

A wide-angle photograph of the Zion National Park Visitor Center. The building is a two-story structure with a mix of dark wood, stone, and blue-tinted glass panels. It features a prominent square tower with a window. In the foreground, a paved walkway leads to a covered picnic area with several tables and benches. People are seen walking and sitting at the tables. The background shows the iconic red sandstone cliffs and mountains of the park under a clear sky.

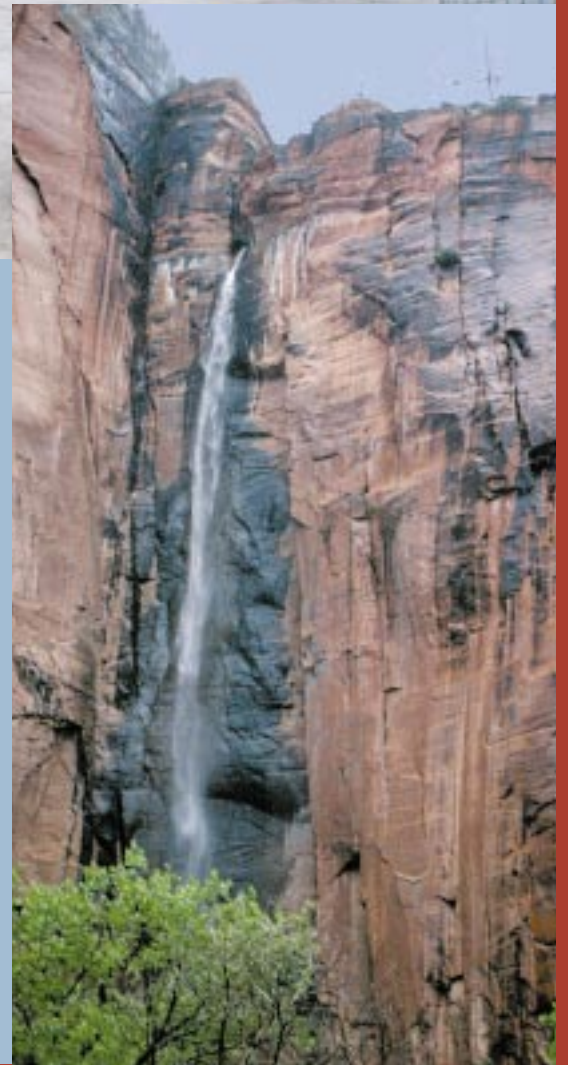
Zion National Park Visitor Center

A Sustainable Building
for the Future

Highlighting high performance

Since the time of the Ancestral Puebloans, visitors to the Zion National Park area have been awed by natural sandstone canyons, mesas, and rock sculptures. Carved by the Virgin River, the narrow canyon provided shade, cool breezes, and natural cooling in the summer and warm rock surfaces in the winter. In 1919, the park was established to preserve the natural beauty of the area for generations to come.

In creating the Zion National Park Visitor Center, the National Park Service, working with the U.S. Department of Energy's National Renewable Energy Laboratory, has stayed true to the tenets of protecting Zion's natural beauty—by creating a sustainable building that incorporates the area's natural features and energy-efficient building concepts into an attractive design, saving energy and operating expenses while protecting the environment. The visitor center, like Zion National Park, serves as an example of how the nation can protect its most precious resource—the earth.



Low-energy design and renewable energy at Zion Visitor Center

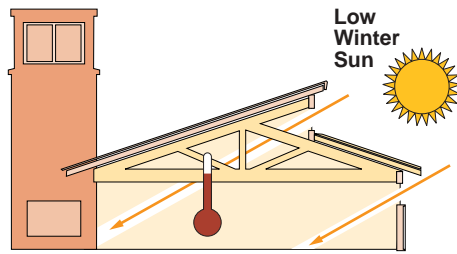
Lighting

The primary source of light in the Visitor Center is daylight. The building's energy management computer adjusts electric light as needed. No incandescent or halogen lights are used—T-8 fluorescent lamps and compact-fluorescent lamps are much more energy efficient. The exit signs provide a gentle glow with solid-state LED technology that also consumes very little energy.

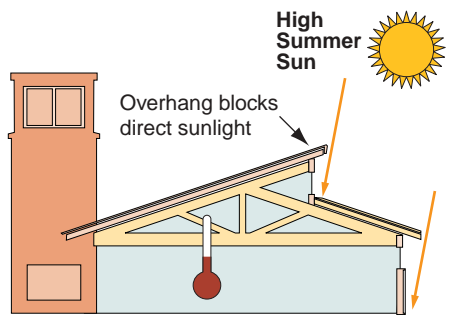
Windows

Clerestory windows are part of the lighting system as well as a part of the heating and cooling systems. Computer simulations helped size the windows to collect the right amount of light. The sun enters in the winter, helping to keep the space heated (passive solar heating), and overhangs shade the glass from the high summer sun. A low-e coating on the glass reduces heat loss from the building while allowing light and heat to enter.

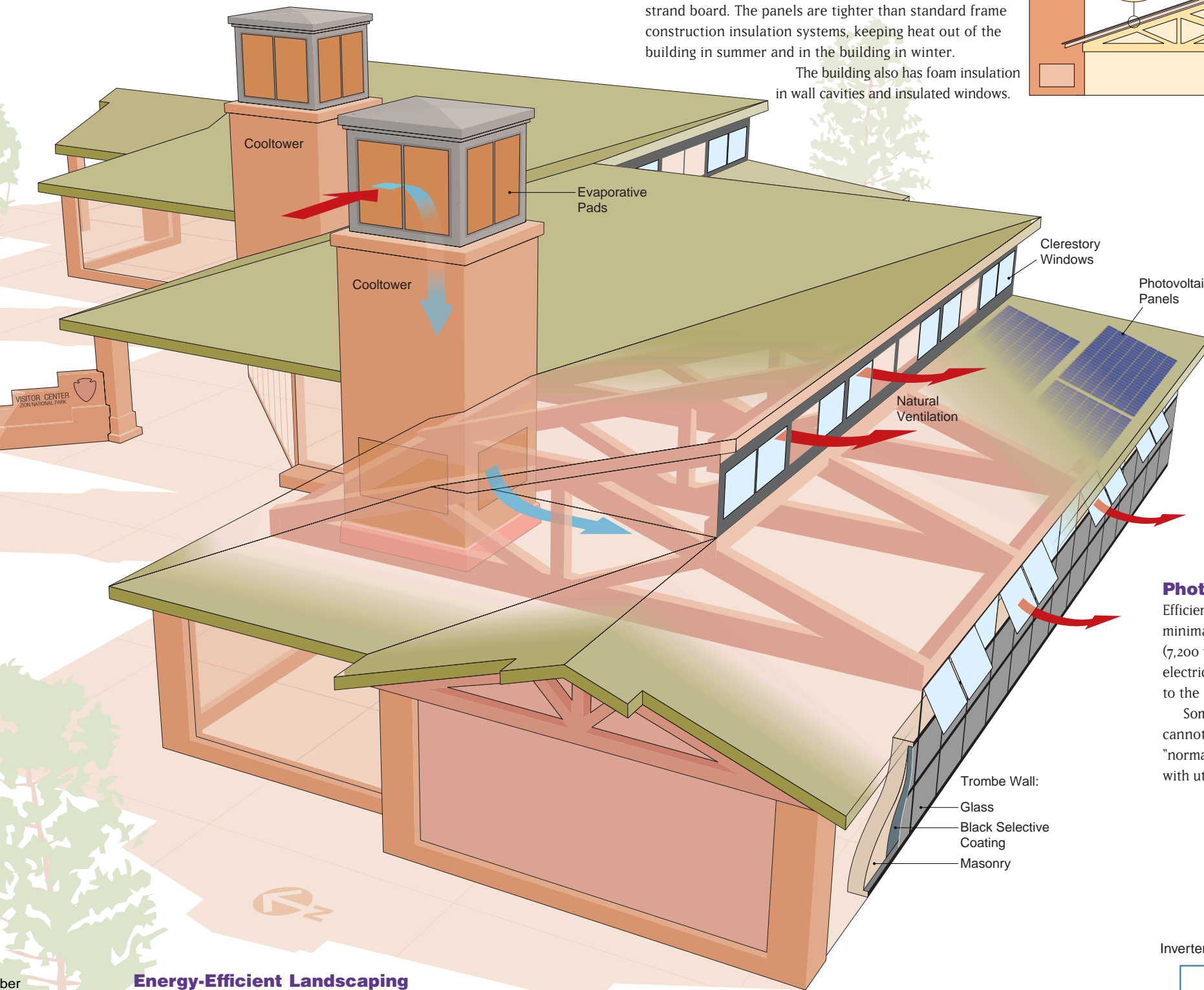
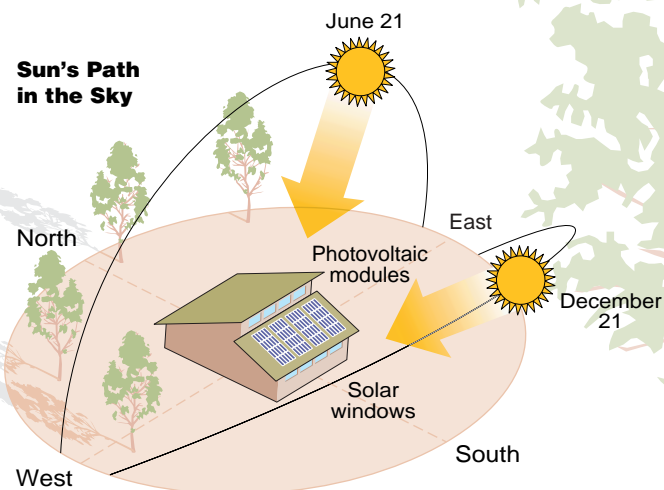
The Visitor Center was designed to block the west windows from the summer sun. These windows are made from glass that diverts the sun's heat. A tree canopy also minimizes heat gain on summer afternoons.



South windows accept direct sunlight to light and warm the building interior



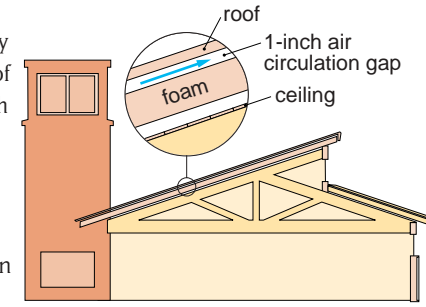
Indirect sunlight lights the building interior without warming it



Insulation

The building is well insulated, designed to use 70% less energy than a typical building without costing more to build. The roof is made of structural-insulated panels. These panels sandwich a layer of rigid foam insulation between sheets of oriented strand board. The panels are tighter than standard frame construction insulation systems, keeping heat out of the building in summer and in the building in winter.

The building also has foam insulation in wall cavities and insulated windows.



Natural Ventilation

The high clerestory windows help cool the Visitor Center by allowing hot air to escape while low windows near the doors allow cool air in. The building's energy management computer controls the operation of the clerestory windows.

Passive Down-Draft Cooltowers

When natural ventilation is not adequate, cooltowers help bring the indoor temperature down. Water sprayed on pads at the top of the towers evaporates, cooling the air. The cool, dense air "falls" through the tower and exits through the large openings at the bottom of the towers. The building's energy management computer controls the size of the openings at the bottom of the tower and can direct the cool air into the building, onto the patio, or both.

Heating

The Trombe wall provides most of the heating for the building. Heat from the sun is trapped between a pane of glass and a black selective coating. A masonry wall stores the heat for release into the building later in the day. Surface temperature of the inside of the Trombe wall can often reach 100°F (38°C). This warm surface provides radiant comfort to the visitors. When the sun is not shining, radiant ceiling panels provide heat.

Photovoltaics

Efficient design of the building eliminated large electric loads—minimal lights and no air-conditioning. Photovoltaic panels (7,200 watts) on the south roof provide the majority of the electricity needed by the building. Excess power is sold back to the power company for use elsewhere.

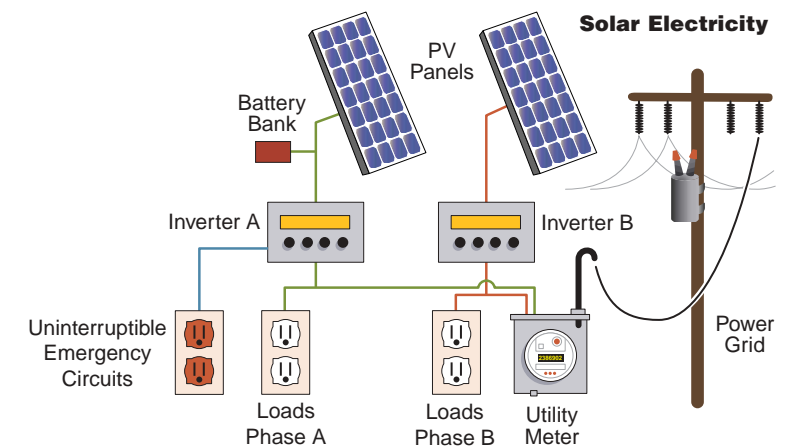
Some of the energy is stored in batteries. When the utility cannot provide power, the batteries provide power for "normal" daytime use. Using photovoltaics in combination with utility power results in a highly reliable power source.

Energy-Efficient Landscaping

Landscaping, including shade structures and existing trees, creates an extension of the Visitor Center. These outdoor "rooms" for permanent displays allow for a smaller building design as well as lower capital and operation costs. Irrigation ditches provide most of the water needed for landscaping, saving pumping energy and water treatment.

Energy Management Computer

A computer ensures that all the energy-efficient features work together, collects weather data, and makes energy decisions about the building. It controls the cooltowers, radiant ceiling panels, lighting, and windows.



Buildings for the 21st Century

Buildings that are more energy efficient, comfortable, and affordable ...that's the goal of DOE's Office of Building Technology, State and Community Programs (BTS). To accelerate the development and wide application of energy efficiency measures, BTS:

- 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
- Provides support and grants to states and communities for deployment of energy-efficient technologies and practices.



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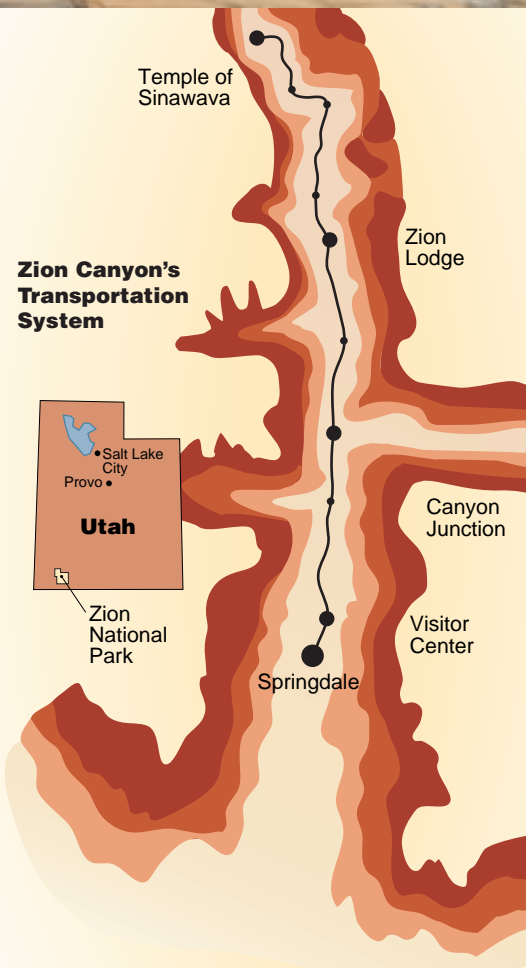


Zion National Park's new transportation system relieves congestion and protects the park.

Transportation: The Key to Protecting the Park

The first automobile road was built into the park in 1917, allowing 1,000 people a year to visit Zion. Today, more than 2.5 million visitors see the park annually. Because Zion exists in a narrow canyon, automobile traffic causes air and noise pollution as well as congestion that is detrimental to the park's resources and visitor experience.

As part of redesigning the visitors' experience, transportation of the park's visitors was an integral part of the plan. Clean-running propane buses were designed to shuttle visitors to nine stops in Zion Canyon and six stops in the town of Springdale, Utah. Visitors are asked to leave their vehicles at parking facilities outside the park. The buses dramatically reduce automobile traffic in the park, protecting the park and providing a pleasant experience for visitors.



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Green Energy Parks Program
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National Renewable Energy Laboratory
Center for Buildings and Thermal Systems
www.nrel.gov/buildings/highperformance

U.S. National Park Service
Zion National Park
www.nps.gov/zion



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