SAND96-2662C
CONF-961016--1

Solar Power Tower Development: Recent Experiences

C. Tyner, G. Kolb, M. Prairie (Sandia National Laboratories)

G. Weinrebe, A. Valverde (DLR, PSA)

M. Sanchez (EU)

Abstract

Recent experiences with the 10 MW_e Solar Two and the 2.5 MW_t TSA (Technology Program Solar Air Receiver) demonstration plants are reported. The heat transfer fluids used in these solar power towers are molten-nitrate salt and atmospheric air, respectively. Lessons learned and suggested technology improvements for next-generation plants are categorized according to subsystem. The next steps to be taken in the commercialization process for each these new power plant technologies is also presented.

1. Introduction

The 10-MW_e Solar One Pilot Plant, which operated from 1982 to 1988 in Barstow, California, was the largest demonstration of first-generation power tower technology [1]. During operation of Solar One and after its shutdown, significant progress was made in the United States (US) and in Europe on more advanced second-generation power tower designs [2]. 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 US and in Europe use molten salt and atmospheric air, respectively.

Molten-salt power towers are currently preferred by the US because the design is simpler and more efficient than water/steam systems and 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 [3]. In Europe, researchers are pursuing the volumetric-air power tower because it is an inherently simple and efficient design that uses a non-problematic heat transfer fluid system and has the potential to be very reliable. In addition, the volumetric-air plant is easily hybridized with gaseous and liquid fossil fuels. Key features of the second-generation systems are depicted in Figures 1 and 2, for the molten salt and air plants, respectively.

American and European industries have expressed interest in commercializing second-generation technology and have recently constructed demonstration power plants. In the US, a team composed of utility companies, private industry, and government agencies is completing startup of the 10-MW_e Solar Two plant, which was constructed by retrofitting the Solar One with molten-salt technology. In Europe, an industrial consortium has been testing the 2.5 MW_t TSA (PHOEBUS Technology Program Solar Air Receiver) plant near Almeria, Spain since 1993.

This paper will present recent experiences with the Solar Two and TSA demonstration plants. Based on the lessons learned to date, technology improvements will be suggested. The paper