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Harnessing the inexhaustible energy of the sun – Backgrounder Solar thermal power plants

The sun is an inexhaustible source of energy. A concentrated solar power plant (CSP) covering just a small percentage of the surface area of the Sahara Desert (300 km x 300 km) could theoretically generate enough power to meet the needs of the entire earth. Electricity from solar thermal plants also has the advantage that it generates no harmful CO₂ emissions. Together with offshore wind parks, solar thermal power plants are a key component of the Desertec project. This project will harness the sun's power, supplying the energy needs of that region as well as transporting power from Africa to Europe along energy superhighways (high-efficiency high voltage direct current lines). Spain is already using solar thermal plants, and they have also been in use in the U.S. for more than 20 years.

The basic principle of solar thermal power generation is quite simple: energy from the sun is used to heat water, which is then converted into steam and used to power a turbine. A generator converts this motion into electricity. Because heat can be stored for hours in tanks with liquid salt, these types of plants can generate power even when the sun is not shining. Experts estimate that the market for solar thermal power plants will experience double-digit growth between now and 2020.

So-called parabolic trough plants are used to concentrate the sun's energy onto a small area through a parabolic mirror. The reflective surface on the open part of the mirror – which is designed to follow the path of the sun – contains a small absorber known as the receiver. This tube is filled with a liquid used to transport the heat, usually a synthetic thermo oil. This oil reaches a high temperature, then transfers its heat to water through a heat exchanger. The temperatures here are much lower than in regular steam-powered facilities, usually between 370 and 550 degrees celsius. Quick power-up times as well as daily start-ups of parabolic trough plants require special turbines. Siemens is the world leader in this market, and has received steam turbine orders for more than 50 projects. These turbines are manufactured in Görlitz, Germany, and in Finspong, Sweden.

In addition, in March of 2009 Siemens acquired a 28 percent stake in the Italian company Archimede Solar Energy. This company has developed an innovative new technology for receiver tubes, in which molten salt flows through the tubes instead of synthetic oil. The advantage of this: the synthetic oil ages from frequent temperature changes and must eventually be replaced, whereas the molten salt stays in the receiver tubes. It works at temperatures of up to 550 degrees celsius, thereby allowing the plants to operate at much greater efficiency. Furthermore, heat can easily be stored in molten salt, permitting the plants to generate electricity at night.

The company Solel is another leader in the field of solar receiver technology. Their tubes have extremely low levels of heat loss, enabling them to convert more of the sun's energy than competing technologies. This technology allows a 50W solar thermal power plant to generate an additional 6,500 megawatt hours annually – enough supply 1,500 four-person families in addition to the approximately 30,000 households who already receive power from a 50 MW power plant.

Siemens AG (Berlin and Munich, Germany) is a global powerhouse in electronics and electrical engineering, operating in the industry, energy and healthcare sectors. The company has around 410,000 employees (in continuing operations) working to develop and manufacture products, design and install complex systems and projects, and tailor a wide range of solutions for individual requirements. For over 160 years, Siemens has stood for technical achievements, innovation, quality, reliability and internationality. In fiscal 2008, Siemens had revenue of €77.3 billion and a net income of €5.9 billion (IFRS). Further information is available on the Internet at: www.siemens.com.