

LUBRICANTS

Renewables sector feeds specialist lubricants business

Enormous forces act on renewable energy systems' mechanical parts when generating power from wind and water. Between the smooth operation and potential loss of multi-million-dollar investments stand gear lubricants. Lubricants are also needed for the hydraulics that pitch the blades a few degrees every time the wind, or the water current, changes direction.

With these lubricants having to be replaced regularly, often under extremely challenging conditions, both the supply of these oils and the services needed to maintain and use them is a significant niche. There are nearly 400,000 wind turbines globally, according to data from the Global Wind Energy Council, which says worldwide capacity is 668 GW. Given that a single wind turbine's gearbox and the hydraulics each consume up to 1,000 litres of lubricants that are exchanged every five to 10 years, according to suppliers such as ExxonMobil, renewables lubrication can be lucrative.

These lubricant applications have been refined over the past 20 years. *Energy World* has talked to some of the players in the business to gain an understanding onto how lubricants and oil change processes have been perfected over time. One, Thorsten Sueling, ExxonMobil's European OEM Manager recalled: 'When we started our journey two decades ago, the farmers typically had to climb up their 150 kW wind turbines every now and then to pour a can of mineral-based engine oil into the gearbox.'

'We are dealing with 10 MW offshore turbines today, and between the old days and today there has been a lot of grief and trouble due to inadequate oils from various brands causing severe failure modes, such as micro-pitting on gears and white etching cracks on rolling element bearings, which are fatigue failures commonly seen,' he added.

Sueling says that ExxonMobil addressed these issues by developing a fully synthetic polyalphaolefin lubricant that maximises equipment productivity through protection from several

Modern wind and tidal energy turbines, and hydropower plants, require specially-manufactured lubricants, which sometimes need to be supplied and replaced in exacting site conditions – such as offshore – writes Jens Kastner.



Hydro power plants contain many moving parts requiring specialist lubrication
Photo: fotolia.com via Klüber Lubrication München

types of degradation; as well as being compatible with mineral-based gear oils.

'It took the wind industry quite some time to realise that the oil is a key sub-component of the gearbox,' Sueling said. 'Indeed, the right oil is key to improving total cost of ownership through minimising unscheduled downtime and maintenance, extending gear and bearing life under high-stress operating conditions as well as extending oil life,' he added.

Munich, Germany-based Klüber Lubrication is another supplier of lubricants for wind turbines. Its flagship oil is sold with promises of good resistance to load and ageing as well as low friction. It enables oil change intervals to be extended, reduces power losses and provides higher plant yield – delivering significant cost savings over the service life of a wind turbine, according to the company.

One problem with older turbines is contamination from deposits caused by aged lubrication oil, so Klüber's portfolio includes a cleaning oil that is added after approximately 10% of the gear oil has been drained for the oil change. In 24 to 48 hours after the addition of the cleaning oil, unwanted residues can be flushed out easily, claims the company.

Klüber has also developed a cleaning grease for the removal of residues in rolling bearings. It overcomes the technical challenges caused by high bearing temperatures and vibrations linked to deposits inside bearings, adds the company.

Availability and compliance

Among the key aspects for decision-makers to consider when designing renewable energy equipment and choosing lubricants is the international availability of these specialist products, and their environmental impact (through sourcing, use and disposal). Meeting regulations, for example those under European Union chemical control system REACH, is also important, said Andreas Hasslinger, Klüber Lubrication's Marketing Officer.

Renewable lubricant service providers also have specialist tasks and controls they need to follow to be successful. One example company is Wilhelmshaven, Germany-based Speed Wind Offshore, which delivers oil change services in the German North Sea, an important offshore wind zone with 20 farms in the region. It started operations in 1994 and has developed a special container-based system for wind power stations to quickly and cleanly deliver suction and refilling during lubricant exchange.

The company uses a container system to deliver its service – a 6 m unit equipped with two separate hose systems that individually fill the gear and hydraulic systems. Protective equipment prevents the tearing of the hoses, so that oil cannot leak and harm the environment.

Speed Wind Offshore's parent company, Kurt Ammann, also

supplies polyalphaolefin lubricants, as well as mineral oils, the latter roughly half the price of the former and mostly used only on older wind power installations nearing the end of service life. Speed Wind also supplies sensor systems that control the real-time condition of the oil online, eliminating the need for oil change at fixed intervals.

The company's container system conforms with international anti-pollution maritime regulations, such as the International Convention for the Prevention of Pollution from Ships, so the vessel carrying it can sail and dock worldwide. This delivers a key competitive advantage.

'Of course, the offshore service is much more challenging than onshore, given that the vessel is always moving, and that a snapped hose falling down from heights of 100 m poses grave risks to the vessel and the crew as well as the wind installation itself,' said Uwe Thiele, a Speed Wind Offshore Sales Manager. 'But our system allows the safe and automatic separation of hoses from the installations until the vessel has been brought in the right position again,' he added.

Thiele added that with the German wind energy market now being mature, the company has welcomed emerging interest in the licensing of its system among wind power service providers internationally, including in Japan and Mexico.

And, countering the notion that gearless wind turbines such as those produced by Siemens would ultimately reduce the consumption of lubricants, Thiele argues that gearless wind turbines have their own vulnerabilities: 'Gearless wind turbines are stuffed with sensible electronics systems that are very vulnerable in the offshore climate,' he claimed. 'If you look at a conventional gearbox or hydraulic system, you can easily spot issues due to affiliated oil leakage, whereas electrical issues are very difficult to sort out when you are on the high seas,' he added.

Lubrication for hydropower

Hydropower plants offer their own challenges regarding lubrication and Speed Wind Offshore has tapped this market by installing its container system on a truck, again utilising a long hose to deliver and suck oil.

ExxonMobil supplies its DTE Oil and Teresstic series for hydropower plants, the selection depending on the hydropower plant design and hardware installed. According to ExxonMobil's Sueling, the requirements for oils for



Wind turbine farms are major consumers of specialised lubricants

Photo: ExxonMobil

hydropower plants are substantially different from wind turbines, given that the former do not involve sensitive gearboxes but larger plain bearings and blades that rotate at much higher speeds than wind turbine blades. 'It's like water falling down a staircase and hitting a turbine,' Sueling said.

Klüber Lubrication, for its part, offers a specialist product for hydroelectric power plants. The product promises reduced efficiency losses in generator bearings by 5% on average, which enables power plant operators to generate more power from the same volume of water.

According to Florian Held, Klüber Lubrication Austria's Head of Technical Consulting and Sales, Austria/South Eastern Europe, a key aspect for hydropower is the long service life of the oils, with oil change intervals spanning from several years to decades, depending on installation design and oil analysis. Large installations typically have fill volumes of several thousand litres. 'The lubricants are an important yet often overlooked component of the system, and we as a specialist lubricant developer can identify limits and push them,' Held said.

'Improved stability and extended service life is beneficial also for the environment, given that these large volumes of oil potentially represent a significant environmental burden.' That said, the company is trying to reduce its environmental footprint further, by: 'developing water-based products with fast biodegradability in order to replace conventional oils in some

applications,' he added. These should be launched in early 2021.

Keeping tidal turbines turning

Marine power systems vary widely and require a wide range of lubricants. Take tidal stream turbine power – although the technology is still in its infancy, ExxonMobil is involved in screening exercises in tidal power projects in Scotland and England.

Customers include specialist companies such as Hamburg, Germany-based SKF Marine, a part of Sweden's SKF Group. SKF powertrain technology was chosen by Scotland-based Orbital Marine Power for a powerful tidal turbine with rotor diameters of 20 m, capable of powering more than 1,700 homes per year. SKF has been supplying bearings and components to Orbital since 2011.

According to Kai-Peter Wennholz, Senior Manager for Simplex Shaft Components, the sales and service arm of SKF Marine, there are mainly two types of tidal turbines, which both impose special lubricant service challenges.

The most common systems are anchored and are lifted to the surface for maintenance. Rarer floating tidal stream turbines allow easier access to the mechanical components either when lifting main mechanical components to the surface or through direct accessibility of the floating tidal turbine structure. The scheduled maintenance interval for replacing the grease and oil for either type is up to six years or more, said Wennholz.

The company uses established lubricants on tidal turbines that are commonly used in wind turbines, but: 'to replace the lubricant, you must remove the sea water seal system first, which itself requires lubrication,' he explained. 'Ineffective marine seals can be prone to water ingress that can be damaging to the system as it causes less lubricity and more corrosion. Add an oil leakage into the mix and you could face considerable maintenance costs and unplanned downtime,' he added.

Growing sector

Ultimately, renewable energy lubrication is a major and growing business, that requires skill and specialisation, and delivers healthy financial rewards to companies able to meet the technical challenges posed by this sector. ●

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