

# CASE STUDY

# THE WAY OF THE SUN

Apolo II | Conersa | Spain

# THE SOLAR PARKS OF CONERSA



The idea is both simple and clever: Photovoltaic modules that follow the path of the sun generate a distinctly higher energy yield than fixed modules. The German entrepreneur Artur Deger took this idea and built a company that today is **global market leader** in the field of tracking systems for solar plants. Because Artur Deger's technology **elevates the energy yield of photovoltaics systems by up to 45 percent**. This is also for the benefit of the Spanish company Conersa.

**Conersa** operates eight solar parks on the Iberian peninsula. Altogether this company feeds **26 to 27 million kWh into the local grid per year**, enough to completely supply more than 8,500 homes. Their geographic location for generating solar energy is most favorable. In the region of Madrid the sun shines more than 2,800 hours on average per year. By comparison: Berlin, by no means the poorest city in Germany in terms of sunshine, only has about two third of that - in 2007 the capital experienced a total of 1,725 sunny hours.

The company operates its largest **photovoltaic park - called Apolo II in Escalona**, approx. an hour's drive west of Madrid. **Apolo II** was built in two stages in 2007 and 2008 and currently produces 2,808 kWp. At this location Conersa uses monocrystalline modules from Sharp with a rated power of 180 Wp for power generation. **520 DEGERtraker 5000 NT tracking systems from DEGERenergie** were installed in Escalona to optimize the energy yield. They make sure that the systems with the solar modules automatically follow the path of the sun.

## AUTOMATIC AND INDIVIDUAL CONTROL

The patented **DEGERconnector** control module, which was developed by Artur Deger, plays a major role in the function of the **DEGERtraker**. In 2001 the heart of this intelligent control was awarded with the Inventor's Prize of the Federal State of Baden-Württemberg.

## JUST DON'T WASTE A SINGLE SUN RAY

The **DEGERconnector** continually measures the intensity and angle of the light rays and aligns the plant with the solar modules accordingly. In this context the **DEGERconnector** not only accounts for the radiation of the sun, but also for the light that is reflected by snow, water, light rock, or even diffused radiation that penetrates through the clouds. This aspects maximize the yield and increase the return on investment.

## THE PATENTED HEART THE DEGERconnector

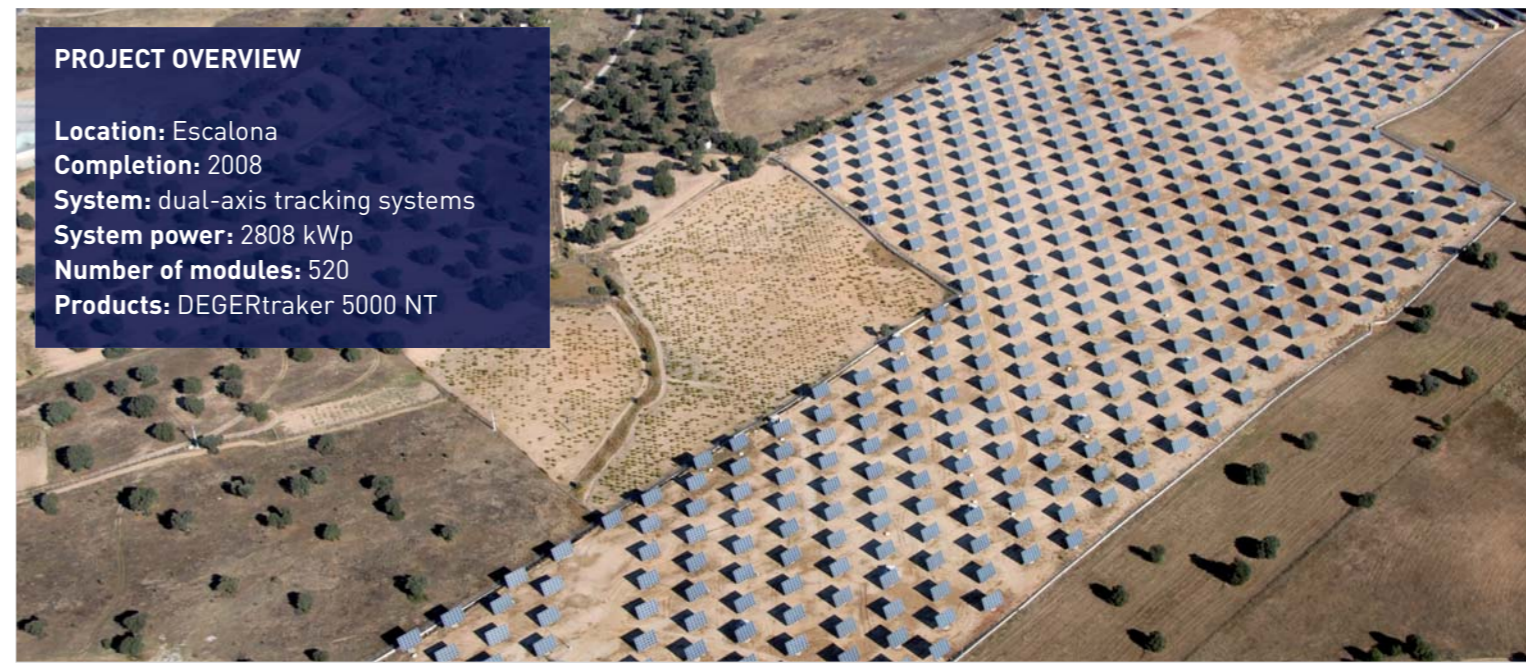
For the operation of the control module, two sensor cells in the **DEGERconnector** deliver reference values, which are evaluated by the integrated logic module, in order to track the module surface according to the radiation of light.

In order to achieve the greatest possible yield even with weak radiation, a differential amplifier accomplishes the transition from the logarithmic characteristic in case of strong radiation to the linear characteristic in case of low currents, as occur with diffuse light. In this dependency the logic module acquires a much higher value in the linear than in the logarithmic characteristic. This leads to a significant increase in the readjustment accuracy as brightness decreases. The differential voltage is additionally charged with a load, whereby the deactivation threshold is set to about 30 watts per square meter, and thus far into twilight.

Since the surface of the solar module is oriented to the west in the evening, a third sensor cell on the back of the control module provides for the system being reset towards in the direction of sunrise in the morning. At dawn the **DEGERconnector** detects the brightest point in the sky and attempts to return the system to this position. The module for the power supply of the control starts with a power output of 0.01 watt or less.

## PROJECT OVERVIEW

**Location:** Escalona  
**Completion:** 2008  
**System:** dual-axis tracking systems  
**System power:** 2808 kWp  
**Number of modules:** 520  
**Products:** DEGERtraker 5000 NT



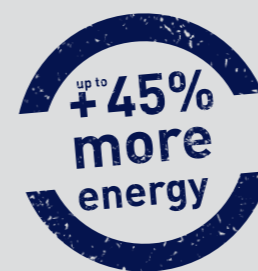
## A SIMPLE PRINCIPLE - TOWARDS THE LIGHT



**DEGERenergie** developed the power converter in order to prevent the control module from continuously activating and deactivating the drive system, and to achieve quick resetting of the photovoltaic modules. It collects even the smallest power from the solar module, which would not yet be high enough to be fed into the grid, in a high-rate capacitor and makes this power available for the **DEGERconnector**. The control module thereby adjusts the system to the brightest point in the sky, even before the modules deliver enough power to be fed into the grid.

In order to prevent both drives in dual-axis systems from running simultaneously, the power converter is designed for giving the east-west drive priority over the elevation. Moreover, the converter ensures that not more than 1 to 3 watts are drawn from the solar module in operation. Every tracking system from **DEGERenergie** is equipped with one or – in dual-axis systems – two DEGERconnectors. In the case of the Spanish Apolo Project, these all are dual-axis tracking systems, which therefore are fitted with two DEGERconnectors each.

## SAVE MONEY, INCREASE EFFICIENCY



The decentralized control thus is one of the essential features of **DEGER systems**: Every single system thereby independently aligns itself to the optimal angle of incidence, without central control. This has several benefits, which pay off in the planning phase and installation: Since the systems work perfectly without a central control, the park does not need to be networked with data cables. This accelerates the construction of the park and saves on costs from the outset. In case of a possible control failure only one single system will be affected – all other systems in the park continue to operate.

The third effect becomes apparent during operation and has detectable effects on the economy of the systems: **DEGERconnectors** always direct each single system in the entire park to the optimal position, even under different and/or rapidly changing cloudiness. Every system therefore achieves the highest possible energy yield. Quick response times ensure that even gaps in the clouds (Eye of Cloud) can be very efficiently utilized.

DEGER systems only execute movements that directly increase the yield. And it is also goes without saying that the tracking systems operate extremely energy-efficient. A **DEGERtraker 5000NT** system, as operating in Escalona, consumes 0.2 watts in control mode and 7 watts when the drive is running. The power consumption per tracker is 3 to 4 kWh per year.

## POSITIVE ENERGY BALANCE, QUICK REDEMPTION

The result of such efficient energy handling becomes apparent in the environment/energy balance, in the earnings of the solar park operators and in their redemption calculations. This starts with energetic amortization, as calculated by Artur Deger: "After about three years a solar park like the one in central Spain using our tracking systems has already generated as much energy from the sun as was needed to set up the entire installation - the complete infrastructure with concrete buildings, structural steelwork and wiring."

**The return on investment for this solar park in Spain will be approximately 9 years.** The tracking systems from **DEGERenergie** thereby play a quite noteworthy role. "By tracking the systems we were able to raise our yield by 38 to 40 percent at Apolo. Without tracking the investments would only be paid back after 12 to 13 years." This comes with a 38 to 40 percent higher yield once the redemption period is over.



## ROBUST PRODUCTS FOR HIGH YIELD

**DEGERenergie** provides **up to a 25 years warranty** on all systems – depending on the service contract. "The customer normally enters into a service contract with us, and the warranty period is determined by this contract."

At any rate, with the solar parks operating in Spain so far, Conersa gathered such good experiences, that the company is currently planning specific projects in other regions of southern Europe.

One of the most frequently installed systems from **DEGERenergie** is the **DEGERtraker 7000NT** - a dual-axis tracking system for professional power generation that produces a 45 percent higher energy yield than static modules. The system is designed for installation in open spaces and is available with different mast lengths. The **DEGERtraker 7000NT** is one of the first systems that is also available in the US market. With its module area of up to 60 square meters it generates power of 6-9 KW.

The **Low Cost TOPtraker 40NT model** is new. The single-axis system is designed for a module area of up to 40 square meters to generate an output of 4-6.4 KW. The system is designed for open area installation in medium to large solar parks and is suitable for all marketable photovoltaic modules. Different versions are available that can be used from the equator up to the 60th parallel. This covers most regions on Earth. The single-axis tracking system achieves an up to a 30 percent higher energy yield than solar modules with static installation.

MORE INFORMATION:  
[www.DEGERenergie.com](http://www.DEGERenergie.com)

DEGERenergie GmbH  
INDUSTRIESTR. 70  
72160 HORB AM NECKAR  
GERMANY

TEL: +49 (0) 7451-539 14-0  
FAX: +49 (0) 7451-539 14-10  
MAIL: [sales@DEGERenergie.com](mailto:sales@DEGERenergie.com)