



DOE, NREL Help DoD Enhance Energy Security

The U.S. Department of Energy (DOE) and the National Renewable Energy Laboratory (NREL) are helping the U.S. government, including the U.S. Department of Defense (DoD), deploy large-scale energy efficiency measures and renewable energy technologies to reduce costs, increase energy security, and meet federal mandates.

As the largest energy consumer within the U.S. federal government, DoD has long recognized the strategic importance of energy to its mission and is particularly challenged to address energy security, reliability, and cost concerns. DoD has more than 500 military installations encompassing nearly 2 billion square feet of space, and had an annual installations energy bill of more than \$4 billion in 2010.

With the help of expertise from DOE and NREL, DoD is establishing net zero energy installations, or NZEIs, which produce as much energy on-site as their buildings, facilities, and fleet vehicles consume.

DoD's ability to reach net zero energy goals at a growing number of installations will have a profound impact on its push toward energy security and surety—as best practices, strategies, and processes are replicated across all military branches.

The U.S. Marine Corps Air Station (MCAS) Miramar in California is one example of a NZEI. To help the facility meet the DoD's goal to get 25% of its energy from renewables by 2025, DOE and NREL performed an assessment at MCAS to evaluate the potential for achieving energy reduction goals.

Determining the Energy Boundary

Each military installation must define its own boundaries before taking an energy inventory. Working with MCAS Miramar, technical experts from NREL's integrated

deployment team and DOE's Federal Energy Management Program determined an energy boundary that includes all Miramar on-site buildings, fleet and commuting vehicles, and tactical flight operations.

The NREL team then helped Miramar inventory energy consumption, which totaled approximately 5,600 billion source British thermal units (Btu). NREL analyzed a least-cost combination of efficiency and renewable energy technologies to help Miramar achieve progress toward achieving net zero energy.

MCAS Miramar is on track to achieve a 40% reduction in facility source Btu through base-initiated projects. DOE/NREL developed an additional plan that would allow the base to achieve a 90% reduction by 2015 if all recommendations were implemented.

Simulations Lead to Good Decision-Making

Using NREL resource maps for solar, wind, biomass, and geothermal energy, the NREL team conducted hour-by-hour system operations and load profile simulations of various MCAS Miramar configurations for distributed energy resources to evaluate performance and identify the lowest cost of energy. The analysis created a combination of recommended energy measures spanning photovoltaics (PV), landfill gas, renewably powered fuel cells, microturbine co-generation, solar water heating, energy efficiency, and additional daylighting.

The team initially analyzed various large-scale PV potential scenarios before recommending that Miramar install 2.2 megawatts (MW) of additional PV to enhance the 2.3 MW of PV, 600 PV street lights (220 watts each), and the 100 kilowatt (kW) concentrating solar power system, which the

base had already planned to install. Although a larger PV installation would enable the installation to achieve full net zero electrical energy status, other options were identified that would provide more cost effective renewable energy.

DOE and NREL also analyzed several combined heat and power opportunities, including cogeneration, biomass, microturbines, and fuel cells. The most cost effective option identified was 2.8 MW of renewably powered fuel cells that could be implemented through a power purchase agreement. These systems would not only produce heat and electricity, but also allow Miramar to strengthen its micro-grid.

In addition, the team analyzed a micro-grid with distributed generation sources to continue critical base operations despite a disruption to the electrical grid and recommended integrated “smart” controls to allow Miramar to maintain power off the grid in emergency situations. NREL is currently working on a follow up project to provide Miramar with a more detailed microgrid design.

Replication Across the Military

MCAS Miramar is on track to achieve a 40% reduction in facility source Btu through base-initiated projects. The installation currently has a 3 MW landfill gas Power Purchase Agreement and approximately 1 MW of solar PV. NREL developed an additional plan that would allow the base to achieve a 90% reduction in facility source Btu by 2015, if all of the NREL recommendations were implemented by the installation.

Based on the MCAS Miramar project, NREL developed a standardized NZEI process template for other military installations. Widespread replication is planned, with assessments already underway at several installations, including: the U.S. Air Force Academy in Colorado, the U.S. Army Garrison’s Pohakuloa Training Area in Hawaii, the U.S. Naval Support Activity South Potomac in Virginia, and the United States Military Academy at West Point in New York.

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DOE and NREL Provide the Framework for Net Zero Energy at Military Installations

DOE’s and NREL’s technical assistance on the net zero energy initiative at MCAS Miramar has resulted in a comprehensive report that provides DoD with the framework for reaching net zero energy at military installations across all branches.

Titled “Net Zero Energy Military Installations: A Guide to Assessment and Planning,” the report details energy strategies for DoD installations and provides recommendations on assessment, planning and implementation.

Because an NZEI assessment typically won’t provide sufficient detail for implementation of all recommended energy projects, the report also outlines how projects can be screened for viability. This seven-element framework was developed at NREL and helps military leadership select projects that bring the greatest value in reaching energy goals.

The report also provides guidance on financing energy efficiency measures and renewable energy projects so that DoD can leverage both public and private resources to complete various projects.

As projects are implemented, the net zero energy assessment presents a benchmark by which to measure progress in reducing energy demand and increasing energy self-sufficiency by reliance on local renewable resources.

Download the report at http://www1.eere.energy.gov/office_eere/pdfs/48876.pdf.



The U.S. Marine Corps Air Station in Miramar, California, installed a 250-kilowatt solar carport in April 2010.

Photo from of U.S. Marine Corps Air Station Miramar, NREL/PIX 18238

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