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Solar One

Solar One was an innovative solar power tower facility built near Barstow, California, that operated from 1982 to 1988. Developed by Southern California Edison and supported by various governmental and energy organizations, Solar One was designed as a large-scale test to demonstrate the efficiency of power tower systems in generating electricity from sunlight. The facility utilized a field of thousands of mirrors, or heliostats, to focus sunlight onto a central receiver atop a nearly 100-meter-tall tower, which converted heat into steam to drive a conventional turbine.

With a capacity of ten megawatts, Solar One was notable for its ability to store thermal energy, allowing it to supply electricity during peak demand periods, particularly on hot, sunny afternoons when energy needs were highest. The system's effectiveness in using water and steam as heat-transfer liquids led engineers to explore more efficient methods, culminating in the development of Solar Two, which utilized molten salt for improved energy storage and efficiency. After its decommissioning, Solar One's tower remained a prominent landmark until its demolition in 2009. The advancements gained from Solar One and its successors continue to influence the development of solar power technologies worldwide.

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Solar One

IDENTIFICATION: The first solar power tower system

DATES: Operated from 1982 to 1988

The Solar One facility proved that power towers work efficiently to produce utility-scale power from sunlight.

Solar One, a pilot plant built as a large-scale test of the tower system of generating power using solar energy, was built in the early 1980s near Barstow, California, by Southern California Edison, with the support of Sandia Labs, the US Department of Energy, the Los Angeles Department of Water and Power, and the California Energy Commission. Rated at ten megawatts of power, Solar One could efficiently and cost-effectively store energy, making it unique among solar technologies. Solar One operated successfully from 1982 to 1988.

A solar power tower operates by focusing a field of thousands of mirrors (heliostats) onto a receiver located at the top of a centrally located tower. The receiver collects the sun's heat in a heat-transfer liquid. This liquid is used to generate steam for a conventional steam turbine, which then produces electricity at the base of the tower. The mirrors of Solar One reflected and focused sunlight onto a central tower that was nearly 100 meters (328 feet) tall. The tower's absorber panels, which were painted black, absorbed 88 to 96 percent of the incident light. In order to capture sunlight from the south, the field of mirrors was oriented mostly toward the north. Solar energy was focused onto six panels to preheat the water that traveled to eighteen superheat panels.

After leaving the superheat panels, the water was at 510 degrees Celsius (950 degrees Fahrenheit). The hot water was sent either to turbines, where it generated electricity at 35 percent efficiency, or to a heat exchanger, where it heated oil that was sent to a **thermal storage** tank and circulated through crushed granite. The stored heat could be drawn back from the tank through the heat exchanger to produce steam for the turbine. In addition, the thermal storage allowed a buffer system for periods of cloudiness so that the plant could keep operating through changes in weather conditions.

Solar One proved that the heat-transfer liquid cycle is reliable, that the system could meet expectations, and that thermal storage is cost-effective. Furthermore, the power tower system with [energy storage](#) showed a unique advantage over other solar power systems because it could supply power to the local electrical utility company during peak periods. In Southern California, these periods occur on hot, sunny afternoons and into the evenings during the summer, when needs are high for air-conditioning of homes and workplaces and power production is most valuable to the power company.

Based on what they learned through the operation of Solar One, which used water and steam as the heat-transfer liquid, solar engineers determined that power towers operate more efficiently using molten salt. The salt also has the further advantage of providing a direct, practical way to store heat. The concept of storing energy in molten salt and decoupling solar energy collection from electricity production formed the basis for Solar Two, which operated from 1996 to 1999. The construction of Solar Two involved the conversion of Solar One from its water and steam system to a molten salt system. After Solar Two was decommissioned, the tower remained as a local landmark in the California desert until it was torn down in 2009. Construction on a third solar power tower plant, named Solar Tres Power Tower, began in 2009 near Seville, Spain; the plant became operational in 2011. Its name was later changed to Gemasolar Thermosolar Plant, and it is three times the size of Solar Two.

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