



Photo: RB+B Architects, Inc.; David Patterson

Fossil Ridge High School Fort Collins, Colorado

Annual energy costs reduced by \$153,000 with no added design or construction costs

“The biggest selling point of sustainable design with a school administrator is that the building will save money. Our ultimate goal is to build the best classroom possible for the educational process, so if we can give occupants the best, save money, and be environmentally friendly, the bottom line is good for everyone.”

—Stu Reeve, Energy Manager, Poudre School District

A Solid Business Decision

Making Fossil Ridge High School an EnergySmart School was a natural step for Poudre School District. Part of an ongoing commitment to energy efficiency, Poudre published Sustainable Design Guidelines* in conjunction with a 2000 bond issue, with the intention of saving money by constructing the most environmentally sustainable and energy-efficient school buildings possible. The Guidelines and lessons learned from applying them to the construction of two new, high-performance elementary schools gave Fossil Ridge an advantage—every decision made during the design process kept sustainability and energy efficiency in mind.

* Available from Poudre School District at www.psdschools.org/documentlibrary/downloads/Plan_Design_and_Construction/Sustainable_Design_Guidelines_2005.pdf

Project Details

First School in Colorado to earn LEED Silver certification, July 15, 2005

Building: Two stories, 296,375 square feet

Completed: 2004

Financing: Bond issued in 2000

Cost: \$38.5 million; \$128 per square foot; \$21,388 per student

Capacity: 1,800 students

Energy Performance and Savings:

60% below ASHRAE 90.1 1999; \$153,076 annual reduction in energy costs

Energy Costs: \$0.33 and 30,000 Btu per square foot annually

Poudre School District:

- 48 schools
- 24,000 students



Photos: RB+B Architects, Inc.; David Patterson

Design Goals

The Fossil Ridge project team aimed to accomplish four design goals with **no added design or construction costs:**

- Create a healthy and comfortable environment that would encourage learning.
- Use the facility as a teaching tool for environmental design and stewardship.
- Make a resource- and energy-efficient building that would reduce operating costs, leaving more district money available for classroom spending.
- Make the design flexible and adaptable to accommodate any future programmatic changes.

Poudre School District added more specific energy-related goals for Fossil Ridge (shown in the table below). To optimize energy performance, Poudre used the

eQUEST (Quick Energy Simulation Tool) program, which interfaces with the DOE-2.2 building energy model (www.doe2.com). The project team began with a simple sketch that evolved into a detailed room-by-room simulation, including daylighting, advanced HVAC, and envelope characteristics. Initial modeling helped determine the most appropriate design paths.

Financing

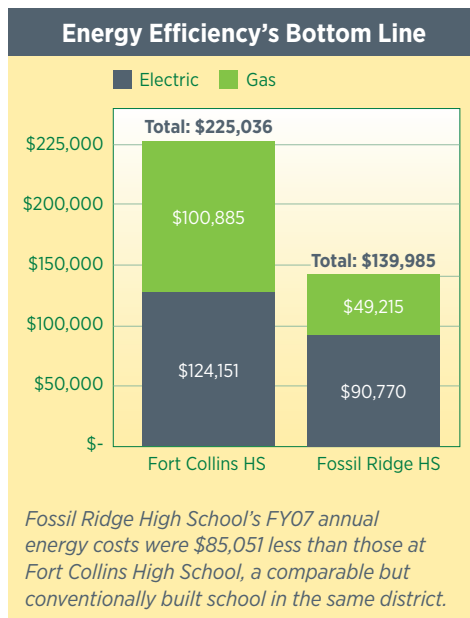
The school was financed with a 2000 bond issue that coincided with the district’s commitment to sustainable design. Fort Collins Utilities’ Integrated Design Assistance Program offered staff support and expertise during the design process and financial assistance to supplement the incremental cost of energy consultants.

“The key factor is right sizing,” said Stu Reeve, energy manager for Poudre School District. “You’re building a better building envelope and the insulation is better, so your mechanical systems get smaller. You rightsize your HVAC—you look at the whole picture, including how asphalt parking lots generate heat in sunshine. It’s building smarter. That’s how you do it.”

Poudre School District Energy-Related Goals	
Goal	Project Outcome
Full daylighting in classrooms for improved student performance and energy savings	Windows sized to provide 100% daylighting in most classrooms year round using clerestories
ENERGY STAR® rated	ENERGY STAR® rated
Maximum cooling demand of 1,000 square foot per ton	Maximum cooling demand of 1,000 square foot per ton
Minimize and shift peak power demand	Reduced lighting demand and efficient HVAC equipment and ice storage lowered peak power demand by 50% and shifted it to off-peak morning hours

The Results

Poudre School District built a high-performance school with no added design or construction costs, saving thousands of dollars a year in operating costs. Completed on time and on a budget of \$38 million, Fossil Ridge is comparable to a similarly sized, conventionally built school. The district collects energy



usage and cost information monthly and compares it against the anticipated energy performance.

As of 2007, energy savings of 60 percent (below ASHRAE 90.1 1999) were achieved at a construction cost of \$128/ft². The result is at least a \$85,000 reduction in annual energy costs (\$271,800 over three years), when compared to Fort Collins High School, that can be put back into the classroom.

The Heschong Mahone Group, building energy efficiency consultants, conducted several studies (available at www.h-m-g.com/projects/daylighting/projects-PIER.htm) to measure the impact of the building's green design strategies. Student and teacher satisfaction levels at Fossil Ridge are very high, and building occupants seem to genuinely appreciate their environment.

The student body has enthusiastically responded to the school's energy-efficient features, forming the FRESH (Fossil Ridge Energy Saving High) organization. This organization focuses on reducing their ecological footprint, learning about the energy saving features of Fossil Ridge, and educating the school community on the benefits of conservation techniques.

"Poudre School District is committed to being a responsible steward of our natural resources and believes that public education should provide leadership in developing an ethic of sustainability in all of its practices ... We believe that by working together in an integrated approach, we can build higher performance schools that provide a superior learning environment, while reducing life cycle costs through conservation of energy and natural resources."

—Don Unger
Superintendent of Schools (2000)
Poudre School District

Fossil Ridge High School—EnergySmart Choices

Feature	Benefit
Solar power	Large shaded windows at the entrance support 5.2 kilowatts of photovoltaic panels that supply emergency power to the building.
Electricity	100% of electricity needs are supplied by wind power purchased from the local utility.
Exterior materials	The white roof reflects solar radiation, reducing the heat island effect and internal cooling loads.
Building envelope	R-values for the exterior walls and roof exceed the ASHRAE 90.1-1999 standard by 37% and 43%, respectively.
Daylighting	Windows provide 100% daylighting in most classrooms year round, using clerestories on the north and south sides. High-performance sensors and dimming ballasts adjust artificial lighting based on available sunlight.
Windows	High-performance, low-E glazed windows provide insulation to reduce heating demand and reduce solar heat gains to lower cooling demand. All classroom windows open for natural ventilation. Automatic sensors turn off heating and cooling when windows are open.
Air conditioning	Chillers produce thermal storage ice at night for cooling during the day. Shifting the cooling load to off-peak demand creates savings of \$9.00 per kilowatt, and allowed installation of a smaller chiller.
Heating	Advanced natural gas condensing boilers are 96% efficient over standard 80% efficient boiler.
Water	Water conservation is a key concern across Colorado. Fossil Ridge uses a raw water pond for campus irrigation, low-flow faucets and toilets, and artificial turf for the athletic field.
Indoor air quality	A primary concern for Poudre, the building features operable windows to let in fresh air, carbon dioxide sensors, and paints and furnishings with low volatile organic compounds (VOCs).

A Successful Model

Key to the success at Fossil Ridge was Poudre School District's commitment to sustainability and holistic, integrated design.

In 1999, the district formed the Green Team to provide direction for practical application of sustainability principles in all of its facilities' construction and operations and maintenance plans. Combining the knowledge and experience of administrators, teachers, operations and maintenance staff, security and food services personnel, architects, engineers, local utilities, and the community, the Green Team developed an integrated, concrete process which reflected the functional needs and realities of all stakeholders while achieving maximum environmental sustainability and energy performance at minimum cost.

Poudre's Sustainable Design Guidelines were released in 2000 and are updated periodically.

Building on the Guidelines and the lessons learned from the subsequent construction of the Zach and Bacon high-performance elementary schools, the Green Team refined the planning and design process for Fossil Ridge. As a result, the Fossil Ridge proposal put out to bid included hard efficiency targets and specific design requirements, so bidding teams knew the client's precise goals. The design budget was increased by two to three percent, enabling the winning design team to collaborate closely with the Green Team to resolve problems before construction began. The district found that spending more time and money upfront to ensure a fully integrated decision process actually reduced problems, construction time, and costs later on.

In the end, Fossil Ridge High School was built at no overall extra cost, saves thousands of dollars a year in operating costs, and is an exceptional facility for learning and working. Poudre School District also has constructed five additional new schools and retrofitted 50 other facilities. Along with Fossil Ridge, these energy-efficient, environmentally responsible projects have reduced operational expenses to among the lowest of the state's 178 districts.

More information about Poudre School District's energy efficiency and sustainability activities is included in its 2007 Annual Sustainability Report, available at www.pdschools.org/documentlibrary/downloads/Operations/Annual_Sustainability_Report_2007.pdf.

"This is a dream building," said Fossil Ridge's media specialist, Lana Fain. "My students have told me that the space and lighting makes it easier for them to focus. They just love being here."

(School Library Journal, 9/1/07)

Lessons Learned

- Start Early—Energy-efficient design takes upfront time, many meetings, and, of course, cooperation.
- Set Specific Goals.
- Use Integrated Design—Know how each component affects the energy performance of other building components.
- Keep it Simple—While sophisticated systems may lead to outstanding energy savings, systems must be easily understood by the maintenance personnel and easily operated by the occupants.
- Be Willing to Compromise—Evaluate each product and system for cost and durability as well as sustainability. An open mind is essential; wearing 'green blinders' is not helpful.

For more information, contact:

Stu Reeve
Energy Manager
Poudre School District
970-490-3502
stur@pdschools.org

Margo Appel
Program Manager
EnergySmart Schools
202-586-9495
www.energysmartschools.gov

EERE Information Center
1-877-EERE-INF (1-877-337-3463)
www.eere.energy.gov/informationcenter

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency &
Renewable Energy

September 2009

Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 10% post-consumer waste.

Endorsed
by



National School
Boards Association

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.