

Landfill to Lighting

Closed Pendleton Landfill Becomes Home to Solar Arrays

RIDING THE CREST of a recent renewable-energy siting wave, Marine Corps Base (MCB) Camp Pendleton is developing solar photovoltaic (PV) systems on otherwise unusable land—a closed landfill. Naval Facilities Engineering Command (NAVFAC) Southwest has completed one project and awarded the contract for a second installation at the 30-acre Box Canyon Installation Restoration (IR)

Site Seven. Once both projects are online, the system is projected to supply enough power for 700 homes.

For all of its benefits, finding suitable sites for solar power generation can be problematic. The solar array systems require open, minimally shaded space and proximity to roads and power transmission lines. Closed landfills that are otherwise unavail-

able for development often meet PV-siting requirements.

The Arrays

MCB Camp Pendleton and NAVFAC Southwest celebrated the opening of the first array at Box Canyon on 3 February 2011. The project, completed on 17 December 2010, is the largest PV array at a west coast

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The PV array consists of 6,300 modules producing 235 watts installed on 225 panels at a 15 degree tilt. Each panel has 28 modules sitting on a racking system, which is anchored with four ballasts.



Marine Corps base. It is estimated that it will save the Marine Corps \$336,000 per year in electricity costs. This first PV array covers approximately five acres and includes 225 panels, each holding 28 modules for a total of 6,300 modules. The size of the system is 1.485 megawatts of direct current and will generate 2,400 megawatts per hour (MWH) annually, enough to power 400 homes. The project feeds into the Camp Pendleton electric grid.

As Bernadette Rose, NAVFAC Southwest's Regional Officer in Charge of Construction Command construction manager at Camp Pendleton, noted at the opening of the first array, "The Box Canyon PV project makes use of a previously unusable piece of real estate, provides renewable energy, and helps MCB Camp Pendleton meet its onsite renewable energy generation goals. It is also one of the largest PV systems in San Diego County."

Approximately four additional acres at Box Canyon will soon host a second array. NAVFAC awarded the contract for the second array in July 2011. The new array will include 5,136 solar modules, each rated at 280 watts, for an estimated annual production of 2,100 MWH, enough for 315 homes. The system will be equipped with a performance monitoring system able to pinpoint with precision the location of any defective single solar module or defective string of solar modules.

The existing panels are installed on an aluminum and steel racking system that is secured by 3,500-

pound concrete ballasts. The ballasts are placed on gravel pads to allow rainwater to flow through without affecting the landfill cap. The ballasts ensure that wind will not disrupt the tilted panels. The PV panels are tilted at 15 degrees to maximize sun exposure and elevated five feet from the ground to prevent native landscaping from growing tall enough to shade the panels.

Have Landfill, Want Solar? Here are Some Things to Consider

SO YOU'RE THINKING about putting a solar array atop your own landfill? In general, landfills can offer suitable settings for solar installations. Nevertheless, there are some things to consider before you start.

1. Lay of the Land

Slope, orientation to the sun, wind and potential shading can influence solar productivity.

a. Slope

Flat or minimal grades are better suited for fixed rack installations, like Camp Pendleton's installation. Flexible solar panels that are fixed to landfill cap membranes have been installed at some landfills that had steep slopes.

b. Orientation

Rack-mounted arrays can be installed to maximize sun exposure. Is there anything that would prevent this?

c. Wind

Tilted and elevated rigid panels must be secured to prevent shifting. Can the landfill closure configuration support necessary ballast?

d. Potential Shading

Evaluate the surroundings for structures or vegetation that could shade the panels.

2. Existing Infrastructure

Are there roads in place for establishing and maintaining the arrays? How close is the location to three-phase power lines?

3. Adjacent Properties

Is there potential for future, potentially conflicting, development near the site? Are there environmental restrictions on nearby lands?

4. Landfill Properties

Age, closure configuration, contents and water runoff can affect the viability of solar on a landfill.

a. Age

How old is the landfill and how is it capped? What is the condition of the cap? Is settling still occurring?

b. Type of Closure

Can the landfill support the weight of racked solar panels mounted onto concrete ballasts? What kind of gas emissions exist and how are they vented? Would another type of solar installation be suitable?

c. Contents

Does the site include toxic wastes for which additional investigations and permits might be required?

d. Runoff

How will solar panels that concentrate rainfall shedding affect landfill runoff patterns?

5. Regulatory Restrictions

What local or state regulations might apply to landfill development?

Siting Power Generation on a Landfill

Although making productive use of otherwise unusable land offers an appealing solution for power generation, it can be challenging. Any solar installation must account for the slope and orientation to the sun, available development and transmission infrastructure, and potential for future use

conflicts. Closed landfills add potential environmental restrictions, including ensuring that the cap is protected, runoff does not comprise the landfill and that settling does not disrupt the solar panels.

MCB Camp Pendleton's round one installation worked through many of the issues. "The project was extremely innovative, utilizing a site

that otherwise would be undevelopable and was equally challenging given the environmental restrictions of working on an inactive/closed landfill and IR site," said Navy Capt. Martin Smith, Deputy Officer in Charge of Construction. "Per regulatory requirements, the ground surface, meaning the upper six feet of the landfill cap, was not to be penetrated



The official ceremony featured flipping the main switch of the photovoltaic system by Marine Corps Installations West (MCIWEST) commanding general Maj. Gen. A. L. Jackson, Camp Pendleton commanding officer Col. Nicholas F. Marano, MCIWEST deputy officer-in-charge of construction CAPT Martin Smith, Synergy Electric president Diane Keltner, and Camp Pendleton energy manager Jeff Allen.



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—Capt. Martin Smith

at all during the execution of the project. Even survey stakes could not be put into the ground while aligning the panels . . . and still the panel alignments are square and plumb. The regulatory bodies were initially hesitant to grant permission to build the project. Regional Water Quality Control Board personnel visited this project as it was nearing completion and stated they were very happy with the results and would have no qualms in approving future PV projects on this site.”

The Road Ahead

NAVFAC Southwest expects work on the second Box Canyon PV array to be completed by August 2012. The two arrays will help MCB Camp Pendleton to meet Marine Corps’ renewable energy goals and reduce its carbon footprint. It also expands NAVFAC’s capabilities. “This project

provides new opportunities for NAVFAC’s expertise and offers engineering innovation by installing the new utility-scale solar photovoltaic systems in an old landfill area, by means of studying the impact of the solar system on the utility power distribution grid, by implementing effective methods to construct these types of facilities, and by utilizing more efficient solar technologies,” said Jorge Perez, NAVFAC Southwest Desert Integrated Product Team construction manager. [↓](#)

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