Solar power boom

Last year the solar industry made record profits. The worldwide demand for photovoltaic (PV) solar systems grew from 125 megawatts (MW) in 1999 to 4500 MW in 2008. This huge increase in demand was largely due to market incentives, in particular the feed-in tariff (FiT). The FiT was first introduced in Denmark, then on a larger scale in Germany and later in Spain. It works as follows: utility companies are obliged by law to accept renewable energy (wind or solar) that 'third parties' produce and feed into the electricity grid. They also have to pay a fixed amount per kilowatt hour (kWh), guaranteed for many years (20 in Germany, 25 in Spain). To cover the costs of the FiT scheme, utility companies are permitted to raise the price per kWh that households pay for their electricity. In most cases, therefore, the costs of the incentive scheme do not appear in government budgets.

Those who oppose the FiT argue that people should not be expected to pay more for their electricity. Germany's response to this has been that the long-term benefits – green electricity and reduced environmental damage from CO_2 emissions – far outweigh the short-term costs.

The FiT has boosted worldwide private investment in the solar industry. It really started to take off in 2003 when Germany raised the FiT for solar to over €0.50 per kWh. Savvy entrepreneurs can now earn a fine living by seeking out tall and well-positioned farm roofs to lease from farmers. They cover the roofs with solar panels, connect the panels to the central electricity grid and wait. The return on the investment is secured within a foreseeable number of years. There are also local communities that together set up fields with solar panels (so-called free-field installations) to become joint shareholders. The million-dollar investments went into projects such as the 11 MW solar tower near Seville in Spain, which can power 6000 homes.

Japan, India, South Korea and quite a few European countries have followed the German and Spanish examples and introduced the FiT. In his contribution to this report, Meinolf Heptner discusses what the FiT has meant for the solar energy market, and why 2009 suddenly presents serious challenges.

Glossary

- **concentrating solar power (CSP):** Technology that uses mirrors to reflect and concentrate sunlight onto receivers that convert the solar energy to heat.
- **feed-in tariff (FiT):** A government-set rate that utility companies pay for 1 kWh of renewable energy (wind, solar) fed into the central electricity grid by 'third parties' (private investors, including households).
- **grid parity:** The situation that the generation cost of PV is equal to the price of electricity at the point of connection.
- **insolation:** The measure of solar radiation received on a given surface area at a given time.
- **kilowatt hour (kWh):** Measure for energy quantity (is power x time (hour).
- **on-grid system:** A solar system that is connected to the central electricity grid.
- **off-grid system:** A stand-alone solar system.
- **photovoltaic (PV):** The technology of using solar cells for converting sunlight directly into electricity.
- **watt (W):** Measure for power (is energy/second = 1 J/s).
- **watt peak (Wp):** The power of PV systems produced under standard test conditions.

By **Ellen Lammers**, research editor for *The Broker*, who was trained as an anthropologist (PhD, University of Amsterdam) and is affiliated with WiW-Global Research & Reporting.

Technological timeline

The solar industry's economic surge has made it worthwhile for companies to invest in costly research and development (R&D). The ultimate objective is to make solar energy competitive with conventional energy without the need for subsidies and incentives. The main competitor for green electricity is gas, the price of which is connected to that of oil. Stephan Slingerland of the Clingendael International Energy Programme (CIEP) in the Netherlands points out that at present, with oil costing just US$40 a barrel, price competitiveness for solar energy is still a long way away. Wim Sinke, executive board member of the EU Photovoltaic Technology Platform, disagrees. There is consensus among PV experts that for the specific case of retail electricity such competitiveness can be achieved within a decade, by using advanced versions of technologies already available.

In some countries in southern Europe, grid parity with retail electricity can already be reached within just a few years. Grid parity means that the cost of producing 1 kWh with a PV system will equal the price paid for 1 kWh to the electricity company. Nevertheless, the costs for PV systems, which have already rapidly reduced, need to come down much more for large-scale commercial and industrial applications of PV to become economically competitive. It would greatly help if the solar industry could change to large-scale use of organic cells and thin-film technologies. In research labs across Europe and the US a lot is happening to

Alamy / Kevin Foy

The solar tower in Andalucia, Spain. Six hundred mirrors reflect sunlight to produce steam for electricity generation.

develop these technologies further. Sinke, who is a staff member at ECN Solar Energy, the Netherlands, says 'Through our broad research programme we can support the industry in their short-term needs and also contribute to the necessary longer-term innovations. Our research reflects the fact that PV is a viable option now, but also still has huge potential for further improvements in terms of performance and economics'.

In his contribution to this report, Johan Trip gives a brief overview of the different solar technologies and their innovative applications.

Solar in the South

Western countries leave the largest carbon footprints, but Africans and Asians bear the brunt of the impact in their struggle against floods and desertification. Is the international community doing enough to help developing countries adopt sustainable energy technologies, including solar? Africa certainly has no shortage of sunlight. Frank van der Vleuten of ETC Energy observes, however, that the global solar industry increasingly disregards Africa and its own role in poverty reduction. 'The African rural market used to be important, but is has now become rather insignificant compared to the enormous subsidized markets in Europe, Japan and the US'.

And yet solar energy has a massive role to play in developing countries: it can give rural households their first access to modern energy. Worldwide, 1.6 billion people do not have access to electricity, and 2.5 billion are still dependent on firewood, dung and charcoal for their daily energy needs. With a small, affordable solar system, families can power a light bulb at night, charge a mobile phone and watch a programme on their black-and-white television. In Kenya, Tanzania and Uganda, Mali, Burkina Faso and Niger, and in Botswana and Namibia, the commercial markets for PV systems are growing fast. In eastern Congo and southern Sudan, as well as in the Sahel, the markets for stolen solar systems are thriving. The piece 'The sunny South' in this report discusses some of the challenges involved with introducing solar energy in Africa.

In his contribution, Jaideep Malaviya describes the situation in India, where government incentives for solar energy are on the way and there are plenty of manufacturing opportunities.

Solar in the oil-rich deserts

In the summer of 2008 oil prices rocketed to a new record of US$140.40 a barrel. The vulnerability of countries without domestic fossil reserves contrasts starkly with the self-confidence displayed by resource-rich countries, especially when prices are rising. This may explain at least part of Europe's self-appointed global leadership in the area of >

climate change (unlike the US, the EU is running out of domestic fossil resources). But even the US is showing signs of change. President Barack Obama appointed Steve Chu as Secretary of Energy. Chu, a Nobel laureate of physics (1997), is known as a very strong advocate for solar energy.

There are people who predict that solar energy may come to test the power of the Organization of Petrolium Exporting Countries (OPEC). Their reasoning is easy: the sun belongs to everyone. No country has a monopoly, not even shared, as is the case with mineral resources. It is a matter of who jumps at the opportunities, has the vision and is willing to invest. At the moment, electronics firms and IT companies are leading in embracing the ET (energy technology) revolution that accompanies the rise of solar. The largest players in the solar industry today are not the big energy companies that were once more heavily invested, such as BP and Shell. Heptner, however, suggests that this may well change, saying, 'I think solar is still too small to have made it onto the radar of big oil. Exxon's 2008 profit is probably enough to buy most of the solar industry at current prices'.

Yet, the oil-rich Middle East has not been idle in the area of renewables. The United Arab Emirates has commissioned the Swiss Center for Electronics and Microtechnology (CSEM) to build prototypes of artificial solar islands, to float in the Persian Gulf, that will generate electricity using concentrating solar power (CSP). Also found in the Emirates are demonstration plants of the Sahara Forest Project, which envisions vast greenhouses that use seawater for crop cultivation, combined with concentrated solar power, to provide food, fresh water and clean energy in deserts.

The most ambitious plan is the Eumena-Desertec programme, which would involve building an electricity network linking the Middle East, North Africa and Europe, based on electricity generation through solar power (CSP and PV), wind and some biomass. To give an idea of its potential, a solar power plant measuring 500x500 km in the Sahara could provide enough electricity for the world's entire population. Prince Hassan Bin Talal of Jordan is playing a leading role in promoting the programme. He calls it 'anti-establishment' – fossil fuels are in the mix only as backup for balancing power.

Some people question this. Van der Vleuten suggests that for the EU this ambitious plan can also be seen as a geopolitical move to safeguard contracts for the supply of gas from Algeria and Libya. 'And then these solar plants would be a nice present', he says. 'We'd call this greenwashing. It is unlikely that the plants would contribute to solving Africa's energy poverty'. Preben Maegaard, vice-president of Eurosolar, considers it absurd to build thousands of kilometres of gridlines from North Africa to Europe, especially if few Africans will benefit (the majority of Africans are not – and never will be – connected to an electricity grid). Sinke, however, sees no reason for such cynicism. 'We can't afford cynicism. The problems of Africa are much too big for that – and the world's response absolutely insufficient. Let us see how far we can get instead of saying what cannot or should not be done. The potential is enormous. Would it not be wonderful to have more than just oil coming from the East'? ■

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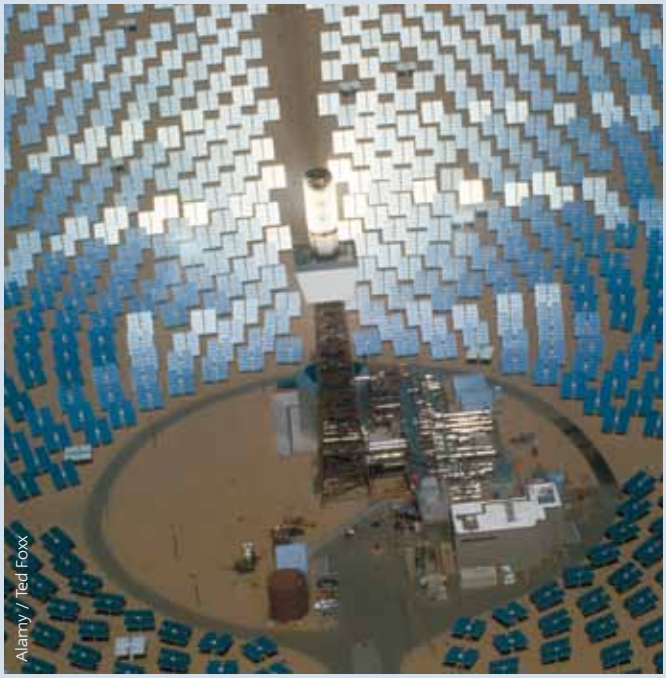
Charging phones and saving lives

In Mali, only 7% of households are connected to the electricity grid. Ibrahim Togola, director of the Mali-Folkecenter, illustrates how solar energy can improve quality of life and contribute to poverty alleviation. Eighty percent of the women in Mali are illiterate. Installing two 60 watt solar panels in a local school and connecting them to a locally manufactured truck battery that powers two light tubes was enough to start evening classes in Tabakoro village in southern Mali. After two years, 50 women could read and write, compared with five women before the project started. Having a solar-powered light in the maternity ward of the local hospital (where solar power is also used to cool medicines and pump water) helped convince women not to give birth in darkness at home (where 60% of children are born). As a result the number of children dying during childbirth has been greatly reduced.

A fast growing demand for solar across Africa is for charging mobile phones. So-called solar shops provide customers with a range of phone chargers, powered by a panel on the roof. People in rural areas no longer have to waste time walking long distances to town to have their mobile phones charged. Many solar shops also provide a power line to the barber or the tailor next door. And the first mobile phone with built-in solar cell is already available.



Aerial view of 1200 6x8 foot mirrors at the experimental Solar One, an electric power generating station in the Southern California desert.