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NOTHING BUT HEAVY-DUTY

Reader Service # GBM 814

LEED FOR HOMES ROLLS OUT

A new USGBC home- and builder-certification program emerges, but it costs to comply, as well as to get homes inspected

thas been 15 years since the first green building program was created in Austin, Texas. Since then, dozens more have been introduced, each with its own structure, its own definition of green, and its own system for deciding who gets a green label. After notable success in the commercial construction sector, the U.S. Green Building Council (USGBC) is piloting a LEED for Homes program, called LEED-H. LEED-H is a rigorous, points-based system, but it differs notably from the NAHB Model Green Home Building Guidelines and other voluntary-compliance programs because builders can be penalized for building large homes (over 2,500 square feet). Builders must also incur costs for the performance audits, as well as costs to upgrade the homes so they pass the audits. It can cost up to \$3,000 per home to get LEED-H Certified by USGBC-approved inspectors, and requires the completion of six forms. (USGBC claims that as the inspection network matures, these inspection costs will drop to around \$1,000 per house.) USGBC estimates that upgrades to a \$300,000 home to certify it for LEED-H would cost around \$10,000. These costs obviously must be absorbed by the builder or tacked on to the price of the home. USGBC will take up to two more years to pilot LEED-H and act on feedback. Then, USGBC will compete in the marketplace with other standard and certifying agencies to offer builders and buyers another system for rating their homes and a method for certifying green builders.

BY TED CUSHMAN

AFFORDABLE ALTERNATIVE ENERGY:

THIS 34-UNIT PROJECT IN MOSIER, OREGON. WILL BE LEED-H CERTIFIED. THE SOLAR PANELS WERE MADE AFFORDABLE THROUGH TAX INCEN-TIVES, AND THE CONDO WILL MARKET FOR AROUND \$225 PER SQUARE FOOT.

The Energy Star Model

Jay Hall has been working with the USGBC LEED-H to roll out its pilot program. Hall says that LEED-H aims to simplify the analysis of a house, much as the Energy Star Homes program does for energy-efficient products and housing. "Consumers don't have to understand what's behind it," says Hall, "but when you see the Energy Star label you know that you're getting substantive energy efficiency, and it's third-party verified."

Indeed, LEED-H used Energy Star as its baseline. "If builders are Energy Star rated, yet want to distinguish themselves in other areas that fall under the umbrella of green (e.g., indoor environmental quality, water efficiency, green materials, and sustainable sites), we can help them do that with LEED-H," he says. "Now they can promote themselves with something that is substantively green and third-party verified. And the consumer doesn't have to do all the homework."

Building a Standard

The core rating metrics used within LEED-H are presented to end users in checklist form separated into eight categories. The pilot checklist now has 108 points (more may be added). If a builder achieves 30 points, he earns a Certified rating, 50 to 69 points earns a Silver rating, 70 to 89 points earns Gold, and 90 to 108 points earns Platinum.





What it takes. Each checklist category includes "mandatory measures" that every house must comply with, and optional ways for builders to score points. The top category, Locations and Linkages, awards points for things like locating near existing infrastructure, avoiding environmentally sensitive sites, and clustering homes. Another category, Sustainable Sites, requires erosion control and includes options like eco-landscaping, permeable paving, and shading. Water Efficiency covers everything from low-flow fixtures to rainwater harvesting. Indoor Environmental Quality applies mostly to mechanical systems (compliance with ASHRAE Standard 62.2 for house ventilation is required, as are closed- or power-exhaust systems on combustion appliances). Materials and Resources rewards a small footprint (and penalizes oversized houses) while encouraging efficient framing and the use of local materials and sustainably produced products. Energy and Atmosphere (the most pointladen category, with 29 potential points), is based on lowering energy use (Energy Star compliance is the mandatory minimum). A point category called Homeowner Awareness offers one point if the builder offers an advanced owner's manual or extra homeowner training. The eighth category, Innovation and Design Process, is a catchall to encourage creativity: builders can earn up to four points for their green solutions, like optimized logistics.

Builders can't certify their own checklist performance.

Builders must pay a USGBC-recognized LEED-H "provider" to certify their checklist performance. The pilot program has just 11 providers enrolled so far, all with advanced expertise in energy-efficient and sustainable construction practices. Providers can contract with trained "raters"—like the ones who perform Home Energy Rating System (HERS) inspections for Energy Star-to verify compliance with LEED-H.



lackie O'Neal

Inspections and paperwork. Engineer Maureen Mahle works for Steven Winter Associates, a provider for LEED-H in the Northeast. Mahle explains that the rating process typically includes two inspections. "At the pre-drywall stage, we do the insulation and air-sealing inspection that goes along with the HERS rating. We also check site measures, like erosion control," says Mahle. Items subject to close-in, like advanced framing techniques or a heat-conserving hot-water system, also get inspected at the first go-round, which Mahle says takes less than a day.

At the final inspection, the inspector looks at finish materials, permanent landscaping, and appliances, and builders must present a paper trail for features that are not obvious to the inspector. "We obviously can't tell whether the lumber is certified sustainable or not," says Mahle. "So we need the builder to provide certification and purchasing documents. And we ask for accountability forms for certain credits that we can't inspect, because, for instance, we can't tell just by looking whether the furnace has been sized using Manual J. So, the heating contractor must complete an accountability form, too."

Different Niches, Different Strengths

According to Jay Hall, USGBC found that many affordable housing builders had a strong interest in green construction. "We are addressing three main market segments. The affordable housing community, the production builders, and the custom builders," says Hall. "Each has unique needs, but the current LEED-H system wasn't designed with that in mind. As we go through revisions, I'm hoping we will move in that direction."

Philadelphia story. In the affordable sector, LEED-H is headed for a test in Philadelphia, Pennsylvania, says Liz Robinson, executive director of the Philadelphia-based Energy Coordinating Agency (ECA), the LEED-H provider for eastern Pennsylvania and Delaware. A private nonprofit serving

AFFORDABLE HOUSE: MANY AFFORDABLE HOUSES
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30,000 low-income households, ECA has already persuaded the Philadelphia Housing Authority—the city's biggest landlord and its biggest builder of affordable housing—to adopt the Energy Star standard, with ECA serving as the HERS rater.

"We worked with the Housing Authority last year to bring hundreds of new units up to Energy Star standards, under a state grant," says Robinson. "But we were also piloting LEED-H, so we asked the city if they would like us to rank the developments for LEED-H just to see what the incremental changes would have to be."

Surprisingly, says Robinson, the units almost made the cut for LEED-H certification as designed for Energy Star. "The LEED-H standard rewards infill housing—units that are close to public transportation [and within] walkable distance to schools and shopping centers," she explains. "We were lacking things that wouldn't cost a heck of a lot," items like planning for waste reduction or documenting jobsite runoff control. Robinson says the company building the units, a sophisticated commercial contractor, easily took the Energy Star verification process in stride. "They could have attained LEED-H with very modest additional effort if they had undertaken it from the beginning."

Production green. In the Madison, Wisconsin, area, the award-winning home builder, Veridian, is shooting for LEED-H certification on six newly completed homes, as verified by Steven Winter Associates. All Veridian homes are Energy Star labeled, and the company already participates in Wisconsin's Green Built Homes program. (Veridian also has a relationship with Steven Winter Associates, as part of the Department of Energy's Building America program.)

"With Green Built," says Veridian vice president Gary Zajicek, "the inspection is just an audit. It's based on the builder's specification, not a physical inspection. But LEED-H says, 'You say you're doing it—I want you to prove it as well.'" Veridian faced some handicaps with LEED-H. "We have 22 communities in towns all around Madison," says Zajicek. "In some of them, the zoning may require large lots. And in some of our communities, we don't offer landscaping in the standard package. We just seed the lots." So although some of the company's homes qualify for a landscaping credit, others don't; and, although the company's average lot size would earn a point for density, some houses are on lots that couldn't qualify for points in any event.

Maureen Mahle handled Veridian's inspections and she observed that, given Veridian's quality, "we were hoping that Veridian's biggest house on the worst lot with no erosion control would be at 30 points." But that didn't happen in the pilot. Instead, Veridian had to make small adjustments to a few



houses—like adding a furnace filter, or upgrading a few light fixtures—to get to the 30-point threshold, and most of

Veridian's changes were to meet mandatory measures, which added costs in addition to the inspection costs. "Items like ASHRAE 62.2-compliant exhaust fans, air-sealing between garages and living areas, and carbon monoxide detectors ended up adding about \$2,500 to the cost of each unit," says Zajicek.

Cutting-edge custom. Green building's core constituency may be the small, local custom builders who create one-of-a-kind green homes—like Syracuse, New York's, Northeast Natural Homes. For company owner Kevin Stack, going green has been a long road. "At home shows, people would ask me, 'So, you mean you paint the houses green?'" says Stack. "For a long time, I was the only green builder in central upstate New York, and I'm still the only one really focusing on it."

Stack has gone whole hog for LEED-H, joining the local USGBC chapter and seeking certification as a LEED-H rater. But he says, "We're not building to the LEED-H checklist. We're doing the things we want to do anyway, and seeing how LEED-H can help us." Says Maureen Mahle, "Kevin was green long before there was any LEED-H program."

Unlike the Philadelphia Housing Authority's townhomes or Veridian's suburban houses, Stack's upscale custom homes have fallen afoul of the LEED-H disincentive that penalizes large houses, and he loses points in the category that covers home sizing, which he has to make up for in other categories. In some areas, he overachieves, earning points with custom touches like cork flooring, sustainably harvested/recycled lumber, and solar electric power. A finished house of Stack's on New York's Lake Skaneateles is on track for a Platinum rating.

CUSTOM HOUSE: BUILDER KEVIN STACK'S UPSCALE CUSTOM HOMES HAVE BEEN PENALIZED BY LEED-H FOR THEIR SIZE. BUT HE MAKES UP LEED-H POINTS IN CATEGORIES OTHER THAN HOUSE SIZE, SUCH AS USING RECYCLED LUMBER (LIKE THIS RECYCLED BARN WOOD FLOOR, LEFT) AND SOLAR ELECTRIC POWER. HE ALSO EMPLOYS RIGOROUS TREE PROTECTION PRACTICES DURING CONSTRUCTION.

Stack hopes to exceed Platinum with points for "just-in-time" delivery systems, where materials are shipped directly from the manufacturers.

Will LEED-H Succeed?

Even for builders who emphasize green, like Veridian, getting LEED-H Certified can take some work, and advancing even to Silver, let alone further, would require major effort. "I don't know any production or affordable builders at this point that are even thinking of going beyond Certified," says Maureen Mahle. "There might have to be some other incentive, like funding

opportunities or sponsors or some kind of outside influences to drive them in that direction." But in a way, that's the whole point. "Officially, LEED-H is aimed at only the top 25% of best practices in environmental home building," notes Mahle. "So, you know—it should be hard."

A single rating system that is comprehensive enough to encompass affordable city townhomes, suburban-market tract homes, and cutting-edge custom homes is an ambitious undertaking. Will it work? It's far too soon to say for sure. At press time, LEED-H has fully processed just six units (one Platinum, one Gold, one Silver, and three Certified). But more than 100 homes are enrolled in the pilot. Liz Robinson says, "We get calls about LEED-H from developers and builders every day, and we have done no marketing at all of this program."

Watch these pages for ongoing reports on the progress of LEED-H.

A well-known building journalist, Ted Cushman writes on a wide variety of topics from his home in Great Barrington, Massachusetts.



ome builder Matt Belcher has a longtime passion for green. For the last two years, he has served as chairman of NAHB's Green Building Subcommittee and chairman of NAHB's Energy Committee. That's volunteer work he does in his spare time. For his day job, he builds homes. Top-quality homes. During the last 15 years, his company, Belcher Homes, based in Wildwood, Missouri (St. Louis County), has built six or seven semi-custom green homes every year. Each home averages 3,000 square feet and has sold for about \$450,000, by today's prices. "I have a three-man crew-me, myself, and I," says Belcher, who regularly works with a team of trusted, highly trained subs. But building green is nothing new to these guys. Belcher and his allied subs began designing and building green houses long before green became the white-hot movement it is today, back when green was a word most people used just to describe Chinese tea.



With Belcher's green building background and passion for excellence, he was a natural partner for *Green Builder Magazine*, when we set out to select a builder for our VISION House 2007 show home in St. Louis. (The St. Louis VISION House is the second in a series of Green Builder® show homes that started with an award-winning green

The Timbers at Creekside is a five-lot, allgreen development near St. Louis. The first home (rendered above) will be a 2,400square-foot home that will sell for about \$450,000. Left: Builder Matt Belcher got a variance for a winding road and sewer configuration that saves more than 60 trees, like this one, that were slated for the chipper.

home in New Mexico.) Even though Belcher builds green, he thinks big, and he didn't want to build just one green home, he wanted to build five! Who are we to stop a man on a mission? So, in St. Louis, Belcher is building the Timbers at Creekside, a five-lot, all-green development of VISION Houses, with prices starting in the \$390,000s and home sizes starting at 2,000 square feet. The first home under construction is a 2,400square-foot home that will sell for about \$450,000. Designed by architect Maren Engelmohr, who will reside in the home, the home will attain NAHB Gold level. Engelmohr will also seek LEED-H certificaTop right: Builder Matt Belcher builds green and thinks big. Green Builder Magazine wanted to work with him on one home. But Matt said he wanted to do five at once. Who are we to stop a man on a mission? Bottom right: Enercept SIPS will serve as the walls and roof, which will achieve R-40 through a formaldehyde-free product.

tion. "It's fairly easy to get to NAHB Gold level with just good building basics and not much additional cost," said Belcher. "In fact, we were probably building to NAHB Gold levels before the NAHB Guidelines even came out."

"Like many projects in an existing neighborhood, this one started with tear-downs and variances," said Belcher. Two existing bungalows on the land were inspected by the St. Louis County Health Department-part of the active recycling and reclamation co-op that Belcher also belongs to-but the bungalows were ruled entirely unsalvageable and they were torn down. For sewers and the road, Belcher got a variance to allow a winding road, not the straight one desired by the town. That new road design, along with an innovative sewer configuration, allowed Belcher to preserve more than 60 trees, which are integral to the heating and cooling of the homes. (Trees that were cut down were mulched on site.) Belcher was also able to keep a natural stream in place, even though the town initially wanted it dredged and channeled through a new rock bed. Now, the VISION Houses will have minimal site disruption as they attain zero-runoff with natural absorption and permeable pavements and sidewalks.

Because so much of a home's energy consumption can be affected by its orientation, Belcher put a great deal of thought into the platting process. The lots were designed to allow the main axis of each home to run east to west, and careful attention has gone into sizing fixed awnings to optimize seasonal sunlight. Today, the ICF basement foundation is in place, and Enercept SIPS are going up for the wall and roof systems. With Enercept, Belcher will achieve R-40 walls and roof with a formaldehyde-free product. Optimized framing will reduce waste, but on-site waste management and recycling are key. (In fact, Belcher likes Enercept because they even recycle the EPS foam left over at the factory after window and door rough openings are cut out.)

By the time the NAHB National Green Building Conference is held in St. Louis in March 25-27, 2007, Belcher will have the first home completed, and four other homes purposely stopped at various stages, so the development can serve as a "living lab" to show exemplary green building practices for builders on the Conference home tour.

We will check back in with Matt Belcher two more times before the National Green Building Conference, once in the January issue and once in the March issue of *Green Builder Magazine*.





VISION HOUSE NEW MEXICO

In 2006, *Green Builder Magazine* worked with award-winning green builder Norm Schreifels, Sun Mountain Construction, Placitas, New Mexico, to build an exemplary green luxury home. We thought the home was a winner, and, well, it seems a few others agree. The Home Builders Association of Central New Mexico has just awarded its 2006 Parade of Homes awards. The VISION House 2006 won a Grand Prize Award for Best Overall Green Home, Build Green New Mexico; a Gold Award for Universal Design; and a Silver Award for homes offered in the VISION House range, which is \$1,190,000. Congratulations to Norm and to the many sponsors who participated in VISION House 2006.



This affordable house from Ideal Homes incorporates low-cost features that make it green, such as sealed ducts, high-efficiency HVAC, and fresh-air ventilation. Yet it's not as costly as you might think. Going green costs around \$3,500 in initial extra costs, but the home will save the occupants up to \$85 a month on their utility bills.

Affordable and Green Get Creative and Go Green for Less

By Debbi Gardiner

This article is the first in an occasional series that takes a snapshot of what's happening in affordable green housing.

hen Vernon McKown, co-owner of Ideal Homes, started selling homes in downtown Oklahoma 16 years ago, saving the environment wasn't particularly on his radar. But making marketable, affordable, quality homes for profit was. Today, Ideal Homes—one of Oklahoma's largest home builders—sells houses that use recycled materials, beefed-up insulation, and high-end, energy-efficient windows. These are typically expensive add-ons, yet the cost of a home from Ideal Homes averages just \$135,000. This is close to the National Association of Realtor's state average for conventional three-bedroom family homes in that region, yet Ideal Homes' houses are green by any measure.

"Lowering costs is easy," McKown insists. "Builders just have to tackle things differently. Why focus on costly sustainable flooring and fancy paints that make the house just look green? Look at getting the best bang for your buck. Think of the building envelope first."

Affordable green building is a new but growing concept for builders; it's a mistake to think that only high-end custom homes can be green. A study by New Ecology Inc. and the Tellus Institute reviewed 16 green affordable U.S. housing projects and found an average "green premium" (the additional costs required to build green) of just 2.42%. Ward

Foundation Grants Enable Affordable Green

Hubbell, executive director of the Green Building Institute—the company that helps market NAHB Model Green Home Building Guidelines—notes that builders often joke that affordable green building is an oxymoron. "In fact, there are many low-cost ways to build energy-efficient structures that are healthier and, therefore, easier for builders to sell and promote," says Hubbell. He claims that building energy-efficient homes costs 8% to 9% more, but with the proliferation of best-practice building standards and the rapid advance of technology that is driving prices down, the increased costs for building energy-efficient homes can start as low as 2% to 3% more than traditional construction.

"If you look at most green building rating systems, 35%-45% of the points are allocated for adopting energy-efficient building practices. Anything you can do through insulation, high-quality windows and doors, site positioning, porches and overhangs all helps," says Hubbell.

Creative with Materials

Ideal Homes' Vernon McKown knows that poorly designed or inefficient HVAC systems can be real energy hogs. Moreover, the Department of Energy warns that ducts lose considerable air volume due to leakage. So to seal connection points where the ducts and registers all connect is a simple solution. McKown uses a white, silicone air-sealant coating that can be applied like paint. He uses the same paintable coating sealant to seal up the sheet-metal joints used for the return plenums in the duct systems. Typically, the metal seam is simply crimped together, which can create massive air leaks, but the sealant can dramatically reduce this loss. The cost of this application per home is about \$200, but the savings realized on utility bills is about \$50 a month or \$360 a year. "Multiply that by 500 houses, and you are massively reducing power outage and keeping your houses green and saleable," says McKown.

McKown sees insulation as another opportunity to implement a low-cost high-impact solution. Batt insulation is compromised when wiring and plumbing routing cause air pockets, which create convection loops in wall cavities that bleed energy. A blown fibrous insulation comprised of cellulose-like ground-up paper or loose-fill fiberglass not only gets into all the nooks and crannies of the walls and attic, it costs zero to switch, McKown notes. Upgrading the windows with dual-pane, low-e coated glass helps keep warmth in the home in winter and keeps solar gain to a minimum in the summer. These improvements cost a few hundred dollars up-front, but they offer real savings on utility bills.

The appeal of these developments has raised concerns about the possibility of speculators buying up these homes. "In the past few years we were a little caught off guard by the number of investors buying in our 'affordable' developments," said Vernon McKown. "This phenomenon had significant ramifications both internally and externally. For instance, our customer care and warranty department got bogged down while dealing with investors who were not local, but were trying to manage the property from a distance. In an effort to preserve the integrity of our developments for our customers, we added a few regulations to offset the impact of investors."

any housing nonprofits have become leaders in sustainable design and construction thanks in part to funding from The Home Depot Foundation and Enterprise. Created only four years ago, The Home Depot Foundation has invested millions of dollars in communities to help people of modest means live in homes they can afford to own and maintain, and which provide safe, healthy environments that conserve energy, water, and other natural resources. The Foundation awards grants to eligible nonprofits three times per year and has created one of the easiest online applications in the foundation industry.

Last year, The Home Depot Foundation started the Awards of Excellence for Affordable Housing Built Responsibly to recognize the outstanding work of nonprofit housing developers who have successfully combined affordability with healthy, sustainable measures in the design and construction of housing.

The other powerhouse behind the green affordable market is Enterprise. Their Green Communities initiative was launched on September 28, 2004, to invest an unprecedented \$555 million in grants, loans, and equity to provide training, technical support, and policy advocacy to help create 8,500 green affordable homes within a five-year period. In the first year alone, Enterprise awarded \$1.9 million in grants to 49 affordable housing developers.

Green Communities is the first national green building program focused entirely on affordable housing. It incorporates many innovations from the "mainstream" green building movement, including the use of environmentally sustainable materials, reduction of environmental impact, and increased energy efficiency. It takes the idea of green several steps further, emphasizing design and materials that safeguard the health of residents, and home siting that provides close, easy access to public transportation, schools, and services.

For information on these two foundations, go to *Homedepotfoundation.org* and *Enterprisefoundation.org/resources/green/index.asp*.



"First, we have a rule that no more that 10% of any section can be investment properties. Second, investors must pay 10% in earnest money versus the 1% that we require of other customers. Finally, by contract, any property purchased for investment purposes must have a professional property management company managing the home. These changes have helped us regulate investment buying," said McKown.

Creative with Labor

Other builders have found that getting creative with their labor source helps make homes more affordable. Walnut Place is a 37-home community in Monterey, California. These homes cost less than half of the area's median house price of \$680,000. The complex has low water use, bamboo and linoleum flooring in the resident center, and windows engineered to optimize solar gain. Solar panels provide substantial supplemental

power for most buildings and the parking lot lighting. Project manager Dana Cleary says her nonprofit organization, CHISPA, subcontracted out the heating, electrical, and plumbing work as they would any project. But through the U.S. Department of Agriculture's Rural Development Mutual Self-Help Housing Program, future owners were responsible for the interior, construction, and landscaping. "That is how we keep much of the green costs down and give these work-force families a much-reduced mortgage and a great place to live."

CHISPA gains enough equity in the project to earn significant returns and commits to renting apartments long-term to people earning only 50%–55% of the median income. In return, CHISPA (as landlord) or the homeowners get their payback for the solar investment.

The Cost of Building Green

ow much more does it cost to build green? Not much if you ask Jack Burger, special assistant for project development with the Redevelopment Authority of Cumberland County in Pennsylvania. He recently initiated construction of 14 town-homes in neighboring Perry County as a demonstration of green residential building and to prove that green construction could be done affordably.

Last spring the Perry Green Building Housing Corporation, a nonprofit group set up by Cumberland County, unveiled the new homes and had all but two of them sold before summer. The townhomes, built by Wagman Construction, are highly insulated with R-30 walls and R-50 roofs. The homes are oriented to take advantage of passive solar heating in winter and include cupolas on the roofs to provide natural ventilation. All appliances in the houses are Energy Star certified, and siding is made of recovered elm.

Burger tracked construction costs throughout the project and then compared those costs to conventionally built townhomes nearby of similar quality. He claims the green townhomes cost 6.2% more to build. Total construction cost for the 14 homes amounted to just over \$1.6 million. "That's a little bit more to build," says Tom Kahler, project manager for Wagman, "but I don't think the difference is enough to worry about. If you compare these homes with decently designed residential projects, we're pretty competitive."

Sales prices for the townhomes are in the low \$100,000s. However, under a special affordable-housing program for low-income first-time home buyers, owners have purchased them for as little as \$88,000. "We want low-income homeowners to be able to afford to buy green houses," explains Burger, "and then be able to afford to live there."

—Deborah R. Huso



Walnut Place is a 37-home community in Monterey, California. These affordable homes cost less than half of the area's median house price of \$680,000. The complex has low water use, bamboo and linoleum flooring in the resident center, and windows engineered to optimize solar gain.

Buying in Bulk

Dan Russell, owner of Element Homes in Santa Fe and Albuquerque, sells his green homes for \$150,000, far below the average Santa Fe home cost. Evergreen is a subdivision of 150 green homes and one of several Russell is building for Homewise, a nonprofit group. For home heating, he uses radiant-floor heating, which uses plastic piping to carry hot water directly through the concrete slab. Russell claims it costs \$3,000 less to install than traditional HVAC. In addition, Russell does not install air conditioning. In higher-end neighborhoods, the lack of air conditioning might deter buy-

ers, but Santa Fe evenings are typically cool, and Russell has found that his buyers do not mind opening windows to cool their homes.

Russell also utilizes the sun's position to help warm and cool these homes. His true profits, however, come from volume. Russell hears his neighbors complaining that subdivision building is "bad growth," but he strongly disagrees. Building a subdivision of 60 green homes drops the cost per square foot considerably more than building one-off, custom homes; and, well, people have to live somewhere. Yes, an engineered 2x4 will cost more individually than a fresh-cut one, but buying in quantity is far cheaper than buying for one house at a time. "For profitable, but cost-efficient green building, bulk is the absolute way to go."

How do Element Homes and Homewise keep out speculators in hot New Mexico housing markets? "Our programs are designed to deliver affordable homes to people who need them, not investors. We require that homes be occupied by the owner," explains Homewise's Emilee Ford. "In fact, the mortgages we write specifically require that people occupy their homes. If the buyers violate that provision, we would have the ability to call in the loan and provide that home to someone else. If we didn't have this requirement, we would certainly be overrun with housing speculators."

Debbi Gardiner grew up in New Zealand and now lives in Chandler, Arizona. A well-known book editor and college instructor, she writes features for the Economist magazine and Wired News.

One Green Builder's Detail

A (VERY) COOL, GREEN ROOF AND WALL SYSTEM

by John D. Wagner

rian Baker's design-build company, Studio 26, owns 44 acres of land in Bucks County, Pennsylvania, just north of Philadelphia, and they plan to make good use of it. "There is a high influx of people moving to this area from New York and Philadelphia," said Baker, "and they have an eco-conscious mindset. The buyers are looking for healthy green homes. We're stepping up to meet the demand." The houses Baker is planning to build in his new Bucks County development will be 3,000 square feet and cost about \$150-\$200 per square foot. Baker is pushing to make them as green as possible.

Baker is an architect with a background in commercial building where he has designed LEED-certified buildings. However, he has recently moved over to the residential sector because he sees a dramatic opportunity to offer advanced energy-efficient designs to a hungry, upscale market. The wall- and roof-system designs illustrated here are for a demonstration home Baker is building for DOE's Building America program. The home will serve as a model for the new homes he is selling now.

BUILDING ENVELOPE INTEGRATION

"We approach each home as a whole-house-building-system integration. Guys on our team don't drive gas-guzzlers, and we don't build them either," says Baker. "We listen to customers as much as we educate them. We consistently hear that they want to save money on utility bills, and they expect a five-year payback on the up-front cost of energy-efficient features. That concern for payback keeps us focused on the building's thermal envelope. As you can see from my illustration, we really tightened up our homes and compromise nothing."

FOUNDATION

"We insulate with R-10 XPS under our foundations and slabs. (All the XPS in our walls and foundations are shiplapped, caulked, and taped.) For foundation walls, we start with a pre-insulated system from Superior Walls. There is R-12.5 built into the wall, but we modify that by blowing Johns Manville Spider Custom Insulation System into the concrete stud bays, and we achieve R-40 foundation walls. You'll see we use Spider in the walls and rafters, too. Spider is a nontoxic, formaldehyde-free blown fiber insulation that performs really well for us; excess insulation isn't wasted because it can be immediately recycled into the blower, or stored for later," says Baker.

WALLS

"We have a unique system for making high-R-value walls, where the floors do not penetrate the thermal envelope of the wall. The result is a continuous outside wall. Floor trusses at ground level rest on top of an extended sill, which is sealed to the foundation wall with Dow's Sill Seal (a flexible polyethylene foam gasket). For upper floors, floor trusses—we use I-joists—sit on Simpson Strong-Tie hangers, which are tied directly into the frame. None of our floors penetrates the outside wall."

"For spot-application spray foams, we use closed-cell Demilec HEATLOK, at least 1-inch thick at the ends of joist and rafter runs," said Baker.

ROOF

"For the roof framing, we use 2x12 rafters sheathed on the top and bottom with %-inch OSB. On top of the lower layer of OSB, we lay 2x4s on their sides to act as purlins. Then we add another layer of OSB that the shingles are nailed to. That way, we get a coolroof effect and a continuous air gap to the ridge. For roof underlayment, we use Elk Building Products' IceGard, and for shingles, we use Elk's Cool Colors. They have unique granules from 3M that create a reflective, colored asphalt shingle," said Baker.

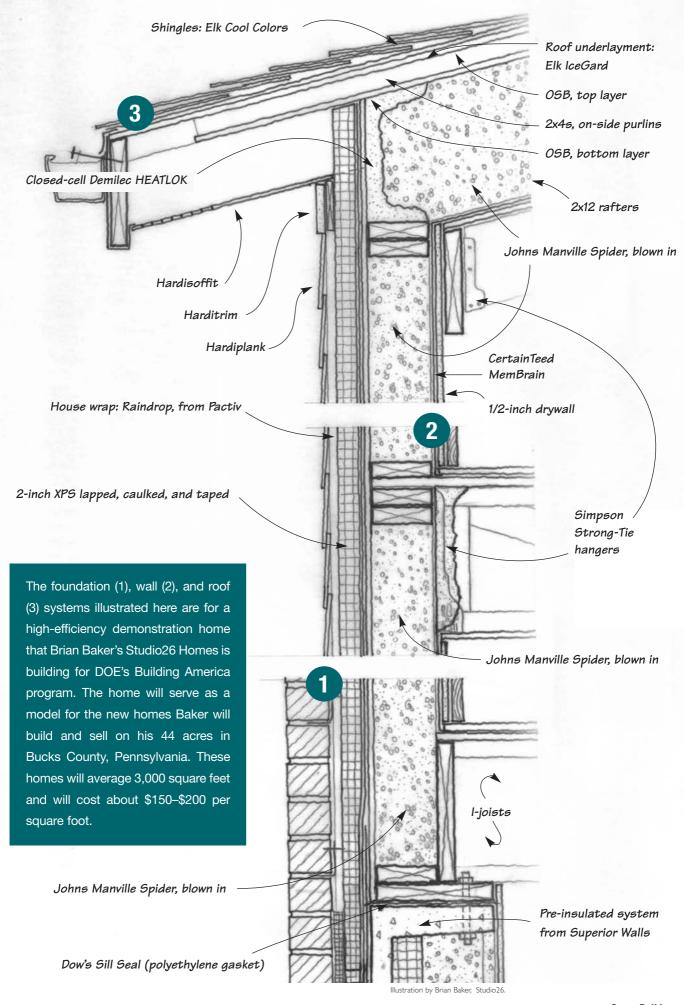
BUILDING SHELL, SIDING, AND TRIM

"For housewrap, we use Raindrop, from Pactiv," said Baker. "It has vented vertical threads that won't collapse and offer good drainage. On top of the housewrap, we have 2 inches of XPS, lapped, caulked, and taped at joints. On the interior walls, we use a Smart Vapor Retarder from CertainTeed called MemBrain, which we cover with ½-inch drywall."

"Our exterior wall achieves R-33. For siding and trim, it's simple: James Hardie's Hardiplank (on ¾-inch trim, fastened to studs), Harditrim, and vented Hardisoffit."



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Green Builder_® Index

- Within the next 10 years, the percent of U.S. jobs that are expected to be construction related: 58.4%
- Amount of salvageable structural lumber that is disposed of annually in the United States: nearly 1 billion board feet
- Percent of construction firms that employ fewer than 10 employees: 80%. 100 or more: 1%
- Amount of garbage the average American generates each day: 4.5 pounds
- Percent of consumers that would pay \$2,000-\$3,000 for \$250 in energy savings per year: 80%
- Percent decline in the use of brick exteriors on newly built homes from 1975 to 2005: 12%. Percent decline in the use of wood exteriors: 29%
- The number-one upgrade among new-home buyers: energy-efficiency enhancements
- Number of people worldwide with diabetes: 180 million. Percent that is type 2 diabetes: 90%
- Number of people in the United States with type 2 diabetes: 17 million
- Amount of additional clean energy that California's Million Solar Roofs initiative will provide: 3,000 megawatts (enough energy to entirely power 2.2 million homes). Amount of greenhouse gases this initiative can prevent: the equivalent of taking 1 million cars off the road 10
- Percent of newly built homes in the Northeast in 2005 that used vinyl siding: 83%
- Percent of home energy that is lost due to insufficient insulation around windows and doors: 17% 12

- Amount of hardwood plywood that was exported from China to the United States in 2005: enough to build cabinets for 2 million kitchens
- Amount of formaldehyde given off by hardwood plywood imported from China: up to 100 times more than is legal in Japan and 30 times that allowed in Europe and China
- Once the new EPA clean diesel rules are fully implemented, the expected annual reduction in the amount of smog-causing nitrogen oxide emissions in the United States: 2.6 million tons. Annual reduction of soot and particulate matter: 110,000 tons
- Estimated number of asthma attacks in children that will be avoided each year due to the implementation of the new clean diesel rules: 360,000 'c
- According to a new study of 28 major metropolitan areas nationwide, the percent of income that the average working family spends on housing: 28%. Percent of income spent on transportation: 30%
- Amount of time the sun would have to shine to create the energy contained in 1,750 billion barrels of oil (the estimated total of all oil that has ever existed): less than 24 hours
- Amount of oil required to produce 2.2 pounds of HDPE plastic: 3.8 pounds of raw material and fuel
- Amount by which the demand for electricity in the U.S. is increasing over the speed at which power plants and lines are being built: 3 times faster. Percent that U.S. energy demand is predicted to increase in the next decade: 19%-20%²⁰

U.S. Department of Labor, Bureau of Labor Statistics

U.S. Department of Labor, Bureau of Labor Statistics

Idealbite.com

Dow Chemical Corp

Dow Chemical Corp.

World Health Organization

⁹ National Diabetes Education Program

¹⁰ Gov.ca.gov

II NAHB

¹² Dow Chemical Corp.

¹³ Cone, Marla. 2006. U.S. Rules Allow the Sale of Products Others Ban. Los Angeles Times. October 8

¹⁴ Ibid.

¹⁵ EPA

¹⁷ Center for Housing Policy. 2006. Working Families Pay More for Transportation Than They Save on Affordable Housing, New Study Reveals. October 11.

¹⁸ Davis, Ged R. 1990. Energy for Planet Earth. Scientific American. September.

¹⁹ Torben Lenau, Technical University of Denmark

²⁰ North American Electric Reliability Council