Building Energy Codes: New Trends

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ABSTRACT

In one fashion or another, building *safety* codes and standards have existed for thousands of years. Building *energy* codes, on the other hand, are relatively new. The first U.S. building energy standard was developed in the mid 1970's, immediately following the first "oil crisis." Since that time, a number of energy codes and standards have appeared.

For instance, the American Society of Heating, Refrigeration, and Air-Conditioning Engineers ("ASHRAE") publishes two building energy standards. Standard 90.1 addresses energy consumption in commercial and high-rise residential buildings while Standard 90.2 addresses energy consumption in residential buildings. The Model Energy Code also addresses energy consumption in new residential and commercial construction. In addition, the U.S. Department of Energy promulgates energy standards for the construction of new Federal buildings. Moreover, several states have developed their own energy codes. Thus, something of a "patchwork quilt" exists with respect to energy codes. The question of which code applies to any given construction project can be, at best, somewhat confusing.

Adding to the confusion is the difference in the way the various energy codes and standards are developed. ASHRAE develops standards using the "consensus process." The Model Energy Code develops a code (as distinguished from a standard). Further, the MEC is *not* developed through the consensus process. DOE develops Federal energy standards in formal rulemakings.

The purpose of this paper is to introduce readers to several of the major organizations that develop energy codes and standards, and to the different developmental approaches employed by those organizations (consensus v. public hearing, period maintenance v. continuous maintenance, etc.). In addition, this paper will provide technical information about code development cycles and the current status of the major energy codes and standards affecting the construction of buildings in the United States.

Introduction

Building *safety* codes and standards have existed for many centuries.[1] Building *energy* codes, on the other hand, are relatively new, appearing for the first time during this century. Moreover, the impetus for energy codes (national defense, preservation of scarce resources, etc.) differs materially from the impetus for other varieties of building codes (public health and safety).

The purpose of this paper is twofold; 1) to provide a brief historical overview to the development of building safety and energy codes and 2) to introduce readers to the current regime of building energy codes and standards, including an overview of new trends. To accomplish these purposes, the paper first looks at the development of building safety codes. Next, it traces the development of building energy

[1]As discussed in more detail *infra*, codes differ materially from standards. Nevertheless, the two are intricately related. For instance, many *codes* simply cite *standards* as minimally accepted practice. In this paper, use of the word "code" shall also imply "standard" unless clearly rejected by context.

codes. As part of that process, the paper illustrates that the rationale for the development of energy codes has changed over time.

Next, the paper shifts away from a historical view of energy codes and standards, and instead surveys the current landscape including the Model Energy Code, ASHRAE standards, Federal energy standards, and others. Finally, the paper offers a brief conclusion.

Historical Perspective

Building Safety Codes

Building safety codes have a long tradition in the effort by organized society to provide for the common good. For instance, in ancient Babylon (18th century B.C.), the Hammurabi Code provided swift justice for victims of shoddy workmanship; if a building collapsed and killed an occupant, the builder should be slain! Likewise, great fires in Rome during the reign of Emperior Nero and in London in 1666 led to regulations aimed at reducing the spread of fires.[2]

In colonial America, laws that regulated roof coverings in New Amsterdam appeared around 1625. Another colonial era law prohibited wooden chimneys (1657). In New York, a fire district was established in 1766 where "all buildings shall be made of stone or brick and roofed with tile or slate." Later, fire disasters in Chicago (1871) and Boston (1872) caused the National Board of Fire Underwriters to call for laws to reduce the incidence and damage from fires by regulating the construction of buildings. In 1892, the Board "framed an electrical code, which led in 1893 to the establishment of the Underwriters' Electrical Bureau, since 1901 called the Underwriters' Laboratories." In 1894, the Board published the first "model building law." The purpose of the model law was to serve as a guide for jurisdictions to adopt for the construction of safer buildings. At about the same time, the National Fire Protection Association was formed. [3]

Shortly after the turn of the century, other model building safety codes began to emerge. Some of these model codes dealt with single subject areas, such as the National Electrical Code. Others were more comprehensive, addressing a number of safety issues including building structure, mechanical, electrical, plumbing and fire codes.[4]

Building Energy Codes

Unlike building *safety* codes, however, building *energy* codes and standards are a relatively recent phenomenon. During the first World War (1917), a shortage of coal for domestic heating purposes prompted the U.S. Bureau of Mines to seek advice from the "four great engineering societies," including the American Society of Heating and Ventilating Engineers ("ASHVE")[5], on ways to reduce the shortage to prevent rationing. ASHVE made several recommendations, including the use of weatherstripping and

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[2]NAHB *1989*.

[3]Encyclopedia Americana.

[4]These more comprehensive model codes tended to separate geographically. For instance, the Building Officials and Code Administrators International, Inc. (BOCA) was adopted by states generally in the Midwest, mid-Atlantic and northeast. The Southern Building Code Congress International (SBCCI) was used primarily in the south and southeast. The International Conference of Building Officials (ICBO) was used primarily in the west. (McQueen 1997)

[5]ASHVE was the predecessor organization to ASHRAE.

storm windows. Fortunately, the rationing contemplated by Bureau of Mines was never required.[6] It was, however, an early attempt by the federal government to become involved in energy policy on the customer side of the meter. In this instance, the driving force appeared to be the desire to equitably allocate coal given the disruption caused by diverting its use to the war effort.

Likewise, during World War II, ASHVE published a guideline that contained a section on emergency war procedures. Among these procedures was information on the energy saving benefits of insulation, storm windows, weatherstripping, and reduced indoor temperatures.

As urban populations grew during the post-war era, the U.S. Department of Housing and Urban Development ("HUD") began an ambitious public building program. In order to manage the process, HUD developed a set of Minimum Property Standards ("MPS") in the 1960's. The HUD MPS prescribed a number of construction details involving matters such as the length of kitchen counter tops, bathroom sizes, paint colors and the like. In addition, the MPS also contained certain energy provisions like wall and ceiling insulation requirements.[7] Unlike the World War II ASHVE guideline referred to above which were driven by national security needs, however, the energy provisions contained in the HUD MPS were driven by cost concerns; insulation in HUD projects would reduce heating costs for persons residing in federally financed housing.

During the late 1960's and continuing into the early 1970's, a debate emerged as to the sustainability of present levels of fossil fuel consumption.[8] While some argued that there was no danger, others suggested that the earth's supply of fuels would be exhausted within the next century. At about the same time, the supply of natural gas fell and moratoriums on its use were imposed. In 1973, the Oil Producing and Exporting Countries ("OPEC") voluntarily reduced their collective output.[9] This had the immediate impact of raising the cost of crude oil derivative products, including gasoline, home heating oil, and fuel oil used by electric generators. Few who were alive at that time can forget the long lines at gas service stations and the incessant talk of gas rationing!

Thus, it is easy to understand how decision makers could rationally conclude that immediate steps needed to be taken to reduce energy consumption. In 1975, ASHRAE, in conjunction with the National Conference of States on Building Codes and Standards, Inc. ("NCSBCS") published the first comprehensive building energy standard, ASHRAE Standard 90.1-75. ASHRAE's Standard 90 was revised in 1980 and again in 1989.[10]

In 1975, Congress passed Public Law 94-163. Among other things, this law provided incentives to states that adopted building energy requirements.[11] The public debate that preceded the enactment of the law, however, was anything but uncontroversial. Some parties questioned whether building *energy codes*, as distinguished from safety codes, were a legitimate governmental function. Ultimately, the issue was couched in terms of energy security and that argument prevailed.[12]

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[6]*Breckenridge 1918.*

[7]As of October 10, 1997, the most recent HUD guidelines "recommend energy efficiency improvements to meet the 1992 CABO Model Energy Code, which is required for all HUD-assisted new construction and now is recognized as a goal for rehabilitated properties." Http://www.hud.gov/cpd/enegmtg.html.

[8]Bandow 1998.

[9]Curiously, the *Washington Post* report in its March 23, 1998 edition that OPEC is again meeting to plan a cut in production in order to raise prices.

[10]Standard 90.1, the successor to Standard 90, is currently under revision again at ASHRAE as discussed *infra*.

[11]42 U.S.C. §6322.

[12]Spielvogel 1998.

After ASHRAE Standard 90-75 was developed, DOE funded an effort by NCSBCS to develop a *code* to regulate the design of building envelopes (walls, ceilings, floors, windows and doors) and the design of mechanical, electrical, and illumination systems and equipment. The resulting document, Model Code for Energy Conservation in New Buildings ("MCEC"), was published in 1977. This effort essentially put the technical criteria of ASHRAE 90-75 into code language that could be adopted and enforced by state and local governments. [13]

In 1983, the Council of American Building Officials ("CABO") published the first Model Energy Code ("MEC"). The MEC was based in most part on the MCEC referenced above. As described in more detail *infra*, the MEC is maintained through a series of annual public code hearings. Accordingly, it has been revised a number of times since 1983.

On January 30, 1989, the U.S. Department of Energy ("DOE") issued an interim rule (10 CFR part 435, subpart A) establishing energy conservation voluntary performance standards for the design of new commercial and multi-family high-rise residential buildings; these standards are mandatory for Federal buildings. The Department's interim standards and (ASHRAE) Standard 90.1 were developed in conjunction with one another and contain similar energy efficiency provisions.[14] [15]

In 1996, DOE proposed to "revise the current interim Federal standards to conform generally with the format and language of the codified version of (ASHRAE) Standard 90.1."[16] As of the date of this publication, DOE has not yet issued the final rule in this matter.

In May 1997 DOE published a proposed "rule that would establish minimum energy-efficiency building standards for new Federal *residential* buildings, including single-family and multi-family low-rise housing, pursuant to the requirements of the Energy Conservation and Production Act of 1976, as amended."[17] (Emphasis added) Like the proposed rule for Federal commercial buildings noted above, DOE has not yet issued a final rule for federal residential housing.

As a final matter, the concept of a *national* energy code for private sector construction was codified in the Energy Policy Act of 1992 ("EPACT").[18] [19] Section 101 of EPACT amended Title III of the Energy Conservation and Production Act (42 U.S.C. 6831 *et seq.*) in several significant ways. First, it requires states to certify to the Secretary (of Energy) that it has reviewed the provisions of its residential building code regarding energy efficiency and made a determination as to whether it is appropriate for such State to revise its residential building code provisions to meet or exceed CABO Model Energy Code, 1992.

Thus, states are not *required* to adopt the Model Energy Code, 1992 ("92 MEC") or its successors but they must *review* their residential building energy codes and determine whether it would be

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[13]McQueen 1997.

[14]61 FR 152 at 40882, 40883.

[15]In 1989, ASHRAE became concerned that DOE was going to publish a commercial building energy standard before it (ASHRAE) would. According to some parties, this "race for publication" led ASHRAE to publish Standard 90.1-1989 prematurely which, in turn, resulted in ASHRAE becoming embroiled in subsequent appeals and a law suit seeking to enjoin publication of the standard. (EEI 1996).

[16]In addition, the proposed federal rule would update the standard by including several addenda that ASHRAE has published subsequent to 1989 but prior to passage of the Energy Policy Act of 1992. *See* 61 FR 152 at 40883.

[17]62 FR 85 at 24164.

[18]Pub L. 102-486, 106 Stat. 2776.

[19]EPACT also directed DOE to issue a rule "within 18 months" that set forth guidelines for a home energy rating system ("HERS"). In response to this legislative mandate, DOE sponsored the organization of the Home Energy Rating Council. The HERS Council developed a guideline and submitted it to DOE. Because of pressure from one single interest group, DOE has not yet issued those guidelines and is in breech of its obligations under EPACT.

"appropriate" to do so.

For commercial building energy codes, however, EPACT *requires* states to . . . certify to the Secretary (of Energy) that it has . . . updated the provisions of its commercial building code . . . to meet or exceed the requirements of ASHRAE Standard 90.1-1989[20].

Hence, EPACT imposes a Federal mandate on states to "update" commercial building energy codes to meet ASHRAE Standard 90.1-1989 (or its successors). According to DOE, all states have met the technical requirements necessary to comply with the aforementioned provisions of EPACT.[21] A review of the legislative history of EPACT reveals that there was no single driving force behind the energy efficiency provisions contained therein. Certainly, the desire to reduce the country's dependence on imported oil was a consideration. Additionally, however, environmental concerns surfaced, particularly as they relate to the potential for climate change.

Thus, the rational behind the support for energy conservation has changed over time, ranging from equitable concerns about rationing in 1917, to national defense in 1943, to reducing utility costs in the 1960's, to concerns with exhausting the supply of fossil fuels in the early 1970's, to goals of national energy self-sufficiency in the mid-1970's, and finally, to environmental concerns in 1992.

New Trends in Model Codes and Standards

From a historic perspective, the rational for energy conservation has changed frequently since their emergence during the first part of this century. Looking forward, however, there are several trends that are readily discernable with respect to energy codes and standards. The purpose of this section is to briefly review those trends, and to identify several of the most prominent energy codes and standards.

Codes v. Standards

As a preliminary matter, it may be useful to distinguish between model codes and standards. Model codes are sets of mandatory requirements used in the construction of buildings which have been developed to protect health, safety and the general welfare of the public. When adopted by a state or local jurisdiction, they have the force of law. Through the code development process (discussed *infra*), interested parties can propose changes and/or voice objections to proposed code changes in an open public hearing.

Standards, on the other hand, are documents that use a common and agreed upon language as a means to define and understand a particular subject. Standards generally fall into one of the following distinct categories: Methods of Test, Design Standards, and Standard Definitions, Classifications or Specifications. Standards are typically developed by Standards Developing Organizations ("SDO") such as ASHRAE, ASME, ASTM, NFPA and the like. The process of actually writing standards is typically delegated within such organizations to specific committees comprised of parties with expertise related to the proposed standard. The modern trend in building energy code development is to write standards in

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[20]In 1997, the U.S. Supreme Court decided *Printz v. United States*, 117 S. Ct. 2365. The rule of that case is that the Federal government may not impose a Federal regulatory scheme where states have the obligation to implement the scheme. The parallels between *Printz* and EPACT's state implementation requirements are striking.

[21]For a contrasting view, *see* Building Codes Assistance Project's *Bi-Monthly Status of State Energy Codes*, May/June 1997.

mandatory, or code language.[22]

Standards Development Organizations

Another trend is for government adoption of voluntary consensus standards whenever possible in lieu of developing its own proprietary standards.[23] The concept of adopting a voluntary consensus standard for building energy efficiency was codified through the passage of EPACT. [24] The American National Standards Institute ("ANSI") is the central body in the United States that, since 1918, has coordinated the development of voluntary consensus standards. ANSI does not develop standards itself. Instead, it reviews the work of various standard developing organizations ("SDO's") like ASHRAE. ANSI approval of a voluntary consensus standard serves to certify that the standard was developed under procedures that ensure openness and fair play, and that no duplicate standard exists.

To keep ANSI approval, existing standards must be maintained by the SDO in one of several ways. Two of the most popular methods are period maintenance and continuous maintenance. Under a system of period maintenance, the SDO will seek to create a replacement standard for the existing ASNI approved standard. This process will typically take years of work to accomplish. For instance, ASHRAE Standard 90.1 (discussed below) is currently on a system of periodic maintenance. A Project Committee has been working since 1989 to create a replacement document for the existing ANSI approved standard. Continuous maintenance, on the other hand, is a system where parties are given the opportunity to make proposals to amend an existing ANSI approved standard on a regular, cyclical basis, often semi-annually. The scope of the changes contemplated under a system of continuous maintenance in not nearly so large as that under periodic maintenance. For instance, a continuous maintenance proposal might affect only one small, discrete section of the standard as opposed to the entire standard.

ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers)

"ASHRAE, the American Society of Heating, Refrigerating and Air-Conditioning Engineers is an international organization of 50,000 persons with chapters throughout the world. The Society is organized for the sole purpose of advancing the arts and sciences of heating, ventilation, air conditioning and refrigeration for the public's benefit through research, standards writing, continuing education and publications."[25]

ASHRAE voluntary consensus standards are developed by project committees appointed specifically for the purpose of writing a standard. ASHRAE defines consensus as substantial agreement reached by concerned interests according to the judgement of a duly appointed authority, after a concerted attempt at

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[22]For instance, while a technically pure standard might suggest that parties "should" use thermopane glass under certain conditions, most standards today would be written that parties "must" use thermopane glass under those same circumstances.

[23]*See* OMB Circular A-119. *See also* the National Technology Transfer Act of 1995, Public Law 104-113.

[24]EPACT defines the term "voluntary building energy code" as a "building code developed and updated through a consensus process among interested persons, such as that used by the Council of American Building Officials; the American Society of Heating, Refrigeration, and Air-Conditioning Engineers; or other appropriate organizations." The Council of American Building Officials maintained the Model Energy Code in 1992 when EPACT was enacted. As an aside, however, EPACT was incorrect when it suggested the CABO process as a consensus process. In fact, the Model Energy Code is not developed through a consensus process. Rather, the MEC (and its successor the IECC) are developed and maintained through the "code hearing" process.

[25]*See* WWW.ASHRAE.ORG "About ASHRAE."

resolving objections. Consensus implies much more than the concept of a simple majority but not necessarily unanimity. ASHRAE makes a concerted effort to balance the interests of materially affected parties on all standards writing project committees.

Major ASHRAE Standards

ASHRAE/IESNA/ANSI Standard 90.1-1989: Energy Efficient Design of New Buildings Except Low Rise Residential Buildings. [26]

EPACT requires states to implement building energy codes for commercial buildings that are at least as stringent as ASHRAE Standard 90.1-1989. An effort has been underway since 1989 to revise this standard. The first draft of the revision was published for public review in March 1996. In response to over 18,000 comments, the Project Committee made changes to the standard and a second draft ("PRD-2") was published in December 1997. The public review for PRD-2 ended on March 30, 1998. It now appears that the second draft of the standard received more comments than the first draft. Because of the controversy surrounding the standard, ASHRAE is considering a move to stop the current effort to craft a replacement for the 1989 version, and instead may place the 1989 version into "continuous maintenance;" a procedure whereby the standard may be amended in smaller, discrete sections (e.g., lighting, equipment, etc.).[27]

ANSI/ASHRAE Standard 90.2 - 1993: Energy Efficient Design of Low Rise Residential Buildings.

A project committee established by the Standards Committee maintains Standard 90.2 - 1993 through the continuous maintenance process. Under this system of maintenance, parties may make proposed changes to the standard for the Project Committee to consider twice a year at regularly scheduled ASHRAE annual meetings. Such proposed changes are then considered (voted on) by the project committee. If the project committee votes in favor of the proposed change, then the change is published for public review. If the public review comments indicate that a proposed change is endorsed by a consensus of the commenters, then the project committee recommends the change to the standards committee. At this point, the standard still requires approval by Technology Council and the ASHRAE Board of Directors before becoming an official ASHRAE standard.[28] After receiving approval by the ASHRAE Board of Directors, the revised standard is submitted to ANSI for approval.

Code Development Organizations

Model Code organizations write, maintain, revise and distribute model codes specifically for adoption by local or state jurisdictions as written or with certain amendments. When adopted by these jurisdictions they effectively become law. Until 1994, most state and local building codes were based on

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[26]Standard 90.1 is jointly sponsored by both ASHRAE and the Illuminating Engineering Society of North America ("IESNA").

[27]"Continuous maintenance" is a different approach to standards development than the approach currently being used for ASHRAE Standard 90.1, which is to wholesale rewrite the standard with the goal to replace the existing standard in its entirety with the new standard.

[28]Typically, ASHRAE goes on to seek ANSI approval of standards as well, although ANSI approval is not required.

one of three model codes. These three model codes were developed and maintained independently by the Southern Building Code Congress International ("SBCCI"), the Building Officials and Code Administrators International ("BOCA"), and the International Conference of Building Officials ("ICBO"). In December 1994, these three model code organizations created the International Code Council ("ICC") to oversee the development of a single set of model codes to ultimately replace the corresponding code of each of the individual code organizations. To date, the ICC has developed the 1995 International Plumbing Code, and the 1996 International Mechanical Code. In addition, responsibility for maintenance of CABO's One and Two Family Dwelling Code and the Model Energy Code has been transferred to the ICC. The ICC is currently developing the International Building Code with a target publication date of 2000. This year, the ICC changed the name of the Model Energy Code to the International Energy Conservation Code ("IECC"). It is also worth noting that the ICC is developing an International Residential Code ("IRC") as a replacement for the CABO One and Two Family Dwelling Code. The IRC will contain a chapter on energy conservation that will be an equivalent to the MEC for compliance purposes. The current draft of the IRC energy conservation chapter (Chapter 38) is much shorter and more prescriptive than the MEC/IECC. Brevity and simplicity is another trend in the development of energy codes, although not necessarily in the development of energy standards.[29]

ICC Code Process

There are two phases in the model code process, a preliminary hearing and a final hearing. On a yearly basis, interested parties may submit code change proposals by a fixed date. These proposed changes are then assembled into a single document and published for public review. At the preliminary hearing, a committee, usually consisting of 6 to 10 members appointed by the model code group, listens to testimony, both pro and con, on the proposed changes. The committee then makes a decision by simple majority vote to approve, disapprove, or to approve as modified each proposed code change.

Results of the preliminary hearing are subsequently published. Anyone disagreeing with a committee decision may challenge that decision in writing. All challenges are assembled into a single document and published for public review prior to the final hearing. Any unchallenged decisions are automatically approved at the final hearing by a vote of the attending membership.

All challenges are heard at the final hearings before the voting members in attendance. Challengers carry the burden of persuading a majority of the voting members in attendance to reverse the committee's prior decision.

Regulatory Standards

The Energy Policy and Conservation Act[30] directs the Department of Energy to develop energy efficiency standards for certain enumerated appliances including refrigerators, air conditioners, and furnaces. While not technically a building energy code, appliance standards developed by DOE directly impact the construction of new building. DOE recently issued a final rule on refrigerator efficiency. In addition, it is

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[29] As an aside, it is interesting to note that the State of Oregon simplified and shortened its state energy code in 1992. Since that time, it has found the simpler, shorter energy codes result in greater energy savings because of their greater enforceability. (Stephens 1998)

[30] 42 U.S.C. 6293.

in the process of developing new efficiency requirements for water heaters, air conditioners, and heat pumps.

Regional Codes

At present, there are several attempts to develop regional energy codes. For instance, a group of New England states have talked formally about working together. Likewise, the NorthWestern Energy Association has discussed the possibility of developing a regional building energy code. Finally, the Southern States Energy Board has been recently created. It met on September 19, 1997 in Atlanta to discuss the integration of national codes in southern states.

Multi-State Working Group

In addition to the regional groups named above, representatives from various states are working to accelerate the development of an advanced and enforceable commercial energy code. The Multi-State Working Group has three objectives; 1) improve efficiency standards, 2) foster simplicity, and 3) develop support for such a code. At present, the following states are involved; California, Connecticut, Florida, Indiana, Maine, Massachusetts, Minnesota, New Hampshire, North Carolina, Oregon, Rhode Island, and Vermont. During the 1997 ICC code cycle, this group proposed and the ICC accepted a change to the MEC that significantly change the scope of the MEC with respect to commercial buildings. Whereas before this change the MEC addressed commercial construction only by a reference to ASHRAE Standard 90.1-1989, the Multi-State Working Group's proposal added a new chapter to the MEC with an abbreviated version of ASHRAE Standard 90.1-1989. These authors have been told that during the 1999 code cycle, a proposal to remove all references to ASHRAE Standard 90.1 will be made. Thus, to the extent the MEC/IECC holds itself out to be an equivalent to ASHRAE Standard 90.1 for EPACT compliance purposes, it competes with ASHRAE Standard 90.1 in the market for energy codes and standards.

CONCLUSION

Codes and standards have the effect of establishing energy policy in the United States. Thus, the method by which they are developed is important and raise numerous issues, including the issues of fairness, timeliness, and useability/enforceability.

With respect to fairness, ANSI standards, developed through the consensus process, appear to provide more due process to parties than does the code hearing development process. However, the code hearing development process appears to be a system that has demonstrated its ability to deliver and maintain codes in a more timely manner than the consensus process.

Finally, codes and standards have the potential to save energy -- but only to the extent they are used (in the case of standards) and enforced (in the case of codes). The less complex the code or standard, the greater it appears that they will be used and/or enforced.

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