

COMMERCIAL GRID-DIRECT PHOTOVOLTAIC SYSTEM: Reclamation District 108 Solar Farm

Overview

DESIGNER: Bob Parkins, PE, director of engineering, Solar Development, solardevelop.com, and Bob Parkins Consultants, bobparkinsconsultants.com

INSTALLATION TEAM: integration: Solar Development; electrical: Butterfield Electric, www.butterfieldelectric.com; structural: Ascent Builders, ascentbuilders.com

DATE COMMISSIONED: November 2009

INSTALLATION TIME FRAME: 45 days

LOCATION: Knights Landing, CA, 39°N

SOLAR RESOURCE: 5.5 kWh/m²/day

RECORD LOW/AVERAGE HIGH TEMPERATURE: 19°F/94°F

ARRAY CAPACITY: 386.4 kW

AVERAGE ANNUAL AC PRODUCTION: 802 MWh

Equipment Specifications

MODULES: 1,680 Trina TSM-PC05, 230 W STC, +3%/-3%, 7.72 Imp, 29.8 Vmp, 8.26 Isc, 37.0 Voc

INVERTER: 3-phase, 480 Vac service, Advanced Energy Solaron 333 kW, 600 Vdc maximum input, bipolar ±330 to ±600 Vdc MPPT range, 97.5% CEC efficiency

TRACKERS: 30 Meca Solar MS Tracker 10+, dual axis, 1/3–1 HP 480 Vac 3-phase motors on both axes, 100 kWh annual motor consumption, gear motor and cogged crown wheel azimuth drive, electrically driven mechanical jack tilt drive



Courtesy solardevelop.com (4)

Reclamation District 108 (RD 108) procured this project to power its irrigation pumps at Sycamore Slough, 5.5 miles northwest of Knights Landing in Yolo County, California. The location and its associated environmental limitations, along with avoided-cost considerations, substantially challenged the project's designers. The array is installed on productive farmland, so a high-power-density solution was needed to maximize energy production while minimizing valuable land area dedicated to the PV system. The project could not disturb an endangered garter snake habitat. In addition, it required elevation above the Sacramento River's 100-year floodplain. Finally, it prescribed adherence to a narrow installation timeline of 60 days to avoid liquidated damages.

These very specific design parameters led RD 108 to select 30 Meca Solar dual-axis trackers, making this the first US installation to utilize the equipment.

Meca Solar tracking systems have been installed throughout Spain in solar farms as large as 50 MW, with a current installed capacity of 180 MW worldwide since 2004.

Optimizing performance at the power-conditioning level was paramount. With a CEC-weighted efficiency of 97.5%, the transformerless, bipolar topology of the specified Advanced Energy Solaron inverter resulted in smaller-gauge dc wire runs and increased output compared to transformer-based central inverters.

To tackle the floodplain issue, the tracker foundations are elevated on a 3-foot earth berm. A reinforced concrete column provides an additional 4 feet on top of the manufacturer-recommended 2-foot foundation. This places the modules above the floodplain when in a stowed, horizontal position. Normally, the trackers are installed with three attached string inverters; however, a centralized approach is used here to



mitigate the inherent flood potential. The inverter is placed on a custom-made steel platform, 16 feet above ground elevation and out of harm's way. The 3-phase, 480 Vac output is transmitted to the service entrance located in a pump house via an above-ground pole line.

Complicating schedule efficiency, the trackers shipped from Spain, and the Trina modules came from China. Once the equipment arrived, the project was fast-tracked and completed in 45 days, ahead of schedule. It achieved its maximum rated capacity immediately. Through a net metering connection to the Pacific Gas and Electric Company grid, the array generates approximately 80%–90% of the pumping load, which varies with changing crop and weather patterns.

"For most of 28 days, I checked the weather data for the North Atlantic daily. I was tracking the delivery ship's route relative



to hurricanes roaring through the region, sweating the loss of even one day. It was a relief when the ship carrying the trackers arrived on schedule in Oakland, California. I am exceptionally proud of everyone on the team. We met our schedule and performance goals and turned over a beautifully constructed project that is a real showcase for the Meca tracker and a valuable asset to RD 108. The RD 108 staff, led by Manager Lewis Bair, were very supportive and helpful team players."

—Bob Parkins,
Solar Development

ARRAY: 56 modules per tracker, 14 modules per series string (3.22 kW STC, 7.72 Imp, ± 417.2 Vmp, 8.26 Isc, ± 518 Voc) 120 strings total—60 positive and 60 negative-to-ground (386.4 kW STC, 463.2 Imp, ± 417.2 Vmp, 495.6 Isc, ± 518 Voc)

ARRAY INSTALLATION: Custom-ballasted surface foundations with embedded J-bolts for direct attachment to tracker framing

ARRAY COMBINERS: 16 Blue Oak HCB8F, NEMA 4X, fiberglass, 14 A fuses, eight PV source circuits per shared combiner (25.76 kW STC, 61.76 Imp, ± 417.2 Vmp, 66.08 Isc, ± 518.0 Voc); two trackers have individual combiners with four PV source circuits each (12.88 kW STC, 30.88 Imp, ± 417.2 Vmp, 33.04 Isc, ± 518.0 Voc)

DC DISCONNECTS: Six Square D H363RB 100 A, 600 Vdc heavy-duty safety switches

SYSTEM MONITORING: Draker Laboratories Sentalis 1000, including string-level monitoring and Web-based reporting in accordance with CEC SB-1 performance requirements