Gas engines

Applications, hardware design and lubricants

As gas from a variety of sources is increasingly used for power generation and in mobile applications, gas engine manufacturers are seeking improved reliability, reduced emissions and enhanced fuel economy. With lubricants expected to make a greater contribution, *Insight* talks to Susanne Chvatal, from GE's Jenbacher Gas Engine Technology Centre of Excellence, about her views on the rapidly changing European market.

While gas engines can feasibly be used in mobile applications like ships, railroad, trucks and buses, the lack of a gas infrastructure means that for the foreseeable future gas engines are far more likely to be used in stationary power generation applications. "The real advantage of the gas engine is that it has low emissions and that is something that the whole world is looking for right now in mobile applications," states Chvatal.

"But, one of the main problems is that the infrastructure is not there yet and it really doesn't make sense for one or two countries to implement it; it must be introduced on a European or even global basis. We expect, where gas is available, whether it is natural gas, biogas, landfill gas or gas processed from industrial waste, it will be predominantly used for power generation."

"We very much see fuel economy becoming a major driver in gas engine design, applications and lubrication"

If the complex infrastructure issue could be resolved then Chvatal firmly believes that mobile applications would be the fastest growing gas engine segment. However, she is quick to point out that a huge investment in innovation and technology would be required to make this happen. In the meantime gas engines will continue to play a significant role in the future of power generation. "The main question is how quickly we can become independent from oil and natural resources – if we can get the non-natural gas produced in sufficient quantities then this will be a very good business."

Jenbacher is constantly looking at ways to improve the combustion process in their gas engines to increase their efficiency and output. "Our new Type 6 engine, which has a two-stage turbocharger, has significantly increased the power output and efficiency," explains Chvatal. However, another issue driving hardware developments is the requirement to reduce emissions. "Getting more out of the gas that we use, in order to reduce environmental problems is essential. Combustion efficiency itself reduces emissions, but we also need to treat the exhaust gas." Dependent on the different applications Jenbacher uses selective catalytic reduction (SCR) or its own exhaust gas aftertreatment system called CL.AIR®. "If landfill or sewage gases are used we have found that harmful contaminants in the gases can inhibit the performance of the oxidising catalytic converters. In the CL.AIR® system we use thermal post-combustion to maintain minimum carbon monoxide, hydrocarbon and formaldehyde limit values. In doing so, the engine can be operated with both maximum specific power and maximum efficiency."

Lubrication issues

Clearly these hardware developments have implications for gas engine lubrication. Increased output puts more stress on the oil and as engines are developed to run on increasingly demanding fuel types the lubricant is subjected to even more stress.

Chvatal explains: "The different fuel gas types will mean different oil applications. Because of this we have separated the fuel gas into three different classes: clean gas (including natural or treated biogas, which contains no sulphur), sour components (biogas) and sour abrasive (landfill and sewage gas). Engine design and operating conditions plus the fuel gas all have a big impact on the engine oil life. Because of this it is very difficult to guarantee the lifetime of the oil. The best scenario is for the oil life to fit in with the maintenance schedule so customers do not have costly unscheduled engine shutdowns." Gas engines cannot make money if they are not running, which means operators look for engine oils that can handle the uniquely high oxidation and nitration stresses of natural gas fuel so that they can increase oil drain intervals while maintaining engine life and reliability. Landfill gas and biogas contain many more contaminants than natural gas including: sulphur, chlorine, and siloxane (a silicon compound used in many household products). These contaminants cause the rapid build-up of strong acids and deposits, which the engine oil must resist.

Customers are increasingly asking for longer drain intervals and Chvatal gives her views on what this means for lubricant quality. "It really depends what is done to increase the oil drain intervals. For modern, high tech. gas engines increasing the total base number is not the solution because they suffer from high ash levels, which can lead to deposits in the combustion chamber. So the solution must lie in the formulation of lubricants with higher quality base oils, and the increased use of lower viscosity grades. Of course the price of the lubricant is a very important factor as well, but if one oil works better than another we will recommend it to our customers in a technical bulletin."

To meet the needs of operators and engine manufacturers, gas engine oils must be carefully formulated for each type of service to maximise the time between overhauls and reduce maintenance costs. It is essential to make sure the total base number and sulphated ash content is correctly balanced so that the valves and seats are adequately lubricated, ash deposits on the piston crown, the cylinder head and combustion chamber are avoided, and combustion acids are neutralised to prevent wear.

Fuel economy has become one of the major drivers for gas engine developments. "We very much see fuel economy becoming a major driver in gas engine design, applications and lubrication. At GE's Jenbacher Gas Engine Division we have made continuous efforts to improve combustion and engine output as this has led to a significant increase in engine efficiency over the last few years. As for lubricants, our engines are currently designed to run on SAE 40. In order to use lower viscosity oils to achieve fuel economy improvements a review of the appropriate bearing technology would be required."

Insight will be watching out for future developments so that we can keep our readership informed.