

Press Release

Investing in great heights

Freudenberg technologies improve wind turbine efficiency and performance

Weinheim, Germany September 20, 2018. Wind power contributed roughly 20 percent of the energy mix in the Federal Republic of Germany last year. Thanks to another 5.1 percent increase relative to the previous year, wind power is the second most common energy source behind brown coal in Germany as a whole. In the coming years, UN climate goals will place greater pressure on policy makers and utility companies to promote sustainable power sources and invest in the construction of offshore wind farms. In doing so, companies face enormous challenges, and these are one of the key points of discussion at this year's WindEnergy trade fair in Hamburg. Servicing and repairing turbines on the high seas is difficult and expensive. The Freudenberg technology group has been examining this problem and offers innovative and tailored solutions.

The name has a military overtone, but it is the future of wind power: In the middle of the Baltic Sea between Germany, Denmark and Sweden, the "Kriegers Flak" wind farm is rising from the sea to over an area of 132 square kilometers. At dizzying heights of more than 100 meters, massive towers bear nacelles and 80-meter blades, giving the wind turbines a total height of almost 200 meters - by comparison the Cologne Cathedral is only 157 meters high. Weather conditions are extreme on the high seas. The turbines have to withstand gale force winds of more than 120 km/h and waves far higher than a single-family house.

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The latest generation of turbines to be built in Kriegers Flak are among the most powerful in the world; each individual turbine can generate up to eight megawatts of electricity.

Multi-megawatt wind farms on the high seas bring more than higher yields. Even though the power generated by each turbine increases with the blade surface, the harvested winds place greater strain on components such as the primary bearings or the rotor blades. This is a technological challenge that Freudenberg Sealing Technologies' innovative wind turbine seals can meet. The seals help keep sand or salty water from penetrating machine elements through important interfaces such as where yaw bearings between the tower and nacelle meet, the rotor blade bearings as well as the primary bearings. Increased winds make this all much more difficult. Freudenberg has thus developed a special Seventomatic seal for extremely large shaft diameters. Instead of the old radial springs Seventomatic seals use a meander spring, which makes the seal less susceptible to big movements and dislocation of the main bearing. The greater flexibility enables better compensation exceeding several millimeters and prevents unwanted leaks.

Wind turbines have an entire series of friction points where the use of specialty lubricants can help eliminate or alleviate wear and tear. The lubricants increase the wind turbine's efficiency and component operating life - helping improve operating efficiency. Also, the less lubricant used, the lower the logistic expenses needed to organize lubricant replenishment, making maintenance more efficient, which can be very costly in offshore farms on the high seas. Special oils are normally used in transmissions, while the lubrication points such as the main bearings, the rotary bearings and bearings in the generator use grease. The yaw gear drives used to shift the rotary blades and the nacelle to track the wind also need to be efficiently lubricated. A family of three special lubricants was developed and precisely tailored to the various

applications and are suitable for all the lubrication points in a wind turbine.

All the components in a wind turbine are designed to have rotation movement driven by the wind transformed into electrical current and transported to the end customer with as little loss as possible. At sea, special submarine cables are used to transmit electricity. Technical nonwovens from Freudenberg Performance Materials help protect these cables. Even though the submarine cables are placed in a trench dug for them on the seabed, they can still be damaged by sharp edges on the sea floor. The submarine cable cannot always be protected from anchors and other mechanical forces. Should there be any damage, a super-absorbent polymer powder in the Freudenberg nonwoven material causes it to swell, blocking off the complex hollow space in the submarine cable and quickly preventing water penetration. The nonwoven material thus plays an important role in limiting damage. As a consequence, power companies replace much shorter lengths of defective cable which reduces the risk and cost. In addition to the swelling, other properties such as excellent conductivity and very high tensile strength are vital to making the Freudenberg nonwoven a functional part of the cable.

Freudenberg provides innovations to many vital technologies allowing wind turbines around the world to produce more environmentally friendly electricity and operate more efficiently and cost effectively than ever before. “Our primary goal is to develop innovative products and services, that help make our customers more energy efficient,” says Freudenberg CTO Dr. Tilman Krauch.

About the Freudenberg Group

Freudenberg is a global technology group that strengthens its customers and society long-term through forward-looking innovations. Together with its partners, customers and research institutions, the Freudenberg Group develops leading-edge technologies and excellent products and services for more than 30 markets and for thousands of applications: seals, vibration control components, nonwovens filters, specialty chemicals, medical products, IT services and the most modern cleaning products.

Strength of innovation, strong customer orientation, diversity, and team spirit are the cornerstones of the Group. The 169-year-old company holds strong to its core values: a commitment to excellence, reliability and pro-active, responsible action.

In 2017, the Freudenberg Group employed approximately 48,000 people in some 60 countries worldwide and generated sales of more than €9.3 billion. For more information, please visit www.freudenberg.com.