Environmental and Energy Study Institute

Issue Brief

High-Performance Manufactured Housing

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EXECUTIVE SUMMARY

Today's manufactured housing looks similar to conventional site-built housing and is regulated by federal quality and safety standards. It represents seven percent of the U.S. housing stock and is a major source of unsubsidized housing for low-income households. While generally considered to be affordable housing, the energy-inefficient older models (built before the federal "HUD Code") are among the most expensive in the nation to heat. They also contribute disproportionately to greenhouse gas emissions which cause climate change. New models, while significantly better, have the potential to use even less energy – making them more affordable and reducing some of the 40 percent of U.S. greenhouse gas emissions created by the building sector.

High-performance manufactured housing is a new generation of HUD-Code housing that begins closing the quality gap between conventional and manufactured housing – while maintaining affordability. "Life-cycle affordability", or low first costs *and* low operating costs, is the essential element of high-performance manufactured housing. High-performance housing also is attractive, functional, water-efficient, resilient to wind, seismic forces and moisture penetration, and has healthy indoor environmental quality. There are several examples of high-performance manufactured housing in use, but they maintain a small share of the market.

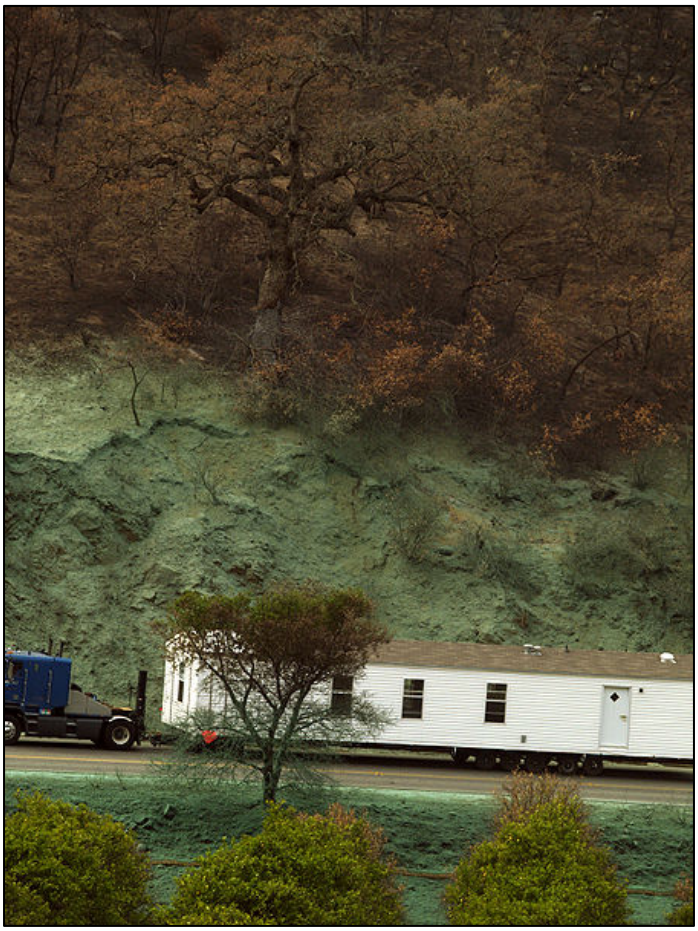
The federal government has taken some steps to improve the quality and performance of manufactured housing, but further action is needed to drive the market. Recommended federal actions include:

1. Implement Section 413 of the *Energy Independence and Security Act of 2007*, which requires the U.S. Department of Energy (DOE) to develop up-to-date energy efficiency standards for the HUD Code, based on technical feasibility and cost effectiveness.
2. Provide active oversight of the HUD Code, updates, and compliance resources.
3. Update requirements for ENERGY STAR-qualified manufactured homes so that ENERGY STAR continues to represent above-code energy efficiency standards.
4. Finish the process of updating federal procurement specifications manufactured housing to address energy efficiency, indoor air quality and other issues.
5. Use voluntary "reach codes" that exceed legal minimums, combined with compliance incentives to provide guidance on best practices and to pull the market toward better quality and performance.
6. Educate consumers to raise awareness of high-performance manufactured housing and improve its image.

Other critical issues to be addressed include obstacles to financing for manufactured homebuyers and the need for integrative, whole-building planning and design tools.

INTRODUCTION

Manufactured housing is a type of single-family detached housing and a unique subset of factory-built housing. Manufactured housing units are built almost entirely in industrial facilities, whereas modular homes and other prefabricated building systems are produced in sections or assemblies and put together on site. Manufactured housing is the only U.S. housing regulated by a federal construction code (the HUD Code implemented in 1976).[1] All other housing is subject to the state and/or local building codes that govern their specific location. There are more than seven million occupied manufactured housing units across the country, ranging from 446 in Hawaii to over 630,000 in Florida. They make up seven percent of the nation's housing stock and are home to 17 million people.



A manufactured home typically is moved only once – from the factory to the owner's private land or a lot leased in a manufactured home community. Source: FEMA Photo Library, Photographer: Amanda Bicknell/FEMA

Manufactured housing evolved from the recreational travel industry that emerged in the United States in the early 1900s. From travel trailers to house trailers to early mobile homes, they were designed more for mobility and affordability than for durability. Mobile homes were at the low end of the housing market in terms of quality, but the low purchase price enabled more Americans to own a home even if they did not own land. To keep prices low, the quality of the construction was also held to low standards. Millions of units were sold on the same financial terms as vehicles, and like vehicles, they depreciated rapidly over their first few years of existence. Even so, industry analysts estimate there are about two million mobile homes that remain from that era and are still in use in all 50 states, even though most are in very poor condition and potentially unsafe. Collectively, mobile homes produced prior to 1976 (when federal standards went into effect) are the least energy-efficient housing stock in the United States. Ironically, the energy they waste results in high monthly energy bills, making them among the least affordable homes for people who have the fewest resources.

Housing, Energy Costs, and Poverty

While the average American family spends four percent of its income on utilities, low-income households often spend percentages several times as high and can be forced to make a choice between paying their utility bills and buying food or medicine. For single, elderly, and disabled persons living on Social Security Income (SSI) in 2009, the average energy burden was 19 percent of SSI. For families on welfare the energy burden was, on average, seven times greater than for families at median income.[2] Affordable housing, generally defined as housing costs that exceed no more than 30 percent of a household's annual income, has been persistently unavailable to low-income Americans and is now out of reach for many moderate-income households. In 2009, U.S. Census data showed that the number of households exceeding 30 percent in housing expenses had risen to 41.7 million, an increase of 1.5 million over 2007. The recent recession and continued economic uncertainty have made the need for affordable housing even more urgent.

Manufactured housing is a major source of unsubsidized housing for Americans with the lowest incomes; it is generally more cost-effective to produce and, therefore, more affordable to purchase than site-built housing. The challenge is to make manufactured housing affordable to *operate* as well. Although the quality of new manufactured homes has

improved significantly over the years, experts say that housing energy efficiency can be improved even more in a cost competitive way.

High Performance Manufactured Housing

High-performance housing improves "life-cycle affordability", or low first costs *and* low operating costs, through energy efficiency. Less energy wasted means lower utility bills and fewer greenhouse gas emissions (buildings account for 40 percent of U.S. greenhouse gas emissions). High-performance housing also is attractive, functional, water-efficient, resilient to wind, seismic forces and moisture penetration, and has healthy indoor environmental quality in terms of air, temperature, acoustics, and lighting. A high-performance house is not necessarily "high tech", although sensors and programmable appliances and equipment are likely to be common features in the near future.

There is no single technology or design strategy that creates a high-performance home or building. Achieving high-performance housing that is affordable for low to middle income households requires planning, creative and innovative design, and efficient implementation. There is a concerted and deliberate effort to establish high-performance goals, either by federal, state, or local law or by the home buyer, architect, builder or manufacturer. An integrative design and construction process ensures that individual building components function well together as a system, with a periodic system evaluation ensure the building operates as well as it was designed.

The most sophisticated producers of manufactured housing are now working on high-performance manufactured housing that meet the growing need for sustainable, affordable housing while addressing safety, accessibility, and environmental considerations in addition to energy conservation at a price that is affordable for working households. By using best practices in holistic planning and design and lean manufacturing, manufactured housing could be a major source of high-performance affordable housing in the future.

Advantages of the Factory-Building Process

Many believe that the assembly line does for houses what it has done for other products: streamline the production process, reduce waste, ensure consistency, control quality, and reduce costs. Manufactured houses are built "off site" in temperature-controlled industrial facilities, which avoids weather delays, saves time and money, and protects inventory. A 2000 update to the HUD Code and the industry's development of installation standards extend quality-control practices to the installation of the homes to ensure they perform according to manufacturer specifications.

The factory-building process offers the opportunity to use the latest knowledge in advanced building systems, digital design, manufacturing technology, and innovative products and materials to achieve the highest quality house for the lowest cost. After adjusting for a range of variables, the cost of a double-section manufactured home averages over 40 percent less per square foot than the costs of a site-built home.[3] In addition, the precision and uniformity in manufacture leads to tighter buildings and lower energy bills.

Meeting the Need for Quality, Affordable Housing

To help sort out the real and perceived obstacles to producing cost competitive and affordable homes of "above-code" quality and performance, this issue brief presents considerations for industry stakeholders as well as relevant questions for policymakers. Even at a time of fiscal austerity, the federal government may have an important role in leveraging existing programs and resources to work with industry on research, technology transfer, training, and demonstrations.

The opportunity of high-performance manufactured housing comes at a time when the manufactured housing industry is under the greatest stress in its history. The U.S. economic recession of 2007-2009 was the longest one since World War II.[4] The housing industry is struggling, with construction unemployment still the highest of any sector,[5] and manufactured housing has been hit even harder than average. According to the Manufactured Housing Institute, the industry's annual shipments of manufactured housing were at the highest in 1973 (579,960) and their lowest in 2009 (49,789).[6] This comes at a time when concern over federal spending and the national debt is curtailing new federal, state, and local programs, however meritorious. Clearly, new solutions for affordable housing are desperately needed.

LEGISLATIVE HISTORY

***The National Manufactured Housing Construction and Safety Standards Act of 1974* (P.L. 93-383)**

In 1974, Congress created the Federal Manufactured Housing Program in the U.S. Department of Housing and Urban Development (HUD), funded by inspection fees for each transportable section of a home produced.[7] Manufactured housing after 1976 was built to the specifications of the Manufactured Home Construction and Safety Standards, known as the HUD Code. Manufactured homes have improved significantly since the HUD Code was implemented nearly 40 years ago and today are far better than trailers and old mobile homes in terms of appearance, safety, and quality.

The manufactured housing industry, which preferred a uniform and preemptive federal code to a wide variety of local building codes, was the moving force behind the 1974 legislation. HUD Code homes are built in the controlled environment of a manufacturing plant and are transported on a permanent chassis. While these homes are usually placed in one location and left there permanently, they do retain the ability to be moved. Even those installed on a permanent foundation have a chassis, although wheels and other parts are removed or hidden.

***The Manufactured Housing Improvement Act of 2000* (P.L. 106-569)**

In 2000, Congress passed legislation to require timely updates to the HUD Code and for each state to institute an installation program. The Manufactured Housing Improvement Act established an advisory body of the Manufactured Housing Consensus Committee and charged it with developing proposed model installation standards. The MHCC also provided recommendations to the Secretary of HUD on the revision and interpretation of the HUD Code and related enforcement regulations.

***Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006* (P.L. 109-234)**

The devastation to the U.S. Gulf Coast by Hurricanes Katrina and Rita in 2005 revealed serious problems with U.S. disaster housing policy, including travel trailers deployed as temporary housing. Congress authorized a one-time grant competition to fund the design and development of better prototypes. The Alternative Housing Pilot Program (AHPP) produced several excellent examples, including the high-performance Mississippi Cottage, a park model manufactured home designed to meet both the HUD Code and the local building code.

***Energy Independence and Security Act of 2007* (P.L. 110-140)**

The Energy Independence and Security Act of 2007 (EISA) Section 413 requires the U.S. Department of Energy (DOE) to develop new energy efficiency standards for manufactured housing based on technical feasibility and cost effectiveness. EISA set a deadline of December 2011 for DOE to publish a Notice of Proposed Rulemaking for public comment.

***Energy Efficient Manufactured Housing Act of 2009* (H.R. 1749, S. 1320)**

Based on successful state programs by affordable housing developers, legislation was introduced in the 111th Congress by then-Rep. Baron Hill (D-IN) and Sen. Jon Tester (D-MT) to assist low-income owners of old mobile homes finance the purchase of new ENERGY STAR qualified manufactured homes. The targeted grant was also intended to help state agencies decommission the old units that wasted energy. With so many of these old units dotting the landscape, the legislation was seen as a solution for reducing energy use and greenhouse gas emissions, boosting production of manufactured housing, and improving communities and the quality of life for those who sometimes were paying more than half of their monthly income for energy. The legislation passed the House of Representatives but stalled in the Senate late in the session.

FEMA travel trailers: Common type of temporary housing that FEMA purchases and delivers to disaster survivors whose homes were destroyed. Source: FEMA Photo Library, Photographer: George Armstrong/FEMA, 5/8/2010, Weir, Mississippi.

CURRENT REGULATIONS

The HUD Code established minimum standards for design and construction, strength and durability, fire resistance, energy efficiency, transportability, and quality of manufactured housing, including standards for plumbing and electrical systems and thermal levels. Appliances are installed separately, on-site; therefore it is important to specify energy-efficient models, such as ENERGY STAR. Energy efficiency standards have not been updated since 1994, which prompted Congress to task DOE with this in EISA Sec. 413.

The area within HUD responsible for the oversight function is the Office of Regulatory Affairs and Manufactured Housing, Office of Manufactured Housing. HUD-approved contractors perform inspections and quality control. Most states have a State Administrative Agency (SAA) that administers the HUD program. The Institute for Building Technology and Safety (IBTS) assists SAAs in carrying out their responsibilities in overseeing manufacturers, retailers, installers and the handling of consumer complaints. A red and silver label on the unit certifies compliance with the HUD Code. A home may also have a blue ENERGY STAR label if it meets the requirements of the ENERGY STAR qualified manufactured homes program.

HIGH-PERFORMANCE MANUFACTURED HOUSING

The concept of a high-performance building, as described in detail in the Whole Building Design Guide and 2007 federal energy legislation, considers energy-use as the key driver of environmental sustainability.[8] Developed in 1998 by leading experts in low-energy, sustainable building design and the Sustainable Buildings Industry Council, the Guide has been expanded, updated, and used extensively by the Department of Defense and military-service personnel, numerous

federal agencies, and private sector building industry professionals and clients. Managed by the National Institute of Building Sciences, the Guide is a unique and comprehensive resource for government and industry practitioners with information on building-related guidance, criteria, and technology from a *whole-building perspective*. To achieve high-performance buildings the Guide recommends that the following design objectives and their relationships to one another be considered in the earliest planning phases of a project:

- Accessible
- Aesthetics
- Cost effective
- Functional/operational
- Historic preservation
- Productive
- Secure/safe
- Sustainable

Section 401 of EISA drew from the Guide to define the scope of the new High-Performance Green Building offices in DOE and the General Services Administration (GSA).

Examples of manufactured homes that address multiple high-performance goals:

1. The Mississippi Cottage developed under the Alternative Housing Pilot Program[9]

- Exceeds ENERGY STAR qualified manufactured home requirements
- Withstands 150 mph winds
- Provides good indoor air quality
- Offers accessibility upgrade
- Features metal roof and other upgrades
- Priced starting at $50,000

2. The Ecoplex™ (Terradime Modular, Inc.)

- Exceeds ENERGY STAR
- Comes in modular units from 320 sq. ft to 960 sq. ft
- Uses structural Insulated Panels for strength + no air leaks
- Incorporates passive solar strategies and optional PV
- Features double-pane fiberglass windows and other environmental features
- Uses raised access floor for air, power, voice/data systems and tall ceilings
- Priced starting at $30,000

3. I-house™, e-home™ — Clayton Homes, a division of Berkshire Hathaway[10]

- Exceeds ENERGY STAR
- Features Water-saving fixtures and Compact Fluorescent Lighting (CFL)
- Contains No-VOC (Volatile Organic Compounds) paint and offers solar panels
- Uses high-performance windows
- Uses rainwater catchment system
- Priced from $50,000 to $150,000

A Mississippi Cottage, based on the prototype developed under a FEMA grant to the MS Emergency Management Agency to design temporary-housing alternatives to travel trailers. A Habitat for Humanity chapter helped modify this cottage into permanent affordable housing by expanding the square footage of the temporary "park model" to meet HUD-Code requirements. Habitat also worked with local zoning officials to satisfy requirements and placed the unit on a permanent foundation. The Mississippi Cottage designers' intent was to create high-quality disaster housing that could then help provide local affordable housing by meeting both the HUD-Code and the local building code. Source: FEMA Photo Library, Photographer: Jennifer Smits/FEMA, October 22, 2008, Diamondhead, MS.

Energy Efficiency

According to the Home Energy Journal, "Manufactured homes can be designed to be at least 60% more energy efficient than standard models currently rolling out of factories."[11] The challenge is to do so cost-effectively. Energy-efficient houses need less energy to do what we need and want them to do (keep heat inside in the winter and outside in summer, power the refrigerator, etc.); therefore they cost less to own over the long term. Energy use is one of the few performance goals that can be measured. Although many building professionals have mastered the integrative design process and energy-modeling tools to optimize a home's energy performance and cost effectiveness, it is still not a widespread practice. In most cases, more insulation, more efficient appliances, and other elements of an energy-efficient home typically cost more than builders or the manufacturers want to spend, unless the buyers are willing and able to pay for them. Without meaningful policies and incentives to use less energy, most builders and manufacturers are compelled to keep their costs and their home purchase prices low for customers by using the least expensive materials and technologies legally allowed – even if the materials perform poorly in terms of energy efficiency.

The ENERGY STAR label means that a home is designed, manufactured, installed, inspected and verified to use at least 15 percent less energy than homes designed to minimum standards. Use of other ENERGY STAR-qualified products and appliances within the homes can reduce energy use even more. State and regional programs have been developed that exceed ENERGY STAR requirements, such as the Northwest Energy Efficient Manufactured Housing Program (NEEM).

Integrated Design Approach to Whole-System Performance

The *integrated design approach* is recognized as the most crucial, though not widely practiced, strategy for creating the best building for the budget. While certainly not the answer to every challenge facing the manufactured housing industry, a holistic process can help manufacturers create "abundance by design."[12] An industry already realigning and consolidating in an era exploding with innovation in digital design and manufacturing technology may indeed be getting closer to providing "levels of cost-effective design flexibility unimaginable even a few years ago," as predicted in the 2003 *Technology Roadmap for Manufactured Housing*. "The industry will be unique in its ability to combine the cost advantages of mass production with individualized customization."[13]

Despite its unique HUD-Code specifications and assembly-line process, manufactured home design is similar to that of other types of homes and buildings. The traditional linear design process is still the most common: from original architectural drawings to engineering to blueprints and specifications to implementation. The traditional design process is outdated. The conventional approach may include incremental changes to individual components that are detailed in a standard design, but these incremental changes can miss synergies and actually add operating costs to the project. According to experts in energy-efficient high-performance building design, this is precisely what not to do. An integrative approach is needed instead to develop a home or building as a system of interconnected parts, which requires all members of the design and manufacturing teams and installers to understand and implement the performance goals. Energy-simulation tools and the use of double or triple purpose strategies further enable modern builders and manufacturers to reduce "first costs" as well as long-term "life-cycle" costs and achieve the best product possible within the budget.

The manufacture of houses in whole or in part in industrial facilities, known as "industrialized housing", is inherently well positioned for system integration and optimization. A fully integrated process from concept design and engineering to manufacturing is also able to exploit advanced computer simulation and information technology to create more precise components and sections that enable high quality assembly and installation on site in less time then already possible. This translates into higher customer satisfaction, fewer callbacks, and increased profits.

IMMEDIATE OPPORTUNITIES FOR FEDERAL ACTION

1. Implement Section 413 of EISA (Department of Energy)

EISA Section 413 requires U.S. Department of Energy (DOE) to develop up-to-date energy efficiency standards for the HUD Code, based on technical feasibility and cost effectiveness. A DOE Notice of Proposed Rulemaking is expected to be published for public comment by the statutory deadline of December 2011. DOE and HUD must coordinate administration of the HUD Code and its new energy efficiency standards, as energy performance must be integrated with other HUD-Code requirements. The benefits of regularly updated minimum standards have been demonstrated. Codes and standards that are technically feasible, cost effective, supported with information and training, and consistently enforced provide a level playing field for industry investments in technology and training and help push the market toward better quality and performance.

2. Provide Active Oversight of the HUD Code, Updates, and Compliance Resources (Department of Housing and Urban Development)

HUD's Office of Manufactured Housing should work with other HUD offices and federal agencies to ensure that the HUD Code is current on appropriate technology, materials and products for manufactured housing as well as manufacturing process efficiency. The Office should evaluate its resources and consider new strategies for providing support (data, training) to manufacturers, retailers, inspectors and installers, as well as information to local planners, developers, zoning officials, consumers, and media.

3. Update requirements for ENERGY STAR-qualified manufactured homes[14] (Environmental Protection Agency)

The ENERGY STAR brand was created by the U.S. Environmental Protection Agency (EPA) to verify and promote the most energy-efficient products, equipment, appliances and homes. A voluntary program, it is intended to reward products that exceed minimum standards, largely through product recognition and energy efficiency tax credits that require conformance to ENERGY STAR standards.

To earn the ENERGY STAR designation, a manufactured home must be designed, produced, and installed in accordance with ENERGY STAR's guidelines by an ENERGY STAR certified plant. A plant must be certified to produce ENERGY STAR qualified manufactured homes on an ongoing basis and produce homes using either pre-approved design packages based on climate region or pre-approved design tools to create other designs that meet ENERGY STAR specifications. Specifications include maximum air leakage from ducts and the whole house, minimum insulation, and heating or cooling equipment with minimum efficiency ratings. After DOE updates energy efficiency standards of the HUD Code, EPA could update requirements for ENERGY STAR qualified manufactured homes accordingly.

4. Update Federal Procurement Specifications

The Federal Emergency Management Agency (FEMA) has the authority to specify requirements for disaster housing, and to improve the existing disaster housing specifications as exemplified by the Mississippi Cottage. HUD is now helping FEMA develop criteria to update procurement specifications to address energy efficiency, indoor air quality and other issues. Since these values are not unique to disaster housing, this work should be carried out in a way that permits the specifications to be adapted by other agencies that use manufactured housing.

The Department of Defense has the ability to procure high-performance manufactured housing in a more effective manner, and by doing so, its specifications could easily become the de facto standard and create economies of scale and drive down costs. High-performance manufactured housing could reduce costs to taxpayers, enhance missions, improve housing for military personnel and temporary use during disasters, and serve as a mitigation and adaptation strategy for climate change. High-performance units that meet the local code as well as exceed the HUD Code could be used to resupply the stock of permanent affordable housing if necessary. Local zoning ordinances and storage capability of temporary housing also need to be addressed.

5. Use Voluntary "Reach Codes" and Incentives

Reach codes, or policies that encourage the manufactured housing industry to improve the overall quality of its products, reward innovation and are a valuable tool in improving the standard of industry performance. For modern manufacturers who recognize the growing interest in green building and the connection between energy efficiency and affordability, reach codes set a higher bar for quality and performance and provide a seal of approval that enables companies to distinguish themselves from their competition. Reach codes provide guidance on best practices and, along with compliance incentives, can pull the market toward better quality and performance. Industry observers see the potential for high-performance, affordable manufactured and modular housing to serve as a greater niche in the American housing market, but it has yet to scale up. These codes will act as an incentive for manufactures to engineer highly-efficient assemblies that builders can construct on-site for high quality, high performance, affordable and profitable housing.

6. Educate Consumers

Manufactured housing has had a problem overcoming the negative public image and rapid depreciation associated with mobile homes of the past. Demonstrations of high-performance manufactured housing and consumer education can improve the image of manufactured housing. In the past, manufactured housing has been consistently linked to lower-income families, leading to prejudice and zoning restrictions, including limitations on the number and density of homes permitted on any given site, minimum size requirements, limitations on exterior colors and finishes, and foundation mandates. Many jurisdictions do not allow the placement of any additional factory-built homes, while others have strongly limited or forbidden all single-section models. By educating consumers, the industry will reach a new market that otherwise may not be aware of manufactured homes.

OTHER ISSUES AND POLICY CONSIDERATIONS

Financing

The most common method of financing a manufactured home is through a chattel loan rather than financing the home as real estate through a retail installment contract. Typically, lending institutions that provide conventional long-term real estate mortgages and government-insured financing plans require the homes to become part of the real estate by being tied down permanently on approved foundations. While some federally-insured mortgage programs do apply to manufactured homes that are set on permanent foundations, many lenders refuse to treat the manufactured homes as part of the real estate, even when the home buyer owns the land on which the home is placed. This prevents manufactured home buyers from qualifying for financing in the mainstream housing finance market.

More than 40 percent of manufactured homes in the United States are installed in land-lease communities, or manufactured-home parks, while the majority of manufactured-home buyers place their unit on a permanent foundation on their own property. Homes sold without land are typically considered personal property and therefore, financed with higher-interest chattel loans versus real estate financed with mortgage loans. In terms of financing, the land-connection issue is as important to address as installation quality if HUD-Code housing is going to be able to help meet the need for sustainable, affordable housing.

New ownership structures, either resident-owned cooperatives or community land trusts, offer homeowners enhanced stability and security by providing increasing the percentage of manufactured housing owners holding title to the land on which their homes are located. Thanks to new partnerships in affordable-housing development and financing, several manufactured-home communities are now cooperatively-owned by their residents. Each household owns a share of the park and the land beneath their home. This gives residents the security of knowing their land cannot be sold without their permission and helps their homes appreciate in value over time.[15] The Corporation for Enterprise Development's Innovations in Manufactured Homes (I'm Home) program reports that by owning the land beneath their homes, manufactured homeowners increase the likelihood of their home appreciating in value.[16]

Part of the problem is that the HUD Code maintains the fiction that a manufactured home tied down on a permanent foundation is still mobile by refusing to let the home owner remove the home's chassis. If this "mobility" requirement, rather than the manufactured home quality, is determined to be the main cause of these homes failing to qualify for conventional financing, the HUD Code should be modified.

Federal Housing Research and Energy Policy

The answer to reviving manufactured housing is innovation, both in technology and in new ways of doing business. Research could lead to reductions in cost and improvement of materials, enhanced systems integration in the design, manufacture, and delivery process — including a highly integrated and energy-efficient supply chain. Research projects under the Department of Energy's Building America program that designs, builds, measures and evaluates innovative, energy-saving designs and renewable energy technologies for manufactured homes will move the manufactured housing industry closer to creating affordable homes that generate as much energy as they consume. Industry, university, or government partnerships for "whole house" research, development, and outreach can accelerate adoption of new technologies, design tools, and building or manufacturing processes.

NEXT STEPS

Will national policy that supports new sustainable energy markets make energy-efficient manufactured housing more cost competitive to produce? Is the HUD Code becoming obsolete, or are there new markets for this unique type of construction? Would a major overhaul of the HUD Code make these homes more marketable? Will new minimum codes, voluntary standards, tax incentives and other government policies or new business models be able to increase the quantity of high-performance manufactured housing and affordable, sustainable housing in the United States?

Recognized experts in energy-efficient manufactured homes suggest updating the minimum standards for energy efficiency, as is expected from the DOE rulemaking process to implement EISA Section 413. Then, update the voluntary ENERGY STAR qualified manufactured homes program. The next step would be to ensure superior indoor air quality. For example, the Indoor airPLUS label is a new specification developed by EPA to address the indoor environment component of green building. Homes that achieve this level of excellence are first qualified as ENERGY STAR, and then also incorporate design and construction features to help protect qualified homes and their residents from mold, chemicals, combustion gases, and other airborne pollutants.

Some manufacturers already are incorporating energy-efficient design and strategies to ensure good indoor air quality with other elements of green-home design, such as water-efficient products, renewable energy technologies, waste reduction, recycling, and sustainable land development practices. Together with the HUD Code, regional requirements, and best practices for fire, wind and seismic resistance, manufactured homes are on the way to becoming a solution for high-performance, sustainable, affordable housing. But unless consumers know what to ask for, they will miss out. Demonstrations of actual houses in target markets are the best way to allow new customers to experience quality.

The manufactured housing industry, which over the years has represented seven to 20 percent of the U.S. housing stock, is a logical starting place for creating a new business model for unsubsidized sustainable, affordable housing development. High-performance manufactured housing will benefit homebuyers, the manufactured housing industry, the U.S. economy, and the environment. This should be part of the discussion and quest to provide sustainable, affordable housing for a new generation of home buyers.

Authors: Ellen Larson Vaughan, Iryna Payosova, Samantha Akella

Environmental and Energy Study Institute
1112 16th Street, NW, Suite 300
Washington, DC 20036
(202) 628-1400
www.eesi.org

The Environmental and Energy Study Institute (EESI) is a non-profit organization founded in 1984 by a bipartisan Congressional caucus dedicated to finding innovative environmental and energy solutions. EESI works to protect the climate and ensure a healthy, secure, and sustainable future for America through policymaker education, coalition building, and policy development in the areas of energy efficiency, renewable energy, agriculture, forestry, transportation, buildings, and urban planning.

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