The Greenest House in America?

It's healthful, low maintenance, and easy on the environment, but this Texas home for a family of six is also lots of fun to live in

BY PETER PFEIFFER

If you were asked to imagine the greenest house in North America or even Texas, chances are that geodesic domes, yurts, or funky, far-out modern structures would come to mind. Yet the highest point rating ever given to a home by the Austin Green Builder Program, arguably the most recognized residential green-building program in North America, went to an Arts and Crafts style house that I recently completed for my family in Austin (photo right).

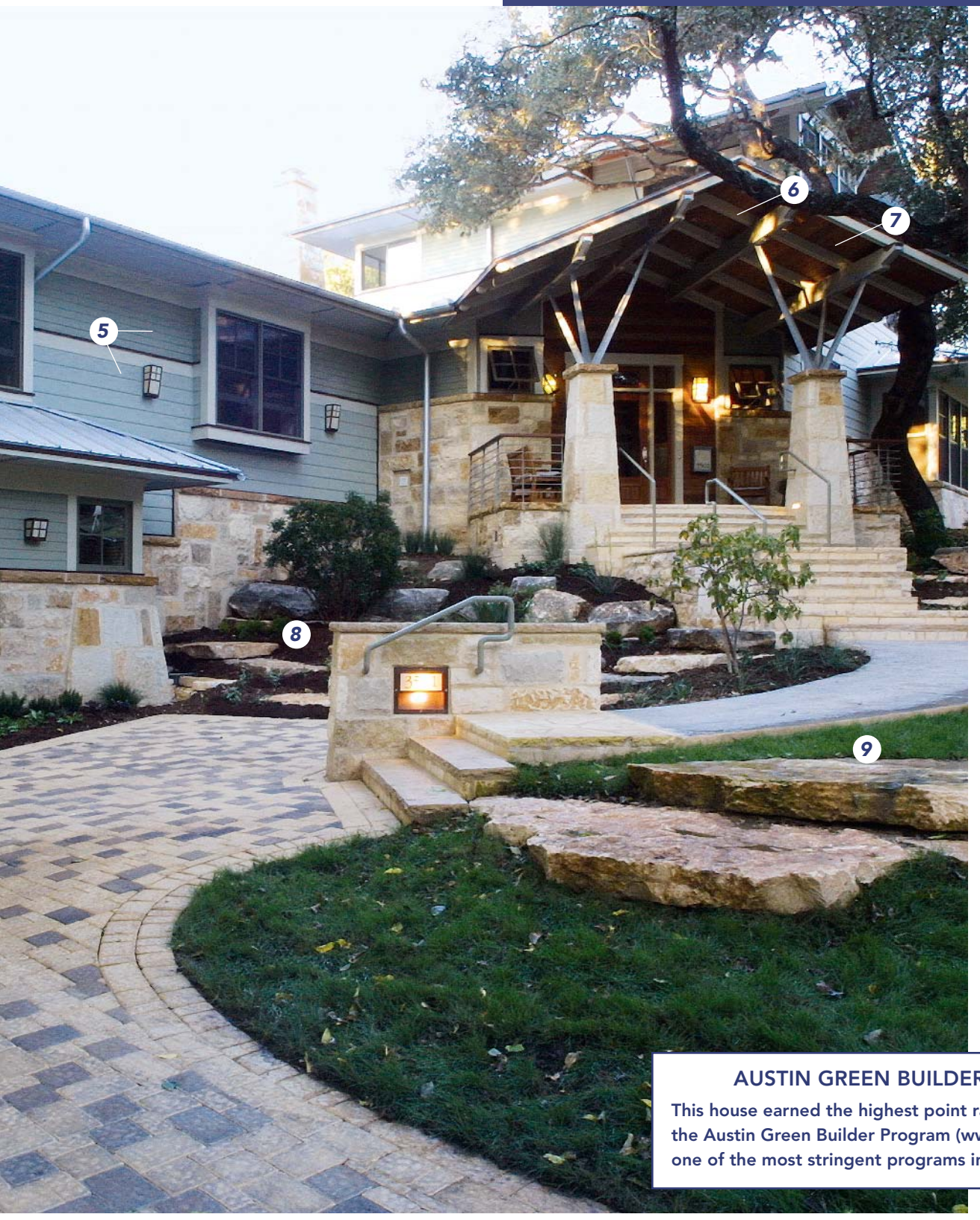
At 4175 sq. ft., this house isn't small, but neither is my family of four rambunctious kids with two active parents. And while the house is unique from a design standpoint, the green elements were blended in such a way that the house fits seamlessly onto its lot and into the neighborhood. This house debunks the common myth that building green demands sacrifice and compromise in design and comfort. On the contrary, the green-building concepts we've incorporated into this house greatly enhance the quality of living.

Maximize the site, minimize the impact

The Austin Green Builder Program describes a green home as healthful, comfortable, efficient, durable, and low maintenance while being easy on the environment. This holistic approach to building begins with planning, which entails not only using a workable floor plan but also foreseeing the homogeneous interaction of all systems and materials in a house. With all the years that I've been involved in green building, I'd argue that I had been planning this house for decades.

For my wife, Karen, and me, a big step in the planning stage was assessing our needs and finding a lot. Our family was rapidly outgrowing our old home, and the search for new digs led us to a 1960s-style ranch. Our initial thoughts were to

BUILDING GREEN NEVER LOOKED SO GOOD



State-of-the-art materials combined in an Arts and Crafts style create a long-lasting exterior that requires minimal care. Even the pool (photo facing page) earns its keep as a heat sink for the home's cooling system.

1 Wide overhangs to shade windows and keep away rain

2 Metal soffits that never need painting and help to reflect light inside

3 Synthetic trim from recycled plastic

4 Locally quarried Texas limestone

5 Cement siding in two different textures, profiles, and exposures

6 Exposed rafters from recycled wood

7 Second-growth sustainably harvested redwood ceiling

8 Irrigation for xeriscaping from gray water and collected rainwater

9 Drought-resistant zoysia grass

AUSTIN GREEN BUILDER PROGRAM

This house earned the highest point rating ever given by the Austin Green Builder Program (www.austinenergy.com), one of the most stringent programs in North America.

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A HOUSE THAT COOLS ITSELF NATURALLY

rebuild and add on to the house, but it soon became apparent that our fixer-upper had to be replaced.

Rather than scrape the lot bare and banish all that labor and material to the local landfill, we found a buyer who moved most of the original house to a property across town. With its new lease on life, the transplanted house now has become a newly renovated home. In return, we had a clear lot that let us design and build the new home we really wanted, truly a win-win-win solution: for us and the salvage contractor as well as for the environment.

With the original house removed, the next step was placing the new house properly on the site. We positioned the long axis of the house to run east and west with the majority of the windows facing north and south. This critically important strategy along with the screened porch takes utmost advantage of the prevailing southeasterly breezes that cool the house even on the hottest days (photos above). Placing the house in this position also maximizes passive-solar heat gain in the winter.

Along with orientation, the low-pitch roof and broad protective overhangs also help to keep sun and rain off exterior windows and doors, the first line of defense for a low-maintenance exterior, which in turn promotes a more healthful (mold-free) indoor environment.

High-durability, low-maintenance exterior

We built the house with a mixture of man-made and natural materials available nearby. Outside, we clad the foundation with locally quarried limestone. Its rich, buttery tone contrasts nicely with the painted cement siding directly above it. To give the house the feel of an Arts and Crafts style bungalow, we ran the siding in different textures, profiles, and exposures.

All the exterior trim on the house, including the horizontal band between the siding treatments and the door and window trim, is made of a new product called MoistureShield (all product sources are listed on p. 81). This synthetic material is wonderfully workable, it won't rot, and it's made of 95% post-consumer recycled plastic and wood chips.

We made the overhanging soffits from sections of corrugated Galvalume sheet metal. Galvalume doesn't mildew in the Texas humidity, and it doesn't need to be painted. This same material clads other parts of the house as siding. As a plus, the air that flows behind its corrugations helps the house to resist the intense central Texas heat.

One of my goals was an exterior that would stand up for a century. Except for the second-growth redwood that provides a warm welcoming accent at the entries, none of the exterior materials should succumb to the forces of Mother Nature.

Smart walls save energy

The finish materials weren't the only things subjected to the scrutiny of my "green" eye. Wherever possible, we framed with lumber that didn't use long lengths or old-growth trees. The floors and roof of the house were engineered trusses, and beams incorporated into the frame were either laminated-veneer lumber or parallel-strand lumber (made from waste strands of timber).

The walls were framed with finger-jointed 2x4 studs (made from recycled wood) along with engineered door and window headers (made from oriented strands of wood). We sheathed the walls with BarrierPanel exterior oriented strand board (OSB), which is manufactured with borates for decay resistance and insect control.

Wall cavities received a 1-in. spray of air-sealing high-density foam, then were filled with borate-laced cellulose. Above the master bedroom on the second floor, we sealed the attic floors with 6-in. low-density foam and created a vented attic above. Environmentally friendly insulation board installed above the ceiling gypsum board provides a thermal break to keep the upstairs more comfortable in the summer.

Over the bedroom wing, the attic is sealed, and the light-colored metal roofing is insulated from below. The roof sheathing is plywood with a radiant-barrier system laminated to the underside. As a result, attic temperatures stay 40°F to 50°F cooler than a typical attic in our area.

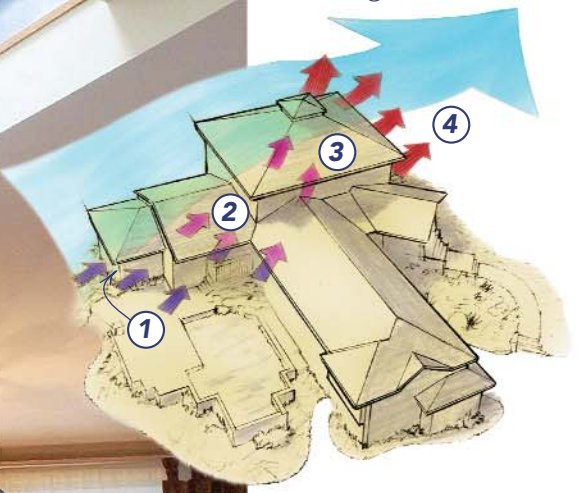
Indoor finishes let you breathe easier

Keeping most of the attics in the house sealed away from the inside spaces or the outside air helps to control humidity and heat gain. The result is low indoor humidity levels, which helps to control mold inside the house. In addition, we used environmentally friendly and nontoxic materials and finishes.

Drawing facing page: Chuck Lockhart

Classic cross ventilation

Positioning the house properly on the site takes advantage of prevailing winds (large blue arrow) that create a draft effect to suck warm air out of the house. Cooler air then enters through the screened-in porch ① and blows through the wide-open interior ②. In the middle of the house, a large stairway ③ acts as a chimney to enhance the flow of air, which exits through second-floor windows ④.



ELEMENTS OF A GREEN INTERIOR

All interior woodwork and trim were milled from old beams collected by the author. Appliances in the kitchen were chosen for their energy efficiency. A skylight above the stairs and the metal soffits outside reflect natural light inside, minimizing the need for artificial light.

1 Energy-efficient lighting

2 Texas-limestone countertops

3 Recycled wood for secondary countertops

4 Central stairway that provides natural light and ventilation

5 Recycled Douglas-fir wood accents

6 No-formaldehyde MDF surfaces painted with low-VOC paint

7 Scuff-resistant metal risers that never need painting

8 Recycled heart-pine floors

I've always been a bit of a pack rat, and I'd accumulated quite a few old beams and floor joists from old buildings that had been torn down. The builders, Matt and Paul Oliver of Oliver Custom Homes, were able to mill all the interior flooring and the trim from this stock (photo above). For painted surfaces inside, we used low-formaldehyde medium-density fiberboard (MDF).

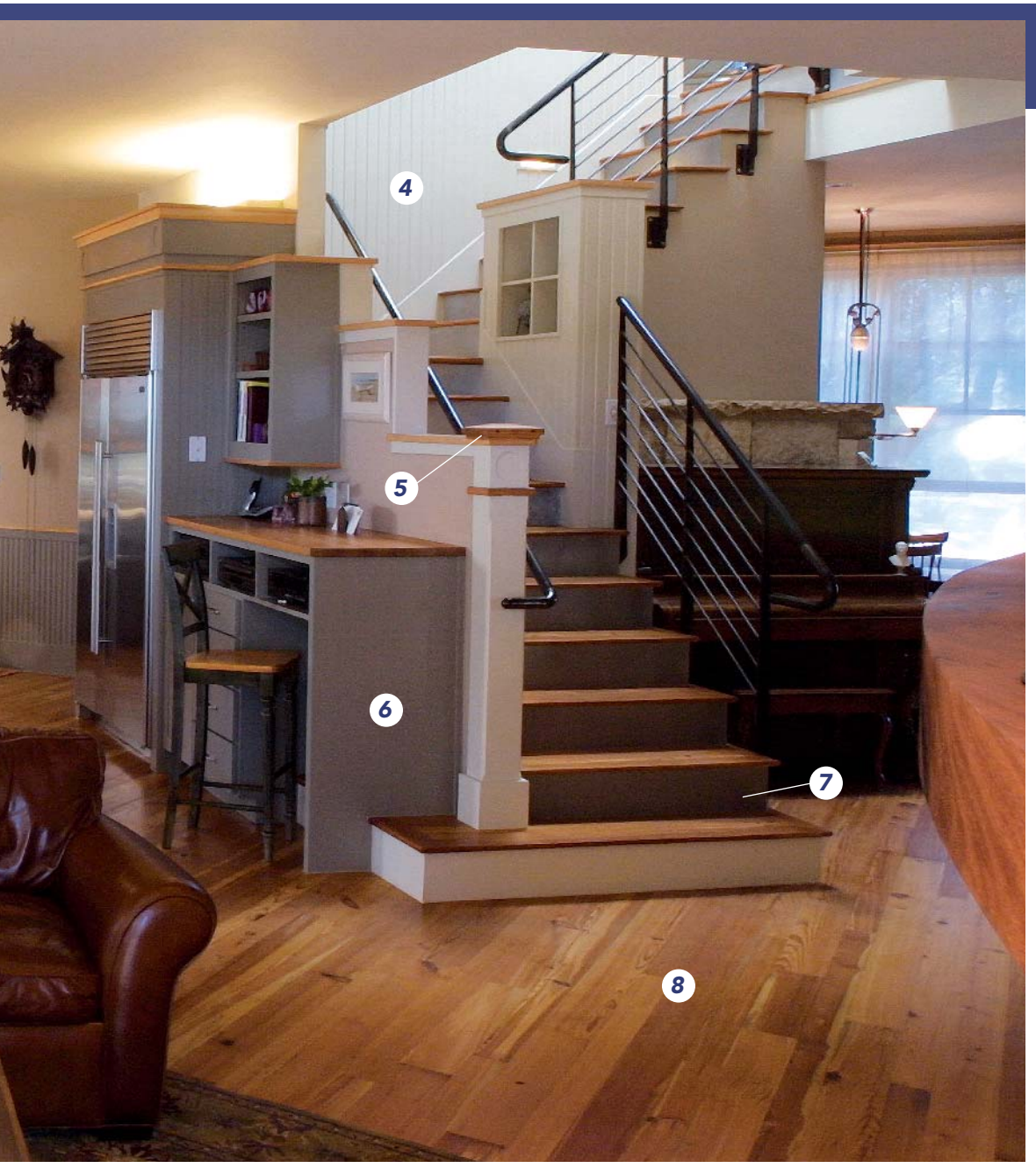
All interior finishes were low-VOC (volatile organic compounds, the stuff that makes finishes toxic). Stained-concrete floors or recycled heart-pine floors through most of the house contribute to a low-maintenance, allergy-free, and dust-mite-free interior. The carpet in the master bedroom is undyed natural wool. We avoided laying carpet over concrete to minimize mildew-causing condensation that can form under the carpet.

Proof of our efforts has come from an unexpected source. Before moving into this house, our son, Zach, had asthma symptoms that we suspected were environmentally induced. After eight months of living in this home, those symptoms have disappeared.

Systems make the house more efficient

Besides the construction of the house itself, the systems that allow the house to function efficiently were chosen carefully, specified and installed to maximize comfort and indoor-air quality while minimizing energy use. Many of them involve information too high tech for the scope of this article, but here are a few features.

The stairway in the center of the house acts as a thermal siphon, sucking cool air from the lower levels and pushing warm air outside. We installed a large whole-house fan that sits above the stair tower. On those wonderful spring and fall evenings, the fan mechanically draws in cool nighttime air, charging the home's interior with cool temperatures. But unlike most attic fans, this fan has a sealed cover box that



GREEN-BUILDING PRODUCTS MENTIONED IN THE ARTICLE

Synthetic trim: Advanced Environmental Recycling Technologies, 800-951-5117, www.moistureshield.com

Galvalume (metal soffits and siding): BIEC International, 360-750-5791, www.galvalume.com

BarrierPanel (borate-treated sheathing): Louisiana-Pacific, 800-648-6893, www.lpcorp.com

Sprayed high-density foam (wall insulation): Demilec, 450-437-0123, www.demilec.com

Borate-laced cellulose (wall insulation): International Cellulose, 800-444-1252, www.spray-on.com

Sealed-combustion water heater: Polaris American Water Heater, 800-937-1037, www.americanwaterheater.com

Swimming-pool interface and cooling tower: Allied Mechanical, 512-443-3938

prevents heat and humidity leakage when not in use. In cooler months, a heat-recovery fan system pulls warm air from the upper parts of the home down to the main level, providing additional comfort and energy savings. Heat is provided with a 94% efficient sealed-combustion water heater feeding hydronic coils in the air handlers.

Keeping the house warm is the least of our worries in Texas. To help fend off the heat, though, we linked the air-conditioning system to the swimming pool. Waste heat from the A/C provides free pool heat during the fall and spring. Pools are traditionally one of the biggest ticket items for energy usage, and using the pool as a heat sink for the cooling system cuts energy usage significantly.

A cooling tower (a miniature version of what is commonly found on commercial buildings) employs evaporative cooling to improve A/C cooling efficiency. All indoor air is purified with high-intensity ultraviolet lamps as well as pleated filters at each air handler.

We also gave a lot of thought to the light inside the house. The central stair shaft brings natural daylight into the core of the house, reducing reliance on electric lighting and enhancing the ambience. A northeast-facing skylight above the back porch brings reflected light, but not solar heat, into the family room and screened porch. Outside, the light-colored Galvalume soffits reflect glare-free daylight into the home. Much of the soft artificial lighting comes from high-resolution fluorescent fixtures that save electricity and help to keep the home cool and comfortable. After monitoring the house carefully for the first year, we determined that our utility bills are less than one-third those of a typical new Austin home of this size. □

Peter Pfeiffer is a building-science consultant and a principal of Barley and Pfeiffer Architects (www.barleypfeiffer.com) in Austin, Texas. Photos by Roe A. Osborn, except where noted.

Photo this page (right): Connie Moberley