Downsizing for Comfort

An affordable in-town house uses sustainable materials, water conservation, and solar energy to improve quality of life

BY CHRISTOPHER STAFFORD

I've always been interested in promoting low-impact, environmentally conscious building in the United States, but my work as a building consultant overseas wasn't helping to change the situation at home. I wanted to demonstrate that you don't have to make serious changes to your lifestyle to be a responsible citizen.

At about the same time, my wife, Sakura, and I began assessing our own housing needs. We lived in a large house (about 3400 sq. ft.) outside Port Townsend, Wash.; between the two of us, we often made three trips daily back and forth to town, which took its toll in time and fuel. Also, we are getting older, and we wanted to be closer to activities and services. We saw the potential of an in-town lot that had been on the market for a while and snapped it up.

Downsizing can be an economical path to fewer headaches

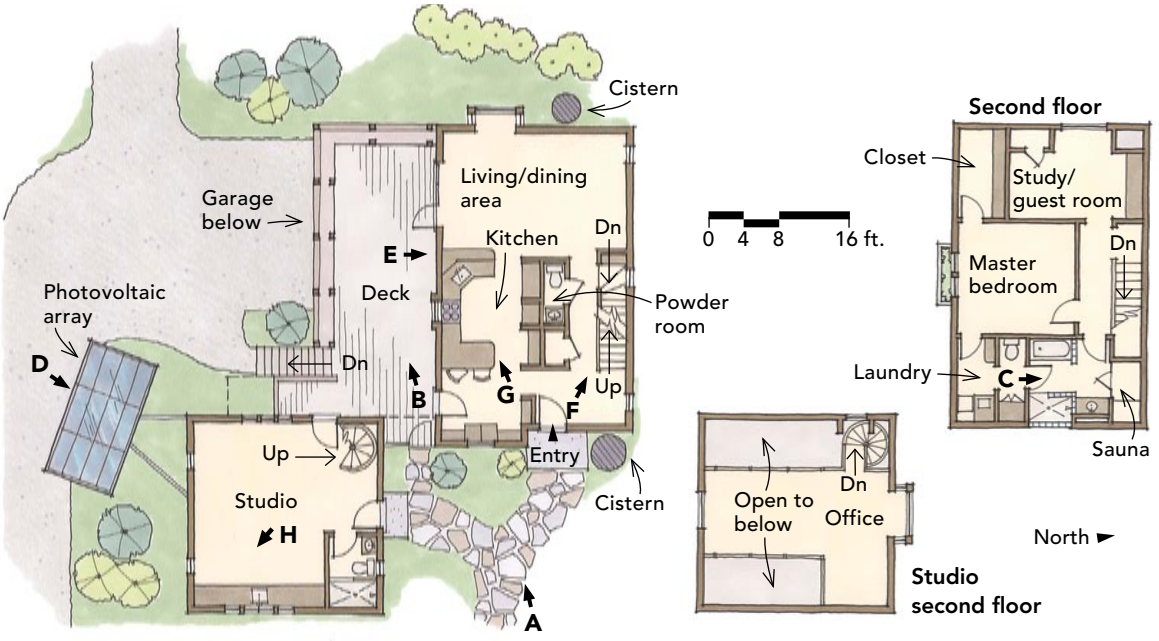
Murphy must have a law that says if you build the space, you will buy more stuff to fill it up. Of course, talk is cheap, and it's easy to tell people to consume less. Actually doing so isn't that easy. We had to think of downsizing this way: What's the smallest space we can live in and still be comfortable? After all, couples sail the world in boats with interior spaces that could fit inside many suburban kitchens. And Manhattan apartment dwellers live comfortably in small efficiencies that have the same square footage as some suburban living rooms.

We whittled the new plan down to 1550 sq. ft. and imagined what it would be like to live in a house of that size. Would it be large enough for our needs? With a master suite and a guest bedroom upstairs, as well as a kitchen and a living/dining area down, we finally decided that 1550 sq. ft. would be plenty.

After living here for the past two years, we've discovered that our home's smaller size fosters more intimacy and accessibility. We don't miss a thing, not even the extra space that we don't have to clean. Storage is not an issue, either, because we jettisoned most things we weren't using. The one-car basement garage holds the remnants resulting from our indecision.

An adjacent 700-sq.-ft. building houses studio/office space, which helps to accommodate the occasional party or visiting family. It has

Drawings: Martha Garstang Hill



Photos taken at lettered positions.

Small, energy-efficient, and energy-productive. Combining responsible building and comfortable design, the house features photovoltaics and rain-collecting cisterns. Photo far left taken at A on floor plan.

Living alfresco. A deck outside the kitchen expands the interior on sunny days and connects house and studio. A bench and trellis at the perimeter further define and personalize the space. Center photo taken at B on floor plan.

Several paths to daylight. The upstairs-bathroom lighting scheme is augmented by one window in the shower area and a reflective skylight tube in the ceiling. A glass-block shower wall lends a little privacy without sacrificing any natural light. Photo above taken at C on floor plan.

JUST THE ESSENTIALS

It's no secret that a smaller house uses fewer materials and less energy. To economize, I pared down the plan to the basic living spaces: efficient kitchen, combined living and dining area, master suite, and guest bedroom. The living room and the kitchen face south and open onto the deck, which leads to an adjacent studio/office.

SPECS

Bedrooms: 2

Bathrooms: 2½

Size: 1550 sq. ft., plus 700-sq.-ft. studio

Cost: $123 per sq. ft., not including photovoltaic system and deck

Completed: 2004

Location: Port Townsend, Wash.

Architect: Christopher Stafford Architects Inc.

a three-quarter bath and easily can become an accessory dwelling unit or an in-law apartment if needed. Oriented-strand-board (OSB) floors, simple details, and a heating/plumbing system shared with the main house kept down the cost.

The house and the studio are connected by a deck, which also makes our home seem larger. Surrounded by benches, planters, and a trellis, the south-facing deck has the spatial qualities of a room that's moved outdoors—and it's a great spot for Sunday breakfast.

Materials should have a low environmental impact

When I started to think about the details of the house, certain materials such as the new, safer ACQ (azole copper quaternary) pressure-treated lumber and FSC-certified (Forest Stewardship Council) decking were a given. I also chose reclaimed lumber for the hardwood floors on the first level, fiber-cement siding because of its long life span, and a metal roof made of 26% recycled material that is itself recyclable. To reduce the potential for products that off-gas, I used natural-wool carpets (instead of synthetics) upstairs and low-VOC paint throughout the interior. The kitchen cabinets (www.ikea.com) also are made of nontoxic materials.

A less-obvious material choice was fly ash, a waste product of coal-fired generators, which we used as a replacement for half of the cement in all the concrete footings and foundations. Often touted as a green material, regular cement actually creates its own weight in CO_2 during the quarrying and manufacturing process. By using fly ash to

Payback is as much altruistic as financial

Generating your own energy is a highly attractive idea these days. At first glance, it's a win-win situation for both the environment and your wallet—or it will be someday.

Our photovoltaic system cost $14,300 in 2003 (prices have risen since then). Seeing a financial return on our investment will take a long time, partially because of our location. Our electricity costs are a rather low 9¢ per kwh. Also, the Pacific Northwest climate doesn't lend itself to bright, sunny days all year long. If your electricity costs are higher, your payback time will be shorter; annual solar gain and local rebates can add to your return.

Nevertheless, over the past 12 months, our grid-tied photovoltaic system generated 2700 kwh, equal to 35% of the electricity that our house and studio/office used. If today's electricity rates are used to calculate a payback time, then factoring in utility and state incentives, we will recoup our investment in 25 years. The equipment has only a 20-year rated life expectancy. However, a safe assumption is that energy costs will increase in the near future, so we still expect to see a return on our investment.

The solar hot-water system's payback is similar. It cost $10,900, and the manufacturer, Thermomax Industries, rates the Solamax collectors with a 10-year life expectancy. Although our estimated payback is 15 years, steadily rising fuel prices will shorten our payback time.

No, we're not going to get rich by generating energy, but we are making a difference, however incremental, and that's what counts. As more people embrace this technology, the law of supply and demand will cause prices to drop—and the benefits to all will grow.

If you'd like to estimate your potential gains and costs with solar energy, check out these Web sites: PVWATTS (http://rredc.nrel.gov/solar/calculators/PVWATTS/) and Find Solar (www.findsolar.com). The sites feature easy-to-use solar estimators as well as links to solar-energy installers and engineers in your area.

Top photo taken at D on floor plan; bottom photo taken at E.

Green can be stylish. A corrugated polycarbonate panel over an aluminum railing gives the entry hall a modest, modern look. Ceiling fixtures use dimmable halogen lamps. Photo taken at F on floor plan.

Bright and frugal. Big enough to handle a large dinner party, the kitchen gets lots of daylight from neighboring spaces. Compact-fluorescent fixtures contribute to the home's low energy usage. Photo taken at G on floor plan.

Save money where you make money. The two-story studio/office was kept to its barest essentials to economize. The flooring is plain OSB, the floor joists are exposed, and the trim is minimal. Photo taken at H on floor plan.

replace 50% of the cement in the foundation's concrete, the embodied CO_2 released to the atmosphere is reduced by half.

We've also been able to cut our water usage with low-flow fixtures and efficient appliances. In 2006, our water consumption was 68 gal. per person per day (pppd), a rate that's 32% below the national average and local water-department goals of 100 gal. pppd, according to the American Water Works Association. A large factor in reducing our water consumption is two cisterns made from galvanized drainage culverts (one 1000 gal., the other 800 gal.). Both collect rainwater from the house's roof for landscaping needs.

A photovoltaic array helps to keep electricity bills to a minimum

Acting as our own general contractor, we built the house and studio for $123 per sq. ft. The money we saved by building smaller was invested in renewable-energy systems. Purchased from Power Trip Energy Corp., a local solar supplier/installer, a grid-tied Sharp 175w, single-crystal, photovoltaic 12-module tracking array is mounted on an 8-in.-dia. by 12-ft.-tall steel pole with a Xantrex inverter (www.xantrex.com). The tracking array generates approximately 28% more energy than if the same array were stationary—energy that's gained predominantly during long summer days.

The combination of a small house, compact-fluorescent bulbs, energy-efficient appliances, polyicynene insulation, and a heat-recovery system reduces overall energy consumption by 23%, compared with similar houses in our neighborhood (according to my research). When purchasing our appliances, we looked only at Energy Star-rated models and balanced their initial cost, durability, noise level, and performance to make our decisions. For instance, our Kenmore front-loading washing machine uses 77% less energy and 67% less water than top-loading washers, based on manufacturer data. Its only downside is that the washing cycle takes a little longer.

Solar hot-water system heats the air and the bathwater

Our solar hot-water system consists of three 20-tube collectors from Thermomax Industries (www.solarthermal.com) and is designed to provide all the hot water for household use and for seven kick-space heaters (five in the house and two in the studio). The heaters, called Toesters (www.turbonicsinc.com), are somewhat noisy and have a slow recovery time. When hot water from the solar collectors in the 120-gal. storage tank hasn't reached 120°F, a downstream on-demand propane boiler (Takagi Mobius T-M1; www.takagi.com) makes up the difference.

For the solar collectors to work, the house needs to be airtight and well-insulated. Nontoxic polyicynene insulation eliminates voids and encapsulates the house with 5½ in. (R-19) of insulation. The small insulated attic is the return-air plenum for the Venmar HEPA 3000 whole-house ventilation system (www.venmar.ca), whose 55%-efficient heat exchanger warms incoming air. Washington State's energy code requires whole-house ventilation systems; our upgraded version adds the heat exchanger and the HEPA filter for heat recovery and improved air quality. □

Christopher Stafford is an architect in Port Townsend, Wash. Photos by Charles Bickford.