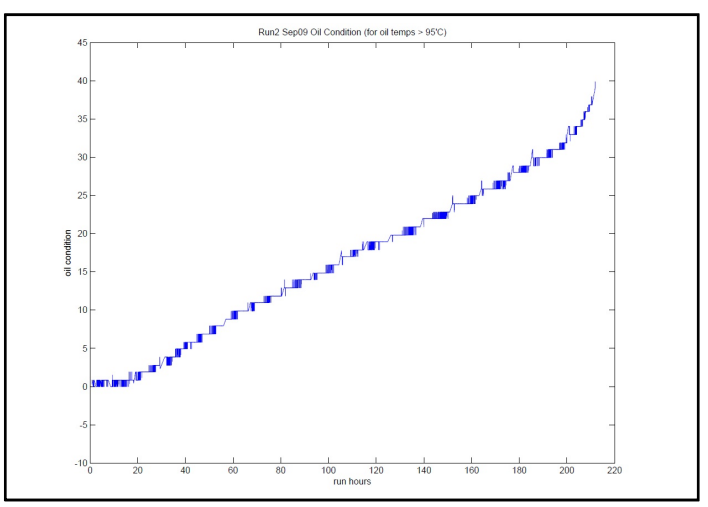
Investigating the effects of lubricant contamination running Diesel Generator Sets on Biofuels

Longma Clean Energy used Kittiwake's Oil Condition Sensor to keep under control the system oil degradation of the Diesel Generator Sets running biofuel.

Longma Clean Energy is a technology transfer company focused on niche technology applications in the Energy Sector. Located in Herefordshire, the company owns large workshop with an on site 0.4 MW Diesel Generator Sets (Gensets). In 2007 the company was instructed on behalf of the Carbon Trust to run an investigation on the use of biofuels for power generation.

Biofuels are manufactured using vegetable or animal fat-based oils. The typical signature of these oils consists in a long-chain alkyl (methyl, propyl or ethyl) esters. In order to allow a correct atomization in the engine combustion chamber typically the viscosity of these oils needs to be optimised and stabilised often blending them with additives and mineral products.

Longma Clean Energy tests were carried on using identical Gensets running different blends of biofuels, mainly based by vegetable oil, diesel and water added in different percentages. The initial tests shown immediately that after just 250 hrs in operation the Gensets running high percentages of vegetable oil were more prone to bearing failures and abnormal wear. A detailed analysis of the bearings hinted that the failures were mainly caused by poor film oil lubrication and acid wear.



"The main conclusion we came to was that the sensor was extremely useful in predicting contamination and degradation of the oil. This is particularly important when running on biofuels, and the sensor is able to be used to advise an oil change prior to fuel contamination becoming dangerous. In future I will use such a sensor on all engines we run with biofuels."
Marc Thomas - Longma Clean Energy Ltd.

The reason of such failures was suspected to be attributed to the exposure of the system oil to the combustion chamber. This led to a consequent polymerization of the lubricant hence a sudden change of viscosity, acid wear and poor film oil lubrication.
From the early tests it was immediately evident that in order to safely run the Gensets on biofuels it was important to have a feedback mechanism connected to the main lubrication system able to detect the early signs of contamination and degradation in the oil.

Kittiwake Oil Condition Sensors were chosen and installed on the test Gensets in order to provide such feedback. The sensors, as shown in the diagram below, immediately provided vital information about how rapidly the system oil was degrading due to the use of biofuels. In just 10 days of continuous operations the Genset system oil was subjected to a change of more than 40 oil quality units with an exponential rate of change. This vital feedback about the oil health combined with adequate Lab Analysis confirmed the changes in fundamental parameters of the system oil such as TAN (Total Acid Number), TBN (Total Base number) and Viscosity. The use of the Oil Condition Sensor allowed Longma to safely run the Gensets and define service intervals compatible with the usage of biofuels.

Longma Clean Energy still runs their Gensets on Biofuel, monitoring closely the changes in the system oil with Kittiwake Oil Condition Sensors.
The main conclusions of this Trial can be summarised as follows:

- System oil polymerization and degradation could occur when running diesel engines on biofuels. In these cases it is advisable to closely monitor the changes in the lubricant characteristics in order to prevent bearing failures.
- Kittiwake Oil condition sensor provides a good indication of sudden changes in the lubricant characteristics, helping the owner in taking vital decisions about asset protection and service intervals.

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