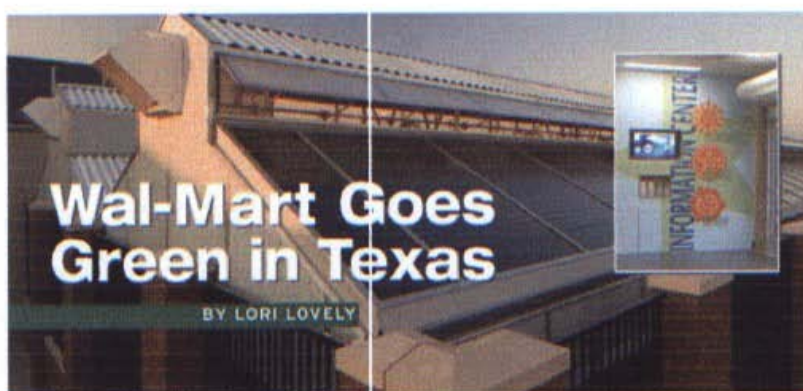


“From top to bottom, designs aim to conserve energy while enhancing amenities. Twelve inches lower than typical Wal-Mart Supercenters, the McKinney store required less material to construct and uses less energy to heat and cool. The reduced height of the building and a reflective coating on its west side reduce the amount of heating or cooling required, and keep air from escaping. Reflective ceramic paint from Cerama-Tech International reduces heat-gain inside the building, saving energy during hot summer months. Large trees—transplanted from a Chevrolet dealership that had planned to cut them down—and several types of shade structures provide shade, combating “urban heat island effect,” a phenomenon that increases city temperatures 6°F to 8°F.”



*The world's largest retailer began a 206,000-square-foot experiment in McKinney, TX, this summer, hoping to lead the way in evaluating their environmental impact and changing the way the retail industry designs, constructs, and manages facilities*

The new Wal-Mart facility in McKinney, TX, incorporates a number of conservation systems and sustainable design technologies to minimize the amount of energy and natural resources used as well as the resultant wasted energy. “The store at McKinney will draw its energy first from onsite resources and systems, and then from conventional utility sources as secondary services,” claims Don Moseley, manager of experimental projects for Wal-Mart.

### **Green Scheme**

Moseley says the company has always had environmental concerns and that there is “no special catalyst” driving the retailer in this new direction other than a desire to illustrate good leadership. “The senior management and the family have always been conscious of their responsibility to the environment.”

But it was just two years ago that the company drafted a mission statement that included plans for two experimental stores to help them be “better stewards of the environment by reducing the amount of energy and resources the store uses and reducing the amount of raw materials required for construction.” At the same time, Wal-Mart developed a land-offset program, committing to preserve an acre of wildlife habitat for every developed acre—past, present and future—and to find new uses for every store it deserts.

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Skeptics doubt the veracity of the newfound philosophy. "We've heard this before from Wal-Mart—that they want to be an environmental leader—but I can't say we've seen that come to fruition," Eric Olson, head of the Sierra Club's anti-sprawl campaign, told Reuters. Many "green" groups oppose Wal-Mart, claiming the hundreds of new stores opened each year cover thousands of acres of green space, and that one green store doesn't make up for the damage already done by 3,700 others.

The Institute for Local Self-Reliance takes another jab at the box store. "This is about improving Wal-Mart's public image, not lessening its environmental impact," reports Stacy Mitchell, senior researcher. He claims Wal-Mart is the major factor behind increased commutes for shopping trips because the giant retailer has "destroyed" neighborhood and downtown businesses, and he holds Wal-Mart responsible for the 40% increase in the number of shopping miles logged by Americans since 1990. "The McKinney store, which is situated on the outer edges of town, continues this destructive land-use pattern."

Wal-Mart initially acquired enemies through its record of locating stores on environmentally sensitive sites, including a wetland area in Bangor, ME, it tried to develop. The Institute, a national nonprofit organization founded in 1974 to advance sustainable, equitable, and community-centered economic development through research and education, estimates that Wal-Mart currently occupies 75,000 acres in the US and has plans to nearly double its footprint over the next 10 years. Many of the new stores are scheduled to be built on undeveloped land rather than inhabiting vacant existing big box stores, shopping centers, or malls.

Even the Wall Street Journal has commented on the public relations nightmare Wal-Mart CEO Lee Scott is battling, with Democrats criticizing the company's employment practices; an increasing number of lawsuits; questions about working conditions, pay, and benefits; and rumors of "squeezing" suppliers. Down in the polls as well as on Wall Street, Wal-Mart is suspected of attempting to clean up its image by cleaning up its environment.

Regardless of the reasons behind its plan, Wal-Mart stands to make a significant contribution to the retail design and construction industries if substantial elements of its experiment prove cost-effective.

Wal-Mart hired mechanical and electrical consultants and a general contractor (Turner Construction) with experience in the "green" building division, who in turn recommended three architects from LTA who have familiarity with "green" projects. From there, brainstorming sessions led to decisions about what should be studied. "The ideas were a joint effort of our design team. We literally pinned ideas on the wall—grouped by category—and worked from there," says Moseley.

One of the first decisions was location. According to Kimberly Randle, Wal-Mart's regional community affairs manager, McKinney offered the perfect locale, because officials wanted a "control" store nearby and a hot climate suitable for testing new energy-efficient cooling and heating systems. An enthusiastic city worked with Wal-Mart, allowing variances in the building's design.

Another experimental store scheduled to open in late 2005 in Aurora, CO, was chosen once again for the proximity of a control store (in Centennial) as well as its climate—this time a high altitude with colder temperatures and less humidity.

## **Wind and Water**

The Bergy XL.50 from Bergy Windpower Co., a 50-kW, 120-foot wind turbine with a 46-foot-diameter rotor, is the newest and most advanced small wind turbine on the market,

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and Wal-Mart is the first company to install one for commercial use. Designed for low-wind areas where wind power has not previously been practical, it's operable in winds as low as 4.5 mph. A 1-kW turbine powers a monument.



Bergey XL 50 wind turbine

A windmill works in conjunction with the rainwater harvesting and treatment pond, where water collected from the roof and two acres of parking lot runoff is aerated and used for irrigation.

Moseley says rooftop rainwater is clean enough to go directly into the harvesting pond, but the parking lot runoff and collected condensation from the store's refrigeration and air conditioning units must first filter through a planted bioswale—a channel of rocks, shrubs, and grasses that acts as a biological filter to trap pollutants and cleanse runoff on its way to a wetlands area, a process called phytoremediation. By slowing water flow, the bioswale also permits infiltration back into the ground, replenishing groundwater and reducing the need for irrigation.

A sub-surface aeration system assists by releasing bubbles into the water. Moseley estimates that the stormwater storage and reuse system will provide 95% of the store's irrigation needs.

Pervious pavement in the parking lot reduces the amount of runoff by allowing infiltration to occur through its surface so rain soaks directly into the ground. Pervious pavement is constructed on two foundations—a layer of large gravel and a granular base. During heavy rains, the gravel lets water pass through the granular base, where it can be absorbed into the subsoil.

Another means of conserving water is to reduce the amount needed by incorporating Xeriscaping into the landscape design. By replacing traditional Bermuda grass with native grasses that don't require irrigation or mowing, and using native plants that are hardy to the region's climate and conditions, Wal-Mart reduces its water usage. Wal-Mart is evaluating various drought-tolerant trees, shrubs, and perennials, as well as different types of mulch to determine which have better water-holding capacity and long-term durability.

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A drip irrigation system reduces wasted water common to other irrigation systems. Officials are measuring the amount of water required to maintain this type of landscape compared to a traditional landscape.

Large open areas on the property have been planted with wildflowers. The self-seeding wildflower meadow does not require irrigation or mowing, thereby conserving water, reducing airborne emissions from mowers and bypassing the need for chemical fertilizers, while providing an aesthetically pleasing vista.

"Aesthetics were a deciding component in everything we did," insists Moseley. Although the retail space remains "highly functional," he says it was important to provide a pleasing setting for customers and employees.

## **Solar Power**

According to the Solar Energy Industries Assoc., solar energy offers the highest technologically exploitable potential of the different kinds of renewable energy currently available. Able to lower energy costs, provide glare protection, and supply heat insulation, solar applications can also be configured to maximize the sun and shade pattern of any building's location.

Wal-Mart capitalized on the sun's energy by incorporating several solar experiments. Moseley calls it a good opportunity to learn about the products, their applications, and the vendors without investing in supplying the whole store.

"Turner researched photovoltaic manufacturers to find us," relates Steve Cohen, Schott North America project manager, whose company combined forces on this experiment with the RWE Group for its first joint venture. "Wal-Mart wanted to experiment with as many types of materials as possible to see what works best, so our team of experts incorporated polycrystalline (PC) and thin-film (TF) panels, and photovoltaic (PV) on the roof."

Cohen says PV is relatively new to the US. When the sun hits the 5-inch opaque purple cell, it makes electricity. Even more uncommon is the thin-cell type—a thin layer of metal on glass with lines etched like graph paper to remove the three layers of protective coatings. Horizontal lines let light through, providing semi-transparent vision, while the coatings block heat. Cohen says that's particularly valuable in skylight applications. "Solar glass takes beauty to the next level, using a silk screen process of enamel for heat-blocking. It's the next evolution."

RWE-Schott chose a hybrid system of both PC and TF panels. "We studied the building design and the types of products, and were able to select different areas to incorporate various parts," says Cohen. Polycrystalline PV laminates have been incorporated into the garden center's canopy. Roof-mounted thin film PV laminates are used in the entry vestibules and the tire and lube facility. Curtain wall and clerestory-mounted laminates of both types are integrated into the south-facing façade in horizontal bands.

The PC panels are more efficient, producing 10 W per square foot, but Cohen says if part of the standard-size panel is in shade, it's not making electricity, and if the temperatures get too high, their efficiency goes down. Unaffected by temperature and able to generate electricity even if part of the panel is shaded, TF panels are still a third less efficient, generating 4 W per square foot, but are more aesthetically pleasing, are available in custom-sized transparent panels, and offer more possibilities for design and integration. Cohen took advantage of that when designing the curtain wall in order to illustrate what can be done.

Wal-Mart chose clerestory, vertical applications of insulated and laminated panels because they wanted to combine vision with energy generation. Panels were spaced one inch to allow natural light into the store. Light sensors monitor the amount of light coming in and automatically turn off store lights when enough daylight is present.

Installation differed little from a typical installation of any ordinary insulated glass in standard brick aluminum frames. "It was simple," confirms Cohen. "The panels are designed with two wiring leads. Pre-designed frames are set up to accept the wires, so an electrician just connects the male and female leads. DC current is inverted to AC current, and wired directly to the power grid."

Moseley says the PV is expected to contribute about 3% of the store's electricity needs. With the wind turbine producing approximately 5% of the store's electricity, the experimental sources will generate 8% of the store's energy requirements—without creating any pollution. Cohen says even more power could have been generated. "We could have covered the entire roof and put thin film in every skylight, but this is just an experiment and Wal-Mart made the decisions." Nevertheless, the 7,500 square feet of solar panels used on the McKinney store are expected to provide more than 48,000 kWh annually—enough to power 17,000 homes for one day—and reduce greenhouse gas by 800,000 lbs. per year, according to Brian Lynch, with Schott's corporate communications department.

### **Recycle and Conserve**

Recycling was drawn into the very first blueprint for the McKinney store. Sidewalks were created from recycled tires, in-store floors are made of reused cork, and ash content was used in the building's concrete. Every ton of fly ash—an inorganic byproduct of the coal industry—used in concrete saves about one barrel of imported oil, according to Moseley. It also reduces the amount of material needed for construction because it replaces traditional materials like lime, cement, and crushed stone, all of which require energy to produce. Approximately 800 tons was used in the building's slab and foundation.

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Local landfills are seeing little traffic from the new Texas store. Instead, construction materials were recycled. Food waste is being separated from other garbage and hauled to a local commercial composting facility instead of a landfill. The organic waste is processed, and the resultant compost is made available for purchase at Wal-Mart.

Cooking oil never even leaves the premises. It's recovered, along with motor oil from the tire and lube service center, in a 2,000-gallon tank. An onsite Energylogic bio-fuel boiler uses it to produce heat for the building—simultaneously reducing waste, increasing energy efficiency, and reducing the demand for natural gas and electricity.

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material to construct and uses less energy to heat and cool. The reduced height of the building and a reflective coating on its west side reduce the amount of heating or cooling required, and keep air from escaping. Reflective ceramic paint from Cerama-Tech International reduces heat-gain inside the building, saving energy during hot summer months. Large trees—transplanted from a Chevrolet dealership that had planned to cut them down—and several types of shade structures provide shade, combating “urban heat island effect,” a phenomenon that increases city temperatures 6°F to 8°F.

Fabric air ducts (DuctSox) with small holes to distribute an even air flow along the entire length of the duct hang lower than traditional metal ducts, supplying air at low velocity from only 11 feet (versus the traditional 30 feet of typical metal ducts). “By introducing cool air closer to people, we use less energy,” says Moseley.

A radiant floor heating system in specific areas of the building increases comfort as it saves energy. Hot water pumped through a series of tubes in the concrete floor warms the slab to provide radiant heat.

Heat generated by the refrigeration system is redirected to heat the water used in the restroom sinks, and to help heat various areas in the building. The refrigeration systems, on the other hand, have focused on retaining cool air. A redesign changed the traditional air-cooled ground-mounted units to distributed water-cooled roof-mounted units with cooling towers. By relocating the refrigeration systems to the roof, copper piping and refrigerant loads were reduced by more than 40%. The addition of glass doors on display cases adds to the estimated annual energy savings of 645,000 kWh. In addition, LED lights replace typical fluorescent light strips in frozen-food cases because they last longer, produce less



Clerestory panels reduce store lighting needs.

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heat, and use less energy.

Conservation comes automatically in some areas. Vertical sliding freezer doors automatically close after 9 seconds in the store room, while the garden center's thermostat opens louvers to release hot air and draw in natural breezes as temperatures rise.

In other areas, it's a matter of what isn't there. The Falcon Waterfree Technologies urinals have no water. Moseley insists they're clean, odor-free thanks to a special oil, and ought to save 80,000 gallons of water annually. However, one of many built-in exit strategies will enable water to be plumbed to the walls with little effort if necessary.

## **Expectations and Lessons To Be Learned**

"It's an educational process," Moseley reflects. "We've incorporated a lot of systems into this store, and we've made a commitment to study and report on the results. Moseley says they "do a lot of our own monitoring," comparing data between stores. In addition, Oak Ridge National Laboratory will monitor and analyze systems and materials for three years. "They're an objective third-party—a government lab under the Department of Energy—and they'll provide a complicated and critical analysis that we will share with the public, our peers, and our competitors."

Moseley says Wal-Mart has developed a detailed list of expectations for each experiment and will await test results before evaluating performances. Successful technology will be incorporated into plans for new stores "where applicable," but might also be used in existing stores. He points out that after exploring LED technology, findings of long lamp life, efficiency, and consistency led them to retrofit all existing stores' outdoor signage. "We changed our entire exterior lighting program."

The education isn't just for Wal-Mart. Extensive interior signage alerts shoppers to ongoing experiments. Three kiosks and Wal-Mart's Web site provide live data reflecting the amount of energy being generated at any given moment. "We want to illustrate to customers how technology can be used," explains Moseley. "They don't get a lot of opportunity to see some of these systems."

Wal-Mart hopes to not only learn environmental conservation best management practices, but also to set benchmarks for future design, land development, and construction in the retail market.

Anticipating sales of \$300 billion in 2005, Wal-Mart continues its aggressive growth plan, with 40 traditional stores and 240 supercenters planned for the US, and over 150 new units internationally. Moseley says the only other experimental store planned is the Colorado facility.

Wal-Mart spokesman Gus Whitcomb admits that this "green" store cost more to build, although he wouldn't release details of construction costs, citing the proprietary nature of the information. Cohen says there are cost savings in the long run, indicating that some states provide financial incentives for the purchase of PV. In those states, he says, the average payback period is 15 years.

Lynch believes the payback in McKinney is different, that Wal-Mart is bringing ideas to a national audience in hopes that more will accept renewable energy options. Cohen says it starts by educating children, adding that the US is picking up European trends, where "green" building and sustainable design are very popular.