Concentrated solar power (CSP)
It is also known as concentrating solar power.
The concentrated solar thermal) systems generate solar power by using mirrors or lenses to concentrate a large area of sunlight into a receiver. Electricity is generated when the concentrated light is converted to heat (solar thermal energy), which drives a heat engine (usually a steam turbine) connected to an electrical power generator or powers a thermochemical reaction.
As a thermal energy generating power station, CSP has more in common with thermal power stations such as coal, gas, or geothermal. A CSP plant can incorporate thermal energy storage, which stores energy either in the form of sensible heat or as latent heat (for example, using molten salt), which enables these plants to continue to generate electricity whenever it is needed, day or night. This makes CSP a dispatchable form of solar. Dispatchable renewable energy is particularly valuable in places where there is already a high penetration of photovoltaics (PV), because demand for electric power peaks near sunset just as PV capacity ramps down (a phenomenon referred to as duck curve).
The CSP is often compared to photovoltaic solar (PV) since they both use solar energy. While solar PV experienced huge growth in recent years due to falling prices, solar CSP growth has been slow due to technical difficulties and high prices. In 2017, CSP represented less than 2% of worldwide installed capacity of solar electricity plants. However, CSP can more easily store energy during the night, making it more competitive with dispatchable generators and baseload plants.

Concentrated solar power (CSP)

A solar power tower consists of an array of dual-axis tracking reflectors (heliostats) that concentrate sunlight on a central receiver atop a tower; the receiver contains a heat-transfer fluid, which can consist of water-steam or molten salt. Optically a solar power tower is the same as a circular Fresnel reflector. The working fluid in the receiver is heated to 500–1000 °C (773–1,273 K or 932–1,832 °F) and then used as a heat source for a power generation or energy storage system.[40] An advantage of the solar tower is the reflectors can be adjusted instead of the whole tower. Power-tower development is less advanced than trough systems, but they offer higher efficiency and better energy storage capability. Beam down tower application is also feasible with heliostats to heat the working fluid.[45]

The Solar Two in Daggett, California and the CESA-1 in Plataforma Solar de Almeria Almeria, Spain, are the most representative demonstration plants. The Planta Solar 10 (PS10) in Sanlucar la Mayor, Spain, is the first commercial utility-scale solar power tower in the world. The 377 MW Ivanpah Solar Power Facility, located in the Mojave Desert, is the largest CSP facility in the world, and uses three power towers.[46] Ivanpah generated only 0.652 TWh (63%) of its energy from solar means, and the other 0.388 TWh (37%) was generated by burning natural gas.[47][48][49]

Supercritical carbon dioxide can be used instead of steam as heat-transfer fluid for increased electricity production efficiency. However, because of the high temperatures in arid areas where solar power is usually located, it is impossible to cool down carbon dioxide below its critical temperature in the compressor inlet. Therefore, supercritical carbon dioxide blends with higher critical temperature are currently in development.

Fresnel reflectors[edit]

Main article: Compact linear Fresnel reflector

Fresnel reflectors are made of many thin, flat mirror strips to concentrate sunlight onto tubes through which working fluid is pumped. Flat mirrors allow more reflective surface in the same amount of space than a parabolic reflector, thus capturing more of the available sunlight, and they are much cheaper than parabolic reflectors.[50] Fresnel reflectors can be used in various size CSPs.[51][52]

Fresnel reflectors are sometimes regarded as a technology with a worse output than other methods. The cost efficiency of this model is what causes some to use this instead of others with higher output ratings. Some new models of Fresnel Reflectors with Ray Tracing capabilities have begun to be tested and have initially proved to yield higher output than the standard version.[53]

Dish solaf,*Solar thermal energy § Dish designs*

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Comparison between CSP and other electricity sources[edit]

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