Residential Energy Standards - A Crowded Market

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In the last five years, independent organizations have made a number of efforts to establish cost-effective energy standards that can be applied to new residential construction. Among the more prominent national organizations are the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE), the Council of American Building Officials (CABO), the U.S. Department of Energy (DOE), the U.S. Department of Housing and Urban Development (HUD), and the National Association of Home Builders (NAHB).

The standard developed by each of these entities is designed to establish reasonable requirements for energy efficiency of new residential construction. Most are designed to take into account, either directly or indirectly, the economic viability of investments in energy-efficient homes. With the exception of HUD's Minimum Property Standards update, which is being developed jointly with DOE, each of these standards was developed independently.

This paper examines the crowded nature of the residential energy standards "market," beginning with the history of this fragmentation and progressing through the various reasons for it. Some consequences of this fragmentation include duplicated costs of standard-development efforts and inefficiencies introduced to the construction industry and building code enforcement bodies by the multiplicity of resulting standards.

A scenario is proposed for consolidating these various standard-development efforts, suggesting a plan that taps into the knowledge bases of all parties and might result in a consolidated voluntary national residential energy standard by the year 2000. The potential technical, administrative, and political barriers that must be overcome to achieve the objective are explored.

Introduction

Over the past 20 years, numerous organizations have developed residential energy conservation standards and codes. These documents vary considerably in form and content. Recently a number of the standard-writing organizations have undertaken to upgrade their standards or produce new ones. Among the more prominent of these are the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE), the Council of American Building Officials (CABO), the U.S. Department of Energy (DOE), and the U.S. Department of Housing and Urban Development (HUD).

With the flurry of activity in this standards "market," it seems an appropriate time to address the question of whether all these separate documents are actually needed. In this paper we examine the crowded nature of the residential energy standards market. We present a history of the emergence of standard-writing organizations and describe reasons for the fragmentation of standard-writing activities. We discuss the consequences of this fragmentation and propose that a consolidation of efforts would be beneficial to all involved.

Generally speaking, standards and codes differ in that a standard specifies minimum reasonable construction practices while a code establishes enforceable requirements to be imposed on new construction. In practice, many codes directly reference existing standards; others adopt a standard's provisions or some modification thereof. In this paper, we use the terms interchangeably.

History

The need to conserve energy is not new, nor was it initiated with the energy "crisis" of 1973. For instance, the Heating, Ventilating, and Air Conditioning Guide published by the American Society of Heating and Ventilating Engineers (ASHVE) in 1943 devotes an entire chapter to emergency war practices and energy conservation. Many

of the recommendations in that document, written almost 50 years ago, are still appropriate today. They, like many other criteria, are recommendations and nonbinding on any particular party. Any individual or organization can publish energy conservation guidance. When that guidance becomes the basis for regulations, it is mandatory, and the impact of the guidance is felt with the force of law.

In 1971 and 1972, President Nixon, in his Energy Messages to Congress, issued energy policy directives that provided the initial guidance to the formation of energy standards. The first policy directed the Secretary of Housing and Urban Development (HUD) to reduce maximum permissible energy loss by about one-third for a typical 1200-square foot home and even more for larger homes. The second policy directed the Secretary to issue revised insulation standards for apartments and other multifamily structures not covered by the earlier policy. The thermal envelope criteria applicable to low-rise residential structures included in the HUD Minimum Property Standards (MPS) became the first of what were to become many modern era building energy codes and standards. This activity is highlighted in Figure 1, along with other notable standards and codes developments over the past 20 years.

In an effort to provide uniformity in the requirements being placed on building design by various state and local governments, the National Conference of States on Building Codes and Standards (NCSBCS) requested in 1973 that the National Bureau of Standards (NBS) develop standards for energy conservation in new building design. In early 1974, NBS published *Design and Evaluation Criteria for Energy Conservation in New Buildings*. This document was used as the basis for a national voluntary consensus standard by ASHRAE and approved as ASHRAE Standard 90-75, *Energy Conservation in New Building Design*, in August 1975.

For the first time, a document was available that could be adopted by those wishing to regulate the energy conservation of new buildings. The adoption of this document was spurred by Public Law (PL) 94-163 which, in part, provided federal financial support to the states if they adopted an energy standard for new construction no less stringent than the ASHRAE standard. This presented a reason for state and local governments to adopt energy standards and created a large "market" for referenceable energy standards. The customers of standards developers were initially state and local government because they had the power to adopt the standard and review conformance. It should be noted that beginning then and throughout this entire period, some states have developed their own standards. In the context of this paper, they are not considered national or regional standards developers because what they develop is not intended for adoption outside their state, nor is it held out and marketed as such.

Initially, some states adopted ASHRAE Standard 90-75, some as early as 1974 when it was a proposed standard. The means of implementation for provisions addressing new construction was commonly through the state or local building regulatory process, which included a review of plans and inspection of construction. The building regulatory community was not familiar with standards language; many of its members felt it was impossible to enforce any document not written in enforceable code language. Efforts to adapt the ASHRAE standard into enforceable code language were initiated.

Separate efforts by each of the U.S. model code organizations sought to include energy conservation provisions into their model building codes. Beginning in 1976, the Building Officials and Code Administrators International (BOCA), International Conference of Building Officials (ICBO), and Southern Building Code Congress International (SBCCI) developed and incorporated energy provisions into their respective codes. These were initially found in the *Basic Energy Conservation Code* (BECC), the *Uniform Building Code* (UBC), and the *Standard Building Code* (SBC), respectively. Concurrently, the Energy Research and Development Administration (ERDA--the precursor to DOE) saw the need for a national level energy code document to serve the needs of state and local government. With ERDA support, NCSBCS, BOCA, ICBO, and SBCCI developed and published the *Model Code for Energy Conservation in New Building Construction* (MCEC). State and local government now had the documents to adopt as energy codes or adapt into existing building construction regulations.

In 1979, the HUD MPS were revised and remain the same today as they did at that time. In 1980, an effort to revise ASHRAE Standard 90-75 came to fruition with the publication of ANSI/ASHRAE/IES Standard 90A-1980. Working with the Illuminating Engineering Society (IES), ASHRAE updated the technical criteria of the original standard. A year later, BOCA published a new edition of its energy code.

After 1980, reduced emphasis was placed on energy conservation and regulations. Federal support for the programs of the 1970s waned, and state and local governments were left to do more with less. Support for the maintenance of the MCEC was not forthcoming from DOE, nor were the states willing to update the document through NCSBCS. The voluntary sector took over through

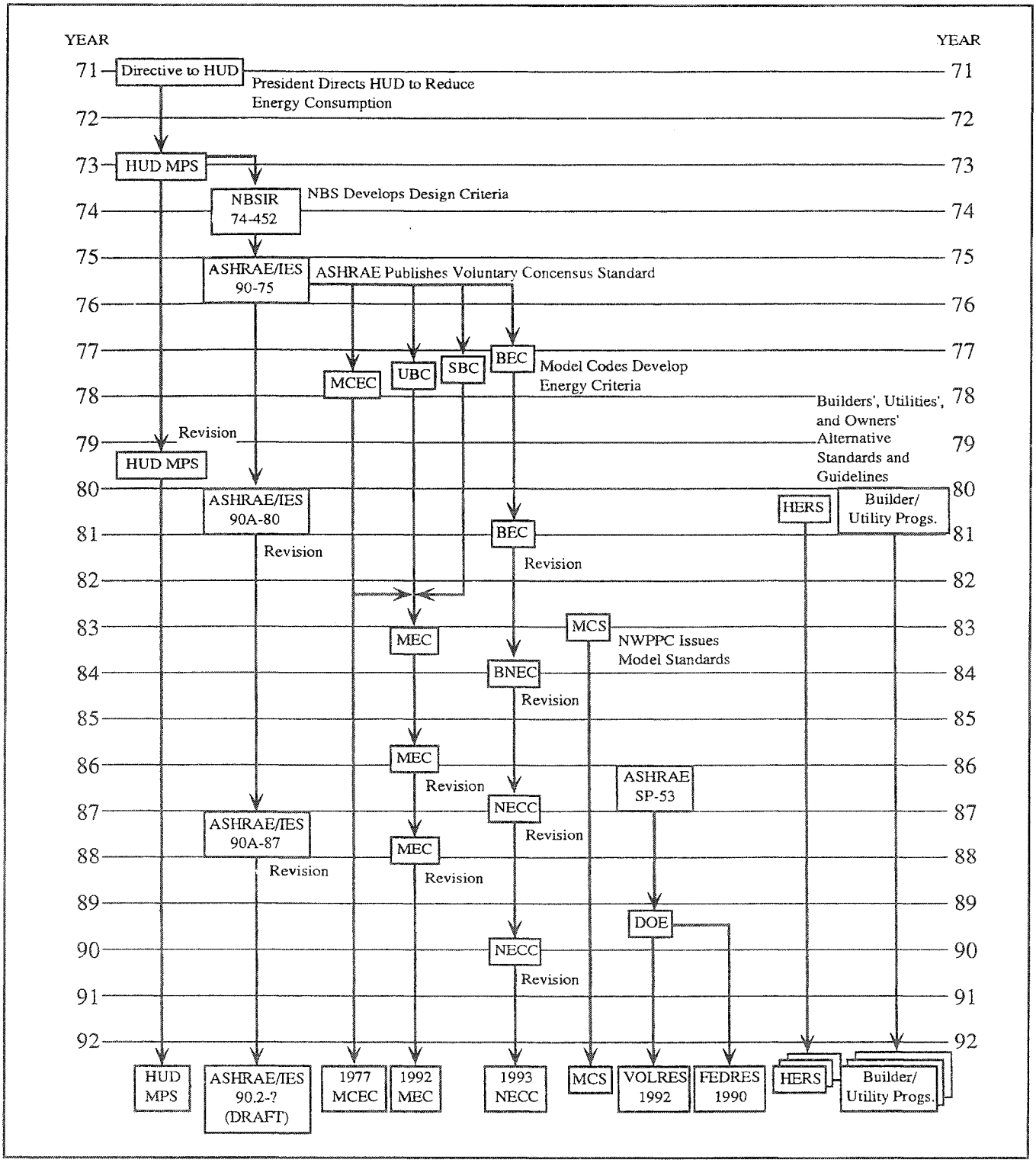

Figure 1. History of Residential Energy Standards and Codes Development

the Council of American Building Officials (CABO), which represents the interests of the three model code groups BOCA, ICBO, and SBCCI. CABO's first efforts in 1983 resulted in the publication of the *Model Energy Code* (MEC), which can be considered a version of the MCEC updated to be technically compatible with ANSI/ ASHRAE/IES Standard 90A-80.

At about this time, others in the voluntary and nongovernmental sector initiated efforts to develop alternative strategies to these energy codes and standards. These efforts suggested an additional customer base for standards promulgation, a base that was outside the normal state and local regulatory routine and consisted of those who also wanted to regulate construction. Builders developed thermal performance guidelines, utilities developed programs directed at more efficient construction, and the concept of home energy rating systems (HERS) was raised. In addition, the creation of the Northwest Power Planning Council (NWPPC) provided for the development and promulgation of the *Model Conservation Standards* (MCS) applicable in the Pacific Northwest.

During the 1980s, the voluntary sector maintained and updated energy codes and standards. These efforts included the revision of ANSI/ASHRAE/IES Standard 90A-80 in 1987 with the publication of an addendum to the standard. The MEC was revised every year and a new edition published every three years, as was the BECC of BOCA.

Numerous activities were undertaken within the federal sector from 1976 until the mid-1980s, but only some resulted in the promulgation of regulations. In 1974, Congress passed the National Manufactured Housing Construction and Safety Act. In response, HUD implemented the *Manufactured Housing Construction and Safety Standards* (MHCSS), which became the preemptive national standard in 1976 and represented the first set of standards for all manufactured housing. Another federal activity in this time frame resulted from a legislative mandate in PL 94-385 for the development of building energy performance standards (BEPS), which were never adopted. Congress later amended that law to require that the standards be voluntary for the private sector. Then, in 1986, DOE funded ASHRAE to form a Special Project (SP) to develop recommendations for the Congressionally-mandated residential energy standards. That methodology forms the basis for federal voluntary residential energy standards that are expected to be proposed in 1992. Finally, the Affordable Housing Act of 1990 requires that HUD update its MPS to at least equal the latest Model Energy Code. That effort is under way.

As shown in Figure 1, any number of energy codes and standards are available today for application to new residential construction. State and local governments desiring to regulate the energy efficiency of new residential construction can adopt any of these documents. Many do, while others develop their own provisions.

From the standpoint of market share, not all standards have the same success. For manufactured homes and federal buildings, the HUD and DOE standards are mandatory and preemptive over state, local, or other adopted standards. As such, there is no free market, and the market is dictated. For nonfederal buildings, the MCEC is really a non-factor, while the ASHRAE 90.2P effort has yet to be completed. State and local governments operate in a free market and typically apply the MEC or the MCEC, or adapt provisions of ASHRAE Standard 90A-1980. In the Pacific Northwest, the MCS are used. The northeast, mid-Atlantic, and north central states use the MCEC, while most other areas rely on one edition of the MEC. The situation in every state is unique and too complex to be covered here. However, a complete delineation of the market share is available from the NCSBCS *Energy Directory*.

Builders, utilities, lenders, and others are also involved in the selection and adoption of standards and guidelines. Granted, the economics, climate, construction practices, and other factors differ across the United States. But is there really a need for the number of documents currently being revised, updated, and maintained?

The Problem With Multiple Standards

The multiplicity of organizations producing standards and codes results in a multiplicity of separate documents that establish minimum requirements for new construction. These various standards often differ from each other, resulting in confusion among those who are responsible for reviewing conformance to the standards. This is especially confusing to those who function in an area where two or more standards would apply.

The standards, or codes based on them, may differ in stringency, scope, and/or format. Of these three broad categories, differences in stringency typically generate the most debate. For instance, the thermal envelope provisions of the MCEC are not as rigorous as those of the MEC, nor do they specifically account for the use of thermal mass. A review of the standards cited in Figure 1 would highlight these differences. However, as we will see, differences in scope and format also generate confusion.

Speculative builders, for example, often construct houses to comply with both the state or local energy standard and the HUD MPS requirements, not knowing whether the eventual buyer will use a HUD-guaranteed loan to purchase the house. Often one of the standards will have more stringent requirements than the other, requiring the builder to select the more stringent of the applicable provisions. This is potentially difficult and may be costly to the builder. It is also likely that the two standards will express requirements using different terms and in different formats. That the builder must work through two separate calculations to demonstrate compliance with the two is more bothersome than the differences in actual construction requirements.

A similar problem faces manufacturers, trade associations, and others who operate at a national or regional level. It is essential for these entities to track or follow codes to ensure that their products meet the specified requirements so they can be distributed and sold in the marketplace. The existence of multiple standards and codes, whether in various states or even in local jurisdictions, creates many problems. Multiplicity means that the manpower, time, and money required to identify, monitor, or participate in and influence the evolution of these documents is significantly increased.

Demonstrating compliance with the various standards is complex because different codes with different formats and scopes require different forms of verification to document product performance. When compliance requires third-party verification, scheduling and labor costs add further to the complexity. Development and distribution of marketing literature is equally complicated because of the multiple requirements. Some, if not all, of these increased costs are ultimately transferred to consumers because they are reflected in the prices of products.

Aside from the problems associated with differences among standards, there are, at least conceptually, problems related to the similarity of various standards. Theoretically, if multiple organizations examine the same issues and make reasonable decisions about minimum construction requirements, then the various resulting standards should be very similar. That two groups analyze the same problem and get the same answer indicates a waste of resources. Information that could be shared among the organizations is not. Each group is working individually to solve the same problems when its resources could be more effectively used in a collaborative effort.

The actual cost of this duplicity is difficult or impossible to quantify. However, the number of trade associations, advocacy groups, manufacturers, and others that must expend time and money to follow the development of each of the standards is quite large. The biggest cost might come in the tendency to ignore energy issues because standards are so numerous and confusing. It can mean that *no* standard is effectively applied. For these reasons, focusing resources on a national standard that recognizes regional needs would seem justified and logical.

One could suggest that the competition in the standards market is good because it would improve each standard. This "free market" competitive approach has existed over the past 15 years. The MCEC is still based on provisions developed in the late 1970s. The MCEC is still referenced by some states, although it was last updated in 1977. It is the authors' view that improvement and evolution can be facilitated from the regular updating and revision of a national-level standard, much the way the MEC has improved over time. Historically speaking, it would be difficult to say that improvements in energy standards have been driven by competition from more stringent standards.

The Difficulty of Consolidating Efforts

Our purpose in this paper is to suggest that consolidation of efforts in developing energy codes and standards would be beneficial to a majority of parties affected by the various standards. However, before proposing any steps that would move toward consolidation, it is important to present the reasons such a move will be difficult.

There are a number of impediments to the merger of the many national standards maintained by various organizations. These include, among others, legislative mandates, differences in "perspective" among various groups, various preferences for presentation style, and institutional inertia. Regional diversity is also an issue where the national standard does not fully represent the broad range of climate, economics, and energy supply issues.

Legislative Mandates

Federal agencies generally promulgate energy standards in response to specific Congressional mandates. The laws differ, but often an act's language will hinder an agency's use of an existing standard (such as ASHRAE's or CABO's) by placing detailed requirements on how the standard must be developed, what it must accomplish, and even how it must be formatted. For example, the federal legislation requiring DOE to promulgate voluntary residential energy standards, PL 94-385, states that the standards must be expressed in terms of energy

performance rather than a prescriptive list of allowable materials and construction methods. That legislation also requires that the standards specifically encourage the use of nondepletable energy sources.

Similarly, HUD is constrained to produce standards that meet or exceed the 1989 Model Energy Code and are demonstrably cost-effective in terms of total (construction plus operating) costs (PL 101-625). What appears to be simple legislative language can have dramatic impacts on the direction an agency must take in developing responsive regulations. Agencies are unable to "adopt" existing standards because they do not comply with Congressional requirements.

Differences in Perspective

Different groups look at the need for energy standards from different angles. One group may be concerned primarily with minimizing energy consumption. Others are concerned about minimizing construction costs. Another may focus on minimizing monthly operating costs (the sum of mortgage payments and energy bills) to reduce the number of loan defaults. Others might prefer standards that optimize markets for certain types of materials or equipment. Even when two groups agree on the objective of a standard, they may espouse radically different ideologies about how that objective must be achieved. For example, two organizations may agree that energy standards should aim to minimize overall life-cycle owning/operating costs of a house. They may disagree, however, as to whether costs are defined as those seen by the original homebuyer, all current and future owners of the home, society at large, or a utility providing energy to the home.

Differences in perspective affect the methodologies organizations use to establish their standards' requirements, the assumptions and inputs applied to those methodologies, and the scopes and formats of the resulting standards. In terms of input assumptions, for example, a "consumer's" life-cycle cost perspective might argue for a high discount rate (the factor used to adjust future costs to present values), citing the mortgage rate as the best indication of a homeowner's cost of money. A builder's perspective may impose very high rates linked to a buyer's willingness to pay higher initial costs for future savings. A government agency's perspective might favor a lower discount rate, viewing the energy savings as a benefit to all of society and explicitly considering environmental costs and other "externalities." A utility's perspective would endorse a discount rate equivalent to its cost of money.

These and other disparities generally result in standards with differing requirements. However, whether or not they effect differences in the standards' requirements, they tend to segregate the organizations and discourage cooperation.

Presentation Preferences

Different standards have different presentation styles and formats. For some organizations, a specific presentation may be viewed as a requirement. For example, insulation requirements may be presented as an R-value minimum by building component, a U-value maximum by component, or an overall maximum U-value for a home. Or, there may be no explicit insulation requirement, the standard instead specifying an energy performance requirement, a point system, and so on. Some forms are very prescriptive, some allow trade-offs, some allow any form of home that is projected to meet an energy requirement. Each format has its benefits and inconveniences; however, over time, a particular format becomes "institutionalized," and changing it is resisted.

Regional Diversity

One reason for the evolution of different codes and standards provisions is the differences in climate, energy supply, cost, and other factors that affect energy in buildings. Because most national standards attempt to address these issues, one cannot argue that regional variation is the reason for the number of standards in the market today. National standards may just not adequately address these regional needs. Although it would be difficult, the multiplicity of variables that affect energy standards could be addressed within one standard. Where regional differences dictated, special provisions having a limited scope to certain areas of the country could be included.

These problems are solvable. Setting the goal of having a single national standard initiative and ultimately merging all national standards is an important first step. Perhaps the organizations creating national standards can implicitly agree that they all suffer a bit from the "not invented here" allergy to the work of other organizations and acknowledge that between the organizations there is a wide body of expertise on which to draw.

Institutional Inertia

The final hindrance to consolidation of standards, institutional inertia, may well be the most difficult to

overcome. Most of the standard-producing organizations mentioned herein have been in the standards business for a number of years. For many of them, energy considerations are a small fraction of the total range of issues covered by their standards. Consolidating energy requirements with those of another standard is difficult because the resulting standard may not readily fit into the existing structure of each organization.

Several organizations receive income from publishing standards or code books. Eliminating energy requirements from their standards or consolidating with another organization's requirements could have a detrimental financial impact. A natural pride of ownership manifests itself among the technical developers of standards, limiting incentive to consolidate efforts. Organizations with a vested interest in the way standards impact the marketplace are reluctant to give up their ability to control the development of standards.

Finally, the schedules of different organizations present a problem, even if the organizations agree to attempt consolidation. Many organizations initiate or complete the development of a new standard on a fixed cycle or specific dates. For example, ASHRAE is on a nominal five-year development cycle, while proposed changes to CABO's code are submitted each January. Other standards organizations follow still other timelines. No single schedule for creation or adoption would allow all groups to simultaneously approve a standard.

Recommended Solutions

It has taken 20 years for energy standards to evolve to their current situation. As shown in Figure 1, the number of available standards is large and increasing with time. Reducing that number will not be easy. One simple resolution would be for Congress to legislate that a single identified standard apply nationwide. Alternatively, market forces could be left to determine which standard (or standards) are widely used.

The former has been tried at the national level with little success. The tide of federalism has shifted in the 1980s away from federal control of building codes. With the exception of appliance and product efficiency standards, there is no easy way to encompass regional differences and conflicting interests at the national level. The latter "free market" approach has also been tried, resulting in the existing duplications.

Between these extremes, the standards community has an opportunity to consolidate and, through a unique and interesting partnership, refocus standards activities toward one national effort. First, private and public sponsors need to explore the opportunities to cooperate. While government agencies must respond to legislative mandates, they should also work with developers of private standards, funding joint research to the mutual benefit of all involved. Further, government agencies can participate in the voluntary-sector development processes. DOE has undertaken this approach with much success in the commercial building sector, and can play a role in the residential sector as well.

The next opportunity for consolidation is to unite the private sector standards. Voluntary-sector standards developers must agree in principle to collaborate to reduce the number of standards. For instance, ASHRAE and CABO might want to discuss co-sponsorship of a joint standard and agree to pursue development of such an approach. Consolidation would succeed only if ASHRAE, IES, CABO, BOCA, ICBO, and SBCCI agreed on one protocol for standards development and revision. They would have to agree further on the technical, administrative, and business aspects of such a merger of interests, and ultimately devote future development efforts to the joint product.

When the efforts begin to lead to a national focus, the need for regional diversity would have to be retained, as it is in many standards today, to address the need for multiple compliance paths. The consolidated standard could have numerous approaches to energy conservation that are both complementary and uniquely individual. For the state or local regulator, the standards could have a chapter of prescriptive and component performance criteria. For utilities interested in offering incentives for energy conservation, an additional chapter with more stringent provisions linked to utility economic criteria could be included. Another chapter might define a Home Energy Rating System, allowing builders or sellers to advertise homes that exceed the standard's minimum requirements. Several approaches and presentations could be accommodated.

The key is to channel all the manpower and financial resources currently being expended to advance duplicative standards into one bold national standards development effort. To make this succeed, everyone involved in the current process will have to compromise a little and collaborate a lot. Through annual meetings, newsletters, and cooperative funding, those interested in evolving toward a focused standards effort could do so. Document revenues may decrease for some, and fewer staff may be needed for others. The goal, however, is not to see how many standards can be produced, but to reduce energy consumption in the new residential market without

unfairly burdening consumers or individual industries. Consolidation of the residential standards market can help us reach that goal without adversely affecting any of the current players in the standards arena.

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