

Concentrated Solar Schemes

Concentrated solar schemes generate large amounts of solar power at a single generating station and sell it to the grid. Thermal schemes capture the sun's heat. In a solar tower, hundreds of large mirrors reflect the sun onto a tank at the top of a tower, where it heats molten salt to very high temperatures. In a solar trough scheme, long troughs reflect the sunlight onto a pipe that runs down the middle of the trough. Oil flows through the pipe, reaching very high temperatures. In both schemes the heated liquids are used to generate steam, which turns a generator. The PS10 solar plant in Spain is a recent tower design with a capacity of 11 mW. Larger tower facilities are planned, but not yet completed.ⁱ The SEGS power plants, in operation since 1991 in the Mojave Desert of California, are trough plants. Two of them, at 80 mW each, are among the largest solar facilities in the world.ⁱⁱ By comparison, the Rush Island Generating Station in Jefferson County, has a rated capacity of 1,208 mW.ⁱⁱⁱ It is Missouri's 3rd largest, and we previously noted that it consumes 720 tons of coal *every hour*.^{iv}



Top—PS 10 Solar Plant. *Wikipedia: PS 10 solar power tower 2.jpg*. Bottom—Solar troughs. National Renewable Energy Laboratory.
http://www.nrel.gov/solar/parabolic_trough.html.

In photovoltaic systems, each solar panel generates a small amount of electricity, but they are grouped together into arrays that generate larger amounts. The largest photovoltaic installation in the United States is at Nellis Air Force Base in Nevada, with a generating capacity of 14.2 mW.^v The installed base of concentrated photovoltaic plants is small compared to thermal.

Thermal schemes have the advantage of a significant body of molten salt or hot oil. These serve as heat reservoirs, allowing the plant to continue generating for several hours if clouds should temporarily cover the sun. Sometimes concentrated solar plants are paired with gas turbine generating plants that can generate electricity at night. Often, concentrated solar power plants are used to handle peak demand, which falls on hot, sunny days, when their generating capacity is highest.

It is difficult to compare the “true” costs of different methods of generating electricity. Costs that vary from region-to-region must be considered, much of the data is not publicly available, costs are often hidden behind subsidies that seem unrelated, but aren't, technology is constantly changing, and hydrocarbon prices are volatile. The Electricity National Market Module estimates that, nationwide, electricity from new concentrated solar thermal power plants would be three times as expensive as from the cheapest new coal fired plants, twice as expensive as new IGCC with carbon sequestration,^{vi} and almost ten times as expensive as gas turbine plants.^{vii} On the other hand, a study by the National Renewable Energy Laboratory estimated that assuming continuation of an existing tax credit, in California, electricity from new concentrated solar plants would be competitive with electricity from standard gas turbine plants.^{viii}

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- ⁱ See *PS10 solar power tower*, Wikipedia. Retrieved online 1/4/2008 at http://en.wikipedia.org/wiki/PS10_solar_power_tower. For a pamphlet that contains a number of examples and discusses the potential for solar thermal systems, see also *Solar thermal power plants: Solair Technology*, retrieved online 1/4/2008 at ec.europa.eu/research/energy/pdf/stpp_solair_en.pdf.
- ⁱⁱ *Solar trough systems*. Concentrating Solar Power Program, Department of Energy. Retrieved online 1/4/2008 at www.nrel.gov/docs/legosti/fy98/22589.pdf. See also *Solar energy generating systems*. Wikipedia, retrieved online 1/4/2008 at http://en.wikipedia.org/wiki/Solar_Energy_Generating_Systems.
- ⁱⁱⁱ *Ten largest plants by generation capability, 2005*. Energy information administration. Retrieved online Nov., 2007 at http://www.eia.doe.gov/cneaf/electricity/st_profiles/missouri.html.
- ^{iv} *Rush Island plant*. AmerenUE. Retrieved online 1/12/2008 at http://www.ameren.com/aboutus/adc_au_RushIsland.asp.
- ^v Nellis Air Force Base web site. Retrieved online 1/12/2008 at <http://www.nellis.af.mil/>.
- ^{vi} Integrated Gassification Combined Cycle. Combined with carbon sequestration, this is the technology known as FutureGen. Discussed in the white papers on coal.
- ^{vii} *Electricity market module*. (April, 2007). Energy Information Administration. Retrieved online 1/12/2008 at <http://www.eia.doe.gov/fuelectric.html>.
- ^{viii} Stoddard, L., Abiecunas, J. & O'Connell, R. (2006). *Economic, energy, and environmental benefits of concentrating solar power in California*. National Renewable Energy Laboratory. Retrieved online 1/12/2008 at www.nrel.gov/csp/pdfs/39291.pdf.