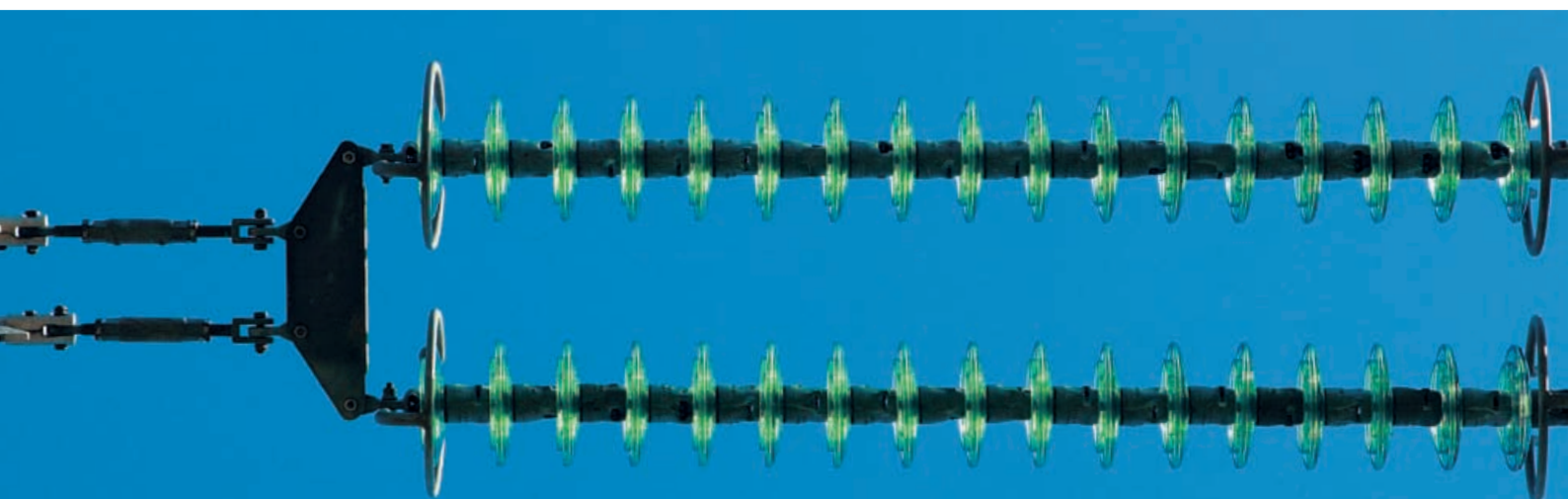
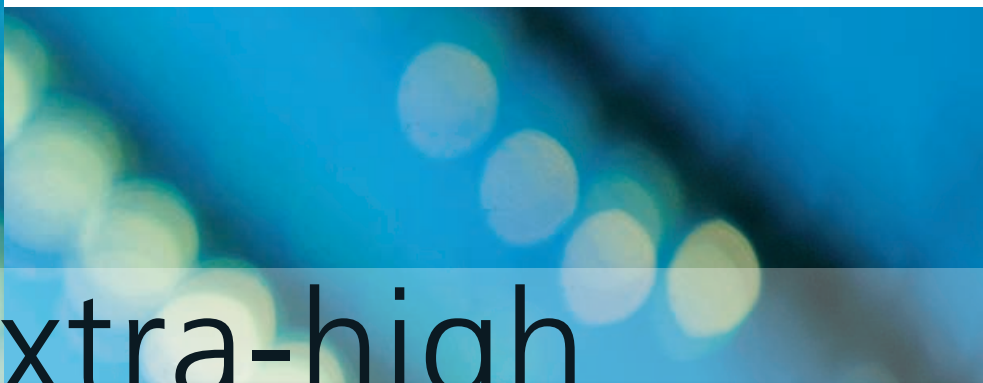


transpower  
stromübertragungs gmbh



We bring  
energy



# Extra-high Voltage



Dear reader,

The transpower stromübertragungs gmbh, with about 700 employees, is responsible for the operation, maintenance and further development of the power transmission grid with voltage levels of 220 kV and 380 kV in large areas of Germany. We stand for reliable and fair access for all market actors to the extra-high voltage grid. transpower uses about 10,700 kilometres of 220- and 380-kV lines from the Danish border up to the Alps to supply some 20 per cent of Germany's and more than 20 million people with energy by way of distributing energy suppliers. With power lines running to nine neighbouring grid areas, transpower is positioned in the centre of all Europe's grid operators and plays an important role in power exchange beyond Germany's borders. About 300 national and international traders send energy for their customers through our grid every day. The extra-high voltage grid is the main artery of our modern society. With its know-how and continual technical development, transpower ensures both a reliable power grid and its efficient management.

We hope you will find our brochure an interesting read!

Martin Fuchs  
Executive Director  
of Grid Management  
and Technology

Hans Hellmuth  
Executive Director/  
Hold Separate  
Manager

Dr. Christof Schulte  
Executive Director  
of Commerce,  
Human Resources  
and Offshore

## Our company

transpower is based in Bayreuth. Two centres of operation in Lehrte near Hannover and in Bamberg provide regular maintenance and necessary repairs to lines and transformer stations in cooperation with our regional service groups. Throughout this area, our experts are on duty 24/7 to restore the transpower grid as quickly as possible in case of failures.

### Key figures

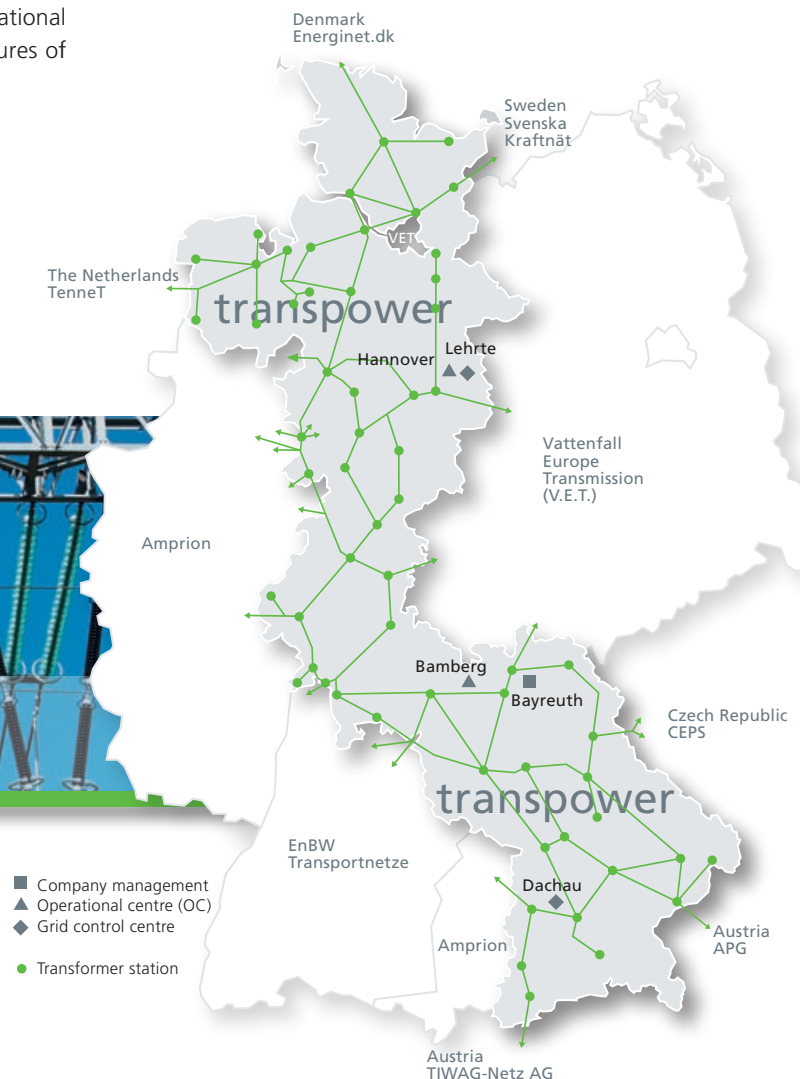
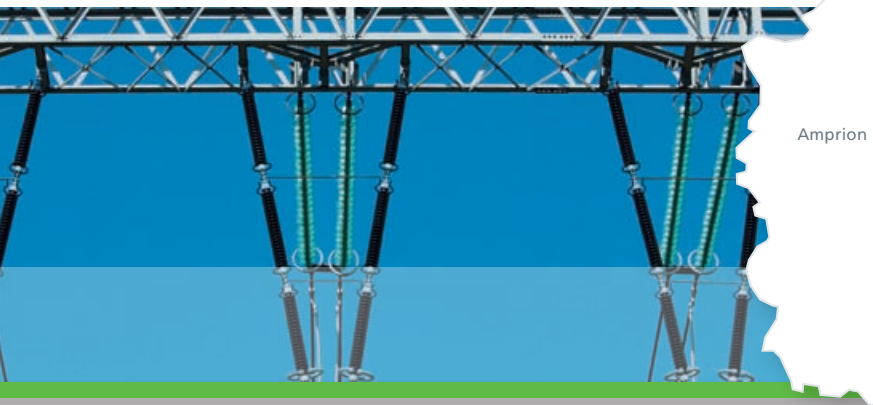
customers	48 grid customers approx. 300 traders
grid area	approx. 140,000 km <sup>2</sup>
line length 220 kV	approx. 4,900 km
line length 380 kV	approx. 5,800 km
transformer stations	115
transformation 220/380 kV	18,550 MVA
installed electrical power	36,400 MVA
grid load (consumption)	
minimum	7,100 MW
maximum	20,200 MW
sales volume 2008 (incl. EEG/KWG-G)	EUR 6.2 billion
employees	about 700



Data  
Company

## Our energy highways

transpower provides efficient long-distance power transport across some 10,700 kilometres of extra-high voltage lines. The transpower grid extends from the Danish border to the Alps, and its 140,000 square kilometres cover about 40 per cent of Germany: Our lines run in Schleswig-Holstein, Lower Saxony, Hesse, Bavaria and parts of North Rhine-Westphalia. More than 20 million people in our area can rely on secure power supply from transpower. Furthermore, our lines are part of the European connectivity grid. The advantage of this integration is increased security of supply: Together with our national and international grid partners we can respond optimally to failures of power plants or to system failures.



## Reliable grid and secure transmission

Since the implementation of a new control system in early 2009, transpower has one of the latest systems in Europe. Our technicians and engineers monitor the secure transmission of power within the 220-/380-kV grid from two grid control centres, 24 hours a day. Our so-called dispatchers direct the power flow on 10,700 kilometres of extra-high voltage lines with the aid of modern information technology. In case of a failure, they can alert the local service staff in order to eliminate the failure as soon as possible. When maintenance work in the grid becomes necessary, the dispatchers ensure that the respective lines or other equipment is turned off so that our service staff can safely work on them. In this case, the power flow must be provided through other lines.

The grid control ensures that power generation and consumption are always in balance to achieve a stable power grid. This often proves difficult in practice because energy traders cannot foresee exactly how much power their customers will consume. transpower must balance any forecasting mistakes by energy traders using respective generation reserves through balancing power.

### **Balancing power for a reliable supply of electricity**

transpower helps keep costs for balancing power to a minimum by closely cooperating with other German transmission grid operators. We have been providing balancing power since 2001 on an open, transparent and non-discriminating market. The provision occurs by open competitive bidding ([www.regelleistung.net](http://www.regelleistung.net)) on the German power balancing market with the involvement of numerous bidders – power plant operators as well as power customers.



### **Close cooperation**

Since late 2008, transpower has been intensifying the cooperation with EnBW Transportnetze and Vattenfall Europe Transmission in the field of power balancing. This solves the phenomenon of balancing against each other; that is the situation where balancing power is used in one balancing zone to balance a production overage while in another balancing zone balancing power is used to balance a production shortage. Intelligent interconnection of information and control systems of the three transmission grid operators substantially reduces the required balancing power. This enables annual savings of tens of millions for energy customers.

### **European security initiative**

Together with ten other transmission grid operators in central Europe, transpower has established the largest European initiative to facilitate cooperation and security of supply. Goal of the "TSO System Security Cooperation" is a permanent security committee with a group of experts and a shared IT platform for data exchange as well as the realization of joint security calculations. This initiative is intended to better manage the growing operational requirements, especially as to wind energy, the growing transnational trade and increasing power transmission.



# the nuts and bolts

## **Strong in the European interconnection**

transpower, in the centre of Europe, is a key player in power exchange beyond Germany's borders

Our lines are part of the European connectivity grid and link to the Scandinavian power market. The transmission grids in continental Europe are electrically connected and – so far – together made up the UCTE grid (Union for the Co-ordination of Transmission of Electricity). To meet the increased requirements of the European power market, the merger of the UCTE and five other regional organizations was initiated. A new European organization was created: ENTSO-E (European Network of Transmission System Operators for Electricity) with 42 transmission grid operators from 34 European countries. transpower will continue to play a leading role in the European interconnection regarding the coordination of grid operation and expansion to ensure reliable and efficient energy supply

## Congestion management at transpower

The single European electricity market is developing continuously. Since the late nineties, power is increasingly traded across national borders. Here, the power flows mainly follow the different price level in Europe. For historical reasons, the transmission capacities at the cross-border transfer points between the individual European neighbours is limited, however. Implications: The demand for transmission capacities for cross-border trading exceeds the available capacity of the lines at many locations by far, resulting in cross-border bottlenecks. If all requests were permitted, line overloads would inevitably be the consequence. The grid reliability could no longer be guaranteed.

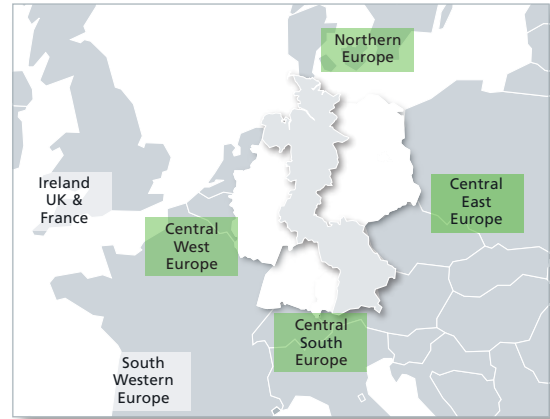


Power  
knows no borders

Various measures are required: transpower invests in the construction of new power lines. However, new lines must pass complex and time-consuming approval procedures. It is therefore necessary to allocate the scarce transmission capacities to the traders to ensure secure grid operation. Methods have been developed to tackle this task, which are listed under the term congestion management. Today, available capacities are mostly allocated by means of auctions. Auctions are transparent, market-oriented and non-discriminating and hence meet all the requirements of the EU. The transmission grid operators have established bi- or multilateral auction offices to conduct joint and coordinated auctions. They take over the operating side of handling congestion management.

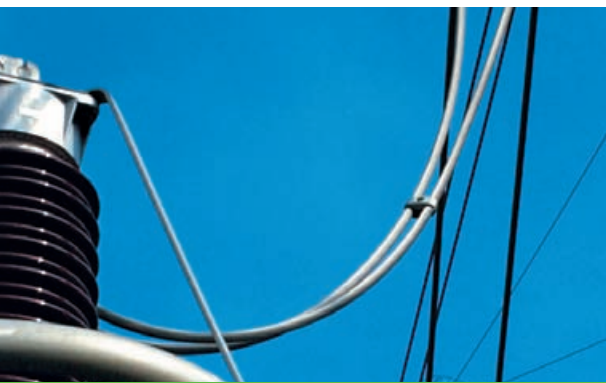
### The transpower grid as pan-European trade platform

The transmission grids are of special significance for creating a single European power market. This is where the cross-border power transmission with the neighbouring transmission grid operators is coordinated. The transpower grid area is a hub for Central Europe. It belongs to four of the seven European regional markets (Northern Europe, Central East Europe, Central West Europe and Central South Europe), where the harmonization of the joint single power market is initially promoted. transpower is the only German transmission grid operator participating in four regional markets and therefore takes on a key role. Within the regional



markets, transpower sets the critical course for simplified market access and more competition:

- Northern Europe: transpower participates in implementing the market coupling for efficient congestion management. In this process, power trade business and allocation of transmission capacity occur at the same time. For this, the Hamburg-based "European Market Coupling Company" (emcc) was created, serving as central interface between market and transmission grid operators.
- Central West Europe: Here, transpower promotes the market-based allocation of available capacity to traders by participating in the Luxembourg-based "CASC-CWE". The "Capacity Allocation Service Company for Central West Europe" conducts harmonized, explicit annual and monthly auctions to allocate capacity. Trade business and capacity allocation still occur separately. Advantages today: merely a contact point for the traders, organizing auctions for all transfer points in the CWE region. In parallel, transpower cooperates with the transmission grid operators and energy exchanges in the CWE region to accomplish market coupling. The objective is the simultaneous allocation of transmission capacity and energy trade business.
- At the borders of Central East Europe (CEE), transpower works with CEE partners on further developing explicit auctions between Germany, the Czech Republic, Poland and Slovakia. In the future, these are to be conducted by the "Central Allocation Office" (CAO), based in Freising near Munich. It is transpower's goal to facilitate and intensify competition in the power market and thus actively contribute to the creation of a single European energy market.

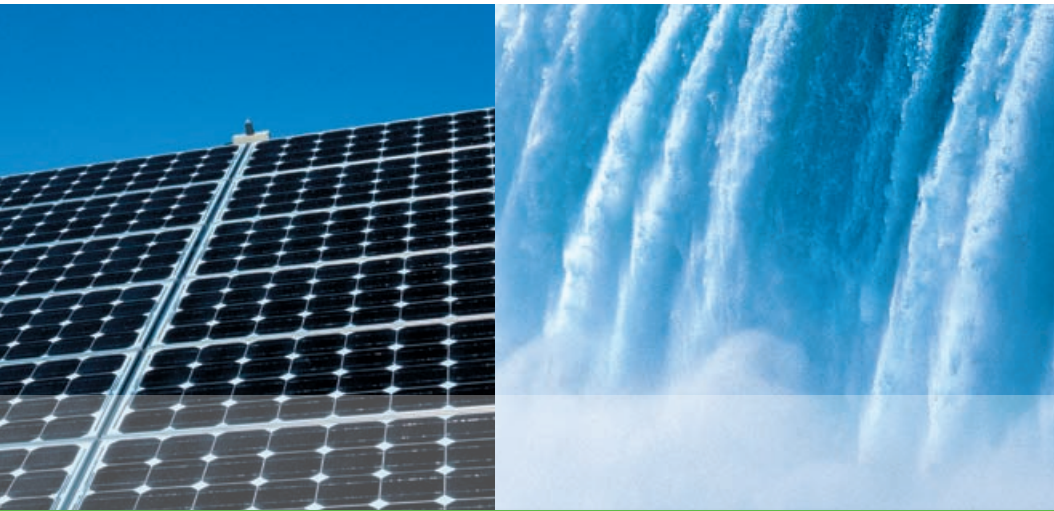




# Respon- sibility

## Renewable energies

The Renewable Energy Act (EEG) is the central instrument for energy policy to promote power production from renewable energies in Germany. By now, there are more than 13,000 MW energy from wind, water, sun and biomass installed, not least because of substantial government sponsorship. transpower, as a transmission grid operator, is tasked with the redistributing EEG subventions without affecting the outcome. Through a multi-level system, the EEG plant operator distributes the EEG power equally via the grid operator to all German end consumers. The following numbers show the significance that EEG has gained for transpower: With 30 per cent of the end consumer sales, the financial circulation volume in the year 2007 was about EUR 4.1 billion with about 150,000 EEG plants to be paid. This is four times the volume of our actual grid business.



## High demands on the electricity grid make grid expansion necessary



### **Wind energy boom**

Germany is world market leader in the field of wind energy use. In 2008, there were more than 23,500 MW wind energy capacity on the grid. With the development of offshore wind energy, this number is expected to double by the year 2020.

### **Newpower plants and pan-European transit**

Besides the wind energy boom, there are 14 new conventional power plants under construction or in planning stages in the transpower grid. transpower enables their grid connection according to a transparent and non-discriminating process. This makes for competition, because transpower brings all power plants to the grid, regardless of which operator plans them. The transpower grid is a neutral hub for competition in the power market.

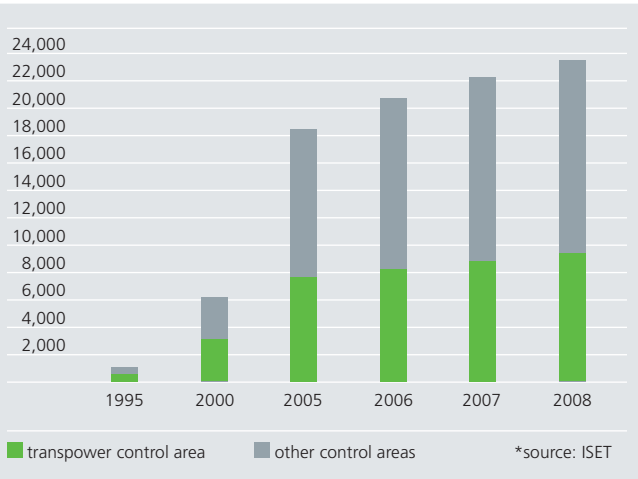
### **Grid expansion necessary**

The function of the power grid has changed greatly during the last few years. In the past, power was generated close to the consumer. It wasn't necessary to transport it over long distances. Meanwhile, large amounts of wind energy, along with power from the new power plants close to the coast, have to be transported from low-consumption regions over long distances to the high-consumption regions in south and west Germany. The power trade throughout Europe is also increasing. It is urgently necessary to develop the power grid to meet the demands. transpower is legally obligated to avoid transport bottlenecks through timely grid expansion. The extensive additional construction of wind power facilities alone will require about 850 kilometres of new extra-high voltage lines in Germany by 2015 (source: dena grid study). transpower is working diligently on permissions for the new lines so that the further development of wind energy use will become a reality. Plans are advanced in close coordination with all involved parties. However, new power lines in the affected regions are strongly opposed.



# Grid expansion

Installed Wind Power Output in Germany (in MW)



Current transpower projects

**Dena Grid Study Projects**

Altenfeld–Redwitz * (Thuringia, Bavaria)	25 km
Diele–Niederrhein * (Lower Saxony)	50 km
Ganderkesee–St. Hülfe (Lower Saxony)	60 km
Hamburg/Nord–Dollern (Schleswig-Holstein, Lower Saxony)	45 km
Wahle–Mecklar (Lower Saxony, Hesse)	190 km

**Power Plant Connections**

Stade–Dollern	20 km
Wilhelmshaven–Conneforde	40 km

All details are approximate values, \*transpower portion



# Power outlets in the North Sea

transpower brings offshore power to shore



Plans call for some 50 wind parks in the North Sea in the coming years. transpower is legally obligated to create and operate the grid connections for these wind parks in its transmission grid area. The respective costs will be allocated to all power customers in Germany through the grid fees. To provide the initial grid connections in a timely fashion, the initial grid connections have been in progress since 2007.

Offshore wind parks close to the coast can be connected by individual cable connections. "alpha ventus" was the first wind farm in the North Sea to be hooked up by such a grid connection. The cable from the offshore wind farm to the transformer station is about 70 kilometres long. It runs as an alternating current connection across the island of Norderney, then links up with the 110-kV grid.

transpower bundles cable connections at sea to connect planned, remote wind farms to the grid in an environmentally friendly and efficient manner. transpower provides a transformer station on an offshore platform. The wind farms are connected there, just like hooking up to a power outlet. From there, the electricity produced by the wind energy plant is converted into direct current and transported through the sea and across land by a so-called high-voltage

direct current line (HVDC) to the next on-shore point of delivery, a transformer station. From there, the direct current is reconverted into alternating current and then fed into the 380-kV grid.

The first project involving direct current technology is the grid connection for the BARD Offshore 1 wind farm. This is the longest direct current connection in the world between an offshore wind farm and the extra-high voltage grid. The wind farm 125 kilometres off the shore will get a high-performance grid connection, enabling them to feed large quantities of wind energy into the grid. This cable connection from the offshore power outlet to the transformer station Diele near Papenburg comprises about 75 kilometres of land cables and 125 kilometres of undersea cables.



# Innovative overhead line monitoring

More power through wind-cooled lines



The traffic volume on the power highways has been increasing strongly during the past years. Because of the development of wind power and construction of new power plants close to the shore, the need to transmit large amounts of energy from North to South has been growing considerably. transpower therefore optimizes the grid using innovative technology. New lines are constructed only where absolutely necessary.

Overhead line monitoring is a promising process to increase transmission capacity. It enables transmitting more power on existing lines under certain conditions.

The transmission capacity of an overhead line is limited by both the conductor rope's distance to the ground and its permissible temperature. When the temperature of the conductor ropes increases, they expand and the ground clearance is reduced. However, a specific safety clearance must be maintained. Besides depending on the current load, the ground clearance also depends on the ambient temperature

and the wind speed. The stronger the wind blows and the colder it is, the less the conductor rope will sag. If current load, ambient temperature and wind speed are known, the transmission capacity of a line can be adjusted to the current climate conditions (online) in real-time by the grid control.

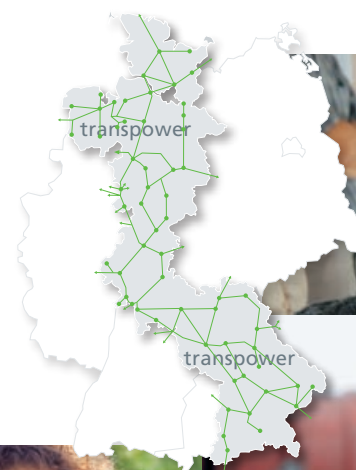
This might sound simple, but requires complicated calculations and modifications to the grid, especially in the transformer stations. Finally, the equipment must withstand the higher current loads. After a successful testing phase, transpower will implement overhead line monitoring also in individual segments in the German extra-high voltage grid for the first time in 2009. Lines that are particularly used to capacity by wind energy feed-in and transmission of electricity are operated with this system.

## Our employees

Our 700 employees have varied and interesting duties and responsibilities: from work in the grid control centres, the heart of our grid, in the local service groups, at the many interfaces to the international market to the connection of offshore wind parks. transpower offers an attractive work environment, exciting challenges and good working conditions, not only in business, but also in the technical field. Investing in employees is the most important investment for the company's success. At transpower's core, there are motivated people. A good reason to attach special importance to continuing education, family friendliness and health care. All employees should be able to optimally apply their skills and to continually pursue individual development.

### Service groups – our "Mobile Task Force"

About 170 employees in 16 service groups provide regular maintenance and repair in the grid. 10,700 km of lines and 115 transformer stations are inspected regularly. Throughout this area, our experts are on duty 24/7 to restore the transpower grid as quickly as possible in case of failures.



Pulling the strings  
in the grid



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