Appalachia-Science in the Public Interest
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ASPI TECHNICAL SERIES TP 71

High Performance Buildings- Bringing Environmentally Sound Building Practices Into the Mainstream in Kentucky

Introduction

The movement to make high performance building standard practice is gaining momentum in the United States and Kentucky. "High performance building," also known as "green building," emphasizes reducing the impact of buildings on the environment. Such buildings have been proven to provide many social and economic benefits to building owners, users, and the wider community. These include reduced long-term operational and maintenance costs and improved health and well-being for building occupants.

This report provides an overview of the benefits and principles of high performance building. It addresses activities around the USA and within Kentucky aimed at bringing high performance building into the mainstream. Examples of green building initiatives in Kentucky are described, followed by strategies which can help this movement flourish in the Commonwealth. The principles and practices of high performance building are being applied in all sectors of the building industry - commercial, industrial, and residential, in addition to schools and other public facilities. The benefits of high performance building can be experienced by everyone who uses these buildings, and all of us who rely upon a healthy environment.

An Overview of High Performance Building

Site-Sensitive Design

Buildings both affect and are affected by the site where they are built. A site-sensitive design process will reduce adverse impacts to the land and watershed, prevent erosion, minimize storm water runoff, and reduce impacts on vegetation, wildlife, wetlands, and waterways. Green design also utilizes the site's available resources to enhance the facility. Sun, wind, soils, water, and vegetation can all significantly contribute to the design and functioning of a building, providing heat, light, cooling, ventilation, construction materials, aesthetic features, and other services.

Energy Efficiency and Renewable Energy

Energy efficient design can reduce the energy use of buildings by 50% or more, using standard technologies and well-tested design strategies.[1] Among the primary strategies for reducing energy use in buildings are: the use of high efficiency lighting, HVAC, and other equipment; natural daylighting; high-efficiency windows; passive solar heating; proper insulation; and an integrated design process. The use of renewable energy sources, such as solar photovoltaics, solar water and space heating, and wind, is another means for reducing environmental impacts of buildings. Renewable energy systems can also increase energy security for building occupants by reducing dependence upon centralized power distribution systems.

Water Efficiency

Green building makes efficient use of water, both within the building and on the surrounding landscape. Using water-efficient appliances, capturing and utilizing rainwater, processing wastewater on-site in biological treatment systems (such as constructed wetlands), and using efficient irrigation systems (or landscaping that does not require irrigation), are among the most common water conservation strategies employed.

Material Use and Waste Reduction

The materials selected for building construction can contribute significantly to local and global environmental problems. For example, the 100 million tons of cement used annually in the United States are responsible for 1.6% of all global CO_2 emissions. Increasing levels of CO_2 in the atmosphere are likely contributing to global warming and climate change.[2] High performance building strategies seek material options which minimize the environmental impacts associated with the manufacture, transport, and installation of those materials. Salvaged materials, materials containing high levels of recycled or rapidly-renewable materials, very durable materials, and materials whose manufacture involves less energy or hazardous by-products are all favored in green design. Locally-produced materials are also favored, because they require less energy for transportation.

Both building design and conscientious site management by contractors can contribute to recycling and the minimization of waste during the construction process. Building design can allow for easier remodeling and renovation, reducing waste when offices are reconfigured or additions made. Designing for longevity, which is commonly neglected in modern construction, is another key component of green design. The longer a building and its components last, the fewer the resources needed to replace them.

Indoor Environmental Quality

Indoor environmental quality (IEQ) involves the overall comfort and health of a building's occupants. This includes good air quality, comfortable temperatures and acoustics, and aesthetic qualities. Numerous studies have found that the use of natural daylighting increases student learning, worker productivity, and occupant satisfaction. Studies have documented student learning rates increasing by more than 25% in daylit classrooms versus non-daylit classrooms. Research has documented reduced rates of absenteeism and increased teacher retention in schools utilizing natural daylighting and other high performance design principles.[3]

The indoor air quality (IAQ) of a building has a substantial effect on the health and productivity of its occupants. IAQ is becoming an issue of national concern, as it has been linked to increased rates of asthma and other illnesses, and has resulted in lawsuits against building owners, the closure of schools and office buildings, and millions of dollars in building renovation costs.[4] Maintaining high IAQ requires the control of air contaminants and the provision of adequate fresh air. This can be a complex procedure in a modern building due to the complexity of ventilation systems and the diversity of air contaminant sources. These sources include building materials such as floor surfaces, wall finishes, furniture, paints, adhesives, and office and laboratory equipment; outdoor pollution sources infiltrating the building; cleaning chemicals used for maintenance; and the occupants themselves.[5] Proper building design, material selection, and construction and maintenance practices are necessary to achieve high IAQ.

Benefits of an Integrated Design Process

All of these aspects of high performance building are brought together through an integrated design process, which views the building as a whole system existing within larger systems - the environment and the community. Understanding how the various components of a building relate to one another, the environment, and building users reveals opportunities for design improvements which are commonly overlooked in conventional design. One key to integrated design is communication between the many professionals working on a building, as well as building owners and users, beginning early in the design process and continuing through construction. When this process is followed, benefits are realized in terms of improved quality of life for building occupants, reduced environmental impacts, and an array of economic benefits.[6]

Significant savings from reduced operational and maintenance costs can be accrued over the lifetime of a building, due to energy efficiency, water conservation, and other green building strategies. Energy savings of 25%-50% or greater can be readily achieved through high performance design strategies, often without increasing the initial cost of construction.[7] Such savings can translate into hundreds or thousands of dollars per year for a homeowner, or hundreds of thousands to millions of dollars per year for large commercial or institutional buildings.

Other benefits of high performance building include reduced liability risks for building owners due to

improved indoor air quality. At the residential scale, healthier homes can translate into healthier families and lower health care costs. At the commercial-industrial scale, increased worker productivity and satisfaction can translate into greater profitability for firms occupying high performance buildings. Increased student performance and reduced absenteeism rates may help schools in certain areas access public funding.

Green Building Rating Programs

There is no single, absolute definition for what a "high performance" or "green" building is. Almost any structure will have some impact on the environment, and buildings can incorporate green design strategies in various combinations and to varying degrees. Green building rating systems such as LEED (Leadership in Energy and Environmental Design) offer a means for assessing "how green" a building is and enable comparisons among buildings. LEED is a national certification program, which is presently only available for new commercial buildings and major renovations. Guidelines for other building types and categories (such as Existing Building Operations and Commercial Interiors) are under development or being field-tested. Several regional programs, such as Earthcraft House in Atlanta and the Austin Green Builder Program in Austin, Texas, offer green building rating programs focused on residential construction.[8]

LEED was developed by the US Green Building Council (USGBC) in the late 1990's. It provides a point-based system for evaluating the level of high performance a building has achieved, and has become the definitive standard for green building in the United States. The system provides objective criteria and a verification and documentation process which increases the accountability of building professionals, yet also allows them to market their services and projects according to a respected standard. The USGBC provides LEED training and certification to design professionals.

LEED-certified buildings must meet green design standards in the following areas: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation and design process. LEED serves not only as a standard but as a design guide, assisting clients and designers in achieving high performance goals. LEED's growing prominence has been a significant force in educating design and building professionals about the green design process, and is helping to shift the building industry towards high performance.

High Performance Building in Kentucky

Interest in high performance building has grown rapidly in Kentucky in recent years. Numerous organizations, design and engineering firms, and government agencies are now actively involved in building, designing, and advocating for high performance building. The following section profiles three green building projects in Kentucky. The first, St. Benedict's Center in Louisville, exemplifies how passive solar design can dramatically reduce energy costs without increasing up-front construction costs. The second project, at the Bernheim Forest in Clermont, demonstrates an array of innovative building strategies in a facility which costs significantly more than the norm. The third project, the Ecovillage at Berea College, provides a model of how green design can be applied to residential structures, multi-family housing units, school buildings, and community planning. Following these case studies, several organizations will be described that are working to make Kentucky's buildings more resource efficient and environmentally sound.

St. Benedict's Center – Louisville, Kentucky

St. Benedict's Center is a childcare center in a low-income section of Louisville, Kentucky. The Center, completed in 1997, serves over 100 children and was designed to be a model of environmental stewardship. The 10,550 square-foot facility's passive solar design includes 1,005 square feet of south-facing glass and a clerestory, which provides natural daylight to north-facing classrooms. As a result of the daylighting design, the building requires almost no electric lighting during the daytime. The building's forced-air delivery system is embedded within its concrete floor, effectively linking a heavy thermal mass to the heating and cooling system. These features combine with super-insulated walls, roof and foundation, resulting in annual energy bills 40-50% lower than typical buildings of its size.[9]

St. Benedict's Center grew out of the vision of the Sister's of Loretto, a Catholic religious congregation whose mission includes environmental stewardship. The Sister's aspired to build a childcare center that was comfortable, healthy, safe, and a credit to the community, in addition to being environmentally responsible. The Center was designed by Gary Watrous of Watrous Associates Architects in Louisville. Watrous specializes in super-insulated, passive solar buildings, and has described St. Benedict's Center as his "best building."[10] This result was achieved at a building construction cost of "about 10% less than comparable school/ institutional buildings in the Louisville area."[11]

Photograph by Gary Watrous

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Bernheim Forest Visitor's Center - Clermont, Kentucky[12]

Bernheim Forest is a 14,000 acre, privately owned, non-profit arboretum and nature preserve near Louisville, Kentucky. Prompted by an expanding educational program, Bernheim began building a new 6,200 square foot Visitor's Center in July 2003. The Center is incorporating a wide array of innovative high performance design strategies and is aspiring to achieve a Platinum LEED rating (the highest possible rating).

To achieve greater energy efficiency, the building will have a "green roof" covered with soil and vegetation, and will utilize natural daylighting and geothermal heating and cooling. Geothermal systems utilize the earth's stable year-round temperature to moderate the temperature of incoming air used in a building's heating and cooling system. The result is that less energy is required to heat the building in the winter and cool it in the summer. Bernheim's existing Visitor's Center and Classroom already uses a geothermal system, which cut the building's electric bill by two-thirds after installation.

The new Visitor's Center will be a post-and-beam structure, constructed almost entirely from salvaged cypress lumber donated to Bernheim by the Heinz Company in Ohio. Bernheim's staff had to disassemble 20 large pickle vats and 39 smaller barrels to prepare the lumber for use in the building. Two local bourbon distillers donated additional salvaged lumber from dismantled whiskey warehouses. The building's foundation will contain 50% fly ash, a waste product from coal combustion that actually produces a stronger concrete. With an emphasis on providing a healthy indoor environment, all paints and sealers used will be among the safest available.

The project will utilize a variety of innovative systems for managing wastewater and storm water. A biological system involving oyster shell mushrooms will treat storm water runoff by filtering and breaking down pollutants from parking lots, to prevent them from contaminating nearby lakes and groundwater. A peat septic system will treat the building's wastewater, and waterless urinals will reduce water use.

The Bernheim Visitor's Center will cost four times more than a similar conventional building. However, the Center expects to recover most, if not all, of the additional costs through reduced operating expenses over the life of the building. Bernheim's staff also views higher up-front costs as the price of innovation, and they are using this project as an opportunity to educate and inspire the local community about green building. They have held workshops for the general public and building professionals on the innovative techniques used in the Visitor's Center and have witnessed a great deal of enthusiasm for the project. The lessons learned on this building will be applied to other buildings at the nature preserve. Bernheim's commitment to research, innovation, education, and environmental stewardship makes them an important resource in the region.

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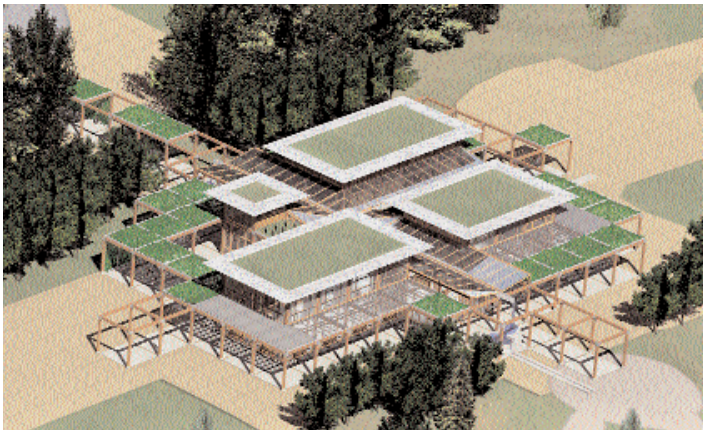

Berea College Ecovillage - Berea, Kentucky

Berea College is a small, progressive liberal arts school located in the western foothills of Appalachia. The College has made a commitment to engage in good stewardship of its natural, human, and material resources. To this end they have taken action to transform their operations and curriculum into a model of sustainability.[13] These actions have included upgrading campus energy systems to make them more efficient and less polluting, renovating historic buildings to achieve high performance standards, and establishing an interdisciplinary Sustainability and Environmental Studies (SENS) program to educate students about the principles and practice of environmental stewardship and sustainability.

Students in the SENS program played an integral role in the design of a five-acre Ecovillage, a student-housing community that will include "50 apartments for married and single parents with children; a state-of-the-art child care center for 120 children; a commons house for community meetings, meals, and study; Kentucky's first living machine that will treat sewage and greywater with natural rather than chemical processes; the [SENS] house, which will be a focal point for education and research on sustainable living; and urban gardens along with a permaculture food forest."[14]

The Ecovillage was designed to meet the following high performance goals:

"Reduce energy use by 75%

Reduce water use by 75%

Generate 10% of its electricity on-site from renewable sources

Treat wastewater and storm water on-site to swimmable quality

Recycle or re-use 50% of its municipal waste."[15]

The site was designed to promote community gatherings and interaction, provide a central green space, and restrict parking to the perimeter of the site. Garden spaces were chosen early on to utilize the highest quality soil, and all topsoil was preserved during construction. The residents of the Ecovillage will be encouraged to participate in community activities, to utilize the childcare facility, and to join in sustainability efforts such as energy conservation and recycling. Student residents of the SENS house will be present to provide support to the other residents, conduct workshops, and monitor the Ecovillage's performance.[16]

The Berea College Ecovillage will serve as a model of high performance, sustainable design on many levels. As a housing project and community development, the Ecovillage will offer an alternative vision and real-

world example of how housing developments can be designed to support environmental stewardship and healthy community. The lessons learned will be relevant to low-income housing providers and residents, as well as people seeking to buy or build their own homes. Berea College's many sustainability projects are helping to drive the movement toward sustainability in Kentucky, in part by involving many building professionals in the process. The College is demanding high performance buildings, and as the building community stretches to respond, they are gaining greater experience in this emerging field.

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Tel: (415) 332-5806, www.vanderryn.com

Principal Architect, Child Development Lab: **GBBN Architects**, Joe Turley,
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Tel: (859) 381-8787, www.gbbn.com

Other Kentucky Initiatives

U.S. Green Building Council

The U.S. Green Building Council (USGBC) is one of the pre-eminent organizations in the United States promoting high performance building. It's 3,000-plus members include corporations, builders, universities, federal and local agencies, and non-profit organizations. The USGBC is responsible for developing and managing the LEED green building rating system. In 2003, professionals in Kentucky's building industry began to form a Kentucky Chapter of the USGBC. Not surprisingly, many of the firms present at the initial USGBC-KY meeting had been involved in green building projects at Berea College. According to one of the organizers of the local Chapter, one of the USGBC's primary roles is educating architects and building owners about the principles of green building design.[17] The Council also works to reduce the perceived risks of building green, by demonstrating that innovative design strategies are reliable and cost effective. The Council's ultimate goal is to transform the building market so that high performance design becomes the standard throughout the nation.

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USGBC, National Office, 1015 18th St., NW, Suite 805, Washington, DC 20036
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USGBC, Kentucky organizing group:
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High Performance Schools Initiatives

The Kentucky Division of Energy (K-DOE) has partnered with the Sustainable Building Industries Council (SBIC) and the Kentucky NEED (National Energy Education Development) Project to promote high performance building within Kentucky's public school system. The many advantages of high performance building, including its potential to increase student learning, provide healthier indoor environments, and reduce operational costs, make it especially attractive to school systems that are constructing new facilities or renovating existing buildings. The SBIC has been providing workshops around the USA to educate school decision-makers, facility managers, architects, and engineers about the benefits and characteristics of high performance buildings, and the process that is most effective for creating such facilities. K-DOE and KY-NEED hosted such a workshop for 150 participants in Georgetown, Kentucky in May 2003. With hundreds of millions of dollars being invested in the renovation or construction of dozens of schools throughout the state, there exists a tremendous opportunity to provide better learning environments (and therefore better futures) for Kentucky's children.

Contact Information:
Kentucky Division of Energy
663 Teton Trail, Frankfort, KY 40601, Tel: (502) 564-7484, www.energy.ky.gov

Sustainable Buildings Industry Council
1331 H Street, NW, Suite 1000, Washington, DC 20005, Tel: (202) 628-7400, www.sbicouncil.org

KY-NEED Project
PO Box 176055, Covington, KY 41017-6055, Tel: (859) 578-0312, www.need.org

KY Pollution Prevention Center

The Kentucky Pollution Prevention Center (KPPC) is a non-profit organization established by the general assembly to provide waste reduction and pollution prevention technical services to Kentucky businesses and organizations. KPPC's services help existing facilities achieve higher performance in terms of energy efficiency, resource conservation, and waste minimization. Their free services include on-site visits to assist clients with problem waste streams, energy efficiency assessments and training, pollution prevention research, and a materials exchange program to find new uses for waste products. These services are non-regulatory, confidential, and have helped KPPC's clients save thousands of dollars.

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Kentucky Pollution Prevention Center
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Kentucky Weatherization Programs

The Kentucky Weatherization Program provides energy conservation improvements to low-income households to help reduce energy costs while making homes healthier and safer. Eligible families must have a total income at or below 125% of the poverty level or have had a resident who received SSI or K-TAP (Kentucky Temporary Assistance Program) sometime in the previous twelve months. The Program is operated by local Community Action Agencies, which have offices throughout the State.

The Weatherization Program typically spends about $2,500 per housing unit and weatherizes approximately 2,000 units each year. The services provided for each home are based on a site assessment and a computerized energy audit. Renovations "may include repair or replacement of heating systems;

elimination of carbon monoxide spillage and fuel leaks; reduction of air infiltration; carbon monoxide detectors and smoke alarms;"[18] or added insulation. Renovations are followed up with an energy education program for participants. Studies have found that participating households save about $300 annually on energy costs. About 50,000 homes have been weatherized in Kentucky since the inception of the program.[19]

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Kentucky Association for Community Action, Inc.
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Louisville Metro Air Pollution Control District

The Louisville Metro Air Pollution Control District (APCD) has taken a leadership role in the Louisville area to bring high performance building further into the mainstream. APCD has provided encouragement and technical support for Louisville Metropolitan Housing Authority to incorporate high-performance green building design into its redevelopment of the Clarksdale housing project. A central component of this project has been a design charrette facilitated by the Southface Energy Institute early in the design process. A design charrette brings together all of the stakeholders and design professionals working on a project to develop an integrated plan. The goals of the project were to provide a case study for the development of future green building projects in the region and to increase the capacity of local professionals to design and build green buildings utilizing the charrette process. This is one of several ongoing projects organized by the Louisville Metro APCD focused on advancing high performance building.

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ASPI and the KY Solar Partnership

Appalachia - Science in the Public Interest (ASPI) operates two demonstration centers for sustainable living technologies in Rockcastle County, Kentucky. They provide models of building systems that can be utilized in high performance construction, such as solar electricity and water heating, composting toilets, rainwater collection, and artificial wetlands. ASPI also houses an extensive library of resources related to sustainable design and construction.

The KY Solar Partnership (KSP), organized by ASPI, was formed to promote the use of solar energy. KSP is developing a network of professionals, organizations and individuals interested in solar energy applications. It provides educational programs, advocates for policy change, and supports the installation of solar systems. In particular, ASPI is advocating for "net metering," which allows a home or business owner to generate power from an on-site solar electric system and pay only for the "net" difference between the energy they generate and the total energy they use. Through ASPI's efforts, net metering was approved by the Kentucky Public Service Commission for certain utilities in March of 2002 and support is building in the state legislature for a bill which would mandate access to net metering statewide.

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ASPI and the Kentucky Solar Partnership
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Kentucky Division of Energy

The Kentucky Division of Energy (K-DOE) is an active advocate of high performance building and has provided significant support to many of the projects described above. K-DOE has provided funding, educational programs, organizational support, and other services to numerous organizations, businesses, and agencies throughout the state that are working on green building, energy efficiency, and renewable energy projects.

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Advancing High Performance Building in Kentucky

Barriers to High Performance Building

What is needed to continue advancing the high performance building movement in Kentucky? How can we reach the point where high performance is the standard in all building sectors? A response to these questions requires a look into the barriers standing in the way of green building. Interviews with Kentucky professionals working in the field revealed a number of significant barriers to high performance building:

Economics- Real and perceived economic barriers inhibit the development of green building projects. While some high performance design strategies and innovative technologies can increase design and construction costs, many high performance goals can be achieved without such cost increases. An integrated design process can shift costs within a project without increasing overall costs. For example, high quality windows and super-insulation may cost more than conventional alternatives, but if they allow for smaller HVAC equipment, the overall project cost may not increase. When long-term building operational and maintenance costs are factored into the equation, the economics of green building often become very favorable, as investments in energy efficiency reduce utility bills over the life of the building.

An added barrier at the state level is the extremely low cost of electricity in Kentucky, currently the lowest in the nation. This reduces incentives for conservation, energy efficiency, and the use of renewables. When energy prices increase, the cost of wasting energy becomes more noticeable and payback times for efficiency investments decrease.

Lack of Education and Information- There is a lack of education and accurate information in all sectors of the building community. Most building professionals remain unfamiliar with high performance design strategies and practices. Most clients who commission buildings - from developers to school officials to homebuyers - are unaware of the possibilities green building affords and the process needed to achieve them. There are also misconceptions that high performance must cost more or that its strategies are unproven and risky.

People interested in green building often face difficulties finding local designers and contractors skilled in this field. They also have trouble locating environmentally preferable building supplies, such as non-toxic paints or sustainably harvested wood.

Resistance to Change- People often resist doing things differently and high performance building can involve unfamiliar construction and development practices. Some of this resistance may be a response to the extra time needed to learn new practices, which can slow down the construction process.

Prejudice Against "Green"- Among some people the term "green building" evokes images of strange-looking solar homes, "tree huggers" living in shacks in the woods without electricity or running water, or designs that are costly, experimental, and impractical. This is one reason why the term "high performance" is sometimes used instead of "green." Green building advocates need to communicate and demonstrate that this approach to building produces facilities that are holistically superior to conventional construction in terms of economics, building performance, health and well-being, and environmental protection.

Perversities in the Design and Construction Process- In "Energy-Efficient Buildings: Institutional Barriers and Opportunities" (1992), Amory Lovins details the "perverse incentives" that reward inefficient practice throughout the process of designing, constructing, and operating buildings. "Fragmented and commoditized design, false price signals, and substitution of obsolete rules-of-thumb for true engineering optimization have yielded buildings that cost more to build, are less comfortable, and use more energy than they should."[20] Lovins explores each of these inefficiency incentives in detail. He offers recommendations for "reinventing the building design process"[21] and calls for significant reforms to the institution and culture of the building industry.

Advocacy Strategies for Advancing Green Building

Numerous organizations across the US are working at the local, regional, and national scale to bring high performance building principles and practices into the mainstream building industry. These organizations are employing a variety of strategies which can be (and already are being) applied in Kentucky, to overcome the barriers that are holding back the green building movement. Some of these strategies are as follows:

Education- Educational programs directed towards all segments of the building industry, government, and the general public are needed to raise awareness of the many benefits of high performance building and the strategies for achieving them. Education will increase market demand for green building and increase the capacity of local professionals to meet that demand.

Training- Green building professionals across the country recognize the need to provide training for architects, engineers, and contractors in high performance design and construction practices. Training is offered to design professionals in areas such as daylighting, passive solar design, and the LEED rating system. Contractors can receive training in areas such as super-insulated construction, solar electric, and solar water heating systems.

Market Transformation- Transformation of the building market is one of the primary goals of the green building movement. Certification programs such as LEED are important mechanisms in that process, providing industry standards for "green" construction and raising the bar for what constitutes "high performance" building. To achieve market transformation, green building advocates work closely with members of the building industry and public agencies, advancing the message that high performance buildings can be more profitable to build and sell, while being less costly to operate and maintain. As the market shifts to favor green construction (as it already has, for example, through building codes that mandate increased energy efficiency), green practices that are presently cutting-edge will eventually become mainstream and familiar to the average designer and builder.

Technical Assistance and Services- Design reviews, energy modeling, on-site energy audits, and building renovations are some of the services that can be provided to help designers, building owners and managers, homeowners, and renters to incorporate high performance strategies into their buildings.

Government Leadership- Working with government agencies and legislative bodies is essential for advancing green building. Local and state governments can support green building through the adoption of high performance building guidelines for public projects; legislation setting high energy efficiency and water conservation goals for public facilities; incorporation of high performance standards into building codes; and providing incentives for investments in energy efficiency, renewable energy, and similar technologies. Legislation can also remove barriers to green building. Net-metering legislation, for example, would require utilities to credit consumers for power generated by on-site renewable energy systems.

Networking and Coalition-Building- Networking is an important role for organizations such as the USGBC. It provides opportunities for professionals to share experiences and expertise, and helps people access resources, information, and support. Networks can foster a sense of community, lending strength to a movement. They can also become a political force, enabling people to organize to accomplish common goals.

Linking Green Building to Other Social Needs- High performance building offers such a wide array of benefits that its advancement can help society to address an equally wide array of social concerns. Green building advocates may find strength and support by linking their movement to other social concerns, forming networks of mutual support with organizations in fields both within and outside of the building industry. Potentially valuable networks may be organized around: energy security; economic development; public health; education; affordable housing; environmental and social justice; community enhancement; transportation; and, of course, the environment. The green building movement has something of value to contribute to each of these social concerns.

Conclusion

The rapidly expanding green building movement is taking hold in Kentucky and is gaining support among building professionals, government agencies, schools, and non-profit organizations. The benefits of high performance building are numerous and, if embraced, can significantly improve the quality of life, the economy, and the environment in Kentucky. While significant barriers remain to the widespread adoption of green building practices, numerous strategies for overcoming those barriers are available and are being successfully employed in many parts of the United States, including Kentucky. Collaboration among diverse groups with common interests may be one key to more fully integrating high performance building into Kentucky's building industry.

Resources

A Builder's Guide to Energy Efficient Homes in Georgia. 1999. Georgia Environmental Facilities Authority, Division of Energy Resources, Atlanta, GA. (404)656-7970. www.gefa.org.

Energy and Environmental Building Association, www.eeba.org - Trade organization for energy efficient builders.

Environmental Building News - A widely respected monthly journal available for $99/year, published by BuildingGreen, Inc., 122 Birge St., Suite 30, Brattleboro, VT 05301, (802)257-7300 or (800)861-0954. Provides objective reviews of green building technologies and materials. BuildingGreen's GreenSpec Directory provides more than 1,650 listings of green building products. Their Premium Web Content offers GreenSpec and past issues of EBN in a searchable database, along with a database of green building case studies. Visit www.BuildingGreen.com.

Environmental Design and Construction magazine - free subscription available at: www.edcmag.com

Green Buildings: Commonwealth of Pennsylvania Guidelines for Creating High Performance Green Buildings, 1999, by Bob Kobet, Wendy Powers, Stephen Lee, Christine Mondor, and Marc Mondor. Produced on behalf of the Commonwealth of Pennsylvania and available on-line at www.gggc.state.pa.us.

Green Building Guidelines: Meeting the Demand for Low-Energy, Resource-Efficient Homes - Produced by the Sustainable Buildings Industry Council (SBIC) with support from the US Department of Energy, and available from the SBIC website, www.sbicouncil.org.

High Performance Building Guidelines - An excellent manual developed by the City of New York's Department of Design and Construction. Available on-line at www.ci.nyc.ny.us/html/ddc/

Oikos Green Building Source - A green building design news service, bookstore, and searchable on-line data base for green materials, products, methods, and companies. www.oikos.com.

Southface Energy Institute, Inc., 241 Pine St., Atlanta, GA 30308, (404)872-3549, www.southface.org. Southface offers extensive resources, technical services, and training programs in the sustainable building field.

U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, www.eren.doe.gov/EE/buildings.html

Footnotes

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4. Brennan, Terry. 2001. "Responding and Preventing IAQ Problems at School: Part 1," in HPAC Engineering, September; and Brennan, T. 2001. "Responding and Preventing IAQ Problems at School: Part 2," in HPAC Engineering, October.

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7. Ibid.

8. Information on LEED and the US Green Building Council from USGBC website, www.usgbc.org. Earth Craft House website, www.earthcrafthouse.com and the Austin Green Builder Program website, www.ci.austin.tx.us/greenbuilder.htm

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19. Ibid.

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