German Aerospace Center

Algeria plans construction of first solar tower power plant in North Africa

17 October 2012

The first solar tower power plant in North Africa will be built in Algeria. The People's Democratic Republic of Algeria Ministry of Higher Education and Scientific Research and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit; BMU) have agreed to collaborate on this project. The aim is to build a solar-gas hybrid power plant with an output of up to seven megawatts. Important components of power station technology were, to a great extent, developed by the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) with partners.

The power plant will be constructed in Boughezoul, on the northern edge of the Sahara desert, and will serve primarily as a pilot and research facility. It will be able to operate using just solar energy or as a hybrid power plant fuelled by a combination of solar power and gas. This combination enables this country, one that holds exceptionally large gas reserves, to manage a relatively smooth and inexpensive transition from fossil fuel to solar power generation with an assured continuity of supply. "We are delighted to be able to further develop relations between Algeria and Germany in respect of environmental technologies and renewable energies through this project," stated the German ambassador to Algeria, Götz Lingenthal, who signed a declaration of intent to promote and support this venture at the EnviroAlgérie trade fair in Oran. Algeria wishes to contribute the necessary funding to implement this project. The BMU intends to contribute up to seven million euro towards the construction of the power plant and a renewables test centre.

From initial laboratory work in Cologne through to the power plant in Algeria

Key components of the technology for the solar tower power plant were developed at DLR. On a laboratory scale, solar researchers initially designed and tested the High Temperature Receiver (HiTRec) currently in use in the solar furnace in Cologne. At the top of the tower, a solar radiation receiver collects the radiation reflected by the mirrors and converts this solar energy into heat. The HiTRec solar radiation receiver uses ambient air, making it very robust and therefore ideally suited to operate in North Africa. The receiver operates at temperatures of up to 700 degrees Celsius, so solar energy can be converted into heat and subsequently into electricity very efficiently.

Researchers tested the first large-scale pilot unit of this type of receiver at the Plataforma Solar de Almería in southern Spain. The breakthrough came when this new technology was applied to the pilot solar tower power plant in Jülich, in southwestern Germany, that was completed in 2009 by the Munich-based plant construction company Kraftanlagen München (KAM). "We are delighted that a solar tower power plant using receiver technology developed at DLR is now, for the first time, about to be constructed in the Sun Belt. This is a great success, only made possible by the pilot solar tower power plant in Jülich. Together with Algerian researchers, we will be able to gain valuable experience to further improve this technology under real desert conditions," commented Bernhard Hoffschmidt, Co-Director of the DLR Institute of Solar Research. "DLR has guided this technology from the early stages of basic research in the laboratory in Cologne through to its use in the Sun Belt in North Africa and, with its partners, continues to develop this concept."

This is how a solar tower power station operates

In a solar tower power station, an array of mirrors reflects sunlight onto the top of the tower. Here, the concentrated rays are converted into heat, giving rise to temperatures of up to 1000 degrees Celsius. This energy is used to heat water and turn it into steam; this steam is then used to drive a turbine. Solar tower power plants operate at higher temperatures than other kinds of solar-thermal power plants, like parabolic trough power plants. Their high operating temperatures make the efficiency rating of these power plants very high – fewer collectors are needed per kilowatt-hour generated, thereby cutting the cost of power generation. In contrast to the parabolic trough design of solar power plants, the first of which entered service some 30 years ago, solar tower power technology is still, comparatively speaking, in its infancy. The big advantage of solar thermal power plants is that they are able to store solar power in the form of heat for several hours, and to do so in a cost-effective manner. This enables them to deliver renewably sourced electricity in line with varying demand.

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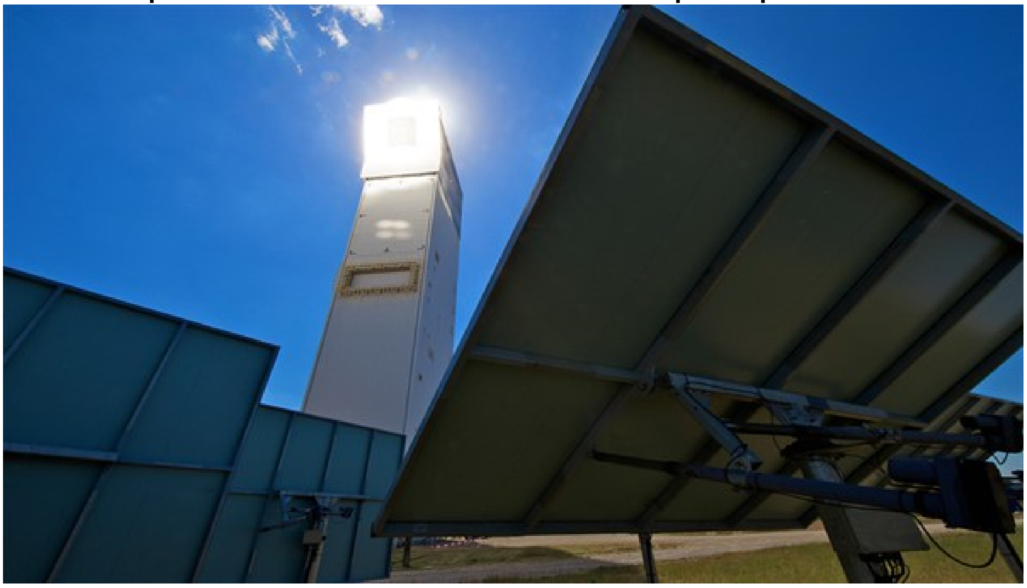
The inspiration for the solar tower power plant in Algeria – the DLR research power plant in the German town of Jülich

The first solar tower power plant in North Africa will be built in Algeria. The People's Democratic Republic of Algeria Ministry of Higher Education and Scientific Research and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit; BMU) have agreed to collaborate on this project. The aim is to build a solar-gas hybrid power plant with an output of up to seven megawatts. Important components of power station technology were, to a great extent, developed by the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) with partners.

Credit: DLR.

DLR developed this radiation receiver for solar tower power plants



The solar radiation receiver used in the HiTRec (High Temperature Receiver) concept was to a large extent developed by DLR researchers working jointly with partners. At the top of the tower, a solar radiation receiver collects the radiation reflected by the mirror and converts this solar power into heat. The HiTRec solar radiation receiver uses ambient air, making it very robust and therefore ideally suited to operate in North Africa. The receiver operates at temperatures of up to 700 degrees Celsius, so solar energy can be converted into heat and subsequently into electricity very efficiently.

Credit: DLR/Lannert.

DLR solar tower in Jülich

At the Jülich site, set up on an area covering about eight hectares, are 2153 moving mirrors (heliostats). These mirrors track the path of the sun and concentrate the solar radiation on a receiver, about 22 square metres in size, installed at the top of a 60-metre-tall tower. The receiver is made of porous ceramic elements permeated by ambient air. This heats the air up to about 700 degrees Celsius and then, it releases this heat to the water-steam cycle. The steam generated here drives a turbine, which produces electrical power.

Credit: DLR/Lannert.
