

GREEN HOMES

By Nancy Hiller
Photography by Steve Raymer

Bloomington-area builders are thinking green. With global warming, dwindling resources, and a host of other ecological problems, it's not surprising that builders have turned to "green" energy-efficient construction. Sure, it's the right thing to do, but as homeowners express increasing concern about a sustainable future, it also makes good business sense.

Here we look at four area homes that were either built or remodeled with green principles in mind. The homes vary in size from 1,100 to 2,250 square feet of finished living space. Two are in Bloomington, and two are west of town. The oldest of the houses purposely built on green principles dates back to 1979; two others were completed in 2007. The fourth is a terrific example of how a house that was originally built with little concern for energy efficiency can be transformed into a home that's snug, comfortable, and economical.

Tracy and Joanna Bruce's newly built home is the spitting image of a 1917 kit house on the outside.





A New Old-Fashioned Bungalow

Tracy and Joanna Bruce weren't planning to build green. They wanted an affordable house that would look like an old-fashioned bungalow. The couple already co-owned 30 acres in western Monroe County with Joanna's mother, and they looked forward to using that rural location to teach their daughters about small-scale farming and other ways of living closer to the land.

Before they built their house, the Bruces lived in Unionville and worked in town—Tracy as a sales consultant for a local manufacturer, Joanna as a volunteer coordinator for Bloomington Hospital. While driving back and forth on State Road 45, they noticed the Prairie Green subdivision taking shape. Attracted by the development's architectural style, they attended an open house, where they talked with builder David Lantz. Though not in the market for a lot, Joanna says, "We knew we wanted [our future home] to have the feel of an old house. We also knew we wanted to live there for the rest of our lives and hand it down to our daughters. It was very important to us that the house conform to our vision."

The Bruces didn't have to pinch pennies, but price still played an important part in their planning. "Our concern was that our house be efficient in terms of cost," explains Tracy. That meant looking beyond the cost of building to the estimated expense of actually living in the home long-term. "We wanted the operational cost to be as low as possible. We had no objection to spending an extra \$12,000 to \$15,000 up front, because that's a cost you can pay off [through a mortgage]." Energy expenses, on the other hand, are forever.

During that first conversation, Lantz encouraged Tracy and Joanna to create a sensibly sized home that would be very energy efficient, using the same

Vital Statistics & Additional Features

- Built in 2007
- 2,000 square feet of finished space, with 1,000 square feet unfinished in the basement
- 3 bedrooms, 3-1/2 baths
- 2x6 exterior wall construction
- Energy Star Andersen windows
- A basement slab fitted with tubing for radiant floor heat in case the family should decide to finish that space in the future

Average monthly total electrical cost, including heating and cooling, from January through October: \$110

Builder: Construction Resources Corp. crcbuild.com

Architectural design: Robinson Residential robinsonplans.com



1. The main floor of the Bruces' home has maple floors and views of the surrounding forest. The house was built with a geothermal heating and cooling system; the gas-fueled fireplace is only for occasional use.

2. Tracy and Joanna were so impressed by their foundation's insulated concrete form construction that they kept a leftover scrap to show friends.

3. The kitchen cabinets were made by Kline Cabinetmakers.



basic methods and technologies as he and his partner, Steve Cordell, had used at Prairie Green.

Tracy, Joanna, and their daughters Riley and Ellie spent their first night in the new house on Christmas Eve, 2007. With three bedrooms and about 2,000 square feet of finished space, the house is the spitting image of a 1917 kit home on the outside. But that's where the similarities to early-20th-century construction end. The Bruces' house has a foundation made with insulated concrete forms (ICFs) in which reinforced concrete is sandwiched between layers of polystyrene to produce a structure with thermal and acoustical insulation equivalent to a conventional framed wall approximately 12 inches thick. ICFs are strong enough to withstand high winds—they are often used for multi-story structures in coastal areas where hurricanes are common—as well as resistant to moisture and fire, which can translate to savings on home insurance premiums.

According to builder Cordell, "Insulating and sealing the thermal envelope are the most important things you can do" in terms of building a green home. Above ground, the Bruces' roof and walls are insulated with sprayed-in-place polyurethane foam insulation that thoroughly seals the house's wood framing, windows, and other structural elements against heat loss and wind infiltration.

The third critical component of this home's energy-efficient design is a geothermal heating and cooling system, which uses energy stored in the earth to heat and cool the building's interior. The Bruces' system has 300 lineal feet of trench that's 5 feet deep, a level at which the ground maintains a constant temperature of about 55 degrees. A freeze-resistant glycol solution circulates through several hundred feet of pipe buried in this trench, absorbing the ground's warmth and carrying it to a heat pump for maximum operating efficiency.

Inside the house, the approximately 1,200-square-foot main level feels spacious and light, with solid maple floors and 9-foot ceilings. The kitchen, dining area, and living room are arranged in an open plan with a mudroom and large pantry off the kitchen. The 800-square-foot upper level has three bedrooms and two baths. "We are so in love with this house!" Joanna exclaims with a smile.

Small Is Beautiful

You could be forgiven for thinking that James and Valerie Gray's home is much larger than its actual size. Colorful, open, and flooded with sunlight, the multi-level house feels anything but small. James and Valerie are the principals of Stone Cabin Design, so it comes as no surprise to find that their home is a knockout in terms of style. What's shocking is to learn that the place in fact occupies just 1,100 square feet.

In 1976, Valerie and James bought a piece of land 14 miles west of Bloomington, thinking it would make the perfect retreat from their life in Dekalb, Illinois. At the time, Valerie was combining her work on a cattle farm with raising the couple's daughter, Cassandra. James was chairman of the industrial design department at Northern Illinois University, where he developed a curriculum in alternative energy systems.

After several years the couple realized they loved their Owen County property too much to limit their enjoyment of it to the occasional getaway. They decided to make it their home and engineered a house that would exemplify the best in energy-efficient construction. They kept the house's footprint and overall volume small, to limit both the materials used for construction and the energy they would need once they moved in.

Besides its cozy size, the home's energy efficiency is significantly enhanced by its shape (a modified salt-box), interior layout, and orientation on the site. A tall, narrow form combined with an open interior that winds playfully among nine distinct levels ("like a tree house," laughs James) encourages "thermal siphoning"; warm air rises, circulates naturally, and is then re-circulated by a mechanical air handler.

James and Valerie situated the house so that it faces 7 degrees east of due south, with 272 square feet of windows on the southern side to optimize exposure to winter sun and 4-foot roof overhangs to



1. The principals of Stone Cabin Design, James and Valerie Gray began building their passive solar home in 1979. Their house and business share the same location.

2. James and Valerie in the kitchen, with wooded views beyond.



3. The living room's slate floor is made from salvaged high-school blackboards. Its dark gray color absorbs the solar energy that streams through south-facing windows, and the warmth is stored by the home's foundation—a system that's clearly cat-approved.

Vital Statistics & Additional Features

- Built in 1979
- 1,100 square feet
- 2 bedrooms and 1 bath
- 1-1/2 times more space on the south face relative to the house's depth maximizes the efficacy of solar heating in winter
- Shade trees planted to west of building site after purchase of property; evergreen tree wind-break at northwest corner of building site (more than 800 trees have been planted on the property since 1979)
- Use of salvaged materials such as slate, brick, and recycled hardwood flooring; lighting fixtures, interior doors and hardware from IU salvage
- Energy-efficient windows
- Berming and no windows on north wall
- 2x6 framed walls, allowing for more insulation than standard 2x4 construction
- High-efficiency gas forced air furnace with central AC
- Jotul Combi-fire woodstove
- Fluorescent bulbs used throughout the house
- Small skylights enhance natural lighting

Average monthly total gas and electrical cost, including heating and cooling: \$141

Designer and builder: Stone Cabin Design
stonecabindesign.com



1. On cloudy winter days a woodstove provides much of the home's heat. An ingenious open-plan interior facilitates air circulation. The bath is the one room that can be closed off.

2. This handbag, a humorously literal take on an otherwise taken-for-granted word, is one of several crafted by James, who learned the art of leatherwork while living in Germany.



keep out the worst of summer heat. Just as important to energy conservation was the absence of windows on the home's northern side, which has just 4 feet of wall above ground level to reduce exposure to winter winds and help keep the home cool on summer days.

Quilted window blinds housed in a draft-resistant track are an integral aspect of the home's design; closed in the daytime during summer, they help the house stay cool. On sunny winter days the blinds are open until dusk, when Valerie and James draw them shut for insulation.

In conjunction with a large woodstove, passive solar design helps keep the Grays' house comfortable in winter. A dark gray slate floor, made of blackboards salvaged from the Owen County High School, soaks up the warmth of sunshine streaming through large, south-

facing windows. Incorporated into the home's foundation, which James describes as "an insulated box," are 22 tons of stone capped with a 4-inch layer of concrete; the resulting thermal mass stores the solar energy absorbed by the dark stone floor. The dining room floor, which is finished with salvaged paving bricks, also functions as a heat sink.

The Grays are documentary filmmakers who travel about three months every year. The heat sink maintains the house temperature at 55 degrees when they are away. Says James: "When we leave, we just shut the blinds."

3. The dining area immediately off the kitchen was created using numerous salvaged materials; among them a tin ceiling and a floor that's finished with paving bricks. Quilted blinds provide outstanding insulation for windows, which are inevitably a point of heat loss.

Here Comes the Sun

For 20 years, Greg and Jan Ellis wanted to build a solar-powered house. After their daughters left home they were ready to leave suburban Noblesville for something closer to town—though they hadn't decided yet which town. They first considered a neighborhood in northeast Indianapolis but rejected it because the development's architectural committee forbade solar panels. An online search for "new homes and solar panels" turned up Bloomington's South Dunn Street development. Already familiar with Bloomington, since both of their daughters had attended IU, they came for a visit and were charmed by the new bungalow neighborhood's style and its near-downtown location. But what clinched the deal was the developer's encouragement of solar technology.

"I was giddy at the fact that they were interested in doing solar panels!" says Matt Press, South Dunn Street's visionary developer. "Early on in the project we were talking about the kinds of restrictions we wanted to [impose] by way of covenants, such as [vetoing] satellite television dishes, but one of the very first things that came up was my desire to see photovoltaic panels be a possibility."

Greg, a pathologist, researched the renewable resource technology that he and Jan, a lawyer, incorporated into their house. Solar panels consist of photovoltaic cells designed to convert sunlight energy into electrical current. A photovoltaic panel is made from two sheets of silicon, each containing small amounts of metals with chemical properties that can be harnessed to produce energy; the Ellises' panels, for example, use arsenic and gallium. Those who took high school chemistry may recall that arsenic tends to give up electrons, while gallium attracts them. When sunlight strikes a photovoltaic panel, it "bumps" electrons off the arsenic atoms. They then flow across the silicon plate to be picked up by the gallium. The electricity generated

Vital statistics & Additional Features

- Built in 2007; homeowners moved in December 2007
- 2,250 square feet of finished space
- 4 bedrooms, 3-1/2 baths
- 2x6 exterior wall construction, allowing for extra insulation
- Urea-foam spray insulation of framing joints and window casings
- Closets built into the exterior walls upstairs for added insulating effect
- Large windows on south side of house increase solar gain in winter
- High-efficiency glass windows
- Energy Star appliances

Average monthly total electrical cost, including heating and cooling, for January through October, 2008: \$100

South Dunn Street architectural design: Kirkwood Design Studio kdsarchitects.com

Builder: G & S Homes gshomes.com

Solar panel work by Alexander Jarvis, Solar Systems of Indiana solarsystemsofindiana.com



1



2



3



4

1. Dogs Bailey and Percy enjoy the sun in a reading area off the kitchen. Large, south-facing windows are designed to maximize solar gain during cold months.

2. Greg and Jan stand in front of a screen showing a page from Greg's detailed presentation about how their photovoltaic system works.

3. The entry of the Ellis home opens onto the living and dining areas, with the kitchen off to one side. On the wall hangs a framed poster of Rosa Parks, signed by Parks herself, which Jan bought at a fundraiser in the 1990s.

4. Electricity generated by the solar panels lowers the Ellises' utility bills significantly. The bungalow's near-downtown location, in Bloomington's South Dunn Street neighborhood, was chosen by developer Matt Press in the hope that it would decrease residents' reliance on their cars.

by this movement is directed from the panels to an inverter box, where it is changed to alternating current for compatibility with the commercial electrical grid. It then goes to the home's electrical box, where it becomes available for use.

The Ellises' system provides between 20 and 25 percent of the electricity they use, significantly lowering their monthly household expenses. The system is designed so that any excess power generated can be routed back through the meter and sold to Duke Energy at the full retail price.

At present, Greg acknowledges, the cost of incorporating photovoltaic systems into residential construction does not make sense on purely economic grounds. The Ellises' 2-kilowatt system added just over \$20,000 to their building expense; at current prices, it will take about 50 years to recoup this through savings on monthly bills. But Greg and Jan don't see this as a problem. "We think that morally it's the right thing to do," they agree.

That sentiment is echoed by developer Press, who adds, "This project and the people who buy into it are essentially pioneers. Like all pioneers they take on the greatest risk and the greatest expense so that others can benefit in the future."

In addition to the solar panels, the Ellises incorporated numerous other green features into their home, such as a high-efficiency geothermal heating and cooling system. But one of the greenest aspects of their home is simply its near-downtown location, which Press specifically selected in the hope that it would reduce residents' reliance on their cars. In the Ellises' case, this plan has worked. "We lived in the suburbs for 22 years and had to drive 15 minutes to get to any kind of shopping," says Jan. "Now we walk over to Bryan Park every day, walk downtown, and ride our bikes."

Using What You Have

Like thousands of other Gunnison brand prefabs, the 1948 house bought by Phil Eskew and Noriko Hara had walls that were just 2 inches thick. A layer of rock wool insulation had originally filled the 1-1/2-inch cavity between the house's 7/16-inch interior and exterior plywood skins, offering little protection against summer's beating sun and making winter heat loss an inescapable fact. The Gunnison's single-pane windows joined in this energy free-for-all, their steel frames the ideal conduit between the home's interior and the temperature outside. It may have been the least energy-conscious moment in American building history.

Noriko and Phil chose the house for its location. Their dream had been to construct a straw-bale house, but available building lots in town were priced beyond their reach. "It would have been really easy to find a lot out of town," they acknowledge, "but then we would have been driving ten to fifteen miles a day, and we felt like that went against everything we want to do in terms of living sustainably." Both Noriko, a professor at IU's School of Library and Information Science, and Phil, a librarian at the Monroe County Public Library, are dedicated bicycle commuters. They decided to buy an affordable house on Hunter Avenue and remodel it to create the kind of home they wanted.

Noriko had done considerable research into sustainable building. She and Phil were most interested in techniques that would be affordable and use locally available, renewable materials. Their research led them to Joe Davis of Indiana Natural Builders, who has extensive experience in straw-bale construction and green building in general. They hired him to design, plan, and oversee the straw-bale aspects of the job.

The couple purchased their 220 bales from a Monroe County farmer more accustomed to using straw for animal bedding than for building homes. A

1. The straw-bale "wrap" of this 1940s house has substantially increased its insulation. When finished, the appearance will resemble adobe. A steel roof is ideal for collecting rainwater and can be recycled at the end of its useful life.

2. Phil in the living room and Noriko in the kitchen. The cutout between the rooms dramatically illustrates the thinness of the home's original walls. The couple chose a kitchen counter made with recycled paper fibers.

3. The couple's cat, The ZZA, is the picture of coziness. The straw-bale wrap has insulated the house so effectively that the furnace doesn't kick on when the woodstove is burning. Deep window-sills were an unexpected benefit of the thickened walls.



lightweight material with a hollow shaft that traps air, straw is a good enough insulator to keep farm animals warm when winter temperatures drop to single digits and below.

Before the straw bales could be set in place, the roof and foundation had to be modified. Like any other exterior siding, the straw-bale system lasts longest when protected from the weather by generous roof overhangs—something lacking in the original Gunnison home. Noriko and Phil chose steel for their roof, not only because it will outlast conventional shingles, but also because it is perfect for collecting rainwater for household use, and it can be recycled at the end of its useful life.

With help from friends and colleagues and guidance from Davis, the couple did much of the straw-bale work themselves on weekends during the summer of 2008. Once set, the bales were secured to the house, and Davis sprayed them with a coarse clay coating. When the exterior finish is complete, the bales will have several coats of earthen plaster made of Indiana clay (some of it dug by the homeowners from their own backyard) mixed with sand, water, and finely chopped straw. The effect will resemble adobe.

The modifications to the home have had unexpected benefits. "One of the first things we noticed after installing the straw bales was how quiet the house became," says Noriko. In addition, the deep window framing necessitated by the thicker walls gives the impression that the house was built with sumptuous bay windows. The original steel-framed windows were replaced with energy-efficient models.

By retrofitting an existing house, Noriko and Phil got an affordable, energy-efficient home in a near-downtown location. As the couple's general contractor Chris Sturbaum said, "We took a shivering little house, put a big hat and new boots on it, and dressed it in a warm overcoat." ✨

4. Preferring to commute on foot or by bike, Noriko and Phil remodeled a house in town rather than building in a rural location. Their straw bales came from a local farm, and they dug some of the clay for their house's coating from their own backyard.

5. To keep costs down, the couple did much of the straw-bale work themselves, under professional guidance—an option made all the more realistic by the non-toxicity of the natural materials.



Vital Statistics & Additional Features

- Originally built in 1948; remodeled in 2008
- 1,500 square feet of finished space
- 2 bedrooms and 2 baths
- Home's basic footprint intentionally not increased, to conserve resources
- Nontoxic straw bales, a locally produced, renewable product, can be safely and easily handled by homeowners, reducing construction costs
- Geothermal heating
- Hearthstone woodstove
- ShetkaStone kitchen counter made with recycled paper
- Bamboo flooring

Average monthly utility costs, March through October: \$55

Contractor: Golden Hands Construction, Inc.

Straw-bale consultation, design, and contracting provided by Joe Davis of Indiana Natural Builders buildwithnature.com