

Solar Two: A Successful Power Tower Demonstration Project

***Hugh E. Reilly
Sandia National Laboratories
Albuquerque, NM***

Abstract

Solar Two, a 10MWe power tower plant in Barstow, CA, USA, successfully demonstrated the use of a power tower for production of utility-scale electricity. This paper provides an overview of the entire project, from inception to final operation in the spring of 1999.

Solar Two built on the success of the Solar One plant. Solar One, a 10MWe power tower that utilized water/steam as its heat transfer medium, operated from 1982 to 1988. Recognizing the shortcomings of a water/steam plant, the Solar Two project was proposed to demonstrate the advantages of power towers utilizing molten salt as both the heat transfer and energy storage medium. The salt chosen was a 60/40 mixture of sodium nitrate and potassium nitrate, which has a melting point of approximately 430°F. The use of molten salt allowed the generation of electricity to be uncoupled from the collection of solar energy. This uncoupling solves the major problems inherent in a water/steam system. For example, during periods of intermittent clouds, Solar One would trip offline, whereas Solar Two continued to produce electricity. In addition, Solar Two was able to efficiently produce electricity after sundown. For a utility company with an evening peak demand, this “dispatchability” of power greatly increases the value of power produced.

A consortium including utilities and industry joined the US DOE in funding the Solar Two project. The project was built on the Solar One site, utilizing the Solar One heliostats and turbine, but replacing the receiver and steam generator with components using molten salt. One of the first tasks was removal of the Solar One thermal storage system, which consisted of a series of heat exchangers and a storage tank filled with heat transfer oil, sand and gravel. During construction of Solar Two, this thermal storage system was replaced with one hot salt and one cold salt storage tank. Solar Two construction began in October of 1994; final operation occurred on April 8, 1999.

This paper provides an overview of each phase of the project, including design, construction, startup/checkout, operation, test/evaluation, and power production. (Detailed results of the Test and Evaluation program are presented in a companion paper [Pacheco, et al].) Included are discussions of the goals of the Solar Two consortium, the planned-vs.-actual timeline, plant performance, problems encountered, and highlights and successes of the project. The paper concludes with a perspective on Solar Two and the next steps being taken to design, fund, build and operate the first commercial power tower plants.