

Testimony of

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For the Hearing on

**Climate Benefits of Improved Building Energy Efficiency**

Before the

House Energy & Commerce Committee

Rep. Dingell (MI) and Rep. Barton (TX) Chairs

Energy & Air Quality Subcommittee

Rep. Boucher (VA), Chair; Rep. Upton (MI) Ranking Member

July 17, 2008

Mr. Chairman and members of the committee, thank you for inviting me to speak. Today, I will focus on the potential for reducing energy use and greenhouse gas emissions for residential buildings, by providing brief answers to six of the questions presented in your invitation.

#### Question 1

**What reductions in energy use and greenhouse gas emissions are possible from state-of-the-art building design, that are cost-effective and do not diminish other attributes and uses?**

There are many state-of-the-art AND tried-and-true methods for reducing energy use and greenhouse gas emissions in residential buildings that do not diminish other attributes and uses. Some of the methods are low cost, others cost nothing, and some are cost saving.

1. **Advance Wall Framing** - The principle of advance wall framing is to reduce the amount of wood used in exterior walls.<sup>1</sup> This is desirable because the wood within the wall causes thermal bridging between the interior and exterior, contributing to unwanted heat losses and gains. Reducing the amount of wood reduces energy use. Advance wall framing lowers cost of construction.
2. **Proper Sizing of HVAC (Heating, Ventilation and Air Conditioning) Systems** - A significant percentage of residential HVAC systems are sized by rules-of-thumb and/or are intentionally oversized. Doing so reduces the energy efficiency of the furnaces, boilers and air conditioners. It also uses more materials for ducts. Equipment should be sized to match loads calculated in accordance with Manual J, "Residential Load Calculation", and ducts should be sized in accordance with Manual D, "Residential Duct Design". Both manuals are published by the Air Conditioning Contractors of America (ACCA). Properly sizing the HVAC systems lowers the cost of construction.

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<sup>1</sup> *Advance Wall Framing*, Office of Building Technology, State and Community Programs, Energy Efficiency and Renewable Energy, U.S. Department of Energy, [http://www.earthcraftshouse.com/documents/factsheets/AWF-Advanced\\_frame%2000-770.pdf](http://www.earthcraftshouse.com/documents/factsheets/AWF-Advanced_frame%2000-770.pdf), May 2000.

3. Heat Recovery Ventilators (HRV) and Energy Recovery Ventilators (ERV) - These are devices that save energy by transferring energy between exhaust air leaving the building and fresh air entering the building. They are off-the-shelf technologies that are easy to integrate into forced air heating and cooling systems, which are the most common type of system used in residential buildings. They have a low cost in comparison to the total cost of the heating and cooling system.
4. Energy Star Certified Roofing Systems - Dark colored roofing systems tend to absorb a high percentage of solar radiation, which is transferred to attics and conditioned spaces. This can result in high cooling loads. Energy Star certified roofing systems reduce cooling loads by reflecting a high percentage of solar radiation away. Since this method typically only requires being selective about the color of the roofing system it cost nothing.

These are just four of the numerous methods available for reducing energy use and greenhouse gas emissions.

## Question 2

**What are the factors that have led new residential construction to fall far short of the potential to reduce energy use and greenhouse gas emissions?**

More than half (61.1%) of all the housing in the United States is single-family detached housing.<sup>2</sup>

Most of it is built as a market commodity by developers and builders. Future owners are typically not identified beyond a specific demographic, such as start up families or empty nesters.

Developers and builders, owners, and mortgage lenders all contribute to underlying issue that restricts this subtype of single-family housing from being energy efficient.

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<sup>2</sup> *Selected Housing Characteristics: 2004*, 2004 American Community Survey, U.S. Census Bureau.

1. Developers and builders produce this type housing as a commodity for market, much in the same way Ford and General Motors manufacture a commodity for market. Consequently, they produce what they see the market as demanding.
2. Most potential owners determine value primarily on size and finishes. Heating and cooling cost is a secondary determinate; and environmental impact is seldom a factor. This creates a market that is extremely sensitive to cost increases associated with reducing energy use and greenhouse gas emissions.
3. As with buyers, most mortgage lenders look at only the initial price and the single bottom line of economic value. Far fewer lenders use the triple bottom line (TBL) of economic, environmental and social values and costs to qualify buyers.

Housing that is truly energy-efficient, such as passive solar housing, is typically produced by developers and builders seeking a niche market or for specific owners. As a subtype it represents a small percentage of single-family housing.

### Question 3

**What can the Federal Government do to address those factors?**

The Federal Government tried to address these factors in 1979 when HUD implemented the Energy Efficient Mortgages Program (EEM), which increases the amount buyers can borrow.

Unfortunately, the perception is that the loans are more complex to obtain than conventional loans. According to the National Energy Renewal Laboratory, after twenty years, only 1.5 percent of the loans currently being made by a major federal lender are EEM loans.<sup>3</sup> HUD reports, "... as many as 250,000 more new homebuyers could qualify per year, according to a 1986 study by the Joint Center for Housing Studies."<sup>4</sup>

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<sup>3</sup> Farhar, Barbara, *Pilot States Program Report: Home Energy Rating Systems and Energy-Efficient Mortgages*, Golden, Colo.: National Energy Renewal Laboratory, NREL/TP-550-27722, April 2000.

<sup>4</sup> U.S. Department of Housing and Urban Development, Energy Efficient Mortgages Program, <http://www.hud.gov/offices/hsg/sfh/eem/energy-r.cfm>, July 2008.

Based on the limited success of this program, and regional issues I will discuss shortly, the Federal Government should take a supportive role in helping state and municipal governments implement regional codes and guidelines for energy efficiency.

The Federal Government has been successful in researching the factors and barriers leading to new residential construction falling far short of the potential to reduce energy use and greenhouse gas emissions. This information enables state and municipal governments to make informed decisions about codes and standards. For that reason, continued research is a function the Federal Government should do to help address these factors.

#### Question 4

**What are my views of efforts to upgrade and provide enhanced implementation of energy-efficiency building codes?**

Success in the implementation of energy-efficiency building codes has been limited to a few states and municipalities. In 1978, California adopted Title 24, Part 6, of the California Code of Regulations, Energy Efficiency Standards for Residential and Nonresidential Buildings. Minnesota has had energy code since 1976. More recently the City of Chicago adopted the Chicago Energy Conservation Code. These three codes are good examples of how regional codes can yield housing that that is more energy-efficient than what is being built throughout most of the country.

#### Question 5

**What are market and non-market barriers that have resulted in much new home construction falling well below cost-effective levels of energy efficiency?**

The U.S. Department of Housing and Urban Development lists four barriers to innovation in housing. They are fragmentation, risk, education, and cultural values.<sup>5</sup> For each of these four barriers there are multiple forms of the barrier. For example, the RAND Science and Technology Policy Institute concluded, "... the housing industry is fragmented vertically, horizontally, and geographically."<sup>6</sup> The report goes on to list "... municipal regulation, industry competitiveness, and the predominance of small builders" as the reasons for geographically fragmentation.<sup>7</sup> Missing from this list is regional building practice. As a laborer, carpenter and general contractor, I have built housing on remote sites in Wyoming, and on south side of Chicago. I have also built housing in the Sonoran Desert of Arizona and the suburbs of Seattle. This set of experiences has shown me a wide variation in regional practices that are based on climate, available materials and local skills. *It is important to note geographic fragmentation barriers intensify when two or more geographic regions with dissimilar forms of fragmentation are combined into one larger region.* The one constant that does exist is a lack of willingness to deviate from the regional norms.

Risk and education are two more barriers I have watched builders struggle with. In a report prepared by the National Research Council the effects of education and risk on advancing energy-efficacy is summarized as follows.

"Although many energy-efficient materials and products do not have higher first costs, builders resist implementing them because additional time is needed to train workers to install them. Also, until the builder gains experience with these energy-efficient materials and products, they are perceived as risky."<sup>8</sup>

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<sup>5</sup> *Overcoming Barriers to Innovation in the Home Building Industry*, Building Technology Incorporated, Silver Spring MD: Building Technology Incorporate, p. 4, 2005.

<sup>6</sup> *Building Better Homes: Government Strategies for Promoting Innovation in Housing*, RAND Science and Technology Policy Institute, Arlington VA: RAND, p. 15, 2003.

<sup>7</sup> *Ibid*, p. 46.

<sup>8</sup> *Energy Research at DOE: Was It Worth It? Energy Efficiency and Fossil Energy Research 1978 to 2000*, National Research Council, Board on Energy and Environmental Systems, Committee on Benefits of DOE R&D on Energy Efficiency and Fossil Energy, Washington D.C.: National Academy Press, p. 25, 2001.

A factor that is amplifying the severity of these barriers is the increasing practice of piece work. Builders routinely pay short-term laborers by the piece, rather than by the hour, to perform specific tasks. The practice has yielded a labor force of workers that float from builder to builder; and, within the labor force each worker typically possesses a very limited set of skills. With workers no longer employed by one builder for a significant period of time to do a wide range of tasks there is little incentive for builders to educate the labor force.

#### Question 6

**How should the market and non-market barriers to inclusion of cost-effective energy efficiency in new housing be overcome?**

The barriers to building housing that is energy efficient and produces less greenhouse gasses can be broken down into two groups, 1) those that are unique to each region, such as regional building practice, and 2) those that are universal throughout the United States, such as risk associated with the adoption of new technologies. Methods for overcoming these barriers range from financial incentives to energy codes. The lack of wide spread use of readily available methods for contractors to build energy efficient housing while reducing costs, as discussed in question 1, and the ineffectiveness of energy efficient mortgages, as discussed in question 3, points to a need to implement energy codes. Given how resistant the housing industry is to change it stands to reason that the less change an energy code requires the more likely it is to be implemented. It also stands to reason that when two or more regions with dissimilar forms of fragmentation barriers are combined into one region through the implementation of a common energy code; it is going require the housing industry to make more changes. This argues for implementation of energy codes on a regional basis, be it state by state or municipality by municipality.

An additional benefit of implementing regional energy codes is that it permits the opportunity to structure the code to enhance regional design approaches, which are commonly used by architects in the designing of energy-efficient and environmentally-responsible buildings.

Thank you for this opportunity.