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For Environmentally Enhanced Lifespan Living

November/December 2006

building with
ICFs & SIPs
*Insulating Concrete Forms &
Structural Insulated Panels*



Pennsylvania LEED® "Green" Home

Optimum Performance Home™



part VI

plus
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Organic Home Design**

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Brad Bird
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The Incredibles, The Iron Giant

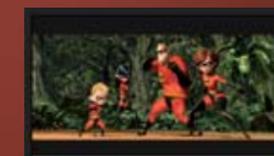
"As a filmmaker and film lover, I love the immersive feeling of movies presented in the widescreen format known as "Scope". So many of my favorite films are made in "Scope" widescreen; LAWRENCE OF ARABIA, STAR WARS, RAIDERS OF THE LOST ARK, AMADEUS, LORD OF THE RINGS — the list is as epic as the films themselves. When Runco first showed me scenes from THE INCREDIBLES and THE IRON GIANT using their new CineWide™ projection system, I was dazzled..."



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Conventional Method—Useless Black Bars



CineWide Technology—No Black Bars



MISSION STATEMENT

The mission of *Ultimate Home Design* is to serve as a catalyst for homeowners to create demand for architects, designers, and builders to adopt the concepts and building practices that define human-centered, optimum-performance home design. *Ultimate Home Design* is aimed at broadening the segment of the American population that is paying closer attention to the products they buy, looking beyond price and branding to focus on other elements of the production and value chain. Increasingly homeowners want to support sustainable building practices that result in a higher living standard. *Ultimate Home Design* is for those homeowners who want to promote a broader shift in patterns of production and consumption by encouraging practices that better reflect their personal values. We are advocates for using products that reduce energy and use renewable, recycled content or otherwise environmentally preferable materials. An important part of our mission is to promote building practices that result in a substantial reduction in energy use for space conditioning, water heating, lighting, and appliance operation. Another important aspect of our mission is to promote construction practices that improve the indoor environment and reduce the risk of building-related illness. This translates to improved occupant health and comfort by improving thermal comfort; natural lighting and electric illumination; and controlling humidity, odor, noise, and vibration.

Ultimate Home Design is for the thinking homeowner, who wants to be educated and learn about intelligent options for home design, whole-house system design, and comprehensive electronic lifestyle features that can enrich the quality of day-to-day life while reducing the cost of operating a home. With the knowledge gained reading *Ultimate Home Design*, you will be empowered to make intelligent choices about the design and make-up of your home, whether considering remodels or additions, planning a new home, or evaluating an already-built home. *Ultimate Home Design* will explore the wide range of possibilities within the context of designing Optimum Performance Homes™ that integrate universal design architecture; sustainable green building materials and techniques; energy-efficient power systems for electricity, lighting, heating, and air conditioning; water conservation techniques; and comprehensive electronic lifestyle features.

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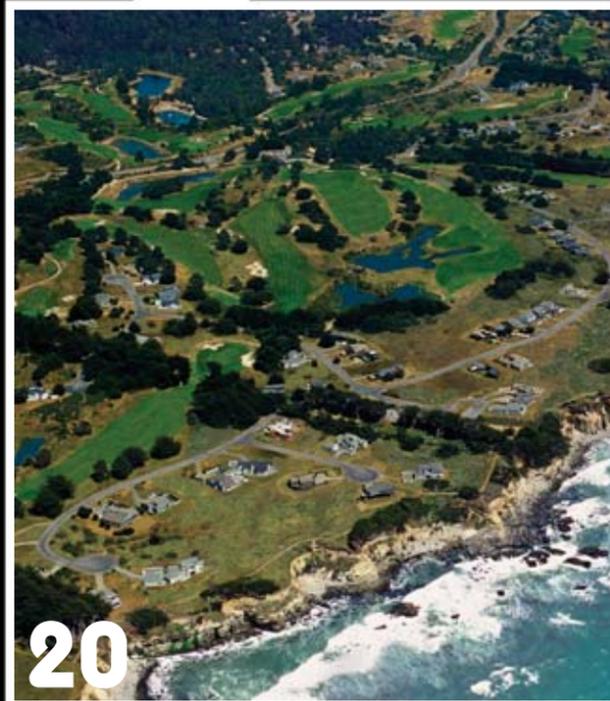
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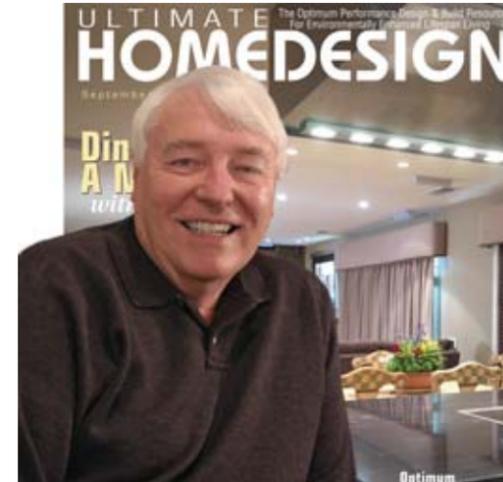
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Going Green

"Going Green" is a theme that is now dominating the direction of the American home building industry. This was evident at the recent West Coast Green Residential Building Conference & Expo, held in San Francisco in late September. This enlightened event attracted homeowners, developers, realtors, and design/build professionals. The specific concerns of design/build professionals were at the center of this event. The level of education was impressive and far exceeded Green Building 101. I was also impressed by the Expo's organizers, who acknowledged that informed consumers are the most powerful force driving the market. They actually organized a special Homeowner Day, giving homeowners access to the full trade show and offering special presentations geared to their concerns for achieving a healthier lifestyle. That fits well with the mission of *Ultimate Home Design*™ and our national showcase LEED® for Homes pilot project home, which embodies all of the concepts and building science principles we advocate in the magazine.

The next major "Going Green" event is the Greenbuild International Conference & Expo, to be held in Denver, Colorado, November 15 to 17 (www.greenbuildexpo.org). This mother of all green building events is sponsored by the U.S. Green Building Council, the framers of the LEED certification programs. (LEED stands for Leadership in Energy and Environmental Design.)

As with the two previous Greenbuild events, this conference offers an outstanding educational track, including

leading pioneers and proponents of green building and a LEED Green Building Rating System™ program, featuring a wide selection of USGBC faculty-led LEED pre- and post-conference workshops. With over 700 vendors, this will be the Expo's largest exhibit hall to date and a not-to-miss opportunity to explore the latest green building products and technologies. So get "Green Smart" and support every "Going Green" event you can, while at the same time educating yourself about the options for a healthier and Mother Earth-friendly lifestyle.

Inside This Issue

Part VI continues as a case study of the design and building of the first Optimum Performance Home™, a Platinum-level LEED® for Homes project. In this part, various structural aspects of the home are explored. Complementing the case study are two articles pertaining to exterior wall structural design, using insulating concrete forms (ICFs) and structural insulated panels (SIPs). Amvic Pacific President Bill Juhl and ThermaSAVE President Hoot Haddock, respective proponents of these two green building construction methods, are interviewed. They provide informative introductions to ICF and SIP applications in home design to significantly reduce energy costs and provide a more durable building structure. In the next installment in this series, the structural infrastructure will be expanded to include the extensive insulated- and solar-gain-reduced-glass vestibule and covered walkway, solarium, ridge skylight, tower skylight, and operable skylights throughout the home. There will also be coverage of the unique design of the dedicated Optimum Performance Home Theatre™ and rear-projection room in the home.

Our cover story features the personal LEED for Homes pilot project home designed by architect David Hartke, which is located in the rolling hills countryside of Bucks County, Pennsylvania. David shows how resource management and the environment were the primary focus. Vera Novak discusses the principles and pathways to organic home design in "Going Green From The Ground Up." Matt Power authors an article entitled, "Ahead Of The Curve," which explores how art and science can—and should—coexist as demonstrated in a Maine solar home. Straw bale construction in central California is explored in an article authored by Paula Aiton, which equates constructing straw bale walls as "much like stacking up children's building blocks." "How To Improve A Home's Energy Efficiency" is the theme of Scott Young's article, which explores conserving energy, a big issue for homeowners.

You might conclude from the contents in this issue that the focus is on "Going Green," and you would be right. Thank you for your continued support of our advocacy mission. **UHD**

New to the neighborhood

Sarah Scaglione

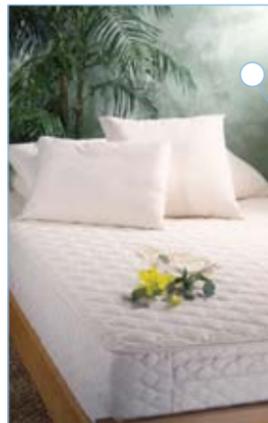
Dow Building & Construction

offers a cost- and time-saving insulation solution for steel stud applications with the introduction of THERMAX™ Sheathing, a glass fiber-reinforced polyisocyanurate foam core insulation board laminated between aluminum foil facers. With an R-value of 6.5 per inch, THERMAX Sheathing is not only an effective barrier against airflow and moisture, but also offers increased energy savings and exceptional fire safety. This innovative product, available in a variety of thicknesses, lengths, and facer technologies to meet any design specification, can be installed in a variety of building types and applications, including concrete structures. It can even be installed directly to the steel studs, to replace exterior gypsum and batt insulation. For more on Dow's insulation solutions, phone 866 583 BLUE or visit www.dowstyrofoam.com/architect.



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elevates the impact of energy-efficient homes by introducing LP® Techshield® Radiant Barrier. These panels are the combination of a thin, yet durable sheet of aluminum, laminated to the smooth side of LP OSB (oriented strand board), creating a durable product that reduces attic temperatures up to 30 degrees and can result in an increased home energy savings of up to 20 percent. This product not only increases home comfort but can even extend the life of HVAC equipment, and in some cases reduce the required size of the AC equipment. LP TechShield panels are available in standard 4 x 7-foot widths in thicknesses of 7/16, 15/32, 19/32, and 23/32 inches. For more information on LP OSB products, please phone 888 820 0325 or visit www.lpcorp.com/lpstructuralproducts.



Meridian Audio Limited boasts a 30-year history of innovation and development of the highest quality consumer audio and video systems. With the introduction of the 200 Series in-ceiling loudspeakers and the extensive 300 Series in/on walls, Meridian proves its commitment to superb sound and elegant design. A prime goal of these new installation loudspeakers is to

offer comparable audio power and quality to Meridian's free-standing designs, in a compact, easy-to-install form. The loudspeakers can be supplied as passive systems to be driven by conventional external amplification, or as "remote active" analog systems driven by the G41 Powered Crossover/Amplifier, which includes 8 x 100-watt power amplifiers and modular plug-in electronic crossovers, which can handle up to five channels of audio. These impressive

Meridian loudspeakers deliver the performance of a stand-alone design in a discreet enclosure with minimal visual impact and awesome power. For more information, phone 404 344 7111 or visit www.meridian-audio.com.



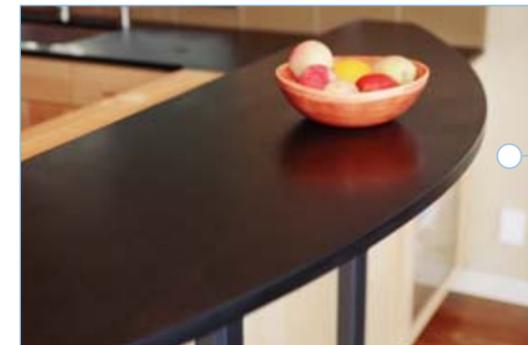
Lifekind® Inc.

Ever thought about how a conventional chemical mattress can contaminate the bedroom, where you spend one third of your life? One of the challenges facing home designers today is finding materials that are low in Volatile Organic Compound emissions (VOCs). Consumers have become very aware of indoor air quality contamination and are seeking to build and remodel with products that don't pollute their homes. Lifekind®, Inc. makes an organic mattress that is the first to be certified by the GreenGuard Environmental Institute as a low-VOC emission product. Lifekind, Inc. is also the only mattress-manufacturing facility to be third-party-certified organic by Quality Assurances International. Phone 800 284-4983 or visit www.lifekind.com. See also *The Toxic Bedroom* (available on Amazon).

Cabinet Tronix defines "plug-and-play" with their specialized design, development, and manufacturing of automated plasma furniture. This innovative San Diego-based company literally took the "off-the-wall" approach to incorporating your flat panel television into any décor. By providing a lift system integrated into a high-end piece of furniture, the homeowner can raise the plasma or LCD up into view and lower it to store out-of-sight when not in use. The complete package—lift system, screen, and furniture—ships completely ready for plug-and-play and can be shipped anywhere in the United States. Available in over 35 cabinet styles, including buffets, dressers, and chests, this cabinetry can also be customized in a variety of finishes and colors. For more information, visit www.cabinet-tronix.com or phone 866 876 6199.



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Deltec Homes offers outstanding energy efficiency in their panelized, circular designed homes. Known best for their success against hurricane-force winds, Deltec Homes are also extremely adaptable and far superior in energy efficiency to that of conventional homes. The aerodynamic shape, the unique, trussed roof design, and their precise construction methods lend themselves to exceptional energy efficiency. Many Deltec homeowners have remarked that their homes' energy consumption is as



little as half their neighbors' average. If you are looking for a unique home offering panoramic views, high performance, design flexibility, and remarkable energy efficiency, phone 800-642-2508 or visit www.deltechomes.com.

PaperStone™ Products'

mission is to design, develop, manufacture, and market the most durable, environmentally friendly, innovative, and cost-effective composites and resins systems in the world. Staying true to their mission, their newest addition to their product line, introduced in November of 2007, is PaperStone™ Certified. The Certified product line has the same great attributes as Original PaperStone™ and is designed to give the beauty of stone and the strength of steel, with the ease of workmanship. Most commonly used for countertops, toilet partitions, and the exterior panels in rain-screen siding systems, this product is made with phenolic resin and cellulosic fibers. The paper fibers utilized in the new PaperStone Certified product line contains 100 percent post-consumer recycled fibers and is FSC Certified. The 100 percent water-based resin system is produced with a cashew-nut shell liquid (CSNL) as well as phenols derived from corn and coal using no petroleum. PaperStone Certified comes in seven colors. For the eco-savvy consumer, PaperStone is the perfect solution. For more information, phone 360 538 9815 or visit www.PaperStoneProducts.com.

Dupont® puts science to work by creating sustainable solutions essential to a better, safer, and healthier life for people everywhere. Dupont Tyvek® ThermaWrap™ is the first insulating, breathable membrane designed with a unique combination of thermal resistance and high vapor permeability for the home building industry. This revolutionary product is specially engineered to provide the best possible balance of breathable barrier properties, so it is light and flexible, highly vapor permeable, but still airtight, wind-tight and will last the lifetime of the building. Its combination of high vapor permeability and thermal protection forms a quality wall defense against condensation and mold. Because it is a low-emissivity (low-e) surface, Dupont Tyvek ThermaWrap increases the thermal resistance, or R-value, of the wall, which reduces the transfer of heat, both in and out of the home, allowing homeowners to save significantly on home energy costs. To learn how this thermal breathable barrier enhances traditional weather-resistant building paper, phone 800-44Tyvek or visit www.construction.tyvek.com.



Innovative Stone is a manufacturer of the most desired surface for kitchen countertops—granite. However, the maintenance involved with keeping the luster of the granite can sometimes be laborious and time-consuming. Not anymore, thanks to Innovative Stone's revolutionary Stonemark™. This 100 percent natural granite countertop is completely maintenance-free and is impervious to staining, scratching, and heat, and does not require sealing. Through a revolutionary technology called PermaShield™, a breakthrough process that uses a heat- and water-based process to penetrate deep into the stone to protect it, these granite countertops harbor zero bacteria and are easier to clean. Available only at The Home Depot and currently sold in the North Eastern and Mid-Atlantic United States, this product is available in 29 core colors, and recently, an additional 26 new exotic colors. To obtain your 100 percent natural granite countertop today, phone 631 273 4445 or visit www.innovativestone.com.



Sylvan Source Studies show that in 2004, more than \$9 billion was spent on bottled water in the U.S. and yet, some would argue that bottled water doesn't always meet minimum drinking water standards. More and more homeowners are taking control of their options for assuring clean, healthy water. Using next-generation, patent-pending technology, Sylvan Source combines degassing, distillation, demisting, and condensing capabilities into a cost-effective, integrated system that reduces contaminants more effectively than any other available technology. The result is a maintenance-free, home-based system that can be installed in new construction or existing homes. The Sylvan Source M-600 is a wall-mounted unit appropriate for homes requiring four to six gallons of water per day with multiple points of delivery, such as faucets, ice makers, and other water sources. For consistent water quality that withstands the test of time, phone 866 905 0012 or visit www.sylvansource.com.

DriTac Adhesive Group, celebrating its 50th Anniversary, is one of the oldest and most experienced manufacturers of adhesives for wood flooring in the market today. As part of the firm's dedication to the "green" building movement, DriTac has released DriTac 9200 FasTac Polymeric Resin with Urethane, High Solids Wood Flooring Adhesive. This fast-grabbing high solid, wet-lay adhesive inhibits the growth of bacteria and mold and has zero VOCs. Requiring no flash time, this product is ideal for installing multiply engineered plank, plain-back parquet, 3/4-inch solid shorts, acrylic impregnated multi-ply engineered plank, and acrylic impregnated plain-back parquet installations. Available in one- and four-gallon containers, DriTac 9200 spreads easily, is almost odorless, easy to clean up, non-flammable, and is recommended for all "green" building wood flooring installations. For more information, phone 800 394 9310 or visit www.DriTac.com.



BSH Home Appliances Corp. Bosch's new touch-control ceramic electric cooktops take the brand's previous lineup of cooktops a step beyond in performance, flexibility, and affordability. Divided into three classes, the cooktops offer many industry exclusives such as POWERBOIL™, which uses 100 percent of wattage for faster boil-up, and PRECISIONSIM™, offering a wider range of simmering options. The 5 and 6 Series models feature a turn-off timer to reduce overflow, while the 4 Series features a countdown timer. With all of these great features and a 36-inch touch-control electric cooktop, the Bosch cooktops are certain to be a consumer favorite. For more information, phone 800 921 9622 or visit www.boschappliances.com.



Perlick Corporation Since 1917, the Perlick Corporation name has been synonymous with innovation and unparalleled quality. Previously focusing their talents on providing beverage-dispensing equipment for the finest restaurants and hotels, Perlick finds its niche in in-home entertaining with its ENERGY STAR®-qualified 48-inch Two Door Multi-Zone Refrigerated Cabinet. Configured with a freezer and a refrigerator, this unit consumes the same amount of energy consumed by a 56-watt light bulb in one year. With full-extension shelving and stainless-steel interiors, these refrigeration units feature patent-pending convention cooling technology that allows the cabinet to maintain incredible control of interior temperature, while still saving energy. For more information, phone 800 558 5592 or visit www.bringperlickhome.com.



Moving Color™ offers two lines of innovative 4 x 4 glass tiles that are manufactured using the "color of infinity," enabling glass tiles to change hue dynamically, responding to applied heat. Recommended for interior applications only, these beautiful tiles are sure to get the attention of any houseguest. Inspired by the stunning Northern Lights of Alaska, the Northern Lights collection features tiles that appear black at room temperature and move through the color spectrum when temperature (warm water, radiant heat, etc.) is applied. The moving color is dynamic to the temperature of the heating agent. The Watercolors line closely resembles the luminous quality of water color. These tiles shift from a base coat of color to colorless when exposed to heat. This collection is currently available in eight colors and is "reversible," meaning the color will be restored upon cooling. To purchase your Moving Color products today, phone 916 337 6296 or visit www.movingcolor.net.



Wayne-Dalton combines the look of wood carriage doors with the insulation, safety, and low maintenance of steel with the release of their new 9700 series garage doors. With an insulating R-Value of 10, the doors ensure the door keeps out the cold and heat, no matter what the season. Available in six core styles, with the flexibility to be transformed into 54 different looks, this system is complete with Wayne-Dalton's exclusive iDrive wall-mounted opener that adds unparalleled looks and performance. Select your 9700 model garage door's trim pattern, windows, color, and accessories to achieve the ultimate distinction. For more information, phone 800 827 3667 or visit www.wayne-dalton.com.

Pennsylvania Green Home

Architect
David Hartke's
LEED® Pilot Project



Gary Reber

synopsis

-  It is not only the building that becomes green but also the integration of the building with the site and the community itself.
-  When dealing with the choices for materials and finishes of the home, resource management and the environment were the primary focus of attention.
-  Engineered lumber for the floor framing replaces traditional dimensional framing members, which in turn saves old-growth trees from being harvested.
-  Passive aspects were planned to help support the heating and cooling of the house.
-  Another distinctive element in this home is that it includes an age-in-place concept.



View from the front porch that serves as an outdoor living space.

The Site

Panoramic views of rolling hills and a countryside touched by small picturesque towns that look as if they are straight out of a Norman Rockwell painting—that is Bucks County—a 620-mile stretch of land ideally located in the southeastern corner of Pennsylvania that is situated within the bustling New York-Washington corridor. The land is bounded by the Delaware River and Trenton, New Jersey to the east and the historic city of Philadelphia to the southeast. One of these small, charming towns nestled in the countryside is Doylestown; a small, affluent suburb north of Philadelphia touched by rich, historic

architecture. Doylestown is a central community that serves as the “County Seat” for this region and is an attractive place to raise a family and build a home.

Architect

David Hartke is a LEED®- (Leadership in Energy and Environmental Design) certified professional and an avid supporter of the green building movement. Mr. Hartke's interest in this movement goes back for many years and, as the principal of Stampfl Hartke Associates, an architecture and engineering firm in Holicong, Pennsylvania, he gets the opportunity to contribute to this cause through his work.

Mr. Hartke and his family were looking for a location to build their dream home when they decided on Doylestown. The idea of designing his own family's home had always been a goal and as the future owner, architect, and builder, he was looking for a place where he could draw on both his devotion to green and his professional craft.

“It is no easy task to compromise the idea of a dream home when trying to construct a residence in a place where there is already such a predominant style, and there are so many existing restrictions.”

Careful thought and consideration were given to exactly where they were going to live. After looking at an assortment of possibilities, they decided to buy a subdivided lot from a longtime resident of the community rather than unearth a new piece of land. The property that was ultimately chosen includes an urban-like quarter acre of land, yet resembles a forest hollow with a multitude of mature fir trees circling the site. The land was attractive because it came with a multitude of advantages. First and foremost, the lot was located in Doylestown Borough, which is a walkable community. The children would be able to walk to their school, which is right down the street, and it's a pleasant stroll into the center of town to catch a cup of coffee in the morning. The location of the lot makes getting places without a vehicle very easy. Many restaurants, museums, libraries, and shops are all located literally right around the corner.



Front View

So, the question arises, what do you do when you finally find the property you've always wanted to build your green home on, and the municipality has control over the “look”? It is no easy task to compromise the idea of a dream home when trying to construct a residence in a place where there is already such a predominant style, and there are so many existing restrictions. This article will cover the planning, thought process, and material selection that went into constructing the Keystone GreenBuilt Initiative's (KGBI) first home, as well as Bucks County's first certified LEED home, from the bottom to the top.

Design Process And Production

After the location had been finalized, the design process and production selection were next in line. The aesthetic of the home was planned so that it would fit within the existing design fabric of the community, rather than attempting to make an extreme architectural statement. The 3,500-square-foot home was designed to fit within a compact 1,800-square-foot footprint. When dealing with the choices for materials and finishes of the home, resource management and the environment were the primary focus of attention. The design and construction team considered all of the products, components, and systems from the home's footing right up to its ridge.

A local firm manufactured the foundation walls, using pre-engineered Superior Walls®, which are made with 5,000 psi concrete, only 2-1/3 inches thick with integrated R-12.5 rigid insulation. Local gravel replaces the traditional 20 x 12-inch concrete footing and creates an extensive, natural “drainage plane.” In addition, gypsum wallboard attaches directly to the engineered foundation wall system, eliminating the need for



Open cell spray-on insulation within the roof framing.



Sun tunnel providing natural daylight for a bedroom's loft space.



The home's stair tower provides a passive means to allow the home to vent heated air via a convection or chimney effect.

additional studs to be installed in order to create a habitable basement area. The foundation also incorporates the home's garage.

The overall plan integrates the Optimal Value Engineered (OVE) framing technique. All framing members, including the exterior walls, the floor joists, and the roof rafters, are "stacked" at 24 inches on center. The thicker (2 x 6) framed walls require less members and use slightly less wood than the industry-standard 2 x 4 (at 16 inches on center) framing system. This arrangement also provides fewer thermal bridges caused by the framing members and a deeper wall cavity to accommodate thicker insulation.

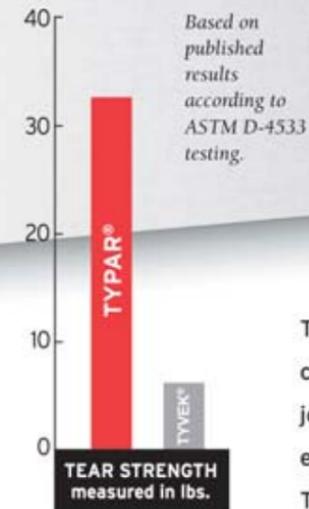
Engineered lumber for the floor framing replaces traditional dimensional framing members, which in turn saves old-growth trees from being harvested. The use of Oriented Strand Board (OSB) sheathing supports the concept of resource-efficient materials and commits to a safer indoor environment. OSB sheathing panels incorporate Phenol Formaldehyde (PF) resin in lieu of Urea Formaldehyde (UF). PF products tend to emit minimal toxins. The upper floor of the home has also been squeezed into the roof framing, eliminating the redundancy of placing a roof on top of a full second floor, which is typically done in home construction.

When choosing insulation, it was decided that Icenyne Spray Foam insulation was the way to go. Icenyne Spray Foam adheres to both the framing and sheathing members and helps to mitigate air infiltration. Another bonus of this design is that there are no toxins emitted from this form of insulation. In addition, low Volatile Organic Compound (VOC) caulk was installed at all exterior framing connections to further seal the home. The overall building envelope, prior to installing the drywall, was blower-door tested with a 0.26 Air Changes per Hour (ACH) result. Ultimately, the tightly sealed building envelope will require less heating and cooling.

Keeping in line with the tight building-envelope strategy, super thermal-efficiency Loewen windows were installed. The efficient characteristics associated with this window product are low-e glazing, an argon-filled cavity and an overall u-0.29 thermal-resistance rating that helps to reduce the HVAC load and usage. The windows were specified to be casements, which provide full opening and natural ventilation, unlike traditional double-hung units. The window locations were strategically placed throughout the residence to provide abundant daylight and solar gain, while interior French doors and openings were designed to further provide "borrowed light" from the sun that will incorporate into the home's living spaces.

In order to maximize the high-performance systems used in the construction of the property, Sustainable Solutions, Inc. was included in the green design team. They helped with designing integral aspects of the sustainable design, especially with regard to the HVAC components. After working on

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an efficiency strategy together, it was decided that a Geothermal Heat Pump (GHP) system would be the most efficient heating and cooling system. The GHP was sized specifically for this home's actual habitable area and volume. The unit required drilling two 300-foot-deep wells to access the local aquifer. The benefit of this system is that it utilizes the earth's latent energy to both heat and cool the home effectively. An additional benefit is that domestic water will be heated as a by-product of the GHP system.

In addition to the HVAC, a Heat Recovery Ventilation (HRV) system was designed to provide fresh air support using an efficient heat transfer system. The HRV system also aerates stale air from the well-sealed indoor environment.

Passive aspects were also planned to help support the heating and cooling of the house. One of these components is a three-story stair and light well that was designed to provide both natural light and a "chimney effect." This is the only multi-story space in the residence, and it utilizes natural convection to help cool the home during the summer by means of an electronically controlled venting skylight. Additionally, a ceiling fan was strategically placed below the skylight to mechanically support the "stair chimney."

Enclosed vestibules were also included at the primary and secondary entrances to provide a "heat trap." Vestibules are an example of a time-honored design component that was created over a century ago when building owners wanted to avoid sudden indoor temperature changes caused by the opening and closing of doors. Today vestibules help manage inconsistent manipulation of the HVAC controls and maintain overall comfort levels.

Solar shading devices were implemented to protect two of the home's south-facing window units from intense summer radiation. All other south-facing windows include roof overhangs that are designed to provide adequate shading for the southeastern Pennsylvania climate zone.

Ceiling fans have been placed throughout the home to both circulate the air and maintain the comfort level. There's one in every bedroom as well as the great room. Interior moisture

and humidity, typically initiated by the home's showers, are being managed using exhaust fans controlled by motion sensors with timers. A similarly controlled exhaust fan is located within the integrated garage to expel carbon monoxide and assure a healthy indoor air quality.

When choosing materials and lighting systems for the interior of the home, sustainability and durability were closely monitored. Environmentally friendly bamboo flooring will be laid down in addition to recycled (and recyclable) carpeting and ceramic tile. All painted surfaces (interior and exterior) will be painted with MAB Enviro-Pure paint. In consideration of energy savings and comfort, over 80 percent of the interior lighting fixtures are ENERGY STAR®-qualified. The Compact Fluorescent Lamps (CFL) use less energy and create less heat than standard incandescent light fixtures, and this helps to reduce the cooling load during the summer. Additionally, low-flow plumbing fixtures will be installed throughout the house, as well as engineered flexible plumbing tubing with manifold distribution.

The interior of the home was uniquely designed to cater to the needs of the family. One of the spaces worth mentioning is a bedroom on the second story. Since the second floor is part of the roof framing, the walls of this room are steep and slanted, making it unlike any other typical boxed bedroom. Taking advantage of the sloping walls and roofline, a solar tunnel was located to optimize the natural illumination of the room along with its child-sized loft area.

Universal Design

Another distinctive element in this home is that it includes an age-in-place concept. An "away room" located on the first floor will allow the Hartkes to switch bedrooms as they grow older and their knees and backs begin to stiffen. Additionally, a closet was designed to allow for a future elevator to physically connect the garage to the two upper floors. There will be no need for an addition or a "major" renovation to accommodate the inhabitants as they grow older. There will also never be a need to move them to an accessible-oriented home later in their lifetime.

Exterior Design

It is clear that many details went into making the interior of this home green, but there are also many exterior elements that contributed to the home's sustainability. For one, the exterior cladding includes pre-painted fiber cement siding by James Hardie® Building Products. A drainage plane was installed under the fiber cement siding to prevent moisture damage and increase the home's durability; that drainage plane is called "Home Slicker plus Typar." The Typar backing

acts as both an air barrier and as rain penetration prevention. The drainage product allows the entire home's exterior framing to breathe, while the Home Slicker's channeled matrix provides a "space" for rain and moisture to drain down the wall, while air wafts up, creating a natural venting device.

Another feature on the front exterior of the home is a large porch. Positioning the porch here orients the home toward the walkable neighborhood. It also encourages outdoor living-activities that require little or no mechanical air conditioning. The porch is also equipped with a 12-foot-deep roof that provides ample solar protection for the south-facing structure, as well as a weather-protected main entrance to the home. On the backside of the home is composite decking and porch railings that are made with recycled material and require minimal maintenance.

Landscape Design

Fringetree Design Studios, LLC—along with Land Stewards, LLC—was part of the initial design process. They developed a natural xeriscape-oriented landscape design that included minimal impervious surfaces and deciduous trees that were positioned in optional locations for seasonal (summer) shading of the home's windows.

For the exterior landscaping, there will be natural locally provided, drought-resistant vegetation. Rain barrels at the roof downspouts will collect up to 50 percent of the storm water from a 3/4-inch rainfall event and in turn provide natural irrigation for the home. Furthermore, a rain garden has been designed to collect storm water and infiltrate it back into the area's aquifer. Moreover, around the exterior of the dwelling, the driveway and patio will have pervious paving surfaces. All of the lighting for the exterior landscaping will be powered by Photovoltaics (PV).

Solar Power

A 1.4 kW polycrystalline PV panel manufactured by Sharp Solar will be attached to the southwest-facing rear roof toward the end of the construction phase. The wiring, meter, and inverter were installed prior to spraying on the insulation and will ultimately help offset the home's energy cost. The plan is to add additional PV panels in the future, once the supply aspect of the PV market catches up to the demand side, and PV costs are reduced to a point that can be offset by energy

use. The infrastructure is prepared to accommodate enough PV panels to create a net-zero-energy home.

Conclusion

All of the work and thought that were put into this home shows that it is not only the construction of the building that goes into making a green home. It starts with a vision that grows into a concept and is refined by all the other people that help create the solution. It becomes clear that it is not only the building that becomes green but also the integration of the building with the site and the community itself.

The Keystone GreenBuilt Initiative decided to launch the inauguration of their program at this homesite on September 26, 2006. The event attracted various media outlets and many home builders that support the green movement and want to provide energy-efficiency homes to their clients. The construction of Bucks County's first certified LEED for Homes pilot project is a giant step for the green home building movement. The home embodies the ideal that green isn't just for extremists or people looking to make a statement. A green home is an achievable feat for anyone, and any house can be made into a green home, whether it's new construction or not. And making a green home is not just about keeping money in the bank, it's about saving the global world's resources as well. **UHD**

The Author

Gary Reber is the President of Ultimate Home Design, Inc. and the founding Editor-In-Chief and Publisher of *Ultimate Home Design* magazine. His diverse background in several fields includes an undergraduate, graduate, and post-graduate university education in architecture, community planning, and economic development planning. For years he was a consultant on community and economic development planning. For the past 15 years he has been an editor and publisher of magazines in the consumer electronics field. Gary can be reached at 951 676 4914 or gary@ultimatehomedesign.com.

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The First Optimum Performance Home™

structural aspects part VI

Gary Reber

synopsis

As with the mechanical infrastructure, the structural aspects of the Optimum Performance Home utilize several leading-edge building technologies to create the most energy-efficient and durable design possible.

The design of the foundations is such that each flooring surface is perfectly level with the other. This is an important aspect of the home's universal design floor plan that eliminates any challenging physical barriers such as steps, humps, bumps, edges, or uneven surfaces that could pose a potential accidental trip or fall.

Three types of wall system construction will be utilized in the Optimum Performance Home: Amvic Insulating Concrete Form Building System and ThermaSAVE Structural Insulated Panel Building System for exterior walls, and light-gauge (cold-formed) steel-frame construction for interior walls.

Introduction

This is the sixth article in the series documenting the design and construction of the first Optimum Performance Home™. The project has been selected by the U.S. Green Building Council (USGBC) for inclusion in the national Leadership In Energy & Environmental Design (LEED®) for Homes pilot program, their new green build certification initiative.

The home will be built at The Sea Ranch, located in Sonoma County, along the Northern California coastline of the Pacific Ocean.

The showcase project is exemplary of the "Ultimate Home Design™" concept, which integrates age-friendly universal design with the best sustainable building practices while exerting minimal impact on the environment. Universal design is the inclusive, non-discriminatory design of products, buildings, environments, and urban infrastructure, as well as information technologies that are accessible to and useable by (almost) all. With respect to home design, the idea is to design and build homes that have no physical barriers, thus sustaining people of all ages and all capabilities in a functional, comfortable, and aesthetic lifestyle.

A building science systems approach to home building is the cornerstone of the project with emphasis on the relationships



The Sea Ranch, Sonoma County, California

"The goal is to demonstrate how today's products and building methods can make life safer, more comfortable, and more enjoyable. The science of optimum performance homes is about building structures that use less energy, are quieter and more comfortable, have fewer problems with material degradation, provide clean air and water, and do less damage to the environment."

between the home's components and the envelope they create. Also paramount is good stewardship—proper regard and respect for the rights of neighboring homeowners, resource efficiency, and the surrounding natural setting. The goal is to optimize occupant health, comfort, and safety; maximize energy efficiency and structural durability; and minimize environmental impact. In addition, the aim is toward providing a nurturing home environment to support independent living and sustainable lifestyles.

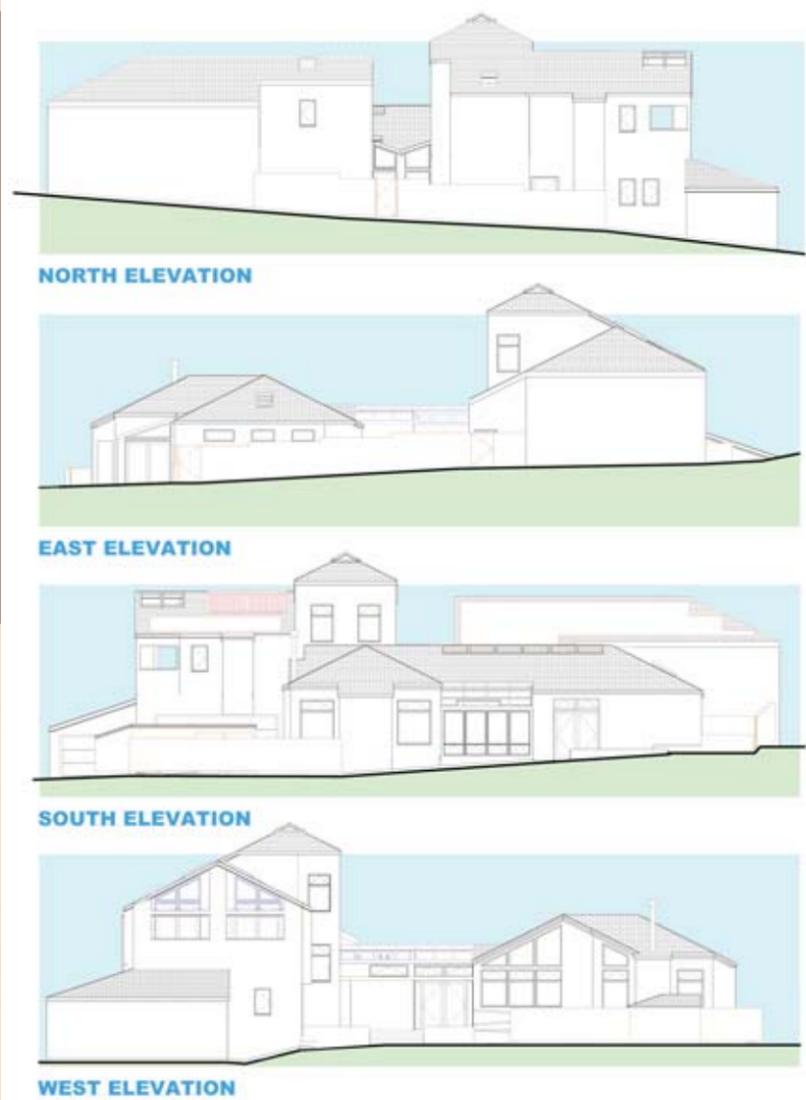
Part I of this case study series appeared in Issue 1, January/February 2006. The introductory article extended to 16 pages and covered extensively the project scope.

Part II appeared in the March/April issue and focused on site planning and preparation.

Part III expanded on the approach to Low-Impact Development (LID) for the site in the May/June issue.

Part IV appeared in Issue 4, July/August, and presented the Revised and Second Revised Final plan submittal to be reviewed by the Design Committee of The Sea Ranch Association. Part of the revisions included further refinement to the site plan and drainage design, which was hopefully the final condition to be met before the project would be permitted to be submitted to the Sonoma County Building Department for final structural and code approval, necessary to obtain a building permit.

Part V presented the initial approval by The Sea Ranch Association Department of Design, Compliance &



The elevations of the Optimum Performance Home at The Sea Ranch



A perspective of the southwest view created by architectural designer Ed Rose.

Environmental Management (DCEM) stating that the Revised and Second Revised Final plan submittal for the proposed home, and the associated grading/drainage and landscape plans were reviewed by The Sea Ranch Design Committee and that the architectural/ structural and grading/drainage submittals have been granted final approval with conditions that translate to clarifications on certain building components and material finishes. These conditions, with the exception of the need to acquire final approval for an on-site landscape plan, have now been satisfactorily addressed in the Third Revised Final plan submittal dated September 20, 2006, and have been removed by the Design Review staff. A letter indicating Final Approval for The Sea Ranch Association Construction Performance Permit was issued on October 11, 2006 for presentation to Sonoma County to obtain a county building permit.

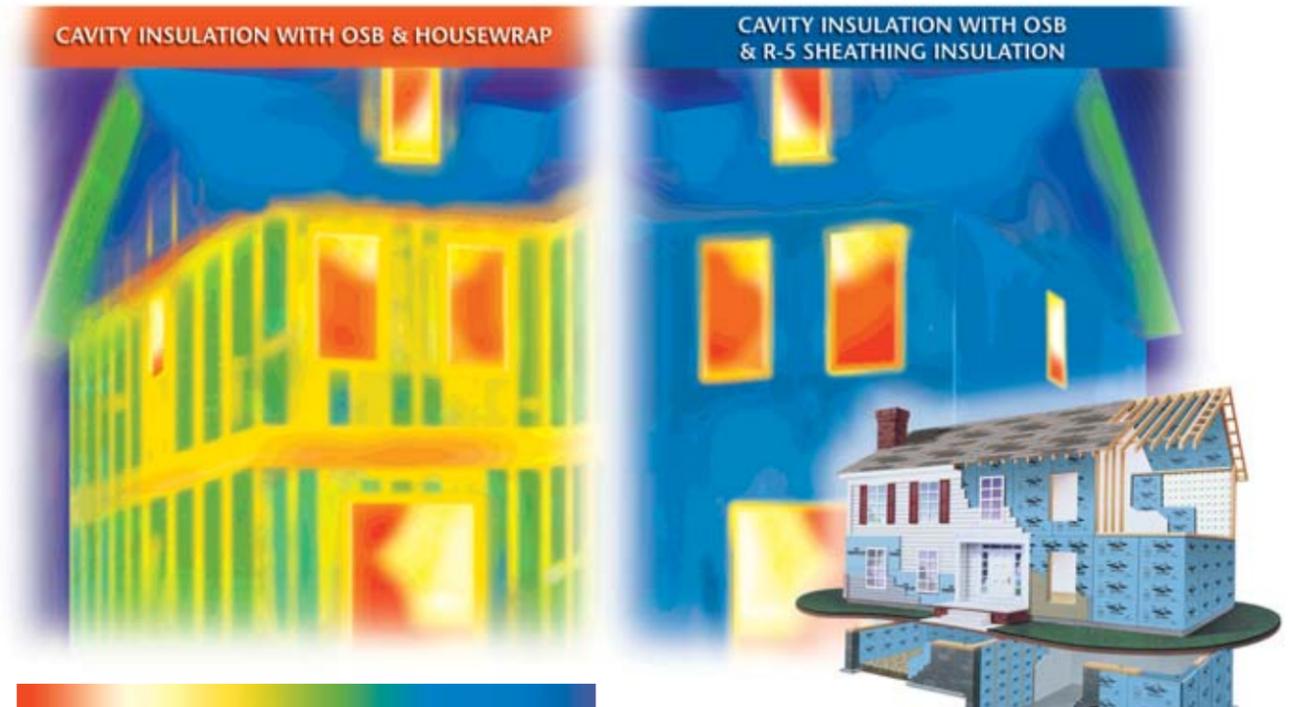
Also covered in Issue 5 were particular aspects of the home's mechanical plan.

The necessary work to address the remaining architectural/structural, grading/drainage, and landscaping concerns is nearly complete. This work includes the structural and mechanical plans for the Optimum Performance Home, necessary as part of the construction plans submittal to Sonoma County. Final construction plans are now in the review process with the Sonoma County Building Department and Third Party Plan Check Review. Assuming no further delays, the issuance of permits, the commencement of construction, site grading, foundation, and mechanical infrastructure could start by late November 2006.

In this, Part VI of the case study series, the focus will be on certain structural aspects of the Optimum Performance Home.

SCIENCE SAYS

it's time for
builders to cross
the thermal bridge.



Graphic re-creation of thermal bridging in a typical building wall envelope. Heat loss is indicated on a scale of red, the most heat loss, to purple, no heat loss.

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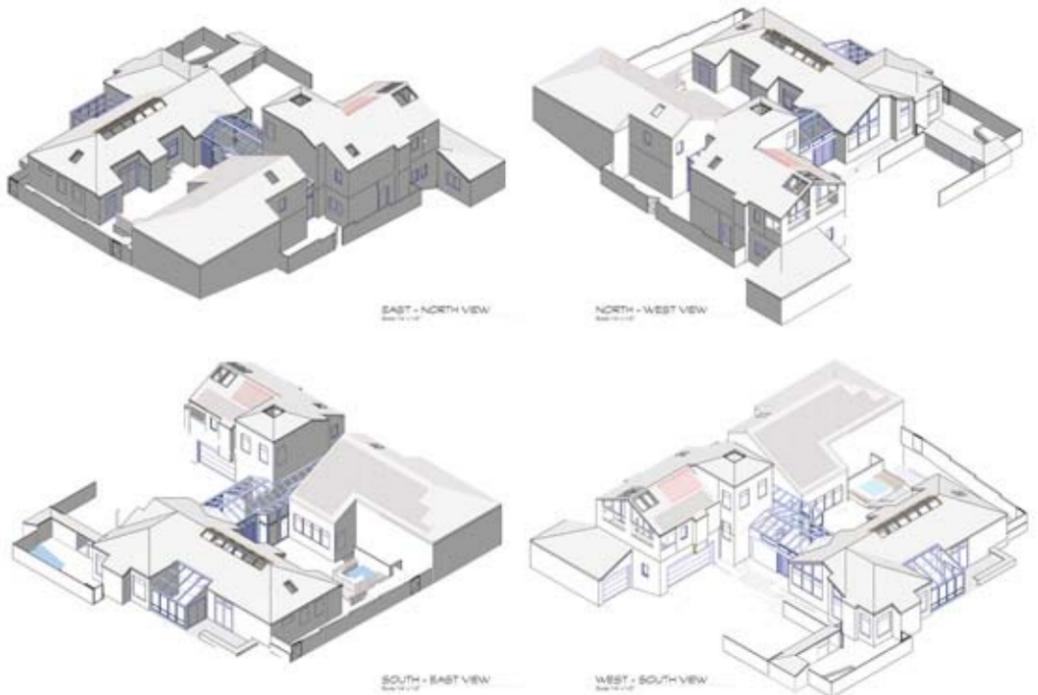


Structural Aspects

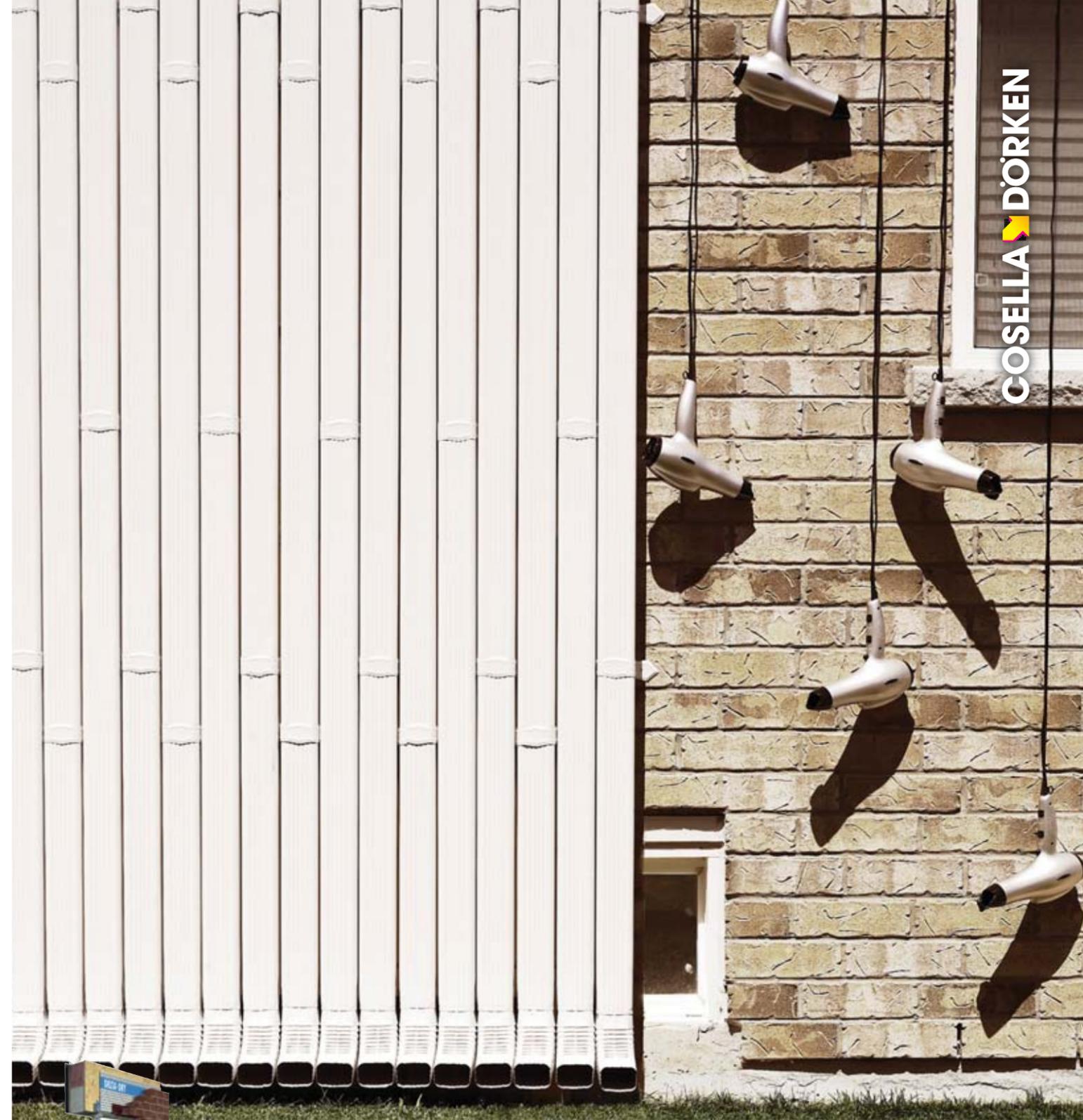
As noted in the previous articles in this series, the home design integrates all of the concepts advocated in *Ultimate Home Design*. The goal is to demonstrate how today's products and building methods can make life safer, more comfortable, and more enjoyable. The science of optimum performance homes is about building structures that use less energy, are quieter and more comfortable, have fewer problems with material degradation, provide clean air and water, and do less damage to the environment. As an integrated holistic design, the house will serve as a home for many people and serve in many phases in one's life.

The Optimum Performance Home's site plan is designed to strongly support the efficient use of the community's water supplies, equitable allocation of water resources provided by the community and harvested on-site, elimination of water pollution and contamination from poorly designed or failing septic systems, and general land use patterns that conserve and protect water resources within the overall ecosystem at The Sea Ranch. The water-efficient site plan and drainage design promotes "smart water use."

As with the mechanical infrastructure, the structural aspects of the Optimum Performance Home utilize several leading-edge building technologies to create



Four perspective views of the Optimum Performance Home at The Sea Ranch



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the most energy-efficient and durable design possible. The home is designed to cut its energy use with efficiency, and then meet the remaining needs with renewable energy sources.

Foundations

The home's 3,272 square feet of living space (4,899 square feet including garages, covered walkways, courtyard, and decks) will be arranged in a three-building compound using a well-sealed, well-insulated, super-tight building envelope that reduces temperature fluctuations and enhances overall energy efficiency.

The slab foundations are designed as two structural elements: one foundation to support the main residence and guest quarters, including the garages and insulated- and solar-gain-reduced-glass vestibule and covered walkway. The second foundation is dedicated to

support the home office and state-of-the-art Optimum Performance Home Theatre™ and integral rear-projection room. This foundation is physically separated from the main residence/guest quarters foundation by an inch. The purpose is to isolate the acoustical vibrational properties of the home theatre complex from the living quarters.

The design of the foundations is such that each flooring surface is perfectly level with the other. This is an important aspect of the home's universal design floor plan that eliminates any challenging physical barriers such as steps, humps, bumps, edges, or uneven surfaces that could pose a potential accidental trip or fall. Where steps are required at the home's entrance, a ramp is also provided as an alternative approach. The second story guest quarters are accessible by either stairs or a residential elevator.

As the home's site is subject to wet or moist soil conditions most of the year, the foundations are designed to be water impenetrable. Working with concrete admixture technology companies and the local concrete mix supplier, Bed Rock of Point Arena/Gualala, a unique mix formula will be utilized for the foundations' pour and for the interior concrete web of the Amvic Insulating Concrete Form (ICF) walls.

Kryton's KIM® Admixture System will be used to create waterproof concrete and replace expensive external waterproofing membranes. KIM admixture renders hardened concrete impermeable to water penetration, reduces drying shrinkage, protects steel reinforcements from corrosion, and improves concrete durability.

KIM admixture is part of Kryton's Krystol™ Concrete Waterproofing System, a complete system for tanking

below-grade foundations and water containment structures. An advanced integral crystalline technology, Krystol chemicals react with water and unhydrated cement particles to form millions of needle-like crystals. Over a period of weeks and months, these crystals grow, filling the naturally occurring pores and voids in concrete, and permanently blocking the pathways for water and waterborne contaminants, even against extremely high water pressure. Krystol will not deteriorate. It lasts the lifetime of the concrete structure.

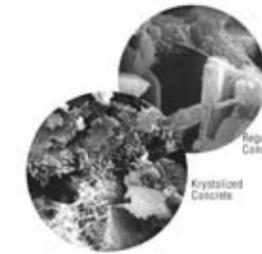
The ability to reactivate in the presence of water gives Krystol-treated concrete the ability to "self-seal." When cracks form due to curing shrinkage, settling, seismic activity, etc., water entering through them causes new crystals to form and grow, blocking and filling the cracks. Its ability to self-seal cracks is one of crystalline technology's most unique and useful features and can help to dramatically reduce the long-term maintenance and repair costs of a concrete structure.

Additionally, the concrete foundation surface for the garages will be treated with Kryton's Hydrostop water-repellent sealer. It contains a blend of silane and siloxane compounds that react with silicates below the surface of the foundation. This reaction forms an insoluble, water-repellent barrier that won't crack, peel, or fade away with time. Hydrostop is resistant to moss, mildew, rust stains, and efflorescence. It dries to an invisible finish, meaning the concrete's original appearance is maintained. As it is breathable, Hydrostop won't contribute to condensation problems.

Headwaters Resources is America's largest manager and marketer of coal combustion products, including fly ash. Fly ash, a residual material produced principally at coal-fueled electric power plants (which is captured from the exhaust of the boiler), will be an ingredient in the ready-mixed concrete admixture for the foundations. Fly ash improves the performance of concrete foundations, making them stronger, more durable, and more resistant to chemical attack, while creating significant environmental

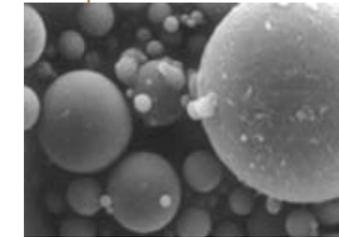
Kryton's KIM® Admixture System

- KIM admixture renders hardened concrete impermeable to water penetration, reduces drying shrinkage, protects steel reinforcements from corrosion, and improves concrete durability. The advanced integral crystalline chemicals react with water and unhydrated cement particles to form millions of needle-like crystals to permanently block the pathways for water and waterborne contaminants.



Headwaters Resources

- Fly ash improves the performance of concrete foundations, making them stronger, more durable, and more resistant to chemical attack, while creating significant environmental benefits through stewardship of an abundant industrial resource. Because the tiny fly ash particles fill microscopic spaces in the concrete, and because less water is required, concrete using fly ash is denser and more durable. And concrete containing fly ash becomes even stronger over time compared to concrete made only with cement.



Cosella-Dörken Products, Inc.

- Based on a uniquely formed air-gap membrane, water is kept from ever touching walls on its way through the soil to the footing drainage tile. The DELTA-MS Clear system ensures permanently dry foundations. DELTA-MS Underslab waterproofing and underslab vapor-retarder membrane is designed to improve the floor performance below concrete slab foundations.



Rehbein Environmental Solutions, Inc.

- Netpave 50 is manufactured from 100 percent recycled polyethylene to provide an attractive, easy-to-use, durable solution for permeable parking and access routes.



LANDSCAPE/SITE PLAN

Amvic Insulating Concrete Forms

- The Amvic ICF 5-in-1 system incorporates structure, insulation, vapor barrier, sound barrier, and studding attachments for drywall and exterior siding in one easy step. AmDeck is designed for floors.



ThermaSAVE

- The ThermaSAVE Structural Insulated Panel Building System consists of an inner and outer skin and a core of super-insulating expanded polystyrene (EPS) or Dow Styrofoam® cores glued together with a special high-strength glue and dried under extreme pressure, resulting in a stressed-skin panel that has amazing capabilities.



EverGreen Slate Company

- EverGreen's 11 natural slate colors and textures afford many architectural effects, contributing to a building's appearance. Slate quarried for roofing stock is of dense, sound rock, exceedingly tough and durable. It is also fireproof and waterproof and resistant to climatic changes, with absolutely no disintegration. EverGreen slate has the highest designation for durability in excess of 75 years.



Revere Copper Products, Inc. & CopperCraft

- Revere Copper Products, Inc. is one of the oldest, if not the oldest, manufacturing company in the United States. Founded in 1801 by Paul Revere. Revere's products include copper and copper alloy sheets, strips, plates, bar, and extruded profiles.
- CopperCraft was established with the goal of preserving the high quality and craftsmanship found in old world metalworking, while enhancing techniques with computerized layout, cutting, and forming.

Image Not Available

Gutter Helmet

- The Gutter Helmet gutter protection system is a multi-patented, flow-limiting, ribbed design that slows and spreads water, causing it to flow easily into the gutters, while debris falls to the ground.



benefits through stewardship of an abundant industrial resource.

In making concrete, cement is mixed with water to create the "glue" that holds strong aggregates together. Fly ash works in tandem with cement in the production of concrete products. Concrete containing fly ash is easier to work with because the tiny, glassy beads create a lubricating effect that causes concrete to flow and pump better, to fill forms more completely, and to do it all using up to ten percent less water. Because the tiny fly ash particles fill microscopic spaces in the concrete, and because less water is required, concrete using fly ash is denser and more durable. And with time, fly ash reacts chemically, giving off cement hydration and creating more of the glue that holds concrete together. That makes concrete containing fly ash stronger over time than concrete made only with cement. And when fly ash is added to concrete, the amount of cement that is necessary can be reduced. As a result, fly ash also reduces the need for cement production—a major energy user and source of "greenhouse gas" emissions.

As an added protective measure, the foundations will be wrapped with DELTA®-MS, an effective foundation waterproofing and protection system developed by Cosella-Dörken Products, Inc. Based on a uniquely formed air-gap membrane, water is kept from ever touching walls on its way through the soil to the footing drainage tile. The system ensures permanently dry foundations. DELTA-MS Clear will be used for the Amvic ICF portion of Building Two that is earth-banked. DELTA-MS Underslab waterproofing and underslab vapor-retarder membrane will be used to improve the floor performance below the concrete slab foundations.

Permeable Driveway, Guest Parking, And Exterior Walkways

Netpave 50, a Netlon Turf Systems product of Rehbein Environmental Solutions, Inc., will be used as the paving

system for the driveway, guest parking, and exterior walkways around the home. Netlon Turf Systems, a brand name of Conwed Plastics, LLC, is an acknowledged leader in the development and application of mesh products for horticulture, civil engineering, landscaping, and storm water management. These products process storm water naturally, prevent erosion and soil migration, and clean water of contaminants.

Netpave 50 is manufactured from 100 percent recycled polyethylene to provide an attractive, easy-to-use, durable solution for permeable parking and access routes. The resulting surfaces are American's With Disabilities Act (ADA)-compliant, while enhancing the environment.

Netpave 50 units are two inches thick and are connected by a rapid fastening system (lugs and slots). These unique flexible elements can be easily installed on irregular surfaces and gradients. Netpave 50 can be filled with turf in the cellular structure. Alternatively, it can be filled with gravel, and the cellular structure will retain the stone and prevent loss or displacement. Netpave 50 can be used in permeable high load-bearing areas, as is the application at the Optimum Performance Home.

Netpave 50 units installed in the guest parking area will cover the WaterFurnace (see Issue 5, September/October 2006) vertical closed-loop geothermal system underneath. This system circulates water through a "loop" of small-diameter, underground pipes made of high-density polyethylene. The ground-loop portion of the geoechange system uses the constant temperature of the earth as a heat source instead of natural gas or propane, for increasing the efficiency of an electric ground-coupled heat pump. The ground loop replaces the "outdoor unit" of a conventional air-to-air heat pump.

Spunstrand special underslab low-velocity insulated ducts (see Issue 5, September/October 2006) will be installed under the dedicated home theatre/rear-projection room building foundation to provide air conditioning to those spaces.

Nordic Structures, LLC



- The advantages of light-gauge (cold-formed) steel framing is that in addition to being recycled and recyclable, steel has a significantly higher strength-to-weight ratio than wood and thus has greater earthquake resistance. Steel framing also is impervious to rot and termites. Steel is non-combustible and does not contribute fuel to the spread of a fire, and steel is an inorganic material, which does not provide an environment on which mold can grow.

Quiet Solution



- QuietRock® 525, a patent-pending CPG (ceramic-polymer-gypsum) composite drywall panel that reduces sound transmission and vibration, weighs about the same as standard drywall and provides superior sound isolation at a lower total cost than other methods.

Bonded Logic, Inc.



- Bonded Logic's UltraTouch insulation product is 100 percent post-industrial recyclable and environmentally friendly cotton fiber insulation that provides maximum health and superior R-value thermal performance. It is Class-A fire rated, offers excellent thermal and acoustical properties, and is treated with a non-toxic mold, mildew, and pest inhibitor.

Latitude



- The natural wool used in Latitude's insulation is from wool-processing in New Zealand. Wool, unlike synthetic materials, actually reacts to changes in temperature and atmospheric moisture. Insulation made with natural wool fibers not only achieve impressive R-value thermal performance, but because of wool's thermoregulation properties, wool insulation has the ability to absorb and release water vapor and has been proven through independent laboratory tests to help keep buildings cool in summer and warm in winter.

James Hardie® Building Products

- James Hardie® provides a 50-year limited transferable product warranty on its lap and panel siding. The products are dimensionally stable and resist cracking, rotting, and delamination. As well, they resist damage caused by extended exposure to moisture, humidity, UV rays, and salt air.

No-Burn®

- No-Burn® fire retardants and reactants are a highly advanced line of non-toxic, non-carcinogenic liquids that render a vast array of materials incapable of burning, as well as inhibiting the growth of toxic black mold. No-Burn removes the fuel a fire needs to burn when applied to wood, drywall, fabric, carpet, and furniture.



OSI Sealants, Inc.

- OSI Sealants is a leading manufacturer of caulks, sealants, adhesives, and wood-patching products with more than four decades of experience in developing and supplying the highest quality products. The company's Green Series features low-VOC construction adhesives, caulks, and sealants.



Carriage House Doors

- Carriage House Doors manufacturers fully modern functioning garage doors and barn doors that are meticulously handcrafted and are made from the finest materials, with hardware available to ensure long-lasting beauty, reliable performance, and low maintenance.



Natural Cork

- The highly durable natural cork floor product is made of natural and renewable material, improving health conditions in homes. Cork floors create a warm, comfortable, resilient surface that is gentle underfoot, is anti-microbial, will not spread flame, and is inherently resistant to molds, mildews, and common pests such as termites.



LP Building Products & Weyerhaeuser iLevel™

- These high-quality OSB structural products are engineered for optimum strength, stiffness, uniform straightness, and level surface performance.



Wall Systems

Three types of wall system construction will be utilized in the Optimum Performance Home.

Amvic ICF Building System

The home theatre and rear-projection room in Building Two, and the first floor of the guest quarters and library/surround music/home theatre in Building Three, which houses the two-car garage, workshop, and laundry room on the ground floor, will be constructed with Amvic Insulating Concrete Forms. The Amvic 5-in-1 system incorporates structure, insulation, vapor barrier, sound barrier, and studding attachments for drywall and exterior siding in one easy step.

An ICF is simply a hollow, lightweight, "stay-in-place" form. Amvic ICFs combine closed-celled expanded polystyrene (EPS) insulation and concrete thermal mass, which evens out temperature fluctuations by absorbing and storing heat. This prevents air movement in or around the cellular structure, creating an airtight seal around the entire perimeter of the building. Rooms enclosed with Amvic ICFs maintain consistent temperature from floor to ceiling, providing superior temperature control and exceptional comfort. This highly effective combination equates to an average of approximately 30 to 50 percent in monthly savings on heating and air conditioning, which translates to an equivalent reduction in harmful emissions. Building with Amvic ICFs generates only one percent of construction waste on average, greatly reducing land filling, which produces methane emissions. Furthermore, Amvic uses steam and cold water to produce ICFs. No CFCs (Chlorofluorocarbons), HCFCs (Hydrochlorofluorocarbon), formaldehyde, or any chemicals are used in Amvic's manufacturing process and no off-gassing is present. An Amvic home saves a lot of trees, which absorb carbon dioxide and emit oxygen.

Because the Amvic Building System uses EPS insulation, all airborne glass fibers and

insulation settlement caused by traditional fiberglass insulation is eliminated. The impermeable walls prevent the entry of dust, pollens, and pollution.

Amvic ICFs use the unique FormLock™ interlocking system. The system ensures a tight and secure interlock between forms, due to deep grooves that virtually align themselves, thus providing greater connection strength without the need for gluing, taping, or tying. This means that an Amvic ICF wall system will not lose its structural integrity over time, as with conventional wood frame construction.

Amvic ICFs are manufactured using 2-1/2 inches of 1.5 pound/cf density EPS foam on each side of the form. These panels are very rigid and, therefore, maintain shape, remain straight and plumb, and require less bracing during concrete pouring and curing to create a strong and structurally superior wall.

Amvic polypropylene webs are placed six inches on center and have a unique steel rebar holding system with built-in clips that hold rebar securely in place without tying, for a superior reinforced wall. During construction, the forms are first stacked together into the desired shape then filled with concrete in order to make stable, durable, and sustainable walls.

Three wall thicknesses will be used. For walls that serve as below-grade retaining walls in Building Two the wall thickness is 15 inches. For above-grade walls in Building Two, the thickness is 13 inches. Interior walls in Building Three are 11 inches thick. All interior wall surfaces are rated for 198 pound pullout strength.

The EPS insulation used in Amvic ICF is comprised of a collection of closed plastic cells that together with concrete walls prevent air movement around the perimeter of a structure, creating an airtight seal and providing performance equivalent to an insulation level of R-40 to R-50. An assembled Amvic ICF wall of a six-inch concrete

core or greater has a fire rating of three hours plus. In addition, while conventionally built structures have a sound transmission class (STC) rating of 36 to 38, an Amvic structure has an STC rating of 50 plus. And the reinforced concrete walls provide resistance to high winds and storms. The non-organic materials in Amvic ICFs prevent insect damage, as well as mold and mildew growth. The latter two benefits are desirable along the Pacific coastline where the Optimum Performance Home is located.

Please see the interview with Amvic Pacific President, Bill Juhl, on page 38.

ThermaSAVE SIP Building System

The ThermaSAVE Structural Insulated Panel Building System will be used for the main residence in Building One, the home office in Building Two, and the second floor guest quarters, library/surround music/home theatre, and boat garage in Building Three.

Structural Insulated Panels, or SIPs, are composed of a continuous core of rigid foam insulation, which is laminated between two layers of structural board to form a solid panel.

The system consists of laminated building panels called ThermaSAVE panels. Consisting of an inner and outer skin and a core of super-insulating expanded polystyrene (EPS) or Dow Styrofoam® cores glued together with a special high-strength glue and dried under extreme pressure, the result is a stressed-skin panel that has amazing capabilities. The inner and outer skins can be of a variety of materials that can form the inner and outer finish or act as an underlayment for the final surface. The panels can be pre-cut and custom fabricated, and are available with pre-cut wire chases and window and door openings. The result is a uniform single panel that has proven strength, durability, and thermal efficiency.

The ThermaSAVE patented spline connection system joins together four-foot wide panels to build walls, floors, and roofs that are lightweight, yet can withstand high wind loads (110 to 200 mph), earthquakes, and the twisting and flexing that slowly deteriorates conventional buildings.

ThermaSAVE wall panels can be finished with either cellulose-reinforced fiber-cement board or oriented strand board (OSB). In the case of the Optimum Performance Home, James Hardie® Building Products will be used for the exterior, and smooth Hardie panel board for the interior. In cases where siding or brick is the desired exterior finish, OSB panels will accept nailing of siding or brick wall ties. Virtually any type of sheet material can be applied. The system gives unlimited design possibilities to the architect for almost any project.

Fiber-cement board used as skins will not rot, burn, support toxic black mold (stachybotrus chartarum), or absorb moisture. No wall board is necessary. Other advantages are that the fiber cement board can be obtained with different finished looks, such as a wood grain, stucco, or smooth, which just needs seams sealed and painted. Using a smooth finish allows stucco, vinyl siding, brick, or stone to be applied.

SIPs provide higher R-values, reduced air infiltration, less thermal bridging, and greater stability. Energy savings with ThermaSAVE SIPs are dramatic—40 to 60 percent.

ThermaSAVE SIPs are rot- and vermin-resistant and are not affected by water vapor and high moisture content. They are produced with a minimum amount of wood products (to be eliminated entirely) and are manufactured using non-toxic products that do not create toxic wastes or affect the ozone layer. The expanded polystyrene used is fire retardant with a flash point between 600 and 650 degrees Fahrenheit. These were important considerations for building with ThermaSAVE SIPs at The Sea Ranch.

Due to ThermaSAVE's unique patented spline fastening system, there are no wood parts extended through the panels from face-to-face except at openings, corners, beams, and roof edges.

Structures built with these panels will have up to 75 percent less heat loss or gain.

Please see the interview with ThermaSAVE Founder and President, Hoot Haddock, on page 46.

Interior Walls

The third form of wall construction will be steel framing of the interior walls. The advantages of light-gauge (cold-formed) steel framing is that in addition to being recycled and recyclable, steel has a significantly higher strength-to-weight ratio than wood, and thus has greater earthquake resistance.

Steel framing also is impervious to rot and termites. Steel is non-combustible and does not contribute fuel to the spread of a fire, and steel is an inorganic material, which does not provide an environment on which mold can grow. The steel framing will be fabricated by Nordic Structures, LLC.

Interior drywall paneling will extensively consist of Quiet Solution's QuietRock® 525, a patent-pending CPG (ceramic-polymer-gypsum) composite drywall panel that reduces sound transmission and vibration unlike any other construction material on the market today. QuietRock weighs about the same as standard drywall and provides superior sound isolation at a lower total cost than other methods. The panel is fire rated for one hour without No-Burn® (see sidebar) added treatment. The rated 51 to 72

STC value far exceeds 5/8-inch gypsum, cinder block, and soundboard panels. And it hangs and finishes like standard drywall. It is also available in a mold-resistance form, the version to be used in the Optimum Performance Home.

Wine Cellar

The underground wine cellar at the Optimum Performance Home will be constructed entirely with cast-in-place reinforced concrete using the same admixture used for the foundations. The wall thickness will be ten inches for structural strength and uniform insulation. A barrel-vaulted formed concrete ceiling will be a feature, as well as textured wall treatment. The natural cork flooring will be supplied by Natural Cork. This highly durable natural cork floor product

is made of natural and renewable material, improving health conditions in the home. Cork floors create a warm, comfortable, resilient surface that is gentle underfoot, is anti-microbial, will not spread flame, and is inherently resistant to molds, mildews, and common pests such as termites. Since cork flooring is protected by five coats of highly durable UV-cured acrylic finish, the floor can be easily maintained.

As well, Cosella-Dörken waterproofing products will be used to seal out moisture. Above the wine cellar will be a living roof.

Garage Doors And Entry Barn Door

Garage doors and an entry sliding barn door will be provided by the Carriage House Door Company. The

custom design of the doors will complement the James Hardie board-and-batten architectural exterior look of the home. These fully modern functioning doors are meticulously handcrafted and are made from the finest materials, with hardware available to ensure long-lasting beauty, reliable performance, and low maintenance.

Roof Systems

ThermaSAVE SIP roof panels will be used for all roofs on the Optimum Performance Home. These panels have the same attributes as the ThermaSAVE wall panels.

Exterior roofing will be comprised of fine natural Vermont slate from the EverGreen Slate Company, Inc., the largest producer and supplier of slate in

the U.S. EverGreen's 11 natural slate colors and textures afford many architectural effects, contributing to a building's appearance. Slate quarried for roofing stock is of dense, sound rock, exceedingly tough and durable. It is also fireproof and waterproof and resistant to climatic changes, with absolutely no disintegration. Evergreen slate has the highest designation for durability in excess of 75 years. The roof slate will be Welsh Black, a rich, textured natural black slate.

The material for the all-copper rain gutters will be supplied by Revere Copper Products, Inc., one of the oldest, if not the oldest, manufacturing companies in the United States. Founded in 1801 by Paul Revere, a prominent silversmith and maker of cast bronze bells and marine hardware. Revere's products include copper alloy

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sheets, strips, plates, bar, and extruded profiles.

Gutter design and fabrication will be provided by CopperCraft. CopperCraft was established with the goal of preserving the high quality and craftsmanship found in old world metalworking, while enhancing techniques with computerized layout, cutting, and forming. This insures quality, consistency, and competitive pricing.

The Gutter Helmet gutter protection system will be installed on all of the full-size copper rain gutters. The multi-patented, flow-limiting, ribbed design slows and spreads water, causing it to flow easily into the gutters. The simple physical law of surface tension forces water around the Gutter Helmet nose and into the gutters, while debris falls to the ground. A 3/8-inch horizontal gap handles the

heaviest rains but keeps out animals and debris. Gutter Helmet's patented Perma-Life™ coating will not fade or chalk and is not affected by corrosive acid rain. A black Perma-Life coating has been chosen to complement the EverGreen Welsh Black natural slate roofing.

Floor Systems

The second-floor system in Building Three will be constructed with the Amvic AmDeck Floor System. This is a modular, lightweight, stay-in-place form made of expanded polystyrene (EPS) that is used to construct concrete floors and roofs. The system provides structural strength through reinforced concrete and insulation through EPS. The AmDeck Floor System uses ten-inch lightweight steel framing studs, which

carry the temporary construction loads until the concrete gains its required strength and acts as furring strips to which interior finishes can be attached.

The second level over the rear-projection room and home theatre in Building Two will be constructed with engineered lumber using either Weyerhaeuser iLevel™ TJI® Trus Joist and/or LP Building Products. These high-quality OSB structural products are engineered for optimum strength, stiffness, uniform straightness, and level surface performance.

Insulation

UltraTouch Natural Cotton Fiber Insulation

In addition to recyclable expanded polystyrene used in the Amvic and

ThermaSAVE Building Systems, interior wall insulation inserted between the steel framing studs will consist of ENERGY STAR®-qualified UltraTouch natural cotton fiber insulation by Bonded Logic, Inc. The UltraTouch natural cotton fiber insulation product is Class-A fire rated, offers excellent thermal and acoustical properties, and is treated with a non-toxic mold, mildew, and pest inhibitor. This 100 percent post-industrial recyclable and environmentally friendly insulation provides maximum health and superior R-value thermal performance. It is the healthy choice, as the high-quality fiber contains no chemical irritants or harmful airborne particulates that can enter living areas and the surrounding environment, causing health problems. UltraTouch has no VOC out-

gassing concerns and contains no formaldehyde or fiberglass. Every natural fiber used to manufacture UltraTouch is treated with an Environmental Protection Agency (EPA)-registered, non-toxic, borate solution to offer complete and safe mold and mildew protection.

Acoustically, UltraTouch natural cotton fiber insulation has an extremely high Noise Reduction Coefficient (NRC) to effectively reduce airborne sound transmissions. The natural fibers that are used to make UltraTouch contain excellent sound absorbing qualities and are manufactured to effectively trap, isolate, and control sound waves. The result is a quiet, comfortable environment between rooms, walls, and floors.

Latitude Natural Wool Insulation

In the dedicated Optimum Performance Home Theatre and rear-projection room, a floating inner-wall and ceiling system will be constructed one-inch out from the interior of the Amvic ICF structural walls. This resilient channel-designed inner room wall system will optimize the sound performance quality in the home theatre. In this case, we intend to use Latitude natural wool insulation.

The natural wool used in Latitude's insulation is from wool-processing in New Zealand. Wool, unlike synthetic materials, actually reacts to changes in temperature and atmospheric moisture. Insulation made with natural wool fibers not only achieves impressive R-value thermal performance, but because of wool's thermoregulation properties,

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wool insulation has the ability to absorb and release water vapor and has been proven through independent laboratory tests to help keep buildings cool in summer and warm in winter.

Latitude is made with 100 percent post-industrial natural recycled sheep wool fibers joined together using an advanced resin-bonding process. Latitude is biodegradable and contains no permethrin, pyrethroids, or formaldehyde. At the end of a building's life, Latitude can be recycled for other environmentally friendly applications. To keep away insects and rodents, Latitude is treated with naturally occurring non-toxic elemental boron salts. Advantageously, wool has higher fire resistance than cellulose and cellular plastic insulations; it does not burn, but rather melts away from an ignition source and extinguishes itself. Latitude is treated with a fireproofing agent to improve its intrinsic fire resistance and complies with the appropriate Class A industry standard.

Acoustically, Latitude properties promote the baffling of unwanted exterior noise and can reduce the level of environmental noise pollution considerably. In sound quality applications, as in the Optimum Performance Home Theatre, natural wool insulation provides desired low-frequency absorption.

Exterior Siding

The exterior siding on the Optimum Performance Home will be exclusively fiber-cement panel siding by James Hardie, manufacturers of one of the world's most durable sidings. James Hardie provides a 50-year limited transferable product warranty on its lap and panel siding. The products are dimensionally stable and resist cracking, rotting, and delamination. As well, they resist damage caused by extended exposure to moisture, humidity, UV rays, and salt air; an extremely important consideration in selecting this siding

product for The Sea Ranch coastal location.

James Hardie panel siding provides durability and low maintenance without sacrificing the beauty and character of wood. And it retains its beauty for decades with very little care. To enhance the beauty and integrate perfectly with the historical architectural look of redwood and cedar siding on homes at The Sea Ranch, Hardipanel® Vertical Siding will be applied to the exterior of the home. A board-and-batten look will be achieved using the Cedarmill® panel (vertical cedar grain look) and trim planks. All James Hardie fiber-cement siding products are pre-primed with the PrimePlus® sealer and primer.

James Hardie fiber-cement panels are composed of Portland cement, ground sand, cellulose fiber, select additives, and water. The siding products contain no asbestos, glass fibers, or formaldehyde.

James Hardie siding holds up against the effects of temperature swings in cold weather climates and resists rotting and cracking, even in extremely damp climates. As well, it resists shrinking and swelling and holds paint or stain longer than wood. Strength and thickness provide impact resistance against hail and flying debris caused by wind. And the siding can be installed to withstand hurricane-force winds. The fiber-cement siding is Class A fire rated and is non-combustible. And the siding resists damage from termites and other wood-eating insects.

No-Burn® Fire Retardants

The Optimum Performance Home will be additionally protected against fire with the structure and whole-house application of No-Burn fire retardants and reactants, a highly advanced line of non-toxic, non-carcinogenic liquids that render a vast array of materials

incapable of burning, as well as inhibiting the growth of toxic black mold. No-Burn removes the fuel a fire needs to burn when applied to wood, drywall, fabric, carpet, and furniture. During construction, all wood components will be treated with No-Burn Wood Gard Mih, a dual-action Class A fire reactant and toxic black mold inhibitor. The interior walls will be treated with No-Burn Plus Mih. Plus Mih provides the same intumescent fire reactant and mold-resistant protections as Wood Gard Mih, but is suitable for applications on the interior surfaces of a structure, such as drywall or in various applications where moisture poses a potential mold problem. Plus Mih is an interior latex paint product that can be used as a base primer or tinted to match the finish coat. When introduced to heat or flame, the surface foams up, providing a protective char barrier that shields the underlying materials from heat and fire. Because No-Burn Plus Mih does not allow the treated surfaces to be readily used as a fuel source for the fire, it can actually reduce the production of deadly toxic smoke by up to 80 percent.

In the Optimum Performance Home, Plus Mih will be applied as a primer coat, applied directly to new drywall surfaces, providing a solid, bright white surface for the application of mold- and mildew-resistant natural clay earth plaster and zero-VOC (Volatile Organic Compounds) paint finish coats. Used on the structural framing, components will give the entire structure a Class A rating, the best possible protection against fire, especially in areas where a high fire hazard exists, such as urban areas with homes in close proximity to each other or in woodland areas, such as The Sea Ranch. No-Burn Original will be used on the ornamental engineered oak wood ceilings throughout the home's open architecture and on all wood cabinetry before stain finishing.

Adhesives, Caulks, And Sealants

OSI Sealants, Inc., now part of the Dusseldorf, Germany-based Henkel Group's North American Consumer Adhesives Businesses, is a leading manufacturer of caulks, sealants, adhesives, and wood-patching products with more than four decades of experience in developing and supplying the highest quality products. The company's Green Series low-VOC construction adhesives, caulks, and sealants has been chosen to help meet the LEED for Homes ratings guidelines.

Next

As stated previously in past articles, the design review process itself has no doubt weighed us down over this unexpectedly long period of time—nearly four years. But now that the Design Committee has granted final approval, with the exception of the remaining need to acquire final approval of an on-site landscape plan, the project is moving forward in a hastened manner, so that commencement of construction can, hopefully, begin by late November, subject to avoiding any serious rainstorm.

The next series of articles will continue to focus on each stage of construction and the design approach taken, and the technologies and building systems and materials used to create the first Optimum Performance Home. **UHD**

The Author

Gary Reber is the President of Ultimate Home Design, Inc. and the founding Editor-in-Chief and Publisher of *Ultimate Home Design* magazine. His diverse background in several fields includes an undergraduate, graduate, and postgraduate university education in architecture, community planning, and economic development planning. For years he was a consultant on community and economic development planning. For the past 15 years he has been an editor and publisher of magazines in the consumer electronics field. Gary can be reached at 951 676 4914 or gary@ultimatehome design.com.

Acknowledgements

Ed Rose is a residential architectural designer. His company is Rosebud Studios based in Monte Rio, California. Ed has been designing homes and remodels on The Sea Ranch and surrounding areas since the late 1980s. His skill in listening to and understanding his client's architectural program and then translating that into a workable and pleasing design acceptable to the rigorous philosophy of The Sea Ranch Design Committee is responsible for the final successful approval of the First Optimum Performance Home™ at The Sea Ranch. This included the fairly new design concepts of universal access and aging-in-place, use of "green" materials, and meeting the exacting guidelines for a residential LEED® designation. It wasn't until Ed joined our team that we began to make progress with the Design Committee in this challenging process. Ed provided all of the images of the site plan, floor plans, elevations, and isometric perspectives for the magazine. His extensive education and experience span numerous disciplines from architecture to industrial and graphic design to technical illustration, photography, and painting. Ed can be reached at 707 865 1146 or 707 785 9180 or rosebud@thegrid.net.

Bill Wilson is an environmental consultant with over 35 years experience working internationally in the field of comprehensive sustainable development, with emphasis in the areas of agriculture, building systems, energy, watershed planning, wastewater treatment and reuse, aquaculture, and marine systems. He holds a degree in Environmental Studies, with concentrations in Aquatic Biology and Political Science, from the University of California, Santa Barbara, and is a graduate of the Special Program in Landscape Architecture, Harvard University Graduate School of Design. Bill Wilson Environmental Planning, LLC is based in Mill Valley, California. His firm planned the water systems for the first two LEED platinum-rated buildings in California, and he is on the LEED Technical Advisory Committee for the U.S. Green Building Council. He is the Editorial Director of the Environmental Design Department of *Ultimate Home Design*. Bill can be reached at 415 383 2919 or on his mobile phone at 805 689 7639 or by e-mail at billwilsonwater@earthlink.net.

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Scott Simpson is a pilot and aerial photographer. His company is West Of One, based in Gualala, California. Scott resides at The Sea Ranch and provided the aerial photos depicted in this article. Samples of his work can be viewed at www.westofone.com. Scott can be reached at 707 785 9445 or scott@westofone.com.

Product Information

- Amvic, Inc., 501 McNicoll Avenue, Toronto, Ontario, Canada 877 470 9991, www.amvicsystem.com
- Amvic, Pacific Inc., 12531 Lowhills Road, Nevada City, Nevada 95959, 530 265 9085, www.amvicsystem.com
- Bonded Logic, Inc., 411 East Ray Road, Chandler, Arizona 85225, 480 812 9114, www.bondedlogic.com
- Carriage House Door Company, 1421

Richards Boulevard, Sacramento, California 95814, 916 375 0575, www.carriagedoor.com

- Copper Craft, 4995 Keller Haslet Road, Keller, Texas 76248, 817 490 9622, www.coppercraft.com
- Cosella-Dörken Products, Inc., 4655 Delta Way, Ontario, Canada L0R 1B4, 905 563 3255, www.cosella-dorken.com

- EverGreen Slate Company, Inc., 68 East Potter Avenue, Granville, New York 12832, 866 872 7528, www.evergreenslate.com
- Gutter Helmet/Southeastern Metals (SEMCO), 11801 Industry Drive, Jacksonville, Florida 32218, 904 757 4200, www.gutterhelmet.com
- Headwaters Resources, 7006 Regents Park Boulevard, Toledo, Ohio 43617, 419 842 8084, www.headwaters.com
- iLevel, Weyerhaeuser Company, 33663 Weyerhaeuser Way, Federal Way, WA 98003, 888 453 8358, www.ilevel.com
- James Hardie Building Products, 26300 La Alameda, Suite 250, Mission Viejo, California 92691, 800 348 1811, www.jameshardie.com
- Kryton Canada Corporation, 8280 Ross Street, Vancouver, B.C., Canada V5X 4C6, 604 324 8280, www.kryton.com
- Latitude/Live Edge, LLC @ Joinery Structures, 2500 Kirkman Street, Oakland, California 94607, 510 451 6345, www.latitudeinsulation.com
- LP Building Products, 414 Union Street, Suite 2000, Nashville, Tennessee 37219, 615 986 5659, www.lpcorp.com
- Natural Cork, 150 Connector 3, Dalton, Georgia 30720, 800 250 6690, www.naturalcork.com
- No-Burn, 1392 High Street, Suite 211, Wadsworth, Ohio 44281, 330 336 1500, www.noburn.com
- Nordic Structures, LLC, 536 Alcoa Circle, Corona, California 92880, 951 493 7770, www.nordicstructures.com
- OSI Sealants, Inc./Henkel Corporation, 32150 Just Imagine Drive, Avon, Ohio 44011-1355, 800 321 3578, www.osisealants.com
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Insulating Concrete Forms

Amvic's Bill Juhl Interview



Gary Reber

Introduction

A significant development is taking place in residential construction that embraces the use of Insulating Concrete Forms (ICFs) in the design and building of homes. I interviewed Bill Juhl, President of Amvic Pacific, Inc., about this development and the performance benefits that ICF construction offers to homeowners. And, as our regular readers know, Amvic ICFs are planned for a significant portion of the construction of the three-building compound Optimum Performance Home™ located at The Sea Ranch development along the Sonoma County Pacific Ocean coastline north of San Francisco, California. The home is a U.S. Green Building Council LEED® for Homes pilot project home. (LEED stands for Leadership in Energy and Environmental Design.)

Gary Reber, *Ultimate Home Design*: What are ICFs?

Bill Juhl, Amvic Pacific: ICF is the acronym for Insulating Concrete Forms. There are multiple types of ICFs, but in general, ICFs are rigid plastic foam forms that are filled with reinforced concrete to create structural walls. They hold concrete in place during curing and remain in place afterward to provide thermal insulation. ICFs are used to make structural concrete walls, and can be used to make either foundation or above-grade walls. The latest design forms are typically made from pure foam-plastic insulation. The foam is typically expanded polystyrene (EPS). In addition to holding the concrete in place while curing, ICFs usually provide a web system to hold rebar in place, properly spaced, so

that wire ties are avoided, and also a system is provided in most ICFs to mechanically attach interior and exterior wall finishes.

UHD Reber: What are the advantages of building with ICFs?

Juhl: Depending on climate zone, and how the owners operate it, typically an ICF building will use 50 percent less energy to heat and cool; and it will be quieter and will keep out more unwanted noise than a conventionally constructed home. The house will have superior wind and fire resistance; and the exterior walls are essentially impervious to rot, decay, rodents, and termites. Overall, you will experience a much more comfortable living environment.

UHD Reber: How does ICF construction compare to SIP (Structured Insulated Panel) construction in terms of performance benefit?

Juhl: The three main elements of energy efficiency of a building envelope are infiltration (air tightness), insulation (ability to resist the transfer of heat in/out of the building), and thermal mass (the ability of the structure to capture and store heat for later release). SIPs rank high on insulation and air tightness, however, they have low thermal mass. ICF buildings are equal or greater in insulation value, about the same in air tightness, and substantially greater in thermal mass.

UHD Reber: You stress thermal mass. Why is that important?

Juhl: In most climates of the country, the outside temperature varies substantially over the 24 hours of each day throughout the year. Thermal mass has the ability to capture and store heat from one part of the day and release it later.

During heating seasons, that daytime-captured heat is later released back into the interior of the home. During the cooling season, the walls absorb and store the heat during the day, rather than passing it through into the structure. By opening windows or mechanically venting the house later in the day or evening when it is cooler, the stored heat in the walls is released into the air in the ventilated house. Thermal mass lets you store and shift heat for several hours from a time that is unwanted to when it is either desired, or easily eliminated, depending on the season.

UHD Reber: Is thermal mass in a building envelope useful in all climates?

Juhl: Generally thermal mass works in your favor in every situation, but the biggest bang for the buck is in areas where the daily temperature swing is substantial. In very mild climates with limited heating or cooling requirements, obviously, thermal mass will have reduced benefit. However, in those regions we do see ICF used frequently for other reasons, such as wind, flood, or termite resistance.

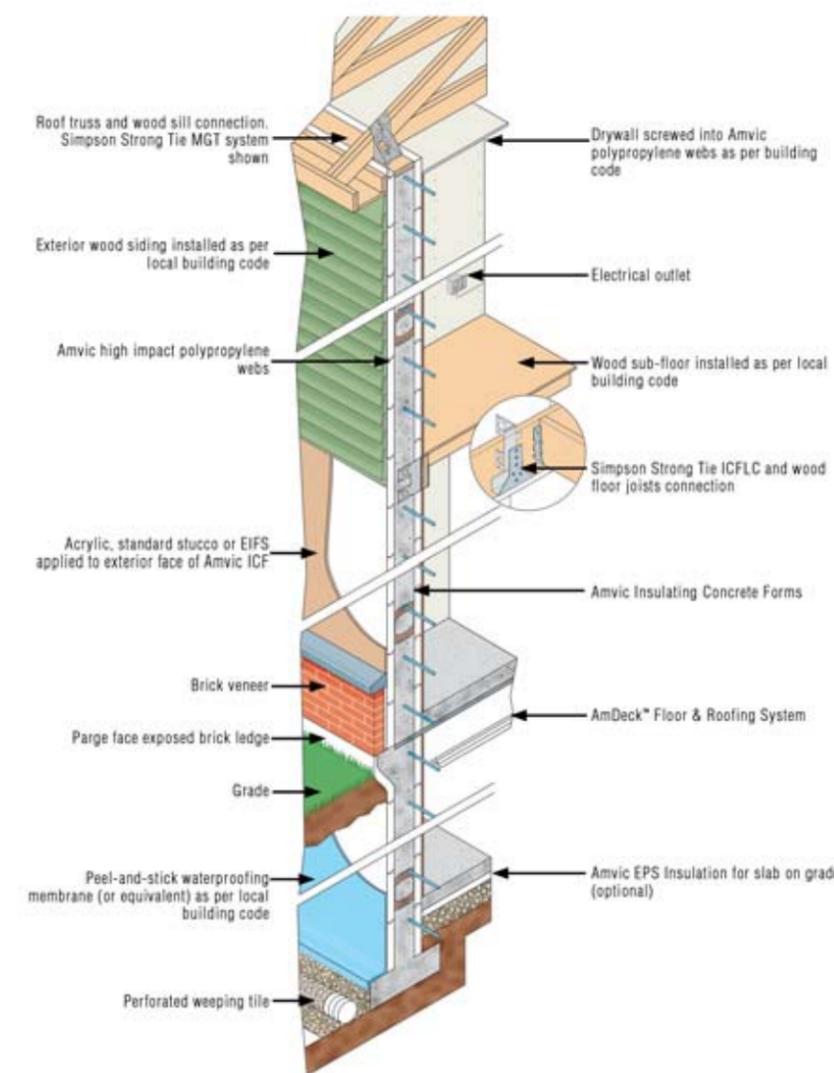
UHD Reber: What is the Amvic warranty?

Juhl: Amvic provides a 12-month warranty against manufacturing defect and will replace any defective material during that time. Bear in mind that the "structural" value of the form is only during the moments of pouring the concrete mix, when its job is to contain and form the concrete. Subsequently, the strength of the structure is based upon the solid concrete walls with imbedded reinforcing steel. The EPS foam insulation and the polypropylene webs will be encapsulated between the concrete and Sheetrock™ and have essentially an extremely extended lifetime.

UHD Reber: Do the Amvic forms stay in place after the concrete is poured?

Juhl: Yes. The Amvic forms are used to allow builders to pour a solid concrete wall. However, upon completion, the forms are designed to provide insulation, nailing and screwing surfaces, and a vapor barrier, all in one step.

UHD Reber: How are doors and windows installed?



Amvic ICF Wall Section

Juhl: A wooden or vinyl framework or "buck" is built to the desired rough opening size and incorporated into the Amvic wall as it is being stacked prior to pouring the concrete. This holds back the concrete and allows the concrete to form around it. Once the concrete cures, doors and windows are installed as usual into this opening.

UHD Reber: Is the Amvic block easy to use?

Juhl: Builders are consistently giving Amvic ICFs strong reviews for ease of use and enhanced speed of assembly. The design of the Amvic blocks makes them the easiest to use of any system available. The blocks arrive on site pre-assembled ready to install. Because Amvic blocks are at least 50 percent stronger than the majority of the blocks on the market, you can build with no fear of concrete blowout. Amvic provides ongoing training and on-site technical support, helping projects run smoothly.



ICF Units



ICF Building Site



Assembling ICFs

UHD Reber: What does “concrete blowout” mean?

Juhl: A blowout occurs when the form that is supposed to be holding the wet concrete in place fails during placement or vibrating of the concrete in the form. In the early days of ICF construction, the forms then on the market (some of which are still sold today) were fairly fragile, and blowouts were common. Blowouts can be minor with just a small section of a form letting go, or very significant with a major section of wall failing. Blocks with their cross-connect webs spaced eight inches or more apart, and blocks that are either hinged, or assembled on site from loose pieces, are substantially more prone to blowout.

UHD Reber: So how is Amvic different with regard to blowouts?

Juhl: Amvic block was engineered from the outset to be highly resistant to blowouts with a long list of advanced engineering features built in that subsequently have been copied by other block companies. Flattery tells the story. At the time Amvic ICF was introduced into the market, the competition widely advised that “internal vibration of the concrete was not required nor recommended.” This was always bad advice, because most of the forms then on the market would blow out if you used an internal vibrator. Amvic’s President, Victor Amend, never quits pushing the envelope to build an even stronger, easier-to-use block.

UHD Reber: What does it mean to be a “reversible” block?

Juhl: A reversible block is the same on the top as the bottom, so that it can be flipped and used in either direction. Also, when a block is ripped in half, the parts generated will have one smooth side and one side with locking nubs. Such cutoffs usually can be flipped over and used rather than discarded. With a reversible block, the need for separate left and right corners is eliminated... flipping the block over achieves the offset needed. Reversibility reduces labor and substantially reduces jobsite waste for the shell, down to as low as one percent.

UHD Reber: How do you run the electrical or plumbing?

Juhl: Any utilities that need to go through the wall require blocking out space prior to pouring the concrete. Examples are exterior porch lights, outlets, water hose bibs, air-conditioning lines, dryer vents, etc. Most electrical wiring and plumbing is then installed after the concrete is poured. Channels for wiring and plumbing are cut into the foam, using a number of different techniques, and the wiring is recessed a safe two inches from the surface.

UHD Reber: How high can you build with Amvic ICFs?

Juhl: Three- to four-story houses can be built with Amvic, one story at a time. Each story is stacked nine to 12 feet and poured in two- to four-foot lifts in a continuous pour. Higher structures are feasible...builders have done numerous six- and eight-story commercial projects above full basements.

UHD Reber: How is interior drywall attached?

Juhl: Sheetrock is attached using drywall screws through the EPS foam into the polyethylene webs (the “studs”), sometimes in combination with an EPS-compatible adhesive.

UHD Reber: How do you hang pictures?

Juhl: Normal to lightweight pictures can typically be hung using a picture hanger with a nail driven anywhere into the Sheetrock just like in frame construction. Heavier weight objects will need to be hung by screwing or nailing into the imbedded web, one of which is imbedded in the block, running floor to ceiling, spaced every six inches apart. The webs can be located much the same as in frame construction, using either a magnetic stud finder (to locate screws) or a sensitive electronic stud finder. Once you’ve located one web, the other webs will be easy, as they are in multiples of exactly six inches. If you need to hang something between the webs, you can use a molly-type anchor into the Sheetrock, just like you would in frame construction. If necessary, in extreme cases, you can use a concrete drill, and go back into the concrete and set a concrete anchor.

UHD Reber: What kind of exterior finishes can be used?

Juhl: Any exterior siding that can be used on a conventional building can be used on ICF, including stucco, clapboards, sheet, shingles, etc.

UHD Reber: How is exterior fiber-cement siding attached?

Juhl: Fiber-cement siding is installed by first installing a code and siding, manufacturer-approved, weatherproof barrier over the block, and then the siding is attached using screws through and into the polypropylene webs. Typically, stainless-steel screws are selected as being the most durable to complement the durability of the fiber-cement siding and the ICF concrete walls.

UHD Reber: What about wood or vinyl siding?

Juhl: Vinyl siding is installed essentially the same as fiber cement siding. Wood siding generally needs to have a modest air space behind it to allow it to breathe and release moisture. This can be achieved with furring strips, or with a variety of commercial membranes that provide an air gap.

UHD Reber: What are the physical differences between an Amvic wall and a stick-frame wall?

Juhl: Most obvious is that an Amvic wall is 11 inches thick (in the case of the six-inch core block) instead of the four inches or six inches of a framed wall, plus sheathing. It is stronger, more soundproof, more resistant to natural disasters, better insulated, has a superior R-value (>R-22), is more energy efficient, reduces air infiltration, and benefits from the thermal mass of the concrete. It is a wall that should stand for 500+ years.

UHD Reber: Is building with Insulating Concrete Forms an experimental construction form?

Juhl: Definitely not. Residential structures have been built in the U.S. of formed concrete for 100 years. Thomas Edison built several homes of formed concrete in the 1900s that are still occupied today. Stay-in-place concrete form construction began in Europe in the 50s and has been widely practiced in Eastern Canada and Eastern U.S. since the '70s.



Pouring Concrete With Boom-Pump



ICFs Holding Concrete In Place

UHD Reber: Is a special concrete mix used?

Juhl: Generally, walls will require 3,000 psi concrete, or as specified by the project engineer or code. Maximum aggregate size is 1/2-inch and a mixture with a 5- to 6-inch slump should be specified.

UHD Reber: Do you recommend a concrete mix that includes additives such as fly ash?

Juhl: Fly ash is recommended where available. Fly ash is a by-product of coal combustion and makes an excellent additive to replace up to 30 percent of the cement in the concrete mix. Fly ash would otherwise be dumped into landfills. In concrete, it makes the concrete flow better during placement and reduces voids. Using fly ash in your mix makes for better concrete and is a good green building practice. Fly ash is widely

available on the East Coast and Midwest, but is somewhat less available in the West.

UHD Reber: What about using liquid Krystol™, a crystalline waterproofing additive?

Juhl: While this type of additive can be very useful for waterproofing exposed concrete, in the case of ICF walls, whether above or below grade, they are designed and constructed so that water will never reach the concrete. As such, a concrete waterproofing additive is not needed for ICF walls. Above grade, the combination of EPS foam, a weather interlock of the ICF blocks, a weatherproof barrier, and flashing and siding keep the water out. Below grade, the combination of a water stop, a waterproofing membrane, an air-gap drain board, and a foundation drain system assure a dry basement. On exposed concrete, such as an exterior ICF deck over a usable space below, a waterproofing additive may be useful, however, best practices still will generally require a water-barrier membrane and a topping slab or wear surface above it.

UHD Reber: What method should be used to pour the concrete?

Juhl: A boom pump is by far the easiest method, using a three-inch or 2.5-inch reducer in the hose to reduce the concrete velocity. A line pump can be used if circumstances require, although it is slower and more challenging.

UHD Reber: Is mechanical vibration using an electric vibrator required?

Juhl: Emphatically, yes. Concrete, as it comes out of the hose, will fill the wall, leaving numerous air pockets and voids, particularly under areas where multiple bars of reinforcing steel are concentrated. Elimination of these voids is required for the concrete wall to take on its full design strength and the only way to be certain this is done is with a mechanical vibrator. Amvic ICF blocks were specifically designed to be strong and tight enough to resist blowouts when they are mechanically vibrated with an internal vibrator. Mechanically vibrating the concrete in your Amvic wall provides assurance that the wall will assume its full design strength. Amvic recommends appropriate vibration.

UHD Reber: What kind of vibrator should be used?

Juhl: An electric vibrator with a 1- to 1-1/4-inch pencil head and a 12- to 14-foot shaft is best. In any case, don't use a head larger than 1-1/4 inches, as it can get stuck in the rebar.

UHD Reber: Why haven't we seen more ICF construction on the West Coast?

Juhl: ICF got its start in more severe climates of the Northeast U.S. and Canada, where the energy savings were obvious and overwhelming. This started as a smart and effective way to do basements initially, and quickly builders found that it worked well to build all exterior walls with it. Along the West Coast, milder weather, abundant wood, cheap energy costs, and business-as-usual made the West slower to adapt this new 30-year old technology. Rising energy costs, cost and quality of lumber, and consumer demand have been changing this. ICF construction

has been growing rapidly in the last couple of years, particularly into areas with significant needs for air conditioning, where the thermal mass of ICF drastically reduces electric bills for AC.

UHD Reber: Are more ICF homes being built?

Juhl: In 2003, 16.2 percent of all new homes built in the U.S. had concrete outer walls. In 2005, half a million homes were built in the U.S. with ICF exterior walls. In 2006, estimates are to continue to grow by 30 percent or more. In the West, with a renewed understanding of the need to be more energy efficient in home designs, there is rapidly growing pressure for change. We're seeing a phenomenal growth in ICF construction, as it is moving into mainstream construction practices.

UHD Reber: What will ICF construction mean for the future value of a building?

Juhl: As energy costs continue to rise, and as ICF construction is more widely understood and appreciated, it is projected that ICF houses will command a 10 to 15 percent premium over comparable stick-built homes in the future.

UHD Reber: Will homeowners be able to find contractors who are familiar with and capable of building with ICFs?

Juhl: There are contractors throughout the country that have built with ICFs, and others that are eager to adapt to the technology. We maintain a listing of contractors that are ICF-familiar and affiliated with Amvic. In addition, we provide training for builders, and that, combined with site assistance from one of our consultants, should overcome any problems associated with a first-time ICF build. Selection of subcontractors will require a bit more screening than normal...some are willing to learn new systems, and others may be inclined to avoid the job by "high bidding" their bid. A little shopping around should find subs willing to work at prices comparable to conventional construction. The only subs that have to do anything different are electrical, and to some extent plumbing.

UHD Reber: I've heard a horror story about an earlier ICF project. Are there many of those?

Juhl: Fortunately, no. Early ICF systems (1970s-80s) were more troublesome to build with and more costly. Many of these systems are still being sold and aren't worth considering. These problems have been functionally overcome in the most recently designed third-generation systems, like Amvic. Training and technical support are critical elements of success. Amvic has a very robust training program, has an extended list of qualified builders, and provides on-site tech support. The advanced design of the Amvic ICF block coupled with our full-service approach to design and construction has produced an enviable track record of satisfied builders and customers who've had truly excellent results consistently.

UHD Reber: Are their limitations on what kind of house you can build with ICFs?

Juhl: Essentially, any conventional design can be adapted for ICF construction. Obviously, due to the thicker exterior



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walls, the outside dimensions have to be stretched out to maintain the same designed interior space. In multi-story construction, it remains simpler to align upper-story ICF walls with the ICF wall below. ICF concrete walls cannot be supported by wood beams or walls below.

UHD Reber: Does an ICF-built house look different than others?

Juhl: From the exterior, there is no distinguishable difference in appearance. On the inside, the interior windows will be recessed deeper, due to the 11-inch walls.

UHD Reber: Do local building departments accept Amvic?

Juhl: Yes. All codes understand and accept ICF construction. At its root, an ICF wall is just a poured-in-place concrete wall—widely used for the last 70 plus years. Most building departments have dealt with ICF construction previously and are knowledgeable about it. Amvic's system has been approved by the primary construction product certification authorities and consolidated into International Code Council ICC Report ESR-1269.

UHD Reber: Does EPS foam present a fire hazard?

Juhl: EPS foam used by Amvic is manufactured with a flame-retardant additive; these foams, unlike lumber, will not support combustion. Tests have shown that in the event of fire, EPS does not emit any gases any more harmful than those emitted by burning wood. A six-inch Amvic wall tests with greater than a three-hour fire rating.

UHD Reber: How much does it cost to build with Amvic compared to other building materials?

Juhl: This is highly influenced by the complexity of the design, as well as the building site itself. As a general answer, when building on a flat lot, an ICF home is within two to four percent of the same cost as building a well-insulated 2 x 6 wood-framed home. If building on a hillside with a retaining wall involved or any below-grade construction, the cost with ICF is generally the same or potentially a bit less expensive than conventional construction.

UHD Reber: Can you construct radius and angled walls using Amvic ICFs?

Juhl: Radius walls are constructed by removing sections from the inside side panel and bending the ICF into the required shape. Similarly, any angle can be made by miter cutting the form at the proper angle and using foam to join the edges. Ninety-degree and 45-degree corners are manufactured to speed construction, since they are the most commonly used corner angles.

UHD Reber: Can Amvic ICF be used below grade?

Juhl: Yes, when using the Amvic ICF below grade, an ICF-compatible waterproofing system should be used.

UHD Reber: What is the recommended way to waterproof below grade?

Juhl: There are three parts to below-grade waterproofing: French drain, waterproofing, and an air-gap drain board—protection course. An ICF-approved spray-on or roll-on liquid waterproofing membrane, such as ePro Ecoline-R, is recommended from

six inches above the finished grade to six inches down the footing. A French drain tile system should be installed at the base of the footing and covered with coarse drain rock. A dimpled drain board product, such as Cosella-Dörken DELTA® and Carlisle MiraDRAIN, should be installed over the waterproofing to provide protection for the waterproofing and to create an air space between the backfill and the waterproofing. When a dimple board product is used, you can backfill with native soil.

Alternatively, there are sheet membrane systems that can be used, but they have been found to be more problematic to install properly.

UHD Reber: Can one get copies of technical reports for Amvic?

Juhl: Yes... go to our Web site at www.amvic-pacific.com or www.amvicssystem.com, and you'll find a wealth of materials and links to other relevant sites as well.

UHD Reber: Is Amvic accepted as a desired construction material in the new LEED for Homes pilot certification program initiated by the U.S. Green Building Council?

Juhl: Undoubtedly, the energy efficiency, durability, reduced carbon footprint, use of recycled materials, and reduced maintenance will all be valued within the LEED rating system. By October, Amvic will have a full LEED rating evaluation available that can be used by any party pursuing a LEED for Homes or commercial project.

UHD Reber: Bill, you talk a good story, but how does this apply to you personally?

Juhl: My background is as a professional meteorologist. Wind and weather have been my game for most of my working life from Alaska to Guam and Maine to Texas. I was increasingly dissatisfied with the energy aspects of my California frame home and began an extended investigation into building science and the physics of energy and structures. At the end of that inquiry, I built the first Amvic house in California, and it is our very happy residence today. I put my money where my mouth was, so to speak. Every day since has been a validation of that good decision—we love our Amvic concrete home and rank our decision to build this way as one of the best of our lives.

UHD Reber: Thank you, Bill, for sharing with our readers the Amvic story. **UHD**

About Bill Juhl

Bill Juhl is President of Amvic Pacific, Inc., a Northern California distribution company focused on products to construct energy-efficient building structures. Founded in 2001, Amvic Pacific is a leading Western distributor of high-energy high-thermal mass wall systems. He has degrees in applied physics and management and is long experienced as a meteorologist, environmental and international business development consultant, and entrepreneur. Living in the Sierra Nevada foothills, Bill built the first Amvic insulating concrete forms house in California and continues to enjoy its unequalled energy efficiency and quietness daily. Amvic Pacific is an activist company with participation in the U.S. Green Building Council, the Department of Energy Building America Program as a participating partner in the Building Industry Research Council (BIRA), and, of course, the Optimum Performance Home™ LEED for Homes pilot project. Amvic Pacific is experiencing very rapid growth as broader understanding of the need to build energy efficiency is moving into general consciousness, both in residential and commercial construction. Bill can be reached at 530 265 9085 or by email at bjuhl@amvic-pacific.com.

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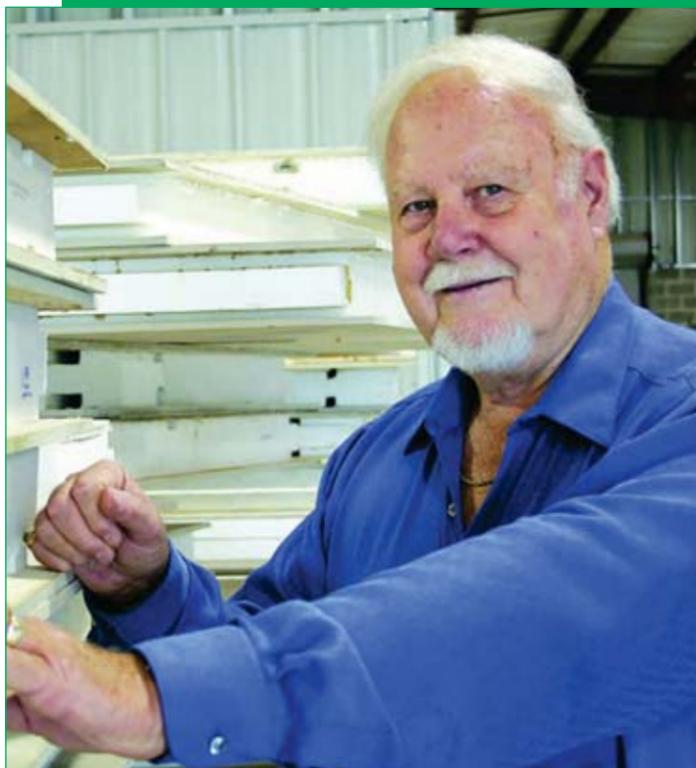
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Structural Insulated Panels

ThermaSAVE's Hoot Haddock Interview

Gary Reber



Introduction

A significant development is taking place in residential construction that embraces the use of Structural Insulated Panels (SIPs) in the design and building of homes. I interviewed Hoot Haddock, President of ThermaSAVE, Inc. and the widely acknowledged "father" of SIPs, about this development and the performance benefits that SIP construction offers to homeowners. And, as our regular readers know, ThermaSAVE SIPs are planned for a significant portion of the construction of the three-building compound Optimum Performance Home™ located at The Sea Ranch development along the Sonoma County Pacific Ocean coastline north of San Francisco, California. The home is a U.S. Green Building Council LEED® for Homes pilot project home. (LEED stands for Leadership in Energy and Environmental Design.)

Gary Reber, *Ultimate Home Design*: What are SIPs?

Hoot Haddock, ThermaSAVE: SIP stands for the Structural Insulated Panel. We build ThermaSAVE panels with EPS (Expanded Polystyrene) and fiber cement boards used as inside and outside skins. These materials are laminated together with a special high-strength glue and dried under extreme pressure to become stressed-skin panels. It works with the two skins resisting each other. The panels are structural and thermal efficient, and we use them for floors, walls, and roofs. There are various widths used for the panels. We build panels from four to 12 inches based on the applications needed.

We use several different EPS widths and two different widths of fiber cement board. Many of our international customers prefer thicker panels in the mistaken belief that "thicker is always better." Usually it's just a cultural issue for areas that are used to using concrete or adobe in their building applications. Since our panels are structural, all we need to do is determine the load factors for the floors, roof, and walls, then we build the appropriate panels. ThermaSAVE panels used for floors can span up to 16 feet between supports. Used as load-bearing walls, they will support up to four stories. Roof panels can span up to 20 feet. The expanded polystyrene provides great insulation. Our energy-efficiency ratings are unmatched. Also, textured fiber cement board skins provide an attractive interior or exterior finish at no extra charge.

UHD Reber: What are the advantages of building with SIPs?

Haddock: Advantages include: faster construction time, significant energy savings (up to 75 percent on utility bills when using DOW Styrofoam™ extruded polystyrene panels), and, when using fiber-cement panels, you eliminate the need for Sheetrock™ on the inside and exterior finish on the outside. In addition, fiber cement panels withstand up to 200-mph winds and the twisting and flexing that slowly deteriorates conventional buildings; they are earthquake proof and eliminate termites. If you have a flood, just clean the outside and move back in. Mold will not grow in the system. In a brush fire, you probably will only need to paint the outside. Our panels

have a fire rating. Noise reduction is substantial. And most importantly, the air quality is phenomenal.

UHD Reber: How does SIP construction compare to ICF (Insulating Concrete Form) construction in terms of performance benefit?

Haddock: Overall, ThermaSAVE panels will meet or exceed all ICF performance ratings. These areas include: Energy Savings—ThermaSAVE panels will save up to 75 percent on your energy costs. Structural Integrity—ThermaSAVE panels have passed an earthquake shake test. The panels do not support mold or absorb moisture and are rot- and vermin-resistant. The panels are nearly soundproof, and the air quality can't be beat. In addition, the ease of construction and reduced labor costs are a big plus. You don't have to pour concrete, and you don't need 11-inch walls. Our panel widths are four inches for interior walls and between six and seven inches for exterior walls. Floor and roof panels vary between eight and 12 inches, based on the load factors. Our entire system can be built with unskilled labor. "Once you build a ThermaSAVE home, you're an expert."

UHD Reber: Does ThermaSAVE excel in terms of thermal efficiency?

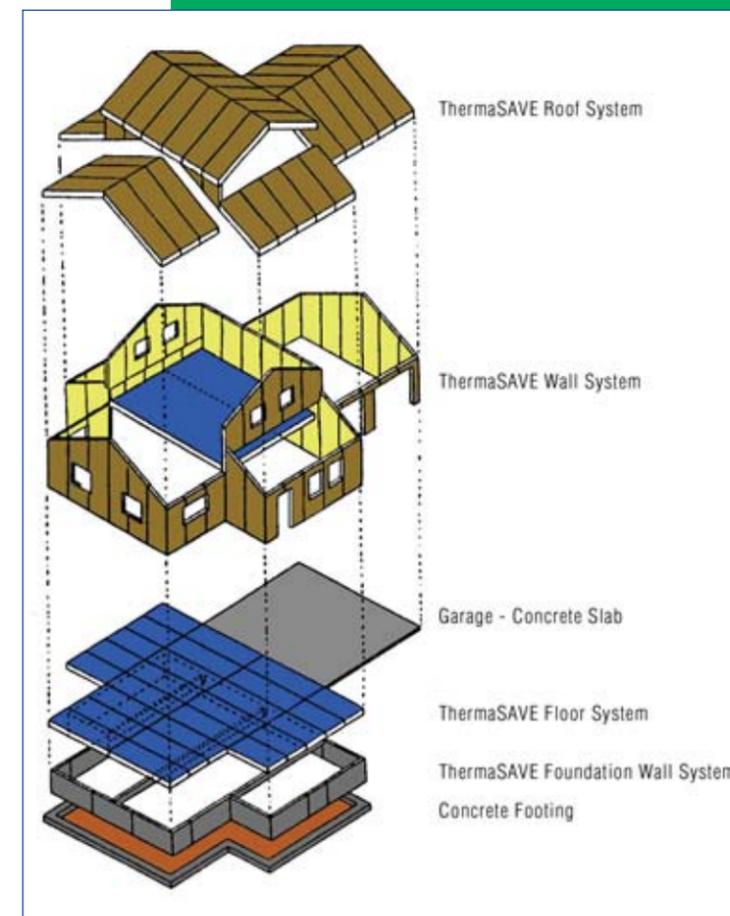
Haddock: Yes, up to 75 percent, and better indoor air quality, too! Think about it this way. If you hold a Styrofoam coffee cup in one hand with scalding hot water, and in the other hand you hold an ice-cold beverage, you can't tell the difference. The cup is only 1/16th of an inch thick. The cups also help retain the heat or cold. ThermaSAVE panels do the same thing, with the heat or cold, to maintain a constant temperature using very little energy. The use of expanded polystyrene foam insures that the panels will not lose their insulation value over the years, as many foams will.

UHD Reber: What about long-term durability and maintenance?

Haddock: The maintenance will depend on what finish you use inside and outside and the doors and windows you select. The panels themselves only need painting. ThermaSAVE panels are maintenance-free. The panels will not rot or warp.

UHD Reber: What about environmental considerations?

Haddock: ThermaSAVE buildings are the most environmentally friendly of all contemporary building methods used. Because of their high insulating qualities, they save energy, which saves fuel that produces them. Using a minimum amount of wood products, the panels help to save our rapidly dwindling forests. The panels are manufactured using non-toxic products and do not create toxic wastes.



ThermaSAVE Uses

UHD Reber: What is the ThermaSAVE warranty?

Haddock: Each ThermaSAVE plant is individually owned and operated, but usually the warranty is 10 to 15 years against delamination, or any other failures, due to defects in workmanship in the manufacture of the panels. All panels are inspected by a third-party inspector, who meticulously checks the quality of each component at the factory before delivery to the customer. The inspector certifies that the panels have met or exceeded fire tests for the types of buildings and structural components for which they are normally used.

UHD Reber: What is the ThermaSAVE spline connection system?

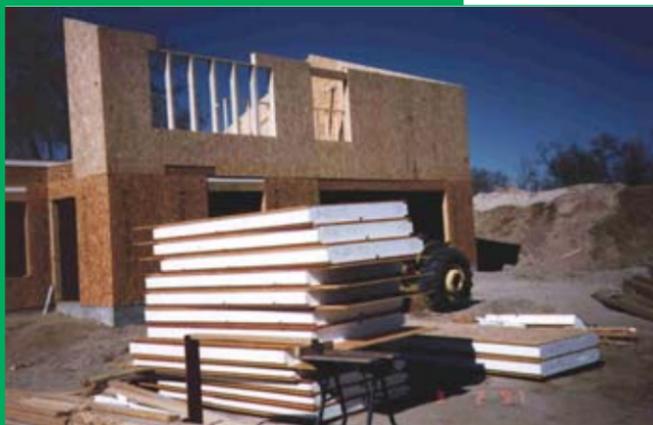
Haddock: The spline is a four-inch string of the same material as the skin on the panel. Each panel comes with the chases precut for all the splines.

UHD Reber: What is the stressed skin technology used in the manufacturer of ThermaSAVE panels?

Haddock: Stress skin is the resistance of the skins on both sides of the panel working against each side. This system provides substantial structural support. Basically, the strength of the panels is greater than the sum of their parts.



SIP Framing



SIPs On Jobsite



Section Of SIP Walls

UHD Reber: What are all of the applications for ThermaSAVE panels?

Haddock: We use the panels for floors, walls, interior walls, roofs, ceilings, foundations, floating docks, fences, basement walls, and many other uses.

UHD Reber: How are doors and windows installed?

Haddock: The same way as any other building. We use a wood 2 x 4 around all openings to hold doors and windows. You can also use a plastic 2 x 4 to eliminate all wood from the structure.

UHD Reber: Is the ThermaSAVE panel easy to use?

Haddock: Very easy. We cut all door and window openings, roof angles, etc. in the shop, then we draw a print with the layout of all panels and number them on the print, and then number the panels to match. You get a house or building that is ready to construct. Even inexperienced labor has no problem with this system.

UHD Reber: How do you run the electrical and plumbing?

Haddock: We place chases in the panel for whatever is needed.

UHD Reber: What finish material is available?

Haddock: You can use any finish on the panel that you use on any other system. But with our fiber-cement board panels, there are a lot of looks we can get on the board—all you need to do is paint. On the inside, we use smooth surface fiber-cement board, so it looks like Sheetrock and finishes like Sheetrock. It also has the necessary fire rating, so Sheetrock is not needed.

UHD Reber: What if interior drywall will be used, how is it attached?

Haddock: If you decide to use Sheetrock, it is installed with power-driven screws like any other construction, but it is not needed. The panels themselves are ready for painting or wallpapering, if desired.

UHD Reber: How do you hang pictures?

Haddock: Anywhere you want, and you don't need to find a stud; the fiber cement board will hold, especially if you use screws.

UHD Reber: How is exterior fiber-cement siding attached?

Haddock: Because our panels are made of fiber-cement board, you don't need additional finishes. However, if you choose, you can attach additional finishes as called for by the manufacturer.

UHD Reber: What about wood or vinyl siding?

Haddock: They can be nailed on just like any other system. You can also use brick, stucco, and almost any other material.

UHD Reber: What are the physical differences between a ThermaSAVE wall and a stick-frame wall?

Haddock: Stick-frame walls have a lot more steps in construction. You have to nail them to the two-by-fours, put sheathing on the outside, and then you have to put a weather-resistance finish over it all. On the inside, you have to have

fiberglass, or blown-in insulation and a vapor barrier, then Sheetrock. The SIP is already finished on both sides. There are no additional materials needed.

UHD Reber: Is building with Structural Insulated Panels an experimental construction form?

Haddock: No. People have been building with panels for over 70 years. In the past, they were expensive and many manufacturers started and didn't stay with the course. This caused many problems. Our fiber cement board panels are very cost effective. And our business has been growing very steadily for several years.

UHD Reber: Why haven't we seen more SIP construction?

Haddock: It's related to supply and demand. We are building better panels than ever before. The general public, builders, and architects are starting to ask for our products more and more. They are becoming better educated and more demanding about energy efficiency, cleaner air quality, wind resistance, etc. This all means that our system will be in much greater demand in the future.

UHD Reber: Are more SIP homes being built?

Haddock: Yes, as utility costs go up, SIPs get more popular, and there are now more qualified companies offering SIP products. Having an International Code Council (ICC) license, we have to make a quality product. According to the Federation of American Scientists, a Washington, D.C.-based non-profit organization, SIP construction accounts for more new housing starts in the next five years than any other construction system.

UHD Reber: What will SIP construction mean for the future value of a building?

Haddock: Our fiber cement board panel eliminates rot, mold, and termites; where stick-built or ORB SIPs do not. The longevity and strength of our fiber cement panels will last for a long time. The future looks very bright indeed.

UHD Reber: Will homeowners be able to find contractors and subcontractors who are familiar with and capable of building with SIPs?

Haddock: More contractors are increasingly available, but in our case, we send a person to show how to build the first project. It is much easier to learn than conventional housing.

UHD Reber: Are their limitations on what kind of house you can build with SIPs?

Haddock: Not really. We can build about anything anybody else can, including commercial buildings.

UHD Reber: Does an SIP-built house look differently than others?

Haddock: No, unless you want them to. You can't tell our house from any other.

UHD Reber: Do local building departments accept ThermaSAVE?

Haddock: Yes, we have an ICC license approval. All building departments accept ICC. It is the ultimate approval and

the hardest license to get. The ICC requires a strict quality-control program and is monitored by an independently licensed company.

UHD Reber: Does EPS foam present a fire hazard? Does ThermaSAVE protect against fire?

Haddock: The foam is fire-retardant and the fiber cement board skins protect it from the fire. You can see the 20-minute fire test on our Web site (www.thermasave.us). We built an 8 x 8 x 12-foot room, then built a fire in the corner that burned for 20 minutes. When the fire was extinguished, the room was fine.

UHD Reber: How much does it cost to build with ThermaSAVE compared to other building materials?

Haddock: It costs about the same at this time. But, it will soon be less. However, the advantages speak for themselves.

UHD Reber: Can you construct radius and angled walls using ThermaSAVE SIPs?

Haddock: We can construct angled walls. We haven't started radius walls yet.

UHD Reber: Can ThermaSAVE SIP be used below grade?

Haddock: Yes. We do basement walls and foundations. The panels are structural and make excellent foundations and basement walls.

UHD Reber: What is the recommended way to waterproof below grade?

Haddock: The International Code Council codes give some options to coat underground products, and it is the same for all systems.

UHD Reber: Can one get copies of technical reports for ThermaSAVE?

Haddock: Yes. The ICC Report and other information can be found on our Web site at www.thermapanel.com. It is downloadable. Our ICC number is 2406.

UHD Reber: Is ThermaSAVE accepted as a desired construction material in the new LEED for Homes pilot certification program initiated by the U.S. Green Building Council?

Haddock: Yes. It is also the choice of the Federation of American Scientists. After they studied all systems for two years, they chose ThermaSAVE as the best building system. They were concerned with issues such as mold, air quality, affordability, availability, ease of construction, wind and water resistance, and earthquake resistance. We are truly honored to be working with them to supply better housing to the world.

UHD Reber: Thank you, Hoot, for sharing with our readers the ThermaSAVE story. **UHD**

About Hoot Haddock

Hoot Haddock is President of Alabama's IHSN, Inc. Haddock built the first ThermaSave house more than 22 years ago in Wasilla, Alaska where he lived for 20 years and started IHSN, Inc. He relocated to his hometown of Florence, Alabama in 1993 where today ThermaSAVE panels are produced in four IHSN manufacturing facilities and are being used to house millions of people in the United States and worldwide.

Straw Bale

Construction In Central California



Visalia, California Straw Bale Home

Paula Aiton

workshop with the Northern California company, Real Goods, in which they built a small kiosk for a river-rafting company. After that experience, they were “sold on straw bale,” Mr. Rubin said.

According to Stuart Rigney, General Manager for Mountain Vista Construction, Inc., the home incorporates many energy-efficient features. “The primary benefit of using straw bale construction is the increase in insulation properties,” he said.

“The primary benefit of using straw bale construction is the increase in insulation properties—straw bale walls have an insulation rating of R-50 compared to the typical R-13 or R-19 in traditional lumber construction with blown-in insulation or expanded polystyrene insulation.”



Early Stages Of Straw Bale Walls



Close Up Of Straw Bale Composition



Front Straw Bale Exterior

A Sound Investment

For homeowners Ira and Brady Rubin, building an energy-efficient home in Visalia, California had long been a dream for the couple and their family. Now a reality, the 3,500-square-foot home, built using straw bale wall construction, sits on five acres of land just outside of town with a sweeping view of the nearby Sierra Nevada Mountains. In an area of Central California where agriculture is the primary industry, and the idea of hay or straw might be more vividly associated with livestock, this type of construction is becoming more and more popular as a means to achieve many goals, not the least of which is energy efficiency and fire protection.

For many years, the Rubin's grown daughter, Daryn, had been reminding them, “There is only one issue: the environment!” When she and her husband, John, invited the Rubin's to create a family home with them and their small children, the entire family embraced the concept of building a sustainable home. They considered a variety of sustainable materials: Structural Insulated Panels (SIPs), rammed earth, adobe, and even discarded tires. In 2005, they participated in a straw bale

“Straw bale walls have an insulation rating of R-50 compared to the typical R-13 or R-19 in traditional lumber construction with blown-in insulation or expanded polystyrene insulation.” As a builder, Mr. Rigney also said that construction using straw bales was relatively simple to research and implement. The building process was uneventful and did not stand out as more difficult or significantly different from other construction types. In fact, Mr. Rigney said that constructing the walls was very much like stacking up children's building blocks.

Located in Visalia, California, and serving the entire State, Mountain Vista Construction has become known as a cutting-edge contractor for sustainable construction in many residential and commercial projects. In addition to their experience with a variety of eco-friendly housing types, they are also a developer of sustainable workplaces and are the design/build contractor for a new office building in Exeter, California that is seeking LEED® Gold Certification. “Although the initial construction cost may be up to five percent greater than a more traditional structure type, a sustainable building will immediately begin to pay back the owner in energy savings,” said Mr. Rigney. The company has shown their clients that building “green” need not be cost prohibitive, while

synopsis

✎ Constructing straw bale walls is very much like stacking up children's building blocks.

✎ Although the initial construction cost may be up to five percent greater than a more traditional structure type, a sustainable building will immediately begin to pay back the owner in energy savings.

✎ The primary element of this home's construction is rice straw, an undesirable agricultural by-product that is traditionally burned by farmers.

proving to other contractors that building responsibly can be profitable.

The Rubin's home was designed by Tom DeVore of the award-winning firm, The Drawing Board of California, also in Visalia. As a member of the American Institute of Building Design and with 30 years of experience designing custom homes, Mr. DeVore had extensive experience with traditional wood-framed designs. After some research into straw bale construction, it became clear that the deep overhanging roof eaves that the Rubin's requested for internal solar control would take some special engineering and design for roof loads. As a result, the entire roof structure is supported by timbers that were harvested as leftover snags from a forest fire, adding further to the home's eco-friendly construction. The timbers were compacted eight feet into the soil and set in concrete. Hand-peeled of their bark and treated with a fire retardant, the timbers are now an integral part of the home's nearly fireproof construction. The windows of the home are deeply set into the walls, while the roof eaves extend eight feet beyond to create a wraparound veranda that evokes the feeling of an Old California-style villa. The overhanging eaves have the added benefit of protecting the interior from the heat of the intense Central California summers. Mr. Rubin is prosaic when he describes his new home, "Plastered organically, straw bale breathes; there is no off-gassing. Straw bale lasts; there are bale homes in Nebraska that have been standing 200 years. Aesthetically, it's delicious; thick walls create an undulating shape, like a warm castle, that is both organic and substantial."

With the load of the roof extended beyond the straw bale walls to the timbers on the veranda, the Rubin family could take advantage of an interior design that was not constrained by the need for load-bearing walls. Large open spaces perfectly suit the family, which is comprised of the Rubins, their grown daughter, her husband, and their four small children. A great room in the center is multifunctional, and is used for gatherings, entertainment, and home schooling. Four bedrooms are on one side of the home for the growing young family, and the other side of the plan contains a suite of rooms designed specifically for Mr. and Mrs. Rubin.

Other features were incorporated into this home to reduce indoor pollutants. For instance, the use of cellulose insulation in the attic space instead of traditional fiberglass, stained concrete floors containing plumbed radiant heat within instead of carpet or hardwood, and a tank-less water heater, which reduces the energy output traditionally spent by natural gas-heated water tanks. In addition, a two-car garage is not attached to the home, but stands separate from it, thereby reducing the amount of vehicle pollutants that might otherwise enter the home. Although currently on the grid for electricity, future plans for the home include the installation of solar panels

on the roof for free, and even profitable, energy. Extra energy they produce can be sold back to the power company during peak summer months.

Considering that the primary element of this home's construction is rice straw, an undesirable agricultural by-product that is traditionally burned by farmers, it is gratifying to the family to have contributed to the environment by removing something from it. This one project represents at least many tons of rice straw that did not become part of the breathable air. The San Joaquin Valley, of which Visalia is a part, is known for its poor air quality. Particulate matter from agricultural refuse burning is a large contributor to an increasing problem. Allergies and asthma are on the rise for residents of the Valley, and it is not uncommon for very young children and senior citizens to have severe respiratory problems associated with its poor air quality. In addition, burning rice straw after harvest has many regulations placed on it, and there is a tangled bureaucratic puzzle as to what to do with this refuse product. Although farmers are also allowed to flood a certain percentage of their fields to encourage the rice straw to degrade, flooding is a waste of another precious resource: water. Using rice straw from Northern California fields also provides a reduction in secondary environmental impact. In this project, the rice straw was grown and harvested within 500 miles of the project site, reducing the need for long-distance transportation. Rice straw, as a primary construction material, is also rapidly renewable, replacing itself every year.

It is interesting to note that the acreage on which the home is built shares a neighborhood once owned by an enclave of Quakers. When subdividing the property into many five-acre plots, the Quakers developed Codes, Covenants, and Restrictions (CC&Rs) that required that all construction by the new owners be sustainable. As a result, the Rubin's nearest neighbor lives in a rammed-earth home, and yet another neighbor is in a home constructed of adobe brick. It is clear that the Quakers' long tradition of a simple life and peaceful coexistence with the land influenced their desire to steward the future of this property.

As Mr. Rubin has said of their experience in building "green," "In the end, everyone benefits. The builder profits, the owners save dollars and live in a vital habitat. Most importantly: the planet gets a little healthier." **UHD**

The Author

Paula Aiton is a freelance writer who lives in Hanford, California with her husband, a licensed architect and LEED® Accredited Professional, and their young daughter.



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Going Green

from the ground up

Vera Novak

Organic Home Design— Principles And Pathways

Home building is a process, like any other. For the most part, in the U.S., this is a design-driven process. The client sets the parameters, which generally include requirements for space, finishes, and architectural style. Once this is determined, other trades and functions adapt to the given design. Function follows form.

A new consumer demand has surfaced that is challenging our design assumptions—a request for “green” homes, or sustainable construction. First and foremost, the home needs to function in a sustainable manner: simple, healthful, interconnected with nature and the

environment. The process of developing such a structure might be thought of as “organic” and the resulting home environment as a living organism. In order to achieve this, the function of the house becomes the primary design force, with form moving to the role of a team player.

As with any living entity, the process of developing a house is progressive and integrated. It will evolve from the initial criteria, which is revisited and amended as each element of the “body” of the house is added. The end result is likely to work as a fully functioning, integrated system, where life flows freely with minimal environmental imprint. Let’s follow a theoretical example.

Function

Judy and Norm Smith are ready for a new house. They strive for balance and environmental awareness in their own personal lives, and are hoping to create a home and hearth that reflects these values. In searching for a building lot, they were drawn to a housing development that has a planned commercial center, a walkable community, and some reserved green spaces. So far, so good.

The Smiths visit their new lot and take in their surroundings. If their house were designed as an extension of themselves, where should they turn their eyes, their ears? They definitely want to hear the sound of the stream but also consider having a pulse on car noise that pulls into the driveway. Operable windows might provide this desired connection with the outdoors, while closed windows on the side of the neighbors will protect privacy. The eyes of the house would ideally point to the highlights of the lot, or out toward the best scenery. In this case, the backyard offers the best view.

Another element of consideration is the availability of natural resources. How will this organic structure interface with the

sun and the wind? In the morning hours, the first rays of the sun offer a warming energy. With the right window and shading orientation, the house could take advantage of the passive solar heating potential. Certainly, the design should allow for daylight to penetrate into the living spaces. For an extra touch, the placement of the windows can mark the progression of the day, or capture the festival of the solstice.

How will this house breathe? A natural air current might help cool the house and provide a natural flow of ventilation. “Clean” air is certainly a great matter of debate, but certainly an air intake located by the garage would not be healthy. The lungs of the house need to feed the right energy to the people and activities, carrying away the moisture from their breath and bringing them new, refreshed air. If the lungs clog from breathing in too much dirty air, or are not in proper working order, the house will go stale and “suffocate.”

A microclimate might exist on the site, or could be created by the sheltering effect of the house. This lends opportunities

“Green building is really about working smarter, planning for simplicity, and organically interfacing—with the environment, the neighborhood, the building components...and the homeowner.”

for creating indoor/outdoor interfaces and cultivating a special garden space. It might also demand special considerations for the building design, e.g. a shaded north-facing wall, bordered by evergreen vegetation, which could cause additional condensation on the exterior wall. This would need to be addressed in the installation of the finishing materials.

The regional climate will also act upon this structure. Cold winds call for protection; snowdrifts will determine placements of walkways and driveways. Climate considerations will influence the choice of materials. For example, in regions with significant day/night temperature fluctuations, a thermal mass wall would buffer the peak heating/cooling loads and create a more stable, comfortable interior environment. Houses in moist climates might want to avoid materials that can rot or mold. Hurricane-prone areas will call for sturdier construction, with tighter joints.

Form

Another aspect to consider is the social interface with the neighborhood. Depending on the cultural flavor of the existing homes, and the intentions of the new homeowner, this could vary from a privacy wall to a functional porch. If designed with clear portals of access and signs of welcome, the porch can be the “lap” of the house, inviting neighbors and friends to come sit for a spell. The location of the garage and the daily entry door will play a role in this as well. While well-concealed garage doors bode well for privacy and security, they no longer serve as indicators of a homeowner’s whereabouts. Other signs, such as the opening of shutters and curtains or the turning on of lights, can serve as alternate visual clues.

The heart of the house is the pulse of human life. The center of life might be in the kitchen. All paths of the house intersect in this common hearth, with private spaces trimming the perimeters. The decisions for room placement evolve out of the style of living and all observations up to this point. Where to capture the sun energy? What room to protect from the cold? The best view is reserved for a room that will be used during the day. This may be the kitchen, the office, or the living room. The decision might be made to have an office facing the street to keep track of happenings outside of the house, and provide privacy for other family rooms—both considerations of safety. The preference for “away” space might be on a second floor, providing a safe haven from which to view the world, or in the basement, offering isolation from the distractions of modern life. All of these parameters define the functional aspects of the house.

The room functionality will dictate the floor plan, which will in turn give the structure its basic shape. A roof shape naturally caps the building, following the main axis, confirming the layout. The next element to enter the equation is that of the mechanical functionality of this house. How will it maintain a comfortable temperature, where will the water flow, and where are the key energy needs?

Integrating these mechanical considerations into the planning process in this early stage is key in the development of an energy-efficient structure. Plumbing is optimally centralized on the fewest number of “wet walls,” minimizing installation cost and the loss of water and energy from delayed delivery of hot water. Solar preheating can be introduced at this stage, as well as options for heating and cooling. In addition to forced-air systems, alternatives include radiant heating coupled with air balancing—both passive and active solar—geothermal, wind, and others. At this point, a preference would be introduced to help integrate the system type in the overall home design, though system sizing will still depend on decisions of insulation, lighting, and other materials. This will prevent the all-too-common stories of flexible duct tubing

synopsis

Home building is a design-driven process in which the client sets the parameters, and generally include requirements for space, finishes, and architectural style.

As with any living entity, the process of developing a house is progressive and integrated, and will evolve from the initial criteria, which is revisited and amended as each element of the “body” of the house is added.

The end result is likely to work as a fully functioning, integrated system, where life flows freely with minimal environmental imprint.

wrapped like octopus arms in the attic, trying to fit into any available left-over space.

Structural decisions come next, together with exterior design options. The basis of the choice is much akin to a person making choices for their own attire—based on the social norms of the day, with varying degrees of individuality, depending on the statement they wish to make. The architectural neighborhood norms might be drawn from the other houses' orientations on their properties, the scale of the elements, or the choice of cladding material.

Materials

Of all the materials to choose for the construction of a house, there are none more important than those of the envelope of the building. In residential construction, these materials will determine the energy efficiency of the building, which is in turn the biggest impact of this organic structure in the greater ecosystem. The largest portion of the environmental footprint of a building is the cost of the heating and cooling. Reducing the demand will directly lessen the draw on natural resources for generations to come.

The building envelope is the skin and bones of the building. Much like their human counterparts, the prized qualities are long life, minimal maintenance, and protection from the elements. In the case of a house, this includes wind, rain, and the greater forces of nature, such as tornados, hurricanes, and earthquakes. The walls should also protect from excess heat and cold, moisture, and mold. From a pure economic viewpoint, this decision is also the most critical, as “cosmetic surgery” on the building envelope is very costly.

Wall insulation is evaluated based on the continuity of the insulation, the R-value of the material, and the reduction in air infiltration. Windows can also provide good insulation, while varying the solar gain coefficient to correspond with passive solar design. In fact, a super-insulated wall, together with energy-efficient windows and ceiling/roofing insulation, may moderate the indoor temperature enough to reconsider the decision on type of HVAC system altogether. For example, if the demand for heating is vastly reduced, a small “traditional” forced-air furnace might be sufficient and very energy efficient, allowing the “green” or “renewable energy” expenditure to be redirected toward solar panels for electric needs. Or, if the cooling load only requires a few tons of AC, the photovoltaic panel option might be of a smaller enough scale as to become economically feasible.

Other material choices follow the same organic premise: healthful, interconnected with nature. The best materials are the simplest, with the fewest parts, serving multiple functions, and requiring minimal maintenance and repairs. Taking a cue from ethnic and historical architecture, the best materials are ones that age “gracefully,” looking well worn and full of

character. A “ding” in a natural stained wood door is not the same as a “nick” in a painted wood door.

Path

An organic structure is holistic—all parts interface. The design process would follow this same integration. The traditionally linear path of home design through the professional trades is adjusted to be more of a team effort. This interaction of trades allows for a cyclical process of decision-making. Additional members of the team might include an energy specialist to help with system choices and “right-sizing” of equipment.

In an effort to quantify sustainability, incentive programs have been developed with specific benchmarks of performance. These include the U.S. Green Building Council LEED® (Leadership in Energy & Environmental Design) ENERGY STAR®, American Lung Association Health House, and the Institute for Business & Home Safety Fortified for Safer Living. New design guidelines include the “Not So Big House” concept, and Universal Design standards. While each of these is very commendable, a combination of these programs identifies remarkably overlapping and interwoven goals. A final parameter of affordable housing helps to refine the design and material choices.

This scenario of Mr. and Mrs. Smith is not entirely fictional. Several factors help this paradigm shift enter the mainstream of design. In the market sector, the consumer is exposed to model sustainable homes and is learning to ask for this quality of life in their own homes. Developers are tuning in to opportunities for constructing environmentally oriented communities with considerations for watershed, public transportation, and mixed-use housing. Design professionals are adapting, as evidenced by the emergence of design/build firms in the commercial market. In residential construction, the barriers between the trades are less defined, and as such, easier to transition. The development of new skills in the heating/cooling market are slower to materialize, but will seek their own solution. A foreseeable development would be the creation of teams of like-minded professionals. Their resulting homes/developments will spawn similar teams and grow the sphere of influence.

Sustainability is an accepted goal and concept in residential constructions. It calls for a rethinking of the principles and pathways of design. “Green” building is really about working smarter, planning for simplicity, and organically interfacing—with the environment, the neighborhood, the building components...and the homeowner. **UHD**

The Author

Vera Novak, LEED AP, is the Technical Services Manager for the Insulating Concrete Form (ICF) Association. ICF construction can play a significant role in sustainable construction, and is increasingly the catalyst for “building a better solution.” This multi-functional exterior wall material provides structural stability, energy efficiency, protection from the elements, durability, and sound insulation. ICF projects have been awarded with ENERGY STAR, USGBC LEED Gold, and Fortified Home recognition.



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How To Improve A Home's Energy Efficiency

Scott Young

synopsis

 A home's energy efficiency is most often compromised by the quality and quantity of insulation.

 Insulated sheathings are truly the only insulation products that maximize heating and cooling efficiency while reducing the potential for moisture.

 To reduce energy loss through walls, even loss caused by air leakage, insulated sheathings have proven to be the most effective method.

 Air infiltration is the largest single cause of heat loss in most homes, accounting for 38 percent of energy loss, 17 percent of which comes from insufficient insulation around windows and doors.

Conserving Energy—A Big Issue For Homeowners

As the cost of energy continues to escalate and the environmental impact of energy production becomes an increasing concern, the pressure to conserve energy resources is at an all-time high. And now, more than ever, both home builders and purchasers are seeking more cost-effective options to meet their demands.

Oil prices are up more than 20 percent from a year ago and are more than 150 percent higher than they were five years ago. It's no secret, energy is a real issue—especially for homeowners and builders, as homes now account for more than 20 percent of the nation's energy consumption.

According to a report from the U.S. Department of Energy, for the winter of 2006, the average price of heating a home was projected to increase approximately \$1,400 for oil customers and \$1,000 for gas customers. It's not surprising then, that after the mortgage payment, most homeowners pay more for heating and cooling than any other bill. And with this past summer's uncharacteristically hot temperatures, it's not just the cold weather months that pose concerns for homeowners.

Building A Better Home With Insulated Sheathing

A home's energy efficiency is most often compromised by the quality and quantity of insulation. Many homes are not properly insulated, particularly those built prior to the 1970s, when the issue of energy conservation and home energy performance first came to the forefront.

Fortunately, the latest insulation and weather-barrier solutions can actually make a home better able to withstand the extreme cold and warm weather months without consuming as much energy. Whether you are building a new home or undertaking a major remodeling project, you can reduce utility bills and improve the performance of the home with Dow Styrofoam™ extruded polystyrene and polyisocyanurate rigid foam insulations.

"Using insulated sheathing is a simple method to increase the overall thermal resistance of the wall assembly, thereby increasing the overall efficiency of the home," says Joseph Lstiburek, Ph.D., P. Engineering, of the Building Science Corporation in Westford, Massachusetts.

Rigid foam insulation is a safety net for the home as it blankets the exterior wall—minimizing heat loss through the studs. In warm climates, the insulation is installed to keep the

inside cool and minimize heat loss/heat gain from the outside into the air-conditioned space.

Insulated sheathings are truly the only insulation products that maximize heating and cooling efficiency while reducing the potential for moisture. Although some insulators absorb and hold water, which reduces insulation performance and fosters mold growth, Styrofoam extruded polystyrene insulation offers the highest moisture resistance of any foam plastic insulation. It, thereby, provides long-term insulating performance and reduces the potential for mold growth.

Without insulated sheathing, the wood framing beneath the siding, or other exterior surface, goes uninsulated. Cavity insulation, like fiberglass batts, only insulates between the framing. In fact, wood framing, wiring, and plumbing account for approximately 25 percent of an average home's exterior wall, where heat can escape in cold climates and intrude in warm climates.

"...Using insulated sheathing is a simple method to increase the overall thermal resistance of the wall assembly, thereby increasing the overall efficiency of the home."

And this doesn't just apply to frame walls. Consider ceilings, attics, and foundations as well. Heat loss from an uninsulated, conditioned basement can account for up to 50 percent of total heat loss in an otherwise well-insulated home.

"Basements are no longer just dark storage spaces, but are lived in. They need to be as dry and as warm as the rest of the home," says Lstiburek.

Rigid foam insulation is easy to install directly over uninsulated studs, using let-in bracing or metal strapping to provide the code-required lateral bracing. And because it helps conserve energy, rigid foam insulation usually pays for itself in the first two years.

Correcting A Misconception—Housewrap Is NOT An Insulator

The increasing popularity of energy-efficient building practices has created somewhat of a "buzz" around insulation products. And suddenly, the way a home is built, and the specific products that make up its core, have become topics of discussion between builders and their consumers.

But unfortunately, there is also some misinformation about proper insulation. Some manufacturers have started marketing

housewrap as an insulator, implying that it has an R-value, when, in fact, it does not. The bottom line is—housewrap is a weather barrier, not an insulator, and it is designed for builders who prefer non-insulated sheathings.

In actuality, you simply cannot get insulation values of R-5 and R-6.5 from thin sheets, reflective foils, and, most importantly, housewraps alone. To reduce energy loss through walls, even loss caused by air leakage, insulated sheathings have proven to be the most effective method. In fact, during independent laboratory tests, Dow's insulated sheathing products blocked air leakage three times better than any housewrap installed over fiberboard. With the joints taped, the advantage improved ten times (International Code Council Evaluation Service, Inc. [ICC-ES] report AC71).

Dow has incorporated messaging about the non-insulating value of housewrap into its most recent advertising campaign, set to debut this fall and winter. And although this may seem odd, given that housewrap is part of the company's building envelope, Dow is dedicated to educating builders on this issue. Because when a builder forgoes insulation for weatherization alone, it is the homeowner that suffers.

"Exterior rigid insulation board can act not only as the insulation, but also as the primary sheathing and, in certain areas, as the drainage plane and vapor control layer for the wall assembly," says Lstiburek. "This system, combined with advanced framing concepts, can provide cost savings from the reduction of building materials used, including fewer studs, the elimination of plywood or OSB sheathing, and housewraps."

Air Infiltration—A Hidden Influencer

Air infiltration is the largest single cause of heat loss in most homes, accounting for 38 percent of energy loss, 17 percent of which comes from insufficient insulation around windows and doors.

The first step in addressing air infiltration is identifying where and how air is leaking in or out. The worst culprits are usually utility cut-throughs for pipes, electrical outlets, gaps around chimneys and recessed lights in insulated ceilings, and unfinished spaces behind cupboards and closets.

A home energy audit can be a good way to identify problem areas within the home and to evaluate possible solutions. Audits can pinpoint where a house is losing energy and can also determine the efficiency of a home's heating and cooling systems.

A professional auditor uses a variety of techniques and equipment to determine the energy efficiency of a structure. These include blower doors, which measure the extent of leaks in the building envelope, and infrared cameras, which expose hard-to-detect areas of air infiltration and absent insulation.

Once these problem areas have been identified, openings can easily be sealed with Dow's Great Stuff™ Pro foam sealants. Great Stuff Pro foam sealants expand to take the shape of cracks and voids, forming a permanent and airtight barrier to stop drafts, completely "air tightening" the entire home. And in addition to increasing energy efficiency, using a foam sealant like Great Stuff Pro constricts pathways for insects, minimizes condensation (which can cause mold and mildew), and cuts down on noise pollution.

For more information, visit www.greatstuff.dow.com/pro.

Conveying The Benefits Of An Energy-Efficient Home

A January poll by the American Institute of Architects (AIA) revealed that 90 percent of respondents said they would be willing to pay \$4,000 or \$5,000 more for a house that would use less energy. This demonstrates a growing consumer awareness of energy issues as related to the home. Builders can demonstrate the specific cost benefits to their prospective home buyers, using the following tools:

- **The Cost Calculator:** Dow Building Solutions' cost calculator can be a useful tool. Builders and consumers alike can visit <http://www.dow.com/styrofoam/na/res-us/tools/> to calculate the estimated yearly savings that can be achieved with the addition of Styrofoam extruded polystyrene, Dow Polyisocyanurate Insulation, or Styrofoam Weathermate™ housewraps, in comparison to other 2 x 4 or 2 x 6 wall construction.

- **Highlighting Tax Credits:** To help promote energy efficiency and conservation, energy tax credits are now available under The 2005 Energy Policy Act for new construction and existing homes. Consumers who purchase and install specific products, such as energy-efficient windows, insulation, doors, roofs, and heating and cooling equipment can receive a tax credit of up to \$500 after January 1, 2006. Manufacturers offering energy-efficient products can assure their customers that these items will qualify for the tax credit if certain energy-efficiency requirements are met. For more information, please visit www.insulateyourhome.com.

Conclusion

Across the nation, residential housing design continues to shift toward the development of high-performing, sustainable, and energy-efficient building systems.

"To be sustainable, a builder must take opportunities to reduce material use (including waste), simplify or integrate systems and details, and potentially reduce overall initial costs of construction," says Lstiburek.

According to the U.S. Department of Energy, energy-smart building choices improve energy performance, lower energy bills, reduce construction costs and waste, and reduce call-back and warranty problems. This further demonstrates that building energy-efficient homes can decrease the homeowners' energy costs and give the home builder a competitive advantage. **UHD**

The Author

Scott Young is the Residential Market Manager of North American Residential Construction for Dow Building Solutions. He is responsible for integrating strategic elements associated with marketing, channel, products, and price management. Since joining Dow in 1989, Young has held various positions in sales, market research, and market development, and has held his current position since 2001.

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Ahead Of The Curve

Built for maximum daylighting, using a careful combination of native materials and high-tech products, this Maine solar home demonstrates how art and science can—and should—coexist.



The couple had decided to move to Maine from New Jersey and build a home, but they wanted to do so in a responsible way. Inspired by their two sons who live completely off the grid, they wanted what Taggart Construction (www.tagcon.com) offers—homes mindful of the environment, yet still comfortable by modern standards.

“The Taggart home is the first home in the nation to achieve a silver certification under the LEED® for Homes (Leadership in Energy and Environmental Design) program, a new, high-performance building standard created by the U.S. Green Building Council.”

Solutions. “We figured out which points they could work on. As I recall, they were already doing very well.”

As part of the LEED certification, Taggart called in Wes Riley of Horizon Residential Energy Services (www.horizon-res.com), a local energy auditor.

“Riley put the home through a bunch of tests,” the builder recalls. “He used a temperature gauge to check for differentials, and he also did a blower-door test.

Mort Panish can attest to the results of those tests.

“I have the exact record right here,” he says, gesturing toward the computer in his home office. “Last year, we spent \$1,600 on propane gas.”

That figure is about what many older homes in the region pay for one month of heating oil in the depths of winter, and it includes domestic hot water, whole-house radiant floor heating, and fuel for the gas range and gas dryer. A single on-demand boiler (see sidebar) provides all of the water heating.

Electric bills come in far below average for a home this size, thanks to the three-megawatt photovoltaic array on the roof. The local utility buys back excess power not used in the home.

“Our average bill is about \$35 a month,” says Mort Panish. “But even when we produce all of our electricity, we still pay them something, because there’s a utility charge for distribution. It’s never zero.

“We average about 1.4 megawatts when the sun is out,” Panish adds. “But one bright, cool day last May, we were generating 2.9 megawatts of power. The people who installed the panels told us we would never achieve that kind of output, but the conditions were just right.”

Matt Power

Organic Home Design—Principles And Pathways

When builder Peter Taggart set to work on this 2,300-square foot custom home on a rural hilltop in Freeport, Maine, he began, as he always does, by focusing on what really matters—performance.

That emphasis resulted in a home that outperforms virtually anything in its class, with R-27 walls, an R-60 roof, high-performance Andersen® Windows, FSC-certified 2 x 6-inch framing lumber, and a long list of durable, renewable materials and products.

A few years ago, a National Association of Home Builders (NAHB) Research Center study found that only about six percent of a home’s “embodied energy” is used in its construction and that includes fabrication of the various products. The other 94 percent of the energy it will require happens during occupancy—heating, cooling, and electrifying the home.

Taggart understands that equation well. “Above all, we want the house to perform,” he says. “We focus on that, before we start talking about flooring material and sinks.”

It takes the right clients, of course, to appreciate the passion that Taggart and his in-house designer Curt Jensch, A., AIA, bring to the table. Mort and Evelyn Panish, the homeowners, were a natural fit.

“We’re very committed to the environment,” says Mort Panish, “but we weren’t willing to live without some things; for example, we wanted to have a freezer for storage.”

Jensch easily accommodated those requests, at the same time considering other practical elements of the design. “They want to live here as long as possible,” he notes. “So we really worked on keeping the eight primary rooms on one level. We put things like guest rooms and bonus spaces on the second floor and in the basement, but not the primary living areas.”

Green Kudos

The Panish home also earned a special distinction. It’s the first home in the nation to achieve a silver certification under the LEED® for Homes (Leadership in Energy and Environmental Design) program, a new, high-performance building standard created by the U.S. Green Building Council (www.usgbc.org).

“When we started working on the home, we weren’t even thinking about LEED certification,” Taggart recalls, “but we heard about the program and realized we were already most of the way there.”

Taggart contacted the local LEED officials at Fore-Solutions (www.fore-solutions.com), a consulting firm in Portland, Maine.

“We sat down several times with Curt and Peter and went through the rating system,” recalls Danuta Drozdowicz of Fore

synopsis

The Taggart home outperforms anything in its class, with R-27 walls, an R-60 roof, high-performance Andersen® Windows, FSC-certified 2 x 6-inch framing lumber, and a long list of durable, renewable materials and products.

Even in the dog days of summer, the Panish house remains relatively cool and comfortable, thanks in part to a combination of passive and active ventilation.



Power Check. A real-time current indicator on the Xantrex panel gives the owner instant access to the effectiveness of the solar array.



Top: The south-facing main living room of the home benefits from passive solar gain all winter. The thin slab concrete base for the tile floor contains a radiant heating system. The owner has installed insulated blinds that he closes during evening hours to prevent excessive heat loss through the windows.

Right: In the loft area of the home, the builder applied custom ironwork and a striking baluster system to the simple design. Varied wood surfaces include fir, Maine-grown eastern white cedar, and renewable bamboo flooring.



Passionate Pragmatism

For Peter Taggart, “green” building is not a marketing gimmick or simply a way to trump his competition. It’s a driving force in his business.

“We’ve been building energy-efficient homes for 12 years,” Taggart says. “It’s a major part of who we are and it’s part of what makes this house special. A truly “green” house is simple, but you still have to make it attractive.”

If performance were the only consideration in a “green” home, Taggart would simply erect a rectangular box with south-facing windows and a wide overhang.

“Instead, we add a jog here, a detail there, enough to break up the elevation,” he explains. “You’re always trying to strike the balance between high performance, appearance, and functionality on both interior and exterior.

Designer Curt Jensch notes that he too must strike a balance.

“In this home,” he says, “one challenge was simply keeping the size of the building small as we added more features. We’re always trying to trim the fat.”

Lighting Smarts

One way of making the home feel larger was by flooding it with daylight.

“We wanted natural lighting in all habitable rooms,” Jensch says. “At the same time, we tried to avoid solid surfaces that would block light—for example, that’s one reason we chose the cabling on the upstairs railings instead of traditional balusters.”

Fully Loaded

Although largely hidden behind the walls and below the living areas, the Panish house is replete with energy efficient systems and products.

Super Walls

The exterior walls of the home achieve about R-27, more than twice the R-value of a typical 2 x 4-framed home. To reach that lofty figure, the builder first framed using 2 x 6 lumber set 24 inches on center. The exterior sheathing was OSB (preferable to plywood because it’s a more efficient use of trees). On top of that, he added a two-inch layer of expanded polystyrene, covered with house-

wrap. “This type of foam allows some water vapor to move through it,” Curt Jensch explains. “We didn’t want moisture becoming trapped inside the wall.” On the interior side of the walls, cavities were filled with dense-packed cellulose, made from recycled newspaper.

On-Demand Boiler

The Baxi-Luna boiler, which is about the size of a small kitchen cabinet, looks like it wouldn’t have the gusto to supply heating for both living spaces and household hot water, but don’t be fooled. Made in the United Kingdom—a country with far greater market penetration of “on-demand” hot water—the boiler runs quietly on propane gas, with a direct

vent exhaust. It achieves very high efficiency—around 87 percent according to company literature—at the same time saving gas, because it requires no pilot light.

Native Siding

It’s a simple enough concept. By leaving a space behind the home’s native pine clapboard siding, the siding can dry out much more quickly, extending the lifespan of both the wood and the paint job. For the Panish house, the builder used a low-tech method, simply adding strapping over the home’s vapor barrier. On other projects, he has achieved the same results with a high-tech product called “Cedar Breather” and/or “Home Slicker” from Benjamin Obdyke. **UHD**

Land Re-Use: Bonus Points

When Mort and Evelyn Panish first approached Taggart Construction, they had already made their first environmental building choice. They purchased their home’s lot on 135 acres of a “conservation subdivision” in Freeport, Maine. This site, carefully mapped out by landscape architect Terry DeWan, only allows home construction on 29 percent of the property. The other 71 percent is protected from development. “The site is also a reclaimed gravel pit,” Peter Taggart notes, “so it is essentially re-using the land.” **UHD**

Originally, Jensch adds, the owners had in mind a timber-framed home. “We used that idea to create a hybrid,” he says, “where you have these exposed posts and beams made of native pine. They allow light to fill the spaces, at the same time avoiding some of the energy sacrifices necessary with a post-and-beam home.”

Another energy-driven choice was the use of fluorescent track lighting instead of recessed cans.

“We’ve learned that even with insulated recessed cans, there’s an energy price,” Taggart explains. “You can easily get a chimney effect, where moisture gets into the roof cavity, and ice forms on the underside of your sheathing. We’d rather avoid the drawbacks altogether.”

The daylighting also serves another important, practical purpose in cooler months. The roof overhangs are specifically designed to allow the low winter sun to stream in, while keeping out the high summer sun. The low-E, argon-filled windows on the south-face allow passive solar sunlight to store heat in the tile floor.

“There’s a lot of mass in the main living area beneath that tile,” Jensch explains. “We put in an inch-and-a-half thin-set concrete floor with a Uponor (formerly Wirsbo) radiant system.”

Mort Panish points out the insulating blinds on the large windows.

“It took me a while to figure out how to use the house,” he says. “Next winter, my heating bills will be lower. Now I lower the blinds at the end of each day in the winter, and keep a lot more heat indoors.”

Art And Science

Even in the dog days of summer, the Panish house remains relatively cool and comfortable, thanks in part to a combination of passive and active ventilation.

But that response to the local climate didn’t happen by accident. It required a deep knowledge of building science and tools.

For example, Jensch uses REM/Design (www.archenergy.com) energy modeling software when choosing products and tweaking elevations. The software helps him specify the optimum energy

Points Of Honor

To achieve LEED® for Homes certification, LEED auditors add (and subtract) points for various building technologies. Here are some (but not all!) of the areas where the Panish home scored.

- Sustainable Site: Homes with no turf and that require no irrigation score higher. Also, use of a distressed site is a plus.
- Water efficiency: This one’s easy. Low-flow fixtures and appliances make the difference.
- Durability Plan: This is where building science matters: The use of a drainage barrier behind siding, vapor barrier (housewrap), metal roofing, and large overhangs—all contributed to the home’s durability score.
- Environmentally Preferable Products: From bamboo finish flooring to formaldehyde-free subflooring to recycled cellulose insulation, products and materials scored well.
- Waste Management: Taggart has a standing policy about minimizing jobsite waste, so this one was a natural win-win.
- OVE (Optimum Value Engineering): The home earned points for the efficient way the builder used framing materials.
- Energy and Atmosphere: This was the testing component—how well the home performed under blower tests and the like—it received high marks.
- ENERGY STAR Lighting: Virtually every fixture in the home meets these standards.
- ENERGY STAR Appliances: All of the home’s appliances meet these standards.
- Renewable Systems: The photovoltaic array installed on the home earned additional points.
- Homeowner Education and Awareness: This goal is mandatory. **UHD**

value of given materials. For example, he used it to weigh the advantages of adding more roof insulation.

Drozdzowicz notes that Taggart encourages this kind of detailed analysis from his team.

“He has the key traits of a good green builder,” she says. “He’s willing to take risks and continually educate himself. Just as important, he sends his whole crew to training on a regular basis.”

For Mort and Evelyn Panish, the payback for that attitude is ongoing.

“The house is totally comfortable,” Evelyn Panish says. She has just arrived at the house in her new hybrid car. “We get a beautiful breeze up here in the afternoon, and at the same time we feel like we’re doing the right thing. That’s a nice feeling.” **UHD**

The Author

An award-winning journalist based in Maine, Matt Power served as Editor-In-Chief of *Custom Builder* magazine. He writes regularly for several trade and consumer magazines. Matt can be reached at mpower@maine.rr.com.

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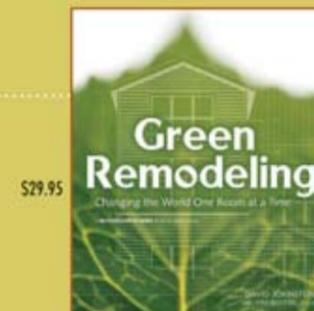
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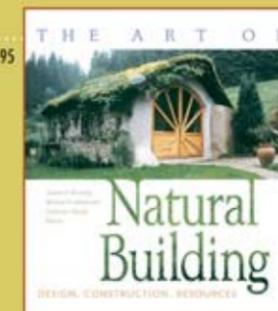
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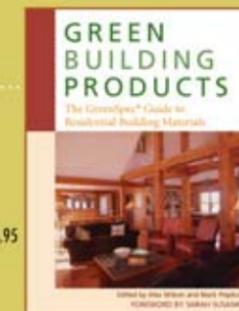
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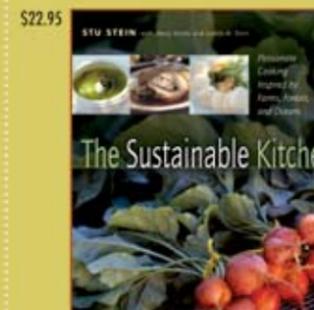


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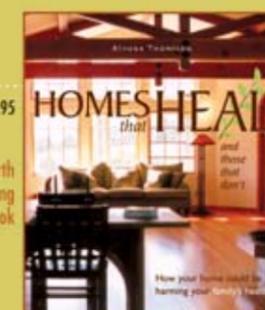
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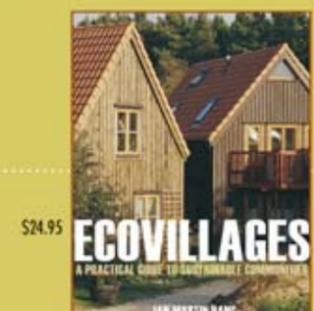


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