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OVERVIEW OF RECENT RESULTS OF THE SOLAR TWO TEST AND EVALUATIONS PROGRAM

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ABSTRACT

The Solar Two project is a collaborative, cost-shared project between eleven US industry and utility partners and the U.S. Department of Energy to validate the molten-salt power tower technology. The Solar Two plant, located east of Barstow, CA, comprises 1926 heliostats, a receiver, a thermal storage system and a steam generator system that use molten nitrate salt as the heat transfer fluid and storage media. The steam generator powers a 10 MWe, conventional Rankine cycle turbine. This paper describes the test plan and evaluations currently in progress at Solar Two and provides some recent results.

PROJECT BACKGROUND AND SYSTEM DESCRIPTION

The 10-MWe Solar One Pilot Plant, which operated from 1982 to 1988 in Barstow, California, was the largest demonstration of first-generation power-tower technology (Radosevich, 1988). During operation of Solar One and after its shutdown, significant progress was made in the United States on more advanced second-generation power tower designs. The primary difference between first- and second-generation systems is the choice of receiver heat-transfer fluid; Solar One used water/steam, and the second-generation systems in the U.S. use molten salt.

The U.S. industries currently prefer molten-salt power towers because the design decouples the solar collection from electricity generation better than water/steam systems and it allows the incorporation of a cost-effective energy storage system. Energy storage allows the solar electricity to be dispatched to the utility grid when the power is needed most which increases the economic value of solar energy. A team composed of utilities, private industry, and government agencies have joined together to demonstrate molten-salt power towers at the 10-MWe Solar Two plant, which was constructed by retrofitting Solar One with molten-salt technology.

Converting Solar One to Solar Two required a new molten-salt heat transfer system (including the receiver, thermal storage, piping, and a steam generator) and a new control system. The Solar One heliostat field, the tower, and the turbine/generator required only minimal modifications. The major Solar Two equipment are described in the paragraphs that follow. A schematic of the plant is shown in Figure 1.

The Bechtel Group, Inc. designed and constructed the new salt system; they developed the plant layout, sized much of the salt handling equipment, and developed specifications for the receiver, storage tanks, steam generation system, and the master control system (Kelly and Singh, 1995). The design was based on experience gained from molten-salt receiver and system experiments conducted at the National Solar Thermal Test Facility (Smith and Chavez, 1992). Bechtel also installed all of the salt piping (except piping in the receiver system), pumps, sumps, instrumentation and controls. In addition, Bechtel was responsible for plant start-up and acceptance testing.

The Solar Two receiver was designed and built by Boeing North American, Inc. It is rated to absorb 42 MW of thermal energy at an

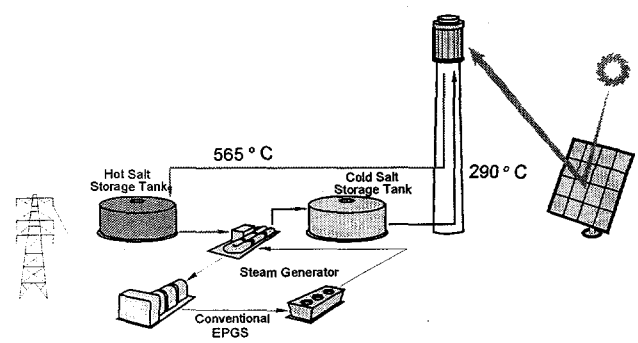

Figure 1. Schematic of a molten-salt power plant. Molten salt is heated to 565°C within a salt-in-tube receiver and pumped to the hot storage tank. After making steam, molten salt at 290°C is returned to the cold tank and pumped back to the receiver.