Sun♦Lab
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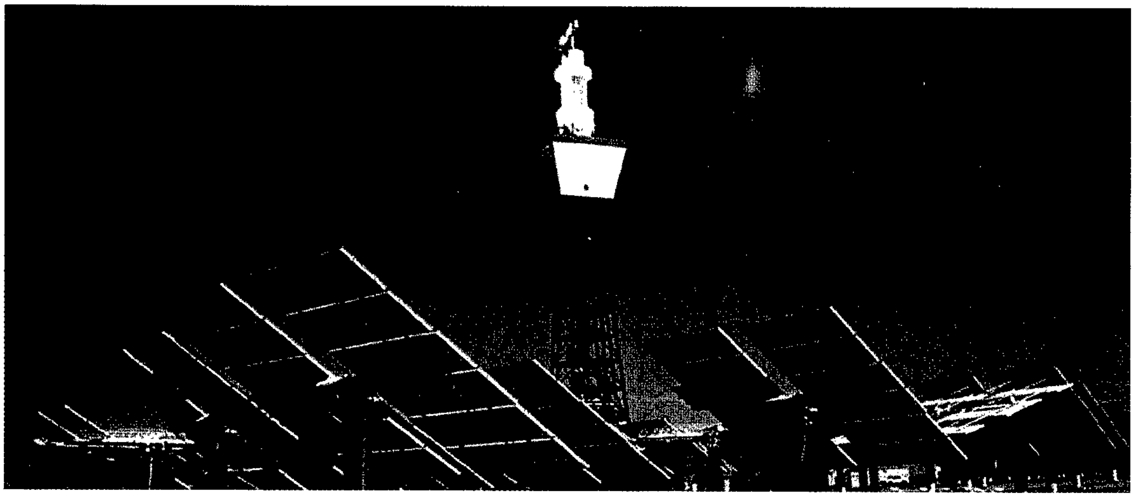
Solar Power Towers

These systems produce electricity on a large scale. They are unique among solar technologies because they can store energy efficiently and cost effectively. They can operate whenever the customer needs power, even after dark or during cloudy weather.



NREL/PIX 06051

During daylight hours, 2000 mirrors at Solar Two track the sun and store its energy as heat in molten salt. This energy can then be used to generate electricity when needed, such as during periods of peak demand for power.

The high desert near Barstow, California, has witnessed the development of this country's first two solar power towers. Solar One operated successfully from 1982 to 1988 and proved that power towers work efficiently to produce utility-scale power from sunlight. Solar Two was connected to the utility grid in 1996 and is operating today. Like its predecessor, Solar Two is rated at 10 megawatts. An upgrade of the Solar One plant, Solar Two demonstrates how solar energy can be stored in the form of heat in molten salt for power generation on demand.

The experience gained with these two pilot power towers has established a foundation on which industry can develop its first commercial plants.

Advancing Technology

Power towers operate by focusing a field of thousands of mirrors onto a receiver located at the top of a centrally located tower. The receiver collects the sun's heat in a heat-transfer fluid, which is used to generate steam for a conventional steam turbine located at the foot of the tower for production of electricity.

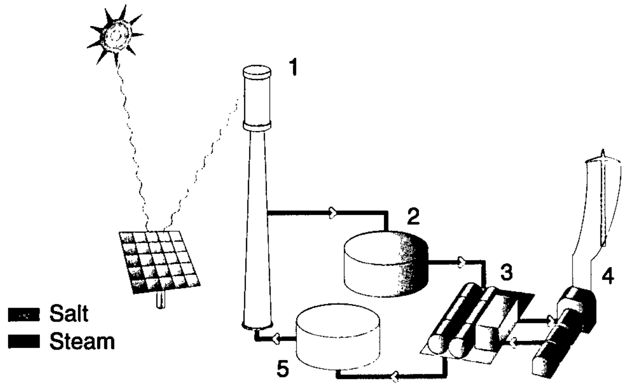
Based on their experience with Solar One, which used water/steam as the heat-transfer fluid, Sun♦Lab engineers determined that power towers would operate more efficiently using molten salt. The salt would have the further advantage of providing a practical way to store the heat.

The concept of storing energy in molten salt and decoupling solar energy collection from electricity production are in fact the bases for Solar Two (see diagram on back page). During operation, the salt is heated to more than 565°C (1050°F) and stored in a tank next to the tower. When electricity production is needed, the hot salt is pumped from this "hot" storage tank to the steam generator.

The power tower system with energy storage has one unique advantage over other solar power systems: Solar Two produces power

Concentrating Solar Power Program

Solar Power Towers



Schematic of electricity generation using molten-salt storage:

1) **sun heats salt in receiver;**
2) **salt stored in hot storage tank;**
3) **hot salt pumped through steam generator;**
4) **steam drives turbine/generator to produce electricity;**
5) **salt returns to cold storage tank to be reheated in the receiver.**

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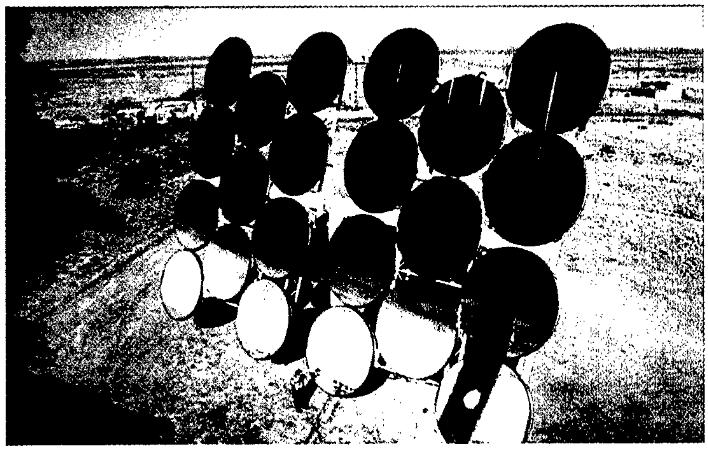

SANDIA/PIX 06067

A new SAIC faceted membrane heliostat is on test at the National Solar Thermal Test Facility.

when the local utility, Southern California Edison Company, needs it most—during peak periods. These periods occur on hot, sunny afternoons and into the evenings during the air-conditioning season when power production is most valuable to the power company.

Power towers also have distinct advantages over conventional power plants. Like all solar technologies, they consume no fuel, so they do not pollute the environment. Similarly, they are capital intensive but cost little to operate. Land use for power towers is about on par with that of conventional power-generating technologies using fossil fuels.

Preparing for the Future

Using the lessons learned from the Solar Two demonstration, DOE, through Sun♦Lab, is conducting research and development on power towers to lower capital costs and reduce the technical risk to investors. These activities include developing advanced components and formulating alternative systems with the potential for commercial success.

In 1998, Sun♦Lab staff are focussing on performance and characterization tests of two major components: a new heliostat, developed by Science Applications International Corporation of Golden, Colorado, and a new receiver, developed by the Rocketdyne Division of Boeing North American, Inc., of Canoga Park, California. Tests will take place both at Solar Two and at the National Solar Thermal Test Facility located at Sandia National Laboratories in Albuquerque, New Mexico. In addition, Sun♦Lab engineers are evaluating a new pump that will simplify the valve and piping design for circulating molten salt in power towers. These new components will improve the performance and reliability of future power towers and will reduce the technical risk of building and operating the first commercial plant.

Sun♦Lab also is formulating alternative hybrid systems that could work well in some power markets. (Hybrid refers to systems that operate on both solar and conventional fuels, such as natural gas.) Sun♦Lab staff are analyzing a number of hybrid configurations and will work with industry to choose and develop the best for future commercial plants.

For on-line information about the U.S. Department of Energy's Concentrating Solar Power Program, please visit its web site: **http://www.eren.doe.gov/sunlab**

For more information on renewable energy or for additional copies of this brochure, contact the Energy Efficiency and Renewable Energy Clearinghouse (EREC): **1-800-DOE-EREC (363-3732)**

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