the mechanisms mentioned above could alleviate some of this tension, the basic structure of the energy code should be assessed as to how it could best promote simple but effective energy efficiency.

An example of this approach was used in Oregon in the mid-1990's. Oregon simplified the residential code by eliminating window-to-wall ratio calculations that characterize the national model codes. This meant that windows in any house must meet the same performance requirements, regardless of the area of glass in the design. To accomplish this, Oregon required high-performing windows. Today, Oregon is achieving 100% of the targeted savings because builders, code officials and product vendors all know what is required – it doesn't vary from house to house. (Baylon 1996).

DOE Strategy and Efforts in Residential Energy Codes

The DOE or its predecessors have been involved in energy codes from the beginning of ASHRAE Standard 90-75 development in the 1970s. The US Government has provided encouragement, financial support, and its own analysis staff to national energy codes development efforts, and DOE continues that tradition by participating in all national efforts today. But national energy codes are just empty documents until they are adopted as law in states, counties, or cities. So DOE actively supports states that are considering adoption of national codes by demonstrating the impact that new codes would have in their states, and by working with them to refine or modify the national codes to make them more suitable for state adoption.

Going beyond the codes themselves, DOE devotes considerable resources to the development of training materials, promotional materials, and software tools to enhance the adoption and implementation of energy codes. And these materials and tools are also modified as necessary for states. DOE also provides grants to states solely for energy code activities that lead to adoption of newer, better codes or that lead to better understanding of code impacts.

On the stakeholder side, DOE works with interested parties to resolve energy code issues and problems and to remove impediments to increased energy efficiency. Resolution may lead to proposals to modify, simplify, or otherwise improve national or state energy codes and associated support materials.

DOE's support of residential energy codes is mandated in the Energy Policy Act of 1992 (U.S. Government 1992) that specifically directs DOE to support the upgrading of voluntary energy codes for new residential and commercial buildings, including the provision of Federal data, assistance in improving the technical basis of the codes, and assistance in determining the cost-effectiveness of these codes. DOE is required to review each new version of the Model Energy Code (or its successor the International Energy Conservation Code) to determine if the new code would improve energy efficiency in residential buildings. If the determination is positive, DOE asks states to review their existing residential energy codes to determine whether it is appropriate for the state to revise their codes to meet or exceed the provisions of the latest "approved" residential code.

Partnering with states and regional groups to provide state or regionally specific codes and support materials is also a major part of DOE's codes strategy. DOE provides funding for the advocacy efforts of the Building Codes Assistance Project (BCAP) (www.bcap-energy.org) and works with regional organizations such as the Northeast Energy Efficiency Partnership (NEEP) (www.neep.org) and others to promote dialog between states and other interested parties on energy code issues.

What's Next for Residential Energy Codes

Obvious areas for improvement of residential energy codes (based on this paper) are:

- Better incorporation of building science;
- More use of above-code program technologies and techniques in codes;
- Better implementation of all energy codes.

Each of these broad areas can be broken down further into several items. And some of these items are already taking place. For example, under "better incorporation of building science", DOE has developed a new set of climate zones for use in energy codes that capture the humidity aspects of climates that are so often treated as an "add-on" to HDD- and CDD-based climate bins. These new zones have been proposed to the ICC for inclusion in the IECC and IRC, and DOE is also planning to propose the new zones to ASHRAE for inclusion in their 90.2 standard. This should make it easier to specify appropriate climates for vapor barrier requirements in energy codes. Other code requirements may also become more "logical" when cast into these new zones. DOE is also working with other stakeholders to develop a comprehensive residential code change proposal that would greatly simplify the existing requirements in Chapters 5 and 6 of the IECC.

In the area of above-code program interaction with codes, DOE is taking a two-pronged approach. One is to pick up any aspects of above-code programs that are suitable for inclusion in residential energy codes and propose those aspects to the appropriate model code organizations. The other prong is to try to craft language in the model codes that essentially exempts homes constructed under nationally recognized above-code programs from having to meet the more restrictive requirements of the national model codes.

In the area of better implementation, DOE is taking a hard look at the relationship between stringency and complexity of codes and the actual energy savings achieved by these codes. Early results indicate that the benefits of simple, understandable, and enforceable codes outweigh any benefits that might be associated with a more stringent but more complex code. In other words, stay tuned over the next couple of years as residential energy codes take on new importance and relevance to real homes and real building science.

Conclusions

Building energy codes can be made more effective through:

- Following the example of above-code programs to transform the market;
- Using sound building science solutions to address construction defects resulting from the use of energy–efficiency technologies with dated construction practices;
- Focusing efforts on simplifying the code to assure that the local code enforcement officials are willing and able to make this efficiency strategy a viable one; and
- Partnering with states, utilities, and others to deliver training and support to the design, construction and enforcement community.

Building energy codes can also help transform building construction related markets. To accomplish this, policy makers should take advantage of the synergy between energy codes and voluntary beyond code programs. Policy makers should link their advanced energy efficiency targets to key marketplace values that are shown to motivate homeowners.

The focus of codes and standards will shift from specifying the installation of prescriptive measures to the actual performance of the final building. This shift is consistent with an overall emphasis on objective or performance-based codes within the building code community. The next generation of energy codes will:

- Incorporate new technologies and practices into the standard that replace less efficient technologies and practices;
- Assure proper performance of measures once specified and installed thereby assuring that energy and environmental benefits to energy codes are realized by building owners and occupants; and
- Improve enforcement through partnerships and support of innovative enforcement practices by local governments.

This panel discussion will focus on bringing leaders in the efficiency community together to discuss ways we can work to make codes more effective. We look forward to hearing your thoughts and ideas.

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