



American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

Testimony of
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To the
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Select Committee on Energy Independence and Global Warming
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Hearing on: “Building Green, Saving Green: Constructing Sustainable and Energy-Efficient Buildings”

Chairman Markey, Ranking Member Sensenbrenner and members of the committee, thank you for the opportunity to speak to you today about energy use, buildings, and opportunities to reduce their climate impacts. My name is Kent Peterson, and I am the current volunteer president of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, better known as ASHRAE.

Founded in 1894, ASHRAE is an international nonprofit technical engineering society of 50,000 members in over 140 countries. Our members represent the breadth of professionals involved in the built environment from consulting engineers and architects to manufacturer’s representatives and academicians.

ASHRAE fulfills its mission of advancing heating, ventilation, air conditioning and refrigeration (HVAC&R) to serve humanity and promote a sustainable world through research, standards writing, publishing and continuing education.

ASHRAE has a long history in energy conservation and is committed to economic energy-efficiency standards and advanced guidance. In the 1970s during this nation’s previous energy crisis, the federal government approached ASHRAE to develop a standard to address the energy use of buildings. This standard became ANSI/ASHRAE/IESNA Standard 90.1--Energy Standard for Buildings Except Low-Rise Residential Buildings. Standard 90.1 serves as the national reference for state adopted commercial building codes through the Energy Conservation and Production Act (ECPA).

As we enter a new time of energy awareness, there are many factors drawing attention to energy use—concerns about our sources of energy, rising energy costs, and the impacts of climate change. Our nation’s buildings account for 40 percent of our primary energy use—more than both transportation or industry. They are responsible for 72 percent of the electricity consumption and 39 percent of the total U.S. carbon dioxide emissions. These CO₂ emissions approximately equal the combined emissions of Japan, France, and the United Kingdom.

Standard 90.1: Its Development and Its Future

Building codes serve as the primary mechanism for reducing energy consumption in buildings. Energy Codes are a subset of a broader group of requirements governing the design and construction of buildings. Building codes establish minimum requirements for issues of importance within a community—including safety, accessibility, health, and energy use. Building codes generally reflect a consensus of current design and construction practice. In this country, building codes generally are considered a state and local government issue.

Standard 90.1 serves as the basis for many commercial building energy codes across the country. As an American National Standards Institute (ANSI) approved standard, the development of Standard 90.1 adheres to rigorous principles based on consensus, openness, balance, transparency, and due process. In fact, ASHRAE is one of only five ANSI Audited Designators which means we have established and maintain a consistent record of successful voluntary standards development.

The Standard is developed by a committee made up of technical experts representing different aspects of the building community including product manufacturers, energy efficiency advocates, academics, government, building owners, utilities, and consulting (or design) engineers and architects. Once the committee reaches consensus on a draft of the standard, it is open for a period of public comment. Once comments are received, the committee must attempt to resolve all comments before presenting the standard to the ASHRAE Board of Directors for publication. Both within the ASHRAE structure and the ANSI structure there are opportunities for appeal for anyone who feels that their comments regarding the standard are not adequately addressed.

Both Congress and the Executive branch have recognized the value of voluntary consensus standards by requiring their use in regulations when consistent with agency policy and appropriate for agency purposes (National Technology Transfer and Advancement Act of 1995 (P.L. 104-113) (NTTAA) and OMB Circular A-119). Many voluntary consensus standards are appropriate or adaptable for the Government's purposes.

As mentioned above, states are required in the Energy Conservation and Production Act to adopt commercial building energy codes at least as stringent as Standard 90.1-2004 (42 U.S.C. 6833). However, there are no real penalties for states who do not comply with this requirement, but incentive funding is available for states and localities to implement the requirements. See attached Exhibit A for a map of the current status of commercial building energy codes within the states.

When a revised version of Standard 90.1 is released, the Department of Energy is required within 12 months to determine if the revisions made will improve energy efficiency in commercial buildings. The standard is updated on a three year cycle with the latest version being Standard 90.1-2007. Once a positive determination is made, each state must within two years certify that it has reviewed and updated its commercial building energy code in accordance with the revised Standard. Such certifications should include a demonstration that the provisions of the state's codes meet or exceed the revised Standard.

Standard 90.1 addresses many aspects of buildings that contribute to the overall energy use attributable to a building. These include:

- Building envelope or shell: includes required insulation values, window characteristics and allowable air leakage
- Heating, ventilation and air-conditioning: includes equipment efficiency requirements
- Service water heating: includes equipment efficiency requirements
- Lighting: includes allowable power use by lighting for particular space uses

Standard 90.1 provides minimum energy-efficient requirements for the design and construction of new buildings, building additions, and new systems and equipment in existing buildings. Thus, the Standard is not applicable for existing buildings except to the extent that replacement systems and equipment should comply with the Standard. Other elements such as the building envelope are more difficult to alter once the building is constructed. It would not be practical to require all building components to be brought up to minimum code requirements established for new buildings when the building is renovated—such a requirement could result in considerable expense or even require demolition of the building (resulting in considerable waste).

Some jurisdictions such as San Francisco require homeowners to bring certain elements of their home up to code before they are sold. Such a requirement could be implemented on the sale of commercial buildings or upon renovation. Additionally, tools such as the building energy labeling program outlined below and incentives such as the commercial building tax deduction can encourage building owners to consider implementing energy saving technologies and practices. Energy service companies (ESCOs) also can provide low cost and low risk solutions to building owners looking to reduce energy use. The ESCO finances the building upgrades and the building owner pays back the cost from the energy savings achieved.

Existing buildings represent a significant proportion of the current building stock and must be considered in strategies to reduce energy use. The Pacific Northwest National Lab (PNNL) has estimated that the median lifetime of commercial buildings is 70 to 75 years. This results in an anticipated attrition rate of just two percent of floorspace per year. About 40 percent of the existing commercial building stock was constructed before 1970 and thus before building energy codes.

ASHRAE has tools and practices to address the energy use associated with existing buildings, and we continue to develop additional tools. ANSI/ASHRAE/IESNA Standard 100-2006 provides a framework for achieving energy conservation in existing buildings. Proper building operations and maintenance also is critical. ASHRAE is near completion on a standard for operations and maintenance (O&M). We are developing an O&M personnel certification

program to recognize practitioners who possess the knowledge to develop and implement an effective O&M program. Recommissioning and retrocommissioning also are important tools to ensure buildings and equipment are operating as they were designed. ASHRAE has several guidelines that lay out the methodologies for completing the commissioning process.

In addition to the need for having up-to-date building codes on the books, jurisdictions must have the necessary enforcement mechanisms and training to assure its compliance. As state and local building departments struggle with smaller budgets and increasing workloads, energy efficiency requirements often are seen as luxuries if time and funding allow. The Department of Energy and private sector organizations like ASHRAE offer excellent training opportunities for building code officials and consulting engineers, but their widespread use also is limited by the availability of financial resources.

As the ASHRAE membership began to recognize the critical role buildings play in energy use and climate change, the ASHRAE Board of Directors established a goal of 30 percent reduction in allowable energy from the 2004 version of Standard 90.1 to the 2010 version. While this goal was established by the Board of Directors, the adherence to the ideals of the ANSI process is paramount. However, I am pleased to report that the standard project committee is working diligently toward the established goal. Additional energy efficiency goals were established for other standards and guidance including publication of guidance for achieving net-zero energy buildings (NZEBS) by 2020 and a standard for achieving NZEBS by 2030.

Going Beyond the Minimum

While Standard 90.1 establishes a minimum level of energy efficiency, we have several initiatives to provide guidance to those who wish to go beyond the minimum requirements and to encourage greater development and deployment of technologies and best practices that can move the market toward increasingly more energy efficient buildings.

These tools include the Advanced Energy Design Guides (AEDGs) which provide prescriptive means for achieving 30 percent savings over Standard 90.1-1999. AEDGs focused on existing buildings and achieving 50 percent and greater energy savings also are in development. These guides are developed in partnership with the Department of Energy and other members of the building community. Over 90,000 copies are in the hands of practitioners and decision makers. Other publications including the *ASHRAE GreenGuide* provide guidance for the design of HVAC systems.

We are working with the U.S. Green Building Council and the Illuminating Engineering Society of North America to develop a code-adoptable standard for the design of high-performance green buildings. Standard 189.1P likely will be released later this year and will cover all aspects of building design from choices on site and orientation to water and energy use. The energy section is aiming for a 30 percent improvement above Standard 90.1-2004. Even before its completion, we have received indications that many jurisdictions are interested in adopting the Standard as part of its building code.

While consumers have a metric for understanding the relative efficiency of their car with respect to other drivers—miles per gallon—the public and many building owners cannot grasp the concept relative to buildings. Therefore, ASHRAE is in the process of developing a building energy label which will provide building owners and occupants (and potential purchasers) with a standard energy metric that can easily be compared across buildings. Such a label will provide an incentive for building owners to provide improved energy efficiency relative to their neighboring buildings. We also are structuring the label to encourage the use of building energy modeling early in the design process. We have already seen that buildings that participate in programs that differentiate them from other buildings (including the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) and the EPA's EnergyStar program) rent quicker and have more satisfied tenants.

In encouraging building owners to go beyond minimum requirements it often is necessary to make the business case for advanced energy efficiency. Through our participation in the Retailer Energy Alliance, we have seen that major corporations such as Wal-Mart, Target, Whole Foods and others have found energy efficiency to be a good investment.

The federal government already is required to meet energy efficiency targets for new buildings that are 30% more stringent than Standard 90.1-2004 (Energy Policy Act of 2005, §109). Federal buildings may account for about 1.4 percent of the total commercial construction volume or 28 million square feet a year. In one year, this new requirement will result in 35,800 metric tons of CO₂ emissions avoided, 317 tons of NO_x emissions avoided, and 625 tons of SO₂ emissions avoided. These savings will compound as federal construction continues and buildings are occupied.

In the energy bill recently passed by this Congress—the Energy Independence and Security Act (EISA)—additional requirements were placed on new federal buildings including reducing the fossil fuel based energy consumed to zero by 2030. ASHRAE and others within the building community are working with GSA and other federal agencies to provide the technical guidance, technologies, and education and training necessary to achieve these requirements.

Providing these above code technical resources now is critical to show what is possible for improved energy efficiency and encouraging the market to embrace such measures by recognizing the social, ethical, practical, and economic reasons for doing so. We must continue on the path of making our nation's buildings more energy efficient, but this requires a significant commitment from all stakeholders.

ASHRAE and Climate Change

As the public, Congress, and ASHRAE members become increasingly interested in developing solutions to address climate change, we see buildings as a necessary part of these solutions. Beyond our focus on energy efficiency, we have a project underway to determine the actual carbon emissions associated with buildings.

The Carbon Emissions Tool Project is focused on estimating the carbon emissions associated with buildings. Currently, building design professionals estimate the annual energy consumption

that will be required to operate the building, and then apply actual average annual carbon emission factors to those estimates in order to estimate the annual carbon emissions associated with the building's operation. There is no standard practice for selecting and applying carbon emission factors applied to electricity whether purchased from a utility or produced on-site.

The ASHRAE Carbon Emissions Calculation Tool is intended to increase the accuracy of the data and methods used to estimate greenhouse gas (GHG) emissions. More accurate data and standardized, improved methods will enable engineers, architects, and other building design and operational professionals to make better-informed decisions regarding the base year carbon intensity of buildings and the potential carbon emissions savings associated with investments in efficiency.

The resulting emissions profile data can be used by designers and operators of buildings to determine the effect of a particular design/operations decision. Designers and operators will be able to determine the best technology or financial "investment" based on maximum carbon emissions reductions.

While this program will provide significant knowledge and contribute to the future development of ASHRAE standards and guidance, it is too early to know exactly how they will be incorporated in the future. However, ASHRAE members are focused on increasing the energy efficiency of buildings without sacrificing the indoor environmental quality (IEQ) of buildings including maintaining good indoor air quality. Since the majority of greenhouse gas emissions associated with the building sector is tied to the electricity and natural gas utilized within the building, we are currently focused on reducing the energy required to power buildings and utilizing renewable energy sources to make up the difference (NZEBs). As indicated above, we are focused on providing the tools necessary to achieve our national energy goals.

Recommendations for Meeting Future Needs

I offer the following recommendations to assure that we meet the future demands placed on buildings:

- Adequately fund the federal agencies that advance the development and enforcement of energy standards and guidelines including the Department of Energy, National Institute of Standards and Technology, Environmental Protection Agency, and the General Services Administration which serves as a leader in the implementation of leading edge technologies and practices.
- Support the research and development necessary to develop and deploy cost effective technologies necessary to achieve our nation's energy goals. This includes the technologies envisioned under the Net-Zero Energy Commercial Building Initiative established in EISA. Additionally, sufficient investment must be made in R&D for renewable energy technologies such as solar, wind, water, biomass, and geothermal. These renewable energy technologies will be critical components of the design and construction of net zero energy buildings—funding for their development must parallel their importance to their role in net zero energy buildings.
- Enact policies that encourage individuals and businesses to implement energy efficient technologies and practices that go beyond the minimum requirements. This includes the

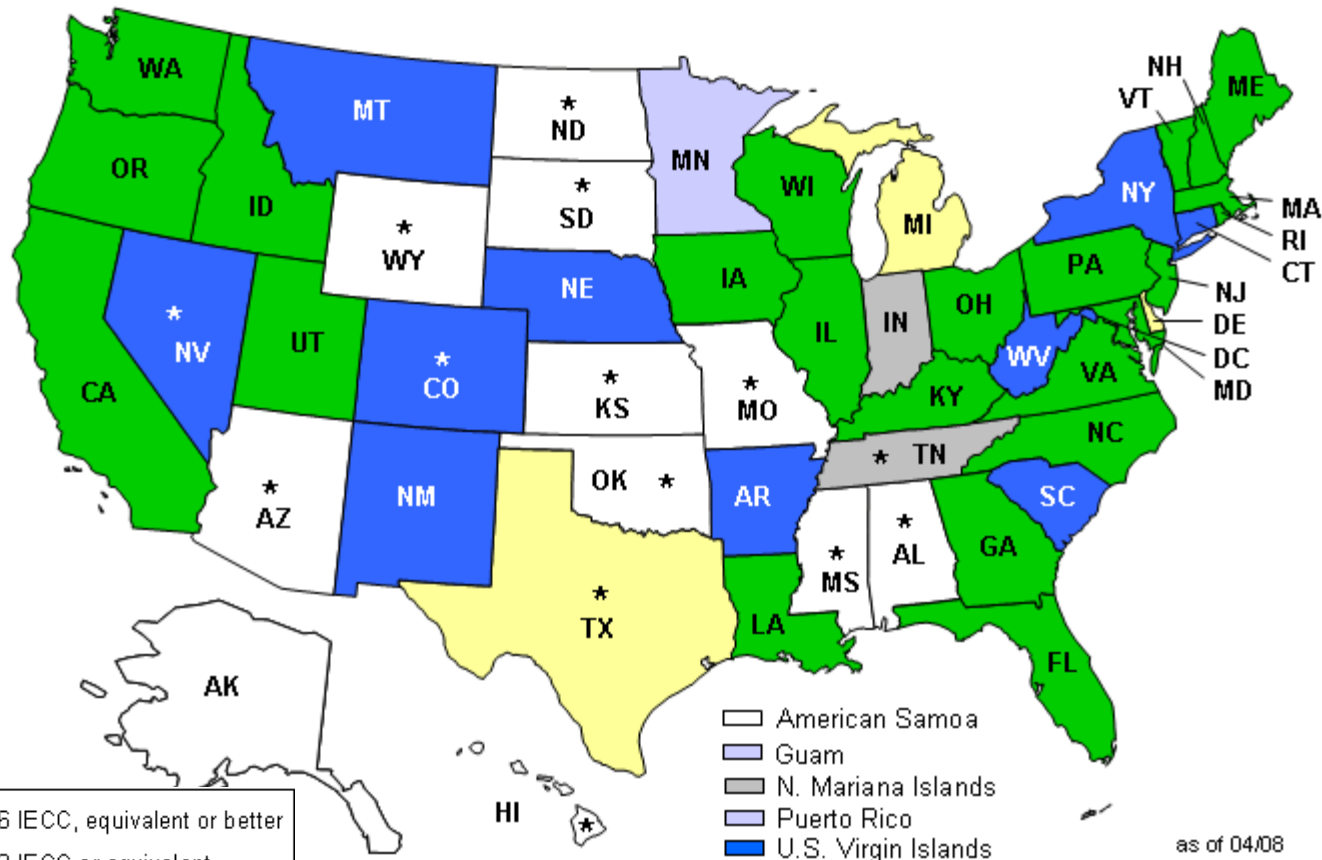
commercial building tax deduction and setting realistic depreciation schedules for HVAC&R equipment.

- Continue to support the utilization of voluntary consensus standards in regulation and codes as recognized by The National Technology Transfer and Advancement Act of 1995 (P.L. 104-113) (NTTAA) and OMB Circular A-119.
- Support education programs focused on providing students with competence in science, technology, engineering and mathematics (STEM). As we are challenged to improve the performance of buildings, we will need a skilled engineering and technician workforce to assure that the buildings are properly designed, constructed and maintained.

Thank you again for the opportunity to address the committee. Please feel free to contact me or our ASHRAE Washington Office should you require any additional information on buildings related issues.



Exhibit A: Current State Adoptions of Standard 90.1



Green	ASHRAE 90.1-2004/2006 IECC, equivalent or better
Blue	ASHRAE 90.1-2001/2003 IECC or equivalent
Yellow	ASHRAE 90.1-1999/2001 IECC or equivalent
Light Blue	ASHRAE 90.1-1989/2000 IECC or equivalent
Grey	Older or less stringent than ASHRAE 90.1-1989/2000 IECC
White	No statewide code
*	Adoption by county/jurisdiction above state mandated minimum