Walking the Talk: Energy Efficiency Begins at Home

Call it an occupational hazard. People active in Rebuild America are continually exposed to cutting edge energy-efficient and environmentally sensitive approaches to building, and some of them are taking it to hearth and home. **Linda Smith** of **Rebuild Colorado**, Partnership Development Manager **Kirk Bond** of Kansas City, MO, and **Mike Glenn** of the **Utah Office of Energy Services** are three Rebuild America players who have adopted green practices in the design and construction of their custom homes.

Smith and Glenn say that their new homes give them a greater connection to the outdoors. For Bond, whose home is under construction, the primary motivation was to live in a high-performance, comfortable house that operates at a fourth of the cost of an average Kansas City home. All three have invested considerable time and effort in getting the details right to create homes that are models of comfort and energy-efficiency.

Smith and her husband, **Holland**, designed and built their passive solar dream house at a 9,000-foot elevation in the Rockies, just west of Denver. At this elevation the heating season lasts nine months and there is no need for air conditioning. Drawing upon energy engineering principles she learned back in graduate school, Smith designed the floor plans and performed the energy calculations, while Holland designed the exterior, coordinated building plans, cleared the site and handled most of the construction.

Kirk Bond, a third-generation builder, gained a working knowledge of both solar and advanced technology while working on demonstration projects years ago with the U.S. Department of Housing and Urban Development and Kansas City Power & Light. With their three adult children moving out, Bond and his wife, **Sally**, decided to downsize their living space and upgrade home comfort by building their own "smart home." They will be able to remotely control the energy, communications and security systems of their 2,800-square-foot home.

Mike Glenn's plans to custom build his passive solar home coincided with the efforts of the Utah Office of Energy Services, where he works, to raise the standards of energy efficiency in new homes and with the startup of Utah's Energy Rated Homes (ERH) and Energy Efficient Mortgages programs. Completed in April of 1997, the house served as the pilot for Utah's ERH program and became the first home in Utah to receive a five-star rating. Since Glenn's trail blazing, more than 725 homes in the state have been rated under the ERH program.

Rocky Mountain Home

The Smith's house was designed to allow the sun to enter through south-facing windows. Excess heat is stored in tile-covered concrete slab flooring that releases

Linda and Holland Smith and their two dogs pose in back of their newly built passive solar home.

the heat later in the day as temperatures drop. The house uses perimeter baseboard heating with propane for backup. Despite the winter temperatures, their propane boiler rarely needs to fire up, even when their neighbors' chimneys are going full tilt. Theirs is a "Built Green Colorado" home, a designation that requires incorporating 38 energy-efficient and environmentally sensitive items into the design. The Smiths tallied 56 items.

Ultra-quiet bathroom fans on three floors are programmed to activate 15 minutes each hour to exhaust air, while windows emit fresh air that is circulated by ceiling fans. Each floor is a separate heating zone, compact fluorescent lights are installed throughout the house and appliances are geared to high efficiency.

The Smith's deck is composed of recycled plastic and wood shavings and will outlast a wooden deck. The house is super-insulated with R-32 walls (R-21 fiberglass batt with 1-1/2 inches of exterior insulation) and an R-56 roof with energy heel trusses. An advanced sealing package helped ensure air-tight construction. The siding is composed of medium-density fiber board made of scrap wood and sawdust, which looks like traditional wood siding but costs less, Smith says.

In their home for a year now, the Smiths are pleased with their small energy bills – just $500 annually and $35 monthly for electricity. Smith says she and her husband are enjoying the comfort of their new home – along with striking views of Mount Evans and the Continental Divide.

Urban Home Building

The high-performance Bond home is under construction on a severe slope that has proved to be a challenge, Bond says. The Bonds chose the lot for its central Kansas City location and wooded surroundings. The house features a 1,000-foot deck that's 20 feet above the ground and at the same level as the tree canopy above a

creek. The home's inverted design features a first-floor master bedroom suite with a spiral staircase leading to a loft library, a living room-kitchen-sunroom that opens onto the upper deck, a walkout basement with a guest bedroom, and an office that accesses the lower deck.

The house will have three air heating/cooling zones and eight warm-floor hydronic heating-only zones, which is the key to year-round comfort in Kansas City, Bond says. A closed-loop, ground-source heat pump will supplement a high-efficiency gas hot water heater for the hydronic floor. Strategically placed ceiling fans and skylights are designed to work in concert with a power-ventilated heat recovery system. The house is being built with R-26 rated structural insulated panels fortified with R-5 urethane foam insulation and sealed with lap-siding. A cathedral ceiling features heavy-duty R-45 insulation. Double, low-E-glazed Pella windows were optimally positioned for daylighting and to capture the best views.

The front of the house has a southwestern exposure and is shaded by trees while the back faces northeast. Four skylights in the rear of the house are positioned to miss direct sun. Two out-of-reach skylights are equipped with sensors and programmed to close if rain is detected. A 12-foot-high Palladian window in the sunroom is oriented to the northeast, allowing light to reach the kitchen and reducing the need for artificial light.

The Bond house will serve as demo to collect information about how thermal coupling works with a structural insulated slab with a hydronic-air heating/cooling combination home. Bond explains that holes and plastic piping were inserted in the concrete floor to enable a camera and other testing equipment to record what happens below the slab year-round.

The back of the Bond house (under construction), oriented to the northeast, features a sunroom that allows light to reach the kitchen and four skylights positioned to miss direct sun.

"The down side of building your own home is that it takes a while, especially when your husband travels a lot for Rebuild America, but it will be worth it," says Sally Bond. The Bonds plan to move in this fall.

Utah's first Five-Star Home

Mike Glenn purchased a floor plan and drawings from a local plan shop and set out to build a 2,550-square-foot energy-efficient house that included a basement with a finished 1-bedroom apartment. But Glenn was building more than a house. His was a groundbreaking Five-Star Energy Rated Home that would set a precedent for residential energy efficiency in Utah. Glenn's 20-year background administering DOE programs for retrofitting homes, schools and hospitals served him well during the design and building process. Ultimately, he incorporated 40 items on an energy-efficiency checklist to bring his home up to Five-Star status. In the interests of saving trees and taking the edge off the extreme summer heat, Glen flip-flopped the building plan.

Mike Glenn's house was the first Five-Star Energy Rated Home in Utah.

He selected a contractor with little experience in energy-efficient design who was interested in learning and open to Glenn's hands-on participation in implementing energy-efficiency measures. Glenn tackled a number of the installations himself, including the ventilation duct work, energy-efficient fluorescent fixtures, the indirect fluorescent lighting system, and the insulation of hot water piping and tanks and the headers on the exterior walls. Glenn selected cellulose insulation to more efficiently fill wall cavities and exterior foam sheathing for additional wall insulation.

He says his "favorite" upgrade was the low-E windows that experience only a fraction of the heat loss that occurs with standard windows. His house has an abundance of windows and no need for artificial light during the day.

Using information from the Sustainable by Design website (www.sustainabledesign.com), Glenn calculated an angle for a skylight that allows light and heat from winter sun to enter the interior while higher-angled summer sun is blocked out. The skylight is opened after hot summer days to release warm air and pull in cool evening air.

Specific energy and other "green" upgrades installed by the contractor cost $6,200. Glenn installed an additional $775 in measures.

Glenn reports that his total electricity and gas bill including the basement apartment averages $37 per month. He has also saved with an energy-efficient mortgage that included a $500 reduction in closing fees. In the wake of his trailblazing, an increasing number of Utah builders and contractors are adopting energy-efficient building practices. And an increasing number of homeowners are experiencing the comfort, energy savings and satisfaction that comes with living in an efficiently designed home.

Efficient, passive solar homes don't make everyone happy, Linda Smith has learned. Case in point is the propane delivery driver who announced "I hate your house!" when he found the Smith's tank still full while their neighbors' were empty.

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