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Photo by Praher Valves

# Clean power from deserts

By Dr. Gerry Wolff\*

*Concentrating solar power (CSP) is 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 a conventional power station. CSP works best where there is direct sunshine and lots of it, as in hot deserts.*



A parabolic trough solar collector

Solar heat may be stored in melted salts so that electricity generation may continue at night or on cloudy days, and gas may be used as a stop-gap source of heat when there is not enough sun. With heat storage and hybridization with gas firing, CSP can be a reliable and flexible source of power.

## The potential

CSP plants have been supplying electricity in California since 1985, new plants came on stream recently in Spain and Nevada, and others are now being planned or built in many places around the world.

The potential is enormous. Every year, each square kilometer 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. It has been calculated that less than 1% of the world's deserts, if covered with CSP plants, would produce as much electricity as is now used by the whole world.

## Cloudy countries?

CSP could become a major source of clean energy for countries that do not themselves have lots of direct sunshine. Some energy-intensive industries may be relocated to desert areas to take advantage of the monumental quantities of energy there. CSP may be used to generate hydrogen which may serve as a fuel for trains, cars, ships or

even planes. But if electricity is the form of energy that we need, then in almost all circumstances the best option is to transmit it directly using highly-efficient 'HVDC' transmission lines. With transmission losses at about 3% per 1000 km, there would, for example, be less than 10% loss of power between North Africa and the UK.

## The DESERTEC concept

The ideas that I have sketched are part of the 'DESERTEC' concept, a set of proposals for Europe, the Middle East and North Africa (EUMENA) that has been developed by the 'TREC' international network of scientists and engineers. The proposals are described in the 'TRANS-CSP' and 'MED-CSP' reports prepared by a team of researchers at the German Aerospace Centre.

An important part of the DESERTEC concept is the creation of an HVDC 'Supergrid' spanning the whole of EUMENA, and designed to work in conjunction with existing HVAC grids. This chimes well with an independent proposal by Airtricity to create a Europe-wide HVDC Supergrid—to take advantage of the fact that wind power is much less variable across a wide area than in any one spot, to improve the security of electricity supplies, and to reduce the large amounts of wastage of renewable energy that may otherwise occur.

Even without the Supergrid, the UK can begin to benefit from 'desert' electricity via existing transmission lines (see [www.trec-uk.org.uk/elec\\_eng/cascade.html](http://www.trec-uk.org.uk/elec_eng/cascade.html)). And, less directly, there is potential for the UK to earn credits via the Clean Development Mechanism or European targets for renewable energy or successors to those schemes.

An interesting bonus is that waste heat from CSP plants may be used for the desalination of sea water—very useful

in arid regions. Also, the shaded areas under CSP mirrors may be used for many purposes, including horticulture using desalinated sea water. Throughout EUMENA, there would be jobs and earnings in a large new industry. And the development of a win-win collaboration amongst countries of EUMENA should help to promote good relations across the region.

## Costs

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

## Conclusion

The DESERTEC scenario, which has been developed with considerable professionalism and care, shows that concentrating solar power can 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. Additional potential benefits include the not-insignificant prize of improved relations amongst different groups of people.

All the relevant technologies are available now. With the right political impetus, the necessary infrastructure can be put in place quite soon. ■

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تركيز الطاقة الشمسية هي تقنية بسيطة لإستعمال الحرارة الشمسية لتوليد بخار يحرك توربينات ومحركات لتوليد الكهرباء، وهذه التقنية تعمل بشكل أفضل في المناطق التي تتمتع بكمية كبيرة من التعرض لأشعة الشمس كالصحراء. يقوم مشروع DESERTEC على مجموعة إقتراحات لأوروبا والشرق الأوسط وشمال أفريقيا طورتها شبكة TREC الدولية للعلماء والمهندسين. يقضي المشروع بإنشاء شبكة كهربائية ضخمة مألقة من تيار مستمر عالي الفولطية HVDC تعبر هذه المناطق ومُصممة لتعمل مع شبكات HVDC موجودة في هذه المناطق تمكن من إيصال الكهرباء الناتجة عن الطاقة الشمسية إلى مختلف البلدان المحيطة.

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