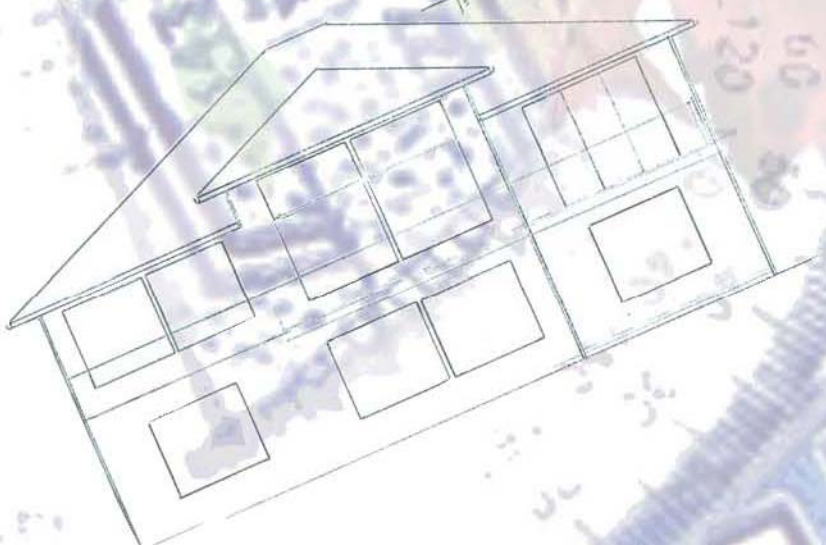
Affordable Green Building in Rural Communities



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HAC, founded in 1971, is a nonprofit corporation that supports the development of rural low-income housing nationwide. HAC provides technical housing services, loans from a revolving fund, housing program and policy assistance, research and demonstration projects, and training and information services. HAC is an equal opportunity lender.

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EXECUTIVE SUMMARY

For many rural affordable housing developers, simply building affordable housing for low-income residents is not enough anymore. These organizations understand the nature of complex, overlapping social, economic, and environmental problems and are committed to responding to them in a holistic manner. For these groups, a green building framework provides the necessary comprehensive structure to respond to these problems and ultimately to build healthier, more efficient, and environmentally sustainable housing and communities.

Green building is defined as a process that creates buildings and supporting infrastructure that:

- minimizes the use of resources,
- reduces harmful effects on the environment, and
- provides healthier environments for people (Karlenzig 2005).

An affordable green building definition builds off the existing definition by adding that green building practices should not create undue cost burden for low-income residents.

In April 2006, the Housing Assistance Council (HAC) brought together national green building organizations, local rural housing organizations with a history of green building, funding organizations, and other stakeholders in the sustainable housing development movement in a roundtable forum to explore the specifics of green affordable housing and the challenges in rural areas. Rural affordable green building is an area with little current research and one that is increasingly important given the current policy and programmatic attention to green affordable housing.

During the roundtable, representatives of rural affordable housing organizations identified their organizations' green building activities, challenges, and responses to these challenges, while funders contributed dialogue on the characteristics of green resource delivery for rural groups. This discussion yielded a rich array of information on rural affordable green building.

Among the most common green techniques being used by rural roundtable participants were:

- compact fluorescent lighting,
- ENERGY STAR appliances,
- low flow fixtures and dual flush toilets,
- environmentally preferable products,
- local sources for materials,
- recycling construction materials and minimizing site waste,
- homeowner awareness education, and
- integrated design processes implemented using a charette.

Some of the most common green challenges for rural roundtable participants were:

- compact development,
- infill development and utilization of existing physical infrastructure,
- use of public transportation and land use planning,

- ⌂ access to and affordability of certain green products and systems,
- ⌂ staff and contractor access and capacity,
- ⌂ access to and costs of third-party verifiers,
- ⌂ federal, state, and local government regulations,
- ⌂ qualifying for certain green affordable funding programs, and
- ⌂ homebuyer awareness.

Even with these challenges present, community groups at the roundtable were often incorporating as many feasible green facets as possible in their affordable housing projects. These organizations are committed to the individual, organizational, community, and global benefits of building green.

These findings provide a foundation for further exploration of the issues surrounding rural green affordable housing**.**

INTRODUCTION

What structured process has the potential to address rising energy costs, health impacts of buildings on people, finite natural resources, and interdisciplinary problems in a holistic manner? In two words, green building. A green building framework provides a comprehensive structure for understanding how building practices intersect and impact the globe, region, community, and individuals. Incorporating a green building framework can also provide the techniques needed to address and build more efficient, healthier buildings that have less impact on the environment.

While the goals of green building are easy to embrace – resource efficiency, habitat conservation, improved occupant health, high-quality building practices – the realities of constructing green units are often difficult, particularly for affordable housing developers (Bradshaw et al. 2005). Challenges relating to affordable green building include slightly higher initial capital costs, capacity challenges, perceived risk, contracting constraints, and the lack of documented success (Bradshaw et al. 2005). These issues can be exacerbated in rural communities where capacity and spatial realities may work against some basic principles of green development.

In April 2006, the Housing Assistance Council (HAC) brought together national green building organizations, local rural housing organizations with a history of green building, funding organizations, and other stakeholders in the sustainable housing development movement in a roundtable forum to further explore the specifics of green affordable housing and the challenges in rural areas. Rural affordable green building is an area with little current research and one that is increasingly important given the policy and programmatic attention to green affordable housing.

This exploratory report provides many examples of affordable green building in the rural context and more details of the challenges rural organizations may face incorporating green techniques in affordable housing projects. Further, experienced rural organizations provide examples of how these challenges can be overcome and the resources needed to make green building possible for rural affordable housing developers. Finally, the report addresses what rural organizations are doing that may already be green and what type of replicable activities they can undertake affordably to promote green building that benefits low-income residents. This report provides a foundation from which to further explore issues surrounding rural green affordable housing.

Methodology

In order to better understand the challenges and benefits associated with green building in rural communities, the study includes rural building experiences collected through a roundtable of rural housing practitioners.

Outside Literature

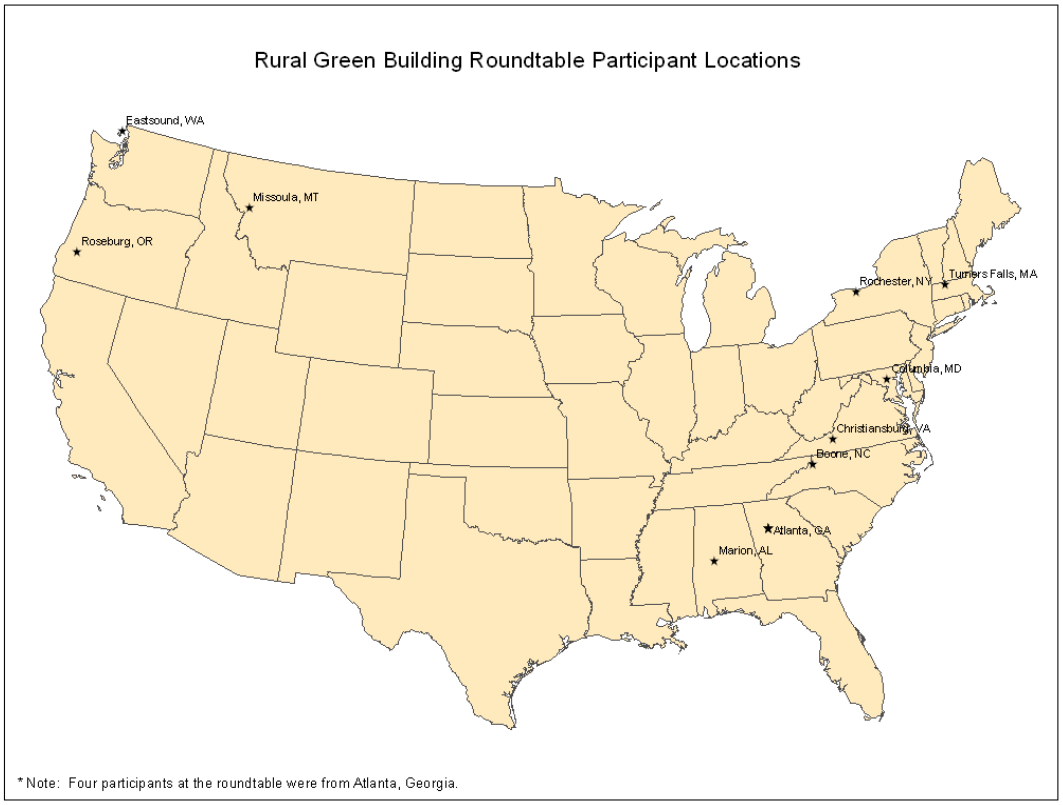
The report presents a general overview of green building and its related components, providing the necessary context and understanding for the roundtable discussion. Readers are recommended to utilize references to learn more in depth about the many facets of green building, since much of it is beyond the scope of this report. It must be noted that very little research has been conducted on affordable green building, and even less in the rural context.

Roundtable

Given the limited research on green affordable housing in rural areas, HAC organized a roundtable to explore the relationship between affordable housing and green building in rural communities. In order to achieve the broadest understanding of rural affordable green building, an effort was made to include individuals with varying green experiences and responsibilities. The roundtable, which was held on April 24, 2006 in Atlanta, Georgia, included rural nonprofit housing practitioners and representatives from federal, state, and regional government along with national affordable green building foundations. An effort was made to represent varied geographic regions. Participants were:

- Colin Arnold, Community Housing Partners Corporation, Virginia;
- Michael "Micky" Beach, Umpqua Community Development Corporation, Oregon;
- Dana Bourland, Enterprise Community Partners, Maryland;
- Lynn Brazen, Federal Home Loan Bank of Atlanta, Georgia;
- Cara Mae Cirignano, Sowing Seeds of Hope, Alabama;
- E.G. "Ned" Fowler, Northwestern Housing Enterprises, North Carolina;
- Betsy Hands, homeWORD, Montana;
- Rosemary Kernahan, Georgia Department of Community Affairs, Georgia;
- Gabriel Olmsted, OPAL Community Land Trust, Washington;
- Anne Perkins, Rural Development Inc., Massachusetts;
- Linda Poythress, U.S. Department of Housing and Urban Development, Georgia;
- Allynn Smith, Bishop Sheen Ecumenical Housing Foundation, New York; and
- Fred Wacker, Home Depot Foundation, Georgia.

The roundtable was co-facilitated by a HAC staff person and Emily Mitchell, Affordable Housing Fellow at the United States Green Building Council (USGBC). To organize this discussion and capture the various techniques being used, HAC utilized the USGBC's Leadership in Energy and Environmental Design for Homes (LEED-H) Version 1.72 building standards. HAC does not endorse any building standard and chose LEED for Homes since it is a national building standard that takes into account local characteristics, and also to provide a common terminology for everyone to use during the roundtable. The report uses the LEED-H terminology and credit category subheadings.



The primary data gathering instrument is the roundtable discussion, which is summarized and presented in the wider context provided by the outside literature. In consultation with experts in the field, HAC created a preliminary set of questions for the roundtable discussion, including, but not limited to, the following.

- What green building components are most commonly used by rural community organizations?
- In what ways does the rural environment affect rural green affordable housing development?
- What barriers are rural community organizations encountering when developing green affordable housing? If possible, how are rural community organizations overcoming these challenges?
- What future plans do community organizations have for green building and how can national funders and intermediaries assist with this type of development?

HAC's rural affordable green building roundtable discussion is synthesized within the body of the report and highlights the characteristics and challenges of green affordable housing in the rural context, along with how practitioners are successfully developing this type of housing.

Study Limitations

The available information and data, although useful, has some limitations that must be noted. First, this report's findings are based on a small survey of rural community housing organizations incorporating green development practices. Although not representative of all rural America, these organizations' experiences provide instructive lessons for other rural affordable housing developers. Given the lack of data in the literature and limited understanding of affordable green housing issues as they currently exist, this study presents an exploratory assessment of affordable green building in rural communities.

WHAT IS GREEN BUILDING?

Green building is defined as a process that creates buildings and supporting infrastructure that:

- minimizes the use of resources,
- reduces harmful effects on the environment, and
- provides healthier environments for people (Karlenzig 2005).[1]

An affordable green building definition builds off the existing definition by adding that green building practices should not create undue cost burden for low-income residents.[2]

The modern green building movement, which incorporates integrated construction and design processes, began in the early 1990s (Kats 2003).[3] Since that time, green building has become an increasingly popular method of development for market rate and affordable developments due to a variety of factors including, but not limited to, increasing energy prices, resource constraints, health concerns for low-income residents, and increased awareness of the integrated nature of the built and natural environments. Thus, there is a great need to understand the impact of this development strategy and be able to document benefits, challenges, and results.

This section provides a green building overview, setting the context and understanding for the outside literature on affordable green building and the subsequent rural discussion. It explains the key features of using a green building framework, most notably the planning components utilized before and during the development process and building to environmentally conscious standards, as well as the economic and non-economic benefits.

[1] The term "green building" is often used synonymously with other terms, including "sustainable building," "high performance building," and "environmentally responsible building" (DOE 2004). Ultimately, all of these describe higher performing, more environmentally sustainable buildings (DOE 2004). For the purpose of this report, the term green building will be used.

[2] A household has a "housing cost burden" if it spends 30 percent or more of its income on housing costs. A household has a "severe housing cost burden" if it spends 50 percent or more of its income on housing. Owner housing costs consist of payments for mortgages, deeds of trust, contracts to purchase, or similar debts on the property; real estate taxes; fire, hazard, and flood insurance on the property; utilities; and fuels. Where applicable, owner costs also include monthly condominium fees. Renter calculations use gross rent, which is the contract rent plus the estimated average monthly cost of utilities (electricity, gas, water and sewer) and fuels (oil, coal, kerosene, wood, etc.) if these are paid by the renter (or paid for the renter by someone else). Household income is the total pre-tax income of the householder and all other individuals at least 15 years old in the household. (Census 2002)

[3] Although green building practices began in the early 1990s, it should be noted that academic research in the early 1980s (Bullard 1983) and 1990s (Bryant and Mohai 1992; Bullard 1990) documented the disparate environmental health problems encountered by low-income and minority communities. This, along with previous community organizing around environmental health issues, advances in spatial analysis, and other factors contributed to the formation of the environmental justice movement.

Green Building Goals, Benefits, and Challenges

Green building practices have numerous direct and indirect benefits at all levels of geography, including global, regional, community, and individual. At the global level, green building practices help protect and conserve natural resources by reducing demand for and improving utilization of virgin materials (Global Green USA 2005). Reduced demand for energy through more energy efficient practices can help stem climate change (Global Green USA 2005).

At the regional and community levels, green-built housing can help increase local economic growth by encouraging use of local and regional materials, which keeps money and tax dollars in the community (FHLBA 2005). In addition, utilization of a green framework can help protect and preserve open space, increase transportation options, reduce solid waste, minimize strain on local infrastructure, more properly manage storm water and reduce water pollution, improve air quality, and enhance community well-being by planning for growth (USGBC 2006).

For individuals, green housing can provide residents long-term cost savings through efficiencies incorporated in the design of the home. Besides decreased financial costs, green built houses offer a healthier and more comfortable indoor environment for residents.

Green building can be challenging for housing developers, due to the higher initial capital costs, contractor capacity and access, added complexity, local regulations, and lack of understanding and familiarity with green products, systems, and the development process (Bradshaw et al. 2005). Although there are challenges, many local building codes throughout the United States already require certain green practices such as water efficiency standards, protection of environmentally sensitive lands, durable materials, and others. Thus, many developers may already be incorporating sustainable techniques and not be aware of it.

Integrated Design Process

Integrated design is often called a “whole building” or a “total systems” approach, and it is recommended that green building projects utilize this process first before beginning construction (New Ecology 2005). Bradshaw et al. (2005) define integrated design “as a process that involves all members of a project team from the outset of the design process in order to provide a shared understanding of project goals, priorities, and constraints.” It is also intended to increase investment and ownership in the end product (New Ecology 2005).

The early thinking involved with the integrated design process helps ensure a healthy, cost-effective, and environmentally and socially responsible home by allowing all stakeholders to communicate and set goals, while determining what green building elements are feasible (New Ecology 2005).

A well run integrated design process has many benefits, including:

- clarifying goals among all project players in the beginning,
- considering all possibilities of greening from the start,
- reducing chances of costly change orders,
- achieving synergies across all disciplines and technologies, and

- reducing overall costs by identifying green savings in the beginning that can be used to pay for any additional incremental costs from greening (Bradshaw et al. 2005).

Integrated design processes are often implemented using a charette model. A charette is defined by Global Green USA (2005) as a "focused and collaborative design process that harnesses the talents and energies of interested parties to create and build support for a feasible plan to produce change or innovation." Charettes provide the necessary inclusive model to implement the integrated design process (New Ecology 2005).

Shades of Green

Although green housing would ideally incorporate all aspects of the green building framework, it is often practically and financially feasible for developers to incorporate only certain green techniques because of time, costs, climate, topography, or other factors. According to Bradshaw et al. (2005) "each building project, whether new construction or renovation, must identify those that are most appropriate and feasible for the particular circumstances, while keeping in the mind the overall goals of affordable housing."

Integrated design enables the project developer to identify the green facets appropriate for a specific project. Thus, it is important for developers to think of green building as a process that comes in different "shades of green." Early planning can help developers decide what shade of green is feasible for their housing projects.

Life Cycle Costing

Life cycle costing is an important concept in green building since traditional costing methods do not usually capture the economic benefits of green housing (Bradshaw et al. 2005). Life cycle costing systematically takes into account the long-term costs of building operation and maintenance to provide a more accurate picture of the total costs associated with green design decisions (Bradshaw et al. 2005).[4] Simply put, it measures the total cost of a structure, including initial construction costs and long-term operating and maintenance costs (FHLBA 2005).

Understanding the long-term economic savings from developing green affordable housing with a life cycle framework is essential. For instance, affordable multifamily projects are typically owned and managed by nonprofit developers for at least 15 years and often for much longer. Thus, the long-term economic benefits experienced with the life cycle approach are very important for the owner and resident, since costs and rents can be kept lower than those for conventional affordable multifamily projects (Global Green USA 2005).

There is a need for more life cycle costing analyses and other evaluation procedures in order to better understand how much money can be saved by residents in affordable green developments and how the rural context affects potential savings. It can be challenging for researchers to quantify these savings due

[4] A free online life cycle calculator is available at http://www.rebuild.org/lawson/calculators.asp.

to the many facets of green building and the new building systems that are introduced at an ever faster rate.

Example: Life Cycle Cost Savings of Using a Dual Flush Toilet

A toilet, either conventional or more water efficient, typically has a useful life of 15 years. On average, a conventional toilet uses $5 per month of water costs, while a dual flush toilet uses 50 percent less. This means that a dual flush toilet uses $2.50 less water costs per month, per toilet. The dual flush toilet, though, has a higher first cost of $150 per toilet. Thus, it would take 60 months or five years (60 x $2.50 =$150) to recoup the added first costs through savings. Over the next 10 years, though, the dual flush toilet would save an additional $300 on water costs versus the conventional toilet.

Facts and Figures
Toilet water: $5/month average
Dual flush toilet: 50% less water
Savings: $2.50/month
Additional first costs: $150
Payback = 60 months (5 years)
Total Long Term Savings (next 10 years) = $300

Source: Global Green USA 2005

Building Standards

Green building standards are an important component of green development since they provide a technical resource and ensure a standardized terminology and formal certification system to rate residential buildings.

As of 2006, more than 50 local programs around the country certify green residential building, sponsored by states, cities, utilities, and local homebuilder associations (Tassos 2005). According to Tassos (2005), these programs have certified more than 61,000 green homes, including 14,000 in 2004. Almost all of these homes are for middle- and upper-income families (Tassos 2005).

The rising popularity of constructing buildings through a green framework is reflected in the increasing number of projects being certified through the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) system, a voluntary consensus-based national standard for designing and rating high performance buildings.[5] Since 2000, over 2,000 projects have registered with USGBC, declaring their intent to seek LEED certification (USGBC 2005b). In addition, over 20,000 professionals are now LEED accredited. The LEED accredited professional program was designed to recognize individuals who have demonstrated the skills and expertise necessary to participate in the green building design process (USGBC 2005b).

[5] For a more comprehensive understanding of green building standards, the reader please refer to the LEED-H building standards found at www.usgbc.org. As mentioned previously, HAC does not endorse any specific building standard and chose LEED to provide a standard terminology and framework for the roundtable and this report.

Although many green building standards are available, LEED has emerged as the premier national standard (Kats 2003) and will be utilized for the purpose of this report.[6] LEED standards are available for various development types, including commercial buildings, commercial interior projects, and others. In September 2005, the USGBC released its LEED for Homes (LEED-H) pilot program. Although not specifically tailored to affordable housing, LEED-H is becoming the national standard for green affordable housing projects.[7] As of 2006, it is being used and tested throughout the U.S. by selected housing developers, including affordable developers. It is anticipated that LEED for Homes building standards will be finalized in 2007 (USGBC 2005a). In addition, the USGBC is also beginning a pilot program for LEED for Neighborhood Development (LEED-ND), which will standardize smart land use planning principles.

For the most part, this report uses LEED-H terminology and credit subheadings. LEED-H has eight environmental categories which are further divided into "credits." For each credit, the rating system identifies the intent, requirements, verification procedures, rationale, outside reference, and technologies or strategies to achieve the credit. One or more points are available within each credit, and points are achieved by meeting specified requirements (USGBC 2005a). The eight credits for the LEED-H program are:

- Location and Linkages
- Sustainable Sites
- Water Efficiency
- Indoor Environmental Quality
- Materials and Resources
- Energy and Atmosphere
- Homeowner Awareness
- Innovative Design

Projects are certified to meet LEED standards after a third-party review is completed. This verification process includes both on-site inspections to ensure that the LEED-H features have been installed correctly, and performance testing to ensure proper performance (USGBC 2005a). LEED-H providers are local and regional organizations that have been selected to provide technical, marketing, and verification support services to builders (USGBC 2005a).[8]

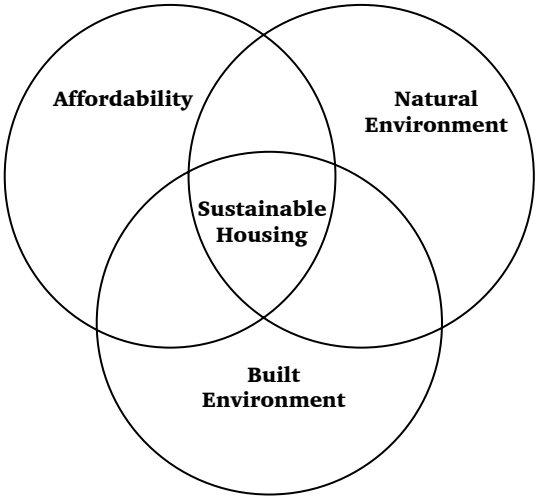
[6] LEED for Homes Pilot green terminology and subheadings are used throughout the report. LEED was chosen since it provides a national building standard, while taking into account local characteristics.
[7] USGBC conducted an affordable housing LEED-H charette at its 2005 Greenbuild conference. Although initially designed for market rate single-family homes, it was determined that LEED-H works with affordable housing projects, including both multifamily and single-family projects. In addition to the charette, USGBC has an Affordable Housing Working Group that provides input from urban and rural affordable housing providers on possible revisions to LEED-H from an affordable perspective.
[8] Please see USGBC's website at www.usgbc.org for LEED-H providers in your area.

Affordable Green Building

> "It is only recently that you could say green and affordable in the same sentence."
>
> - Roundtable Participant

Affordable green building is a more recent development of the general green building movement. Affordable green building combines housing and community development with a sustainable development framework. It provides a conscious framework for understanding how the built environment intersects with and affects the natural environment, affordability, and sustainability, all within a low-income viewpoint (Figure 1). The components of affordable green building address the many factors associated with development and its ramifications, particularly those affecting low-income persons.

Figure 1. Linkages Contributing to Sustainable Housing



Greening affordable housing presents an opportunity to reduce variable costs, such as utility and transportation expenses, which disproportionately affect low-income people. According to Boehland (2005), "after the rent or mortgage payment, utility bills represent the largest housing related expenses; water, gas, heating oil, and electricity bills can strain a small budget." Green affordable housing can keep housing related expenses down for low-income people and promote greater housing stability due to the efficiencies incorporated into the home.

Many affordable housing providers already incorporate certain green elements in their housing developments. For instance, many community housing organizations have traditionally provided weatherization services that decrease low-income residents' energy bills through better home insulation. Incorporating holistic green practices that address the full spectrum of development issues, though, is new to most community housing organizations and more rare (Karlenzig 2005).

Benefits

Many of the numerous benefits of green building, which vary based on housing type (i.e., multifamily or single-family), have significance for low-income residents. According to Bradshaw et al. (2005), "project

residents and homeowners almost always experience a net benefit over a project's life while building owners and developers receive a net benefit in a majority of the cases."

There are many benefits at the individual level from using green affordable housing practices. The most often cited advantage, which is especially salient for low-income residents, is the lower utility costs from using energy efficient products and properly insulated homes (Boehland 2005). For low-income residents this is especially important since these costs represent a proportionally higher share of their income. According to the Energy Information Administration, in 2005 the average price of residential heating oil rose almost 20 percent and the average price of residential natural gas rose more than 43 percent from 2004 (Anderson 2006).

Besides lower utility rates, green building practices improve occupant health and comfort through the use of better ventilation systems and better construction materials, providing cleaner indoor air, and helping reduce the occurrence of asthma, respiratory diseases, and other ailments (FHLBA 2005). This is significant for low-income and minority residents who are more prone to live in neighborhoods with higher rates of asthma and environmental health hazards (Frumkin 2005).

According to the Federal Home Loan Bank of Atlanta (FHLBA) (2005), incorporating green building benefits community housing organizations that manage rental housing by promoting higher tenant satisfaction, reducing turnover, improving marketability, and lowering operating costs. All of these factors contribute to lower management costs for community organizations.

Challenges

The main green building challenge commonly identified by affordable housing providers is the higher initial capital costs. However, Bradshaw's et al. (2005) study of green affordable housing found that on average this type of development had a "green premium" of only 2.5 percent relative to up-front development costs of comparable conventional affordable housing. Taken from a life-cycle cost perspective, operating savings far exceed the incremental capital costs of greening (Bradshaw et al. 2005). Even though the initial capital costs are small, additional subsidy is usually needed for affordable housing developers that already struggle with limited financing resources. In addition, higher initial capital costs can dissuade affordable housing developers to build green since low initial capital costs are a critical factor in the scoring systems of some affordable housing funding allocation criteria (Bradshaw et al. 2005).

> "Comprehensive affordable green building is challenging. You must have a passion for it."
> - Roundtable Participant

Another challenge for affordable green building is the lack of research on how to quantify the savings achieved through green homes. Life cycle costing techniques are easier to perform on certain green products and systems than others. Once reliable information is available on a project's long-term savings, it can be included in a project's underwriting and may – for example – allow homebuyers to qualify for higher mortgages because utility savings make more money available for their monthly payments.

Besides difficulties in capturing cost savings, other challenges involved in evaluating green building benefits include difficulty understanding non-economic benefits for individuals, or identifying the full external costs of building material production.

In addition, "green" definitional factors challenge all interested stakeholders. The lack of a well accepted green building definition hinders policy initiatives, public education and support, and, most importantly, development of green affordable housing.

Bradshaw et al. (2005) found the following nine main green building challenges for affordable housing developers:

- ***"Perceived risk.*** Affordable housing developers are often risk adverse, since they have little margin for project failure. Unsuccessful projects can greatly hinder or even cease operations at many nonprofit affordable housing developers that lack capacity and resources. In addition, many affordable housing developers and funders believe that building green costs more. This has led to a perception that nonprofit developers who build green may lose their developers' fees. Developers' fees are important for community housing organizations ability to finance future projects.

- ***Multiple funding sources.*** Affordable housing developers utilize many funding sources, each with its own criteria and regulations. It can often be difficult for new technologies and ideas to be funded.

- ***Variety of players.*** Affordable housing projects require the support of many funders, the community, and other stakeholders. All of these parties require buy-in and may not be interested in green building.

- ***Regulatory burdens.*** Affordable housing developers usually use public financing sources. Some public funding sources include per unit cost caps and design requirements that may limit green design.

- ***Lack of documented success***. With the exception of energy efficiency, there is a lack of research related to affordable green building. Thus, it is more difficult to evaluate and quantify benefits to interested parties.

- ***Contracting constraints***. Most affordable housing construction contracts are granted to the lowest bidder, making it challenging to select a contactor with specialized training and green building experience.

- ***Short-term focus.*** Affordable housing developers and funders often think increased planning and design for projects will cost more and prolong project schedules.

- ***Limited institutional capacity.*** Many affordable housing providers lack the necessary organizational capacity to complete conventional affordable housing development. Thus, incorporating green buildings processes may add even greater challenges.

- ***Learning curve.*** Incorporating green building practices requires additional training for affordable housing developers. Although there is increased attention associated with this development type, there is still a lack of information, resources, available information on green contractors and consultants, technologies, and materials for interested community organizations. In addition, many community groups are challenged by how to prioritize green building opportunities in tight fiscal environments."

The Wisconsin Environmental Initiative (2005) found additional land use challenges to developing green affordable housing. Many of these are enacted through local ordinances, zoning, or subdivision regulations. These local regulatory barriers may include:

- "minimum building size requirements,
- exclusion of multifamily dwellings,
- restrictions of number of bedrooms,
- prohibition of mobile homes,
- frontage (lot width) requirements,
- lot size requirements, and
- deed restrictions (building size, design criteria)."

Rural Green Affordable Housing Financing Resources

Although initial green capital costs can be or are small in relation to the total project budget, additional subsidy is usually needed for affordable housing developers that already struggle with limited financing options. Financing sources for green affordable housing can be found at all levels of government, as well as foundations, utility companies, and corporations. In addition, green affordable financing sources are found in various public agencies that affordable housing developers may have not traditionally worked with, such as the U.S. Department of Energy (DOE). This is due to the holistic nature of affordable green building and its work with physical, environmental, health, and social factors.

> "Green is another thing that helps sell affordable housing."
> - Roundtable Participant

At the federal level, the Low Income Housing Tax Credit (LIHTC) is increasingly being used to further green principles. The LIHTC is the main source of funding for affordable multifamily projects and is administered by state finance agencies. These state agencies develop Qualified Allocation Plans (QAPs) that establish selection criteria, some of which are mandatory. States are allowed to establish other criteria, and introduce set-asides for policy objectives (e.g., preservation of existing affordable housing) (Tassos 2005). Tassos's (2005) study of state QAPs found that most states addressed at least some green building components in their QAPs. Seventeen states included at least one major green principle in their QAPs related to smart site locations, energy efficiency, resource conservation, and healthy living environments (Tassos 2005). Affordable housing developers interested in utilizing tax credits for green multifamily projects should consult their states' QAP.

According to HUD (2005), programs assisted by HUD can incorporate ENERGY STAR qualified products in their new or existing homes. Developers can use the HUD and ENERGY STAR websites to obtain information on specific products, use energy-savings calculators, locate rebates, and develop a clear procurement policy.[9] In addition to promoting energy efficient appliances and fixture, the Federal Housing Administration provides incentives for energy efficiency practices through the Energy Efficient Mortgage (EEM) program.[10] This program finances energy saving improvements by factoring their impact in the initial mortgage or in stretching the debt-to-income qualifying ratio on loans. A DOE recommended Home Energy Rating must be conducted to determine eligibility for an EEM (Dean 1999).

[9] HUD recommends the ENERGY STAR *Guide to Energy Efficient Cooling and Heating*, found at www.energystar.gov/ia/products/heat_cool/guide_2color.pdf.
[10] More information can be found at http://www.hud.gov/offices/hsg/sfh/eem/energy-r.cfm

Enterprise Community Partners has made a large commitment to making green affordable housing possible with its Green Communities™ initiative. The program has more than $550 million of financing resources, plus training and technical support, to encourage and enable multifamily and single-family developers to go green in a cost-effective manner (Tassos 2005).[11]

Many utility companies, along with state and federal agencies, have incentives or rebates available for energy efficiency and water conservation (Global Green USA 2005). The Database of State Incentives for Renewable Energy, www.dsireusa.org, supported in part by the Department of Energy, provides comprehensive information on state, local, utility, and selected federal incentives that promote renewable energy.

Global Green USA, a national environmental organization committed to affordable green building, suggests eight steps for funding green affordable housing (Table 1).

Table 1. Global Green USA's Eight Steps to Fund Green Affordable Housing

1.	Minimize additional costs through integrated design.
2.	Work with contractor on cost estimates throughout the design process.
3.	Identify partnership opportunities with local government, utilities, state agencies, and nonprofits.
4.	Utilize technical support provided by utilities and state and/or federal programs.
5.	Apply to utility and state programs for rebates on energy and water components.
6.	Include remaining unfunded green items in the final bid documents as specification alternatives.
7.	Approach local governments and foundations to fund green alternatives.
8.	Use any residual construction contingency funds to upgrade finish materials to the green alternatives.

Source: Global Green USA 2006

[11] Please see www.greencommunities.org for further information and application criteria.

AFFORDABLE GREEN BUILDING IN RURAL AMERICA

Rural affordable housing developers across the country are working to integrate green building techniques and materials into their affordable housing projects. HAC convened a roundtable of rural housing practitioners to discuss the techniques they are using to create more environmentally friendly, energy efficient, and healthier affordable homes in rural areas. Participants were also asked to discuss the challenges they face developing green housing and the resources and methods that have been used to overcome these challenges.

This section of the report, organized using primarily the LEED-H categories, provides a summary of the experiences of several rural development organizations from across the country that have incorporated sustainable development principles as they create affordable housing options for low-income rural residents. These organizations have explicitly and deliberately included green building planning processes, materials, tools, and techniques. This section also provides illustrations of the projects these organizations have completed, as well as examples of some accessible green techniques.

Integrated Design Process

Due to the comprehensive nature of green building and the possibility of added costs, an integrated design process can be one of the more important green building facets for affordable housing developers. The comprehensive planning involved with this process provides affordable housing developers and interested stakeholders with the necessary structure to discuss and decide what will be possible in the proposed green project. This is especially important for affordable housing developers since it has the potential to decrease overall costs and increase support from all stakeholders.

Rural Experiences

> "Charettes help us plan early with the community what level of greenness we will be able to achieve in our project."
>
> - Roundtable Participant

Most roundtable participants utilize some form of early planning to gain a more comprehensive view of their housing development projects. These sessions are used to determine the level of greenness that will work for their projects, incorporate community input and buy-in for their projects, implement community sensitive design, and help stem any possible Not In My Back Yard (NIMBY) reactions from the local community. Rural community groups stressed that charettes are essential community education sessions, which help reduce misunderstandings about affordable housing and help form partnerships with often reluctant planning boards and neighbors.

Rural Challenges and Responses

In order to work effectively, charettes require staff time, expertise, and some additional costs. While design charettes are an integral part of the process for most of the roundtable participants, several stressed the need for additional financial support to conduct these planning sessions. Some groups were able to receive grant subsidies from national intermediaries, but community groups were adamant about the need for more support to conduct charettes and other planning for green development.

Green on the Ground:
Integrated Design Process

Organization: homeWORD is a nonprofit housing organization working in both eastern and western Montana. The organization is committed to using innovative, sustainable, and replicable methods to develop affordable housing and asset-building strategies for those most in need. homeWORD develops both single- and multifamily housing with all projects including strategies for resource and energy efficiency, waste reduction, smart land use, sustainable transportation systems, healthy indoor air quality, and community sensitive design.

A small group at work during the Orchard Garden design charette.

Techniques: Like all of homeWORD's housing projects, its most recent multifamily project, Orchard Gardens, incorporated the community's voice through early planning. Development of Orchard Gardens began with an intensive upfront planning process, which included a community design charette, an eco-design charette, and establishment of green building goals for all professionals involved in the project. The charettes, which were led by homeWORD staff and the group's architects, were attended by neighbors, interested community members, local government officials, and planners.

homeWORD's community design charettes last a day and a half and are held over a weekend. The first evening is spent introducing homeWORD, the goals of the project, and presenting a slide show of the group's other housing projects. Attendees also hear from a panel of speakers on the needs of low-income renters.

The second day is spent in small groups with a facilitator and architect. As the small groups discuss ideas for the project, the architect takes notes and draws the concepts to be included in the possible final design of the housing. At the end of the day, each group presents its drawings and ideas and finally this is synthesized into common themes and links. homeWORD staff note that it is important to keep people well fed and to provide them with time to brainstorm in the small groups during the sessions. After the charette, homeWORD's architects pull all the ideas into one site plan and produce several sketches. These drawings are presented at a follow-up meeting where the original participants are invited as well as other interested neighbors.

Benefits: The benefits of utilizing an inclusive planning process are numerous. homeWORD finds that charettes help them explain the project to the local community, while gaining input and support. homeWORD states that many of the best ideas that emerge during the design charette are the features that make the end project most successful. For instance, the Orchard Gardens' design charette prioritized a need for garden and orchard space and opened discussion around clustering the housing on one parcel of the land in order to preserve open space for the residents and the neighbors.

homeWORD states that many community members often have negative perceptions of how developers, both market rate and affordable, operate and have never been approached for involvement in the development process. Using charettes provides a structured process for dialogue with the community and has the effect of providing good public relations for homeWORD and building strong support for affordable housing that is integrated into the community.

Adapted from a Rural Voices article (2005) by Betsy Hands of homeWORD, Missoula, MT.

Building Standards

As stated, there are more than 50 local or regional green home building standards throughout the United States (USGBC 2006). Each set of green building standards provides a consistent terminology and format to rate and certify green housing. It is important for affordable housing developers to think of green building standards as a series of options, instead of a set list to follow. Given an organization's context, capacity, and resources, it may not always be feasible to incorporate all aspects of green building (Bradshaw et al. 2005).

Green building standards are increasingly being incorporated and required by green affordable housing funding sources. For instance, Enterprise Community Partners, a national green affordable housing development funder, requires grant applicants to utilize specific building standards. Community housing organizations applying for funds must meet these requirements to access these green resources. Thus, affordable developers need to be aware of green building standards and how they are used by funders and builders interested in green certification.

Rural Experiences

Fewer than half of the roundtable participants utilized green building standards in developing their projects. While several of the attending groups engage in comprehensive green housing development, many have been more conservative in their approach, adding green materials and techniques when possible. Groups that are doing more limited green activities were less likely to utilize any standards.

Those housing developers that use building standards testified to their merits. These groups use a mix of local, regional, and national building standards when designing and developing their green housing. Many emphasized how building standards serve as an important learning resource for understanding the different components of green building. Groups appreciated the detailed and easy-to-understand structure that building standards provide, which ultimately helped many learn about green building techniques.

Rural Challenges and Responses

As noted above, projects that use specific building standards may have certain verification processes to certify that those projects adhere to green development processes and utilize appropriate materials. A few community organizations emphasized the challenges of finding third party verifiers and those who can perform building commissioning[12] in rural communities. More remote rural areas have the most difficulty in finding persons who can perform this type of work. In addition, funding challenges can hinder groups that hire these specialists.

[12] Building commissioning is defined as "documented confirmation that building systems function in compliance with criteria set forth in the project documents to satisfy the owner's operational needs" (Building Commissioning Association 2006).

Several community organizations noted that they were able to access some foundation grant funding to pay for verification and commissioning costs. Others were able to find skilled faculty and staff at local colleges and universities to provide technical assistance in these areas.

Green on the Ground: Building Standards

Organization: Rural Development, Inc. (RDI) was created by the Franklin County Regional Housing and Redevelopment Authority in 1991 to provide affordable housing for low-, moderate- and middle-income people in rural Franklin County, Massachusetts.

Techniques: Since 1999, RDI has been employing green building techniques in its housing projects. At first, the organization focused mostly on energy efficiency due to the area's long cold winters. Increasingly, RDI became interested in utilizing comprehensive green building techniques and in 2005 the organization contracted with the U.S. Green Building Council to participate in the LEED for Homes Rating System Pilot program. The organization uses the LEED-H standards while developing scattered site single-family houses in Franklin County.

RDI submitted this single-family house for green certification under the LEED-H rating system.

RDI staff report that LEED-H was difficult to use initially due to the holistic nature and complexity of the process. RDI benefited from technical support from a LEED technical assistance provider. The first house developed with the LEED standards was not certificated due to a technical mistake; RDI considered that to be part of its learning process, however, and expected to obtain certification on its second house.

Benefits: Participating in the LEED for Homes program and learning about green building standards helped RDI understand all facets of the green building process. RDI was awarded the Home Depot Foundation's Award for Excellence for Affordable Housing Built Responsibly in 2005. The combination of the award and its involvement in LEED-H helped the organization earn local support, media attention, opportunities to comment on state green affordable housing policy matters, and accolades.

Adapted from an article by Anne Perkins of Rural Development, Inc., Turners Falls, Massachusetts (HAC 2005).

Location and Linkages

Location and linkages refers to siting housing in proximity to the overall community's infrastructure and resources. It stresses the need to avoid environmentally sensitive sites while utilizing existing infrastructure, incorporating compact development, and siting housing within walking distance of community resources and public transportation (USGBC 2005a).

What You Can Do:

Location and Linkages

- A*void environmentally sensitive sites*. Environmentally sensitive sites (e.g., wetlands, prime farmland) should be avoided due to ecological and human concerns (USGBC 2005a).
- *Use infill development*. Building new projects on already developed tracts of land saves resources by utilizing existing infrastructure.
- *Develop near public transportation and community resources*. Increased transportation options can increase resident accessibility, reduce transportation costs, and promote public health by incorporating walkable communities.
- *Develop sites compactly*. Compact development utilizes less land and makes public transportation more viable (USGBC 2005a).

Including location and linkage practices can reduce transportation related costs for low-income persons by encouraging non-motorized transportation options such as walking and bicycling.[13] Transportation is the second largest expense for a family behind housing and has been steadily rising (Surface Transportation Policy Project 2003). According to the Surface Transportation Policy Project (STPP) (2003), low-income families spend a disproportionate amount of their income on transportation, with the poorest 20 percent spending 40.2 percent of their take home pay on transportation costs. Many poor residents of low-density rural areas may spend disproportionately more on transportation than those who live in low-income urban areas, due to lack of transit access and pedestrian friendliness.

Rural Experiences

Roundtable participants uniformly agreed that achieving high densities and developing close to community resources is the most challenging aspect of green development for rural housing developers. Rural areas, especially the more remote, low-density communities, face various challenges incorporating compact development, infill development, and smart growth land use planning principles.

Despite these spatial limitations, a few rural community housing organizations working in larger rural communities had incorporated location and linkage techniques in their projects. One group in a mid-size rural community had worked with the local public transportation provider to add a bus route to serve a new green multifamily housing development. In addition, the organization provided free bus passes for

[13] It should be noted that there are mortgage products designed to encourage people to move to location efficient areas. The location-efficient mortgage® (LEM) takes into account a home's proximity to transit and community resources. Individuals who live in these areas and apply for this mortgage product may be able to qualify for a larger loan due to their lower transportation costs. As of 2006, the LEM is available only in four metropolitan areas in the United States. (Institute for Location Efficiency 2006)

residents to encourage transit use. Several community groups utilized existing infrastructure by developing single-family homes on empty lots in incorporated small towns.

Rural Challenges

The challenges related to incorporating location and linkages techniques in rural communities stem from a range of geographic, cultural, and structural factors. Rural areas are inherently low density – large tracts of land with few people. Housing development patterns in rural America often reflect residential and cultural preferences for low density development, which are difficult to reverse. Local community organizations also faced general challenges related to location including NIMBY attitudes, land availability, and costs.

In addition, roundtable participants cited the lack of infrastructure in rural areas as a significant challenge. While there is a lot of land in many rural areas, it may lack streets, water, and sewer infrastructure, particularly in unincorporated areas. Housing developers working in rural areas must often provide new infrastructure when building housing projects. Thus, there is often less opportunity for infill development in these areas. Many rural communities also lack public transportation, given the higher costs associated with operating transit systems in communities with small populations.

Local land use regulations may also be a barrier to compact development (Wisconsin Environmental Initiative 2005). Several participants noted that their rural communities have minimum lot sizes and other restrictive ordinances; such measures may limit housing density.

Rural Responses

Location and linkages proved to be the most challenging green building component for rural organizations and funders, although some groups were able to respond to the many challenges. Community groups and funders emphasized the role that early involvement and charettes can have in educating the public about the linkages of transportation and land use planning. In addition, a couple of the groups were able to partner with local transit providers and social service agencies that provide transportation options.

Sustainable Sites

Green site planning and design techniques stress minimizing environmental site impacts, managing surface water through permeable materials, incorporating green landscaping, and using non-toxic pest control (USGBC 2005a). Site planning decisions are very much site specific due a local area's topography and weather.

What You Can Do:

Sustainable Sites

- *Minimize site impact during construction*. Minimizing the impact (e.g., protecting and reusing topsoil) of constructing a home helps lessen the building's footprint on the site (USGBC 2005a).

- *Use permeable materials and surface water management techniques.* Utilizing permeable paving materials (e.g., grid pavers) can help minimize erosion and run-off from the site by allowing water to be absorbed more readily into the ground (USGBC 2005a).

- *Utilize native plants for landscaping*. Native plants can be more cost effective since they require less watering (USGBC 2005a).

- *Use non-toxic pest control*. Toxic pest control methods can be unhealthy for residents, particularly children (USGBC 2005a).

Rural Experiences

Most of the community organizations present at the roundtable incorporated various sustainable site components. Community groups were:

- using permeable paving options,
- minimizing site disturbance,
- reusing native vegetation,
- planting native plants, and
- utilizing non-toxic pest control practices.

In addition, community organizations were educating residents about avoiding harmful pest control products and using green landscaping techniques.

Rural Challenges

Community organizations cited several specific challenges related to incorporating sustainable site practices in their affordable housing developments. Regulatory and funding requirements may prohibit the use of permeable paving options. Several groups could not incorporate permeable paving because at least one federal affordable housing program requires paved driveways and sidewalks. Local governments have also imposed restrictions against permeable paving materials in at least one of the rural communities represented on the roundtable. This organization mentioned the potential for receiving a variance from the county government, although the variance process increases the project timeline and ultimately the needed resources. In addition, some groups found it difficult to access permeable concrete providers. There was general agreement among the rural community housing organizations that rural areas tend to have less access to specialized building materials (see Materials and Resources section below).

Another rural specific challenge concerns the use of septic systems, which are more common in rural communities than in cities. Septic systems often require land to be set aside for filtration, while sustainable site principles encourage minimal impact on building lots and leaving part of the lots undeveloped.

Rural Responses

Rural community groups at the roundtable were able to respond to some of the challenges associated with incorporating sustainable site techniques. Some affordable housing developers educated local officials around storm water management issues and the need to allow permeable paving surfaces. In addition, some groups were simply reducing the amount of paved surface areas in their developments.

Green on the Ground: Sustainable Sites

Organization: Community Housing Partners Corporation (CHPC) is a nonprofit community development corporation established in 1975 to serve the needs of individuals and families of low income and low wealth. Over the past 30 years, CHPC has built or preserved over 4,000 units of affordable housing and assisted more than 120,000 individuals with their economic, housing, and social needs.

Techniques: Community Housing Partners is committed to incorporating green and sustainable materials and practices in all aspects of its work, from initial design meetings through resident education. CHPC incorporated many sustainable site practices in its Blacksburg duplex project, including a sediment control plan to retain valuable topsoil, and reduce storm water and sediment runoff associated with construction activities. In addition, a pervious paving system was used in almost 50 percent of the paved parking areas, which reduced storm water runoff by allowing storm water to soak into the ground. This paving system also reduced the urban heat island effect that is caused by impermeable paved surfaces.[14]

The Blacksburg duplex project utilizes pervious paving systems and other sustainable site features.

Benefits: CHPC states that incorporating sustainable site techniques in the Blacksburg project improves local and regional long-term economic and environmental sustainability by reducing site impact and improving surface water management practices. In addition, the organization recognizes the improved resident comfort created by shading of hardscaping and reduction of the heat island effect.

Adapted from an article by Colin Arnold of Community Housing Partners Corporation of Christiansburg, Virginia (HAC 2005).

[14] According to the U.S. Environmental Protection Agency (2006), heat islands form as cities replace natural land cover with pavement, buildings, and other infrastructure. Many U.S. cities and suburbs have air temperatures up to 10 degrees warmer than the surrounding natural land cover (EPA 2006).

Water Efficiency

Water efficiency practices emphasize conserving water through low-flow fixtures such as toilets, showers, and faucets. In addition, green water efficiency practices include using high efficiency irrigation systems and incorporating water reuse systems.

What You Can Do:

Water Efficiency

- *Install high efficiency toilets, showers, and faucets*. Low-flow water fixtures are important in green houses since faucets, showers, baths, and toilets can account for two-thirds of indoor water use (USGBC 2005a, American Water Works Association 1999) (Table 2).
- *Reuse water*. Water reuse systems (e.g., rainwater harvesting systems, grey water systems) save water resources and reduce operating costs for residents.[15]
- *Use water efficient irrigation systems, if necessary*. If needed, use water efficient irrigation systems to save water resources and costs (USGBC 2005a).

Table 2. Typical Household Indoor Water Use

Type of Use	Daily Use (gallons per person)	Percentage of Total Indoor Use
Toilets	20.1	27.7
Clothes Washers	15.1	20.9
Showers	12.3	17.3
Faucets	11.1	15.3
Leaks	10.0	13.8
Other	1.5	2.1
Baths	1.2	1.6
Dishwashers	1.0	1.3
Total	**72.6**	**100.0**

Source: American Water Works Association, 1999

Rural Experiences

Almost all the participants at the roundtable incorporate water efficiency components in their green affordable housing developments. Water efficiency standards have risen during the past decade and are now standard on some products, including shower heads and toilets. Almost all groups were utilizing the standard low flow fixtures (e.g., showers and faucets) and some incorporated dual flush toilets. Other water efficient practices, including water catchment systems, composting toilets, and tankless

[15] Grey water is defined as the wastewater produced from baths and showers, washing machines, and lavatories. Grey water reuse systems can often be used for irrigation purposes although some localities have ordinances prohibiting these systems. Check with your local government body before proceeding with these water systems.

water heating systems, although more limited in use, were still included in some organizations' green affordable housing.[16]

In terms of irrigation and other outdoor water management issues, participants reflected on the regional nature of community needs. While one organization noted its use of high efficiency rain sensing irrigation systems, several others did not require irrigation systems given the abundance of rain in their local communities.

Rural Challenges

Many rural areas are likely to have farms and animals in close vicinity to housing. Therefore, contamination from pesticides and animal fecal waste can contaminate water supplies, so developers must be cognizant of filtration concerns in communities with these issues. As was the case for other green building components previously mentioned, some rural community housing organizations had trouble accessing and being able to afford certain water efficient supplies.

More general barriers to incorporating specific water efficiency practices were related to local ordinances prohibiting grey water systems and to regional factors. Several participants noted that their regions simply do not receive enough rainfall to reuse.

Rural Responses

Some community organizations were overcoming certain water efficiency challenges by working with local municipalities to lessen local regulatory barriers (e.g., local ordinances) that prevent water efficient practices. Some community organizations also take an active role in educating the public about these concerns through op-ed pieces in local newspapers and local community events. Also, community groups explained how water efficient appliances have become more affordable in recent years as they have achieved greater market penetration.

All the community organization representatives remarked during the water efficiency discussion that resident education is essential. Residents need to understand the reasons for utilizing water efficient products and systems and how to operate them effectively.

Indoor Environmental Quality

Green indoor environmental quality (IEQ) practices incorporate ventilation systems, toxin-free materials, contaminant control, and maintenance practices that reduce indoor environmental impacts on human health including asthma, respiratory diseases, and other ailments (FHLBA 2005). According to Global Green USA (2006), the Environmental Protection Agency (EPA) has recently declared poor indoor air quality as one of the nation's top five environmental health risks, and "off gassing" from paints, carpets, and cabinetry as the major contributors. This is especially important since Americans spend almost 90 percent of their lives indoors, according to the EPA (2006).

[16] Water catchment systems capture and reuse rainwater. Composting toilets use biological processes, instead of water, to break down human excrement into compost material. Tankless water heating systems achieve greater water efficiency since they provide heated water only when needed. Please see the Partnership for Advancing Technology in Housing (PATH) website (www.pathnet.org) for more information.

What You Can Do:

Indoor Environmental Quality

- *Improve air filtration, distribution, and ventilation*. Installing and using air flow systems and exhaust fans will improve indoor air quality and resident health in the home by reducing humidity, pollutants, and odors (USGBC 2005a).

- *Reduce any potential exposure to radon and vehicle emissions*. Installing radon systems (if needed, based on region) and tightly sealing off garages will provide a healthier environment for residents (USGBC 2005a).

Improving health through green building practices and materials can have a significant impact on residents, specifically vulnerable populations such as children, elderly persons, and low-income residents. More than four million children in the U.S have asthma, and it is estimated that more than 40 percent of doctor-diagnosed asthma among U.S. children is due to residential exposures (Green Communities 2005). Asthma rates are highest among children, minorities, and people with low socioeconomic status (NIEHS 2005, Vittori 2004).

Rural Experiences

Overall, community organizations and funders expressed commitment to providing healthy indoor housing environments for residents through green indoor environmental quality practices. Almost all of the community organizations were incorporating certain IEQ techniques, most notably improving air filtration and reducing potential humidity and mold concerns through exhaust fans. Other IEQ components being used by rural community organizations include radon detection systems and waste heat recovery systems. Waste heat recovery systems help achieve greater energy efficiencies with heating systems by recycling wasted heat from furnaces. Another commonality that emerged during the discussion was the need to educate rural contractors on ways to install and use some IEQ facets.

Rural Challenges

Community group representatives stated that rural areas have less access to contractors with specialized green knowledge. Those contractors who are available are not always knowledgeable about green or emerging building construction techniques, thus limiting the correct installation of some IEQ systems. In addition, all of the participating developers found comprehensive IEQ packages to be prohibitively expensive. For example, the ENERGY STAR Indoor Air Package, which is a comprehensive set of indoor air quality measures, is very expensive to purchase and install. In addition, many of the community organizations spoke about the learning curve associated with understanding how to incorporate some IEQ practices such as technical air filtering systems.

Rural Responses

Rural community organizations were able to overcome some cost challenges associated with IEQ systems by buying green materials in bulk and keeping green design elements simple. Rather than use the ENERGY STAR Indoor Air Package, most community groups incorporated individual IEQ systems (e.g., exhaust fans). Again, using a design charette to clarify goals early and understand what green facets to include helped keep costs down for some organizations. In addition, some organizations utilized local universities' technical assistance to acquire the expertise needed to install and utilize IEQ components.

Green on the Ground: Indoor Environmental Quality

Organization: Bishop Sheen Ecumenical Housing Foundation, Inc. is a nonprofit corporation that provides safe, decent, and affordable housing for low-income families, seniors, and persons with disabilities in 13 counties in western New York.

Techniques: Sheen Housing offers a wide range of housing assistance programs. In the last five years, Sheen Housing has included a green initiative in its home repair and rehabilitation program. The organization provides services such as weather-stripping, properly maintained heating systems, energy efficient windows, and caulking of windows, doors, and sills, to eliminate air infiltration. Sheen Housing also provides plumbing repairs, venting, replacement of damaged drywall, insulation, gutters, and roof repairs to eliminate sources of moisture or water infiltration which cause mold.

Sheen Housing renovated this home to improve its indoor air quality and efficiency.

Benefits: Sheen states that better indoor environmental quality ultimately produces a more comfortable, energy efficient, and cost effective home. Other benefits of its IEQ practices include improved health of the occupants, higher market value, and improved durability of the home. Improved IEQ has also had ripple effects throughout the community, including improved health care, reduced school transience, stabilized employment, and reduced demand on local social services.

Adapted from an article by Allynn Smith of Bishop Sheen Ecumenical Housing Foundation, Rochester, New York (HAC 2005).

Materials and Resources

Materials and resources practices encourage the construction of homes smaller than the national average, using material efficient framing, creating a durability plan, utilizing environmentally preferable products, smart waste management practices, and utilization of locally made materials and supplies (USGBC 2005a).

What You Can Do:

Materials and Resources

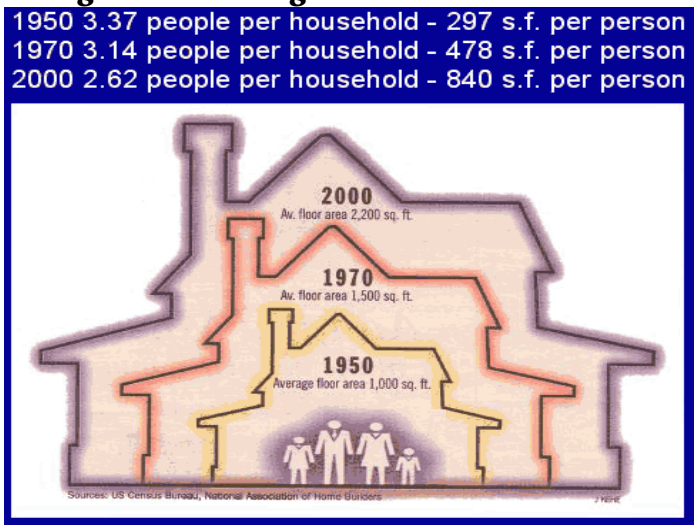
- *Build small homes and limit material use*. Home size continues to increase although smaller homes utilize less energy and materials (Figure 2). Limiting materials used for aesthetic purposes saves resources (USGBC 2005a).

- *Use local sources for materials*. Utilizing local material suppliers reduces the amount of energy needed to deliver materials that are produced far away. Furthermore, supporting local business helps keep money in a local community by promoting horizontal economic linkages instead of vertical linkages that occur through franchised businesses (Powers 1992).

- *Use environmentally preferable products*. Incorporating environmentally preferable products (e.g., paints containing low levels of volatile organic compounds) in housing helps reduce the demand for virgin materials, improve the home's overall environmental performance, and increase demand for reused and recycled products (USGBC 2005a).

- *Limit construction waste.* Reducing and recycling construction waste can reduce the substantial amount of waste caused by home construction (USGBC 2005a).

Figure 2. Average Home Size Increases



Source: USGBC 2006.

Rural Experiences

Roundtable participants were actively involved in utilizing environmentally preferable materials and resources. Most groups made efforts to buy locally when available, use recycled or reused materials, minimize waste, and select paints with low volatile organic compounds (VOC). Community organizations in rural areas not only save money when incorporating reused materials or when buying locally, but they are often expected to do so in tight-knit rural communities. In addition, achieving smaller than average home size was not difficult for the rural affordable housing developers at the roundtable, since affordable housing tends to be smaller in square footage than market rate housing.

Green on the Ground: Materials and Resources

Organization: OPAL Community Land Trust's mission is to acquire and own land so that community residents in need may have access to permanently affordable homes. Based in Eastsound, Washington, OPAL and its partners develop housing and infrastructure, and steward the land in a manner that is cooperative, stable, environmentally sensitive, and socially responsible.

A green home in OPAL's Lahari Ridge development.

Techniques: OPAL's Lahari Ridge project consists of six single-family homes that are affordable for households earning less than 80 percent of the county median income. The houses are small – 840 square feet – and designed with single-wall construction, roof trusses, and non interior support walls so that each may be easily and affordably adapted from a studio to a one-bedroom or a two-bedroom configuration. Materials used in construction include metal roofs (more durable and better suited to water catchment), marmoleum flooring, formaldehyde-free insulation, and certified green cabinets. The cabinets were assembled and installed by the homeowners in a workshop with OPAL's project manager and general contractor.

Benefits: OPAL staff state that the benefits of using green materials and resources are numerous. For instance, the houses are healthier to live in because the products and systems used have less off-gassing than comparable products. In addition, OPAL states that the homes will last longer and be less expensive to maintain because of the use of more durable materials.

Adapted from an article by Elisabeth Byers of OPAL CLT, Eastsound,Washington (HAC 2005).

Rural Challenges

Challenges were identified that hinder the use of sustainable material and resources practices in rural communities. The challenge of access to specialized suppliers came up during this session as it did earlier in the roundtable discussion. In addition, community organizations described how transportation costs can be high when shipping green materials large distances.

Community organization staff stated that local building codes often prevent use of certain materials, including ones that are environmentally preferable. One community group representative stated that some federal housing programs limit the type of wood a developer can use for home construction. This challenged the rural affordable developer since they intended to use wood certified by the Forest Stewardship Council (FSC) a national organization that certifies wood has been grown and harvested in an environmentally responsible and socially beneficial manner (FSC 2006).

Rural Responses

Community organizations were able to respond to some of the barriers by forming collaborations. For instance, one community group formed a green builders organization in its community to put pressure on local lumberyards and stores to supply more green products. Also, several community groups spoke about having materials donated by the community or working with deconstruction companies to use materials they salvage from other homes in the community.

Energy and Atmosphere

Energy and atmosphere (EA) practices are perhaps the best known component of green building (Dean 1999). These techniques encompass building or retrofitting homes to make them more energy efficient through better insulation practices and the use of energy efficient appliances, fixtures, windows, lighting, water heaters, and renewable energy systems, along with properly sized and highly efficient mechanical systems. Energy efficient practices can save individuals and property managers money through lower heating and cooling bills, while minimizing energy use and helping contribute to healthy living environments.

According to the EPA (2005), "energy consumed in homes accounts for nearly 17 percent of total U.S. greenhouse gas emissions and 15 percent of energy consumption nationwide." Over half of the energy use in a home is for space heating, space cooling, and domestic water heating (USGBC 2005a) (Figure 3). An ENERGY STAR qualified home is both designed and tested to use 30 percent less energy for these end uses than a comparable home built to the Model Energy Code (USGBC 2005a, 94).

Energy ratings are performed by home energy raters (HERS), who review homes to identify energy characteristics such as insulation levels, window efficiency, wall-to-window ratios, heating and cooling system efficiency, solar orientation of the home, and the water heating system (RESNET 2006). Reviewers usually use a blower door test to determine air and duct leakage (RESNET 2006).

What You Can Do:

Energy and Atmosphere

- *Construct well insulated homes*. Improved insulation regulates the loss of heat and assists in cooling, thus allowing residents to use fewer resources and save money (USGBC 2005a).

- *Use energy efficient windows, lighting, water heaters, and appliances*. Energy efficient products can save resources and money, often in a very short period of time. The federal government rates energy efficient products through its ENERGY STAR program.[17]

- *Use active and passive solar design systems*. Active solar design refers to the use of photovoltaic panels or other systems to produce energy for a house. Passive design strategies stress the importance of how the house is sited in relation to the sun.[18]

- *Check duct tightness*. Leaks in air ducts are a major source of energy loss, so it is important to test for any possible air leakage (USGBC 2005a).

Rural Experiences

All the community organizations utilize various energy and atmosphere techniques when constructing and rehabilitating affordable housing in rural communities. The developers at the roundtable described routinely using ENERGY STAR rated appliances, windows, and lighting. In addition, some rural community organizations used other EA techniques, including solar preheated water, cellulose insulation, radiant floor heating, photovoltaic panels, on demand water heating systems, and passive solar heating and cooling techniques.[19]

Rural Challenges

Like other aspects of rural green affordable housing, access to and costs of some energy and atmosphere products posed challenges for rural affordable developers. For instance, groups' staff noted that conventional vinyl windows are cheaper than high performing double paned ENERGY STAR windows. Two groups present at the roundtable had used photovoltaic panels and this was possible only through a grant from a national foundation. The groups all agreed that utilizing photovoltaic panels was

[17] More information relating to the ENERGY STAR program can be found at www.energystar.gov. The ENERGY STAR mark is found on more than 40 categories of products and appliances which, to qualify, must meet stringent performance criteria set by the Environmental Protection Agency (EPA) or the Department of Energy (DOE) (HUD 2005).

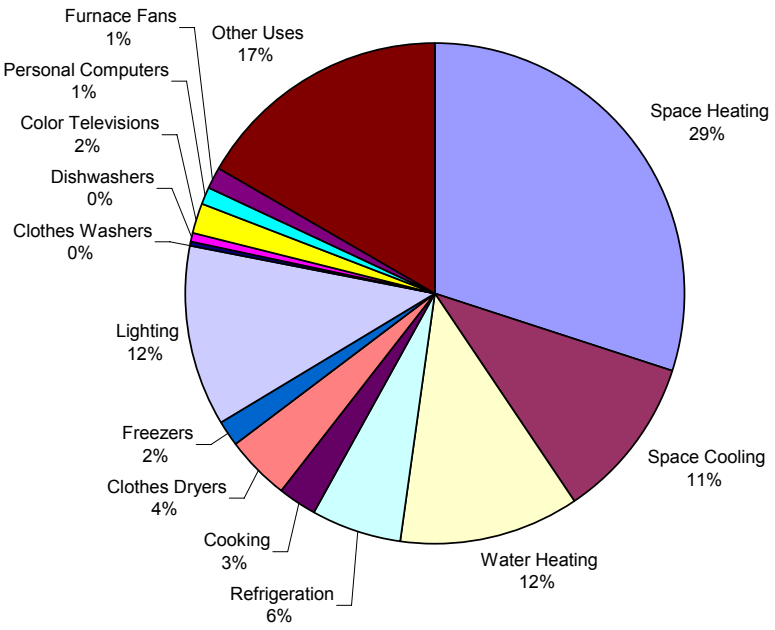
[18] Passive solar design techniques include orienting the house to minimize summer afternoon solar heat gain and optimize winter solar heat gain, incorporating cross ventilation techniques, daylighting, and the use of overhangs for cooling (DOE 2004). Passive strategies are often less expensive to incorporate than active design components. Active strategies such as the use of photovoltaic panels reduce energy costs by storing and producing energy for the home.

[19] Please see PATH's website (www.toolbase.org) for further information on compact fluorescent lighting, solar water systems, cellulose insulation, radiant floor heating, photovoltaic panels, on demand water heating systems, passive solar heating and cooling techniques, and a variety of other energy and atmosphere practices.

prohibitively expensive without grant assistance. In addition, contractor capacity and access came up again as a challenge during this section of the roundtable. Many community organization staff stated they had to train contractors how to properly utilize energy and atmosphere technology.

Group representatives also spoke to the challenge of educating their own staff about green building materials and systems. Community organization staff noted that it takes time, training, and resources to adequately educate new staff members who may not have backgrounds in green development. Some community group participants stated that it is harder to find competent staff in rural communities than urban areas.

Figure 3. Residential Energy Use for 2005



Source: DOE, 2006[20]

Rural Responses

As before, community groups overcame some EA challenges by utilizing local universities for technical assistance, duct testing, and other performance testing. In addition, community organization participants reiterated that although some products were more difficult to access and sometimes more costly, finding green products was becoming easier as they achieved greater market penetration.

[20] Dishwashers and clothes washers each consume less than 1 percent of energy used and were rounded to zero percent for the purpose of the pie chart.

Even though active solar strategies, such as the use of photovoltaic panels, are still too expensive for most affordable developers, many groups were able to incorporate passive solar design techniques in their homes. For instance, most community organizations were siting houses to minimize summer afternoon solar heat gain and optimize winter solar heat gain, incorporating cross ventilation strategies by taking advantage of prevailing breezes, utilizing roof overhangs to cool the homes, and planting shade trees.

Green on the Ground: Energy and Atmosphere

Organization: Umpqua Community Development Corporation (CDC) is a nonprofit organization in southwestern Oregon founded in 1991 to provide affordable housing to the rural counties of Douglas, Coos, and Curry. Umpqua CDC's target population is those who make less than 80 percent of area median income.

Techniques: In 2003, Umpqua CDC completed Calapooia Crossing, a solar subdivision with 11 multifamily rental units for low-income tenants and five single-family homes for first-time homebuyers. This was Umpqua's first experience at providing active and passive solar energy features such as south facing windows for winter sun and awnings to prevent summer sun intrusion, photovoltaic panels on the laundry room to produce electricity with a net metering system (the meter runs backwards when the sun is shining), and solar water heating. The organization also incorporated underslab insulation, energy efficient appliances, fluorescent lighting, and a heat recovery system in the water piping.

The Calapooia Crossing subdivision includes both active and passive solar design features.

Benefits: Umpqua CDC states that there are numerous benefits to incorporating EA techniques. The use of solar design features has produced significant energy and utility cost savings for residents and the organization (Table 3). In addition, the use of EA components has improved indoor health quality and produced higher comfort levels for residents.

Table 3. Calapooia Crossing's Energy Savings

	Average Monthly	Average for Winter Months	Average for Summer Months
Standard Duplex	$57.34	$106.65	$23.57
Solar Duplex	$21.23	$33.10	$12.58
Energy Savings from Solar Design Features (per month)	**$36.11**	**$73.55**	**$10.99**

Adapted from an article by Betty Tamm of Umpqua CDC, Roseburg, Oregon (HAC 2005).

Homeowner Awareness

Homeowner awareness refers to the need for residents of green homes to understand how to use and maintain the green building components included in their houses.

What You Can Do:

Homeowner Awareness

- *Provide a homeowner's manual and walk-through of the green home.* Providing a homeowner's manual, walk-through, and continuing education will help residents understand, effectively utilize, and maintain the various green facets in their home (USGBC 2005a).

Rural Experiences

There was agreement at the roundtable that homeowner awareness is one of the most important aspects of affordable green housing, since the green facets used in the home will not provide an improved environment for residents if they do not understand what they are and how to utilize them effectively. Therefore, all organizations provide residents with homeowner's manuals and walkthroughs of the green homes. In addition, most organizations provide ongoing follow-up with residents through staff visits and mailed surveys, while also encouraging residents to call with questions about any green products or systems in their homes.

Rural Challenges and Responses

Although very important, on-going follow-up with residents takes staff time and resources. All organizations stated that is difficult to devote limited staff time and resources to homeowner awareness activities. For instance, community groups noted that residents may not be aware of potential contaminants in household cleaning products or paints. Thus, it is necessary for staff members to hold educational sessions on maintaining green products and systems while knowing which products to tell residents to avoid bringing into their home. In addition, community organization staff remarked that homeowner awareness activities must always be on-going since new persons can enter the home and not know how to use the green products and systems.

One community organization representative described how one organization utilizes a green peer-to-peer educational process for residents. This organization formed a structured process where residents assumed the educator role and informed other residents about how to use and maintain the green features in the home.

Summary of Roundtable Participants' Green Techniques and Challenges

Rural affordable housing developers are utilizing a range of green products and techniques. The most common identified by rural roundtable participants include:

- compact fluorescent lighting,
- ENERGY STAR appliances,
- low-flow fixtures and dual flush toilets,
- environmentally preferable products,
- local sources for materials,
- recycling construction materials,
- minimizing site waste,
- homeowner awareness education, and
- integrated design processes implemented using a charette.

The most common challenges to using these techniques identified by rural roundtable participants were:

- infeasibility of compact development,
- difficulty utilizing existing physical infrastructure and infill development practices,
- lack of public transportation and land use planning,
- inadequate accessibility and affordability of certain green products and systems,
- inadequate staff and contractor access and capacity
- insufficient access to and ability to pay the costs of third-party verifiers,
- federal, state, and local government regulations,
- qualifying for certain green affordable funding programs, and
- sustaining homebuyer awareness educational programs.

Funding Rural Green Activities

The costs of incorporating green building components differs based on what aspect is being utilized. Rural community housing organizations at the roundtable stated that certain green products are now very similar in price to conventional products, and usually are higher performing with greater long-term savings (e.g., compact fluorescent bulbs). Group participants did state that some green products and systems they would like to incorporate in their housing projects are still prohibitively expensive without additional financial resources (e.g., photovoltaic panels).

For community organizations working in rural communities, the rural context seems to have the ability to lessen access and increase the price of some green products due to increased transportation costs and fewer economies of scale. Groups in the most isolated rural communities usually have the most difficulty accessing and affording such products, compared to rural groups closer to metropolitan areas.

A challenge discussed among rural community organizations at the roundtable was the difficulty in utilizing a green framework with federal housing and community development resources besides the LIHTC program. Although an increasing number of states are creating incentives for green factors in their QAPs, most federal housing resources do not incorporate green criteria. Thus, groups who use green components in their projects may have slightly higher costs than those who build conventional

affordable housing, thus potentially missing out on sorely needed competitive funding, a possibility that serves as a disincentive for incorporating green in their housing projects.

Community groups at the roundtable have found ways to access resources to overcome funding challenges, while not passing on any additional costs to residents. Most of the groups received financial support for their green housing projects from foundations, intermediaries, government at all levels, local utility companies, and outside supporters such as universities. Rural affordable housing developers already have to combine multiple funding sources to finance projects. Green affordable building can add complexity and new resources, so groups need additional supports when beginning green projects.

Two other important responses that emerged throughout the roundtable were the needs to plan early and to use green building standards. Due to the holistic nature of green building, community organizations stressed the importance of deciding early what aspects of green building to incorporate in housing projects. It is not often practical or financially feasible to integrate green facets later in a project. Planning early through charettes can help organizations decide what is most important and viable, and is essential to minimizing cost overruns and keeping the project within budget.

As mentioned earlier, green building standards can serve as an important learning resource for new and experienced rural community housing organizations. Green building standards provide an easy to use and structured template to knowing the many facets of green development. In addition, some green funding organizations require nonprofit developers to adhere to certain building standards when applying for and utilizing financial resources. It is important to understand what green building standard is appropriate for your organization, since the use of building standards seems to be becoming more common among funders and developers.

Summary of Important Resources

- ⌂ Early planning through integrated design processes and charettes
- ⌂ Green building standards
- ⌂ Partnerships with utility companies, funders, intermediaries, local and state government, and universities

CONCLUSION

As an increasing number of rural affordable housing developers are incorporating aspects of green building in their housing developments, understanding how these practices benefit and challenge affordable developers becomes increasingly important. Currently, there is little research on affordable green building, and even less on how the rural context affects this development type.

A roundtable that comprised experts in the field of green affordable housing provided insight on the techniques, challenges, and methods of overcoming barriers for affordable green building in rural communities. From this discussion, it was determined that community housing organizations can and are developing affordable green housing at various levels in rural communities, although certain characteristics of the rural environment can challenge nonprofit developers. Smart growth land use planning principles, access to and affordability of certain green products and systems, and staff and contractor access and capacity can be more difficult for rural nonprofit developers due mostly to the spatial, economic, and cultural realities of rural areas.

Even with these challenges present, community groups and green funding organizations at the roundtable were often incorporating as many green facets as possible in their affordable housing projects. These organizations are committed to the individual, organizational, community, and global economic and non-economic benefits of building green.

Asked to comment on future needs and supports necessary to continue green development practices, community organization representatives at the roundtable stated the need for housing intermediaries and government to provide additional training opportunities and resources for rural nonprofit developers and local government. In addition, they stressed it is important for researchers to develop green cost savings analysis techniques to help justify the benefits of affordable green building, while ideally leading to the incorporation of green criteria in loan underwriting standards. Clearly there is a need to develop additional training and technical assistance, loan products, and research in regards to rural green affordable housing.

Besides increased support, assistance, and research, rural community organizations' staff stressed the need for green funding organizations to understand the rural context. Many rural areas, especially the less populated communities, cannot meet the smart growth land use planning criteria (e.g., location and linkage aspects), and are thus disqualified from certain green funding sources. Developers stated that incorporating rural considerations in this category could help rural housing organizations access greatly needed funding sources and ultimately help them continue building green housing for low-income rural residents.

REFERENCES

American Water Works Association. 1999. *Residential water use summary*. Denver, Colorado: American Water Works Association.

Anderson, Bendix. 2006. Green building comes of age. *Affordable Housing Finance*. 13(3): S-2.

Boehland, Jessica. 2005. Greening affordable housing. *Environmental Building News*. 14(3): 11-19.

Bradshaw, William et al. 2005. *The costs and benefits of green affordable housing*. Cambridge, Massachusetts: New Ecology Inc.

Bryant, Bunyan and Paul Mohai, eds. 1992. *Race and the incidence of environmental health hazards: A time for discourse*. Boulder, Colorado: Westview Press.

Building Commissioning Association. 2006. http://www.bcxa.org.

Bullard, Robert D. 1983. Solid waste sites and the black Houston communities. *Sociological Inquiry*. 53: 273-288.

Bullard, Robert D. 1990. *Dumping in Dixie: Race, class, and environmental quality*. Boulder, Colorado: Westview Press.

Census Bureau, U.S. (Census). 2002. Cost and income component descriptions from U.S. Census Bureau. Census 2000 summary file 3 technical documentation. http://www.census.gov/Press-Release/www/2002/sumfile3.html.

Dean, Michelle. 1999. Building green. *Shelterforce*. 21(103): 24-26.

Energy, U.S. Department of (DOE). 2004. *Green building guidelines: Meeting the demand for low-energy, resource-efficient homes*. Washington D.C.: Sustainable Buildings Industry Council.

_____. 2006. Annual energy outlook 2006. Release date December 12, 2005. Data can be found at: http://www.eia.doe.gov/emeu/aer/.

Environmental Protection Agency, U.S. (EPA). 2006. http://www.epa.gov/iaq/.

_____. 2006. What is a heat island? http://www.epa.gov/heatisland/about/index.html.

_____. 2005. A decade of change in home building with ENERGY STAR. http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/DecadeofChangeESHomeBuilding.pdf

Federal Home Loan Bank of Atlanta (FHLBA). 2005. *The little green book*. Atlanta, Georgia: Federal Home Loan Bank of Atlanta.

Forest Stewardship Council. 2006. http://www.fsc.org/en/about.

Frumkin, Howard. 2005. Healthy, equity, and the built environment. *Environmental Health Perspectives*. 113(5): 290-291.

Global Green USA. 2005. Greening affordable housing: Trends and opportunities. Presentation at USGBC Greenbuild Conference, November 7.

Global Green USA. 2006. 8 steps to funding green affordable housing. http://www.globalgreen.org/greenbuilding/GAHI_8steps.html.

Green Communities. 2005. The need for green now. http://www.greencommunitiesonline.org/things-to-know02.asp.

Housing Assistance Council (HAC). 2005. *Rural voices: Rural housing goes green.* Washington, D.C.: Housing Assistance Council. 10(3).

Housing and Urban Development, U.S. Department of (HUD). 2005. Affordable housing meets ENERGY STAR: New partnership brings ENERGY STAR qualified products and practices to HUD-assisted programs. *Research Works* 2(1): 5-7.

Karlenzig, Warren. 2005. *A blueprint for greening affordable housing: Developer guidelines and resource efficiency and sustainable communities*. Santa Monica, California: Global Green USA.

Kats, Greg. 2003. *The costs and financial benefits of green buildings: A report to California's sustainable building task force*. California: Sustainable Building Task Force.

Institute for Location Efficiency. 2006. Location efficient mortgage®. 2006. http://www.locationefficiency.com.

National Institute of Environmental Health Sciences (NIEHS). 2005. Asthma research at NIEHS. http://www.niehs.nih.gov/airborne/home.htm.

National Low Income Housing Coalition (NLIHC). 2006. *2006 advocates' guide to housing and community development policy*. Washington, D.C.: National Low Income Housing Coalition.

New Ecology, Inc. 2005. Green part II. The integrated design process: The earlier the better. *Making the design process work for green affordable housing*. Online webchat November 16.

Powers, Ronald. 1992. Why work together? In *Multicommunity collaboration: An evolving rural revitalization strategy*, ed. Peter F. Korsching, Timothy O. Borich, and Julie Stewart. Ames, Iowa: Iowa State University.

Residential Energy Services Network (RESNET). 2006. Frequently asked questions about home ratings. http://www.natresnet.org/ratings/faq_rating.htm.

Surface Transportation Policy Project. 2003. *Transportation and the American dream: Why a lack of transportation choices strains the family budget and hinders home ownership*. Washington, D.C.: Surface Transportation Policy Project.

Tassos, James. 2005. *A greener plan for affordable housing: How states are using the housing credit to advance sustainability*. Columbia, Maryland: Enterprise Foundation.

United States Green Building Council (USGBC). 2005a. *Rating system for pilot demonstration of LEED® for Homes program, version 1.72*. Washington, D.C.: United States Green Building Council.

_____. 2005b. Press release: USGBC announces over 20,000 LEED accredited professionals. Washington, D.C.: United States Green Building Council.

_____. 2006. Presentation at HAC's Rural Affordable Green Building Roundtable, April 24.

Vittori, Gail D.A. 2004. Greening affordable housing. *Journal of Affordable Housing*. 13(4): 458-462.

Wisconsin Environmental Initiative. 2005. *The green built way to affordable housing*. Madison, Wisconsin: Wisconsin Environmental Initiative.

APPENDIX A

Rural Affordable Green Building Research Roundtable

Monday, April 24, 2006
9:00-5:00
Atlanta, Georgia

Agenda

- Introductions and Agenda (20 minutes)
  Joe Belden, Deputy Director and Theresa Singleton, Research and Information Director
  Housing Assistance Council

- Overview of the LEED for Homes Building Standards (40 minutes)
  Emily Mitchell, Affordable Housing Fellow LEED for Homes
  U.S. Green Building Council

I) Discussion of green affordable housing in rural America (1 hour and 45 minutes)

- What techniques are rural community groups and funding organizations utilizing and supporting in relation to rural green affordable housing?
- What challenges do community organizations and funding organizations have in relation to rural affordable green building?

II) Present most common green building techniques and challenges from earlier discussion (30 minutes)

III) Discussion of how rural community organizations are making green building work (2 hours and 45 minutes)

- What resources and methods, if any, are being used to overcome rural affordable green building challenges identified during first part of the day?
- What are your future plans for green building?
- What roles can funders and intermediaries play in advancing rural affordable green building?

APPENDIX B

Notes from HAC's Rural Affordable Green Building Research Roundtable
April 24, 2006

Participants

Colin Arnold, Community Housing Partners Corporation
Michael "Micky" Beach, Umpqua Community Development Corporation
Dana Bourland, Enterprise Community Partners
Lynn Brazen, Federal Home Loan Bank of Atlanta
Cara Mae Cirignano, Sowing Seeds of Hope
E.G. "Ned" Fowler, Northwestern Housing Enterprises
Betsy Hands, homeWORD
Rosemary Kernahan, Georgia Department of Community Affairs
Gabriel Olmsted, OPAL Community Land Trust
Anne Perkins, Rural Development Inc.
Linda Poythress, U.S. Department of Housing and Urban Development
Allynn Smith, Bishop Sheen Ecumenical Housing Foundation
Fred Wacker, Home Depot Foundation

HAC Staff

Shonterria Charleston
Kelly Cooney
Surabhi Dabir
Mark Kudlowitz
Caitlin MacKenzie
Joe Belden

Facilitators

Emily Mitchell
Theresa Singleton

Roundtable Notes

I) Discussion of green affordable housing in rural America

- What techniques are rural community groups and funding organizations utilizing and supporting in relation to rural green affordable housing?
- What challenges do community organizations and funding organizations have in relation to rural affordable green building? Which are specific to the rural context?

Location and Linkages	
Technique	**Challenge**
• Adaptive reuse • Utilization of existing infrastructure • Compact development • Working with local public transportation provider	• Available land may be near environmentally sensitive sites • Septics near wetlands–R • State regulations for smart growth–R • Resident preference for larger lots–R • Lack of zoning or exclusionary zoning–R • Lack of infrastructure–R • Lack of public transportation–R • Not in My Back Yard/Build Absolutely Nothing Anywhere Near Anyone (NIMBY/BANANA) • Community characteristics • Topography can make large sections not developable–R • Land availability and costs

Sustainable Sites	
Technique	**Challenge**
• Native landscaping • Non-toxic pest control practices • Tree preservation efforts • Logging with horses to protect native vegetation • Permeable driveways by utilizing crushed rock driveways • Saving topsoil from work site for reuse • Rain gardens and bioswales • Minimizing site impact during construction	• Trouble with permeable concrete providers • Landscaping issues (foundation disturbance) restrictions for no-disturbance zones • Storm water management issues • State requirement for bioswales • Local government restrictions limiting use of permeable surface materials • Local/funder requirements for paved driveways and sidewalks

"R" indicates a rural-specific challenge.

Water Efficiency	
Technique	**Challenge**
• Tankless and solar water heater • Rainwater harvesting systems • Low flow water fixtures, toilets and appliances • Dual flush toilets • Compost toilets • No irrigation systems	• Contamination from pesticides and animals–R • Restrictions on water use • Affordability and accessibility • Gray water reuse too expensive, time intensive, high maintenance and knowledge needs • Local regulations may limit reuse (e.g., gray water or rainwater harvesting) • Lack of awareness and importance on water conservation strategies

Indoor Environmental Quality	
Technique	**Challenge**
• Exhaust fans for air filtration • Humidity control systems • Radon detection systems • Heat recovery ventilation systems • Hydronic systems • Radiant floors • Waste heat recovery systems (preheated combustion air) • Contractor training	• Affordability • Mold issues • Humidity control • Third party testing–R • A design issue that must be done in beginning • Finding an expert that understands the integrated design process • Assessing costs • Contractor access and limitations–R • Supply and cost of low VOC paints • Tenant behavior • Carpet and cabinets (off-gassing, asthma, etc.)

"R" indicates a rural-specific challenge.

Materials and Resources	
Technique	**Challenge**
• Minimize and reuse construction materials • Use recycled materials • Develop waste management plans • Purchase and use local materials • Use environmentally preferable products • Limit home size • Use salvaged materials • Use FSC wood when possible	• Fewer suppliers–R • Transportation, labor, and material costs are high–R • Limited contractors–R • FSC product availability is limited–R • Quantifying waste management • Local codes prohibiting metal frames • Contractor buy-in • Regulations on wood use • Defining a local lumber source

Energy and Atmosphere	
Technique	**Challenge**
• ENERGY STAR appliances • Use hydropower energy • Photovoltaic panels • Passive solar design • Use overhangs • Structurally insulated panels • High performing windows and flashing • Blown cellulose insulation • Solar and on demand water heating • Ground source heating systems • Use compact fluorescent light bulbs • Air leakage testing	• Vinyl windows are cheaper than environmentally preferable windows • Cellulose costs and availability–R • Air infiltration and air leakage • HERS difficult to monitor and administer • Staff capacity and contractor oversight • Contractor knowledge • Cost of renewables

"R" indicates a rural-specific challenge.

Homeowner Awareness	
Technique	**Challenge**
• Ongoing follow up with residents • Resident boards • Manuals • Newsletters • Training on green homes	• New tenants coming in • Ongoing follow-up and maintenance • Lack of resources and time for housing counseling • Cleaning products, repainting

"R" indicates a rural-specific challenge.

II) Present most common green building techniques and challenges from earlier discussion

Most Common Green Techniques and Challenges	
Techniques	**Challenges**
• Compact fluorescent lighting • ENERGY STAR appliances • Low flow fixtures and dual flush toilets • Environmentally preferable products • Local sources for materials • Recycling construction materials • Minimizing site waste • Homeowner awareness education • Integrated design process implemented using a charette	• Compact development–R • Infill development–R • Public transportation and land use planning–R • Access and affordability of certain products and systems–R • Staff and contractor access and capacity–R • Federal, state, and local government regulations • Homebuyer awareness

"R" indicates a rural-specific challenge.

III) Discussion of how rural community organizations are making green building work

- What resources and methods, if any, are being used to overcome rural affordable green building challenges identified during first part of the day?
- What are your future plans for green building?
- What roles can funders and intermediaries play in advancing rural affordable green building?

Location and Linkages	
Challenge	**Response**
• Available land may be near environmentally sensitive sites • Septics near wetlands–R • State regulations for smart growth–R • Resident preference for larger lots–R • Lack of zoning or exclusionary zoning –R • Lack of infrastructure–R • Lack of public transportation–R • Not in My Back Yard/Build Absolutely Nothing Anywhere Near Anyone (NIMBY/BANANA) • Community characteristics • Topography can make large sections not developable–R • Land availability and costs	• Put a "face on the residents" • Sustainability tour of each development • Community design charette highlighting public amenities • Early involvement of community • Showing design to community residents • Involvement in policy-making process • Partnership with the city for public transportation options (free bus passes for residents) • CDBG funds for acquisition costs

Sustainable Sites	
Challenge	**Response**
• Trouble with permeable concrete providers • Landscaping issues (foundation disturbance) restrictions for no-disturbance zones • Storm water management issues • State requirement for bioswales • Local government restrictions limiting use of permeable surface materials • Local/funder requirements for paved driveways and sidewalks	• State incentives for preservation and restoration • Region-specific incentive to increase permeable surfaces because of stormwater runoff • Smaller paved surface areas • Pushback on unnecessary hardscaping requirements

"R" indicates a rural-specific challenge.

Water Efficiency	
Challenge	**Response**
• Contamination from pesticides and animals–R • Restrictions on water use • Affordability and accessibility • Gray water reuse too expensive, time intensive, high maintenance and knowledge needs • Local regulations may limit reuse (e.g. gray water or rainwater harvesting) • Lack of awareness and importance on water conservation strategies	• State and local jurisdictions revisiting aquifer requirements • Encouraging progressive thinking on part of municipalities • High efficiency fixtures make sense for homes on septic systems, less demand on system • Education across all stakeholder groups – local government first • Guest column in local newspapers to elevate issue • ENERGY STAR appliances more affordable

Indoor Environmental Quality	
Challenge	**Response**
• Affordability • Mold issues • Humidity control • Third party testing–R • A design issue that must be done in beginning • Expert that understands integrated design process and synergies • Assessing costs • Contractor access and limitations–R • Supply and cost of low VOC paints • Tenant behavior • Carpet and cabinets (off-gassing and asthma)	• Design charette (particularly in dealing with mechanical systems) with facilitator that understands interplay between systems and strategies • Community meeting as alternative to charette • State university involvement, analysis, and verification support • Bamboo flooring • Painted plywood sub-floor • Buy in bulk (e.g., ceramic tiles) • Polished concrete floors

"R" indicates a rural-specific challenge.

Materials and Resources	
Challenge	**Response**
• Fewer suppliers–R • Transportation, labor, and material costs can be higher–R • Limited contractors–R • FSC product availability is limited–R • Quantifying waste management • Local codes prohibiting metal frames • Contractor buy-in • Regulations on wood • Defining a local lumber source	• Engineer can grade-stamp lumber • Hire contractor prior to going out to bid (partnering w/ contractor) • Framing plans • Quantifying waste diversion (average dumpster weight) • Considering modular development (more controlled work environment, less waste, on time, labor market) • Form green builders group to put pressure on local lumberyards • Donated materials from deconstruction • Building materials rep to green conferences

Energy and Atmosphere	
Challenge	**Response**
• Vinyl windows are cheaper than environmentally preferable windows • Cellulose costs and availability–R • Air infiltration and air leakage • HERS difficult to monitor and administer–R • Staff capacity and contractor oversight • Contractor knowledge • Cost of renewables	• Ceramic tile for thermal heat gain • State universities for technical oversight, performance testing (departments of technology, architecture, engineering) • Projects become photovoltaic/solar hot water heater-ready for future • Commissioning (third-party verification) • Environmental Building News resources, LEED for Homes Providers, HUD newsletter

"R" indicates a rural-specific challenge.

Homeowner Awareness	
Challenge	**Response**
• New tenants coming in • Ongoing follow up and maintenance • Lack of resources and time for housing counseling • Cleaning products, repainting	• Pre-qualified homeowners involved at design/pre-construction phase (early buy-in) • Mailings, handouts, continued contact with homeowners, tenants • Reserve fund (7 year period) • Build houses that don't need a lot of maintenance • Homeowner manual • Post-construction charette for owners and operators • Tenants educate each other • Maintenance calendar (multifamily projects)

1) What are your future plans for green building?

- Peer-to-peer training
- Zero net energy homes
- Entering housing project in a design competition

2) What roles can funders and intermediaries play in advancing green building?

- Provide support for local organizations
- Incorporate input from groups doing local development work
- Provide policy advocacy for affordable green building
- Support education for local municipal staff (on-site education)
- Develop cost savings analysis to show potential green costs savings, while making sure not to overburden local affordable developers with data requirements
- Develop green underwriting standards so low-income residents can borrow more
- Educate policymakers about how smart growth laws can have disparate impacts on rural communities
- Develop monitoring systems for data collection on green affordable housing

"R" indicates a rural-specific challenge.

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The Housing Assistance Council brought together national green building organizations, local rural housing organizations with a history of green building, funding organizations, and other stakeholders in the sustainable housing development movement in a roundtable forum to explore the specifics of green affordable housing and the challenges in rural areas. This report synthesizes the roundtable findings and provides a foundation for further exploration of the issues surrounding rural green affordable housing.

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