"FTC TECHNOLOGY" REDUCES MINE FUEL COSTS

Diesel fuel is a major operating cost at most mines operating mobile mining equipment (and sometimes power generation plant). Unfortunately nothing man-made is 100 per cent efficient — and diesel engines are no exception! Also combustion of diesel fuel is inefficient. There are three reasons for this:

1. The fuel will not start to burn until it has become sufficiently hot. This is called the ignition delay period.

2. Once the fuel has ignited, it does not burn quickly enough.

3. The fuel is not burnt completely. If it did, the products of combustion would be carbon dioxide and water only: no black smoke, no carbon monoxide, no hydrocarbons, no aldehyde odour and no engine or exhaust deposits and lubricating oil of clean appearance.

How much useful energy is extracted from the fuel is calculated as the *thermal efficiency* of an engine. The makers of today's "high tech" diesel engines claim up to 35-40% efficiency. A considerable gain due to design advances, but still very inefficient! So where does the waste energy go? Well, a lot of it is lost as heat from the exhaust. The rest is lost to the cooling system as it removes excess heat build-up from the engine, together with radiation losses.

But what if we could achieve the sort of perfection that we so often see in nature? If ideal combustion took place, fuel would burn completely and almost instantaneously, while the piston is at top dead centre of the power stroke. Because the cylinder volume is at its minimum, the maximum amount of energy (heat) would be extracted from the fuel and used to power the engine. Less heat would be lost to the cooling system.

However, under actual practical operation the fuel's energy is made available more gradually (by the slower burn), cylinder pressure rises fall well short of the ideal and engine performance is reduced. It seems unlikely that on-going engine design improvements can offer any major solution. The performance characteristics of today's diesel fuel has declined markedly over recent years. It seems something of a contradiction that this has happened when engine performance has steadily increased.

Fuel technology itself is an area which could provide significant fuel saving increments.

However, fuel quality is tipped to decline further in years to come. The only apparent path to pursue is to chemically improve the overall combustion reaction. This can be achieved by use of a ferrous picrate catalyst, trace amounts of which will improve combustion measurably.

In Australia, thermodynamic studies at the Western Australian Institute of Technology (now Curtin University of Technology) have confirmed diesel fuel savings and increased power.

With almost two decades of commercial field use by the mining industry in Australia, the cost-effectiveness of ferrous picrate use has been confirmed: 6-8% fuel savings for mine mobile equipment and 3-5% for large medium speed engines in power generation service.

An intensive study involving approximately fifty large diesel power generation sets was conducted by Fuel Technology Pty Ltd, a company specialising in combustion and fuel technology. The study showed that when using catalyst treated fuel, exhaust temperatures were reduced an average 9.2°C, under static load conditions. This means that when you use the catalyst, more useable heat is obtained from the fuel, so less fuel is used and less heat is wasted via the exhaust.

A further insight can be gained by measuring the cylinder pressure during normal engine operation. The modern performance monitoring equipment used reveals that, with catalyst use, cylinder pressure rises due to combustion occurring earlier, indicating less ignition delay. This was confirmed during studies at Curtin University. As well as this, the pressures were noted to peak higher than for untreated fuel. This confirms that the catalyst does in fact speed up the combustion process. Once again, confirmation that when engines will be more fuel efficient when using ferrous picrate catalyst treated fuel.

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