

520 KILOWATT SOLAR PHOTOVOLTAIC ARRAY SEWERAGE COMMISSION— OROVILLE REGION, CALIFORNIA

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ABSTRACT

During 2001, the state of California experienced frequent power outages coupled with rapidly rising electric rates. Even prior to 2001, the Sewerage Commission—Oroville Region located in northern California saw its energy costs skyrocket by 41%. In this uncertain energy environment, the superintendent of the sewerage commission investigated alternative energy sources that would stabilize its energy supply and reduce energy expenses. Normally, cost increases would be passed on to the rate payers in the form of higher utility bills. The result was the installation of a 520-kW solar photovoltaic (PV) array, consisting of 5,184 panels on three acres of unused land adjacent to the treatment ponds. The solar system combined with the utility credit reduced annual net power bills by over 80%. The PV system was commissioned and went on line in November 2002. The solar array is the largest dual-tilt array in the world and one of the largest PV arrays in the United States. It is also the only wastewater treatment plant in the U.S. to be primarily powered by solar energy.

INTRODUCTION

In 2001 the state of California experienced frequent power outages coupled with rapidly rising electric rates. Over the two years prior to 2001 the Sewerage Commission-Oroville Region (SC-OR) saw its energy costs skyrocket by 41%.

In this uncertain energy environment, Ray Sousa, superintendent of SC-OR, investigated alternative energy sources that would stabilize his energy supply and significantly reduce his electric bill so he wouldn't have to raise rates to his customers. Normally, electric bill increases would be passed on to SC-OR's ratepayers in the form of higher sewer bills.

SC-OR has a mission-critical need for a stable power source. The wastewater plant runs year-round, 24 hours a day, seven days a week, on Thanksgiving, Christmas Day and the Fourth of July. SC-OR's 60-acre wastewater treatment plant is designed to treat 6.5 million gallons of wastewater a day and serves 15,000 families and numerous industries in the greater Oroville area, which includes the city of Oroville and outlying rural areas.

SC-OR Superintendent Sousa researched renewable energy systems on the Internet and discovered the attractive state rebate program for solar. He approached Sun Power & Geothermal Energy in the spring of 2002 to submit a proposal for a solar array for his facility.

Sun Power & Geothermal Energy of San Rafael, California is an independent project developer and construction manager of on-site solar energy systems. Sun Power provides a full range of turnkey solar solutions including energy forecasting, engineering, installation, and commissioning. Services include feasibility studies, design of photovoltaic systems, project management and financing. Sun Power is a licensed and bonded General B and C-10 Electrical Contractor.

In early 2002 Sun Power installed a large commercial solar array, 150 kilowatts, at the Mt. Tam Racquet Club in Larkspur, California. This is one of the largest privately-owned solar arrays in the nation. Superintendent Sousa recognized that Sun Power was a leading designer/installer of solar systems in California, with the ability to engineer and construct the large solar arrays appropriate for the needs of SC-OR.

BACKGROUND

Oroville is a historic Gold Rush town situated on the Feather River north of Sacramento. SC-OR is part of the Joint Powers Agency of Oroville, which includes the Thermalito Irrigation District, the Lake Oroville Area Public Utility District and the City of Oroville. The Joint Powers Agency has worked together for 30 years to plan for the needs of the growing area.

Oroville is a hub of renewable energy. It is the home of the Oroville Dam, a hydroelectric facility with the potential for up to 68,000 megawatts, and Pacific Oroville Power, a large cogeneration plant next door to SC-OR that produces 18 megawatts by burning scrap wood.

POWER MANAGEMENT

Sun Power's challenge was to design a solar array that would provide enough power to run the entire SC-OR wastewater treatment facility during peak demand hours on a sunny day. Sun Power assessed the energy needs and the physical site of the SC-OR facility. SC-OR uses pumps and aerating machines as well as control and monitoring systems that can never go off-line. SC-OR has backup diesel generators to keep operations running in the event of a blackout. Sun Power determined that, even with a solar array, SC-OR must remain tied to the grid so it can continue to draw energy from the utility while running at night and on rainy days.

Sun Power submitted a feasibility study that included an analysis of the plant's average power usage and its potential growth. Sun Power designed a series of large, interconnected solar arrays for SC-OR that would produce 520 kilowatts at peak hours during sunny days. This is the equivalent electricity needed to supply 200 average homes.

The 5,184 solar photovoltaic panels that make up the arrays would be mounted on three acres of unused land adjacent to the SC-OR treatment ponds. SC-OR would remain connected to the local public utility grid. Utility rebates would pay for about 50% of the costs of the solar array.

NET METERING

Sun Power engineered the SC-OR solar system to work within California's "net metering" regulations, which require public utilities to credit renewable and alternative energy generators for the electricity they send to the grid. This is a benefit of California's deregulation of its energy system.

Sun Power designed the solar arrays to produce more power than SC-OR needs during peak demand hours, noon to 6:00 PM from May 1 to October 31. After SC-OR takes the energy it needs from the solar arrays, the system sends the extra electricity out to the grid and SC-OR earns credit with the utility at the higher peak demand rates.

The solar system is most productive during the mid-afternoon hours when the sun is highest in the sky. This is also the time of highest demand on the grid in California, when businesses all over the state switch on their air conditioning and the utility charges the highest commercial rates for electricity. SC-OR earns credit at the high commercial retail rate for sending power out during the afternoon peak demand hours. At night or on rainy days, when SC-OR needs grid electricity, it taps into the credit. The solar system combined with the utility credit reduces SC-OR's annual net power bills by over 80%.

DUAL TILT MOUNTING SYSTEM

Sun Power mounted the solar photovoltaic arrays on steel supports in rows on the ground. An innovative dual-tilt support was designed for the solar panels by Sun Power founder Dan Thompson. In the spring, summer, and fall the panels rest on the steel supports at a 10 degree angle to maximize their exposure to the sun during peak demand periods.

Each panel is hinged at the bottom. In the winter, when the sun is lowest in the sky, all 5,184 panels are tilted up to a 30 degree angle to expose them to more sunlight. A crew of laborers tilts up each panel with a portable pneumatic lift, and locks it into place manually with a pin. The system requires no maintenance and eliminates the electrical power required for an automatic sun tracking system.

CONCLUSION

The 520 kW SC-OR system was commissioned and went on line in November 2002. Upon completion, SC-OR received a renewable energy rebate for \$2,342,502, the largest California Public Utilities Commission rebate in state history. PUC rebates are funded by California public utility ratepayers through their local utility.

The SC-OR solar array is the largest dual-tilt solar photovoltaic array in the world and is among the top ten largest solar energy systems in the U.S. SC-OR is the only wastewater treatment plant in the U.S. to be powered primarily by the sun, and has become a model for similar public utility projects around the world, receiving attention in Italy, Germany and England.