Solar thermal power stations

There are two ways to generate electricity directly from the sun: solar thermal power, and solar photovoltaic. Both have their advantages, and the cost of both is falling. Solar thermal power (also known as "concentrating solar power" or CSP) is currently cheaper, and can generate electricity into the night by storing heat. Whereas photovoltaic panels can be used anywhere, solar thermal power only works in areas with plenty of direct sunshine.

Solar thermal power stations use mirrors to concentrate the sun's heat, boil water and drive a conventional steam turbine. Solar thermal electricity has been generated on a modest scale for more than 20 years in California's Mojave Desert, and the technology has worked without problems. New power stations have recently been built in Spain and Nevada, with more in planning or under construction. The Australian-American company Ausra, which recently established itself in Silicon Valley, has signed agreements to produce 1,000 MW of electricity for two major US utilities. Spain is building up its solar thermal power industry with a special feed-in tariff. India has recently announced plans for initial incentives to encourage the development of CSP there.

Pictured below is a solar thermal power station which opened in 2007 outside Seville, Spain.

Studies in the US have calculated that if an area in the Southwestern United States 92 miles by 92 miles square were to be covered with solar thermal power stations, it would produce as much electricity as the entire US produces today. Naturally, the power stations do not all have to be built in one location, and not all of a country's power needs to come from one technology.

The best place for generating solar thermal power is dry regions which have little cloud cover, as the power stations need direct sunshine. Best of all are deserts, which have the advantage that there is plenty of land that is not being used for other purposes.

Two recent studies by the German Aerospace Centre for the German Government looked at the potential of solar thermal power in the Europe-Mediterranean region. They concluded that this single energy source could provide a substantial part of the region's energy, using high-voltage direct-current (HVDC) powerlines to transport the energy with very little loss from southern Europe, North Africa and the Middle East to northern and central Europe.

More than 90% of humanity lives within 3,000 kilometres of a desert. In the same way as in the Europe-Mediterranean region, HVDC power lines could bring energy to virtually all parts of the world. Much of the Indian subcontinent is suitable for solar thermal power, especially the Thar Desert, as is north-west China, large parts of North Africa, Southern Africa and East Africa, and parts of Mexico, Brazil and the west coast of South America. Australia could produce vast quantities of energy in this way, exporting energy to Southeast Asia. And so on.

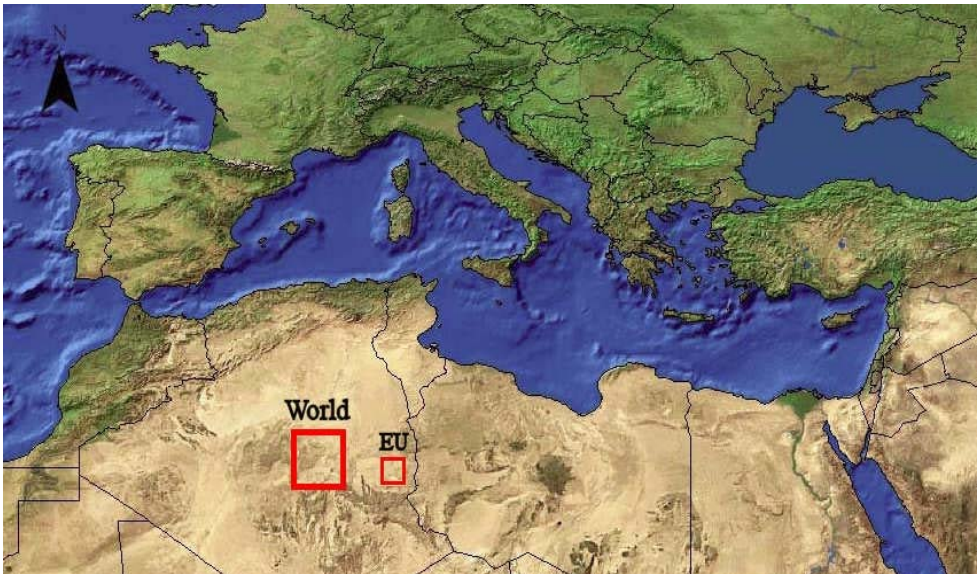
Thus solar thermal power could play a key role in a solution to the climate problem. There is no limit to how much energy we can generate in this way. It boils down to a political decision about how many mirrors we want to build.

One advantage of solar thermal is that energy can be stored as heat, in effect in a giant thermos, so that the steam turbines can continue running well into the night. If the heat runs out, fossil fuels can be used as a back-up to generate steam for the same turbine, ensuring power 24 hours a day. Solar thermal power stations can thus produce reliable baseload power.

Another advantage is that, in power stations on the coast, sea water can be used to cool the steam, so that the power stations can desalinate sea water through evaporation at the same time as generating power. In many dry regions of the world water is rapidly becoming a scarce and precious commodity.

Ausra, the solar thermal company mentioned above, says that by using cheap, flat strips of mirror to concentrate the sun’s rays on an overhead pipe, together with heat storage at night, they can produce electricity for US$0.08 per kilowatt hour (kwh), roughly the same as wind power and competitive on price with gas fired power stations. (Coal is still cheaper at around $0.05 per kwh, but according to an MIT study that would rise to $0.08 if carbon were priced at $30 a ton or if the CO2 had to be captured and stored underground.) Some other solar thermal power companies say they produce energy in the range of $0.09-0.13 per kwh. Prices are expected to fall quickly to as low as $0.07 per kwh as solar thermal power is deployed on a larger scale in the next few years.

The following map shows an estimate of how much desert land would need to be covered with solar thermal power stations to produce all the electricity that Europe and the world produce today.



There will be some parts of the world where people are less than enthusiastic about relying too heavily on other countries for energy supplies, especially where political relations are sometimes troubled. A few points to keep in mind:

- **A transmission cable is not like an oil tanker**, which can sail in any direction. If a country chooses not to export its solar or wind energy, it will suffer from lost export income.
- **Every country is already interdependent with its neighbours**. If political relations should worsen, those neighbours have many ways to apply leverage. A regional electricity grid and cooperation on renewable energy development, like the early European Coal and Steel Community which led to the European Union, could help to build closer political relations.
- **Any political risks from energy interdependence pale into insignificance beside the risks of climate change**. If the desert sun can help us to prevent dangerous global warming, we should use it without hesitation.