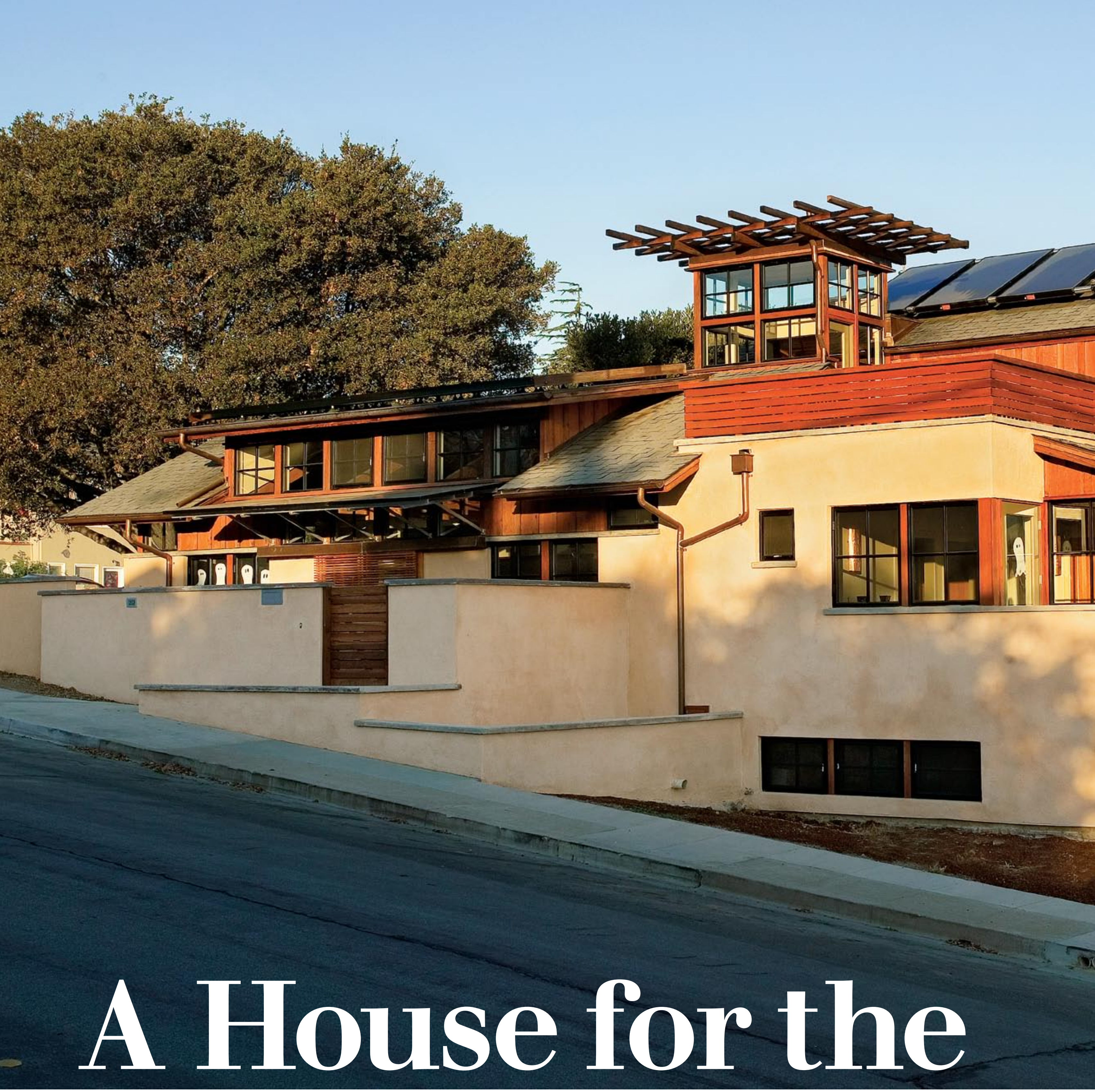


# A House for the End of Cheap Oil

BY DAVID ARKIN

It is no coincidence that this house is a mere two blocks from El Camino Real. In the days of the Spanish missions, it was the only road up and down northern California. Today, it is still an important artery, with ready access to the freeway and the commuter rail. This proximity to public transportation, along with unpolluted air and first-rate public schools, was a primary consideration when Gladwyn d'Souza and Martina de la Torre began looking for a site for a new house. Creating a more healthful home was the prime motivator, as their daughter Gabriella had developed asthma in their last house near smog-prone Silicon Valley.

Gladwyn and I met on a tour of a remodel my partner Anni Tilt and I had designed (see "Daylighting Strategies for a Ranch-Style Home," *FHB* #137). He and Martina liked many of that project's green features and wanted us to design a house that used both passive and active energy strategies. It would be built on a small urban lot they had purchased in Belmont, Calif.

### Outdoor living on a busy street

In architecture, there's an adage tinged with irony: "Your limitations are your friends." Between the traffic on two sides of the sloping corner lot, two large oak trees, a city-mandated two-car garage, and a 4987-sq.-ft. lot, we were not short on limitations. Fitting even a relatively small home within the setbacks required a variance and some juggling.

Our first move was to minimize street noise. An entry court with masonry walls, finished with stucco to match the house, provides a comfortable, private buffer on the sunny but noisy side of the house.

We wanted to reduce square footage wherever possible. Multiple uses are made of circulation spaces; for example, the stairwell is also a library and an office (floor plans, p. 86). The laundry, the connection to the children's bedrooms, and their play and

Healthful, light-filled, and energy-efficient, this home reaches back to its California past and toward a sustainable future

***Capture the sun in many, many ways.*** *Photovoltaic and hot-water panels face southeast, converting solar energy into electricity and heat. A trellis-topped cupola admits light into the center of the house. On the street side, the masonry walls of the entry courtyard muffle the sounds of passing vehicles. Sliding screens add privacy while allowing ventilation. Photo left taken at A on floor plan; inset taken at B.*

Photos this page: Edward Caldwell

## A multitasking floor plan

The key to getting the most usable space from every square foot is to make the rooms no larger than they need to be and to make some do double duty. In this plan, the hallway that leads to the kids' rooms is expanded slightly to be both a laundry and a study; the upper-floor stair landing is an office/library.

### SPECS

**Bedrooms:** 4

**Bathrooms:** 3

**Size:** 1823 sq. ft., plus 670-sq.-ft. heated garage

**Cost:** $300 per sq. ft.

**Completed:** 2004

**Location:** Belmont, Calif.

**Designer:** Arkin Tilt Architects

**Builder:** Ebcon Development; Ray Baldhosky, supervisor


*Photos taken at lettered positions.*

***Multipurpose passage.*** *A wide hallway outside the kids' bedrooms is both a laundry area and a study space. The wall to the right contains a pair of pop-up desks that are supported by steel brackets when in use and appear as paneling when retracted. Photo taken at C on floor plan.*

homework areas are all one space, and the short hall to the master bedroom is also a dressing/makeup area. The kitchen, dining, and living areas are a single volume. A high ceiling and southeast-facing clerestory windows give this room a sense of spaciousness. Long views through the house, the entry court, and the oak trees also help the room to live large.

The guest bedroom has easy and unobstructed access for aging grandparents, allowing both entry and contiguous living on the main level of the house. The bathroom in this suite, built with universal-design principles in mind, doubles as a powder room (for more on universal design, see "A Home for the Next 50 Years," *FHB* #163).

### This house heats and cools itself, and generates its own electricity

Unlike cars, buildings are fixed in the landscape and can be tuned to optimal performance based on their latitude, microclimate, and other circumstances. Where feasible, we like to point houses toward the morning sun, especially in moderate climates prone to late-afternoon overheating.

One of the paradoxes of a well-designed passive-solar home is that when the sun is shining, there is little need for additional heat; when the weather is cloudy and cold for a week or two, however, solar energy is most needed yet hardest to come by.

This home incorporates a combined passive/active system pioneered by Bob Ramlow of Artha Renewable Energy in Amherst, Wis. Thermal-energy storage is accomplished by banking the sun's heat in 2-ft.-deep sand beds underneath the floor slabs in the garage, playroom/laundry, and living-room areas. The solar fluid, a 50-50 mixture of glycol and water, is heated most days between 130°F and 180°F. It first circulates through a heat exchanger that heats domestic hot water. Then the fluid flows through tubing in the sand beds, where heat is stored and slowly

Floor-plan drawings: Paul Perreault

***Long views and high ceilings.*** *Sightlines that take the eye beyond the bay window and to the backyard deck make a modestly scaled room feel generous. A high ceiling held aloft by timber-frame trusses daylit by dormer windows doesn't hurt, either. Photo left taken at D on floor plan; inset taken at E.*

rises into the home. The stored heat is typically enough to obviate any need for additional heating for up to three weeks of overcast skies.

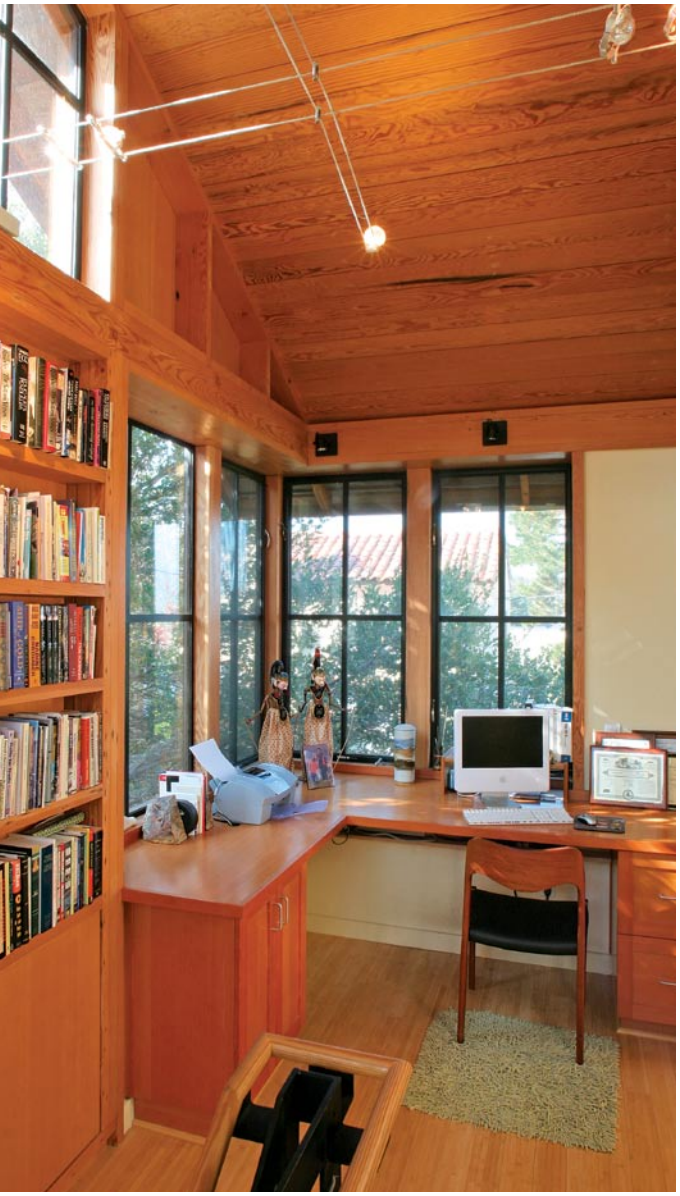
The flow of heated fluid to the sand beds is turned off in late spring and diverted to a shunt loop beneath the entry terrace. The sand beds cool down and, due to their high thermal mass, keep the home comfortable through the summer. At the same time, the heated terrace extends outdoor living into cool Bay Area evenings.

A photovoltaic (PV) array on the roof of the living room provides the home's electrical needs. The system doesn't store electricity in any batteries, but instead feeds it into the grid until called on for use in the house. In areas with reliable utility grids, this setup generally is recognized as more efficient than battery storage. If the grid goes down, though, the house is also without power, despite the PV panels.

For information on the economics of these systems, see

The tall ceiling and southeast-facing clerestory windows give this room a sense of spaciousness.

Inset photo: Edward Caldwell



***Enlarge a landing, make an office.*** *Widening the hallway that leads to the master bedroom and adding a quartet of windows created a treetop corner office out of what otherwise would have been seldom-used space. Photo taken at F on floor plan.*

"The costs of going green" on the facing page.

### Green, salvaged, and recycled materials abound in this house

While energy use is a home's primary impact on the planet, building materials are another consideration. We try to pay attention to the origin of materials, their environmental and health effects, and whether they are renewable or recyclable. Of course, the best option is to eliminate a material altogether, or at least to reduce it, which gets back to the ideal of building as little as possible.

Admittedly, we are quite fond of wood. It is renewable, recyclable, and increasingly available from sustainable forests. We opted for FSC-certified wood (Forestry Stewardship Council; www.fscus.org) for the bulk of the framing lumber. This added about $2,500 to the project, less than one-third of 1% of the total.

Plenty of salvaged wood also can be found in this house. The fir ceiling trusses were once warehouse beams, and the ceiling decking came from vinegar barrels procured from Recycled Lumberworks of Ukiah, Calif. (www.oldwoodguy.com).

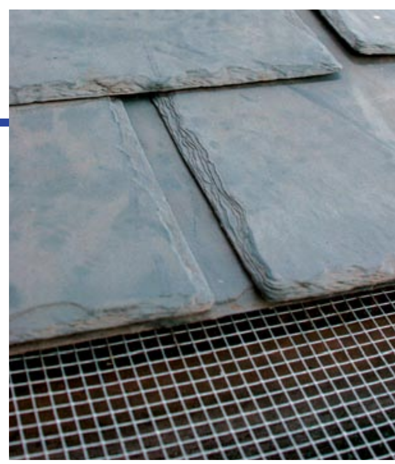
Most of the studs in the bookshelf walls had a previous life as floor joists. They came from the same local supplier that also provided the stair treads, which are milled from "urban forestry," or trees cut in people's backyards.

A favorite detail of ours is the soffit sheathing. It's old redwood siding reclaimed from Bay Area houses torn down to make way for new ones. To our delight, Gladwyn and Martina agreed to leave this wood as is, revealing its past life in a subtle yet telling way.

Many of the doors and windows also were found at local salvage yards, including the bifold garage doors that once hung in a Berkeley elementary school. Salvaged interior windows are a great way of sharing daylight and space.

## RECYCLED MATERIALS

SALVAGED REDWOOD siding boards add character and pattern to the roof as exposed eaves and soffits.



MADE FROM RECYCLED TIRES and industrial plastics, these rubber shingles are dead ringers for slates.

BUSTED-UP GLASS BOTTLES find new life as the aggregate in this concrete counter.

***Daylight goes deep.*** *Sunlight from the cupola floods through the frosted-glass flooring of the upper landing. The open risers of the stairs foster ventilation and connection between floors. Photo left taken at G on floor plan; inset taken at H.*

Flooring on the upper levels of the house is laminated bamboo, except on the top landing. The floor there features thick frosted-glass panels that let light into the spaces below. The panels are custom-made of 1⅛-in.-thick laminated glass; the top surface is frosted for slip resistance and visual privacy. In the kitchen, the peninsula top is a terrazzolike material made of recycled glass bottles (www.counterproduction.com)

On the roof, EcoStar rubber slates are made of 100% recycled industrial plastic and synthetic rubber (www.ecostarinc.com). They are one-fourth the weight of traditional slates and half the cost. Plus, they won't break. Granted, at $2.90 per sq. ft., a rubber roof costs more than twice as much as a typical asphalt-shingle roof ($1.25 per sq. ft.). With a life span of 40 to 50 years, though, the rubber slates likely will come out ahead in the end. We expect the owners of this house to do so as well. □

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## The costs of going green

Gladwyn and Martina wanted a radiant-heating system for comfort and health reasons: Forced-air heaters can spread a lot of contaminants harmful to their daughter, who has asthma. A typical gas-fired radiant floor costs about $15,000. Operating this system, along with a water heater and a stove, would cost $100 a month at current rates.

The solar radiant-heating system we installed cost $26,920, including labor and materials for sand beds, tubing, solar panels, controllers, sensors, and piping. Natural gas powers backup water and space heating, cooking, and a decorative fireplace. In the system's first year of operation, gas bills averaged $25 a month. With $75 in monthly savings, the simple payback time on the additional $12,000 spent to install this system is about 13 years. This estimate assumes no rise in the price of natural gas, which is quite likely to go up over that period of time. (It is also worth noting that the thermal-mass cooling value of the system's sand beds means no air conditioning is necessary.)

The 2.5kw photovoltaic (PV) system cost $29,344. The rebate from the California Energy Commission's buy-down program was $11,140, for a net cost of $18,204. In the first year of operation, the PV system generated as much electricity as the house used, resulting in bills that totaled $0.00. Given the typical monthly electric bill for a house of this size (1823 sq. ft.) is about $100 at current rates ($0.1544/kwh), the simple payback time is about 15 years. As electricity costs go up, the payback period shortens; at payback, future electricity is essentially free. And there is great satisfaction in watching your electric meter run backward.