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The brightest ideas under the sun

Federal Research Center at White Oak Photovoltaic System

System Profile

- 25.9 kW
- Flat Plate Crystal Silicon
- 170 Square Meters
- Pole Mounted Fixed Array
- Grid-Tied to Combined Heat and Power Plant
- 3-Phase, 480 Vac Output
- Estimated Annual Energy Output ~ 38,237 kWhr

Formerly the Naval Surface Warfare Center, the renamed Federal Research Center in White Oak, Maryland, will be the site of 2.7 million square feet of office buildings and laboratories valued at $740 million for the Food and Drug Administration (FDA). Five facilities will share infrastructure, with energy delivered from a central utility plant. Construction began in 2002.

Under a technology specific (photovoltaic) Energy Savings Performance Contract, Sempra Energy Solutions signed a 20-year agreement with the U.S. General Services Administration to provide electricity, hot water, and air conditioning to the new complex. Sempra's contract included installation of a photovoltaic system to feed power to the Central Utility Plant (CUP) of the FDA complex.

In response to an August 2003 solicitation from Sempra Energy Services, Capital Sun was the successful bidder to design and install the photovoltaic system. The solar electric project was kicked off in November 2003 and completed in February. SunAmp Power Company of Phoenix, Arizona, consulted to Capital Sun on the system design and furnished the PV array, pole mounts, and inverters. Capital Sun's own staff prepared the site, performed all the excavation work, installed, and commissioned the solar equipment.

System Design

The photovoltaic system consists of 144 Sanyo HIT 180W Photovoltaic Modules. Each module has a nominal conversion efficiency of 15.2% and rated output of 180 watts. Sanyo's hetero-junction technology has achieved individual cell efficiency of 17.3% by surrounding a single thin crystalline silicon wafer by ultra-thin amorphous silicon layers. The panels carry a 20-year power output guarantee.

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The panels forming the array are wired in sets of 12, six in series and two six-panel sets feeding a single 2500 watt Sunny Boy inverter in parallel. At the maximum power point 12 panels deliver 2160 watts at 324 volts DC to each of nine inverters. The Sunny Boy inverters feed power to a single 3-phase transformer (208 Vac to 480 Vac) that sends the electricity into the CUP. Because the system array had to be mounted in one long line along an unimproved road, Capital Sun distributed the inverters in the field to minimize line losses. The system combiner box, transformer and electric meter are installed at the mid-point of the array. DC disconnects are located between each PV array string and its dedicated inverter. The grid-tie solar system inverters read the power harmonics of the cogeneration plant electricity and precisely match it.

FRC Central Utility Plant Systems

The Sempra CUP is a cogeneration facility that serves all the buildings in the new FDA complex. It contains the following energy systems:

- 5.8 megawatt dual-fuel diesel cogenerator (fuel oil or natural gas)
- Unfired heat recovery boiler attached to diesel generator set
- 2.0 megawatt diesel back-up electric generator
- 3 fire-tube boilers, 10 million Btu/hr each, for hot water
- 1130 ton absorption chiller, hot water-fired
- 2260 tons of centrifugal vapor compression chillers

The solar electric system, with a peak output rating of 25.9 kilowatts, delivers 480 V three-phase AC power directly to the CUP. Installation was completed in February, and it began operating on March 1, 2004.

Installation Challenges

GSA and Sempra specified that the system was to be pole mounted along a dirt access road. Undulating terrain put a premium on precise measurement and placement of the mounting poles in the concrete caissons. In addition, Capital Sun had to:

- Protect the construction site against rain water runoff erosion.
- Contend with a Naval Industrial Wastewater Disposal Area containing hazardous materials that was 25 feet from the work site.
- Avoid a natural gas supply line buried 5 feet from the pole caisson excavations.
- Avoid 67,000 Volt electric power lines directly over the PV installation.
- Dig thirty-six 30-inch wide, 88-inch deep holes in clay and mica for 6-inch steel mounting poles to ensure that the PV panel array could withstand 120 mph winds.

When restoring the construction site, Capital Sun planted native Maryland grasses and wildflowers as a low-maintenance strategy.