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The background of the page is composed of several horizontal bands of different textures. At the top, there are three bands of light purple or lavender color with a vertical wood grain pattern. Below these are two bands of light orange or peach color with a horizontal wood grain pattern. The central part of the page features a dark blue band with a fibrous, paper-like texture, and a light brown band with a horizontal wood grain pattern. The title 'Building GREEN' is overlaid on these central bands. The word 'Building' is in a green, serif font, and 'GREEN' is in a white, serif font with a green outline. Below the title, there is a central orange band with a horizontal wood grain pattern, containing the subtitle and author information. At the bottom, there are two bands of light beige or cream color with a horizontal wood grain pattern.

# Building GREEN

How to be earth-friendly  
— from small changes  
to major construction

BY JIM MOTAVALLI



**G**reen is a bright color, but you can't always see it. If you happened to walk past a construction site on Byfield Lane in Greenwich's storied backcountry anytime in the last few months, what you saw was a 9,000-square-foot luxury home being built. Earthmoving equipment created the usual moonscape, and workers in hard hats negotiated rickety temporary bridges while carrying loads of building materials. The rhythmic music of saws and hammers filled the air.

Unless you're exceptionally sharp-eyed (or Al Gore), you probably missed the large photovoltaic solar array on the south-facing rear of the house, the ducts insulated not with fiberglass but with cotton, the super-efficient natural gas boilers, the oriented strand board (made from scrap lumber) that replaces plantation wood for sheathing, and myriad other environmentally friendly innovations.

The situation is changing rapidly as geothermal systems get better and oil and gas prices rise.

Taken together, the cutting-edge green technology in Steve Evans's new home probably cut its carbon footprint in half and its electricity bills by a third. But Evans, the British-born head of technology at Greenwich-based Tudor Investment Corporation, says saving money wasn't his only goal. He also wanted a healthier house for his family (since indoor air can be two to five times worse than outdoor air) and to set a good example for his neighbors. "I wanted to do the right thing," Evans says, "and I don't do things halfway, so that meant the best and greenest materials available."

Evans is not alone. Despite the economic downturn, there are still many new homes and additions being built in Greenwich, and a growing amount of the new construction is green. According to Greenwich-based architect Richard Granoff, whose firm designed the Evans house, "I'm getting a lot of calls from clients who find out about green building and want to make it part of their own projects."

The best of these projects are green all the way through. On Byfield Lane, that meant not only recycling as much building waste as possible, but also finding new owners for many parts of the 1960s ranch the new house replaces, including patio doors, shutters and gutters.

For different reasons, both photovoltaic (PV) solar electricity and geothermal heating are catching on in Greenwich. PV has always had its adherents, but the economics have been very favorable since 2003, when the state legislature passed a bill that, through fees generated by local utilities, subsidizes as much as 50 percent of purchase and installation costs of new solar projects up to a very large 10 kilowatts. Couple those subsidies, administered by the Connecticut Clean Energy Fund, with a \$2,000 federal tax credit, and you have a solar system that will last at least thirty years but pay for itself in ten to twelve.

"The future looks very bright for solar," says John Rountree, the Westport-based solar architect who designed Evans's grid-connected 5.2-kilowatt SunPower system. Rountree is so



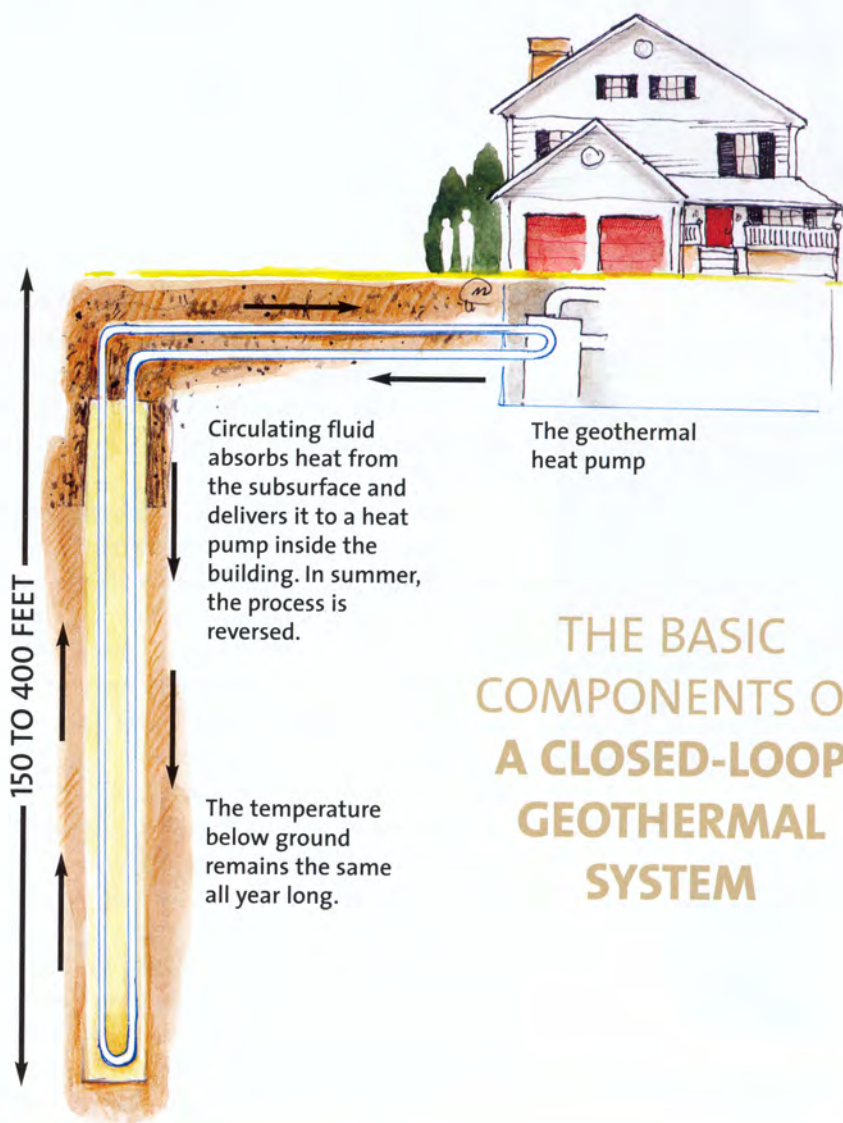
enthusiastic about solar that he built the system on his own home in pre-subsidy 1999. The Byfield Lane installation is interesting because the panels are flush with the roof, which was built with the optimal thirty-degree pitch for solar.

Rountree explains that because Connecticut has a progressive “net metering” law, the Evanses, electric meter spins backward when their panels soak up the sun. Evans pays only for the net difference between his electrical production and his consumption.

Also benefiting from our state’s support of solar is B. Holt Thrasher, another backcountry resident whose day job is advising on the mergers and acquisition of technology companies for Greenwich-based Mooreland Partners.

Holt and Juliet Thrasher are avid hikers and have been major supporters of Audubon Greenwich for many years. Holt Thrasher serves on the National Audubon Board of Directors, and is also on the board of the League of Conservation Voters.

The Thrasher family of four put up their



## THE BASIC COMPONENTS OF A CLOSED-LOOP GEOTHERMAL SYSTEM

Believe it or not, even luxury homes can be eco-friendly, like this one designed by Chuck Hilton on Greenwich's waterfront.







Cutout of double-hung window from Artistic Doors and Windows



Bamboo flooring



LED downlight from Patdo lighting



Formaldehyde-free beadboard



Beams made with recycled materials

five-kilowatt system, with twenty-seven Sharp panels and a Fronius inverter, in 2006. “We’re getting remarkably positive results,” Thrasher says. “Our bills are down 30 to 60 percent, and with utility pricing up 25 percent, we really notice it.”

A remarkable fact about the Thrashers’ home is that when it was built in 1975, the owners not only put solar panels on the roof but also heated the house with a wood stove. Solar and other alternative energy technology enjoyed a brief heyday during the Carter administration, when memories of the Arab oil embargo were still fresh.

New owners removed the solar panels in 1991 and also considerably expanded the house. Thrasher says he had no idea of this history until recently, when a neighbor showed him photographs of the house under construction in 1975, with the solar panels clearly visible.

It’s safe to say Holt and Juliet, who invests in health-care businesses, are committed to being green, and that colors their plans for a new Greenwich home. They have looked at dozens of potential home sites with an eye toward good sun exposure. Their plans include a passive solar design and building at least a third of the house below grade as a natural insulator. A goal is to make the house petroleum-free, meaning no oil or natural gas.

In his current home, Thrasher installed an Energy Detective meter that monitors electric use in the house. He’s using it to identify the biggest energy hogs in his home — the electric dryer, the oven — and plans to replace them with more efficient appliances. It’s all part of the family’s campaign to, as much as possible, live lightly on the earth.

Another Greenwich family is also letting the sunshine in. Their dramatic contemporary house is going through an energy-efficiency makeover that includes both photovoltaics to offset grid electricity, and a solar hot water system. To reduce waste, they’re also installing a monitoring device that will measure the natural light coming in through their large glass walls and dim or brighten electric lights accordingly. A film

installed on the outside of the windows will reduce heat incursion in the summer, and re-insulation of the attic cavity with water-based, spray-in icynene foam will seal off the roof from energy loss.

The traditional furnace is going, too, replaced with a geothermal system that taps into the warmth deep within the earth. The system will require eight to ten wells hundreds of feet deep and laid out in a grid. That far down, water maintains a constant temperature of fifty-five degrees winter and summer. Water is drawn up into the home and put through a heat exchanger that produces warmth to evaporate a refrigerant, which then is drawn through a compressor, which produces home heating. In the summer, the situation is reversed and the fifty-five-degree water condenses refrigerant through the heat exchanger, producing cooling.

Geothermal systems have been more talked about than actually installed, but the situation is changing rapidly as systems get better and oil and gas prices rise. In Iceland, where reservoirs of up to 700-degree water are very close to the surface, 93 percent of the country’s homes are heated with geothermal, which saves the country \$100 million per year in oil imports. Western United States is dotted with such reservoirs, but heat pumps are the best recourse here in the East.

“Geothermal is very efficient,” says Hilton-VanderHorn architect Chuck Hilton, who is installing such systems on two new houses on the town’s waterfront. “It’s a serious investment, but in the end you save a whole lot of money.” Hilton adds that geothermal systems can cope with more than 90 percent of the temperature variation they encounter (a traditional backup is often installed to deal with the coldest days).

Seth Ginsberg is the green building guru at New Canaan’s Hobbs, Incorporated, which is overseeing the backcountry contemporary (Hobbs is also building the Evans house). “We met with the owners last winter to plan how to green their house with an emphasis on energy efficiency,” he says. They went through a checklist provided by LEED for Homes, a voluntary



rating system created by the U.S. Green Building Council that has become an industry standard. LEED stands for Leadership in Energy and Environmental Design and was established for commercial buildings (with ratings from certified to platinum) before its residential application started to take off.

## Size Matters

Heating and cooling will always be easier in smaller houses, but Americans have been moving in the other direction. The average American home grew from 983 square feet in 1950 to 2,349 square feet in 2004, a 140 percent increase. The green building movement embraces downsizing as expressed in bestselling books like Sarah Susanka's *The Not So Big House*. The Thrashers, for one, are planning to downsize, from their current 7,500 square feet to approximately 3,500 square feet, which means that a five-

want a big home, it's incumbent on them to build it as green as possible."

Chuck Hilton says that most of his clients have "a clear idea of what rooms they want and how they want to live. With the addition of wine cellars, exercise rooms, mud rooms and home offices, people's appetite for space is insatiable." But making all that space as green as possible is, he says, an easy conversation with clients. "For the most part, people in Greenwich are very interested in energy efficiency," Hilton says. "They know about global warming, and they know that their heating and electricity bills are going up."

Often, it's the clients themselves who drive the greening process. Architect Jonathan Halper of locally based Halper Owens Associates is building a 7,500-square-foot contemporary shingle-style summer home in Southhampton, Long Island, for a couple whose primary residence is in Greenwich. Among the many energy-efficiency features are solar panels, a geothermal system with radiant heating, highly insulating spray-foam in the walls, argon-filled windows and on-demand water heaters for the bathrooms.

Outdoors there will be a rainwater retention system for recycled irrigation and an organic landscape created with local, noninvasive plants.

"This is my first foray into this," Halper admits. "These are repeat clients who became very interested in environmental issues. They wanted to know if I was game, and I jumped in

eagerly because a lot of it is good common sense and good building practice."

Many of the green additions, including the indigenous plants and the outside trim that doesn't need regular painting, have the advantage of being low-maintenance.

"It's their weekend house, and they didn't want to be chasing down contractors and workmen all the time," Halper says. "We're all very excited about the way it's coming out." »

The state legislature passed a bill that ... subsidizes as much as 50 percent of purchase and installation costs of new solar projects.

kilowatt solar system could probably provide most, if not all, of their electricity.

For the most part, however, Greenwich's new homes, even its greenest ones, are not likely to be reduced to the size of 1950s Capes. "Yes, it's great to build smaller," says builder Barry Katz, whose recently sold showplace green home (soy-based spray-in foam insulation, low-loss insulated windows filled with argon gas, geothermal heating) in Westport is 5,750 square feet. "But if people

Hardy plank siding

Formaldehyde-free plywood



Denim insulation

Azek, a PVC plastic exterior trim

Icynene foam





Solar panel by Rountree Architects

Beach houses usually enjoy full sun, a big plus with photovoltaics. Hilton likes the solar concept — and the state rebates — but has some doubts about its widespread application in Greenwich's backcountry because of shadows cast by mature tree cover, chimneys, dormers and other obstructions. "You also need the right roof

orientation, and it's almost impossible to get that all in place," he says.

Mark Pizzi, Rountree's partner in Westport Solar Consultants, says that part of his job is working with architects on roof design. "Greenwich's roofs are generally pitched, but a hipped roof may not support solar as cleanly as a regular pitched roof," Pizzi says. "We're also helping architects design recessed roofing systems so solar can sit flush. With retrofits, the panels have to be elevated."

Homeowners are very motivated to add solar, Pizzi says, because they're convinced it's the right thing to do. "Our phones are ringing a bit more on the residential end," he says. "With commercial properties, the progress is a little slower because the process is more weighted on economics."

If money does matter, Hilton says smaller projects can be very cost-effective. He offers particular praise for environmentally friendly insulation that provides energy retention well beyond conservative building codes (up to R38 for ceilings and R45 in attics). He also singles out advances in energy-efficient compact fluorescent (CFL) bulbs that address some of the



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# LEARNING THE LINGO

**CLEANER ADHESIVES:** Indoor air can be two to three times worse than exterior air, and one big reason is offgassing from glues and adhesives that are holding down carpets or bonding furniture joints. Environmentally friendly carpeting can be tacked into place without toxic glues, and low-emission furniture and other furnishings are also widely available. Products like Titebond are solvent-free adhesives used to attach trim, paneling, drywall and more.

**COMPOSITES:** PVC (polyvinyl chloride) plastic exterior trim such as Azek (used on the Evans home on Byfield Lane) is a wood replacement material that has the clear advantage of not needing to be painted. Azek is also made from recycled plastic and should last longer than cedar or mahogany.

**FLY ASH:** This by-product of burning coal is commonly discarded, but when it's mixed into cement, it creates a stronger product because the small, glassy beads have a lubricating effect that allows the cement to flow and pump more evenly. Cement with fly ash requires less water and is denser and more durable.

**FOAM INSULATION:** Sprayed between exterior and interior walls, nontoxic insulation, such as Icynene, forms a very tight barrier against air leakage and can improve the quality of indoor air.

**FOREST STEWARDSHIP COUNCIL:** FSC (fscus.org) provides a widely accepted national standard for wood that was harvested in a sustainable manner.

**GEOTHERMAL SYSTEMS:** In New England, geothermal heat pumps use deep wells to tap into the warmer temperatures below the surface of the earth for year-round comfort. High oil and gas prices and available subsidies enable homeowners to pay back their cost in just a few years. In winter, the warmth is drawn into a heat exchanger and then distributed through the home; in summer, heat is drawn out and pumped back into the earth.

**LOW-E GLASS:** Conventional windows can be responsible for 30 percent of a home's heat loss. Low-e glass, introduced in 1979, is a two-pane sandwich, sometimes with inert argon gas inside, that sharply reduces heat loss. Low-e glass both reflects infrared

light experienced as heat and blocks some ultraviolet light that can fade interior fabrics.

**LOW-VOC PAINT:** Volatile organic compounds, present in most conventional paints, are released in gas form from painted surfaces and "may have short- and long-term adverse health effects," says the EPA. New green formulas reduce VOCs to very low or zero levels.

**PHOTOVOLTAICS:** Solar panels, usually roof mounted on a southern exposure, generate electricity that can "spin the meter backwards" on sunny days. A typical Greenwich installation would generate five kilowatts and provide a third to a half of the electricity needs of a luxury home.

**RADIANT FLOOR HEATING:** Heat, from a conventional or alternative-energy source, is supplied directly to the floor. It's more efficient than baseboard or forced-air heat because no energy is lost to ductwork. And because there's no moving air, radiant heat is beneficial for people with allergies.

— J.M.

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quality-of-light issues that made some early adopters skeptical. The new light-emitting diode (LED) arrays offer excellent color rendition and are also extremely efficient, he says, with the equivalent of a 75-watt incandescent using just 12 watts. The bulbs have a high initial price but last 50,000 hours in use.



## Green Inside and Out

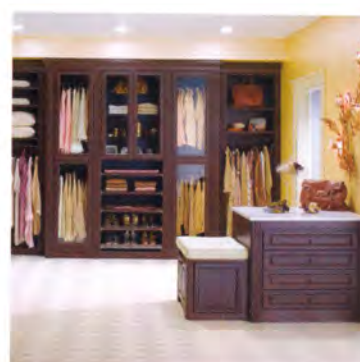
Interior design is also undergoing an environmental makeover. Linda Ruderman-Rosier (whose business is Linda Ruderman Interiors on East Elm Street) is developing a new green wallpaper and fabric line with her husband (Thierry Rosier of Tassels and Trims) using organic cotton and other natural fibers. "We're getting clients who are eco-friendly," she says, "and they're requesting water-based instead of oil-based stains, low-VOC paints and carpets made with natural fibers and vegetable dyes."

It's certainly not necessary to forgo a beautiful interior to go green. Ruderman-Rosier says her work now involves designing around recycling bins in the kitchen, but she adds that CFL light bulbs, natural carpets and eco-safe paint "have no impact on the aesthetics of the project. The trend is to a more traditional look that is also more energy efficient. Disposable interiors will be a thing of the past."

One green client startled her with a request for a "bake-off." No, it has nothing to do with cooking. With the interior fully installed, the home is heated to a minimum of ninety-five degrees and kept there for four days. When the windows and doors are finally opened, the house emits the vaporized chemicals (particularly solvents used in paints and adhesives) that would otherwise emerge over years of living there.

Of course, as Ruderman-Rosier points out, a house built with clean materials inside and out may not need a bake-off, so the owners are still making up their minds. She's worked with recycled paper for wallpaper, kitchen countertops made from recycled glass bottles, and reclaimed floors from Vermont barns that finished their offgassing a long time ago. And that's also an important but usually overlooked benefit to what we might call pre-owned furniture.

"Antiques are our specialty, and they're very green, too," she says.



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