MOUNTAIN LIVING®

THE **GREEN** ISSUE

GROUNDBREAKING IDEAS IN MOUNTAIN HOME DESIGN

ACTRESS JOSIE BISSETT & JEFF REED
CREATE A GREEN GUEST RANCH IN MONTANA

0 09281 03346 2

THE EDGE HOUSE

RODWIN ARCHITECTURE IMAGINES A CONTEMPORARY RESIDENCE ON THE CUTTING EDGE OF SUSTAINABLE DESIGN

pace that encompasses the living, dining and mily rooms flows easily n outdoor dining room via a fully retractable cordion-like glass wall. design team achieved a healthy indoor ronment by eliminating l formaldehyde and by ing exclusively low- or zero-VOC products, cluding formaldehyde-ree engineered lumber, low-VOC construction dhesive, and zero-VOC paints and prefinished bamboo flooring.

"Architecture is typically defined and inspired by its constraints," says Scott Rodwin, principal of Rodwin Architecture in Boulder, Colorado. "It's an architect's job to find the most graceful, intelligent and efficient way to respond to those constraints."

So it was most unusual when a new client approached Rodwin not with a list of do's and don'ts, but with one simple directive: "design a home that's as green as you can make it, and do the very best job possible."

So began the process of designing a LEED Platinum-certified, near-net-zero-energy home in Boulder that uses about the same amount of energy as it produces over the course of a year. The home includes a 10-kilowatt photovoltaic system, a solar-thermal system and ground-source heat pump, as well as passive-solar design, a super-insulated thermal envelope, high-performance fiberglass windows, and a palette of building materials low in VOCs and completely free of formaldehyde. >>

STORY BY **CHRISTINE DEORIO**
PHOTOGRAPHY BY **JEFF SCROGGINS**

DAY LIGHTING

A Kalwall skylight filled with Nanogel, an ultra-lightweight, translucent, R-22 insulation material, provides natural day lighting in the home's core. "We took full advantage of the day lighting we achieved by putting a giant stone wall below the skylight," Rodwin says. "We then created a floating staircase that slides up this 'slot canyon;' its open treads let light filter down about two-and-a-half stories." Situating the large stone wall in the middle of the house also provides valuable thermal mass, which helps to naturally regulate swings in interior air temperature between day and night.

But it's the features you won't yet find on a LEED-certification checklist that make this project so notable: pioneering methods and materials that will change the way tomorrow's sustainable homes are built, from the city of Boulder's first legal gray-water system, to an experimental three-part insulation technique that achieved super-insulated walls with an R value of 38—exterior walls typically have an R value of about 19—an R-20 slab and an R-65 roof, with no thermal breaks.

Before Rodwin and his team could implement this cutting-edge design, the site's existing 43-year-old, 7,000-square-foot home had to be addressed. "The house was a disaster," Rodwin recalls. "It had six floors and was filled with asbestos and shag carpeting from top to bottom. There weren't any windows on the south side, and almost none on the western side, which is where the view is. And it was built over the property line on two sides, right down to the foundation. We quickly determined that it was unsalvageable."

The amount of material that comes from an old house—and that usually goes to the landfill—is staggering, and until recently, it has cost significantly more to salvage those materials than to send them to the landfill. But this project changed that. Rodwin's team helped to introduce a new method of accounting to Boulder County that gives homeowners the replacement value of deconstructed materials rather than the resale value. This change, which adds up to a much better tax benefit, allowed 91 percent of the old home's materials to be deconstructed and salvaged at virtually no additional net cost to the homeowner. >>

"BRIGHTER" LIGHTS

A smart lighting system features efficient, long-lasting and dimmable compact-fluorescent and LED lighting controlled by occupancy sensors in every room. "Each light switch is actually a little computer that's hardwired back to a central computer in the basement," says project manager Ron Flax. "Any switch can be programmed to perform a wide variety of operations." For example, the central computer can save energy by adjusting artificial lighting according to ambient light levels.

LOW-TEMPERATURE RADIANT HEAT

A ground-source heat pump (also known as a geothermal system) powers the home's radiant in-floor heating system. Because this home has such a tight thermal envelope, the system requires a lower-than-normal water-delivery temperature. "As a result, you can more efficiently use heat collected via the geothermal system," says Flax. "You can use smaller pumps and pump more slowly, which requires less energy, and yet the house maintains a very constant, comfortable temperature from floor to ceiling. It's also better for the hardwood floors, which don't like high temperatures."

"We contextualized the house by drawing inspiration from the neighborhood's materials palette, using local buff sandstone from Lyons, Colo., stucco and reclaimed FSC-certified cedar." — Architect Scott Rodwin

With the existing house removed, Rodwin and his team turned their attention to ensuring that the new structure would function optimally. "When net-zero energy is the goal, you have to start employing some extraordinary measures," Rodwin says. "When you combine a 10-kilowatt photovoltaic system with a ground-source heat pump and throw in solar-hot-water panels, you have the opportunity to cut your energy bills to nearly zero."

What's most remarkable about this array of high-tech systems is that the house can actually recognize the most efficient means of heating or cooling itself at any given time—and use that particular method. As a result, the house has achieved a Home Energy Rating System (HERS) index of 6, which means it uses 94 percent less energy than the HERS Reference Home, which has an index of 100 (based on the 2006 International Energy Conservation Code).

"Our goal was to get as close to net-zero energy as possible," says Rodwin. "That meant passive solar design was critical. The trick was doing that while still opening to the huge western view." This sort of give-and-take, the thoughtful balancing of form and function, is what makes this home as appealing to its owners as it is sustainable. "Throughout the design process," says Rodwin, "we looked at both architecture and energy systems and found the point of convergence."

RODWIN ARCHITECTURE, BOULDER, CO, 303-413-8556, RODWINARCH.COM

ENERGY INDEPENDENCE

The home's electricity is provided almost exclusively by a 10-kilowatt photovoltaic system that captures energy from the sun via rooftop panels. When the system makes more energy than the house can use, it's sent back to the power grid, literally spinning the electrical meter backward. Roof-mounted solar-thermal panels also collect heat, which preheats the home's domestic hot water and can also be used to provide heat for the radiant in-floor heating system. A ground-source heat pump powers the home's radiant in-floor heating and indirect evaporative cooling system.

INSULATED WINDOWS

To protect the home's windows from the sun, Rodwin specified super-high-performance, fiberglass-framed low-E windows that are "tuned" with a special film that reflects the sun's radiant heat. East- and west-facing windows are tuned to prevent the house from overheating, while south-facing windows are tuned to allow 65 percent of solar radiation into the house, maximizing passive solar gain. The U-24 windows are so well insulated, says Rodwin, they feel warm to the touch on even the coldest winter day.

more ML For a guide to this home's products and pros, visit mountainliving.com.

A WATER LEGACY

When the homeowner requested a gray-water system and was told it wasn't allowed, he and Rodwin Architecture worked with the city to change the building code and create Boulder's first legal gray-water system. The homeowner not only installed a prototype in his house but started a company called Water Legacy (waterlegacy.com), which makes these sustainable systems available to the public.

HOW DOES IT WORK? The Water Legacy gray-water system collects used bathing water from baths and showers, then filters and disinfects it using hydrogen peroxide and ultraviolet light. The clean water is then stored and supplies filtered water to toilets on demand.

HOW MUCH WATER DOES IT SAVE? The average household will save approximately 12,000 gallons of water each year.

IS IT EASILY INSTALLED? Because the system requires gray water to be separated from black water, it's best suited for new construction and serious remodels; retrofits can be challenging and costly.

WHAT DOES IT COST? A new Water Legacy system costs an average of $3,000, while the additional required piping typically costs less than $500.