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**Research Report**

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SWP Comments, No. 13/2009

**Provided in Cooperation with:**

Stiftung Wissenschaft und Politik (SWP), German Institute for International and Security Affairs, Berlin

*Suggested Citation:* Werenfels, Isabelle; Westphal, Kirsten (2009) : Solar power from the desert: A sensible and feasible energy solution?, SWP Comments, No. 13/2009, Stiftung Wissenschaft und Politik (SWP), Berlin

This Version is available at:

<https://hdl.handle.net/10419/256088>

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## Solar Power from the Desert: A Sensible and Feasible Energy Solution?

*Isabelle Werenfels / Kirsten Westphal*

The idea of supplying Germany and Europe with solar energy from the desert remains highly controversial, but it is an idea that has been gaining traction with both policy makers and the private sector. This is because of two recently launched, large-scale projects: the Solar Plan of the EU and Southern Mediterranean countries, and the Desertec Industrial Initiative, a solar energy project privately financed by a group of European companies. Despite all the financial, political, and economic uncertainties these projects entail, there is virtually no viable energy alternative. What is required now are clear policies at the German and European level, providing appropriate incentives for the successful implementation of these projects—without which, they will remain just a vision.

On July 13, 2009, a consortium of German and international companies lead by the Munich Re Group unveiled the Desertec Industrial Initiative. The consortium plans to generate power from solar and wind energy in the Middle East and North Africa. The aim is to produce sufficient power to meet about 15% of Europe's energy needs by 2050. The estimated total investment costs are around 400 billion euros. To start with, however, investment plans are to be drawn up.

Even earlier, in July 2008, another large-scale project was announced at the founding summit of the Union for the Mediterranean (UfM): the Mediterranean Solar Plan. The objective is to install 20 gigawatts of new renewable energy capacities by 2020 in the region, which would mean investment costs of about 80 billion euros. But the Solar

Plan has hardly progressed further since it was put forward, primarily because the official meetings of the UfM were suspended in late 2008 and early 2009 due to the Gaza conflict. Moreover, divergent ideas within the EU have resulted in logjams: France is pushing for high-profile pilot projects, while Germany wants to create a master plan.

In the case of the Desertec Industrial Initiative, the driving force is not coming from government policy makers but from the business sector. The recently founded planning entity includes—along with banks, component manufacturers, and power plant constructors—also the German energy giants E.ON and RWE. Thus, the most important players are already on board for the implementation of this large-scale project, which will include not just the construction

of power plants but also transmission, distribution, sales, and financing. With the Algerian company Cevital, Desertec includes an important private sector business from a potential exporting country, and with the Spanish ABENGOA, a company already operating solar thermal power plants.

### Feasibility Questions

The hurdles involved in implementing these solar projects are high.

► *Technical questions.* The technology for large-scale solar energy generation has evolved rapidly over the last few years. Now, not just wind but also what is known as “concentrated solar power” is to be used to produce energy. In comparison to photovoltaic energy systems, this form of energy offers not only higher production capacities but also the additional advantage that solar energy is first transformed into heat. And heat can be stored easily, which makes it possible to generate power at night as well. Consequently, solar thermal power plants are capable of meeting basic power needs independent of the time of day or year.

Concentrated solar power plants have already been tested: plants with an output of 500 megawatts are in operation in Spain and the US, further 1 gigawatt power plants are being built, and 10 gigawatt plants are in the advanced planning stage. For comparison: Krümmel Nuclear Power Plant’s gross power production is 1.4 gigawatts, while that of the coal-fired power plant Schwarze Pumpe is 1.6 gigawatts.

► *Transmission questions.* The energy produced by these projects has to be fed into the European power grid through the Mediterranean region. Technically, this is only possible via the new high-voltage direct-current transmission lines. The losses are relatively low, at 3 to 4% per 1000 kilometers.

Up to now, there is just a power link between Morocco and Spain. In addition, the power ring around the Mediterranean basin would have to be enlarged. In order to transport power further, both to and within Europe, additional lines would be needed.

Efforts to promote and develop renewable energies and initiatives for improved energy efficiency in Europe must crucially be accompanied by the construction of a close-meshed and intelligent power network—a SuperSmart Grid (SSG)—encompassing all of Europe. Only in this way can power from renewable energies be fed into the power grid at the time and place it is produced. Here, one can reasonably expect synergy effects to emerge.

► *Commercial questions.* The investments required are extremely high, at least at the outset, since solar thermal installations are not yet being built industrially.

Initial subsidies and/or purchasing guarantees may be necessary to make concentrated solar power economically viable within about 10 to 15 years and to achieve economies of scale. According to some estimates, 10 gigawatts of installed output mark a turning point for a significant cost reduction. At this stage, production costs would sink drastically. The power plant projects would then be commercially profitable, and bank financing could be obtained.

But it is also important to note that the renewal of existing European power plants will also require significant investments in the coming years. Thus, from a commercial point of view, the time is ripe for conversion of the energy system.

► *Security Policy Aspects.* The Middle East is not a stable region. Nor can North Africa—which will probably be the site of the first large-scale solar power projects due to its geographic proximity to Europe—be considered secure and stable in the long term. Nevertheless, the security concerns appear less severe in comparison with the risks of gas and oil and those of other alternatives like nuclear energy. Furthermore, after the implementation of the Desertec Industrial Initiative, just 15% of European power would come from the region. In addition, this power would not be transmitted by cable, nor would it be generated at a single location. Rather, solar and wind power projects in the southern Mediterranean would entail a significant diversification of energy

exporters, since countries like Morocco, Tunisia, and Jordan that are poor in petroleum and natural gas would also become producers. This would also diversify the security risk.

Furthermore, from a security policy perspective, it can only be seen as an advantage if North Africa shifts toward solar and away from nuclear energy, which is considered an attractive alternative there. If terrorist attacks on power plants were ever to take place, the consequences would be incomparably less severe if the plants were solar thermal and not nuclear.

Finally, a successful “solar partnership” between the Arab states and Europe would tend to have positive repercussions on the stability of the export countries, since it would promote the development of local economies. The precondition, however, is that a significant share of the power generated in the region also remains in the region, available at an affordable price.

## Interests and Conflicts

One hindrance to the rapid implementation of the solar projects is the existence of various interests that diverge on several different levels: the national government level, the European level, and the European-Mediterranean level. Proponents of photovoltaic energy production argue in favor of decentralized implementation in Germany. Critics of Desertec and the Solar Plan also propose using the solar power directly in the Southern Mediterranean region. This seems illusory insofar as it would be almost impossible to finance concentrated solar power plants without the perspective of exports to Europe. In this situation, both the photovoltaic and the solar thermal “lobbies” are focused on garnering market shares and government subsidies. Moreover, in Germany, as in many European countries, it is disputed whether renewable energies from other EU or third countries should be subsidized or not.

Efforts within the EU to promote solar energy from North Africa differ among the

various member states. While Spain, Italy, and Germany have shown an extremely high commitment to this undertaking, the constellation of interests is more complicated in France, where exports of nuclear technologies for civil purposes take high priority. In general, the passive attitude of most of the EU countries toward the solar projects is striking.

But even in the Southern Mediterranean countries, there exist divergent interests in solar thermal energy production and export. The interest is particularly strong among the North African countries and in Jordan. This is reflected to some degree in ambitious laws passed there on renewable energies. At the same time, in almost all potential export countries of the Arab world, there exists concern about neocolonial imbalances of power. It is feared that mainly European companies will profit, while all the Southern Mediterranean countries will get is overpriced solar power.

## An Indispensable Resource

Despite the hurdles and conflicts of interest described above, one thing is clear: the idea of producing energy in the desert and importing it is one of the few coherent strategies for future energy supply. After all, the sun will remain a reliable energy source for millions of years, and it is even low-emission and comes “delivered to your door, free of charge.” Solar power is the key to solving two major global challenges: ensuring a secure supply of affordable energy and thereby reducing energy poverty, and making the conversion to a sustainable and environmentally friendly energy system.

► *Energy security.* The present-day energy system is reaching its limits. The shortage of the fossil fuels oil and gas not only raises questions about the affordability of carbon-based energy supplies; it also creates potential for conflict over the right to access, use, and distribute fossil fuels.

In the North African littoral states of the Mediterranean, it is estimated that demand will increase by 6% annually in the coming

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ISSN 1861-1761

Translation by Deborah Bowen

(English version of  
SWP-Aktuell 38/09)

years, due in part to the construction of energy-intensive desalination plants. Although the power needs in Europe should only increase very slightly, thanks to improvements in energy efficiency among other things, future energy needs will have to be satisfied increasingly by alternative energy sources.

Europe does not adequately fulfill the geophysical conditions for solar thermal energy generation. This technology demands extremely strong sunlight and therefore can only be used in the so-called Sun Belt, between the 35<sup>th</sup> parallel north and the 35<sup>th</sup> parallel south of the equator. The mirrors required to concentrate the solar energy also require a large amount of space, for which reason it makes sense to build them in desert regions. It also makes sense to use the available technology for both regions, and thus make it globally marketable.

► *Combating global warming.* An international consensus now exists on limiting global warming to 2 degrees Celsius. In order to stop global warming, emissions of harmful greenhouse gases would have to be reduced by more than 50% worldwide by the year 2050, and by 80% in the industrialized countries. This goal can only be achieved through a massive expansion of renewable energies. Implementing the Desertec Industrial Initiative would bring about a reduction of harmful carbon dioxide emissions on a level that would correspond to the current emissions produced in Germany in a six-year period.

► *Profitability.* As demand increases, future prices of fossil fuels will increase dramatically as well. The volatility of these prices is costly for national economies. With solar thermal energy, the “fuel costs” are practically zero. Thus, developing this technology further offers a means to keep the costs of energy provision calculable in the years to come. Furthermore, it should be kept in mind that with the use of fossil fuels like coal, gas, and oil—but also with nuclear energy—many of the costs of pollution, final disposal, and so on are not (or not adequately) integrated into the price

and are thus passed on to the general public and future generations.

## Fundamental Policy Decisions

With the Desertec Industrial Initiative, businesses have taken an important step. This initiative undoubtedly makes good sense, but it can only succeed if many—ideally, all—European countries take crucial steps to set the course.

► *Creating incentives, boosting competitiveness, increasing acceptance.* Up to now, both at the EU and national levels, there has been a lack of fundamental policy decisions to develop a green energy market. Granted, the EU has taken a first important step with its Directive on the promotion and use of renewable sources of energy of April 2009, promoting imports of renewable energies from third countries into the EU grid (Art. 9 and 10). Now, concrete measures must follow to make solar thermal energy competitive. What is needed specifically are tax breaks, subsidies, feed-in tariffs, provision of space, as well as national investment funds. The ultimate goal must be an energy market that is integrated in terms of both its legal/regulatory framework as well as its infrastructure. This also means—especially when considering the expansion of the power grid—raising public awareness so that infrastructural measures do not fail due to the NIMBY (“not in my backyard”) syndrome.

► *Creating an energy partnership.* A key to success is creating a win-win situation on both sides of the Mediterranean. Thus, it is imperative to create a market for renewable energies so that the countries in the region pay European prices minus transmission costs. And not least of all, these countries need to profit from such a partnership: in energy supply, grid expansion, jobs, but also in the transfer of technology and know-how.

Given the enormous challenges and the passivity and logjams that currently exist, an effective approach may be to create a “Coalition of the Willing” from Europe and the Southern Mediterranean to push the solar energy vision forward.