

# How to get wind turbine function smoothly?

## A discussion about lubrication technology for wind turbine

### Role of lubricants in wind power generation

Maintenance of a machine is very important and to maintain the performance is much more important than that. To enhance the machines performance and to have smooth functioning of machines or any device lubricant plays a vital role. Wind power generation is equally taking place on a high note, there is an increasing demand for wind power generation. To generate energy out of wind, wind turbine needs to be functioning properly and for this many lubrication companies are bringing out new solutions.

A wind turbine comprises of various small and big components and their ultimate goal is to convert the kinetic energy of wind into electrical energy. There are many small and big components transferring the motion and loads through meshing of various gears, bearings and keeping all these components healthy is the key function of lubricants.

In non-gear applications in wind turbine like slew ring bearing (blade bearing and yaw bearing raceways), different bearings inside gearbox, generator etc, and the other moving surfaces are either in sliding motion or rolling motion. Gear teeth, however, are facing both

the types of motion – sliding as well as rolling at same time. These types of conditions make the situation a little tricky while selecting the ingredients of lubricants.

How does a designer of lubricant system select the ingredients for various applications in a wind turbine? To answer this question in simpler way, it is explained how lubricants are categorised: Enclosed gear lubricant, open gear lubricant, bearing raceways lubricant.

There is a basic method to select the suitable lubricant for all the Enclosed gear lubricant, open gear lubricant, bearing raceways lubricant type of lubricants: What is the target of your lubrication? whether you have clear idea on the subject (basically component), expert opinion on compatibility from manufacturer or designer of component, type of load applicable on component, awareness on construction of component, due consideration of operating environment effects, viscosity requirement, rotational speed of component in meshing, fluid durability, evaluation of lubrication cost.

Lubricant technology plays a vital role in keeping wind turbines running reliably and efficiently. The customers today are constantly striving to







Maintaining and prolonging the performance of the main gearbox is the greatest lubrication challenge for wind turbines.



Imtiaz Ahmed, Asia Pacific Mobil SHC Brand Manager, ExxonMobil Lubricants Private Limited

improve efficiency and operational reliability, and enhance competitiveness by avoiding lost output and maintenance costs. "Poor lubricants and lubrication practices can cause equipment downtime which can lead a firm to losses. Hence, a lubricant becomes a critical element in the lifespan of a turbine, in today's operations where severe conditions and cyclic peak loading are the new norm," explains Akhil Jha, Vice President Technical, Shell Lubricants India while sharing his views on role of lubricants in wind power generation.

At Shell Lubricants, they understand the deep understanding of the product demands of the wind industry and its commitment to provide enhanced protection of critical components to reduce replacement costs; extend turbine life, and improve operational efficiency through synthetic oil technology. Shell Lubricants produces market leading lubricant products in power sector from, power engine oils, turbine oils, electrical oils, gear oils, hydraulic oils and greases; Shell supplies a wide range of innovative products and supporting services backed up by international expertise.

Speaking about the products and its performance Jha explains, "One of our products, Shell Omala S5 Wind is advanced fully synthetic wind turbine gear oil that offers exceptional lubrication performance, even under severe operating conditions. This high performance lubricant will protect wind turbine gears and bearings by minimising wear, protecting against micro-pitting, maintaining fluidity at extremes of temperature and controlling foam even when used in conjunction with fine filtration."

The key to any successful operation is productivity. The right lubricant helps the equipment perform under the most demanding conditions and improves the reliability and profitability of power generation operations. Unplanned outages from lubrication failures are costly, as they could result in downtimes and equipment damage.

"Increasing the productivity of wind turbines across the globe, is what we hope ExxonMobil's lubricants can do for the industry. Our products can help power generation operators mitigate the challenges they face in extreme weather conditions," states Imtiaz Ahmed, Asia Pacific Mobil SHC Brand Manager, ExxonMobil Lubricants Private Limited.

Mobil SHC Gear 320WT, a high performance wind turbine gear box oil, helps to solve the biggest issue involved in increasing productivity by protecting your equipment in every possible climate. With superior wear protection, it also tackles unscheduled downtime. Excellent protection against rust and corrosion minimises maintenance costs and results in less frequent drain intervals. This not only increases productivity, but minimises safety risks and injuries as there will be fewer instances where personnel come into contact with the machines. At the same time, the longer material life cycle and reduced volume of waste oil improve safety, environmental care and productivity.

"To date, more than 40,000 wind turbines run reliably using Mobil's specialised lubricants across every component of a wind turbine. With Mobil SHC Gear 320WT, ExxonMobil provides a next-generation wind turbine gear oil that enhances the efficiency of wind turbines," informs Ahmed.

Lubrication in general used to reduce friction and wear to ensure high life of the specific components. The lubricants used in turbines are expected to offer constant high load resistance and good thermal stability throughout a long service life. Wind turbine lubrication exists at the very extremes of industrial gear applications in terms of temperature, load weights, bearing wear, maintenance, accessibility and basic lubricant performance.

Performance expectations for lubricants used in offshore wind turbines are higher due to the demand for extended life, explains Rakesh Sarin, CEO- International Business, Suzlon Energy Ltd. A quick check tip for fluid condition is to ensure



SKF-Lincoln Quicklub





As far as lubrication is concerned, wind industry is still facing the biggest challenge of balancing the quality of lubrication versus price of lubrication.



Kailash Lal Tarachandani,  
CEO, Inox Wind Ltd

that at a minimum, the turbine operators should be measuring cleanliness (contamination by ISO class), oxidation, water and viscosity.

By trending these four major parameters, 90 per cent of the lubricant and component information is accessible onsite in a short time. Another important thing is quality control of incoming oil batches. When refilling with new greases and lubricants, it is important to control the quality and make sure the right oil is added to the reservoir to avoid mixing and creating deposits in the gearbox.

It is an important expectation from oil companies that they continuously invest in developing gear box oils for better efficiency, life and anti-wear. For example, friction modified, latest generation anti wear and antioxidants can impact both the life of Lou. And the gear box reliability.

Another important expectation from the reputed oil suppliers is the systematic oil condition program. Lubricant suppliers should offer this service to the wind turbine industry which can be an important differentiator for selecting a particular supplier.

Grease to play an important role in efficient upkeep of wind turbines and deserves innovative approach both from the OEM and oil companies to bring better reliability of the greased components of the turbines.

SKF is a leading global supplier of bearings, seals, mechatronics, lubrication systems, and services which include technical support, maintenance and reliability services, engineering consulting and training. SKF in India has consolidated its operations in three different companies, namely SKF India Limited, SKF Technologies (India) Pvt. Ltd and Lincoln Helios India Ltd. Explaining about role of lubricants in wind power generation, Sandip Sen, Managing Director, Lincoln Helios (India) Limited says, "For flawless operation of bearing and other moving parts of WTG, lubrication plays a critical role in ensuring service life of lubricated parts."

Wind turbine consists of many mission critical parts like gear box, pitch and yaw gear, generator, bearings for main shaft and slew rings which are subjected to large loads and

vibrations. Ingress and presence of dust, moisture and heat pose threat to service life of bearings. Optimal and timely lubrication is a must to minimise breakdown, costly downtime and maintenance cost.

This is best done by having auto lubrication system fitted in wind turbines. They ensure measured quantity of grease is dispensed to all lubricant points at a regular time interval and the lubricant points are positively lubricated, thereby ensuring reduced maintenance cost, higher uptime and longer parts life.

### Challenges in lubrication of wind turbine

A wind turbine not only delivers higher energy output but also offers higher ROI (Return on Investment) to the customers. However, wind turbines present some unique challenges.

"Repairing of wind turbines can often be difficult for several reasons as most of the wind farms are located in remote areas, making it difficult to reach the site," Explains Sarin.

Unlike natural gas-fired or coal-fired plants, operators can expect to repeat this process multiple times because of the comparatively small capacity of wind turbines. One of the key strategies to prevent cost and time-consuming repairs is planned maintenance.

Wind turbines are very expensive and the lubrication system is very important to keep the machine working well. A lot of the parts of the wind turbine need to be lubricated, using lubricants from greases and gearbox fluids to hydraulic oils. Keeping a wind turbine's gearbox properly lubricated is important in extending the life of wind turbine parts.

The oil that is used in a turbine's gearbox – and for all other parts of a wind turbine – is generally designated by the original equipment manufacturer for the units. One of the main differences is whether the lubricant is a synthetic or mineral. In terms of the gear oil, customers use the same gear oil from three to five years without change out.

Due to remote area and height of turbine, there is constraint to apply lubricants frequently as per designed intervals. To take care of this PLC based Centralised Auto Lubrication systems are used to lubricate the parts.



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International Business, Suzlon  
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President, Technical,  
Shell Lubricants India

Customers today are constantly striving to improve efficiency and operational reliability, and enhance competitiveness by avoiding lost output and maintenance costs. In a world of increasing demand for energy and diminishing spare capacity in existing power grids, keeping industry moving is more challenging than ever before.

While speaking about the challenges in lubrication of wind turbine Jha says, "The lubricant is a critical element in the lifespan of a turbine, in today's operations where severe conditions and cyclic peak loading are the new norm. However, the importance of adopting a comprehensive Lubricant Management Strategy should not be underestimated."

Besides reducing friction and offering strong reliability to equipment, Lubricants also play a vital role in terms of energy efficiency. For power generation industries or plants, both traditional and renewable forms of energy including gas turbines, nuclear turbines, wind turbines or HFO fuel based engines; reliability and uptime are considered extremely important factors.

"Poor lubricants and lubrication practices can cause equipment downtime which can lead a firm to losses," states Jha. Shell's specialised product portfolio helps reduce power-engine maintenance time with extended-life oils, improve efficiency to increase combined-cycle turbine output and increase the reliability of remote wind turbines which can further lead to substantial savings by improving equipment availability, extending oil-drain intervals and improving engine cleanliness.

As per Ahmed's observation gearbox is biggest challenge for lubrication. On this note he says, "Maintaining and prolonging the performance of the main gearbox is the greatest lubrication challenge for wind turbines." The most common cause of gearbox downtime is related to bearing failure. Considering the variable load, speed and dramatic temperature conditions wind turbines operate in, bearings are put under significant amount of stress. These factors, combined with improper lubrication, result in the need for bearing replacements. If damaged bearings are not replaced promptly, it can cause significant harm to the gearbox.

The main gearbox drives the generator and is the heart of a wind turbine. With their advanced designs and importance to system performance, repairing or replacing gearboxes can be costly and time consuming after the warranty expires. The drive to minimise up-tower weight has resulted in compact gearbox designs, which in combination with high loads found in wind turbines, makes these surface hardened gears susceptible to micro-pitting that can cause numerous surface cracks. The cracks propagate at a shallow incline to the surface, forming extremely small pits that may reduce gear tooth accuracy and lead to significant gear damage.

While giving suggestions on how to overcome challenges in lubrication for wind generation, Sen states, "With wind turbines installed in more numbers at hard to access and remote areas including off-shore locations and subjected to work under harsh environment, Automatic Lubrication System (ALS) ensures lubrication without necessitating stoppage of wind turbine."

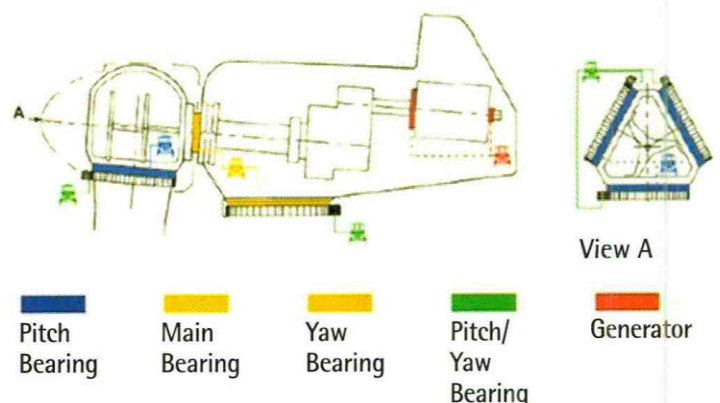
The lubrication system design needs to take care of high and low operating temperature which affects flowability and other characteristics of the lubricant. Also it is to be ensured that the lubrication system and parts supplied are corrosion resistant.

Wind turbines have multiple subsystems requiring different lubricants to be used. This calls for multiple and different types of lubrication systems. Challenge faced is in optimising the system suitable for each subsystem.

Maintenance and operation of windmill also requires refilling of lubricants, challenge here lies in optimising the refilling time and effort. Refilling containers are to be carried to WTG at heights which range from 60 to 100 meter.

Effective collection of used greases for environmental reasons and avoiding grease spillage for maintaining machine cleanliness are of paramount importance. It is also necessary to ensure safety of maintenance crew by avoiding possibility of slipping.

"As far as lubrication is concerned, wind industry is still facing the biggest challenge of balancing the quality of lubrication







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Sandip Sen, Managing Director, Lincoln Helios (India) Limited

versus price of lubrication" observes Tarachandani. Lubrication is present at each and every step of operation of a wind turbine: pitching, yawing, gearboxes, generators and various fasteners. All lubrication needs replacement periodically. Cost of lubrication and the cycle of replacement constitute life cycle cost of lubrication for the machine.

There are various high performance lubricants under development which have given very good results during various trial tests at test bench and in actual environment as well, but the cost is exponentially high adding to the life cycle cost of the turbine. Designer and application engineers are rallying to overcome this obstacle.

### Offerings and solutions

Mobil industrial lubricants offer a comprehensive line of high performance lubricants, which include turbine oils, gas engine oils and gear oils. For the power sector specifically, its portfolio includes:

**Turbine oils:** Mobil SHC 800, Mobil DTE 700 series Mobil DTE 800 series and Mobil DTE 900 series.

**Gas engine oils:** Mobil Pegasus and Mobil SHC Pegasus.

Range of industry leading wind turbine lubricants – Mobilgear SHC XMP series, Mobil SHC Gear 320WT and Mobil SHC Grease 460WT. Other Mobil SHC branded products for power generation auxiliary equipment.

"To support Mobil's available product portfolio, high level of performance is not enough; it is also important to deliver technical services and support to our customers in a timely manner, to achieve superior product performance and deliver sustainability benefits," states Ahmed.

Mobil's Signum oil analysis program is specifically tailored to monitor critical indicators for in-service lubricating oils. With more than 40 years of expertise in lubricating oil analysis, Signum has is recognised globally. It delivers safety, productivity and environmental care because it is supported by the full technical rigor of ExxonMobil's formulators, scientists and engineers. These teams not only develop the products, but understand their performance and life cycle in the field. The Signum program also uses the most sophisticated interpretation logic and the most

extensive used-oil analysis limits database available today—a full spectrum of analytics to ensure accuracy.

Signum oil analysis is recommended for our customers worldwide across industries such as wind, mining, steel, power, cement, petro chemical and paper, commercial vehicles (for both on-highway and off-highway equipment).

Key mission at Shell is to deliver lubrication related technical services which add real value to ones business, by applying its expert knowledge, understanding and resources. Shell's aim is to deliver real business improvement, value and cost savings that ultimately bring competitive advantage to ones business. Backed by strong technology leadership complimented with superior products and technical services, Shell offers comprehensive solutions for lubricant players.

**Shell Lube Analyst:** is a global oil and equipment condition monitoring service which includes a comprehensive range of tests. These are based on a simple-to-use pre-paid kit format for the most common high volume samples, and more advance less frequent post-paid specialist diagnosis services

**Shell LubeMatch:** is a 24/7 web-based product recommendation tool which provides simple lubrication recommendations for vehicles and equipment plus oil drain intervals when applicable

**Shell Lube Coach:** coaches your team to deliver better performance through this in-depth lubrication training programme

**Shell Video Check:** This sophisticated fibre optic tool lets you inspect the inside of your engine without dismantling it.

SKF-Lincoln have complete portfolio of auto lubrication solutions for all subsystems of wind turbines.

The portfolio comprises the entire gamut of solutions – right from single point lubricant applicators to sophisticated SCADA controlled system solutions. Also on offer are grease refilling systems for easy and uncontaminated refilling. Used grease collection system with grease suction pump is also offered as solution along with reusable grease collection bottles.

There is a wide range of systems and product variants to suit performance and customisation expectation of demanding users for their valuable machines needed to operate trouble free for very long duration of operating life.

### Conclusion

Lubrication for wind turbine has become very vital as wind turbines are costly and need high maintenance. Many companies are bringing out best solutions for the lubricant players. Which will also help the wind generation in a great way ahead.

