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Win-win: concentrating solar power

This article was written by Gerry Wolff, coordinator of TREC-UK.

Concentrating solar power (CSP) is potentially a revolutionary renewable technology. It is, in short, the remarkably simple technique of arranging mirrors to concentrate sunlight and using the resulting heat to raise steam to drive turbines and generators, just like in a conventional power station. CSP works best where there is direct sunshine and lots of it, as in hot deserts.

CSP offers considerably more flexibility than conventional solar technology. Solar heat may be stored in molten salts so that electricity generation can continue at night or on cloudy days. Gas may be used as a stop-gap source of heat when there is not enough sun. With these options available, CSP plants can provide base load, intermediate load and peaking power according to need.

CSP plants have been supplying electricity in California since 1985. New plants came on-stream recently in Spain and Nevada, USA and others are now being planned or built around the world. The potential is enormous. Every year, each square kilometre of hot desert receives solar energy equivalent to 1.5 million barrels of oil. Multiplying by the area of deserts worldwide, this is several hundred times the entire current energy consumption of the world. If it was covered with CSP plants, an area of hot desert measuring about 254km square – less than 1% of the total area of such deserts – would produce as much electricity as is currently consumed worldwide.

With long-distance transmission, CSP could also become a major source of carbon-free energy for countries and regions, such as the UK and Northern Europe, that do not themselves have high direct sunshine levels. Electricity generated by CSP could be transmitted directly using efficient high voltage direct current (HVDC) transmission lines (see below). With transmission losses at about 3% per 1,000km, there would, for example, be a power loss of less than 10% between North Africa and the UK. However, some energy-intensive industries could be relocated to desert areas to take advantage of the vast quantities of energy available there, obviating the need for transmission. Moreover, CSP may also be used to generate hydrogen as a fuel for trains, cars, ships or even aeroplanes.

The DESERTEC concept

These ideas are part of the DESERTEC concept, a set of proposals for Europe, the Middle East and North Africa (EUMENA) developed by the

Trans-Mediterranean Renewable Energy Cooperation (TREC) international network of scientists and engineers. The proposals are described in the 'MED-CSP' and 'TRANS-CSP' reports prepared by researchers at the German Aerospace Centre.

An important part of the DESERTEC concept is the creation of an HVDC transmission grid, spanning the whole of EUMENA, and designed to work in conjunction with existing high-voltage alternating current grids. This chimes well with an independent proposal by Airicity to create a Europe-wide HVDC grid – to reduce the high wastage of renewable energy that may otherwise occur and to take advantage of the fact that wind power is much less variable across a wide area than in any one spot.

The DESERTEC concept also offers spin-off benefits for host countries. Waste heat from CSP plants could be used for desalination of sea water – a useful bonus in arid regions. The cool, shaded areas under CSP mirrors could be used for horticulture, using desalinated sea water. Throughout EUMENA, new jobs would be created in a large new industry. The expansion of win-win collaborations among countries of EUMENA would promote good relations across the region – a positive alternative to the confrontational policies of recent years.

The MED-CSP report (2005) suggests that CSP, like other forms of renewable energy, will need public support for a time but that, with economies of scale and refinements in technology, the cost of CSP electricity is likely to tumble relative to more traditional sources of electricity. The TRANS-CSP report (2006) concludes that CSP is likely to become one of the cheapest sources of electricity in Europe, including the cost of transmission. CSP is already proving to be attractive to investors.

The DESERTEC scenario shows that CSP has the potential to be an important source of carbon-free electricity, not just for countries in the sun belt but for many other countries as well – including the UK. The relevant technologies are available now and with the right political impetus, the necessary infrastructure can be put in place quite soon. It only remains to be seen whether governments will take the initiative and help to make this exciting vision a reality.

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The reports mentioned can be found on: www.trec-uk.org.uk/reports.htm