



# New Technology for the Next Generation

Alternative Drives and Renewable Energy

Made for Motion



[www.ktr.com](http://www.ktr.com)



# Full speed ahead for green drives

Internal combustion engines are extensively used today, but times are changing. Fossil fuels are not available in sufficient quantities any longer. The future belongs to alternative types of energy. That is why the mobile world of the future needs hybrid and electric motors and energy efficient drives to use solar energy as well as wind and water power. Mechanical engineering is becoming greener.

## Grey theory, green practice

In all fields of engineering design engineers are working on developing and testing alternative, energy efficient drives. Bearing this in mind they are easily tempted "to save" the coupling. Applications in the field prove more and more frequently that the installation of a coupling is less expensive both from the point of view of economics and engineering. It is, in fact, necessary to make sure that everything is running smoothly from the very beginning.

Couplings serve to connect, sometimes in a torsionally stiff, sometimes in a torsionally flexible way. Some can be plugged in, some need to be screwed. Every kind of design has to fulfil a special task to make sure that the coupling meets with a specific demand: Design and performance are one.

The perfectly designed and perfectly adapted coupling

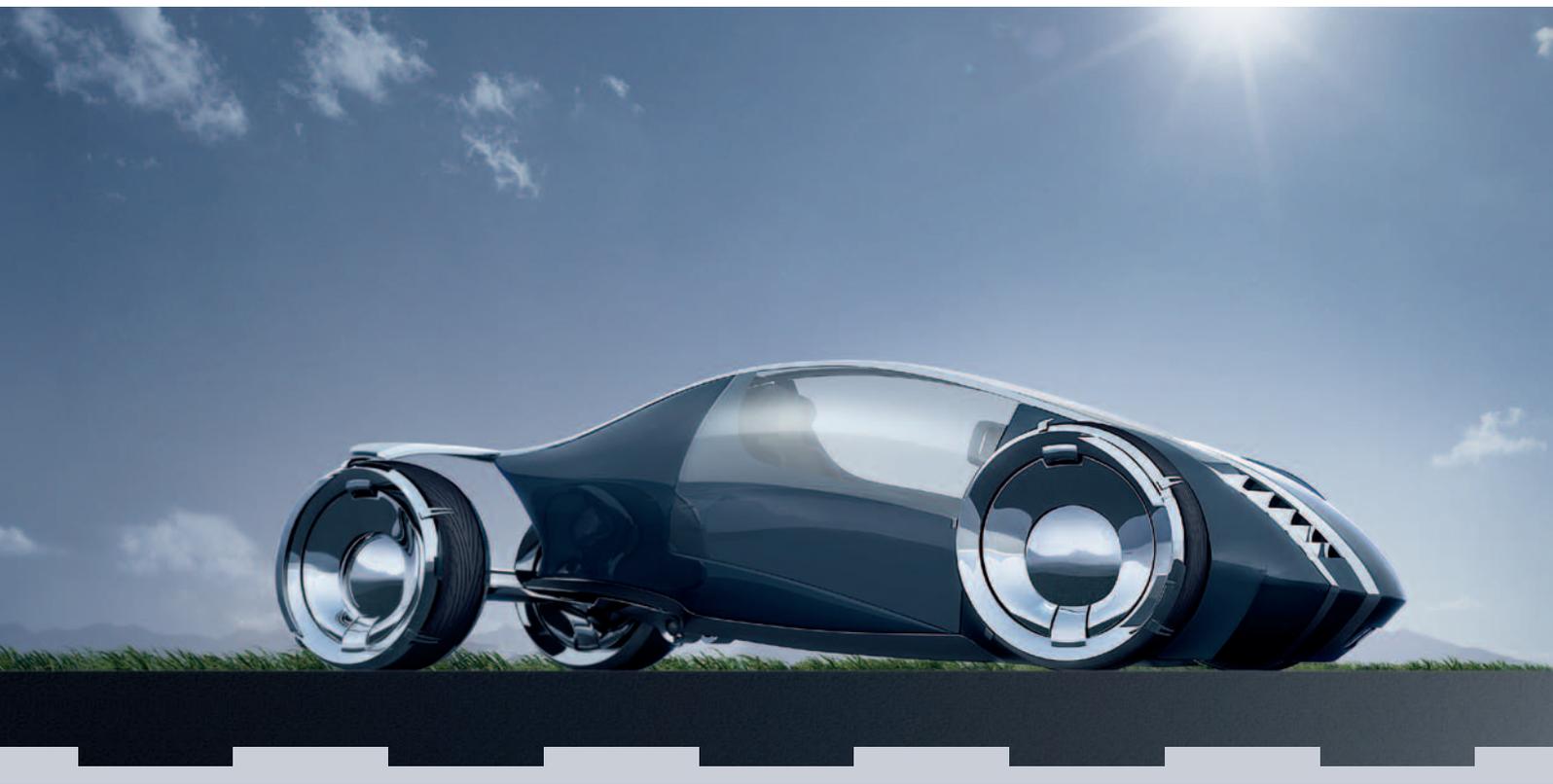
- simplifies the assembly, because the electrical and mechanical drive components can be pre-mounted as assemblies which only have to be plugged together
- compensates for shaft displacements resulting from production tolerances, heat expansion or distortions in the drive caused by third parties; it compensates for restoring forces, in this way preventing damages on bearings, seals and splines
- dampens vibrations whenever necessary, therefore supports structure-borne noise separation and prevents intrinsic noise
- increases the service life of the overall drive system and reduces its life cycle costs.

## Always well connected

As a leading manufacturer of high-quality drive components, KTR is the right partner for all those who want to set things in motion. From the very beginning we have been pioneers in the development of coupling technology: We developed both the first curved-tooth gear coupling as a connection between nylon and steel, BoWex<sup>®</sup>, and one of those drive components being used most frequently around the world: the ROTEX<sup>®</sup> jaw coupling. Since its introduction in 1966 it followed the life story starting as a trendsetter and becoming a classical product "without any loss of power". Using regenerative energy it is applied often and out of conviction. In 1992 we developed the steel lamina coupling RADEX<sup>®</sup>-N particularly for wind power stations which has made us the world's market leader for this industry. These are only a few examples of our success as a company solving problems.

## Coupling design as precision work

With our know-how gained from thousands of applications in the field, we will assist you to realise your visions. In a partnership cooperation with you we will design the suitable components for your specific application. One thing is for sure: There is not one perfect coupling for all drives: As one element out of the overall system, the coupling needs to be adapted individually, depending on the mounting space and the power of the drive. To make sure that the drive lives up to its promises.



## Green phase for electric drives

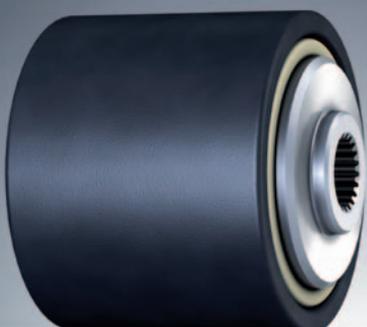
Today at least half of all car drivers could imagine that their next new car maybe an electric vehicle. Within then next ten years millions of electric cars are expected to be produced and sold. By 2020 half of all new passenger cars are supposed to have a hybrid or electric drive.

### Considering electric mobility as a change

A survey conducted by the management consultants Bain & Company quotes that “The electrification of vehicles is compelling, without any alternative and irreversible”. It goes without saying that the demand depends on the degree of attractiveness of the supply. This is highly defined by the joy in driving, here in particular: by the dynamics of the drive, and consequently by the coupling design.

### Electric drives as a challenge

Electric motors set different demands on all components of the drive train, also the shaft coupling as an interface between motor and gearbox. Since the speeds are in most cases much higher than with internal combustion engines, misalignment has to be compensated for in long term, by low-wear materials and maintenance-free designs. At the same time the electric insulation needs to be assured, since current is like poison for the gearbox. Leaking current damages both the bearing and the spline and causes an early failure. A coupling can reliably solve this problem, provided that it is the right coupling.





### **Keeping up with the times: BoWex®**

KTR shaft couplings are widely used in mechanical engineering, for example the curved-tooth gear coupling BoWex®. It has been successful for over 50 years and is said to be synonymous with maintenance-free, torsionally stiff shaft couplings in the international market. Today it is available in numerous designs and is indispensable, among others, in the automobile industry. It allows for a positive-locking power transmission and compensates for axial, radial and angular displacements.

At the same time our experience in the wind energy technology where the electric insulation needs to be assured with larger dimensions and higher amps than with electric vehicles is proof of our competence with electric drives.

Thus, for the automobile industry we can already offer a coupling covering all demands: a specifically adapted type of BoWex®. A further development of the classical BoWex® it is assembled directly between electric motor and cylindrical gear, compensates for misalignment and prevents current flow.

It was tested successfully in the BMW MINI E.

### **Perfectly insulated, backlash-free and maintenance-free**

The BoWex® coupling ensures the full electric insulation of the motor by means of a coupling sleeve from fibre-glass reinforced polyamide and some extra space between the coupling hubs: spark-over is not possible.

Moreover, the combination of steel hub and nylon sleeve allows for a fully maintenance-free operation. The sliding combination does not require any lubrication at all.

In addition, high-quality seals from polyurethane prevent water or dirt from penetrating the contact surfaces, in this way assuring long-term, smooth operation.

### **Dynamic joy in driving without any emissions**

Electric vehicles equipped with BoWex® couplings work well in urban traffic by utilising high torque which is available immediately. The electric drive is able to keep pace with high speed, too. Electric vehicles that are equipped with a KTR coupling will inspire many car drivers. The adaptation is vital: Each vehicle needs a coupling of its own – which we will be pleased to develop.



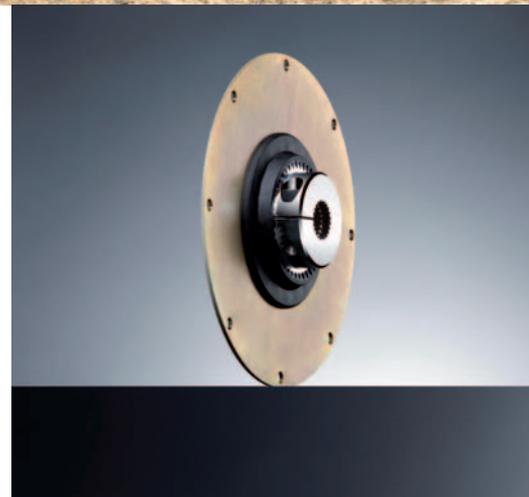
### Lower power, bigger effect

Diesel-electric hybrid drives offer numerous benefits whose importance depends on the particular application. Let us consider the improvement of the efficiency: Whenever power peaks are covered by the electric motor, the internal combustion engine can have smaller dimensions. Fuel consumption and emissions decrease. At the same time noise emissions will decrease, since the electric motor is virtually noiseless.

In addition, there is the benefit of space: Wherever there is only limited mounting space or the weight needs to be distributed ideally, it is better if the drive unit can be positioned in any place.

### Hybrid drives on land: Construction machines

For agricultural and construction machines hybrid drives are becoming more and more interesting because they provide for the option to operate more efficiently and at the same time reduce the fuel consumption and also the CO<sub>2</sub> emission. Savings from 25 to 30 % are expected by the initial machines which are already operating at the moment. Among those machines is, as an example, a wheel loader having a 51 kW diesel engine with 74 kW output. If the power required falls below 51 kW, the lithium ionic battery is loaded; if the power required exceeds 51 kW, the electric motor provides the extra power required via the battery.



### Hybrid couplings for hybrid drives

To meet the complex demands of the hybrid drive, KTR offer a coupling solution which is just as much "hybrid": the BoWex® FLE-PAC curved-tooth gear flange coupling. Based on the material combination of nylon and steel it ensures a high-quality power transmission. Its novelty in design is a carbon fibre reinforced polyamide flange minimising wear and in this way increasing the service life. Thanks to the thin-walled carrier plate from steel for the nylon spline element, compact solutions can be achieved in the drive train.

That is why you do not only save both energy and money with KTR, but also space and designing expenses.

## A strong combination: hybrid drives

### Hybrid drives on the sea: marine technology

Ship traffic already makes use of hybrid drives, not only for economic or ecologic reasons, but also to optimise the ship design. There are numerous benefits:

- Saving space and having more freedom to position the heavy drives in the hull of the boat
- Saving fuel by operating the motors within the optimum power limits and by batteries
- Environmental protection by driving without any emissions
- Slow and noiseless driving in harbours, on inland waters and in nature reserves.

In sporting boats hybrid drives operate according to the same principle as in construction machines: If the full power of the internal combustion engine is not needed, it feeds the battery via the generator, the stored charge is retrieved by the electric motor later. For the power transmission a flexible flange coupling with compact dimensions is needed which is tailor-made for the application.

It is true that large freight and passenger vessels are driven by diesel engines or gas turbines, but often they are moved by pod drives. These are electric propeller motors that are encapsulated and can be rotated by 360° and which are mounted outside the hull. In this case torsionally flexible couplings are required which again have to be adapted individually. Nobody can do this better than the KTR product specialists.





## Environmental technology on the up and up

The wind power industry is growing: Large onshore potentials are yet undeveloped, offshore sites are being expanded and the first generation wind power stations are being continuously replaced by more powerful plants. In 2009 almost 950 new plants with a total of 1.9 gigawatt were installed in Germany alone.

### Efficiency even with turbulence

In addition to highly valuable energy, wind produces extreme loads. Whoever wants to utilise wind power has to be able to control it as well.

It is mainly up to the drive train that is heavily loaded by the dynamic forces of the wind. That is why the gearbox and generator need a flexible bearing and have to be connected by a flexible coupling compensating for misalignment and ensuring a safe and efficient operation, even with a pod height of 100m and a rotor diameter of 120m.





### **Close to the wind: RADEX®-N**

KTR couplings have been used in wind power stations throughout Europe, Asia and America for more than 20 years. We have developed our steel lamina coupling RADEX®-N for high power wind turbines: The backlash-free, maintenance-free all-steel coupling having a lamina from highly stiff spring steel allows compensation of high displacements with low restoring forces due to its special lamina shape. A specifically designed GRK spacer enables electric insulation.

One pleasant side effect is as follows: The total weight of the coupling is reduced and the ease of servicing is increased.

### **Overload is not a burden**

KTR do not only supply couplings, but complete multipurpose assemblies for wind power stations. Among those are usually a brake disk integrated on the gearbox side and a sensor disk for speed monitoring as well as an overload system to protect the gear against load peaks on the generator side: The RUFLEX® torque limiter is integrated into the coupling spacer in a space-saving way limiting the power flow as needed.

In this way you utilise the wind's power at the full extent as well as protecting against turbulence at the same time.

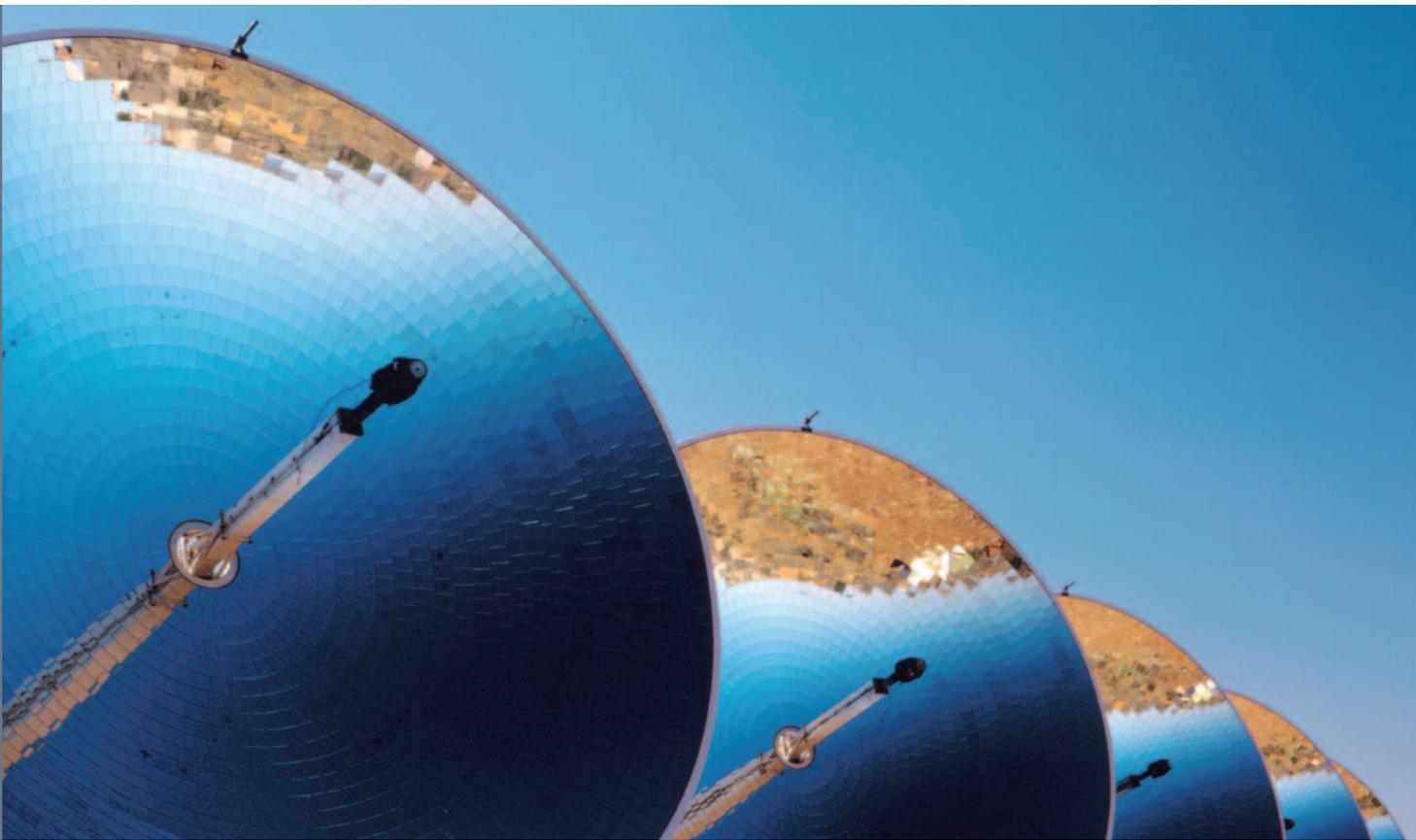
### **Cooling technology at the highest level**

The demands on thermo management increase in parallel with the continuously higher power of the wind power stations: The heat produced by generators, frequency converters and gearboxes has to be dissipated efficiently and adequately.

Based on our 40 years of experience in hydraulics and cooling, we have developed special cooling power packs with a cooling power up to 110 kW. For offshore applications in aggressive salty air they are coated with a KTL dipping paint which protects the heat exchanger between the laminas as well and which does not have any influence on the heat transfer. For cooling the gear oil, we offer an oil-air cooler having the same characteristics. The compact cooling systems will not have any problem in finding space to be fitted into the narrow machine pod.

### **Getting better from our experience**

More than 40,000 KTR coupling systems have been installed in wind power stations with a rated power from 25 kW to 6 MW and more than 10,000 new applications are added every year. Time is not standing still in KTR, either. We extend our programme on the one hand by new coupling types for even higher power ranges, on the other hand by more efficient offers as a set. As a pioneer in wind energy technology, a well-experienced supplier of systems and solutions and as a development partner of leading manufacturers we are pleased to consult with you for your products, too.



### **The sun, the wind, the sea and more**

For today's engineers the sun, the wind and the sea are not a hint to holidays, but work, along with a huge innovation potential. They are aiming at converting regenerative energy into usable power. KTR is the right partner for that purpose.

KTR products are indispensable in wind energy technology but they are part of many other future technologies as well. As an example, the backlash-free, flexible ROTEX® GS coupling, is most suitable for precision operations: for positioning pods of wind power stations, for aligning solar paddles and for the hybrid drives of some passenger vehicles. In hydropower plants KTR couplings can be used on main and auxiliary drives of Pelton or bulb turbines. This is only the very beginning.

### **Sun: Energy falling from the sky**

The technology of solar farms is being focussed on at an increasing extent. Solar plants in which the collectors are charged need miniature couplings in the control unit. The plants using the sunlight to heat a carrier fluid in order to produce current need the suitable couplings for pumps and turbines.

Solar energy is also involved in biomass. The utilisation of biogas is a big potential for KTR.

In systems where methane is produced and burned to produce electricity and heat in parallel, KTR couplings can be used in worm conveyors, mixers and pumps, and between generator and motor in an engine-based cogenerator. The construction of CHP (Combined Heat and Power) plants is increasing in many countries as they also use material for power which would have otherwise ended up in land refill.

### **Wind: Immeasurable power?**

If a manufacturer wants to determine the power in the drive train in detail, it is possible to use the torque measuring shaft DATAFLEX® developed by KTR. It can easily be installed with the approved RADEX®-N, performing accurate torque and speed measurement continuously both on the main drive and on the azimuth and pitch drive. This allows for planned preventative maintenance to take place.

# Engineering for the future

## Water: Pure energy by motion

Tidal power stations have been in existence for some time. The latest thinking is to make use of the oceans power via oceanic current power plants. Similar to the onshore/offshore wind turbine power stations, the tidal power station turbine can be positioned on a pole to harness the oceans current and be encapsulated. KTR have a wealth of experience connecting the gearbox and generator with wind power stations throughout the world. This experience is highly valuable when it comes to under the water applications as well.

The use of wave energy is currently under development as well, for example in a wave power station off the Portuguese coast. Thick steel pipes form the segments of the “sea snake” having a length of 150 metres which is moved by sea waves in a way that the segments are displaced against each other. This movement is absorbed by a hydraulic system driving the generators to produce current. The power transmission is transmitted utilising the ROTEX® couplings from KTR.

## If you want to set things in motion: KTR

There are numerous potential applications for KTR couplings in drives using renewable energy. It is up to you to stipulate your demand. We will develop the solution to suit your individual needs. The better the coupling, the better the drive. Visit our website [www.ktr.com](http://www.ktr.com) for more information on how we can help save the environment.





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