

SOLAR TODAY[®]

Renovate Green

Family transforms a forsaken school
into a solar-powered arts center

Is a hydrogen energy
economy the right goal?



LISA BODWALK

Once abandoned, a historic school finds new life as a solar-powered community center.

Retro Green

By Scott Graham

If the word "revolutionary" can be applied to something 68 years old, then the efficient, solar-powered Smiley Building is exactly that. Built in 1936 as a junior high school in Durango, Colorado, and named for a popular superintendent, Smiley was abandoned in 1994. But through the vision of a trio of partners, in 1997 the building began a second life.

In the seven years since Charles Shaw, his wife Lisa Bodwalk, and brother John Shaw purchased the three-story Mission Revival-style brick building, the partners have transformed the Smiley Building from an abandoned eyesore into a vibrant community arts center. The 45,000-square-foot Smiley Building features countless conservation and solar-energy innovations: solar thermal panels, a photovoltaic array, high-efficiency boilers, motion detectors, compact fluorescent lighting, low-flow faucets,

Top: Unlike most green buildings, which are designed with energy-efficiency in mind, the Smiley Building is on the National Register of Historic Places.

CHARLES SHAW



The Smiley Building in 1997, before its renovation.

tubular skylights, on-demand water heaters and wastewater heat exchangers.

Unlike most green buildings, however, which are constructed from the ground up, the Smiley Building has been around since the Depression. By preserving the original fixtures where possible while installing the latest in energy-efficient technology, the Shaws and Bodwalk have revived a legacy of 20th-century Durango—built for the next hundred years.

Turning Vision into Reality

The Durango School District 9-R accepted

the proposal by the Shaws and Bodwalk to turn the Smiley Building into a center for arts and activism in 1997. At the time, Charles was 31, Lisa 30 and John 28 years old.

The brothers brought perfect expertise to the job. Both are plumbing contractors. Charles is an electrical contractor, as well. Bodwalk, owner/director of The Dance Center—the largest tenant in the Smiley Building—brought invaluable insights for building a thriving arts center.

Indeed, the partners have transformed the Smiley Building into a hub of cultural, educational and artistic activity. The building's 30 rented rooms buzz with activity from dawn until late at night, with classes ranging from dance, tai chi and yoga to ceramics, photography and Web design. One wing of the building houses the 665-seat Smiley Theater, the largest performance space in Durango.

Tenants of the Smiley Building are limited to those involved in the arts, community and environmental conservation. To provide space for such perennially cash-short organizations and individuals, the Shaws and Bodwalk have set their lease rates at half to two-thirds the market rates in Durango. As a result, the building has maintained full occupancy since its rehabilitation began.

Those low lease rates are one reason the owners have explored efficiency as a way to keep costs down. The Shaw brothers, however—dedicated conservationists who bike everywhere in Durango—say they would have remodeled the building with efficiency in mind no matter what.

Fixing the Basics

Before they could consider conservation efforts, the partners faced the Herculean task of rehabilitating the structure.

They began with the building's rotted window frames. Thanks to a state historic fund grant of \$129,889, the Shaws restored all 275 windows in the building, rebuilding 20 from scratch. They also had the building re-roofed and installed a state-of-the-art heating system using natural gas boilers that are 97 percent efficient.

The Smiley Building's 30 tenants—artists and community and environmental organizations—offer classes ranging from tai chi to Web design. Here, textile designer Heather Laurie works in her studio.



LISA BODWALK

"We've found that it really is possible to preserve a building's historical flavor while bringing it into the 21st century in terms of efficiency and solar-energy production."

—Charles Shaw,
president of the
nonprofit Smiley
Building organization



CHARLES SHAW

Smiley Building tenant Mark Stroud inspects the solar thermal collection system installed on the building's roof to provide space heating and hot water.

They tore out old lockers and painted the walls and ceilings cheerful hues. They also repaired and refinished 12,000 square feet of maple floors in the building's former classrooms, and renovated the theater with curtains, booms and a new lighting system.

In addition, the Shaws landscaped the city block of land on which the building sits, adding trees, flowers, paths and seating areas. Many locals visit just to enjoy the gardens.

Mixing Antique and Innovation

The installation of super-efficient boilers represented the brothers' first foray into cutting-edge conservation at Smiley. To maintain the building's historical character though, they kept its original radiators. Similarly, they replaced all the lights in the building with compact fluorescents, but retained the original fixtures.

"We've found that it really is possible to preserve a building's historical flavor while bringing it into the 21st century in terms of efficiency and solar-energy production," Charles says.

Next, the brothers added insulation throughout the building and installed a whole-building ventilation system that draws cool outside air into the building each summer morning. The system eliminates the need for air conditioning in all but the dance studio.

They added tubular skylights to illuminate the top-floor hallway, and installed

Ultimately, the Shaw brothers target zero net energy use for the Smiley Building.

low-flow faucet heads and on-demand water heaters in the sinks to avoid the energy-wasting shipment of hot water throughout the massive building. They even added a wastewater heat exchanger below the building's sole apartment.

Of all the efficiency additions, however, the simplest has been the most

effective: "Motion detectors," says John. "Booooring."

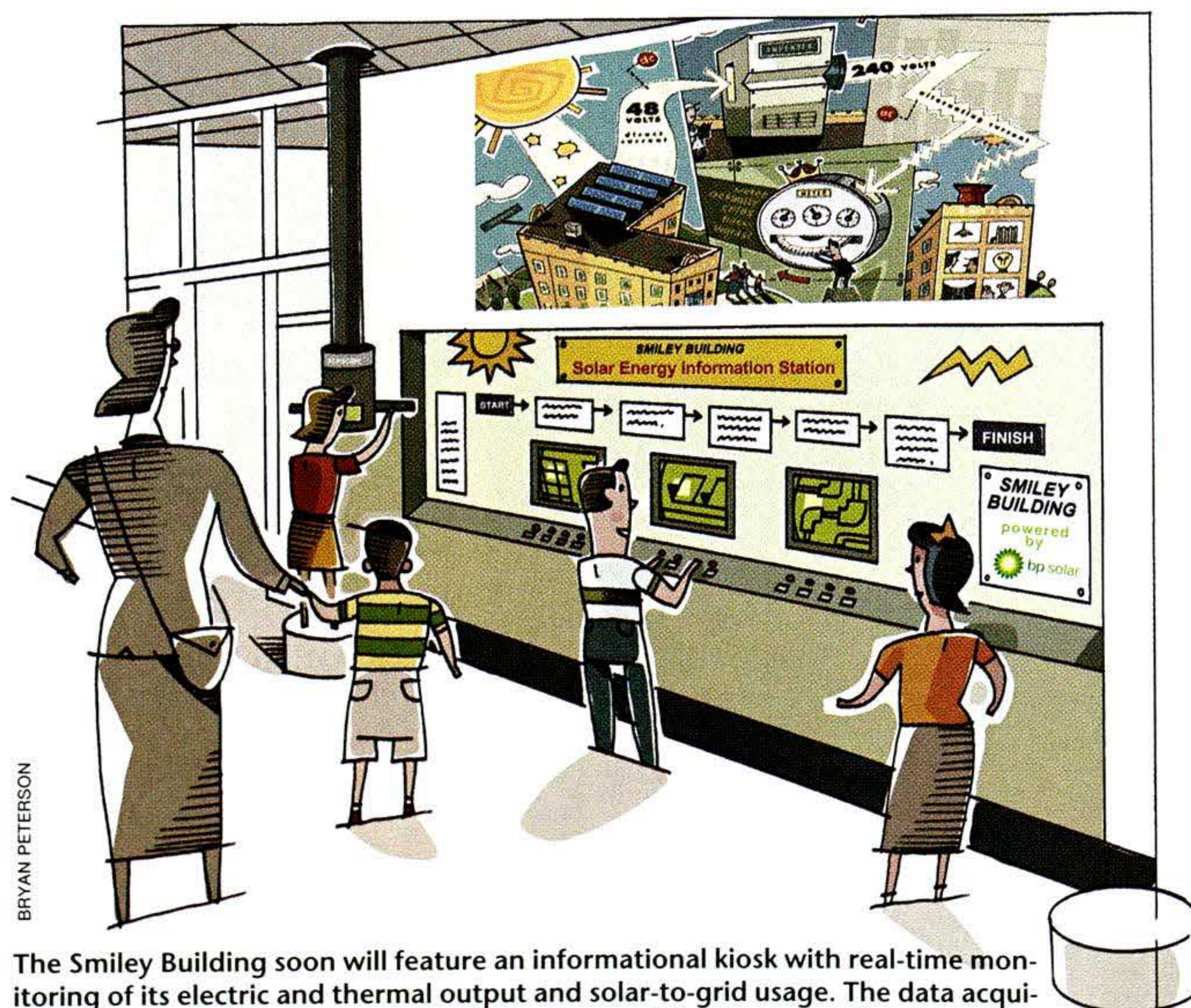
But incredibly effective for efficiently providing heat and light during the irregular hours kept by Smiley's tenants. Teamed with valves and relays, motion detectors placed in the building's rooms and hallways track the movements of the building's users. The system provides light and heat wherever tenants go, and turns off lights and heat if they forget to flip the switch when they leave.

Solar Supply Saves Thousands

When the brothers had done all they could to minimize the building's energy demand, they turned to the supply side. First came solar heat.

Five years ago Charles noticed that a fitness center in Durango was being remodeled. The center's 20-year-old solar thermal panels, which never had been installed correctly and so never had worked well, were about to be discarded. Charles and John got them for free.

The brothers removed the 1,000 square



The Smiley Building soon will feature an informational kiosk with real-time monitoring of its electric and thermal output and solar-to-grid usage. The data acquisition system uses a Triangle Research programmable logic controller to monitor the systems and transmit data to a desktop computer for analysis.

Utility Bills Plummet 84 Percent

Bills through the roof: When it was purchased from the school district in 1997, the 45,000-square-foot Smiley Building's utility bills were more than \$5,000 per month.

Solution: Complete energy-efficiency retrofit of the building, plus the addition of 11.64 kilowatts of photovoltaic panels and 1,000 square feet of solar thermal collectors for hydronic heating and domestic hot water.

Results: The Smiley Building now uses less than 1 kilowatt-hour of grid-supplied electricity per square foot per year, and approximately 7,000 ccf (hundred cubic feet) of natural gas annually. Monthly utility bills are about \$800. Greenhouse gas emissions are down 80 percent.

To view a real-time comparison of the Smiley Building's use of solar-generated and grid-provided electricity, visit www.smileybuilding.com/graph.

Source: Charles Shaw

feet of panels from the fitness center and installed them on the roof of the Smiley Building. They placed the panels horizontally to hide them from view, thus maintaining the building's pleasing skyline. Doing so required significant pipe work, "but, hey, we're plumbers," John says with a grin.

The Shaws installed cast-iron radiators—scavenged from old buildings—throughout the building and connected them to a pair of 500-gallon tanks in the basement. Heat exchangers transfer heat from the antifreeze running through the solar panels to the water in the tanks, which is then pumped to the radiators.

All told, the system produces about 20 percent of the building's heat and most of

On a February weekday around noon, 85 percent of the building's power usage was solar.

its hot water needs. Savings amount to about \$1,200 per year.

The jewel of the Smiley Building is located on the roof above the classroom wing of the former school: an 11.64-kilowatt array of photovoltaic (PV) modules.

Though the system of 72 Kyocera 120-watt modules and 18 BP Solar 170-watt modules has generated as much as 9,500 watts of power, it averages about 45 kilowatt-hours per day of energy. At Durango's electric rates, that amounts to \$4.50 in savings every 24 hours. Because of all the building's conservation additions, however, that savings equals 35 percent of the building's total electricity use. In rare instances, excess electricity generated by the PV system is fed back into the grid.

To demonstrate the potential of renewable energy, the Smiley Building soon will include an informational kiosk detailing its solar capabilities. The Smiley Solar Information Station will provide real-time data on how much solar vs. grid power the building is using. Already Charles Shaw and Chris Johnson, vice president of the nonprofit Smiley Building organization, have devised a data acquisition system that monitors electric and thermal output of the solar systems, as well as solar-to-grid electrical usage. They plan to add real-time monitoring of solar-to-natural gas usage, as well.

Real-time solar-to-grid electrical usage data from the system is accessible at www.smileybuilding.com/graph. On a February weekday around noon, it reported that 85 percent of Smiley's power usage was solar.

Pioneering a Better Way

"The solar stuff we did later is the fun stuff," Charles says. "But it's the things we did first, when we addressed the demand side of the equation, that really have paid off."

For example, the compact fluorescents in the hallway light fixtures have a payback of as short as two months. The payback on the motion sensors is less than a year. And other retrofit projects, such as upgrading to more efficient boilers and installing on-demand water heaters, have paybacks that range from one to five years. By comparison, solar heat and PV take longer to return their initial investment.

Why do it then? "To show it can be done," says Charles, standing atop the roof beside the solar-heating panels late one sunny afternoon. "To prove that it works." He smiles. "To save the world."

Ultimately, the Shaw brothers target zero net energy use for the Smiley Building. To that end, they plan to add 40 kilowatts of PV capacity during the next five years. They also plan to develop about 10,000 square feet of unused space into more rental spaces, four more residential units and a café.

When the building's rental pool is expanded, the partners foresee finally earning a return on their purchase. But all three are comfortable with the long-range aspect of the renovation. As John explains, "It's a lifelong project."

Back atop the Smiley Building, standing alongside the PV array, Charles turns to the low afternoon sun. The late-day light paints his face with a golden glow. Gesturing toward the PV array, Charles expresses the thinking of all great pioneers: "This is just the start." ●

Scott Graham is a business, travel and energy writer who lives in Durango, Colorado. He is the author of Backpacking and Camping in the Developing World and Adventure Travel in Latin America (Wilderness Press) and Handle With Care: A Guide to Responsible Travel in Developing Countries (Noble Press). Contact him at grahams@gobrainstorm.net. For updated information about the Smiley Building, visit www.smileybuilding.com.

The Greening of Smiley

Seven years since being purchased by Charles Shaw, Lisa Bodwalk and John Shaw, the Smiley Building is a leader in the use of renewable power and conservation. The partners received the 2002 Green Business Leadership Award from the Durango Area Chamber of Commerce for their efforts. Highlights of the building's green features follow.

Solar thermal collection system:

Previously used to heat a swimming pool, 1,000 square feet of solar thermal panels on the roof provide sun-heated water to six of Smiley's radiators. The system produces 500,000 to 700,000 British thermal units daily.

Efficient boilers: Non-solar radiators get their hot water from 97 percent energy-efficient, sealed combustion boilers located in the basement.

Photovoltaic (PV) array: An 11.64-kilowatt array of 72 Kyocera 120-watt modules and 18 BP Solar 170-watt modules, one of the region's largest, generates 40 to 60 kilowatt-hours daily. BP donated the BP Solar modules and an SMA America Sunny Boy 2500 grid-tie inverter.

Point-of-use water heaters:

Modulating electric water heaters reduce standby losses of traditional tank water heaters. Centrally located water heaters are backups when solar-heated water is available.

Waterless urinal: A specially designed trap and non-toxic fluid replace flushing water to help reduce potable water use.

Photocells: Photocells minimize use of outside lighting and some interior lighting based on available daylight.

Ventilation: Natural convection flows, operable windows, ceiling fans and an attic fan provide cooling.

Source: Charles Shaw