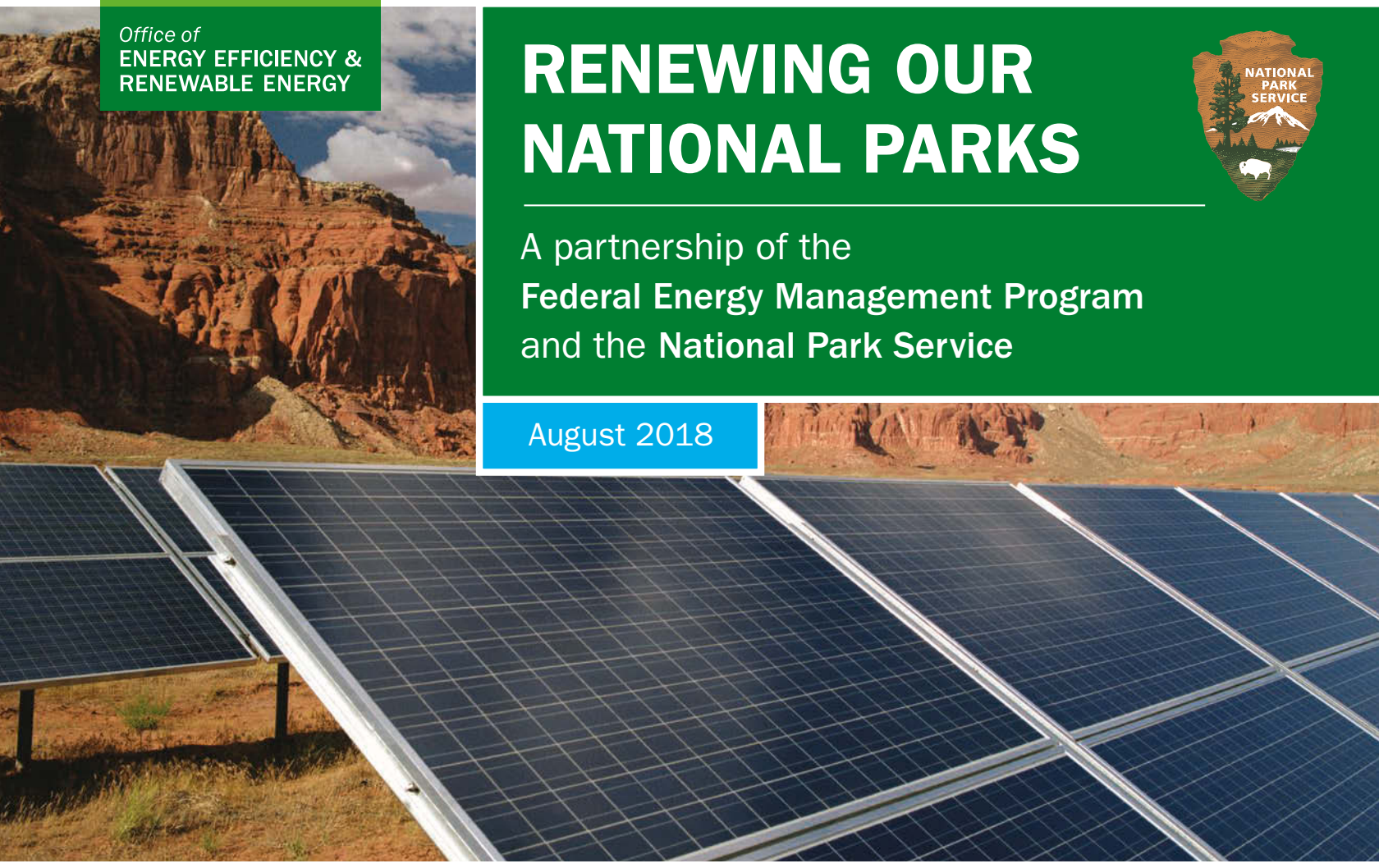
U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY

RENEWING OUR NATIONAL PARKS

A partnership of the
Federal Energy Management Program
and the **National Park Service**

August 2018



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Alcatraz Island

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Federal Energy Management Program

Location:	San Francisco, California
System Type:	Photovoltaic (PV) microgrid
System Size:	305 kW
Installation Cost:	$8.5 million
Project Completion:	2012
Project Savings:	400,000 kWh/year (energy), 337,000 kg/year greenhouse gases (GHG)
Load Service Area:	Cell house building
Project Champion:	Laura Castellini
FEMP Assistance:	Feasibility study, design development, design review, and system performance evaluation

With $8.5 million from the American Recovery and Reinvestment Act of 2009, NPS installed a solar-powered microgrid atop the roof of the main cell house building. The microgrid system integrates the new PV system with diesel generators via digital controllers and inverters to power the island. The surplus of electricity is sent to a special energy storage unit.

Prior to 2012, power generation was provided via diesel generators. The volume of **diesel fuel shipped** to the island **has decreased** approximately

75%

from 2012.

Biscayne National Park

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Location:	Homestead, Florida
System Type:	Photovoltaic (PV)
System Size:	15 kW
Installation Cost:	$411,500
Project Completion:	2011
Project Savings:	9,738 gal/year diesel and 217,194 lb/year carbon dioxide emissions
Load Service Area:	Two residences, wastewater treatment plant, and comfort station
Project Champion:	Elsa Alvear
FEMP Assistance:	Technical assistance, design reviews, funding assistance, and system performance evaluation

Ninety-six percent of Biscayne National Park is water and wetlands, and fuel spills can be a risk when transporting fuel to the park. A 15-kW PV system replaced two 60-kW diesel generators, reducing the need for fuel transport in addition to the noise pollution from the generators.

This project was a

2011

Federal Energy and Water Management

Award nominee.

Blue Ridge Parkway

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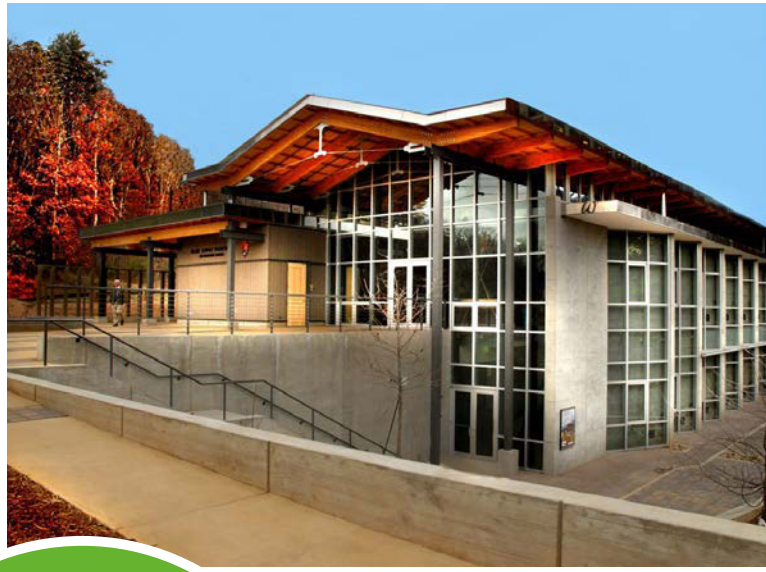
Federal Energy Management Program

Location:	Virginia and North Carolina
System Type:	Photovoltaic (PV)
System Size:	1,560 kW
Installation Cost:	$56,000
Project Completion:	2012
Project Savings:	$19,000/year (estimated) in materials and labor hours, fuel, vehicle maintenance, and hazardous waste (alkaline batteries)
Load Service Area:	469 miles of parkway
Project Champions:	Michael Molling and Debra Northrop
FEMP Assistance:	AFFECT funding, design development, design review, and system performance evaluation



Blue Ridge Parkway is one of the most visited parks in the national park system. Its 1,560-kW PV system includes 300 safety lights, which provide lighting for nighttime visitors and improve site visibility throughout the day. The PV panels operate with rechargeable batteries to power LED lamps during the night.

300

solar-powered barricade lights replace 300 alkaline battery-powered barricade lights along 469 miles of mainline roadway of the Blue Ridge Parkway.

Channel Islands National Park

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Location:	Ventura, California
System Type:	Photovoltaic (PV) and wind hybrid
System Size:	Two 10-kW wind turbines; one 5-kW and several 400-W PV arrays
Installation Cost:	Not available
Project Completion:	2000
Project Savings:	Reduced fuel costs
Load Service Area:	Various
Project Champion:	Kent Bullard
FEMP Assistance:	Feasibility study, design development, design review, and system performance evaluation

Channel Islands National Park is an early and sustaining member of the NPS Go Green campaign. Two wind turbines and several PV systems provide power to facilities on Santa Cruz, Santa Rosa, and San Miguel islands. These power sources significantly reduce diesel consumption in generators and risk in transporting fuel from the mainland to the islands.

The park headquarters in Ventura has a

1-kW PV system that supports the radio and alarm systems.

Chickasaw National Recreation Area

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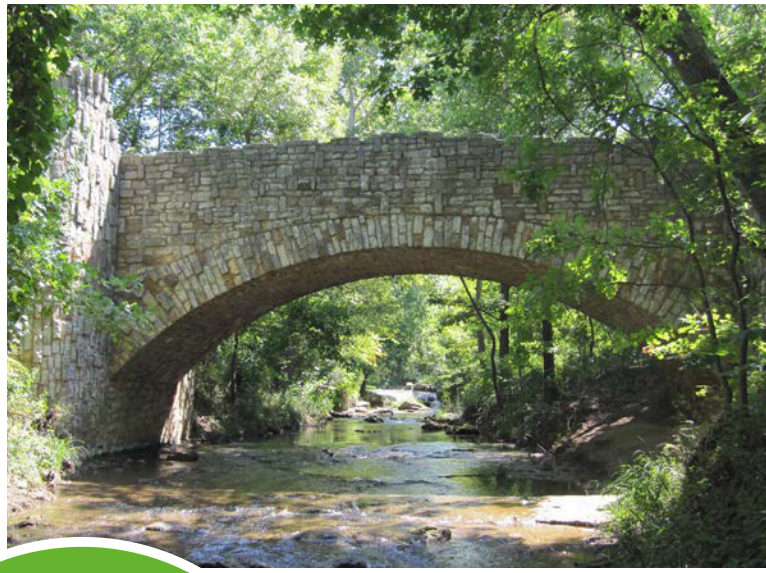
Location:	Sulphur, Oklahoma
System Type:	Solar hot water
System Size:	500-gal tank (small stations) and 1,000-gal tank (large stations)
Installation Cost:	Not available
Project Completion:	1994 and 2000
Project Savings:	9,394 kWh/year totaling $867/year (small station) and 18,194 kWh/year totaling $1,789/year (large station)
Load Service Area:	Comfort stations
Project Champion:	Kent Bullard
FEMP Assistance:	Feasibility study, design development, design review, and system performance evaluation



The solar hot water system provides water to comfort stations at a consistent temperature of 105°F. Tanks store hot water for each of the stations: 500 gallons for the small stations and 1,000 gallons for the large stations. Water demand is reduced by the use of low-flow showerheads and 1-minute push-button timers.

For the comfort stations equipped with storage tanks,

100%

of the hot water comes from the solar hot water system.

Crater Lake National Park

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Location:	Crater Lake, Oregon
System Type:	Photovoltaic (PV)
System Size:	360 W
Installation Cost:	$15,000
Project Completion:	1994
Project Savings:	Reduced diesel fuel costs
Load Service Area:	North Entrance Station
Project Champion:	Brian Coulter
FEMP Assistance:	Design development, design review, funding assistance, and system performance evaluation

Crater Lake National Park, home of the deepest freshwater lake in the world, is an early pioneer of the NPS Go Green campaign. PV panels provide power to Crater Lake's North Entrance Fee Station, which has no connection to a commercial power source. The PV system eliminates the need for a noisy diesel generator.

The
360-W
PV panels at the park's north entrance station provide
100%
of needed power.

Death Valley National Park

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Federal Energy Management Program

Location:	Death Valley, California
System Type:	Photovoltaic (PV)
System Size:	90 kW
Installation Cost:	$793,000
Project Completion:	2012
Project Savings:	150 MWh/year
Load Service Area:	Furnace Creek Visitor Center
Project Champion:	Sarah Craighead
FEMP Assistance:	Feasibility study, funding assistance, design development, design review, and system performance evaluation

The remodeled Furnace Creek Visitor Center, which opened in February 2012, includes two PV systems—a 60-kW shade structure array and a 30-kW field array near the headquarters parking lot. The original visitor center, built in 1960, was nominated as a national historic structure and the remodel preserved significant features of the facility.

Multiple PV systems, totaling more than **40 kW** throughout the park, **are used for reverse osmosis plants and dorms.**

Glacier National Park

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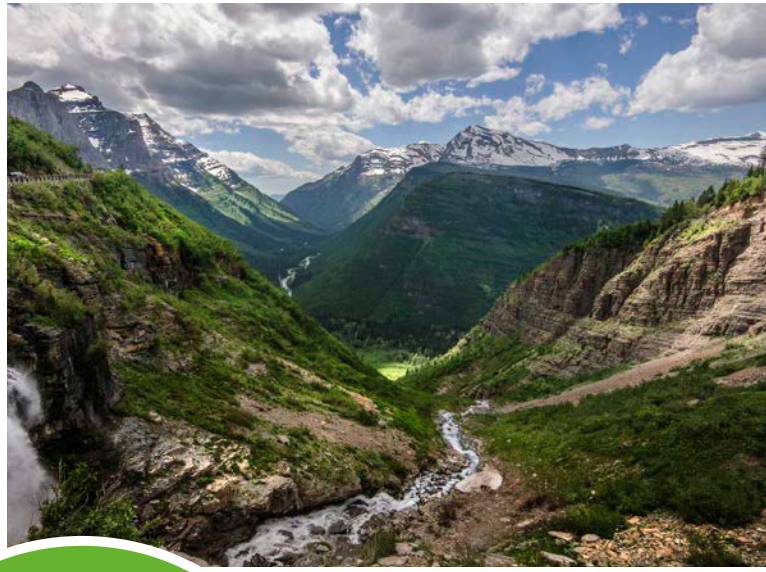
Location:	Goat Haunt, Montana
System Type:	Photovoltaic (PV)
System Size:	3.6 kW
Installation Cost:	$5,000
Project Completion:	1994 and 2010
Project Savings:	Reduced fuel costs
Load Service Area:	Goat Haunt International Visitor Center
Project Champion:	Jim Foster
FEMP Assistance:	Design development, design review, funding assistance, and system performance evaluation



Glacier National Park is an early pioneer and sustaining member of the NPS Go Green campaign. The seasonally open visitor center just south of the Canadian border obtains its electricity from over 3,600 W of solar panels (an older 1,280-W rooftop PV system and a newer 2,320-W system). Both are integrated into the site to enhance visual quality.

99% of the visitor center's electricity comes from **micro-hydroelectric power supplied via an on-site dam.** The remaining **1%** is generated from **PV systems.**

Grand Canyon National Park

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Location:	Grand Canyon, Arizona
System Type:	Photovoltaic (PV)
System Size:	1.44 kW
Installation Cost:	Not available
Project Completion:	1995
Project Savings:	Reduced fuel costs
Load Service Area:	Visitor center lighting display, lighting, and computers
Project Champion:	Curt Edlund
FEMP Assistance:	Design development, design review, funding assistance, and system performance evaluation

Grand Canyon National Park is an early pioneer of the NPS Go Green campaign. Its North Rim—which is more remote, less developed, and less visited than the South Rim—offers a serene and enthralling Grand Canyon experience. The North Rim's integrated PV system is the primary power source for a combined visitor contact station and ranger residence.

The 1.44-kW PV system on the remote North Rim of the park provides

50%

of the power to the visitor center.

Isle Royale National Park

FEMP
Federal Energy Management Program

Location:	Houghton, Michigan
System Type:	Photovoltaic (PV) hybrid system
System Size:	91.8 kW (Rock Harbor), 42.1 kW (Windigo)
Installation Cost:	$2.6 million (phases 1 and 2)
Project Completion:	2014, 2015
Project Savings:	$122,400 (estimated) diesel fuel cost savings for Phases 1 and 2
Load Service Area:	Rock Harbor and Windigo developed areas
Project Champions:	Phyllis Green, Betsy Rossini, and Keith Butler
FEMP Assistance:	Design development, design review, funding assistance, and system performance evaluation

In 2011, NPS utilized an energy savings performance contract (ESPC) for a two-phase sustainability and solar PV project at isolated locations within Isle Royale National Park. Phase 2 consisted of hybrid PV/diesel power generation at the Rock Harbor and Windigo developed areas. The Rock Harbor and Windigo PV arrays are both paired with diesel generators to handle seasonal loads.

The two project phases at Rock Harbor and Windigo developed areas **were funded**

100%

by innovative third-party funding—no upfront costs were paid by NPS.

Lake Mead National Recreation Area

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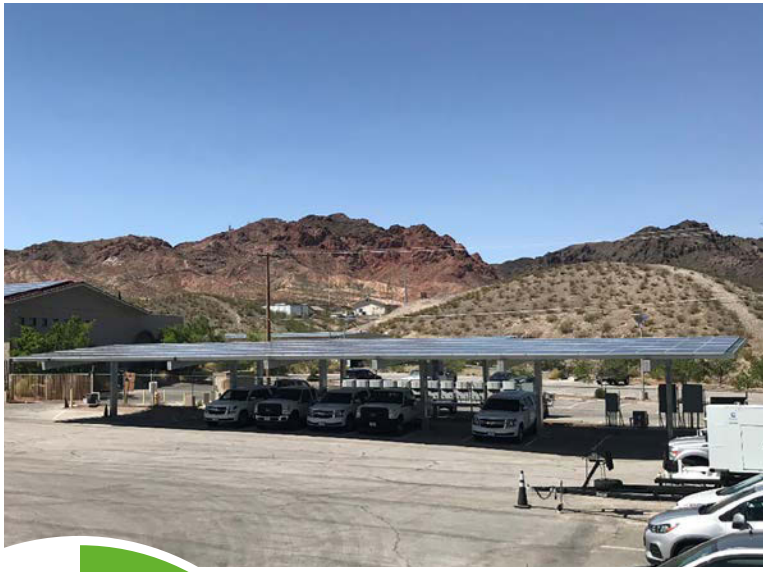
Location:	Boulder City, Nevada
System Type:	Photovoltaic (PV)
System Size:	121 kW
Installation Cost:	$863,000
Project Completion:	2010
Project Savings:	106,000 kWh/year
Load Service Area:	Alan Bible Visitor Center; admin area parking and maintenance warehouses
Project Champion:	Bruce Nyhuis
FEMP Assistance:	Feasibility study, design development, design review, and system performance evaluation



Since 2010, Lake Mead National Recreation Area has continued to "Go Green" with more than 600 PV panels recently installed on three shaded structures in an administrative area parking lot. The park's new PV systems power their new maintenance warehouses, new Interagency Communications Center, and new offices in Boulder City.

The PV system at the Alan Bible Visitor Center **is designed to handle**

90%

of power needs from April through October.

Mesa Verde National Park

Federal Energy Management Program

Location:	Mesa Verde, Colorado
System Type:	Photovoltaic (PV), solar hot water, and micro-hydro turbine
System Size:	67-kW PV, two solar collectors (30 tubes each) with a 115-gal storage tank, 22-kW micro-hydro turbine
Installation Cost:	$14.3 million
Project Completion:	2012
Project Savings:	184,000 kWh/year (estimated)
Load Service Area:	Curatorial facility and visitor center
Project Champions:	Frank Cope, Bethany Mills, William Nelligan, Scott Thomas, and Jodie Petersen
FEMP Assistance:	Design support, funding assistance, and system performance evaluation

Through efficiency and mechanical systems improvements, energy use at the park's curatorial facility and visitor center is estimated to be 193,893 kWh/year (compared to 700,000 kWh/year for similar buildings).

On-site renewable energy systems can provide

95%

of **building energy requirements, and park staff plan** to achieve net zero energy operations in the future.

Mojave National Preserve

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Location:	Barstow, California
System Type:	Photovoltaic (PV)
System Size:	42 kW
Installation Cost:	Not available
Project Completion:	1998
Project Savings:	Reduced fuel costs
Load Service Area:	Hole-in-the-Wall Visitor Center
Project Champion:	Dave Paulissen
FEMP Assistance:	Design development, design review, funding assistance, and system performance evaluation

Mojave National Preserve is an early pioneer of the NPS Go Green campaign. Beyond the Hole-in-the-Wall Visitor Center area, a large bank of solar panels is tucked behind rocks, preserving visual quality. The PV panels provide power to the visitor center and have mostly eliminated the need for a noisy diesel generator.

The 42-kW PV system (with 11-kWh batteries) provides

100%

of the power to the visitor center.

Natural Bridges National Monument

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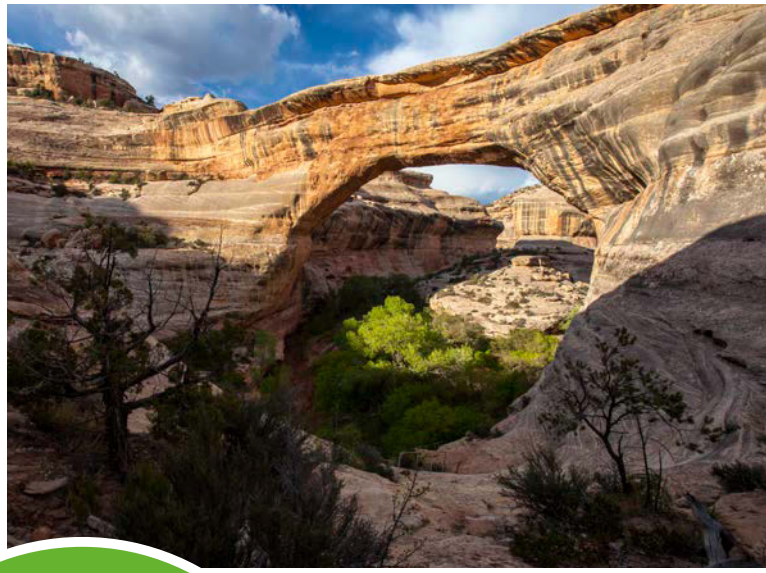
Location:	Southeastern Utah
System Type:	Photovoltaic (PV)
System Size:	112.6 kW
Installation Cost:	Not available
Project Completion:	1995
Project Savings:	Reduced fuel costs
Load Service Area:	Visitor center
Project Champion:	Bob Coulter
FEMP Assistance:	Feasibility study, funding, design development, design review, and system performance evaluation



Natural Bridges National Monument constructed a 112.6-kW PV system to supply electricity for the small community of NPS personnel, their families, and the visiting public. Natural Bridges' moderate, sunny climate, remote location away from commercial power sources, and the PV system's accessibility to the public make the visitor center an ideal location.

The PV system provides

100%

of the site's power.

The site was previously served by diesel generators, and fuel deliveries were very costly.

Santa Monica Mountains National Recreation Area

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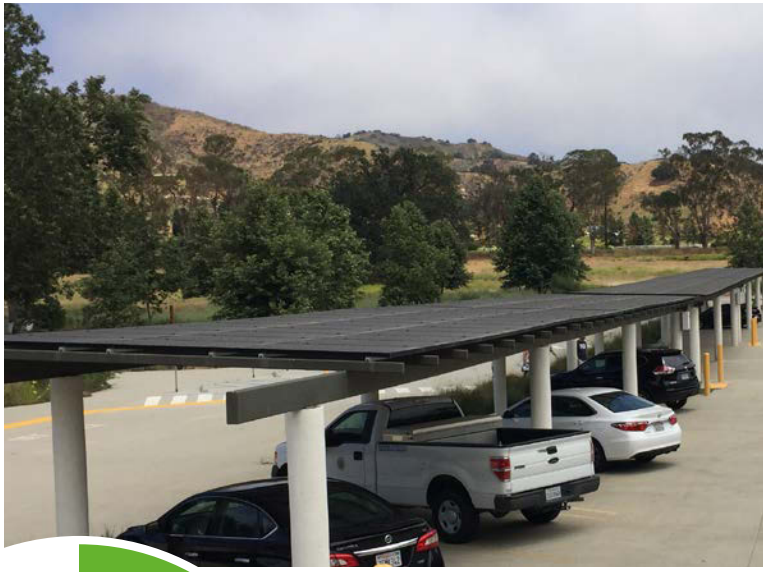
Location:	Calabasas, California
System Type:	Photovoltaic (PV)
System Size:	94 kW
Installation Cost:	Not available
Project Completion:	2013
Project Savings:	Several PV and geothermal systems saved 310 billion Btu in heating and cooling in the first year.
Load Service Area:	Parking lot and visitor center
Project Champion:	Garry Brown
FEMP Assistance:	Feasibility study, design development, design review, and system performance evaluation



Santa Monica Mountains National Recreation Area utilizes a geothermal cooling system via high-efficiency heat pumps at its visitor center. PV panels mounted on carport structures adjacent to the center provide shade for parking and reduce the heating effect on the parking surface. The stored electricity from the solar carports supplies power to the center and to the exterior lighting at the carports.

A geothermal cooling system provides about

80%

of hot water needs, and a back-up system is powered by the solar PV carports.

Yellowstone National Park

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Federal Energy Management Program

Location:	Yellowstone National Park, Wyoming
System Type:	Photovoltaic (PV)
System Size:	18 kW
Installation Cost:	Not available
Project Completion:	2011
Project Savings:	Reduced life cycle costs by approximately 26%, from $400,000 to $295,000
Load Service Area:	Bechler Ranger Station
Project Champion:	Harold Anderson
FEMP Assistance:	Feasibility study, funding, design development, design review, and system performance evaluation

Yellowstone National Park operates the Bechler Ranger Station from late May to early November. This remote outpost accommodates six to eight park rangers and functions as a contact station for visitors entering the backcountry. In 2011, the park constructed a mobile system with 32 280-W multi-silicon PV modules, 2,500 amp hours of battery storage at 48 volts, a 183-amp charge controller, and three inverters, totaling 18 kW of capacity.

The PV system provides

100%

of the site's power.

The site was previously served by a propane tank, and propane deliveries were very costly.

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