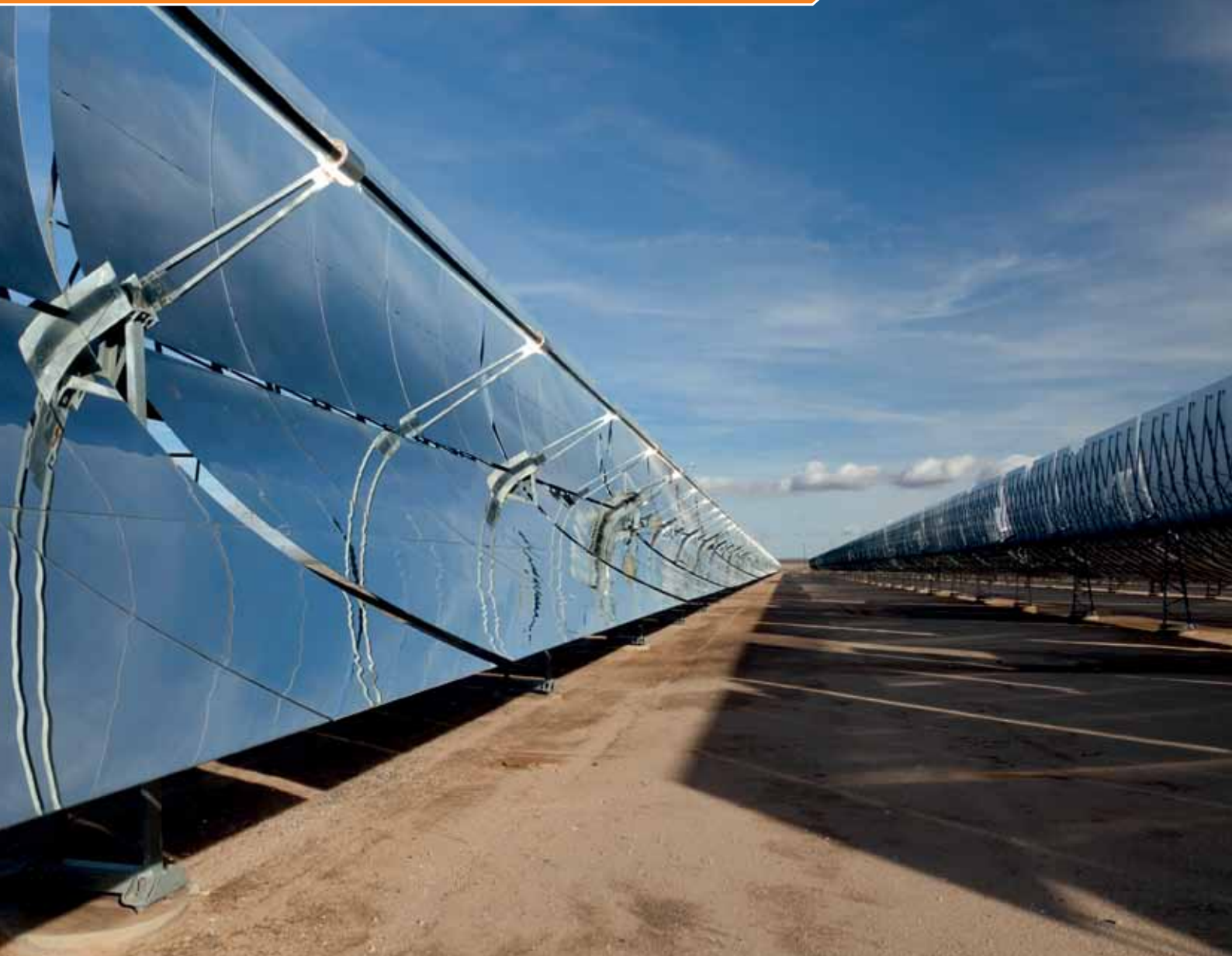
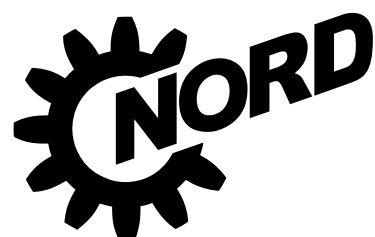


Intelligent Drivesystems, Worldwide Services



**Drive for solar
thermal solutions**



DRIVESYSTEMS

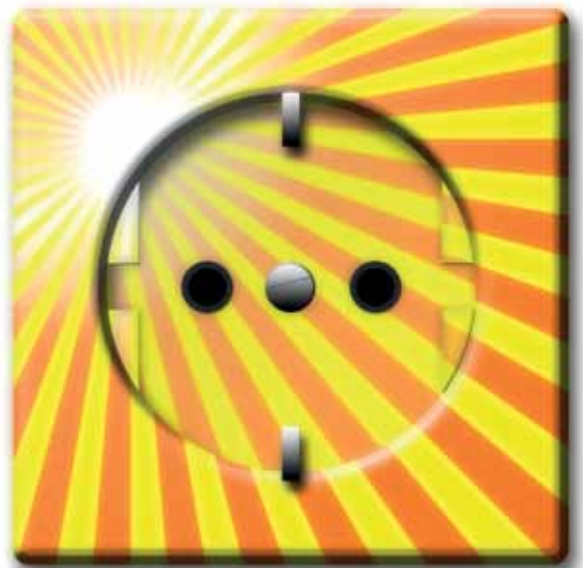


Canned heat

Driving forces behind next generation solar thermal energy solutions

Bargteheide – Most people view photovoltaic panels as the token for solar power. What they fail to see is that a different technology for harvesting the sun's energy has fast become commercially viable as well: solar thermal plants. Long relegated to mere tech demonstrations and R&D facilities, solar thermal installations built around a central tower are now making the leap to full-scale production sites. Leading the way is Gemasolar in the south of Spain. In this pioneering plant, thousands of drive units ensure that a vast field of heliostats facing a central tower reflect a maximum of sunlight onto a receiver at the top of the tower, where the intense heat is transferred to a liquid that flows through it.

The Gemasolar plant's basic set-up consists of a central tower structure with a receptor area in its top segment, a liquid circulation cycle including storage tanks and heat exchanger facilities for power generation via an adjacent turbine, and an array of mirror units that focus the rays of the sun onto the receiver. These mirrors are designed to turn and tilt in order to ensure that as much sun-light a possible is reflected onto the designated area on the tower – from dawn till dusk, as long as the sun remains in the line of sight throughout the day. Providing key equipment for this crucial capacity, German drive manufacturer NORD Drivesystems has supplied 5,300 NORDBLOC.1 design geared motors for the Gemasolar heliostats. In each of the 2,650 flat mirror units, two such geared motors enable highly accurate movements for two axes to track the path of the sun.



DRIVESYSTEMS



The Gemasolar thermal plant in Andalusia stretches over an area of 185 hectares.

In order to equip the vast mirror array of the Gemasol site, SENER's manufacturing facilities have churned out drive units by the thousands.



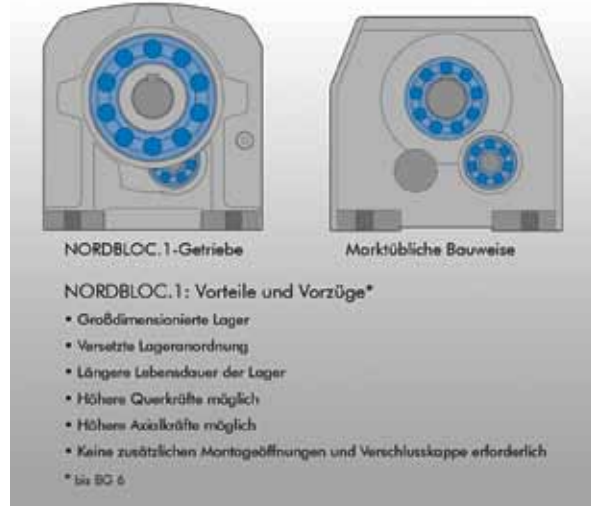


Keeping the heat in the can

High performance plant

Midway between the Andalusian cities of Seville and Cordoba, in one of the most sun-drenched regions of the European continent, the Gemasolar site extends over an area of 185 hectares to accommodate the vast field of heliostats. Operated by Torresol, a joint venture between Spanish engineering giant SENER Ingeniería y Sistemas and Masdar, Abu Dhabi's state-owned future energy enterprise, Gemasolar is the first ever commercial-scale CSP (concentrated solar power) plant with central tower technology that implements a heat storage system based on molten salts. Liquefied nitrate salts are pumped up from a storage tank, run through the receiver section, and absorb the heat impact of the highly concentrated solar radiation in that tower segment. The temperature of the liquid that has passed through it usually exceeds 500 °C. Once they leave the receptor, the molten salts flow through a heat exchanger where they cool down again, with the resulting water vapor driving a steam turbine that feeds a generator.

The generated energy is supplied into the electrical grid. Most notably, though, the molten salts cycle at Gemasolar incorporates an innovative storage option. Whenever there is more heat energy available than the turbine is able to convert, the extra energy is stored by diverting some of the flow of molten salts before the liquid reaches the heat exchanger. Kept in a special tank, the hot medium can be used at a later time when insufficient solar radiation – or none at all – is available for standard operation of the plant. This solution enables the system to generate power from stored heat for up to 15 hours, i.e. throughout long periods of cloudy skies or even darkness. The resulting total of 6,500 hours of productive operation per year makes this plant much more efficient than more conventional renewable energy facilities that are totally dependent on changing conditions.



NORDBLOC.1 series geared motors provide substantial user benefits.



Two robust geared motors for every heliostat enable high-precision movements for two axes.



DRIVESYSTEMS



GEMASOLAR, the world's first solar thermal plant consisting of central tower technology and salts receiver

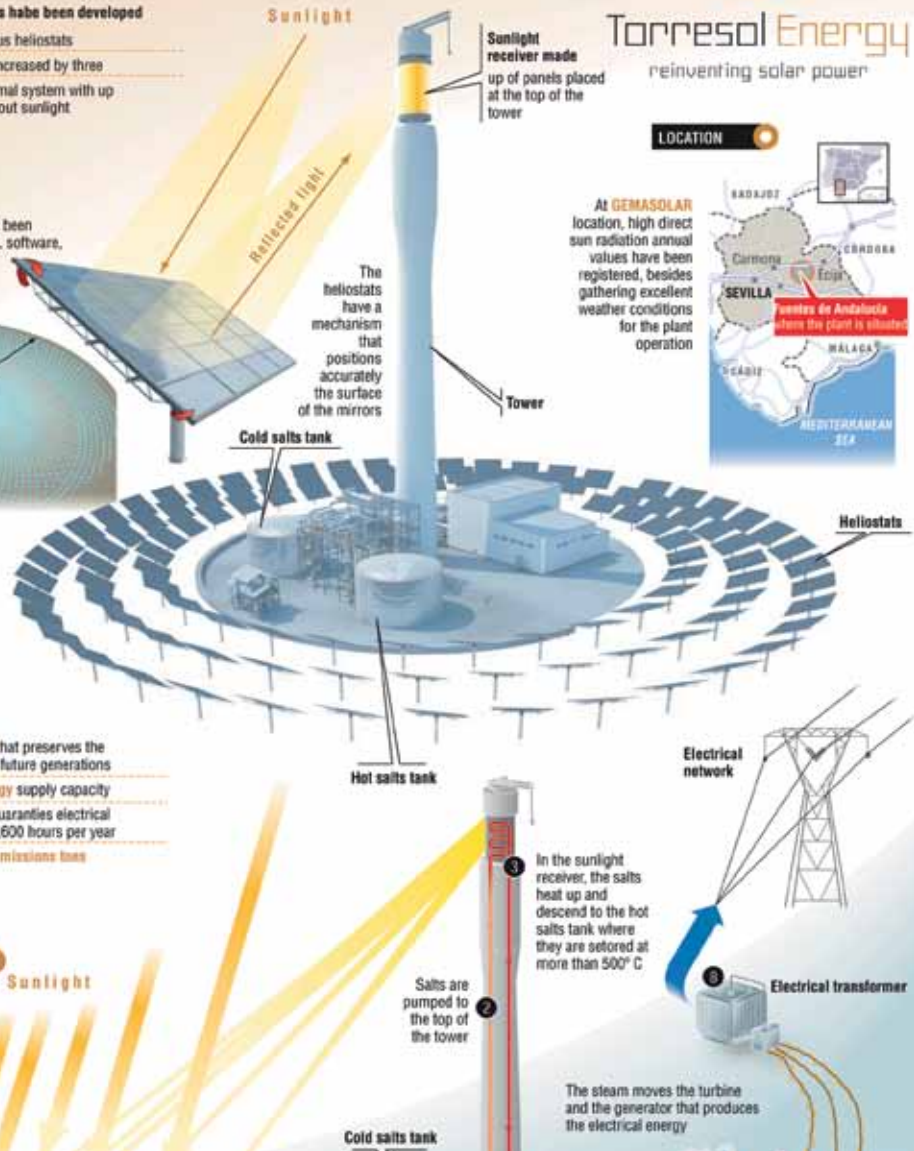
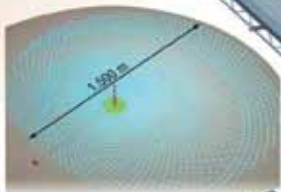
GEMASOLAR, with a nameplate power of 19,9 MW, will be the first commercial plant in the world with heliostats, central tower and molten salts receiver technology

Key technological solutions have been developed

- Bigger and more numerous heliostats
- Receiver thermal power increased by three
- Molten salts storage thermal system with up to 15 hours capacity without sunlight

SOLAR FIELD

2,650 heliostats
The heliostats location has been established by the SENSOL software, so as to reach the optimum plant dimensions



BENEFITS

- Safe and clean energy that preserves the environment thinking of future generations
- 25,000 households energy supply capacity
- Energy efficiency that guarantees electrical production for around 6,600 hours per year
- More than 30,000 CO₂ emissions tons saved every year

OPERATION PROCESS

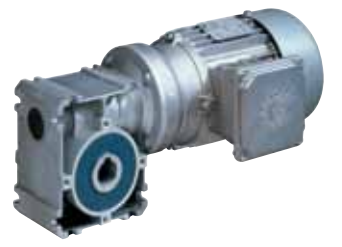


Torresol Energy
re inventing solar power

LOCATION



At GEMASOLAR location, high direct sun radiation annual values have been registered, besides gathering excellent weather conditions for the plant operation



High performance at maximum strain

Always geared towards the sun

Concentrated solar power (CSP) plants are so named because they function by focusing sunlight onto a single point for solar thermal energy generation. In the case of the Gemasolar plant, this concentration is achieved by 2,650 flat mirrors all continually pointing at the same receiver region on the installation's one central tower. Given the size, weight, and shape of these mirror units, each of them depends on a powerful, sturdy, and robust drive solution to ensure reliable tracking of the sun. Obviously, this is an application exposed to very high environmental temperatures, so all equipment used here must be manufactured to withstand such conditions. Moreover, each heliostat has a flat surface of about 120 m², which makes them markedly susceptible to strong, not to mention gale-force winds that naturally occur from time to time. Still, proper operation of the heliostats and the power plant as a whole is ensured in all but the most extreme weather conditions.

The geared motors working throughout the array of mirrors play an instrumental part in that. Torresol's heliostats are equipped with size 5 NORDBLOC.1 series geared motors. Compared to same size previous generations of one-piece housing solutions, these systems are suitable for much greater forces than before. Mounting options are particularly user-friendly, allowing for either cost-efficient, direct motor mounting, or an attachment of very short, space-saving lightweight IEC adapters. Ventilation is ensured in all mounting positions. The gears' aluminum housings provide robust, natural corrosion protection out of the box – without the need for a paint finish. Based on FEM-optimized designs, these models are not only more robust, but also considerably lighter than their predecessors. For gears up to size 6, the UNICASE design enables the mounting of larger bearings – the units therefore withstand higher overhung loads, or last longer under a given load. For even more demanding conditions than high temperatures and adverse environmental conditions, ATEX versions of all types can also be supplied.

Conclusion

Solar thermal energy plants with a central tower receiver constitute a major innovation in the renewable energy sector that has only recently left the confines of R&D installations. Bolstering the technology's potential, Spain's pioneering Gemasolar site is the first ever concentrated solar power plant with central tower technology to include storage facilities for the liquid medium. With an overall rated power of 19 MW, Gemasolar's expected net electrical production is 110 GWh per year – enough to supply about 30,000 households, and to cut CO₂ emissions by about 40,000 tons per year. In order to ensure precise and reliable operation of the plant's mobile heliostats that focus the sunlight, the vast array comprising 2,650 mirrors is equipped with 5,300 robust geared motors supplied by NORD Drivesystems. These units enable high-accuracy movements while ensuring extra durability due to their aluminum housings and FEM-optimized NORDBLOC.1 design.



DRIVESYSTEMS

Company Background NORD DRIVESYSTEMS

A developer and manufacturer of drive technology, NORD Drivesystems employs some 2,600 people and is one of the world's leading suppliers of full-scale, comprehensive drive solutions. NORD's portfolio ranges from standard drives to customized solutions for demanding application requirements, e.g. based on energy-efficient or explosion-protected drives. Gross sales amount to EUR 337 mn p.a. (2010 prelim. figure). Founded in 1965, the company has grown to include 35 subsidiaries around the world today. NORD has established an extensive distribution and service network to ensure minimal lead times and provide customer-oriented services wherever needed on short notice. NORD's wide variety of gear types covers torques from 10 Nm to 200,000 Nm. The company also manufactures motors delivering outputs from .12 kW to 200 kW, and power electron-ics ranging from frequency inverters to servo controllers. NORD's inverter line-up features conventional models for installation in control cabinets as well as design types for fully integrated drive units in decentralized automation environments.



Company Background Torresol

Torresol Energy began to take shape in 2007, when SENER decided to promote its own thermosolar plants all over the world and invest in them in the long term. To address this important challenge it identified MASDAR as the ideal partner. Both companies shared the same vision on the development of thermosolar power. Thus, in 2008 Torresol Energy was incorporated, 60%-owned by the SENER Grupo de Ingeniería and 40% by MASDAR, the alternative energies company of Abu Dhabi. In 2008 work got under way on the building of the Gemasolar plant in the province of Seville (Spain). In spring 2009, work began on the construction of a further two plants, Valle 1 and Valle 2, equipped with cylindrical-parabolic collector technology (CPC) and located in the province of Cadiz (Spain). For the portfolio of projects currently in progress, entailing an investment amounting to almost one billion euros, Torresol has closed long-term "Project Finance" funding lines, which has enabled it to address these projects thanks to the continuous support of international and Spanish financial organizations.





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