

Living Lightly on the Whole Lot



Multiple levels enrich the house. A backyard dining deck off the kitchen takes advantage of Berkeley's seasonable weather. The deck off the upstairs master bedroom doubles as a roof over the home office. Photo taken at A on floor plan.

In a dense urban neighborhood, this remodeled bungalow goes green with recycled materials, solar energy, gray water, and room for the owners' day jobs

BY GEOFFREY HOLTON

In 1993, my wife, Margaret, and I bought a house in Berkeley, Calif., that had been nearly gutted by its previous owner, an architect with imagination and a penchant for unfinished projects. Margaret and I are both hands-on people, so the clean slate was one of the house's best features.

We started with a modest budget and a commitment to as much reuse and recycling as we could muster. We took on common-sense conservation items first: insulation, upgraded windows, weatherstripping. We also spent a lot of time searching local salvage yards for cool stuff that looked like it would fit into our emerging sense of what the house might become. I collected chunks of old bowling alley and reclaimed Douglas-fir beams, while Margaret worked tirelessly, stripping the beautiful old beadboard we pulled out of the house's tumbledown back porch. All these materials and many others eventually found their way into the cabinets, finishes, and structure of the house.

Realizing the house's potential, both inside and out

When we first acquired the house, the twin urgencies of rising energy costs and climate change were not so clearly upon us. As they

LIVING AND WORKING WITH EVERY SQUARE FOOT



A **woodshop** and a **pottery studio** share space in the northwest corner of the lot and make for a very short walk to work. A sliding barn door extends the shop workspace into the backyard.

Architect Geoffrey Holton and his wife, potter Margaret Norman, transformed their drafty bungalow and its 37-ft. by 130-ft. lot into a compound that has room for living, working, growing food, and generating sufficient electricity to run the house, workshop, and studio. The south-facing portion of the second-floor roof is maximized to ensure plenty of solar exposure for the photovoltaic and water-heating collectors.

The backyard is home to a **small vegetable garden**, an herb garden, a raspberry patch, and a couple of small fruit trees, making for fewer trips to the farmer's market.

A lower-level deck bridges the gap between the kitchen and the patio grill, creating the perfect space for **outdoor dining**.



Gray water from the house flows to the backyard, where it's collected in a tank made from a defunct hot tub and is used to water the garden.

The homeowners' love of cycling is reflected in a steel-wheel motif on the deck and on stair railings throughout the house. A **small garage** at the back of the lot provides ample bike storage when they're not pedaling around town.

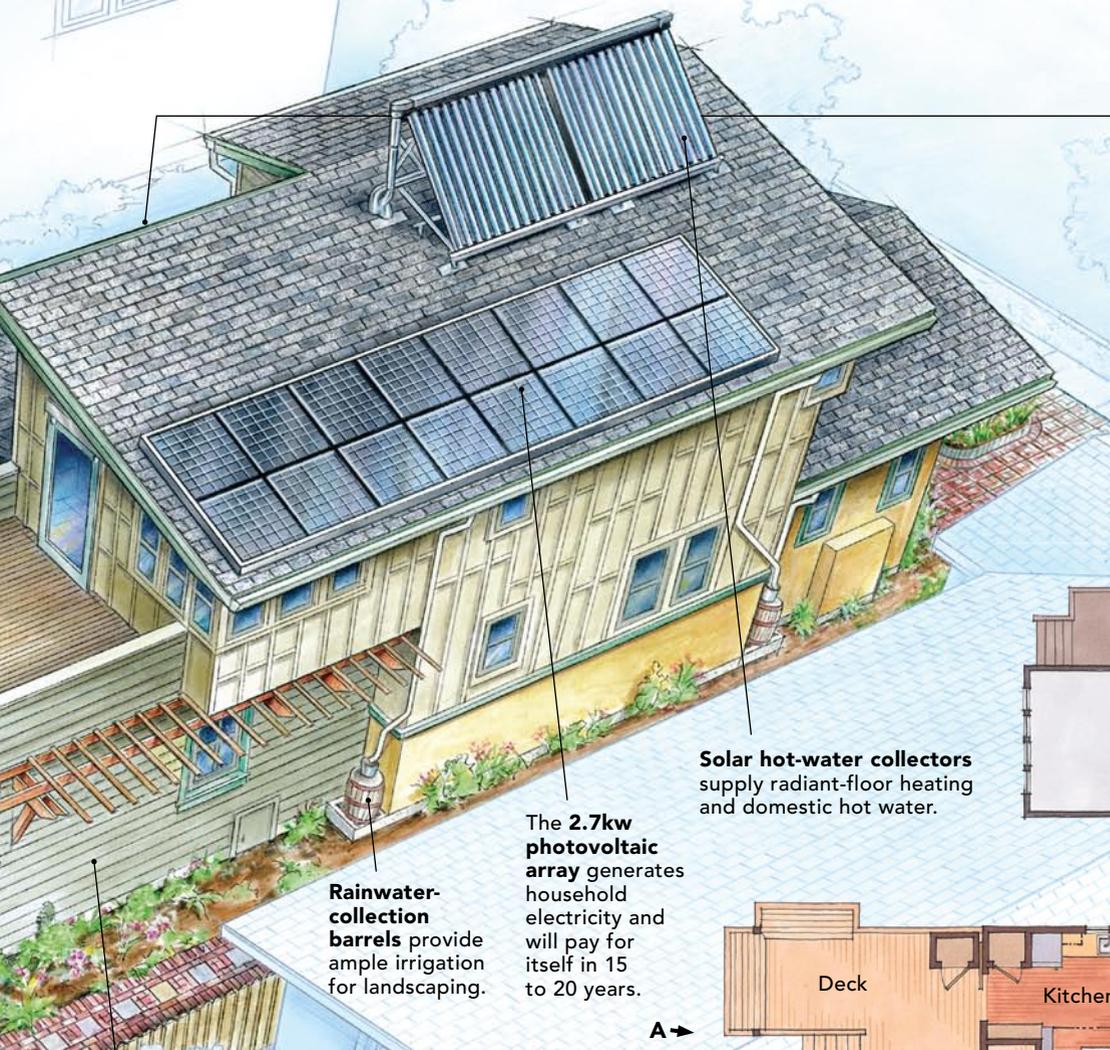


Gray-water dos and don'ts

Living with a gray-water system requires you to be aware of what's OK, and what's not OK, to put down the drain.

Conventional gray-water wisdom is that all soaps and shampoos are OK because they will be highly diluted.

The rule is "Keep an eye on the plants, and if they don't seem to like it, make some changes." We use old-fashioned soaps like Kirk's Castile soap for hand and body washing. For clothes washing, we use biodegrad-



On the north wall, **modular tanks** linked together store rainwater piped in by way of the roof's gutters and downspouts.

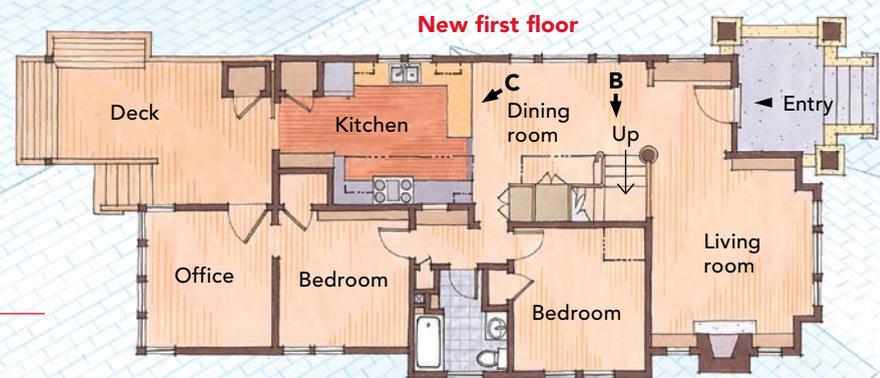
Rainwater-collection barrels provide ample irrigation for landscaping.

The **2.7kw photovoltaic array** generates household electricity and will pay for itself in 15 to 20 years.

Solar hot-water collectors supply radiant-floor heating and domestic hot water.



Original first floor



New first floor



New second floor

Photos taken at lettered positions.

SPECS

- Bedrooms:** 3
- Bathrooms:** 2
- Size:** original, 1100 sq. ft.; 1600 sq. ft. with addition
- Cost:** \$275 per sq. ft. for addition, PV, solar hot water, remodel
- Completed:** 2007
- Location:** Berkeley, Calif.
- Architect:** Geoffrey Holton
- Builder:** Jamie Carlen & Co.

A **home office** on the first floor shrinks the homeowners' carbon footprint by reducing their reliance on cars and commuting.

able detergents such as Ecover, Bio Pac, or Oasis. If you can't find these products, check the ingredients list on other brands, and be careful not to use soaps that contain salts of any kind. In general, liquid soaps and detergents

contain fewer salts than powdered varieties. Also steer clear of chlorine bleach, boron, borax, or bicarbonate of soda. Avoid drain cleaners as well. Our system has a valve that can divert the gray-water flow

back to the city's sewer line. If we need to use a drain cleaner or bleach, we engage the diverter and keep it there for a while to rinse out residue. Don't grow root vegetables, such as beets or carrots, with a gray-water system. Instead,

stick with aboveground fare such as tomatoes, beans, and berries. For more on gray-water systems, study the book *Create an Oasis with Grey-water* by Art Ludwig (available at www.oasisdesign.net).

RESCUED MATERIALS

ADD STYLE, UTILITY, AND A TOUCH OF WHIMSY

Stair treads made from **old gymnasium bleachers** lead to the master suite. Above them, a railing composed of **bike wheels** rolls on up the stairs. The metal risers are industrial scrap. Photo taken at B on floor plan.



The master bath has a concrete-vanity counter with aggregate made from **obsolete porcelain toilets**, which are notoriously hard to recycle.

In the kitchen (photo facing page; taken at C on floor plan), **recycled beadboard from the back porch** finds new life as cabinets. The wall opening below the skylight lets daylight into the center hall.





emerged, our thinking about how we could minimize our reliance on the resources that we had always taken for granted began to evolve. As an architect who preaches the virtues of sustainable building, I think it's important for our house to walk the talk that my clients hear from me on a regular basis. We had to go way past weather-stripping and better windows here.

We decided to take advantage of the resources available to us, such as sunshine for electricity, gardens for growing food, and rainwater for irrigation, and to lessen our reliance on cars by making room for our day jobs at home. Our big project in the late '90s was a small workshop for me and a studio where Margaret could pursue her career as a potter (top photo, p. 64). Squeezed into a single small building, the two spaces share daylight through a translucent wall and take advantage of the landscape with a large barn door that opens onto a patio workspace. The patio has room for an outdoor grill just a few steps down from an outdoor dining room that we added off the kitchen (photo p. 63).

Our son was born in 2000, which gave us the impetus to build a second-story master bedroom and bath addition in 2006. Its roof provided the real estate necessary for a solar water-heating system and a 2.7kw photovoltaic (PV) array.

The PV system supplies all our electrical power, averaged out on an annual basis, including Margaret's electric-kiln firings (8 to 10 a year). The system cost about \$16,000 after rebates and tax credits. Given our energy use prior to building the addition, and assuming a 5% annual increase in energy costs, we're looking at a 15- to 20-year payback period. Of course, if we get a hoped-for plug-in hybrid in the next few years, it will be akin to having free fuel for as long as we own the car. This will accelerate payback. We've slightly oversized the PV system to make that possible.

We use the solar-thermal system for domestic hot water (DHW) and for radiant-floor space heating. At about \$26,000 installed, it was significantly more expensive than just a straight solar-thermal DHW system (which, in my experience, is generally in the \$7,000 to \$12,000 range). But our price included all the radiant tubing, aluminum heat-distribution plates and insulation, a 100-gal. storage tank, and a boiler—basically, a whole new heating system for the house.

Stretch the water supply

In California, water use and groundwater replenishment take on more importance every day. We've approached that problem in two ways. First, we installed a row of modular rainwater-holding tanks along the north wall of the house (www.rainwaterhog.com; photo p. 65) and a couple of old-fashioned rain barrels on the south side. The gutter downspouts run through a leaf catcher/filter and feed into the tanks and barrels. At current capacity, we can bank about 500 gal. of rainwater for irrigation.

The water-saving feature that we're most excited about, though, is our gray-water garden (sidebar pp. 64-65). This

very simple technology takes advantage of the ability of plant-root systems and naturally occurring soil bacteria to filter and clean water. Here's how it works:

The clothes washer is connected to a drain line that leads to a gravel-filled collection tank in the backyard. (The toilets, the kitchen sink, and the dishwasher drain to the city sewer line.) Water-loving plants grow in the gravel, largely cleansing the gray water. The outlet from this "constructed wetland" (drawing pp. 64-65) leads to a perforated pipe buried in mulch, 8 in. belowground, beneath



a native-plant garden and two fruit trees. Two similar perforated pipes run from bathroom sinks and showers to a lushly productive raspberry patch, and to a second native-plant garden in the front yard. Both pipes are also buried safely belowground, at least 8 in., where public-health officials like them to be.

Seeing the garden thrive on water that would otherwise have gone down the drain and into San Francisco Bay is a delight. And keeping the water here is a small step toward making our city and the natural systems that support it healthier and more drought resilient. □

Architect Geoffrey Holton is based in Oakland, Calif. (www.ghadesign.net). Photos by Charles Miller.