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Producing electricity with concentrated sunlight

Constructing solar thermal power plants more efficiently and cheaply

The use of high-temperature solar heat for generating electricity has become an established technology. Scientists are now currently working on further optimising the components and concepts. The BINE-Themeninfo brochure “Solar thermal power plants” (II/2013) presents the main research areas. The authors describe the bases for solar thermal power plants, storage technologies and quality assurance processes.

More than 95% of the commercially operated solar thermal power plants are parabolic trough systems. In 2017, a further one is scheduled to enter operation in the southern Moroccan town of Ouarzazate on the edge of the Sahara Desert. The fully planned and funded power plant is designed to supply up to 500 MW of electricity. To achieve this, large parabolic mirrors will concentrate sunlight onto absorber tubes. The thermal oil flowing through the tubes will be fed into a power plant block. Here the stored heat is transferred to a water circuit. This drives a steam turbine that is used to generate electricity. A cheaper version of the parabolic trough technology is provided by Fresnel systems. Because the incident solar rays are less concentrated in this version, the collectors have greater optical losses. A challenge for the scientists is to control the high temperatures of about 500 °C on the receiver. Another research goal is to provide constant steam parameters.

To ensure that solar thermal power plants work efficiently, the quality of components and systems must be continually checked. Here, for example, the proportion of the reflected radiation and its direction play an important role. The latter is influenced by the mirror shape and slope. In order to assess this, the scientists are deploying optical measurement processes.

The authors of the BINE-Themeninfo brochure are Professor Robert Pitz-Paal and further employees from the Institute of Solar Research at the German Aerospace Centre (DLR).

The BINE Themeninfo brochure, which can be obtained free of charge from the BINE Information Service at FIZ Karlsruhe, is available online at www.bine.info or by calling +49 (0)228 92379-0. The brochure cover and additional image material can also be downloaded from the press section in this Web portal.

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