



Use of special lubricants can minimize friction and increase component efficiency by 10 percent (courtesy of Klüber).

A Need for Reduced Energy Costs

OPTIONS ABOUND FOR INCREASED EFFICIENCY IN LUBRICATION

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When a bearing or gearbox fails in a wind turbine, the result is typically a domino effect. The component needs to be replaced, the new part needs to be manufactured and shipped and the turbine is out of commission until further notice. Operating costs rise, time is wasted and money lost in the process—typically thou-

sands of dollars, considering the equipment involved. It's no wonder a component's efficiency is a priority in the manufacturing sector. Proper lubrication can reduce downtime, increase efficiency and improve the overall reliability of a system.

In manufacturing today, the push continues to cut energy

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costs, minimize friction and reduce CO₂ emissions. Highly specialized lubrication options are available for companies that work with gears, bearings and compressors in a host of power transmission applications. There are even monitoring systems specifically focused on lubrication to keep up with maintenance and reliability concerns. *PTE* magazine took a look at some of the different lubrication options available on the market.

Increasing Efficiency with Klüber Lubrication

Day after day, countless large and small cogs and wheels can be seen spinning in industrial installations worldwide. Innumerable gears, bearings and compressors work incessantly in assembly belts, baking lines, escalators, in cars and trains. This means not only a continuous flow of production, transport and assembly, but a constant consumption of energy as well. The reduction in energy consumption is therefore a major issue for the designers and operators of these installations, in particular because energy costs figure quite prominently among all the items on a company's bottom line. While energy is a major cost factor for its consumers, it should not be forgotten that its generation is also one of the main sources of greenhouse gas—CO₂—with its harmful effects on global climate. In North America, for example, the generation of one megawatt-hour of energy causes an emission of approximately 602 kilograms of CO₂ on average, depending on the regional energy mix of fossil fuels, nuclear power and renewable sources of energy. All over North America, approximately 5.1 million GWh of energy is generated each year, leading to a total emission of more than three billion tons of CO₂. Depending on the region, energy consumption by industrial users can be up to 20 percent.

Numerous national and international regulations and guidelines aim at reducing CO₂ emissions worldwide. In addition, a range of simple measures can be taken to efficiently reduce energy consumption. One such element is the use of specialty lubricants. In every set of gears and all bearings, friction is generated and thus valuable energy is lost. Measurements made on test rigs of Klüber Lubrication, München KG have shown that the use of suitable special lubricants can help to minimize friction and increase the component efficiency by up to 10%.

"In order to obtain maximum efficiency, tribologists look not only at the materials used for making the components, but also at the ambient conditions under which the component is intended to work in real life," explains Dennis A. Lauer, P.E., vice president engineering for Klüber North America.

"Very high or very low temperatures may play a major role, as well as many other factors such as pressure, rotational speed or moisture. The selection of the right additives is decisive in any specific characteristics a lubricant will have."

An everyday example of this significant savings potential can be found in Munich's public transport system with its 761 escalators. These are driven via worm gears requiring an average driving power of 7.5 kW. With 4,000 operating hours per year, their total energy consumption is 30,000 kWh per unit. The use of specialty gear oil can help reduce energy consumption by some 10%. Consequently, the Munich public transport operator could cut costs by more than 200,000 euro each year and save the environment approximately 1,400 tons of CO₂. In a mega-city like Shanghai, with its 2,600 escalators in the public transport sector alone, savings of huge proportions are feasible.



SKF's WindLub helps extend turbine life and reduce operational and lubricant costs (courtesy of SKF).

The potential for savings becomes even more apparent in another example: a large airport may utilize more than 20,000 gear units, for example, in conveyor belts and escalators. Approximately 15,000 of them may be spur and bevel gears with a mean power of 5 kW and another 5,000 worm gears with a mean power of 15 kW. With some 4,000 operating hours a year and a utilization rate of 40%, total power consumption is at approximately 240 GWh. Replacing a mineral oil with a polyglycol specialty oil will increase the efficiency of all gears by roughly 5.25%, on average. The power saved is 12.6 GWh—or the annual power consumption of approximately 3,000 private households. Put another way,

12.6 GWh (12,600 MWh) translates to, on a North American average, the emission of more than 7,500 tons of CO₂. Based on an energy price of 7 cents-per-kWh in North America, more than 880,000 U.S. dollars can be saved in this way.

"These calculations clearly show how lower energy consumption can benefit the environment and at the same time reduce operating costs in the long term," explains Lauer. "When looking at the whole picture, and when considering the cost benefit aspect, a seemingly higher-cost, high-performance lubricant can in fact be more economical. After all, less friction means less wear, longer maintenance intervals, lower energy consumption and hence less strain on valuable resources."

Following extensive R&D work and a comprehensive performance test program, Klüber Lubrication has developed three synthetic high-performance, high-load gear oil products including Klübersynth GEM 4 N (polyalphaolefin), Klübersynth GH 6 (polyglycol) and Klübersynth GEM 2 (rapidly



A large airport may utilize more than 20,000 gear units in conveyor belts and escalators (courtesy of Klüber).

biodegradable ester). These gear oils meet the demanding requirements for gear performance, offering wear protection and resistance to micropitting, foam and residue formation. Compared with other standard gear oils, these products show good aging resistance, high load-carrying capacity and low friction values. Consequently, oil change intervals are increased, power loss is reduced and the resulting yield increases over the operative life of a wind turbine, for example.

Shell Meets Challenging Operating Conditions

To meet the growing demand for wind energy in North America, Shell Lubricants is making available a new portfolio of products that meets the toughest applications, specifically in hydraulic systems, blades, gearboxes, yaw and pitch drives. Shell Lubricants provides products and services for the entire wind value chain—e.g., component manufacture, turbine assembly, transportation, construction, installation and service. The company recognizes the impact of reduced reliability and the demands of operating wind farms in remote locations (both on- and off-shore) and in challenging climatic conditions. As a result, high-quality lubricants and greases suitable for providing long service life and equipment protection are required. In order to keep a wind turbine running reliably and to extend component life, Shell supplies a wide range of products.

“Our laboratories in Asia, Europe and North America provide the Shell Lubricants team the ability to develop cutting-edge technology for wind energy customers,” says Felix Guerzoni, product application specialist. “Our strong belief in

‘world-class technology working for you’ helps us to develop our most technically advanced products and services for our customers. Our lubricants are rigorously tested in our labs, with equipment manufacturers and in real turbines during the development process so that our products meet the demands of our customers’ operations throughout North America.”

Shell Lubricants works closely with leading wind turbine manufacturers, component suppliers and industry associations to understand emerging lubrication needs and rapidly changing industry and manufacturer specifications. Shell Lubricants complements its products with a comprehensive oil analysis program, Shell LubeAnalyst, which can be used to help operators monitor the condition of their lubricant and equipment and avoid unscheduled downtime.

Some of the leading products Shell Lubricants offers to meet the demands of wind turbines include Shell Tellus Arctic 32, a hydraulic fluid used for extreme-climate wind turbines and recommended or listed by leading suppliers such as Svendborg Brakes, and by wind turbine OEMs including GE Wind, Voith Wind, Vestas, Dongfang Wind Turbines, Sinovel, RePower, Nordex and DHI. The product has demonstrated its performance in the harsh winters of Mongolia, Scandinavia and the Americas at temperatures as low as -40 degrees C.

The massive blades of a wind turbine are adjusted using grease-lubricated blade bearings, which if insufficiently lubricated can fail through fretting and false-brinelling. Shell Rhodina BBZ is designed to provide protection to bearings

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against fretting corrosion, moisture contamination and false brinelling at temperatures as low as -55 degrees C. Shell Rhodina BBZ lubricates the blade bearings of many wind turbines globally with leading blade bearing suppliers such as Rollix, Rothe Erde, IMO, Rotek, Liebherr and wind turbine OEMs including Vestas, Acciona, Gamesa, Dongfang Wind Turbines, Sinovel and Siemens.

Gearbox reliability is also critical for wind turbines. Shell Omala HD 320 synthetic gear oil provides protection against common failure modes, including micropitting and bearing wear. Offering low-temperature fluidity and long oil life, Shell Omala HD 320 provides benefits for difficult-to-maintain wind turbine gearboxes. Additionally, Shell Lubricants offers Shell Tivela S 150 & 320 synthetic gear oil for yaw and pitch drives; Shell Albida EMS 2 electric motor bearing synthetic grease; Shell Stamina HDS main bearing grease; and Shell Malleus GL & OGH premium quality open gear grease.

SKF Offers

Wind/Lubrication System

With the SKF WindCon system, operators can take a proactive approach to maintenance. The system allows the operator to monitor a turbine or an entire wind farm and predict when maintenance will be necessary. WindCon collects and analyzes the mechanical data, compiles it, and provides a reliable performance overview in order to extend time between site visits, predict failures before they occur and plan maintenance activities more effectively. SKF WindCon is easy to use and requires no special training or software. Data is presented using an Internet browser, and the information is up-to-the-minute. The web-based version of SKF WindCon takes advantage of WebCon—SKF's data warehousing and web hosting services. WebCon helps to shorten lead-time from alarm to solution, since authorized personnel can do monitoring from any location with a computer or hand-held device with Internet access.

The simplified maintenance and increased reliability that SKF WindCon provides can be enhanced with WindLub—SKF's centralized automatic lubrication system for wind turbines. WindLub easily integrates with SKF WindCon; so along with fully automated lubrication, the combination provides operators with a complete overview of the lubrication system, including pump status and grease levels.

"Ensuring constant and well controlled lubrication is a challenge," says Victoria Wikstrom, marketing manager general industry. "This is usually done through a central lubrication system that pumps grease or oil to the locations where it is needed."

While SKF WindCon is user-friendly enough to be op-

erated by wind farm technicians, many users choose to have SKF monitor and manage the system for them. A team of SKF engineers does so from The SKF Intelligence Centre Wind - a facility in Hamburg, Germany dedicated solely to wind turbine condition monitoring issues and the management of installed systems. To simplify maintenance and reduce environmental impact, SKF WindLub centralized lubrication system delivers the exact quantity of the appropriate lubricant at the right positions at the right time to all rotating equipment. SKF WindLub helps to increase turbine reliability and availability and helps to extend the turbine's service life and reduce operational and lubricants costs. Additionally, SKF WindLub minimizes environmental impact by avoiding over-greasing.

The combination of WindLub and WindCon provides operators with a complete overview of the lubrication system. "Our ability to increase service life with greater precision will increase thanks to an improved understanding and computer modeling of lubricant behavior," Wikstrom adds.

The advantages of an investment in a central lubrication system include the high-pressure technology that makes it suitable for rotary operation; greases with high solids content can be fed easily; it's available as a pre-assembled kit, which means low mounting effort and reduced mounting errors; individual supply of lubrication points; electronic fill level control; visual stroke monitoring of the lubrication cycle; and the system

components are available in corrosion-resistant designs for off-shore applications.

Timken Adds

Power Transmission Systems and Services

Leveraging organic investments sustained during the recession to expand both its wind power offering and capacity domestically and internationally, The Timken Company introduced a number of new product developments this year. Timken recently retooled and expanded facilities in Asheboro, NC and Tyger River, SC, to serve its customers, in addition to existing wind bearing production in Wuxi, China; Chennai, India; and Ploiesti, Romania. In May, the company began shipping its initial production from a new plant in Xiangtan, China. Timken also provides clean steel from its facilities in Canton, Ohio for its own production and various wind energy components for other customers. Now working with the world's leading wind turbine manufacturers at varying stages of development, Timken has established a supply chain dedicated to serve the wind industry.

"From engineering investment to our manufacturing and service capabilities in every part of the world, Timken is in the best position to deliver exceptional value and life cycle



SKF's WindCon provides a performance overview and plans turbine maintenance for operators (courtesy of SKF).

support to customers who are developing the next-generation, multi-megawatt-class turbines,” says Christopher Coughlin, president of Timken’s Process Industries Segment.

One recent development is a wind energy lubrication system, offered in high pressure and low pressure variants, providing a versatile pumping method. The lubrication systems provide ‘cold climate’ pumping properties, reduced side loading and maximum bearing life by ensuring precise amounts of lubrication are delivered to each bearing row.

Timken’s LP system is a low-pressure centralized lubrication system that directs grease inlets and uses an active purging method to reliably lubricate bearings. With this system, a central pump automatically delivers lubricant through a supply line to multiple banks of injectors. When used with tapered roller bearings, each injector bank operates independently to lubricate each bearing row at the small end of the roller.

The economical high pressure system provides automatic lubricant delivery through a single divider block, which displaces a fixed amount of lubricant to each lube point on the bearing assembly. A moving indicator pin attached to the divider block allows for easy monitoring through a proximity switch. Injected grease creates pressure in the system to force out old grease into disposable waste containers.

Other new developments from Timken for the wind energy industry include wear-resistant cylindrical or spherical bearings, tapered roller bearings, three new wind energy seals, an online intelligence system for condition monitoring and Syber, an advanced wind system analysis program.


Turbine Efficiency with Dow

A more efficient wind turbine that will generate even more wind-driven electricity is now possible with the recent introduction of the Dow UCON GL-320 lubricant. Dow introduced the new product during the 2010 STLE Annual Meeting in Las Vegas. Dow UCON GL-320 lubricant was developed to better lubricate the gearboxes of wind turbines, though the same lubricant can be used effectively for other types of gearboxes. The company believes organizations may produce and sell more power with this lubricant for three reasons: First, in cold weather, turbines can shut down due to filter failures caused by high lubricant viscosity. The higher inherent viscosity index of UCON GL-320 lubricant addresses this issue without the need for additional viscosity index improvers. Second, when turbine output is at the maximum, high gear oil temperatures can lead to shutdowns. UCON GL-320 lubricant has a higher heat capacity than hydrocarbon oils, which allows it to move more heat, reducing these shutdowns. Lastly, UCON GL-320 lubricant has better lubricity at ambient conditions, meaning that it has the potential to shift the power versus wind speed curve to the left, leading to greater power output when the production is less than the maximum design output.

Dow UCON GL-320 lubricant is a new polyalkylene glycol (PAG)-based lubricant developed based on Dow’s experience in manufacturing PAG-based products. The combination of the PAG base along with a proprietary Dow additive package yields a ready-to-use product with specific performance properties required for the successful operation of wind turbine and other gearbox operations.

The main components of the wind turbine are the huge

blades that turn in the wind. But there is much more to this sustainable power source than these. The gearbox and the generator to which it is attached are both key mechanical and power generating elements of a wind turbine. Keeping gears and moving parts well lubricated is important to overall system efficiency and longer equipment life, according to Dow. Gears and bearings can be permanently damaged after only a few minutes of improper lubrication. Less expense for maintenance and a better overall operation are benefits this new lubricant will deliver to wind turbine owners and operators.

“Imagine the expense of working on a wind turbine that is located out in the Gulf of Mexico,” says Brian Goldstein, marketing manager for Dow UCON. “If using better lubricants extends equipment life and maintenance intervals, therefore reducing costs associated with rental of crew boats and offshore cranes, plus the people with the special skills needed for this type of work, then we believe that Dow UCON GL-320 is an excellent value.” 

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