National Park Service: Spotlight on Partnerships

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Photo by Dennis Schroeder, NREL 55200

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Alcatraz Island. *Photo from* https://www.energy.gov/femp/alcatraz-island

NREL at a Glance

3,675 workforce, including:

- 2,732 regular/limited term
- 490 contingent workers
- 211 postdoctoral researchers
- 152 graduate student interns
- 90 undergraduate student interns

—As of 9/30/2023

World-class research expertise in:

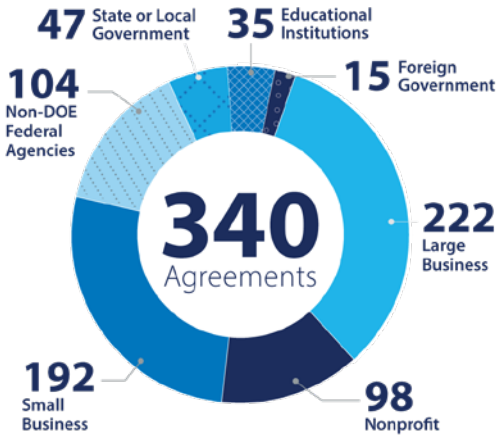
- Renewable Energy
- Sustainable Transportation & Fuels
- Buildings & Industry
- Energy Systems Integration

Partnerships with:

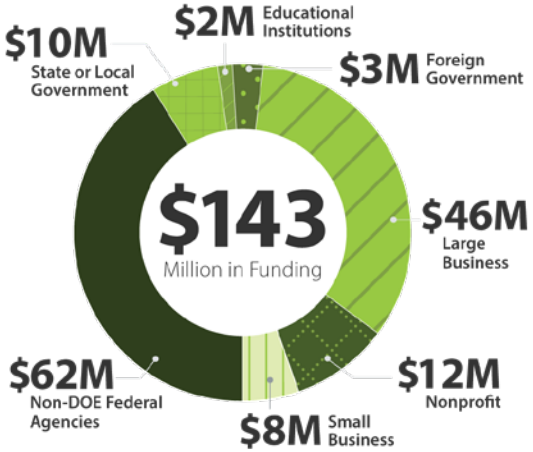
- Industry
- Academia
- Government.

4 campuses operate as living laboratories

More Than 1,000 Active Partnerships in FY 2023



Agreements by Business Type



Funding by Business Type

NREL Science Drives Innovation

Renewable Energy

- Solar
- Wind
- Water
- Geothermal

Sustainable Transportation & Fuels

- Bioenergy
- Hydrogen and Fuel Cells
- Transportation and Mobility

Buildings & Industry

- Buildings
- Industrial Efficiency and Decarbonization
- Advanced Materials and Manufacturing
- State, Local, and Tribal Governments

Energy Systems Integration

- Energy Security and Resilience
- Grid Modernization
- Integrated Energy Solutions

Photo by Werner Slocum, NREL 66364

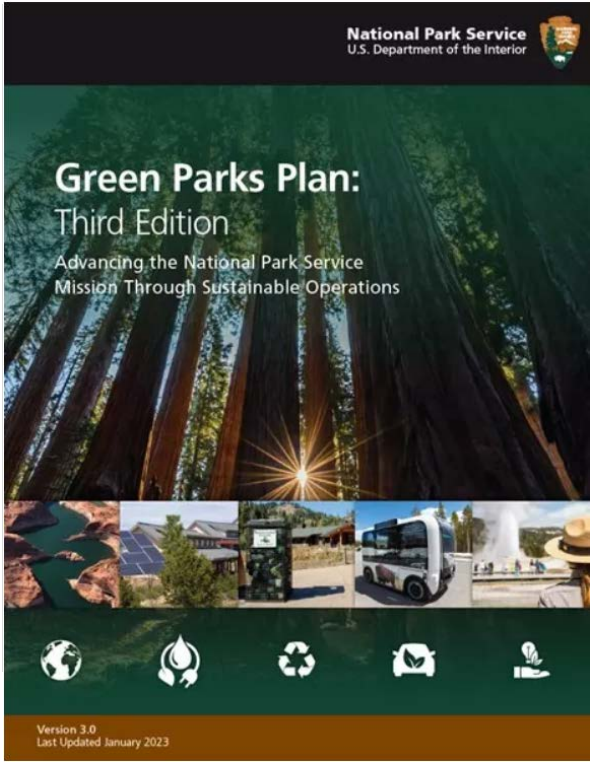
NPS/NREL/FEMP Partnership

- Partnership spanning more than a decade
- Technical support encompasses renewable energy analysis, audit support, fleet technical analysis, resilience assessments, and more.

Photo by Warren Gretz, NREL

Green Parks Plan Goals

- **Be climate friendly and climate ready.** Combat the climate crisis by achieving net-zero greenhouse gas emissions.
- **Be energy smart and water wise.** Achieve net-zero water use and net-zero energy for facilities and operations.
- **Buy green and reduce, reuse, recycle.** Achieve net-zero waste and sustainable procurement.
- **Green our rides.** Adopt and support zero-emissions transportation methods.
- **Foster a sustainability ethic.** Engage the National Park Service (NPS) workforce, partners, visitors, stakeholders, and communities to support and participate in sustainability, climate resilience, and environmental justice.



See https://www.nps.gov/subjects/sustainability/green-parks.htm.

Audits

- Past audit review and analysis:
  - Reviewed 20 audits completed in 2019 and 2020 (all remote)
  - Identified commonalities, gaps, and opportunities:
    - Example findings:
      - Most common measures:
        - Install general lighting opportunities (18 of 20)
        - Install programmable or addressable thermostats (17 of 20).
        - Replace existing aerator with low-flow equivalents (16 of 20).
      - No irrigation measures investigated
      - No plug-load measures investigated.
    - Provided best practices for procuring audit services
    - Reviewed NPS audit services procurement language and suggested additions associated with decarbonization and electrification:
      - Identify opportunities specifically related to decarbonization
      - Require carbon/emissions savings in ECM calculation/results.

Resilience

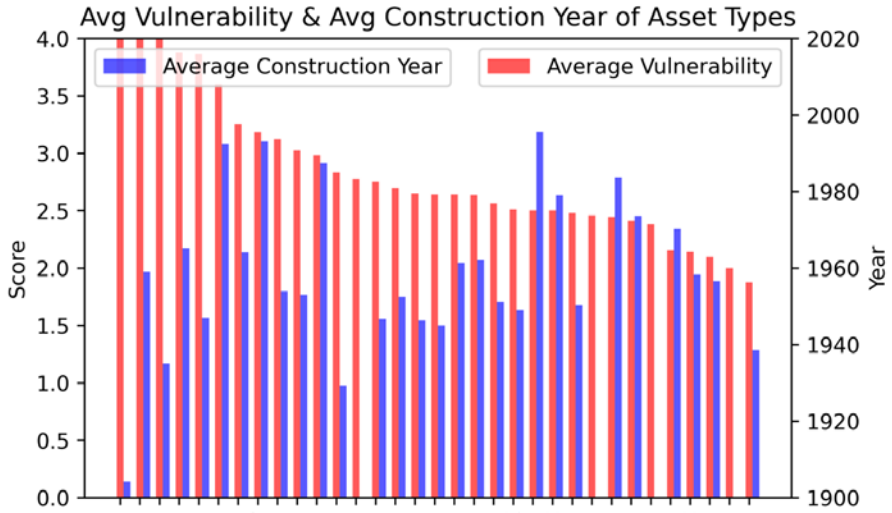
- NREL reviewed vulnerability data within:
  - Nineteen coastal hazards sea-level rise asset vulnerability assessments created by Western Carolina University
  - Two integrated coastal climate change vulnerability assessments by the University of Rhode Island.
- Results classify vulnerability as such (high, moderate, etc.)
- And cross-reference vulnerability with high priority asset (by Asset Priority Index).

Assets	High Vulnerability		Moderate Vulnerability		Low Vulnerability		Minimal Vulnerability		Total #
	#	%	#	%	#	%	#	%	
Structures	8	24%	4	12%	17	52%	4	12%	33
Transportation	4	40%	0	0%	4	40%	2	20%	10
All Assets	**12**	**28%**	**4**	**9%**	**21**	**49%**	**6**	**14%**	**43**

Resilience: VA Data Analysis

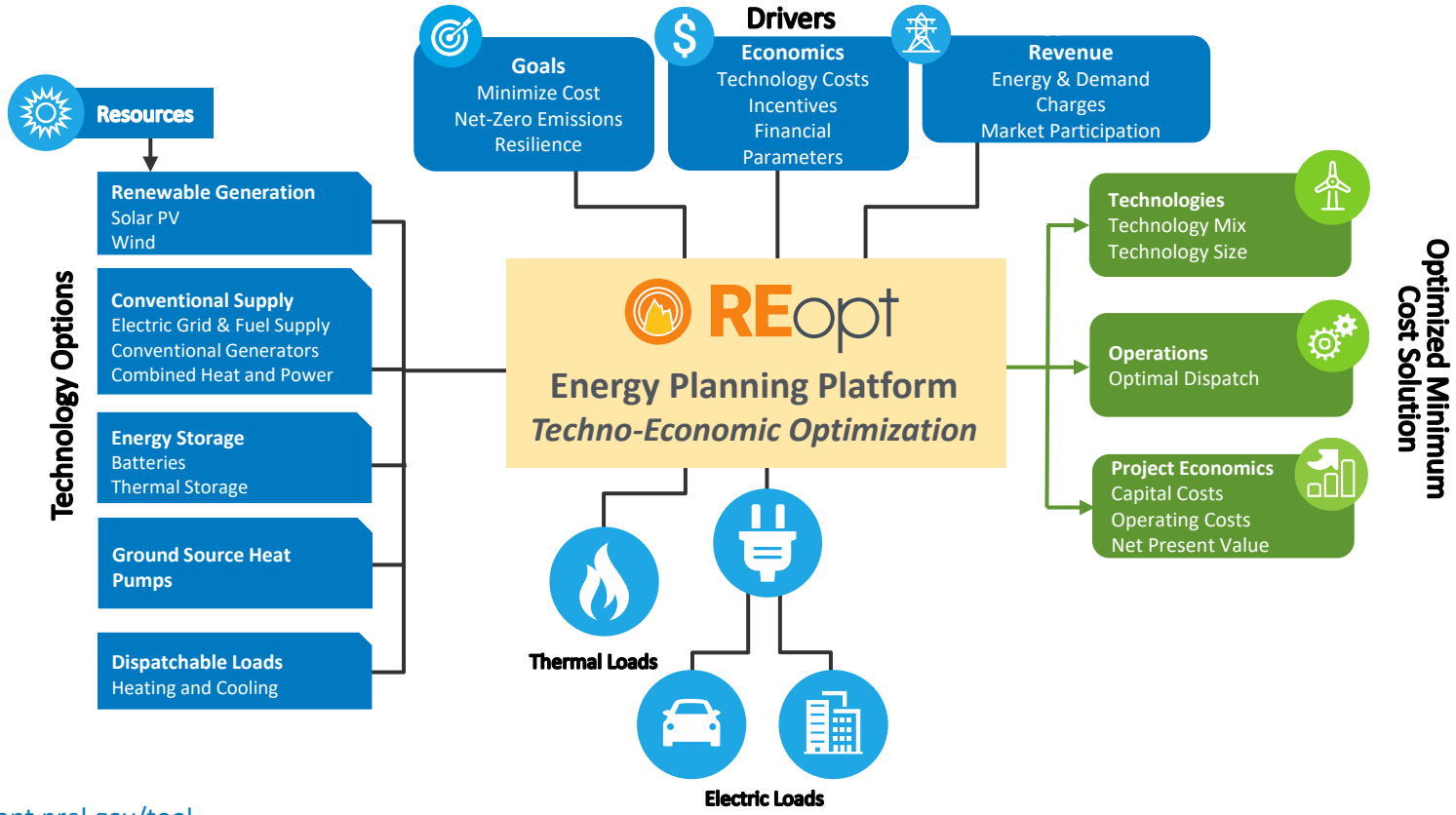
Performed data analysis and data visualization on vulnerability data collected by Western Carolina University:

- No clear correlation.



REopt Energy Planning Platform

Formulated as a mixed integer linear program, REopt® provides an integrated, cost-optimal energy solution. This diagram represents REopt's many options. A subset of these options was used for the current NPS analysis.



See https://reopt.nrel.gov/tool.

REopt

- Conducted enterprise-wide REopt analysis at 338 parks for:
  - PV
  - Small wind
  - Battery energy storage systems.

	Number of Parks with recommended Projects (Direct Purchase)	*Total Capacity recommended for all analyzed parks (Direct Purchase)*	*Number of Parks with recommended Projects (Third-Party Financed)*	*Total Capacity recommended for all analyzed parks (Third-Party Financed)*
PV	302	46,665 kW	275	35,960 kW
Wind	110	3,201 kW	83	2,224 kW
Battery Storage - Power	48	472 kW	30	279 kW
Battery Storage - Capacity	48	3,020 kWh	30	1,821 kWh
Total Initial Capital Cost	$90,092,658		$68,099,463	
Total Net Present Value (NPV)	$55,651,059		$42,995,233	

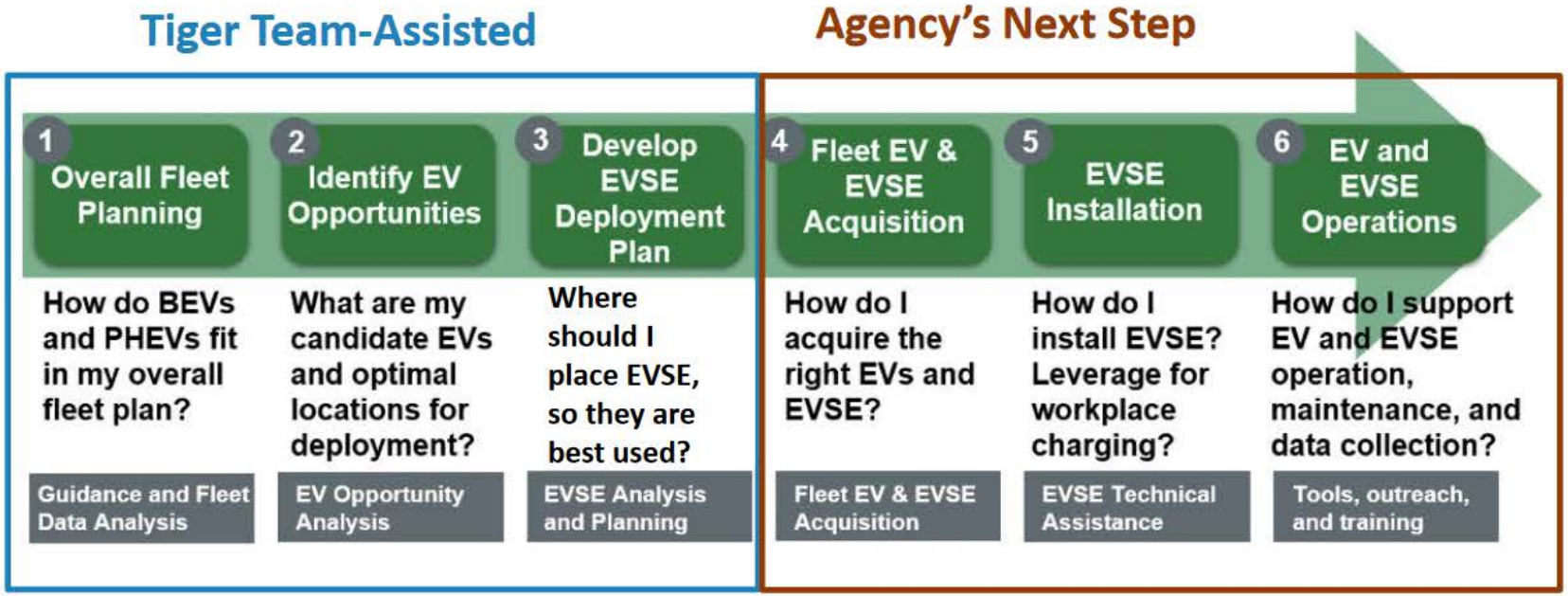
Note: for each park, the results for the most constrained scenario (30% of total building area) are reflected. Only 16 of 338 parks showed any difference between the 3 constraint levels.

Booklet

Over many years, the Federal Energy Management Program (FEMP) provided technical support for renewable energy and energy-efficiency projects at select national parks across the United States. Many of these projects were implemented 10 or more years ago and still provide significant cost savings and efficiency benefits.

See https://www.energy.gov/femp/articles/renewing-our-national-parks-partnership-federal-energy-management-program-and.

Process for Fleet Electrification



BEV = battery electric vehicle
EV = electric vehicle
EVSE = electric vehicle supply equipment
PHEV = plug-in hybrid electric vehicle

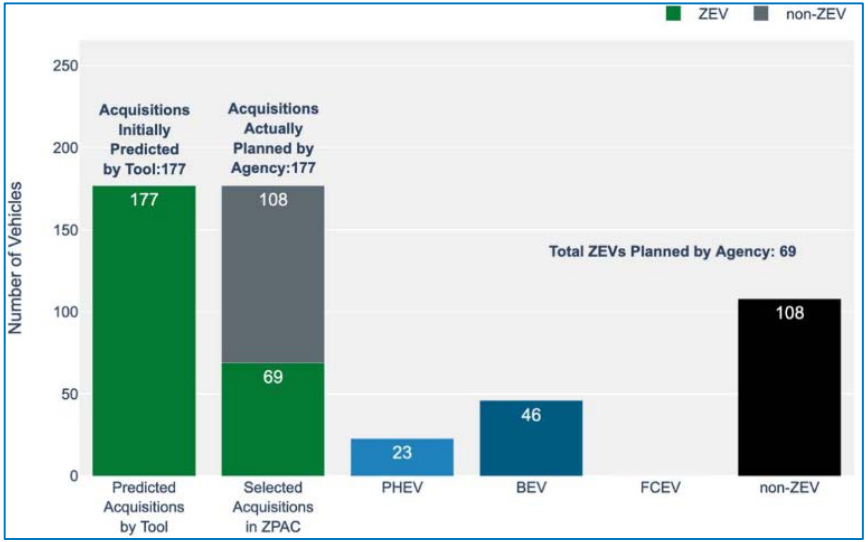
Grand Teton National Park

To accelerate the transition from internal combustion engines to electric vehicles, Grand Teton staff worked closely with FEMP and NREL to evaluate their fleet inventory and operations. The focus of this evaluation was to develop an electric vehicle supply equipment (EVSE) site assessment or deployment plan near Grand Teton headquarters.

Grand Teton National Park's first all-electric vehicle.
Photo by David Reus

Golden Gate National Recreation Area

Golden Gate began the assessment by reviewing their site-specific Zero Emission Vehicle Planning and Charging (ZPAC) tool for their entire fleet. In FY 2022, they had 10 vehicles up for replacement. Working with FEMP and NREL, the Golden Gate-specific ZPAC informed them on which vehicles were available to electrify, and they were able to submit a request for two zero-emission vehicles (ZEVs) under their FY 2022 budget and considering driver needs.



ZPAC summary results as of Dec. 20, 2021

Golden Gate National Recreation Area (Continued)

See https://www.energy.gov/femp/golden-gate-national-recreation-area-assessed-zevs-and-evse-possibilities-femp-evse-tiger-team.

After understanding their near-term ZEV options, Golden Gate worked with the FEMP EVSE Tiger Team to complete the EVSE planning spreadsheet, where they focused on two locations (with more than a dozen throughout the park) to plan for EVSE deployment.

- 13% of fleet at the three sites were already ZEVs.
- An additional 43% were determined to be potential ZEV candidates in FY 2022.

The EVSE Tiger Team provided a detailed assessment for the locations that housed vehicles that would be replaced with ZEVs in the near term while providing GOGA with the knowledge and tools to assess their remaining sites for EVSE potential in the future.

Yellowstone National Park

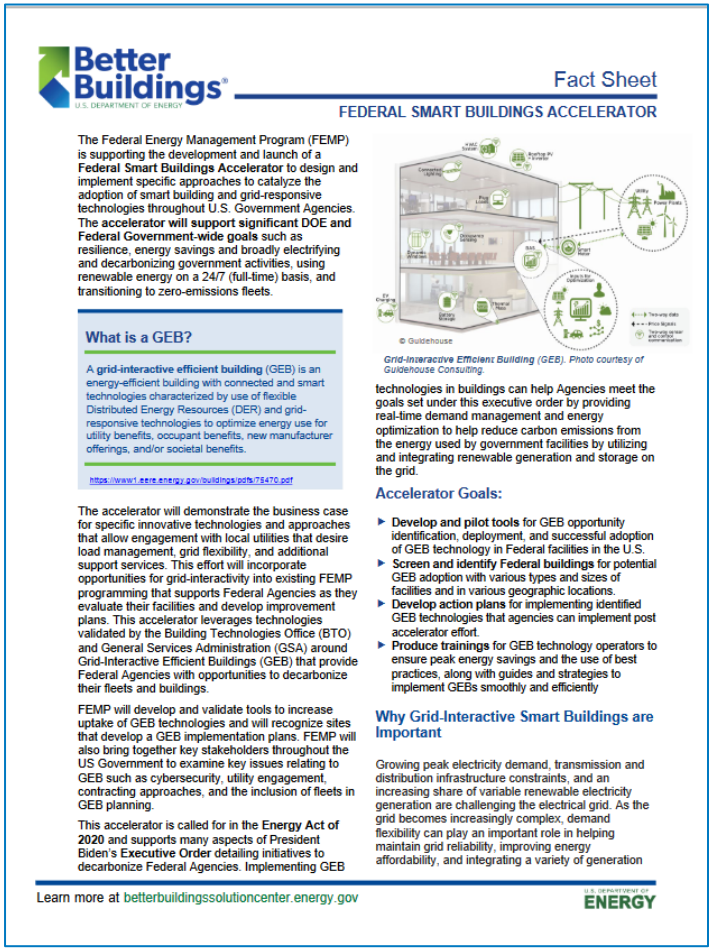
Yellowstone performed an EVSE assessment throughout the summer of 2022. The assessment focused on parking areas at the Mammoth headquarters, including the administrative building, canteen, post office, and fleet garage.

The assessment began by using the ZPAC tool to identify vehicles that are the best candidates for fleet electrification based on the distances the vehicles typically travel, where they usually park, and whether an equivalent electric vehicle model will soon be available. Of the 457 vehicles in Yellowstone's fleet, 146 light- and medium-duty vehicles are operated out of the Mammoth area and were also identified as good candidates for conversion to ZEVs.

A plug-in hybrid electric vehicle at Yellowstone National Park.
Photo by Jesse Bennett, NREL

Federal Smart Buildings Accelerator

- As referenced in the Energy Act of 2020, FEMP is supporting the development and launch of a Federal Smart Buildings Accelerator to:
  - Design and implement specific approaches that would accelerate the adoption of smart building and grid-responsive technologies.
  - Develop and validate resources to catalyze the adoption of grid-interactive building (GEB) technologies and develop a GEB-ready recognition program.
- **Participating agencies:**
  - GSA
  - EPA
  - DOI (NPS and BLM)
  - DOD
  - VA
  - DOE
  - DHS



Better Buildings
U.S. DEPARTMENT OF ENERGY

Fact Sheet

FEDERAL SMART BUILDINGS ACCELERATOR

The Federal Energy Management Program (FEMP) is supporting the development and launch of a **Federal Smart Buildings Accelerator** to design and implement specific approaches to catalyze the adoption of smart building and grid-responsive technologies throughout U.S. Government Agencies. The **accelerator will support significant DOE and Federal Government-wide goals** such as resilience, energy savings and broadly electrifying and decarbonizing government activities, using renewable energy on a 24/7 (full-time) basis, and transitioning to zero-emissions fleets.

What is a GEB?

A **grid-interactive efficient building** (GEB) is an energy-efficient building with connected and smart technologies characterized by use of flexible Distributed Energy Resources (DER) and grid-responsive technologies to optimize energy use for utility benefits, occupant benefits, new manufacturer offerings, and/or societal benefits.

https://www1.eere.energy.gov/buildings/pdfs/75470.pdf

The accelerator will demonstrate the business case for specific innovative technologies and approaches that allow engagement with local utilities that desire load management, grid flexibility, and additional support services. This effort will incorporate opportunities for grid-interactivity into existing FEMP programming that supports Federal Agencies as they evaluate their facilities and develop improvement plans. This accelerator leverages technologies validated by the Building Technologies Office (BTO) and General Services Administration (GSA) around Grid-Interactive Efficient Buildings (GEB) that provide Federal Agencies with opportunities to decarbonize their fleets and buildings.

FEMP will develop and validate tools to increase uptake of GEB technologies and will recognize sites that develop a GEB implementation plans. FEMP will also bring together key stakeholders throughout the US Government to examine key issues relating to GEB such as cybersecurity, utility engagement, contracting approaches, and the inclusion of fleets in GEB planning.

This accelerator is called for in the **Energy Act of 2020** and supports many aspects of President Biden's **Executive Order** detailing initiatives to decarbonize Federal Agencies. Implementing GEB

Grid-Interactive Efficient Building (GEB). Photo courtesy of Guidehouse Consulting.

technologies in buildings can help Agencies meet the goals set under this executive order by providing real-time demand management and energy optimization to help reduce carbon emissions from the energy used by government facilities by utilizing and integrating renewable generation and storage on the grid.

Accelerator Goals:

- **Develop and pilot tools** for GEB opportunity identification, deployment, and successful adoption of GEB technology in Federal facilities in the U.S.
- **Screen and identify Federal buildings** for potential GEB adoption with various types and sizes of facilities and in various geographic locations.
- **Develop action plans** for implementing identified GEB technologies that agencies can implement post accelerator effort.
- **Produce trainings** for GEB technology operators to ensure peak energy savings and the use of best practices, along with guides and strategies to implement GEBs smoothly and efficiently

Why Grid-Interactive Smart Buildings are Important

Growing peak electricity demand, transmission and distribution infrastructure constraints, and an increasing share of variable renewable electricity generation are challenging the electrical grid. As the grid becomes increasingly complex, demand flexibility can play an important role in helping maintain grid reliability, improving energy affordability, and integrating a variety of generation

Learn more at betterbuildingssolutioncenter.energy.gov

U.S. DEPARTMENT OF ENERGY

See https://betterbuildingssolutioncenter.energy.gov/better-buildings-accelerator/federal-smart-buildings-accelerator.

FEMP Federal Smart Buildings Accelerator

- Activities:
  - Site GEB and utility offerings analysis:
    - Queried each accelerator site on GEB technology interest areas
    - Provided information on priority GEB technologies via site-specific fact sheets
    - Conducted tailored analysis and research for each site on GEB-supportive utility offerings and incentives relative to priority GEB technologies.
  - REopt analysis:
    - Completed REopt analyses for multiple accelerator sites to identify cost-optimal renewable energy + storage sizing.
  - Data center and labs assessments:
    - Completed deep dives into facility data centers and laboratories to ensure the most efficient operations to enable a GEB-ready future.

Looking Forward

- Upcoming treasure hunt with Boston area parks
- Piloting the Technical Resilience Navigator (TRN) Lite (in partnership with Pacific Northwest National Laboratory)
- Continued REopt and EVSE/Tiger Team analyses
- Decarbonization and electrification support and analysis:
  - Case study write-up for Fort Cronkhite electrification project.
- Potential pilot of Customer Damage Function with a park.

Resources

- *Grand Teton National Park Federal Fleet Tiger Team EVSE Site Assessment*: https://www.nrel.gov/docs/fy22osti/83250.pdf
- *Golden Gate National Recreation Area Federal Fleet Tiger Team EVSE Site Assessment*: https://www.nrel.gov/docs/fy22osti/82572.pdf
- *Yellowstone National Park Federal Fleet Tiger Team EVSE Site Assessment:* https://www.nrel.gov/docs/fy23osti/84084.pdf
- FEMP treasure hunts: https://www.energy.gov/femp/energy-and-water-treasure-hunts-federal-agencies
- TRN Lite: https://trn.pnnl.gov/lite
- Customer Damage Function Calculator: https://cdfc.nrel.gov/
- "FEMP Aids National Park Service in Advancing Clean Energy Goals Through the Green Parks Plan": https://www.energy.gov/femp/articles/femp-aids-national-park-service-advancing-clean-energy-goals-through-green-parks-plan.

Thank you!

www.nrel.gov

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