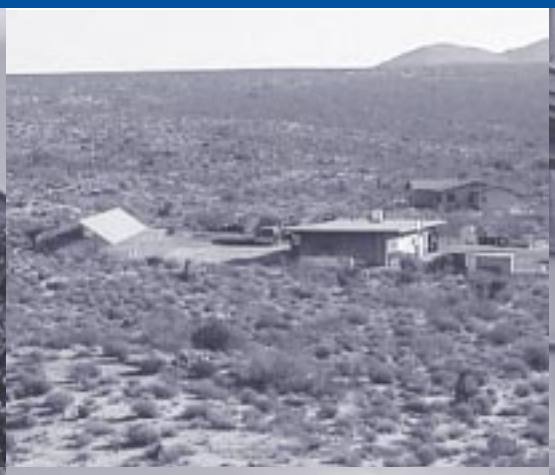
Federal Energy Saver Showcases 1999

FEDERAL ENERGY MANAGEMENT PROGRAM • U.S. DEPARTMENT OF ENERGY



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Executive Summary

Thanks to the efforts of numerous Federal agencies, Federal facilities are becoming less costly to operate. A variety of agencies have implemented significant energy and water efficiency improvement projects. These projects, which employ a wide variety of technologies and products, represent savings in both dollar and environmental costs.

Since 1996, Federal agencies have had the opportunity to share their methods for improving energy and water efficiency through the Federal Energy Saver Showcase program. To date, 75 new or existing buildings have been designated Federal Energy Saver Showcases. This year, nine more sites from a number of regions across the country will be added to the list.

Among the showcases this year are the General Services Administration's Seattle and Denver Federal Courthouses, as well as the National Park Service's (NPS) Visitor Center at Zion National Park in Utah. These three new buildings demonstrate "whole building design"; buildings are designed as integrated systems rather than a series of independent components. For instance, efficiency measures such as additional insulation could make it possible to use a smaller heating, ventilating, and air conditioning (HVAC) system without compromising comfort.

The Seattle and Denver Courthouses also incorporate building-integrated photovoltaics (BIPV). In this technology, photovoltaic (PV) arrays are built into building structures such as skylights and supplement conventional grid-supplied electricity.

NPS and the National Oceanic and Atmospheric Administration (NOAA) also chose to employ PV technology. PV arrays with battery banks and backup generators now supply electricity to remote sites at Joshua Tree National Park and Sleeping Bear Dunes National Lakeshore. When NOAA's project on Maui is complete, the National Marine Sanctuary there will house the first grid-intertied PV-hybrid system on the island.

Showcase facilities at Whitman Mission National Historic Site (NHS) and Palm Beach International Airport (PBI) demonstrate how we can improve energy efficiency by simply replacing less-efficient, outdated equipment. Whitman Mission NHS reduced energy consumption by retrofitting the lighting in its visitor center and maintenance shop. PBI installed additional insulation and a new roof made of light-reflecting material and then replaced old, inefficient HVAC equipment with the most energy-efficient equipment possible.

The National Institutes of Health, Louis Stokes Laboratories Building 50 makes use of state-of-the-art HVAC equipment as well as desiccant energy recovery wheels. The wheels recover energy from conditioned air and use that energy to condition incoming air.

Successful projects such as these are implemented through partnerships with utility providers and the U.S. Department of Energy's national laboratories and Federal Energy Management Program. Assistance may take the form of rebates and creative financing options that encourage the use of energy-efficient products and renewable energy technologies, as well as design and technical assistance and low- or no-cost energy audits.

Federal agencies are charged with identifying showcase facilities in accordance with Executive Order 13123, Section 406(e). Showcases have been selected according to several criteria: the historical significance of the building, the high number of non-Federal visitors it receives, the opportunities that exist to teach visitors about energy improvements, and the ease with which a project's features can be replicated. Federal agencies designate the projects that best incorporate energy efficiency, water conservation, and renewable energy as showcase facilities. These successful showcase projects help our government save money and run more efficiently.

Hawaiian Islands Humpback Whale National Marine Sanctuary

Department of Commerce
National Oceanic and Atmospheric Administration
Kihei, Maui, Hawaii

Each year, thousands of tourists arrive at this newly designated Federal Energy Saver Showcase facility to watch the annual migration of humpback whales. The site also attracts much scientific attention and was featured in the May 1998 issue of *National Geographic* magazine. Not surprisingly then, the energy-saving and renewable energy improvements planned for the sanctuary are not being made simply to save money—although cost saving is one of the benefits. They will also help to educate the sanctuary's visitors.

The U.S. Navy originally built the main building just before World War II. The National Marine Sanctuary (NMS), under the auspices of the National Oceanic and Atmospheric Administration (NOAA), moved to the site in 1994. In 1997, NOAA installed two thermosiphon-type, solar water heaters and security lighting that operates on a stand-alone photovoltaic (PV) system. Inside facility buildings, NMS staff increased the energy efficiency of lighting by installing electronic ballast fluorescent tubes as well as occupancy sensors. The result was a reduction in demand of about 27%.

Now the sanctuary facilities are undergoing a more extensive transformation as conventional grid-supplied electrical power is replaced by renewable sources. The U.S. Department of Energy's Federal Energy Management Program at the National Renewable Energy Laboratory and a Maui Electric Company (MECO) matching grant are funding a Pilot PV Intertie Congeneration Project that will make the facilities at the sanctuary energy independent. Phase I of the three-phase grid-intertied PV system is complete with 1.3 kW of electrical power that lowers demand on the local utility. Phase II will add 2.6 kW of additional power and will include the installation of inverters to prepare for Phase III, as well as dual metering. Phase III will extend the PV system by an additional 3.6 kW of power. Upon completion, NMS will house the first grid-connected system on Maui.

Electrical costs are high on Maui so the prospect of saving an estimated $3,000 per year, as well as being able to sell excess energy back to MECO, is a positive one. This is especially true for an agency whose true intention was to display a clean alternative to fossil fuel, not necessarily to save money. The public may visit this showcase site at 726 South Kihei Road, Kihei, Maui.

Hawaiian Island Humpback Whale NMS/PIX09144

The main building at the Hawaiian Islands Humpback Whale NMS was constructed in 1942. Very few improvements have been made since that time, but now the building houses a part of the first PV-hybrid grid-intertied system on the island of Maui.

Hawaiian Island Humpback Whale NMS/PIX09145

The solar panels on the roof of the Education Center at the Hawaiian Islands Humpback Whale NMS are part of the PV-hybrid grid-intertied system that will allow NOAA to sell excess energy back to the local utility provider.

Denver Federal Courthouse

General Services Administration
Denver, Colorado

The General Services Administration (GSA) approached the expansion of this Federal Courthouse in Denver as a showcase of sustainable design. One of GSA's project goals was to "use the latest available proven technologies for environmentally sensitive design, construction, and operation."

The project's sustainable design consultant, Architectural Energy Corporation of Boulder, Colorado, and the design team developed the building's overall sustainable design strategies. The building achieves a high level of energy efficiency through a combination of strategies that seek first to reduce building energy loads as low as possible and then to satisfy the remaining reduced loads through state-of-the-art, high-efficiency mechanical and electrical systems and renewable energy sources.

The new courthouse makes a statement about alternative energy sources with its highly visible building-integrated photovoltaics (BIPV). The building is crowned by a series of glazing-integrated PV modules incorporated into the top horizontal roof louver of the tower. This PV array will be recognizable from many places around the city. Direct current from the BIPV system is fed into the building's electrical system via a DC to AC power-conditioning unit. The system is utility-interconnected so no battery storage is necessary. Estimated total energy production from the system is approximately 25,000 kWh per year, or about 2% of the building's total annual electrical consumption.

Another important consideration in the sustainable design of the building was the selection of building materials. Local materials, such as brick and native stone, will be incorporated into the exterior cladding system. The building will have steel frames with recycled material content. Most of the flooring materials will be made from recycled or native sources, including native stone, cork, or recycled plastics.

In addition to high-efficiency mechanical systems, renewable energy

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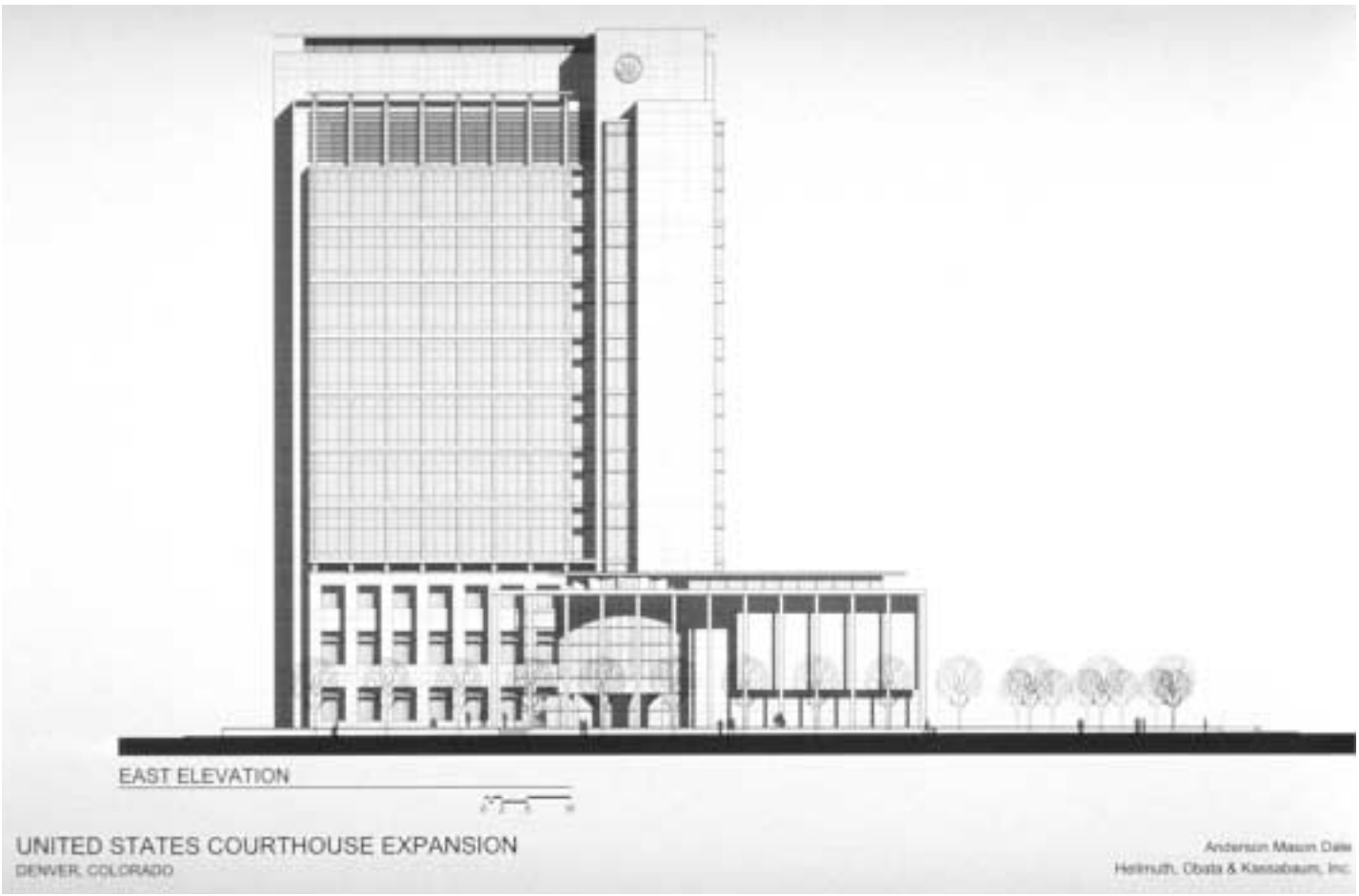
The U.S. Courthouse expansion in Denver will be a showcase for sustainable building design.



Photovoltaics will be integrated into the top roof louver of the tower and into a skylight above the lobby rotunda.

sources, and environmentally sensitive materials, the building's design includes low-impact landscaping to minimize water use, reduce the "urban heat island" effect, and provide an attractive outdoor space. Low-flow lavatory faucets and water closets will also be used throughout to minimize water use. And all interior finish materials were carefully selected on the basis of their impact on the environment and occupants.

This GSA pilot sustainable design project received funding from a congressional budget line item, as well as from the Judiciary. When finished, the building will consume 43% less energy than a building designed according to U.S. Department of Energy standards for energy efficiency. Because the courthouse expansion has been designated a "demonstration project" by GSA, it will be used to influence future courthouse design projects. With an expected 500–600 visitors per day to the building, there will also be ample opportunity to educate the public about sustainable building design. The PV array will be equipped with a data acquisition system that will feed via standard telephone line into a computer display terminal located in a busy area, such as the lobby. The computer will have custom-designed software for displaying both real-time and archived data, as well as educational information.

Seattle Federal Courthouse

General Services Administration
Seattle, Washington

The new Federal Courthouse in Seattle, to be completed in 2002, will showcase the General Services Administration's (GSA) commitment to designing buildings in a sustainable fashion. The nearly $200 million facility has received widespread support from the community and will serve as an opportunity to educate hundreds of visitors per day about sustainable building practices.

The U.S. Department of Energy (DOE), through the Federal Energy Management Program (FEMP) and appropriate national laboratories, provided technical and design assistance to the project. FEMP established sustainable design guidelines to assist the architectural and engineering firm in the whole-building design process and to ensure that energy efficiency is measurable. Using the computer software DOE-2 to create a building energy simulation, the designers established an annual building energy use target of 50,000 Btu per square foot (about half that used by conventional buildings). FEMP also assessed the feasibility of adding renewable energy technologies, such as building-integrated photovoltaics, that can supplement conventional grid-supplied power.

The design of the courthouse includes a minimized building footprint, allowing for an open courtyard that will contain plants requiring little water.

The building's orientation on the site provides solar heat gain in the winter and natural lighting in workspaces. In addition, the building features energy-efficient lighting, occupancy sensors, and a building management system that dims or turns off lights not in use.

Between open offices, low partition heights permit better air circulation and reduce the number of air supply and return locations. Separate air handling unit zones are closely related to the function and anticipated occupancy of the spaces they serve; only the necessary amount of cooling and heating will be delivered to each zone. The air handling units will be variable volume so that, as cooling and heating loads are satisfied, fan speeds can be reduced. And the building will contain a displacement air ventilation system that differs from conventional systems by using natural convection to move air.

Funding for this project came from several sources. GSA appropriated funds for the design and construction of the new building. Seattle City Light, the local utility provider, offered incentives and rebates for the inclusion of energy-efficient systems and equipment. And DOE provided financial assistance through the expertise of the FEMP staff.

As a result of energy-efficient mechanical systems, water conservation, and the application of renewable energy technologies, this 615,000-ft^2 facility will save $300,000 in energy costs per year, in comparison to other facilities of this type. And a projected 50% cost savings in utility consumption will be achieved through attainment of the U.S. Green Building Council's Leadership in Energy and Environmental Design gold rating. This rating system measures a project's sustainability in terms of environmental impact, energy efficiency, occupant comfort, and other criteria.

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The new Federal Courthouse in Seattle will serve to educate hundreds of visitors per day about sustainable building practices.

The Louis Stokes Laboratories—Consolidated Laboratory Facility Building 50

Department of Health and Human Services
National Institutes of Health
Bethesda, Maryland

Building 50 on the National Institutes of Health (NIH) Bethesda campus is scheduled for completion in the spring of 2001. This technologically advanced, consolidated laboratory facility for structural and cell biology research will replace three outdated facilities.

The design of Building 50 includes high-performance, energy-saving features as well as open labs and minimal corridor space. These elements will make the facility efficient in terms of both usable space and energy usage. The efficient use of space allows more funds to be spent on energy-efficiency measures while, overall, the project's construction costs per gross square foot remain reasonable.

The six-story, 290,000-gross-ft^2 building will include several mechanical components that will contribute to an estimated 40% reduction (in comparison to typical research laboratory facilities) in energy consumption.

Dessicant energy recovery wheels rotate between the supply and exhaust air streams in each of the eight, 50,000-cubic-feet-per-minute (cfm) air-handling units. In colder months, outgoing warm air raises the temperature of the wheel, which, in turn, spins through the cooler incoming outdoor air and raises its temperature. In warmer months, the opposite occurs, and the incoming air is precooled.

In order to reduce the risk of contamination, only general exhaust passes through the energy wheels. Fume hoods and other containment devices have a separate exhaust system.

Ernie Branson, Medical Arts, NIH/PIX09134

The Louis Stokes Laboratories design and construction team poses at one of the eight Semco™ desiccant energy recovery wheels. Clockwise from top right: Frank Kutlak, NIH Architect/Project Manager; Michael Ufer, HLM Design Inc.; Stefan Domby, Mechanical Engineer, RMF Enginnering Inc.; Brian Temme, Project Manager, Sverburp-CRSS; and Jeremy Bardin, Project Manager, The Bell Company (general contractor).

The energy wheels filter out most of the summertime humidity and increase the humidity of dry, incoming winter air. These energy recovery wheels will provide up to a 50% reduction in peak demand load for cooling, heating, and humidification of the building.

Variable air volume (VAV) supply and exhaust systems consume 30%–50% less energy than the more common constant-volume systems. With VAV systems, airflow per volume and temperature vary according to demand.

Instead of a constant volume of supply air, maintained by a motor running at a constant speed, variable frequency drive (VFD) fans can operate within a range of speeds. VFD fans can reduce or increase the volume of incoming air from a maximum of 400,000 cfm (fifteen air changes per hour) to a minimum of 160,000 cfm (six air changes per hour). VFD pumps work in the same way, but instead of moving air they pump water as required by load demands.

Building 50 also uses VAV fume hoods that allow a maximum airflow of 1,000 cfm and a minimum of 300 cfm. This flexibility prevents conditioned air from being unnecessarily exhausted.

Building 50's design incorporates double-height windows that provide natural lighting in work areas. Task lighting is used in individual workstations. And the building is equipped with high-efficiency, electronic-ballast lighting and LED exit signs as well as programmable lighting and occupancy sensors.

Unlike most new buildings, Building 50 did not require a central heating and chilling system because those systems were already central to the NIH campus. Funds that might have covered those installation costs went, instead, toward systems to increase energy efficiency. As this building will cost approximately 40%–50% less per year to operate than typical research labs, its energy-efficient features will quickly pay for themselves as well as result in a two-million-dollar reimbursement from the energy provider.

Joshua Tree National Park Cottonwood Visitor Use Complex

Department of the Interior National Park Service Twenty-Nine Palms, California

The Cottonwood Visitor Use Complex in sun-drenched Joshua Tree National Park is one of several National Park Service (NPS) sites that have been designated Federal Energy Saver Showcases. Until 1998, the park used 32-kW diesel generators to provide electricity to the remote Cottonwood site. Individual gasoline generators powered the park's campground amphitheaters. The U.S. Department of Energy's Sandia National Laboratories recommended that the diesel and gasoline generators be replaced by two photovoltaic (PV) systems. A 21-kW PV array, a 250-kWh bank of batteries, a 30-kW inverter and battery charger, and a 30-kW propane generator for backup power replaced the diesel generators. And a separate 2.0-kW PV system now supplies electricity to the park's amphitheaters.

Sandia also recommended several additional changes to increase energy efficiency. The park switched electric heating loads to propane, installed occupancy sensors to control lighting, retrofitted all lighting with fluorescent fixtures and lamps, equipped residences with highly efficient refrigerators, increased building insulation, and added shading structures to reduce cooling requirements.

The Federal Energy Management Program assisted NPS in evaluating financing options for the Joshua Tree project and supplied $20,000 for the changes made to increase energy efficiency. Appropriated funds would have been the least expensive way to finance the project, but, at the time of project planning, such funds were not available. Savings lost while waiting for appropriated funds to become available represented a cost greater than that of alternative financing options.

Ultimately, NPS contracted with Southern California Edison (SCE), the local utility provider. SCE installed the PV system for a 10-year fixed monthly service charge of 1.6% of the installation cost. SCE also assumed responsibility for the operation and maintenance of the system. The contract provided for the option of renewal for an additional five years at the end of the 10-year term. A buy-out schedule was also devised to allow NPS to pay for the PV system without penalty should appropriations become available.

The cost of the new PV system was $265,000, with an estimated annual operating cost of only $1,100. The simple payback (which does not include the cost of future battery replacements) is 5.4 years. Battery replacement will be necessary in 10 years and will cost $25,000.

NPS has a guideline that assigns a dollar value to pollutant emissions for inclusion in life-cycle cost analyses. In this case, basic annual operating expenses for the generators used at Cottonwood were about $27,000 per year. With the cost of emissions included, total operating costs were estimated at about $49,700 per year. Annual emissions from the generators at Cottonwood were estimated at 5,770 pounds of nitrous oxides, 286 pounds of sulfur dioxide, 218 pounds of suspended particulate, and 120 tons of carbon dioxide. The new system eliminates pollutant emissions by about 85% and lowers annual operating costs by about 90%.

According to John Williams, Buildings and Utilities Foreman at the park, "All the component parts of this project are 100% replicable anywhere the sun shines." Joshua Tree staff have taken special care in documenting the process and outcomes of the project. The staff even provide interpretive tours to high school groups wishing to learn more about renewable energy.

Harry Carpenter/PIX07260

After increasing energy efficiency at the Cottonwood Visitor Complex, NPS replaced diesel generators with a 21-kW PV array and a propane generator for backup power.

Sleeping Bear Dunes National Lakeshore, North Manitou Island

Department of the Interior
National Park Service
Empire, Michigan

North Manitou Island is a 15,000-acre wilderness area in Lake Michigan. In addition, the island is home to a separate, 52-acre, National Historic Landmark site. The Landmark contains several historic structures that serve as an administrative area.

Each year from May 15 to November 15, the island plays host to some 10,000 hikers, campers, birdwatchers, and other outdoor enthusiasts. Before installation of the photovoltaic (PV) hybrid system that now supplies the island's electricity, visitors and staff contended with noise and air pollution caused by three 30-kVA diesel generators. In addition to the air and noise pollution of the generators, the transport of fuel to the island by boat also posed the threat of an accidental spill. According to the maintenance foreman, Paul LaValley, even a small amount of fuel spilled in a lake or at an isolated location can necessitate a difficult and costly clean up. Diesel and propane used for cooking also had to be stored on the island, which created some safety concerns.

In collaboration with the U.S. Department of Energy and Sandia National Laboratories, the National Park Service invested $190,000 in the hybrid-PV system that now provides 85% of the island's energy needs. The system consists of a 10-kW PV array, installed in three subarrays; a 2400-Ah battery bank at 120 V (sufficient for five cloudy days); a 15-kW inverter to convert 12 V DC to 120 V or 240 V AC power; and controllers and switchgear needed to optimize the system's functioning and backup. Diesel generators are required occasionally, especially from Labor Day to November, and they continue to supply about 15% of the island's energy needs.

Currin Corporation/PIX05667

A hybrid PV/diesel generator system provides energy to the historically significant buildings that house administrative offices on North Manitou Island in Sleeping Bear Dunes National Lakeshore, Michigan.

Currin Corporation/PIX08886

A new 10-kW hybrid PV/diesel generator system protects the wilderness area on North Manitou Island by significantly reducing the noise and air pollution caused by the old diesel generator system.

A hybrid system such as this, consisting of PV arrays, battery banks, and diesel generators, is especially useful in an area not served by the conventional electric-power grid. It provides power 24 hours per day, and reduces the noise and air pollution caused by the diesel generator system by 85%. The hybrid system will also save $2,500 per year in diesel fuel costs as well as the costs of transporting fuel to the island.

The NPS staff on North Manitou Island have been using the PV-hybrid system for three years. They believe it is a system that could and should be used throughout the Park Service as a way to conserve and protect the National Parks. The system also educates visitors and encourages them to be more environmentally conscious in their own homes.

Whitman Mission National Historic Site Visitor Center

Department of the Interior
National Park Service
Walla Walla, Washington

Whitman Mission National Historic Site/PIX08907

New "green" lighting retrofits in the visitor center museum reduce energy consumption without compromising quality.

Whitman Mission National Historic Site (NHS) is one of several National Park Service (NPS) facilities that have been designated Federal Energy Saver Showcases. Since 1992, Bruce Hancock, Chief of Maintenance, and other staff at the park have retrofitted outdated lighting systems in the maintenance shop and visitor center. The result is a 25%–40% reduction in energy consumption in 1999, representing cost savings of $825–$1,580.

Denise Fong of Lighting Design Lab, Steve Butterworth, NPS Regional Energy Conservation Manager, and the park staff worked together to identify locations and ways to update the park's lighting. Most of the costs for the lighting retrofits were paid with funds authorized for park maintenance, but some special regional funding for equipment procurement was used in the early stages of the project. Federal Energy Management Program staff assisted Whitman Mission NHS with an agreement between the U.S. Department of Energy and the Lighting Design Lab.

Because lighting accounts for 20%–25% of electricity used annually in the United States, it is a logical place to begin when making changes to reduce energy consumption. In the visitor center and maintenance shop, most of the old light fixtures were fluorescent, electromagnetic ballast, 40 W T-12 tubes. These were replaced with electronic ballast, 32 W T-8 tubes. Some overhead fixtures were also replaced with task lighting fixtures designed for energy efficiency. And many of the old incandescent fixtures in the facilities were replaced with compact fluorescent lighting (CFL) retrofits.

In the auditorium and exhibit areas, incandescent lighting could not be replaced with CFL without compromising the quality of light and the use of dimmers. Fourteen fixtures with 120 V, 60 W incandescent lamps were replaced with 130 V, 20 W R-30 Hytron lamps. In the exhibit area, 120 V, 75 W reflector lamps were replaced by 130 V, 45 W halogen IR Lamps. These replacements save energy because of their lower wattage, and, because of their higher voltage, the lamps have a greater life expectancy.

Occupancy sensors were also installed in the exhibit area. The space, originally designed for 8–10 hours of illumination each day, was monitored for one year after installation of the sensors and was found to require only about two hours of illumination per day.

Approximately 80,000 visitors tour Whitman Mission NHS facilities annually. The staff at the park are dedicated to encouraging sustainable practices. Plaques at the park already educate visitors about recycling. And now Whitman Mission NHS staff are revising the Web site and field trip guide to include information about the energy-efficient lighting.

PIX09159

In creating the Zion National Park Visitor Center, the National Park Service protected 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.

Zion National Park Visitor Center

Department of the Interior
National Park Service
Springdale, Utah

Since its designation as a National Park in 1919, the number of visitors to Zion's natural sandstone canyons, mesas, and rock sculptures on the Virgin River has grown steadily. Now, the National Park Service (NPS) has worked with the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) to create a new visitor center to serve both the park's current 2.5 million annual visitors as well as visitors in the future.

Completed in May 2000, the Zion Visitor Center demonstrates the concept of "whole building design," a process that operates from a systems engineering perspective. Buildings designed in this way are conceived of as a system rather than as a series of independent components. The result at Zion is a sustainable building that incorporates the area's natural features and energy-efficient building concepts into an attractive design that saves energy and operating expenses while protecting the environment.

The Visitor Center uses 70% less energy than a typical building. And, because the building required no mechanical systems such as air conditioning, construction costs were lower. An energy-management computer that ensures all of the building's energy-efficient features are working together is key to the design of the building. The design also incorporates "outdoor" rooms that allow for a smaller building design, as well as lower capital and operation costs. Instead of adding fully enclosed rooms to the building, shade structures and existing trees create space for permanent displays.

PIX09160

Water sprayed on pads at the top of this passive down-draft cooltower evaporates and cools the air. This cool dense air "falls" through the tower and exits through large openings at the bottom of the tower, reducing temperatures inside the building.

In the winter most of the heat for the building comes from the sun. A Trombe wall traps the sun's heat between a pane of glass and a black selective coating. Heat-storing masonry in the wall can exceed 100°F (38°C) and provide radiant comfort to visitors. Another source of heat is the thermal mass flooring. The colored concrete floor is heated by sunlight entering the building during the day. That heat is then released at night. A low-e coating on the window glass allows light and heat to enter but reduces the amount of heat loss to the outside. On days when the sun is not shining, radiant ceiling panels provide heat to the building. The roof is made of structural-insulated panels that sandwich rigid foam insulation between sheets of oriented strand board, thereby reducing heat loss in the winter.

The roof insulation also keeps heat out of the building during the hot summer while passive down-draft cooltowers help to reduce interior temperatures. Water sprayed on pads at the top of the towers evaporates and cools the air. This cool dense air "falls" through the tower and exits through large openings at the bottom of the towers. The energy-management computer controls the size of the openings at the bottom of the tower and can direct cool air into the building. Optimized overhangs, the length and position of which were determined by hourly computer simulations, shade high clerestory windows from the summer sun. The energy-management computer can open the high windows to allow hot air to escape while low windows near the doors allow cool air in.

The clerestory windows are a part of the lighting system as well as the heating and cooling systems. Computer simulations were used to carefully size the windows to collect the right amount of light. Heating and cooling needs were considered, maximizing direct sunlight in winter and minimizing it in summer. The building's energy-management computer adjusts electric light as needed, but the primary source of light in the building is daylight. When needed, the building uses only energy-efficient T-8 fluorescent, T-5 fluorescent, and compact-fluorescent lamps as well as LED exit signs.

Paul Torcillini, NREL/PIX08931

The Trombe wall provides most of the heating for Zion National Park Visitor Center. 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.

Efficient design of the building eliminated large electric loads. On the south roof, a 7.2-kW photovoltaic (PV) array provides the majority of the electricity needed by the building. The PV system also provides uninterrupted power supply (UPS) for the building. During power outages, the energy-management computer will shut down nonessential electrical loads so that the PV/UPS system will support enough building operations to continue business for at least one-half hour without any additional PV power, or all day if PV capacity is available.

Officials at Zion have negotiated a net-metering agreement with the local utility—excess power will be sold back to the power company for use elsewhere.

Palm Beach Air Traffic Control Tower

Department of Transportation
Federal Aviation Administration
West Palm Beach, Florida

As a part of the Energy Policy Act of 1992, Federal agencies were required by 2000 to reduce per-square-foot energy consumption by 20%, compared to a 1985 baseline. In 1999, Executive Order 13123 issued further directives to improve energy management within the Federal Government—a 30% reduction in facility energy use by 2005, and 35% by 2010, relative to 1985 levels. Despite the fact that the Federal Aviation Administration (FAA) is exempt from such directives, FAA National Energy Manager Howard Kernodle, Southern Regional Energy Manager Ray Ryle, and Energy Coordinator Odel Torres have developed an excellent energy savings program for FAA facilities.

The Air Traffic Control Tower at Palm Beach Airport is one example of the program. The tower showcases the opportunities for energy savings that occur when outdated equipment is replaced with the latest energy-efficient equipment. Using appropriated funds, the FAA completed a lighting retrofit at the tower. They also installed a new light-reflecting, well-insulated roof, which reduces cooling costs in southern Florida's warm climate. At the same time, four out of six older air-conditioning units were replaced. A generator, which supplies power for the 24-hour facility in the event of an emergency, was also replaced. The new generator not only uses significantly less energy than the old one but is also capable of supplying more power.

Florida Power and Light (FPL), the local utility provider, assisted the FAA with decisions about new equipment and gave rebates to the local FPL-approved contractors who installed the new products—a savings that was passed on to the FAA in the form of reduced contractor fees. With the guidance of FPL, the staff at the tower selected the most energy-efficient products available. The result of their careful selection demonstrates the ease with which energy and cost savings can be achieved.

Odel Torres, FAA/PIX09140

Although FAA facilities are exempt from the energy-efficiency requirements of the most recent executive order, the FAA updated lighting and air conditioning equipment, replaced the roof, and improved insulation at the West Palm Beach Air Traffic Control Tower. The best energy-efficient products available significantly reduced energy consumption without compromising the agency's mission: "To make the U.S. air traffic system the safest in the world."

Odel Torres, FAA/PIX09141

To ensure uninterrupted power at the West Palm Beach Air Traffic Control Tower, the FAA replaced an older generator with this new generator that not only uses significantly less energy than the old one, but produces more power as well.

Energy consumption and costs are being tracked in order to make accurate total-energy and cost-savings comparisons. Current estimates are that the lighting retrofit and air-conditioning projects will have a payback of less than three years.

Technology Links

The Federal Energy Management Program (FEMP):
http://www.eren.doe.gov/femp

Order FEMP Materials, including Federal Technology Alerts, Renewable Energy and Energy Efficiency Project Case Studies, and Renewable Energy Technology Focuses, on the Web at:
http://www.eren.doe.gov/femp/ordermaterials.html

Showcase program overview and showcases past and present:
http://www.eren.doe.gov/femp/prodtech/successstories.html

The Center for Renewable Energy Resources
http://www.nrel.gov/energy_resources/

The National Center for Photovoltaics (NCPV):
http://www.nrel.gov/ncpv/

Sandia National Laboratories Photovoltaics Program:
http://www.sandia.gov/pv/

The U.S. Department of Energy photovoltaics (PV) Web site:
http://www.eren.doe.gov/pv/

A Web-based PV Fact Sheet:
http://www.eren.doe.gov/erec/factsheets/pvbasics.html

FEMP's revised *Greening Federal Facilities* document will be available by fall 2000 on the FEMP Web site:
http://www.eren.doe.gov/femp/

About whole building design:
http://www.eren.doe.gov/buildings/build_design.html
http://www.sbicouncil.org/about/wholeBld.html

About fuel cells:
http://www.fuelcells.org/

Pacific Northwest National Laboratory fuel cell power Web site:
http://www.pnl.gov/fuelcells/

Lighting Systems research group at Lawrence Berkeley National Laboratory:
http://eetd.lbl.gov/btp/lsr/

FEDERAL ENERGY
MANAGEMENT PROGRAM

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