



## Energy Management System Lowers U.S. Navy Energy Costs Through PV System Interconnection

To meet the U.S. Navy's energy goals, the National Renewable Energy Laboratory (NREL) and the Naval Facilities Engineering Command (NAVFAC) spent two years collaborating on demonstrations that tested market-ready energy efficiency measures, renewable energy generation, and energy systems integration. One such technology—an energy management system—was identified as a promising method for reducing energy use and costs, and can contribute to increasing energy security.

The energy management system was one of eight demonstrations performed on bases in Hawaii and Guam, and evaluated the benefits and compatibility of the technology with the Navy's mission and practices. The overall project focused on identifying new or underutilized

On-site renewable energy generation can be a cost-effective way to improve energy security and reliability. An energy management system can help ensure safe and stable delivery of that renewable energy.

commercial technologies that could help meet the Navy's ambitious energy goals of producing at least 50% of shore-based energy from alternative sources and ensuring that 50% of Navy and Marine Corps installations will be net-zero energy.

### The Technology Demonstration

#### Overview

The NREL-NAVFAC team demonstrated an energy management system (EMS) at the Pacific Missile Range Facility in Hawaii in order to improve utilization of existing photovoltaic systems.

#### Key Results

The EMS enabled the successful interconnection of the facility's PV system, resulting in an energy savings of 320 megawatt-hours during the sixth-month demonstration period and yielding long-term energy cost savings.

A collaborative effort by the NREL-NAVFAC integrated project team was a key success factor to the project, resulting in technology demonstrations that met stringent Navy requirements while providing credible performance data to help guide energy-related decisions.

### Energy Management Systems

An energy management system (EMS) is a robust monitoring and control technology used to optimize the performance of an electric power system, and is sometimes augmented with energy storage. As on-site renewable energy generation becomes a significant portion of a facility's energy supply, an EMS can be employed to maintain system stability and meet utility interconnection requirements.

During the demonstration at the Navy's Pacific Missile Range Facility (PMRF), an EMS was installed alongside an existing photovoltaic (PV) system to facilitate the



The energy management system installed at the Pacific Missile Range Facility holds the system's main controller, advanced batteries (shown in the inset) with power conditioning equipment, and the human machine interface.

*Photos by Robert Butt, NREL, and Gregory Martin, NREL (inset)*

successful interconnection and operation of additional PV capacity that exceeds the site's minimum load. Doing so enables the site to decrease the amount of energy purchased from the utility, resulting in lower energy costs. The PMRF EMS works by adding up to a 70-kilowatt load to the utility grid by charging its 68-kilowatt-hour battery bank, and then disconnecting or "curtailing" the renewable energy generation to prevent backfeed to the utility if the site load reaches a minimum threshold.

The interconnection permitted by the EMS resulted in an energy savings of 320 megawatt-hours over the sixth-month demonstration period, with the system paying for itself in the fifth year. In addition, the EMS successfully demonstrated several objectives of the project: preventing power export to the utility, supporting power quality, and maximizing PV generation.

To learn more about the demonstration projects, download the NAVFAC Hawaii and Guam Energy Improvement Technology Demonstration Project reports at [nrel.gov](http://nrel.gov), visit NREL's Department of Defense website at [www.nrel.gov/defense/](http://www.nrel.gov/defense/), or contact Jeffrey Dominick at [jeffrey.dominick@nrel.gov](mailto:jeffrey.dominick@nrel.gov).

*Photos: Denver Museum Nature and Science, NREL 18045; iStock 15629344; iStock 12812261; iStock 11051853; U.S. Army Fort Carson, NREL 17394; iStock 12248484*



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