



research works

A bridge linking housing research and practice

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High-Performance House Maximizes Green Design



Workers connect a radiant floor heating system in the Paterson Showhouse.

This summer, in Paterson, New Jersey, ground was broken for a 2,900-square-foot, three-story demonstration house that combines some of the best building practices, materials, and technologies available to homeowners today. Many affordable housing technologies evaluated by the Partnership for Advancing Technology in Housing (PATH) will be demonstrated. The project is part of a global "Better Home, Better Planet Initiative" launched by BASF-The Chemical Company, which seeks to "...offer real-life solutions for builders, architects and homeowners that are mindful of the environment." Although BASF is spearheading the project, over 50 companies and organizations are contributing products, materials, technologies, and time.

Features of the Paterson Showhouse

The smart technologies incorporated into the Paterson Showhouse highlight "green design solutions." Green

design results in healthy, energy-efficient homes that are economical, durable, and have aesthetic – as well as environmental – appeal. The high-performance Paterson Showhouse will be used to educate homeowners, architects, builders, government officials, realtors, financial institutions, and others in the art of the possible. In addition, this home is being designed to be fully accessible, in that it will eventually be donated to a physically challenged individual.

Aggressively energy-efficient, the Paterson Showhouse will reduce energy consumption by taking advantage of renewable energy sources and will even generate supplemental energy. It all begins with an upgrade of the building envelope, or exterior wall structure, which uses three foam technologies:

- Basement walls are made of insulating concrete forms (ICFs), each consisting of two panels of expanded polystyrene (EPS) rigid insulating foam connected by steel ties. Concrete is poured into the space between the foam panels, which provide thermal insulation;
- Monotech Building System panels are used in the first-floor walls. The core of the Monotech panels is rigid EPS insulation. Once the panels are in

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place, a one-half-inch layer of a fiber-reinforced polymer-enhanced blend called Monocrete is sprayed or troweled on both sides of each panel. The Monocrete, which has been specifically designed to bond to the EPS foam, is then finished into the desired texture or style, creating a rigid structural skin; and

- The second floor and roof consists of structural insulated panels (SIPs) from Insulspan. The system consists of solid, one-piece, pre-cut panels that are ready to install as wall, floor, or roof components. Each SIP consists of a core of molded EPS insulation with engineered oriented strand board (OSB) laminated to the top and bottom faces.

All three types of building materials—the PolySteel ICFs, Monotech panels, and the Insulspan SIPs—use Styropor EPS from BASF, which, according to Jack Armstrong, business manager for BASF's Styropor EPS business in North America, "provides the best cost-to-R-value ratio of thermal insulation foams." In addition to being energy-efficient and green, the three foam-based building materials reduce construction time due to installation efficiencies. They're also durable and resistant to insect infestation, and result in quieter, more comfortable homes.

Beyond the building envelope, the Paterson Showhouse features a number of other smart building techniques and technologies. For instance, it incorporates Zero Energy Housing (ZEH) concepts developed by the Oak Ridge National Laboratory. A zero-energy home uses solar panels and other alternative energy sources to generate as much energy as it consumes. As a result, the home draws no energy from the power grid, and in some cases, can even feed electricity back into the grid. This turns the home's electric meter backward,



Structural insulated panels (SIPs) form the second floor of the Paterson Showhouse.



Insulating concrete forms (ICFs) in the basement walls provide thermal insulation.

a condition known as 'net metering.' The Paterson Showhouse has a solar energy system that not only generates electricity, but is also integrated with the home's domestic hot water and heating systems for maximum efficiency. The system is architecturally integrated into a cool metal roof.

Other technologies and systems being integrated into the Paterson Showhouse are:

- A Rehau radiant floor heating system integrated into precast concrete floor panels on the first and second floors;
- A properly-sized HVAC (heating, ventilation, and air conditioning) system that includes a Viessmann condensing boiler, indirect water heater, and solar storage tank;
- Low-e film-treated windows to block most solar heat gain while allowing visible light to enter the home;
- A plastic plumbing manifold, which acts as a control center to feed hot and cold water through flexible supply lines to individual fixtures;
- A two-stage, variable-speed Amana air-conditioning system and UltimateAir RecoupAerator whole-house energy recovery ventilator to improve indoor air quality and to control indoor temperature and humidity levels; and
- A Siemens automated home control and security system with touch-screen programming.

Other green, energy-efficient features will include Energy Star® appliances, natural linoleum flooring, a

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Typically administered by a public or quasi-public agency, a housing trust fund (HTF) provides financial assistance to meet the housing needs of low-income households. The Center for Community Change (CCC), a nonprofit organization that monitors HTFs, reports there were over 400 being run by cities, counties, states, and regional entities at the end of July 2005—and the number continues to grow.

However HTFs around the nation are designed, they all have something in common. Each has a dedicated source of public revenue for developing and preserving affordable housing, established by ordinance, legislative act, or public vote. Beyond these general characteristics, no two housing trust funds look exactly alike. One reason is that there's a great deal of diversity in what fuels HTFs. Arizona's HTF, for example, receives over half its revenue from unclaimed monies left in bank accounts, deposits, layaway fees and refunds that add about \$6 million annually to the fund. Washington and Connecticut fund their HTFs with general obligation bonds and document recording fees. Illinois doubled its real estate transfer tax, directing half of every dollar collected to its HTF. Duluth, Minnesota will divert a portion of its share of casino revenues to its HTF each year for the next five years. Others use revenue from developer fees, property and sales taxes, tourist taxes, permit fees, demolition and conversion fees, tax increment funds from redevelopment districts, interest earned on real estate escrow accounts, and tideland oil revenue. HTFs may also receive appropriations and special allocations from such sources as budget surpluses, lottery earnings, or the sale of public property.

The CCC reported in 2002 that housing trust funds accrued anywhere from \$100,000 to over \$300 million per fund annually. That year, approximately \$750 million in housing trust funds were spent on housing projects nationwide. The use of funds is often coordinated with other housing-targeted dollars, perhaps as a required match. Illinois, for example, leveraged \$5.50 from other sources for every trust fund dollar spent during the 1990s.

How are the funds used?

Community members appointed to advise, oversee, or direct the use of trust funds typically include lenders, developers, nonprofit organizations, and low-income residents representing a broad spectrum of the housing community. The monies often flow

out of trust funds in the form of competitive grants or low-interest loans—perhaps to a developer, a housing authority, a nonprofit organization, or a Native American tribe—for eligible housing activities. First-time homebuying, rental assistance, emergency repairs, rehabilitation, weatherization, and new construction are among the types of programs funded. Burlington, Vermont's program is steered by a policy that stresses the opportunity to move up a ladder of housing options, starting with shelter housing at the bottom and progressing to ownership at the top.

Those most in need, with the lowest incomes, are the usual recipients of services. The Missouri Housing Trust Fund, for example, sets an income ceiling at 50 percent or less of the area's median income, and dedicates one-half of its resources to households with 25 percent or less of the median income. A regional housing trust fund in King County, Washington prioritizes target populations for housing services, directing a larger portion of the funds toward meeting the needs of families, rather than for homeless and transitional, elderly, and other special needs populations.

Pluses and Minuses

One of the problems experienced with housing trust funds is reaching an adequate level of funding. For example, California's offshore oil drilling generated only \$2 million a year for its HTF, instead of the anticipated \$20 million. Budget troubles may also jeopardize an HTF, as was the case in Tennessee. In 2000, the Tennessee General Assembly redirected HTF-dedicated tax revenue to the state's general fund to help meet shortfalls, and has not made the HTF whole again. There is also some concern that HTFs sometimes fail to serve the lowest income groups. On the other hand, HTFs permit leverage and coordination with other resources, elicit local input and solutions, and can address the immediate needs of particular communities, such as the elderly, the disabled, farm workers, rural residents, low-wage earners, and the homeless.

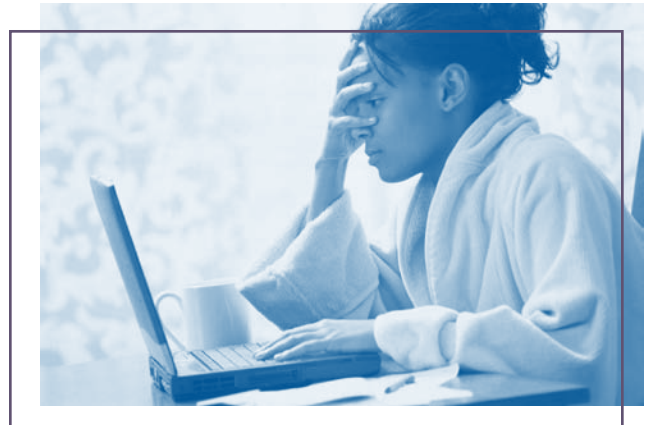
For more information, see CCC materials at www.communitychange.org/issues/housing/trustfundproject; the Fannie Mae Foundation Issue Brief, "Affordable Housing Trust Funds," at www.knowledgeplex.org/kp/new_content/policy_brief/relfiles/ahtf_brief.pdf; and Community Investments (Sept. 2005), a special issue on affordable housing published by the Federal Reserve Bank of San Francisco at www.frbsf.org/community. ■■■

p Linking Housing Need With Opportunity

Seekers of decent, affordable housing and property owners looking to rent or sell are turning to web-based services to find one another. Some services are locally developed and managed. Both Portland, Oregon, and the State of Wisconsin have websites that illustrate how a vendor product, HousingPoint, can be adapted to local community housing needs.¹ Others, such as Minnesota, Massachusetts, and Tennessee, have their own uniquely formatted web-based services. Minnesota's site helps people seeking affordable rental housing while Massachusetts' site more specifically assists people with disabilities in finding accessible rental housing.² Tennessee provides a web-based residential housing locator service for persons with severe and persistent mental illness.³

The name of one web-based service frequently appears as a means for bringing affordable rental housing owners and tenants together in local communities. Socialserve.com is run by Non-Profit Industries, a 501(c)(3) organization that assists agencies, municipalities, and the general public in connecting tenants and property owners easily and cost-effectively through the application of leading-edge technology.⁴ This web-based service enables owners to list, and potential tenants to search for, affordable housing, rental housing, Section 8 housing, accessible housing, and homes for sale.⁵ Seven hundred communities in 13 states use Socialserve.com, which meets accessibility standards, is Section 508 compliant, and is offered in English and Spanish. Socialserve.com's services are also available through a call center that provides assistance in additional languages and helps those with no access to the Internet.

Local communities that wish to make affordable housing services available through Socialserve.com find community sponsors to support the program. One example is a coalition of 17 local agencies and housing groups who jointly sponsor the program in Cuyahoga County, Ohio. In the Kansas City



Web-based housing services provide a convenient way to locate residential housing.

metropolitan area, funding is supplied by a variety of public and private entities. Other interested groups, like the University of Missouri at Kansas City, the local chapter of the Home Builders Association, and the Heartland Apartment Association, contribute professional and in-kind support.

Using a Web-Based Service

Colorado's online housing database at www.coloradohousingsearch.com is an example of a local application of Socialserve.com. Upon entering the site, the user learns that this is a public service to the residents of Colorado, jointly sponsored by the Colorado Housing and Finance Authority and the Colorado Division of Housing. Multiple agencies with a stake in developing, financing, and preserving affordable housing helped develop the site.

When seeking a home to rent, the user must decide whether to do so in English or Spanish (Buscar para arrendar). Once a city is selected from a long list of searchable cities, such as Denver, two of the tools provided are immediately helpful: a chart that shows how much rent (plus utilities) one can afford in Denver at hourly wage rates from \$5.15 to \$15.00 an hour and the Median Family Income (MFI) Calculator. The MFI Calculator showed that with a hypothetical annual income of \$36,000, a head of household in Denver could afford to pay a maximum of \$900 in rent.

Under this scenario, one click revealed 198 properties available at or under \$900 a month. One choice was a duplex with a fenced lawn, two bedrooms, and wheelchair accessibility that rents for \$695 a month.

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1. www.housingconnections.org and www.wifrontdoorhousing.org
2. www.housinglink.org and www.massaccessshousingregistry.org
3. www.state.tn.us
4. HUD cannot attest to the accuracy of information provided by linked sites. Linking to a website (or more generally, referencing a product or service by name) does not constitute an endorsement by HUD or any of its employees, of the sponsors of the site, or the products presented on the site.
5. www.Socialserve.com

Linking Housing Need With Opportunity continued from page 4

Another choice was an apartment with two bedrooms, two bathrooms, and an off-street parking space for \$685 a month. Amenities included a wraparound balcony, a dishwasher, an onsite playground, and onsite laundry facilities. A photograph of the building, surrounded by landscaping and small trees, provided a sense of place. A map showed nearby parks, a hospital, and a major intersection. The apartment was located one block from a bus stop. The phone number to call for a viewing appointment was available once a renter spotted an acceptable listing. Other helpful tools included a guide and a calculator for estimating moving costs, budgeting tips, and a monthly budget worksheet.

When an owner wishes to list a property, a choice of pertinent tools and information is immediately available to the potential landlord. There is a flow chart depicting the tenant-based Section 8 housing process, a chart that displays listing limits for rentals and homes for sale, information about housing quality standards, and links to other housing information, including HUD websites (for information on Fair Market Rents, the Housing Choice Voucher Program, and public housing assistance, with a direct link to information specific to Colorado). Last but not least, the steps necessary to list a property are described.



Web-based housing services can help families find affordable housing more quickly.

The property owner merely has to acquire a user name and password, register, and list the rental property. The registration form takes only a few minutes to complete. There is no charge for listing property and the owner can remove the listing at any time.

What do actual users of this service say? Socialserve.com provides pages of signed testimonials on its home page. Property owners like the quick, high-volume response from prospective tenants, the short listing times, and, because the service is free, the absence of advertising costs. When using the service, renters are more likely to find desirable, affordable housing in neighborhoods they prefer. Also attractive to renters is the convenience of this web-based service. It saves on the time and cost of locating a residence, while the links to maps and information about nearby public transportation, parks, and other neighborhood features help ease the transition to a new neighborhood or city. Representatives of housing agencies and community service organizations note that it minimizes rental vacancies, increases Section 8 housing voucher use, and is an excellent source of referrals. **HJ**

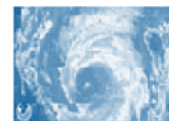
HUD's Office of Policy Development and Research has assembled a toolkit that can assist in rebuilding the Gulf Coast hurricane-affected area.

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www.HUDUSER.org/publications/destech/hurricanes05.html



What do adobe, rammed earth, and straw bale have in common? All three are traditional materials used to build housing in the hot, arid southwestern United States. Because they excel at passive conditioning (both heating and cooling), these readily available building materials could provide an energy-efficient, cost-effective way to build affordable housing.

Southwest Housing Traditions: Design, Materials, Performance, a new Partnership for Advancing Technology in Housing (PATH) report, offers an overview of housing issues along the 1,500-mile U.S.-Mexico border. The region's climate is predominantly hot and arid, with summer temperatures exceeding 110 degrees and annual rainfall of less than 12 inches. Mountain areas along the border, which are above the frost line, experience cold winters as well as hot summers. Many low- and moderate-income people live in the colonias, residential areas along the border that lack potable water or sewers, lack major infrastructure in terms of roads and other amenities, and have unsafe or inadequate housing.

Southwest Housing Traditions examines housing problems and proposes solutions for improving conditions along the border. Among the most promising are: urban and rural traditional housing designs; traditional building materials for walls and roofs (including adobe, straw bale, and rammed earth); an examination of the structural and thermal performance of standard wood-framed housing vs. adobe and straw bale houses; and prototypes that could be used as models for affordable housing throughout the border region. The publication also includes an annotated bibliography and an appendix with thermal performance modeling data.

Beating the Heat

Southwest Housing Traditions presents examples of traditional housing from the Native American, Hispanic, and Anglo cultures of the Southwest. Numerous photographs and diagrams of adobe row houses, Anglo bungalows, adobe houses with L-shaped and U-shaped courtyards, and zaguán houses, which feature a central entry hall/breezeway that connects the street to the patio at the interior of the house, illustrate housing that's been adapted to suit both climate and geography. The study describes how adobe walls store heat during the day and release it at night, how patios and vegetation can help cool a house, and



Adobe houses are well-suited to the climate of the Southwest.

how deep roof overhangs can block the high summer sun but allow the low winter sun into a home to promote passive heating and cooling.

All of these approaches demonstrate basic principles of building in a desert climate. Adobe, rammed earth, and straw bale walls provide thermal mass, and all three materials are readily available. A simple rectangular shape minimizes exposure to the elements and facilitates ease of construction. Small openings (doors and windows) reduce heat gain. Many of the examples make use of shared courtyard walls, which reduce construction costs and life-cycle energy costs by reducing the amount of exterior wall required and the amount of wall exposed to the elements. This can also yield a higher density, while still providing light and privacy to homeowners, resulting in lower house and land costs.

Reducing Costs with Passive Conditioning

Because passive conditioning strategies require little or no energy consumption, they are ideal for use in the design of contemporary affordable housing. For some families, the affordability of a home depends nearly as much on the operating costs for utilities and maintenance over the lifetime of the house (life-cycle cost) as on the initial purchase price.

The high thermal mass of adobe absorbs and releases energy. During hot summers, the cool night air is stored in the massive walls and moderates interior temperatures during the day. In cooler months, adobe stores heat from the sun during the day and releases it into the interior of the house at night. Thermal mass strategies work best in regions where there is a

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gluing component that will stop air infiltration and seal cracks, compact fluorescent bulbs, and low-VOC paints and sealants, which can enhance indoor air quality. In addition, the Florida Solar Energy Center has donated a monitoring system that will track the energy performance of the house.

From the beginning, the goal has been to create a home that treads lightly on the planet. This particular project has two unique “value-added,” according to Paterson Mayor Jose ‘Joey’ Torres. First, it will provide a home for the family of a quadriplegic boy seriously injured in a car accident at the age of five. Once the construction and demonstration phases are complete this spring, the house will be donated to St.

Michael’s Housing Corporation, a nonprofit, charitable organization that plans to turn it over to the family. Consequently, the demonstration house will include a number of accommodations to meet the needs of a disabled person, including an elevator, an accessible porch, and a wheelchair-friendly backyard.

Additionally, the project will help reestablish Paterson as a leader in smart community development, says Torres. Paterson is historically recognized as the first planned industrial city in the United States. The Showcase project, Torres notes, will serve as a prototype “for infill developments in the city, where fire-proofing, staying cool in summer and warm in winter are important.” **HJ**

Traditional Building Materials May Hold Key to Affordable Housing in Southwest *continued from page 6*

significant diurnal temperature swing of at least 32 degrees, generally in deserts where the humidity is low. Small windows reduce solar gain in summer while providing natural ventilation. The study notes that a southern orientation for the length of the house is best for year-round passive conditioning. A courtyard with plants can function as a microclimate that provides cooling via shade and humidity.

Analyzing Interior Comfort

The authors compared the effects of the building form, shared walls, and thermal mass of three houses to determine how well they functioned in the desert environment: a conventional wood-framed manufactured home, an urban adobe house, and a rural adobe house. Performance modeling results predicted that the adobe house—with its high-mass walls—would maintain interior temperatures with a 5 degree Fahrenheit temperature fluctuation during the day. Meanwhile, temperature fluctuations in the low-mass, wood-framed house ranged from 20 to 40 degrees during the day, which means the homeowner must rely on mechanical heating and cooling to stay comfortable.

Working with the Climate

The authors developed several prototypes for housing that’s well-suited to the Southwest:

- Detached single-family home, based on the Anglo ranch house and bungalow tradition;



Plants provide shade and humidity to the patio.

- Attached L-shaped or U-shaped courtyard house based on the Hispanic tradition; and
- Attached two-story row house based on the Native American tradition.

The publication includes several neighborhood designs using the housing prototypes, indicating how higher density housing can still provide light and privacy for individual homeowners. The authors conclude that, while the cost of building a traditional house using southwestern building materials is higher than using conventional materials, it will cost less to own and operate the house over its life span.

Southwest Housing Traditions: Design, Materials, Performance can be downloaded from the HUD USER website at [www.huduser.org/publications/Southwest Housing/SW_Housing_Traditions.pdf](http://www.huduser.org/publications/Southwest_Housing/SW_Housing_Traditions.pdf) or ordered for a nominal fee from HUD USER at 800.245.2691. **HJ**

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- Winter heating costs are forcing more Americans to look for ways of improving their homes' energy performance and reduce overall utility expenses. We'll explore new tools available to homeowners, including owners of manufactured homes. Topics to be addressed include special mortgage purchasing programs and incentives designed to reward energy efficiency, and sustainable building and restoration.
- The HUD USER website contains a variety of housing data. This article will review the many data resources available on our site, where you can access electronic data sets and other housing-related information. The article will provide a brief overview of selected data sets, including the American Housing Survey, Fair Market Rents, Geographic Information Systems, Low-Income Housing Tax Credit, and the Office of Policy Development & Research's comprehensive market analysis reports.
- A large majority of the 86 million Americans who are 50 years of age and older want to remain in their current homes as they age. However, most homes are not elder-friendly. At issue are codes and standards, common barriers and solutions, and product ideas and resources. We'll look at a number of initiatives underway to educate homeowners and housing professionals on home modifications that support aging in place.
- A community mapping project in the Five Wounds-Brookwood Terrace section of San Jose by students at San Jose State University (SJSU) has changed how residents and city officials view the neighborhood. Students interviewed residents about neighborhood needs, observed local landmarks, and recorded their locations with GPS receivers. Responding to project outcomes, the city is now adding streetlights, sidewalks, and traffic signals in the neighborhood. We'll examine the community mapping project and the city's extension of mapping into other neighborhoods.

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