



**Wuppertal Institute**  
for Climate, Environment  
and Energy

# **Economic Opportunities for the German Industry Resulting from a Global Deployment of CSP (Concentrated Solar Power) Technologies**

Study on behalf of Greenpeace Germany,  
the German Association for the Club of Rome,  
and the DESERTEC Foundation

## **Executive Summary**

Daniel Vallentin

Dr. Peter Viebahn

Assistance by Johannes Oos

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**GREENPEACE**



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**Executive Summary**

In order to let global warming not exceed an additional 2°C, which is the aim required by the Intergovernmental Panel on Climate Change (IPCC), a global CO<sub>2</sub>-emissions reduction of 80% by 2050 compared to the level of 1990 is urgently needed. Solar thermal power plants are becoming a technology of growing importance to reach this aim. They bundle solar radiation using concentrating mirrors which is why this technology is also called Concentrated Solar Power (CSP). The concentrated radiation is then transformed into thermal energy and used to power conventional steam and gas turbines or Stirling engines.

CSP makes it possible to offer „power on demand“ via heat storage and will be of particular interest for generation units between 200 and 400 MW<sub>el</sub>. It works as a regenerative alternative to conventional power generation technologies both for base load and peak load as well as for balancing varying power supply from wind and photovoltaics. Apart from producing electricity, the process heat emitted by CSP may be used to cool buildings and industrial processes, production of hydrogen or operation of facilities for the desalination of sea water.

Currently the discussion focuses on four CSP technology options: Parabolic Trough Power Plants, Solar Towers, Fresnel and Dish Stirling Facilities. The overall capacity of globally installed CSP plants amounts to about 604 MW<sub>el</sub>; 569 MW<sub>el</sub> of which are Parabolic Trough Power Plants. Other CSP technologies have smaller shares (32.5 MW<sub>el</sub>). With a capacity of 419 MW<sub>el</sub> the majority of currently operating plants is situated in the USA (354 MW<sub>el</sub> however were already installed in the 1980's). Spain follows with a capacity of 183 MW<sub>el</sub>. Currently 761 MW<sub>el</sub> of CSP capacities are under construction, 5,780 MW<sub>el</sub> are planned.

German companies play a prominent role in conception, planning and production of CSP power plants worldwide. Companies like MAN Ferrostaal and Solar Millennium are well positioned general contractors who co-ordinate planning, construction and operation of CSP plants. Component suppliers like Schott Solar (receiver), Flabeg (mirrors) and Siemens (turbines) are among the leading technology providers worldwide.

Nevertheless there is more and more competition on the international CSP market. Regarding scheduled plants and those under construction, particularly Spanish companies like Abengoa Solar, Solel, Aries or Iberdrola are strongly represented. In the U.S. technology supplier BrightSourceEnergy plays an important role. To take part in the worldwide development of CSP technology German companies would have to considerably expand their production capacities.

To what extent could the German CSP industry profit from a global expansion of this technology? Greenpeace International together with solar professional associations SolarPaces and ESTELA recently published two scenario paths for „moderate“ and „ambitious“ global expansion of CSP until 2050. The scenarios presume that until 2050 831 GW<sub>el</sub> (*moderate scenario*) or 1,524 GW<sub>el</sub> (*ambitious scenario*) of CSP capacity could be in use. Based on existing cost profit and economic value added (EVA) studies the present study makes a rough estimate of sales opportunities for the German industry following the Greenpeace scenarios. Learning curve calculations from the EU-NEEDS study as well as an EVA study by MAN Ferrostaal provide the basis for these estimations. The MAN Ferrostaal study assumes that the German industry could participate in the emerging added value that goes along with the expansion of CSP with 10%, 33%, or 41% - depending on different framework conditions. 33% is the current capacity of the German industry. A shrinkage of the German share to 10% could result from lack of financing, an increase to 41% from the

development of strategically important areas. The three mentioned shares of sales for German companies are taken as a basis for the calculation of German value added shares in the global expansion of CSP. As the MAN Ferrostaal study does not include all cost components of a CSP plant, a fourth version applies the share of sales given in the study to a complete reference plant. This results in a 37% share of sales.

The strong extension dynamics in the *moderate* as well as in the *ambitious Greenpeace scenario* would make it possible for German companies building solar thermal power plants to generate significant turnovers which will rise continually until 2050. In the *moderate scenario* this development starts between 2011-2015 with turnovers of 8.4 and 34.4 billion Euro per five years and goes up to 58.3 and 239.1 billion € at the end of the scenario time span (2046-2050). In the *ambitious scenario* turnovers amount to between 10.2 and 41.7 billion Euro per five years in the beginning and rise up to between 113.1 and 463.7 billion Euro between 2046 and 2050. This wide gap results from the above mentioned four different added value percentage shares German companies could potentially receive. The *whole* added value potential for German companies between 2010 and 2050 adds up to 269-1,102 billion Euro in the *moderate scenario* and to 476-1,953 billion Euro in the *ambitious scenario*.

CSP expansion goes along with great employment potential. In the year 2050 globally between 357,000 (*moderate scenario*) and 582,000 (*ambitious scenario*) employees for the construction of solar thermal power plants would be needed to implement the outlined expansion paths. The number of jobs in German companies would be between 36,000 and 146,000 following the *moderate scenario* and between 58,000 and 238,600 following the *ambitious scenario*. If German companies were also involved in the operation of these plants more jobs would emerge. Gross employment in the whole renewable energy sector in Germany 2008 was 274,700. In its optimistic prognosis the German Federal Ministry for the Environment so far assumes an increase to 415,000 jobs until 2030 (including solar thermal power plants).

However, the results of this study point out a bottom limit of estimation only. If the plants were not built with a 7.5 h storage but with doubled storage capacity to increase their full load hours, there would be one extra collector field per plant as well as a second storage necessary. This would induce higher investments and more jobs. The study presumes a plant life cycle of 40 years, meaning that so far no replacement of plants until 2050 has been considered. Furthermore, it only looks at electricity generation capacities and does not take into account that for the development of sea water desalination facilities extra plant capacities would have to be installed.

**The complete report (in German) is available at**

<http://www.wupperinst.org/en/projects/rg1/> or direct at

[http://www.wupperinst.org/en/projects/proj/index.html?projekt\\_id=276&bid=136](http://www.wupperinst.org/en/projects/proj/index.html?projekt_id=276&bid=136)

**Contact:**

M.Sc. Daniel Vallentin

Tel.: ++49 (0) 202 / 2492-309

Fax: ++49 (0) 202 / 2492-198

Mail: [daniel.vallentin@wupperinst.org](mailto:daniel.vallentin@wupperinst.org)

Dr. Peter Viebahn

Tel.: ++49 (0) 202 / 2492-306

Fax: ++49 (0) 202 / 2492-198

Mail: [peter.viebahn@wupperinst.org](mailto:peter.viebahn@wupperinst.org)

Wuppertal Institute for Climate, Environment and Energy  
Research Group 1 „Future Energy and Mobility Structures“  
Doeppersberg 19  
42103 Wuppertal  
Germany  
[www.wupperinst.org](http://www.wupperinst.org)