

Robert A. Bothman, Inc.

Fort Hunter Liggett Army Base



Courtesy Robert A. Bothman, Inc. (4)

Overview

PROJECT DEVELOPER: Robert A. Bothman, Inc., bothman.com

ELECTRICAL DESIGN FIRM: McCalmont Engineering, mccalmont.net

INSTALLATION FIRM: InterMountain Electric Company, im-electric.com

DATE COMMISSIONED: April 24, 2012

INSTALLATION TIME FRAME: 251 days

LOCATION: Jolon, CA, 36.0°N

SOLAR RESOURCE: 5.8 kWh/m²/day

HIGH/LOW DESIGN TEMPERATURES: per Solar ABCs solar reference map: 100°F/21°F

ARRAY CAPACITY: 1.16 MWdc STC

ANNUAL AC PRODUCTION: 1,802 MWh

A federal mandate to Army base facilities nationwide to utilize on-site renewable energy generation set the stage for the Fort Hunter Liggett project in 2010. Phase One is composed of two 581 kW canopy array structures commissioned in April 2012. Robert A. Bothman, Inc., served as the project's developer and general contractor, working directly with McCalmont Engineering, the Army Corps of Engineers, Pacific Gas and Electric Company (PG&E), Nuño Iron and InterMountain Electric during the project's implementation. The base's installation was one of the first US Department of Defense projects funded through the Energy Conservation Investment Program. All components were required to meet the Buy American provision of the ARRA.

The PV system is designed to meet the Army's stringent requirements for electrical installations and went through numerous reviews and quality control

checks. In many cases, the safety protocols, installation methods and materials exceeded those utilized in comparable civilian installations. For example, daily safety equipment checks were required prior to work commencement and rigid metallic conduit was required for all exposed conduits.

Phase One is located in the base's logistic center, with two arrays that are 1,175 feet long by 45 feet wide. The array surface is elevated approximately 20 feet above grade. To accommodate the large vehicles to be parked under the array, the installed piers are spaced 28 feet apart to allow an adequate turning radius. Due to previous ground contamination issues at the site, the foundation design limited penetration depth to minimize soil disturbance.

Nuño Iron custom built the steel substructure supporting the Unirac ISYS mounting system to specifically match the racking. The structure's welded tabs



connect directly to the ISYS racking and require a tolerance of 7/16 inch over the approximately quarter-mile-long array structures. The project's installation firm, InterMountain Electric, had up to 13 electricians on site at the peak of the installation, with multiple scissor lifts working in tandem to access the elevated array.

Two Advanced Energy Solaron 500 kW inverters, located on a single pad underneath one of the arrays, are connected directly to a dedicated 480 Vac-to-12.47 kVac transformer. This configuration allows for direct interconnection to the base's medium-voltage distribution system via 1,500 feet of new underground conductors. An additional megawatt of system capacity will be deployed during Phase Two of the project. All electrical design and installation was planned in anticipation of the expansion.

The DECK Monitoring system tracks production and environmental data,

and is configured to transmit alarms to site personnel if sections of the array are underperforming. The monitoring system connects to the Internet via a 3G wireless signal and broadband routers, and includes intrusion logging and reporting as well as denial service to mitigate any hacker attacks.

"Since this project was one of the first funded ECIP projects through the Army Corps of Engineers in Sacramento, there was tremendous political oversight. Local contractor and vendor participation was a highly valued aspect as well. Our solicitation and contracting of numerous local subcontractors and vendors was essential in completion of the project on time and on budget.

—*Brian Bothman, vice president, Robert A. Bothman, Inc.*



Equipment Specifications

MODULES: 4,844 Sharp NU-Q24OF2, 240 W STC, +10/-5%, 7.98 Imp, 30.1 Vmp, 8.65 Isc, 37.4 Voc

INVERTERS: 3-phase, 277/480 Vac service; two Advanced Energy Solaron 500 kW PV, 500 kW, ±600 Vdc maximum input, ±330–±600 Vdc operating range

ARRAY: 14 modules per source circuit (3,360 W, 7.98 Imp, 421.4 Vmp, 8.65 Isc, 523.6 Voc), inverter 1: 172 source circuits (577.9 kW, 1,372.6 Imp, 421.4 Vmp, 1,487.8 Isc, 523.6 Voc), inverter 2: 174 source circuits (584.6 kW, 1,388.5 Imp, 421.4 Vmp, 1,505.1 Isc, 523.6 Voc); 1.16 MW array capacity total

ARRAY INSTALLATION: Two custom canopy structures, Unirac ISYS Roof Mount racking, 235° azimuth, 5° tilt

ARRAY STRING COMBINERS: 32 SolarBOS Disconnect Combiners, 15 A fuses

SYSTEM MONITORING: Deck Monitoring production and environmental monitoring

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