FRITZ SCHUR ENERGY

How unique retrofit solution enhanced lifetime of pitch oil and hydraulic pitch system

A unique challenge

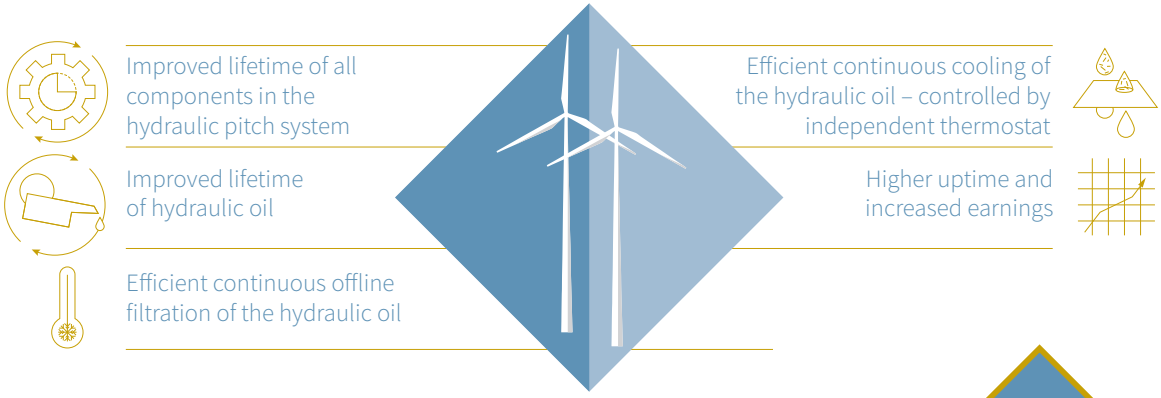
In 2016 Fritz Schur Energy took on the assignment of customizing a retrofit solution for an international wind farm. The farm had experienced continuous turbine stops due to overheating and high hydraulic oil temperature in their machines caused by very turbulent wind conditions. This was not a typical operational failure seen in numerous farms, but nonetheless a failure that had a recurring negative impact on the farm's efficiency and production.

Our retrofit solution

To solve the problem, Fritz Schur Energy installed our Oil Conditioning Unit (OCU). A unique retrofit solution that Fritz Schur Energy developed specifically to tackle challenges in keeping the pitch oil cool and clean in turbines with high pitch activity, as well as periods with very low wind.

The outcome at a glance

After fitting the OCU on one of the farm's turbines, the farm experienced no downtime due to high pitch oil temperature in that particular turbine. In addition, the OCU also extended the lifetime of the oil, as well as the lifespan of the entire hydraulic system.



Read the full performance study in the following case report.

About Fritz Schur Energy

Fritz Schur Energy is a leading engineering and manufacturing company within hydraulic solutions for wind. With 30 years of experience, offices and production in Denmark, the U.S. and China, we supply hydraulic system solutions and components worldwide.

Over time, Fritz Schur Energy has designed prototypes, retrofits and serial produced hydraulic solutions for various high-profile customers. Currently, that is more than 20,000 solutions from Fritz Schur Energy.

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1. Introduction

This document explores the thermal performance improvements of a wind turbine fitted with an Oil Conditioning Unit (OCU) in the pitch system.

The data used corresponds to two turbines installed side by side on an international wind farm. The datasets include temperature data for diverse temperature sensors installed on each turbine.

The data is sampled every 10 minutes.

2. Case study
2.1 Main results

High hydraulic oil temperatures in pitch systems represent a hazard to the proper functioning of the hydraulic components, mainly seals and pumps, and decrease the efficiency of the system by allowing higher internal leakage in the components. Normally, under high oil temperature conditions, the turbine triggers an emergency stop at a reasonable level to protect the system. Ideally, the system should be properly designed to maintain acceptable oil temperatures in operating conditions.

Figure 1 shows the time series for the hydraulic oil temperature of the pitch system for each wind turbine. Before installation of the OCU in Turbine 1, both turbines reach top temperatures of 65 °C / 149 °F often during operation, with Turbine 1 clearly peaking slightly more often. In March 2016, the OCU is installed in Turbine 1, clearly improving its thermal performance, and keeping the turbine from reaching critical temperatures. Turbine 2 still peaks frequently, presumably under heavy operational load.

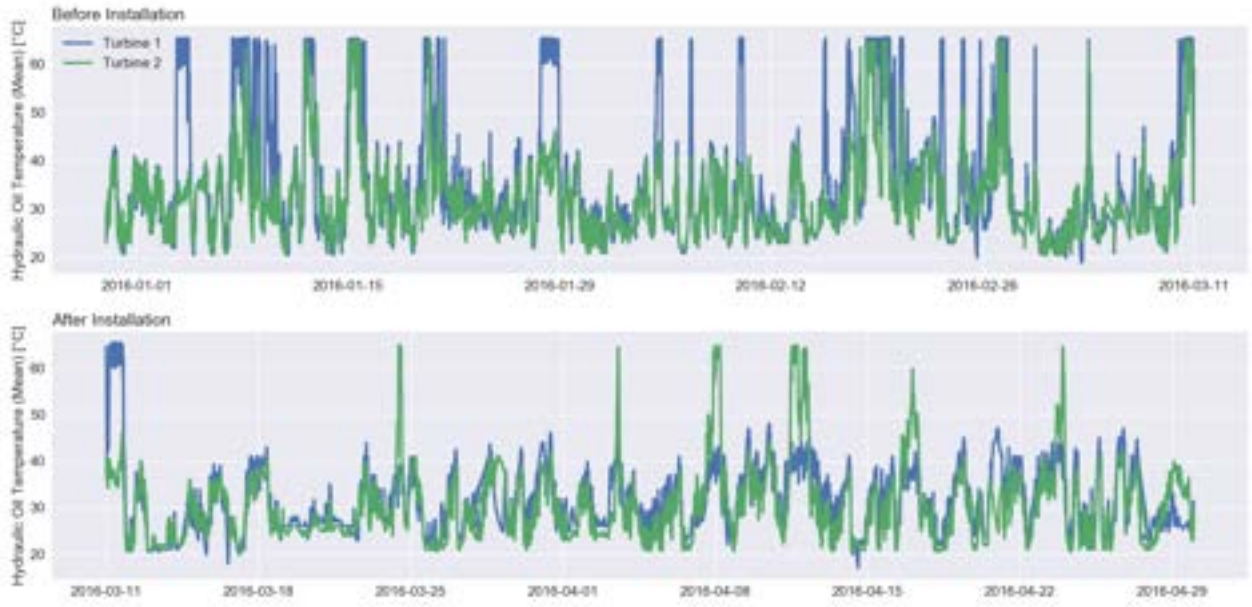

Figure 1
Hydraulic oil temperature (mean) time series for both wind turbines.

A more detailed view of the temperature behavior can be seen in Figure 2. Before the installation, the mean temperatures of both turbines behave similarly, close to 26 °C / 79 °F, but there is a clear peak at 65 °C / 149 °F for Turbine 1, showing that there are frequent overheating situations. Turbine 2 has a smaller peak, but still shows some overheating patterns.

After installation of the OCU on Turbine 1, the 65 °C / 149 °F peaks are almost non-existent, which is evidence of greatly improved thermal behavior with almost no overheating. In general, the overall temperature increases a couple of degrees, with the mean at 28 °C / 82.5 °F, but with reduced overheating, suggesting that the system's thermal capabilities are now more balanced under heavy operational loads.

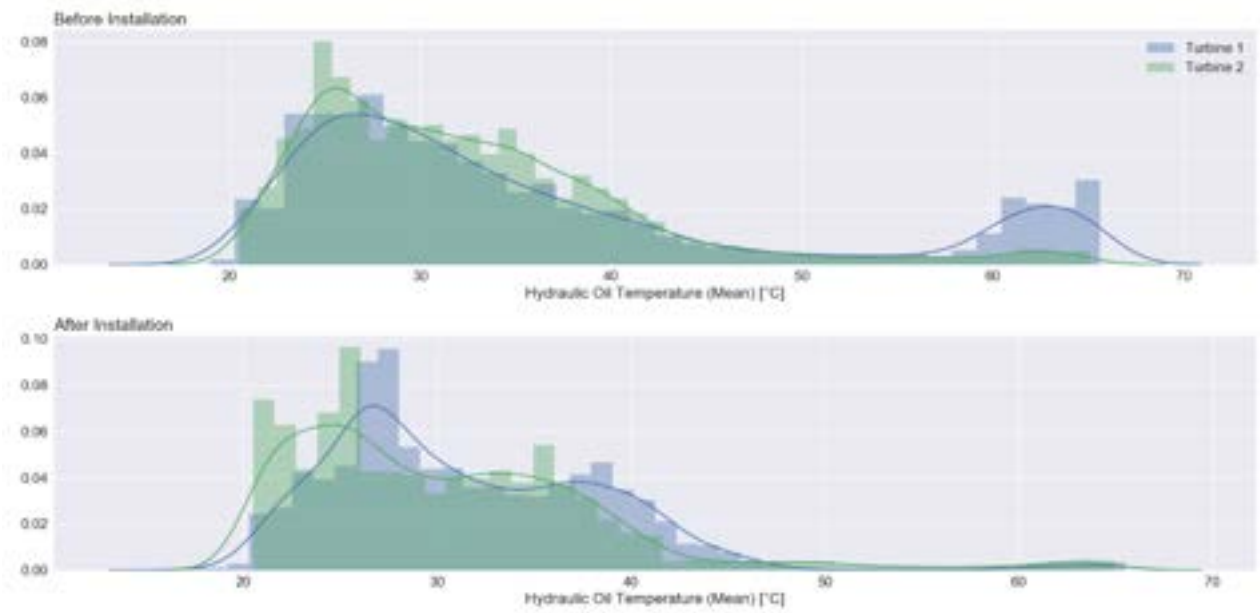

Figure 2
Distribution lots for the hydraulic oil temperature (mean) on both turbines.

2.2 Further data exploration

The available data provides a deeper understanding of the temperature behavior in the turbine – mainly Nacelle, Hub and Ambient temperatures – and how they interact with each other. Figure 3 shows the temperature behavior in the hub, nacelle, and hydraulic oil before and after the OCU installation.

The available data shows that the higher oil temperatures before the installation increase the average temperature of the nacelle, as expected since the oil tank is located there.

It also shows that the nacelle is between 12 °C / 53.5 °F and 14 °C / 57 °F hotter than the environment, while the hub is normally 5 °C / 41 °F colder than the nacelle temperature – also expected due to the more direct exposure of the hub to the weather conditions. Furthermore, the overheating temperatures in the oil coincide with the highest possible nacelle and hub temperatures, suggesting that the extra heat affects the surroundings negatively.

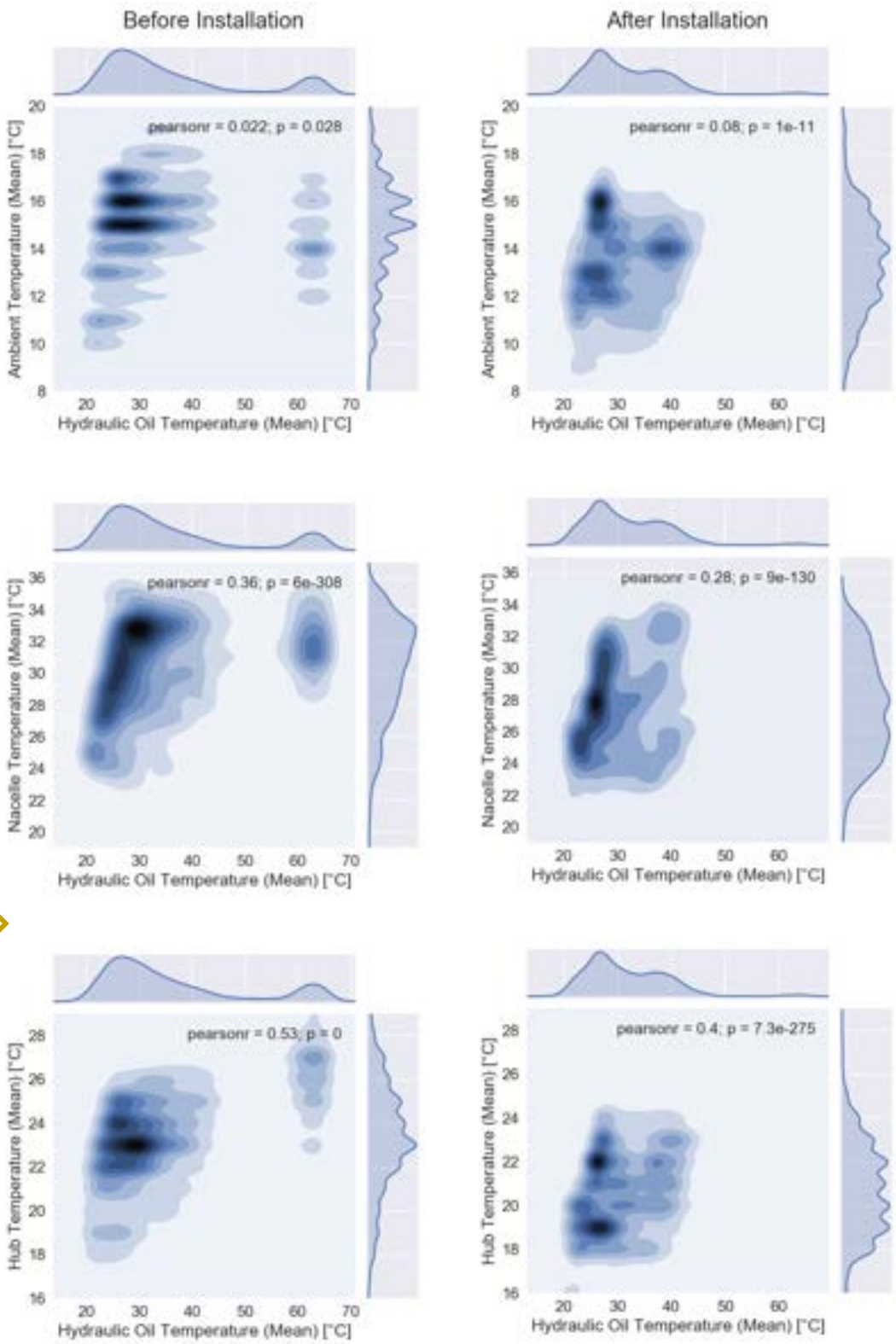

Figure 3
Temperature exploration of the hydraulic oil with respect to the temperatures in nacelle, hub and ambient.

3. Conclusion

The current study effectively shows the benefits obtained by installing an Oil Conditioning Unit on the pitch system of a wind turbine with overheating problems. The thermal performance was improved, and the overheating reduced to a minimum.

Having the data available from the different sensors on the turbine aids in diagnosing problems in the system and assessing the influence of enhancements like the one described.

However, the OCU also has an added benefit. It is a well-known fact that oil wears much faster in high temperatures than in low temperatures. So, avoiding high temperatures is not only beneficial in turbines with many overheating stops; it is also beneficial that the oil is mostly 50-60 °C / 122-140 °F and causes no stops. Data shows that for every 10 °C / 50 °F increase in temperature, the lifetime of the oil is cut in half.

Removing high temperature situations completely will therefore have a positive impact on the maintenance of the entire hydraulic system, e.g., fewer oil replacements, improved lubrication performance, and less wear.

Interested in unique retrofit solutions?

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