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THE BEST-LAID PLANS

EFFICIENT DESIGN, EXPERT BUILDERS, AND PERFORMANCE MATERIALS EARNED NAHB-GOLD FOR THIS PLAN-BUILT HOME

By Cheryl Weber, LEED AP

When an empty-nester couple decided to build their dream home among Eastern Pennsylvania's rolling green hills, scaling back wasn't an option. After all, they were gearing up to enjoy the next phase of their lives, entertaining a passel of guests including children and grandchildren. The couple found a picturesque lot—just over an acre on a gentle south-facing slope. And after poring through house plan books, they chose drawings for a contemporary Craftsman house.

Rather than simply plunk the house down on the lot, however, they made sure it would embrace the climate and terrain. Starting with a house plan designed by Alan Mascord Design Associates of Portland, Ore, modified for the property by studio26 homes, a local builder in Orefield, Pa., the owners were able to create a home that satisfied their green standards. In fact, their new home was hardy, region appropriate, and energy efficient enough to earn a Gold rating under the stringent National Association of Home Builders (NAHB) Model Green Home Building Guidelines.[1]

Custom Green, Off-the-Rack Prices

It's not just expensively designed custom homes that are going green. With a little motivation on the homeowner's part and a knowledgeable builder, predrawn plan specifications can be fine-tuned to help reduce a building's carbon footprint. Proper orientation to the sun, energy-efficient windows, and the smart use of building materials and techniques can punch up a house plan's environmental profile without

A mix of contrasting materials emphasize the Craftsman details of this hardy design by Alan Mascord Design Associates.

ALL PHOTOS BY JOHN STERLING RUTH PHOTOGRAPHY, COURTESY STUDIO 26 HOMES.

Energy Star-rated triple-pane windows and patio doors offer the highest available performance for a cold weather home.

compromising the basic design.

In addition, house plan designers, architects, and publishers are addressing today's eco-challenges by providing builders with additional "greening" guidelines for the construction of their plans. For example, ePlans.com in conjunction with Mascord, now offers the Efficient Living upgrade package of construction specifications (see sidebar), which outlines how to build the home from any of their house plans to earn ratings by third-party green certifiers like NAHB or LEED for Homes. Gary Higginbotham, Mascord's green building specialist, describes the package as a menu of "good-better-best" green building choices. "The blueprint package shows builders how many points they'll get [from certifiers] by following the plans, but also outlines choices," he says, adding that each home plan is keyed to the U.S.'s six climates zones. In other words, homeowners and builders can choose how green they want to build out the house plan, according to their own priorities, access to materials, and budget.

Activating the Plan

One of the first modifications made to the original house plan, which was designed for construction on a flat lot, was to adapt it for the property's south-sloping grade. Doing so would increase passive solar

The second-floor master calls for a fireplace and private balcony (on right).

Decoder Rating

Thanks to a combination of smart features such as super-insulated walls, triple-pane windows, and carefully installed ductwork, this house received a HERS rating of 54. But what is HERS, and how is it measured?

HERS is the acronym for Home Energy Rating System, a method that analyzes a new home's energy efficiency on a scale of 0 to 100—the lower, the better. The scoring system, developed by the Residential Energy Services Network (RESNET), uses the 2006 International Energy Conservation Code (IECC) as a benchmark. A home built to IECC specifications would score 100, for example, while a home that achieves net-zero energy use would score 0.

To test the house, a builder or homeowner hires an energy rater to perform a blower door test (to check the leakiness of the house) and a duct test (to check the leakiness of the ducts). These results and others are used to determine the home's HERS rating.

Each one-point decrease translates to a 1-percent increase in energy efficiency compared to the benchmark of 100. So a home that scores 80 is 20 percent more efficient than the standard. For more information, visit www.natresnet.org or www.energystar.gov.

Efficient Living Upgrade

This addition to your blueprint package will show your builder exactly how to build this home—or thousands others on ePlans.com—to NAHB, LEED, or Energy Star standards. For full details, turn to page 187.

Green Guts

Here is a list of the key energy-efficient materials and design decisions that went into the home.

Foundation Walls: The prefab foundation, Xi from Superior Walls, consists of high-strength concrete and Styrofoam panels reinforced with steel rebar and polypropylene fibers. It insulates to R-12.5, requires no additional dampproofing, and meets or exceeds IECC and IRC energy conservation standards. www.superiorwalls.com.

Windows: The house's 120 triple-pane windows and patio doors are Pella Designer Series with between-the-glass blinds, achieving a U-value of .23 and a SHGC of .26. www.pella.com.

Mechanical System: The XL16i two-stage heat pump from Trane has a SEER rating of up to 17 and an HSPF of 9.2. The 4-ton Energy Star unit, which heats and cools the house's 7,365 square feet (including basement) in four zones, is about half the size of that required by a similar house built to code minimum, Baker estimates. The smooth metal ducts are in conditioned space and sealed with Mastic all the way to the registers, then covered in R-5 blanket insulation. The home achieved zero duct leakage to the outside. www.trane.com.

Air Quality: Due to its ultra-tight construction, this home "breathes" through its Energy Recovery Ventilator (ERV), Trane FreshEffects, which continuously exchanges stale air with fresh air and transfers heat and moisture between incoming and outgoing air via a dual-chamber pipe. Before the incoming air is distributed through the home, a Trane CleanEffects air cleaner removes up to 99.98% of airborne allergens, according to the company. www.trane.com.

The home owners chose to increase outdoor living areas and to add a walk-out basement. This increased the total square footage to 7,365.

heating and daylighting of the home, as well as add a bright walkout basement.

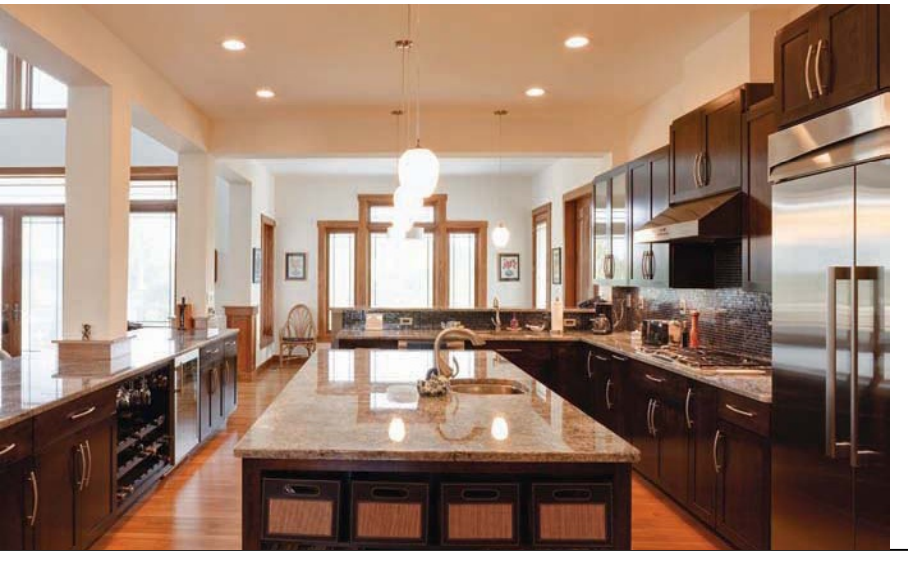
Studio26 vice president and designer Brian Baker oriented the house's long portion east-west with the rear facing south. The two-story wall of windows opens the kitchen and great room to the sun's free energy, warming the living spaces in the winter and letting the owners save electricity by keeping the lights off during the day. In the summer, a slender eyebrow roof between the upper and lower windows deflects heat gain. Also, Baker added a wraparound deck, which does double-duty by multiplying the outdoor living space and shading the basement below. As Baker explains, "In winter, when the sun is lower, it penetrates 6 feet into the basement and helps heat the tile floor on the concrete slab. This thermal mass collects heat and disperses it in early evening, so the owners can keep the thermostat lower."

Other energy-saving modifications were higher tech and hidden behind walls. To protect against Pennsylvania's cold winters, the homeowners chose a Superior Walls concrete-and-Styrofoam foundation made of 10 ¼-inch-thick panels. For extra measure, formaldehyde-free Johns Manville batt insulation was stuffed into the basement stud cavities, boosting the combined insulation values to a robust R-33.5.

The plan already called for 2x6 studs on the first and second floors. To stop air leakage—the biggest threat to energy loss—the builder packed the walls with blown-in insulation and affixed 1-inch-thick extruded polystyrene panels to the exterior. Above all, Baker was aiming for an air-tight box, which included the liberal use of caulk and spray foam to seal up vulnerable points in the walls and roof.

"If you could pick up our house and drop it in a lake, would it stay afloat or allow water to penetrate?" Baker asks. Well, if the only concern were efficient heating and cooling, you'd want the house to float. But a house also has to be able to exchange air—to breathe—in order to prevent moisture and air-quality problems inside the home. To that purpose, an energy recovery ventilator (ERV) was installed to provide a constant supply of fresh air by efficiently exchanging heat between stale air being exhausted and cooler air coming into

The builder installed a custom bookcase to increase function for the kitchen and great room.



Insulation: First and second floor walls are blanketed in formaldehyde-free Johns Manville Spider Custom Insulation. It passed Environmental Specification 1350 and provides an R-value of 23 in the 2 x 6 walls. Closed-cell spray foam insulation by Tiger Foam seals up hard to reach corners, headers, sill plates, and band joists where the floor meets the outside wall. Johns Manville blown-in insulation: www.specjm.com. Spray foam: www.tigerfoam.com.

Moisture Management: Given its location in a climate where moisture levels are significant for most of the year, the house has a CertainTeed smart vapor barrier between the insulation and drywall. It's engineered to let walls breathe by allowing water vapor to pass through when humidity levels reach 30 percent or more.www.certainteed.com.

Garage: Located on the house's west side to help block westerly winds, the garage's insulated walls, ceiling, and insulated (R-17) steel Coachmen Clopay garage doors keep interior temperatures approximately 20 degrees warmer than outside air without heating, Baker says. This also keeps the rooms above the garage comfortable. www.clopaydoor.com.

Plumbing: A PEX manifold system delivers heated water directly from tank to tap rather than filling the entire piping system with water, and PEX tubing resists corrosion and retains heat better than copper. Two propane-fueled Noritz tankless water heaters work in tandem to supply hot water. Heaters: Noritz 0751 Series. www.noritz.com. Plumbing: Watts Plumbing Manifold/Potable PEX Tubing. www.watts.com.

Exterior: CertainTeed Independence lifetime asphalt shingles earned green points for the home's proximity to the plant. James Hardie integrally colored fibercement siding saved the need for on-site painting. Roofing: www.certainteed.com. Siding: www.jameshardie.com.

Bay windows in the master bath face the front of the home.

the house. Additionally, a "breathable" vapor retarder was added to absorb excess moisture behind the drywall, releasing it back into the house, where it would be flushed away by the ventilation system.

Although a solid grasp of building science is key to greening a stock plan, some performance-enhancing gestures only take a bit of forethought—such as placing the electric heat pump and ductwork in conditioned space, and the mechanical and plumbing systems in the middle of the basement to shorten duct and piping runs. Studio26 also included a 6-foot-by-6-foot chase that runs from the mechanical room to the underside of the roof to hold wiring for future solar panels.

"People can take a stock plan and make it their own, and make it green," Baker says. "No matter what the home owner falls in love with, we can modify wall sections to meet our requirements of building to a minimum 40 percent savings over code."

Cheryl Weber is a writer in Lancaster, Pa.

[1]The NAHB grades homes at one of four levels, which corresponds to the home's cumulative performance score: Bronze (222), Silver (406), Gold (558), and Emerald (697). To learn more about the NAHB program and about third-party certification of homes, see "Proving Grounds" in the Summer 2009 issue of EcoHome Designs. Or go to www.nahb.org.

An energy-recovery ventilator improves indoor air quality and heating efficiency, keeping even larger spaces comfortable.