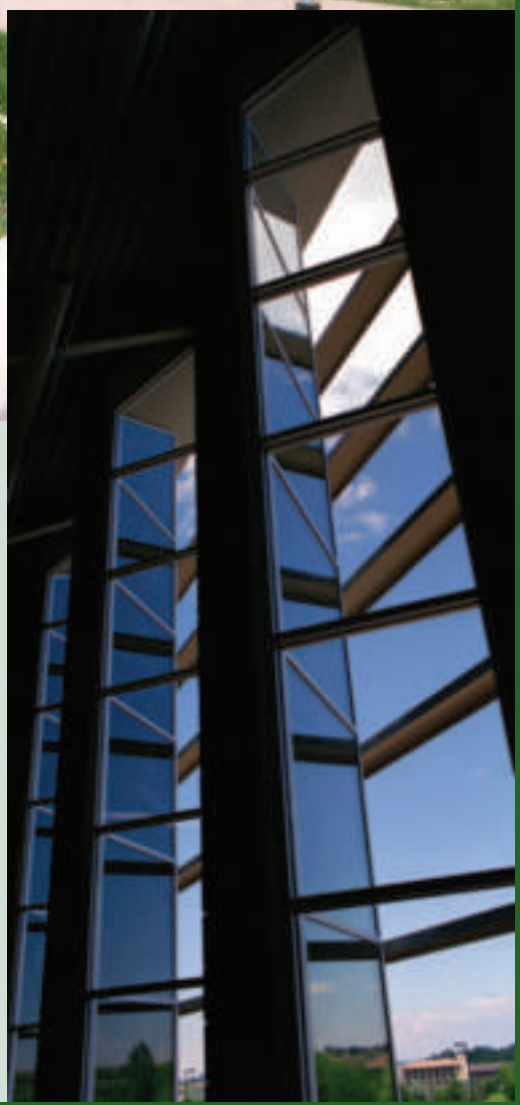
National Renewable Energy Laboratory's Visitors Center

Golden, Colorado

Highlighting high performance

The Dan Schaefer Federal Building, or Visitors Center, at the National Renewable Energy Laboratory displays a variety of interactive exhibits on energy efficiency and renewable energy—energy derived from such sources as the sun, wind, plants, and heat of the earth. Through self-guided tours and workshops, visitors learn how to use renewable energy technologies in their homes, vehicles, and communities to save money and protect the environment.

But the 6,400-square-foot building is also a model for energy-efficient design. Located in Golden, Colorado, the building includes an auditorium, a public reading room, and office space. It incorporates passive solar energy technologies, energy-efficient lighting, and other features to minimize energy costs and environmental impact. Designers used an integrated approach—considering how the technologies can work together—to optimize the performance of the building.



Sections of a Trombe wall, which absorbs solar radiation and slowly releases heat into the building, alternate with windows that take advantage of daylight and early morning heat.

Low-energy design and renewable energy at the Visitors Center

Lighting

Daylighting provides much of the lighting for the Visitors Center, particularly in the exhibit hall. Where daylighting is insufficient, energy-efficient lights fill in. The electric lighting system for the building demonstrates many types and styles of efficient lighting technologies, including compact fluorescent lamps, compact metal halide spotlights, and exit signs illuminated by light emitting diodes (LEDs).

Many of the fixtures are decorative, and some of the fluorescent fixtures are dimmable. Color rendering, including warm and cool lighting, was taken into consideration when choosing lamps to match their environments.

Energy-efficient lights cut down on the building's energy costs.

Energy Management System

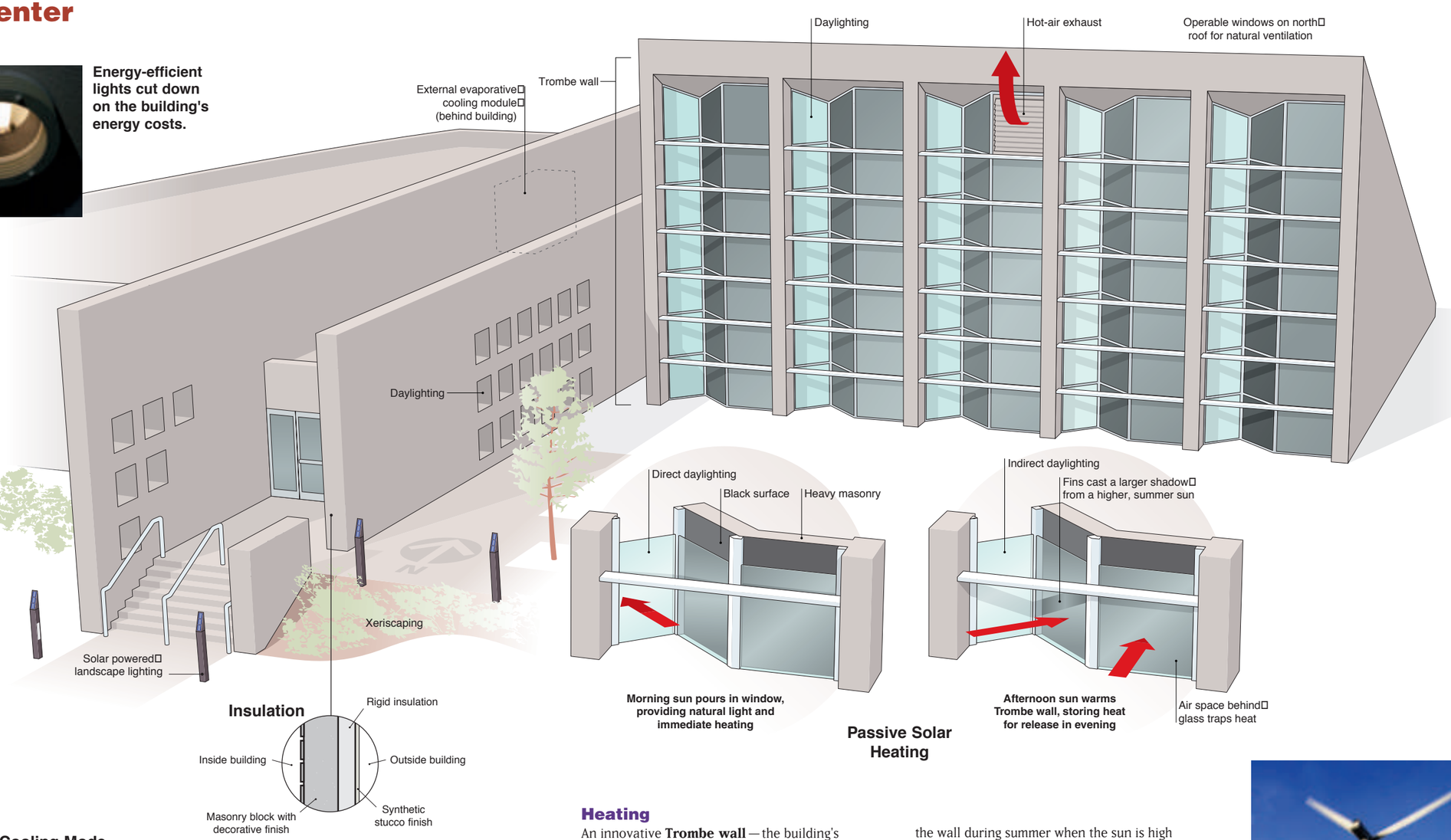
A computer optimizes space conditions, maximizing comfort while minimizing energy consumption. The system monitors temperature, humidity, and occupancy to determine the most efficient method for maintaining appropriate levels in the occupied space. The computer also monitors and records building performance.

Xeriscaping

The Visitors Center is located in an arid climate, where water conservation is important. In keeping with the environmentally friendly building design, the center is **xeriscaped**—landscaped with rocks and drought-resistant plants.

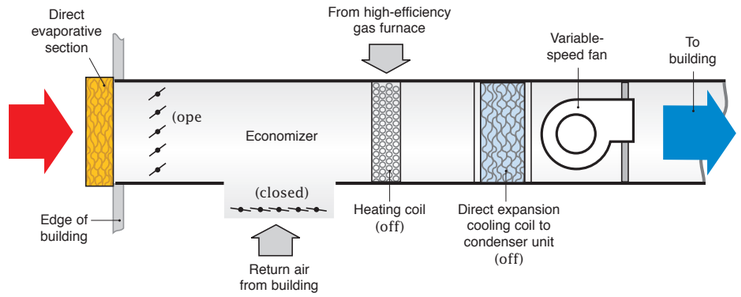
Insulation

The building's exterior walls are designed to help improve the building's energy performance by storing heat. The system consists of a layer of synthetic stucco on the outside, 4 inches of rigid insulation, and 8 inches of decorative concrete block.



Passive Solar Heating

HVAC System — Evaporative Cooling Mode



Cooling

In the building's direct **evaporative cooling system,** the air stream moves over pads sprayed with water. When this water evaporates, it removes heat, cooling the air. This technology works well in environments with low humidity.

A direct expansion air-conditioning system provides additional cooling, when needed. With a minimal amount of energy, variable-speed fans control the amount of cool air directed through the building.

Heating

An innovative **Trombe wall**—the building's most striking architectural feature—lights and heats the exhibit hall. The south-facing wall has five sections, each angled in a "V" shape. Windows on the southeast side of the "V" provide natural daylighting and early morning heat.

Facing south and southwest are thick concrete walls coated with black paint and faced with glass. A small airspace separates the wall from the glass. Direct solar radiation is absorbed by the wall, trapped by the glass, and conducted inward to gradually heat the exhibit hall later in the day. Horizontal beams on the Trombe wall were engineered to shade the wall during summer when the sun is high in the sky. During winter the sun is not blocked by the beams, allowing heat to penetrate into the Trombe wall.

Additional heat is provided by a high-efficiency gas furnace that heats water. A heating coil in the ductwork transfers the heat into the air.

Wind-Powered Electricity — The building's entire electric load of approximately 4,000 kilowatt-hours per month comes from the *Wind*source program of the local utility company. The *Wind*source electricity is generated by large wind turbines in northern Colorado.

Buildings for the 21st Century

Buildings that are more energy efficient, comfortable, and affordable…that's the goal of the U.S. Department of Energy's Building Technologies Program. To accelerate development and wide application of energy-efficiency measures, the program:

- Conducts R&D on technologies and concepts for energy efficiency, working closely with the building industry and with manufacturers of materials, equipment, and appliances
- Promotes energy/money-saving opportunities to both builders and buyers of homes and commercial buildings
- Works with state and local regulatory groups to improve building codes, appliance standards, and guidelines for efficient energy use.

OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

BUILDING TECHNOLOGIES PROGRAM

U.S. DEPARTMENT OF ENERGY

Energy Exhibits

The center is open to the public for tours, and visitors enjoy many interactive exhibits that show the power and the benefits of renewable energy. A favorite exhibit is the outdoor Solar Neighborhood, hosted by Roofus the solar dog. A few small, model homes illustrate the power of the sun and energy-efficient features such as double-paned windows and proper insulation.

The National Renewable Energy Laboratory is located just off I-70, Exit 263, in Colorado. Call 303-384-6565 for additional information.

More Information

The following table shows some of the energy-efficient features of the building as designed, compared to a similar, conventional building. R-values and U-values measure how well the insulation or windows transfer heat—the higher the R-value or lower the U-value, the more resistance. Window solar heat gain coefficients (SHGC) measure the amount of solar heat that enters a building through the glass. High SHGCs allow more heat to pass through and are useful for passive solar applications.

Key Energy-Efficiency Features

	Base Case	Visitors Center
Wall insulation	R-value = 11	R-value=13
Roof insulation	R-value = 19	R-value=20
Floor insulation		
— Perimeter	R-value = 10	R-value=7
Windows		
— SHGC	0.78 double pane	0.56 low-e
— U-values	0.55	0.31

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Through exhibits, visitors learn how to use renewable energy to save money and protect the environment.

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