



Solar Two in Barstow, California

Solar Power Tower

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June 2008

A “power tower” uses thousands of sun-tracking mirrors called heliostats to concentrate the sun’s light at a single point on the top of a tower. In the newest receiver technology, a molten nitrate salt is heated by solar radiation to 1050°F in the tower. The heated salt can then be stored in tanks for later generation, or run directly through the heat transfer system to produce 1000°F steam. The steam powers the turbine, which produces electricity. Because solar towers operate at higher temperatures than solar trough or compact linear Fresnel reflector systems, they are able to achieve slightly higher power cycle efficiency, which may help to produce more energy at lower cost.

History:

Solar One, a 10 MW tower near Barstow, CA, operated from 1982-1988 and produced over 38 million kWh of electricity. It was upgraded – and renamed Solar Two – to test thermal storage technology using nitrate salt as the heat transfer fluid, and operated successfully from 1998-99.

The first commercial power tower, an 11 MW tower began selling power in April 2007 near Seville, Spain. Other projects are proposed for Spain and North Africa. A power tower project called Ivanpah, located in the California desert near the Nevada border, is currently undergoing environmental review by the California Energy Commission as part of its permitting process. The Ivanpah project would consist of three plants with a total capacity of 400 MW. The project’s sponsor, BrightSource, plans to begin construction early in 2009, and finish late in 2012.



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Land Use:

Power towers require relatively level land, with less than 3 percent slope desirable, and sites are partially graded. Each tower requires approximately 5-10 acres/MW of capacity. The Ivanpah project, for example, will involve 3400 acres, or 8.5 acres/MW.¹ As experience is gained with this technology, the acreage requirements will likely be reduced due to more efficient placement of the heliostats (mirrors).

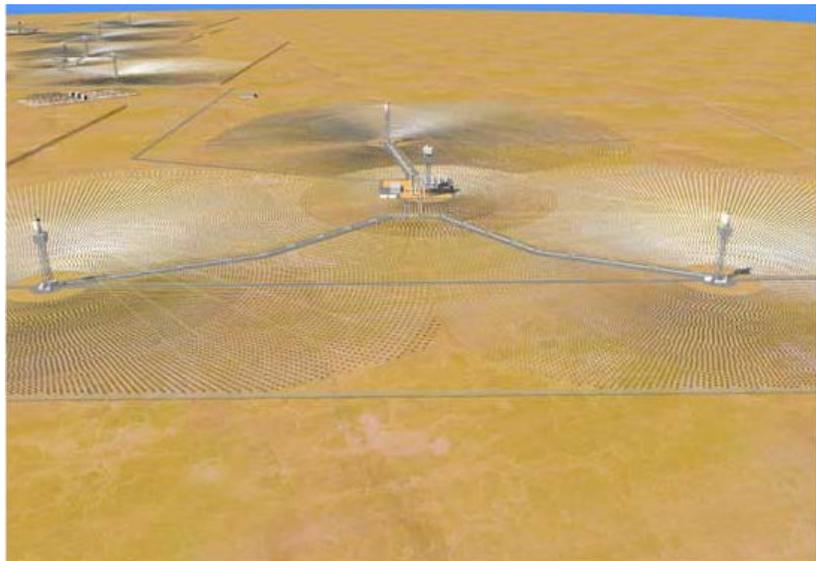


Photo credit: Credit: Ivanpah Application for Certification, image by CH2M Hill

The Ivanpah Project

Water Use:

Like all steam turbines, power tower plants require water in order to generate the steam that powers the turbine. The technology employs a closed-loop circulation but some “make-up” water is required to replace water lost in the system. Water is also required for regular washing of the mirrors to maintain high efficiency. If wet cooling is used, water is also required for the cooling towers in amounts similar to conventional steam plants, about 600 acre-ft/year per 100 MW. Dry cooling has been proposed for the Ivanpah plant and permits indicate 75 acre-feet/year would be required for process make-up and heliostat washing. This translates to about 18 acre-ft/year per 100 MW.² For comparison, one acre-ft/year of water is enough for three to six families in California.

¹Application for Certification for Ivanpah Solar Electric Generating System. Submitted to the CEC on Aug 31, 2007. Available at: <http://www.energy.ca.gov/sitingcases/ivanpah/index.html>

²Ibid.



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