



MAXIMIZING OPERATING EFFICIENCY OF CRITICAL WIND TURBINE AND POWER GENERATION COMPONENTS

RSC ENVIROLOGIC® CASE STUDY ON GREAT LAKES SCIENCE CENTER WIND TURBINE MAINTENANCE



BACKGROUND

Great Lakes Science Center (GLSC) is a museum and educational facility in Cleveland, Ohio. Established in 1996, the science center is home to exhibits aimed at teaching kids and adults about science, technology and interdependence with the environment. In 2006, GLSC installed a Vestas V27 225kW wind turbine in its front lawn to teach about efficient energy generation and advanced energy technology.

GLSC teamed up with RSC Bio Solutions to demonstrate the biobased, readily biodegradable* RSC EnviroLogic® HF 32[†] lubricant versus the conventional petroleum-based hydraulic fluid in the

wind turbine. The demonstration was intended to analyze the performance and safety benefits of using a biobased, readily biodegradable fluid in the hydraulic pitch control mechanism.

CHALLENGE

Wind turbine maintenance presents real challenges, particularly considering the conventional use of hazardous cleaners and functional fluids to keep power generation equipment, turbines and nacelles in top operating condition. The accessibility of wind turbines creates a difficult environment for conducting routine maintenance, so extended oil life translates to less downtime for the turbine. A turbine's height, restricted space and limited accessibility characteristics also increase the risk of hazardous chemical exposure to maintenance technicians.

[†]Previously EnviroLogic® 132 Hydraulic Fluid

ANALYSIS

As a valuable benefit to using RSC EnviroLogic, RSC Bio Solutions provided routine checks on certain fluid life parameters including physical properties and additive levels against the target rate throughout the life of the oil.

When the hydraulic oil had exceeded its target life, analysts were able to determine that the kinematic viscosity, total acid number and wear metal levels of RSC EnviroLogic HF 32 had been sustained longer than the petroleum-based oil: a total of 5.5 calendar years and 47,832 operating hours before the regular oil sampling and analysis program noted the need for an oil change. The prior oil-based hydraulic oil had exceeded its target life after approximately three years.

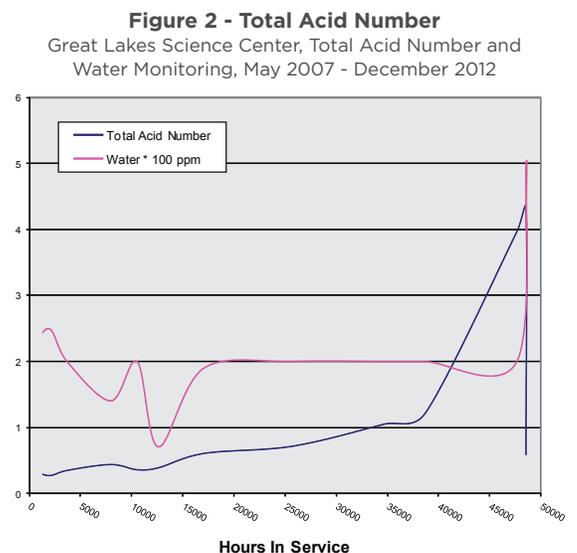
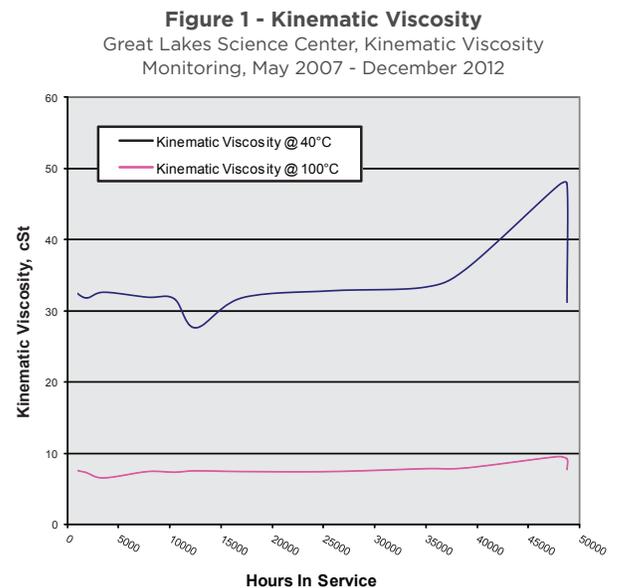
The 83 percent extension in oil life allowed for more power generation, uptime and lower overall turbine maintenance, which drives cost. With maximized efficiency and performance, the biobased oil also offered GLSC reduced risk and safety concerns that often come with using petroleum-based fluids.

The efficiency of wind turbines is greatly impacted by oil viscosity. Low viscosity oils can result in excessive wear, increased heat generation and loss of energy efficiency. High viscosity oils cause excess energy consumption and poor cold-start pump ability. After switching to biobased, readily biodegradable hydraulic fluid, the kinematic viscosity levels in the GLSC turbine, displayed in Figure 1, remained within specification throughout the 5.5 years the RSC EnviroLogic oil remained in the hydraulic circuit of the wind turbine.

During the field demonstration, the total acid number of RSC EnviroLogic HF 32 remained

low much longer than the previous hydraulic lubricant. Total acid number (TAN) is the measurement of the level of acidity in the oil. The more acidic a lubricant is, the faster the attack occurs on metal components and elastomeric seals.

The third test measured during GLSC's regularly scheduled sampling and analysis program was an elemental analysis of additive metals and elements, as well as wear metals. With RSC Bio Solutions' biobased oil, the need to change the oil was delayed by two years, indicating that the turbine worked



more efficiently and with less downtime than the average petroleum-based fluid.

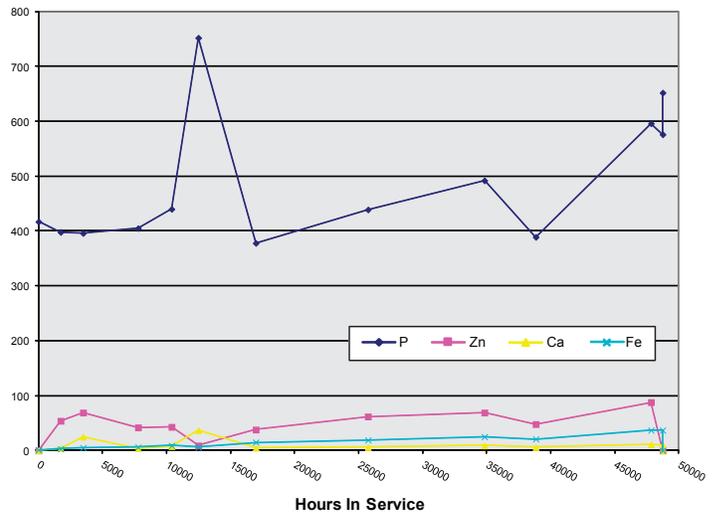
SOLUTION

According to the field application study, it was shown that readily biodegradable, nonhazardous, biobased and synthetic lubricating fluids play a significant role in maximizing the operating efficiency of critical wind turbine and power generation components by providing long-lasting anti-wear and corrosion resistance that allow for more time spent harnessing wind and less time maintaining equipment. This is especially important to the wind industry as demanding turbine duty cycles present a significant challenge for maintaining lubricant performance. The use of biobased cleaners can also provide marked health advantages over their petroleum-based counterparts by reducing the risk of immediate and lasting harm.

RESULTS

Biobased chemicals from RSC Bio Solutions improved the exceptional corporate responsibility profile of GLSC and their wind power generator by further reducing environmental and safety risks, creating a safer system with a more holistic green image, while offering highly effective cleaning and lubricating solutions. The organization was so pleased with the outcome of the study that it has continued using RSC EnviroLogic after changing the fluid out at the end of 2012.

Figure 3 - Elemental Metals
Great Lakes Science Center, Metals Analysis
May 2007 - December 2012



ABOUT RSC ENVIROLOGIC® HF SERIES

The RSC EnviroLogic HF series of hydraulic fluids is readily biodegradable, nonhazardous hydraulic fluid and intended for general purpose hydraulic systems. Formulated from readily biodegradable low toxicity base stocks that afford exceptional oxidation and thermal properties, the RSC EnviroLogic HF series is ideal for hydraulic systems operating in environmentally sensitive areas. The fluids exhibit enhanced wear protection and longer life than conventional petroleum hydraulic oils. RSC EnviroLogic HF hydraulic fluids can directly replace petroleum-based hydraulic fluids while reducing environmental impact in the event of a leak or spill. This series can perform in temperatures ranging from -30° to 200° F and pressures up to 5000 psi.

For more information about RSC Bio Solutions, visit us at rscbio.com or call +1 704.684.6100.



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