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TARONG COAL

Evaluation of
FTC Combustion Catalyst as a means
of reducing diesel fuel costs
in mobile mining equipment

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C O N T E N T S

EXECUTIVE SUMMARY

The FTC Combustion Catalyst is the only fuel chemical yet proven by the world's leading independent testing authority, Southwest Research Institute (Texas), to produce a fuel efficiency benefit in an as new 2500HP diesel engine, operating at its most efficient state.

Under the control of Tarong Coal project engineer, Mr Werner Ewald, a tightly controlled series of fuel consumption measurements determined fuel efficiency improvements averaging **6.2%.** The method used measured specific fuel consumption and conforms to an engineering standard. It was performed during normal mining operations.

The results have indicated that implementation of this product at Tarong Coal operations will result in a cost reduction in excess of **$220,000 pa**, with a payback of any capital equipment cost in under two weeks (based on a projected annual fuel consumption of 10 million litres and a fuel cost of 45 cents/litre).

In addition, reduction of greenhouse gases is calculated at **1792 Tonnes** CO_2 pa.

BACKGROUND

The FTC Combustion Catalyst is the only fuel chemical yet proven by the world's leading testing authority, Southwest Research Authority (Texas) to improve fuel efficiency in an as new 2500HP diesel engine operating at its most efficient state. SwRI also determined that FTC does not alter the physical or chemical properties of diesel fuel.

SwRI also determined, using the Caterpillar 1G2 Test (ASTM 509A) that there are no detrimental effects that could cause increased wear or deposit problems.

These findings have been verified by countless field studies in diverse applications, which have confirmed efficiency benefits of 5-8% for mine mobile fleets. Maintenance benefits documented include reduced oil wear metal profiles and reduced oil soot. Combustion and exhaust spaces become essentially free of any hard carbon with continuous catalyst use.

FTC's action in producing fuel efficiency gains is to cause a faster fuel burn, which releases the fuel's energy more efficiently. That is, a larger portion of the fuel burn occurs when the piston is closer to top dead centre.

Tarong Coal management chose two Komatsu 630E trucks, fitted with 12V 4000 Series MTU engines to determine fuel efficiency changes initiated by the FTC Combustion Catalyst. Tarong Coal's Mr Werner Ewald was appointed project supervisor, and in conjunction with Fuel Technology Pty Ltd's Brid Walker, planned and conducted this trial.

The evaluation was designed to measure fuel consumption during normal mining operations. To eliminate the effects of driver variability, it was agreed that a portion of the haul cycle be marked out that required full throttle, or maximum speed application. Also to ensure that the method used was both reliable and repeatable, a minimum 12 replicate runs were to be made for each test component.

PROCEDURES

The procedure adopted by Fuel Technology Pty Ltd and approved by Tarong Coal, is an engineering standard that is adapted from the SAE Type II Truck Test. This method measures the mass of fuel consumed to haul a set payload over a marked route.

Flowscan fuel flow meters were fitted to the engine supply and return fuel lines at the fuel tank. Thermocouple probes are fitted to these meters. The flowmeters, which have been calibrated to +/- 0.5% by a NATA certified laboratory, were connected to a KEP Minitrol totalizer mounted in the truck cabin. The thermocouple probes were connected to a dual readout Fluke digital thermometer. A stopwatch was used to time each cycle performed.

At both baseline and treated measurements, a fuel sample was drawn for density determination.

Fuel volume, temperature and density provide the information to determine fuel mass (Kg) consumed, for each replicate run. A minimum 12 replicates provides statistical significance to the results.

A minimum interval of 200 hours is required between baseline and treated measurements for catalyst action to take effect.

The test route included two components. The loaded up ramp component was a 900 metre section of Ramp 8A, where from a standing start the drivers foot is kept to the floor for the entire section. The empty return was marked off from “Cactus Corner” to the top of Ramp 8A, a distance of 1700 metres. Measurements started from a flying start at normal maximum speed (ie about 53 kph). Loaded and unloaded down-hill running introduced excessive driver variability, which was reflected in very poor repeatability (presumably from retarder use), so these legs could not be evaluated.

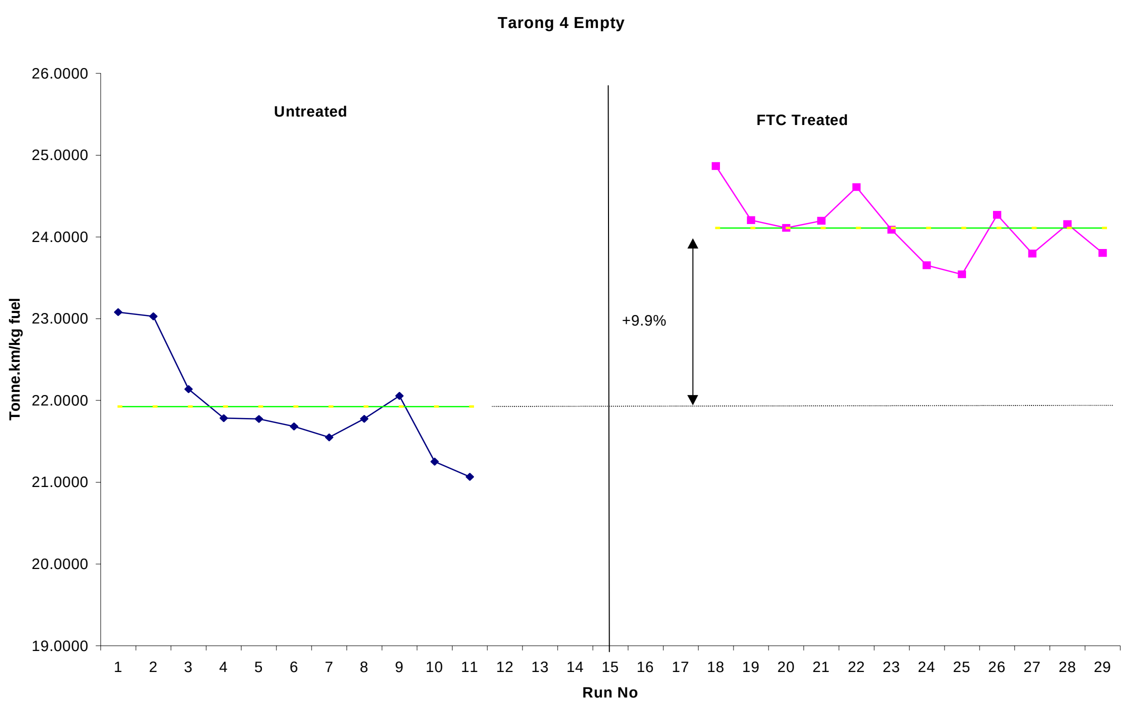
RESULTS

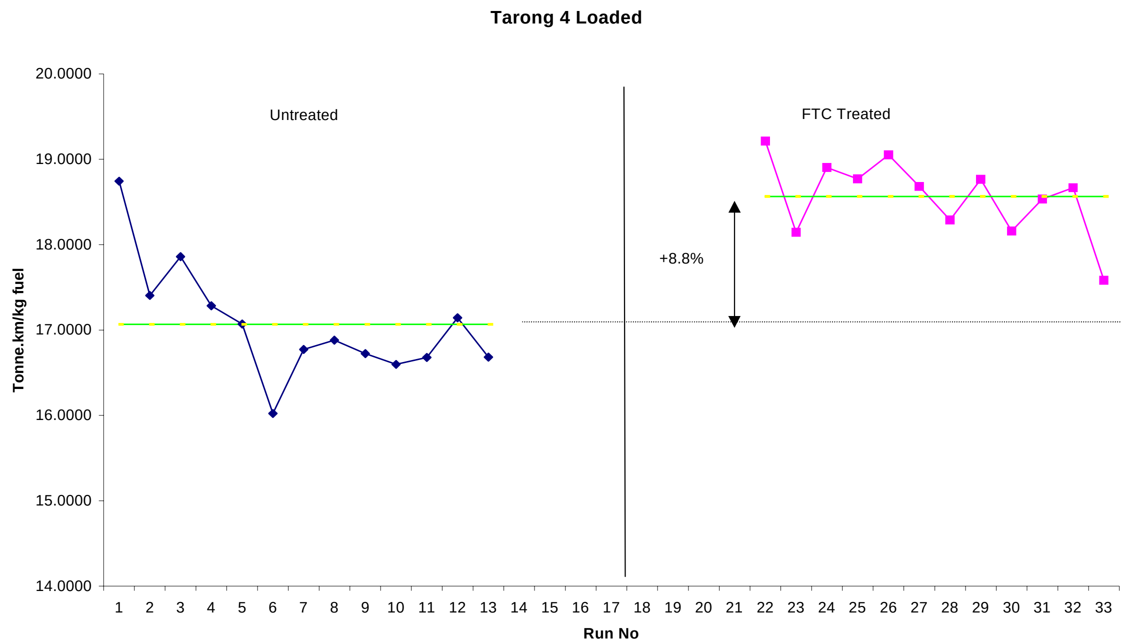
Table 1 displays the average fuel efficiency, in Tonne.km/kg fuel, for each truck and test route. Complete data including original measurements and calculations are shown in the Appendix.

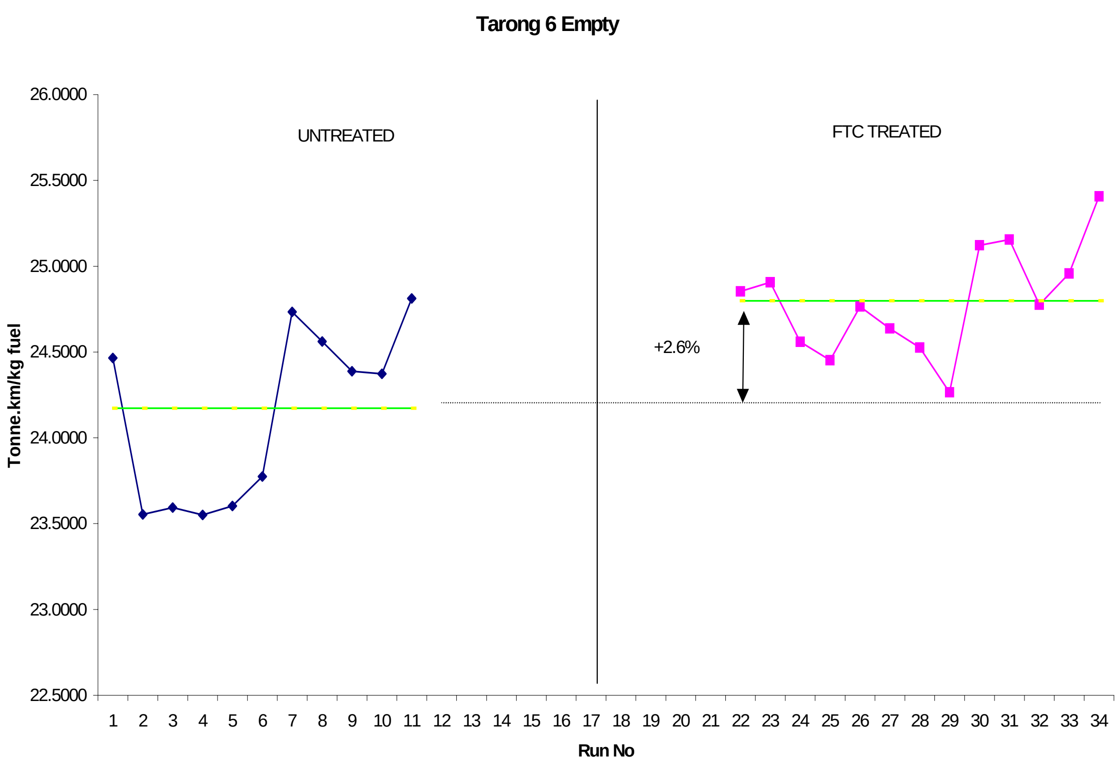
Table 1
Truck Fuel Efficiency (Tonne.km/kg Fuel)

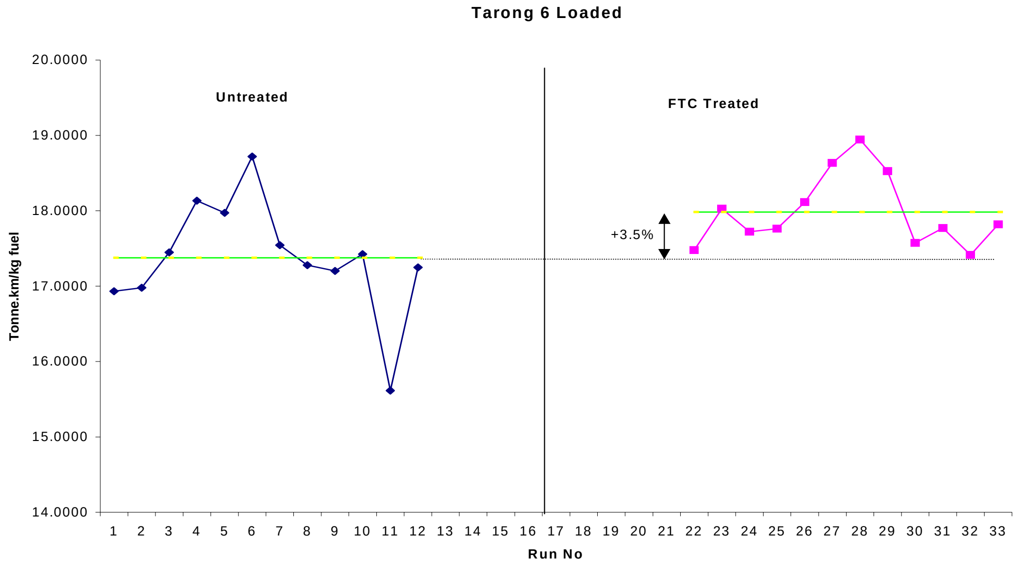
Test Unit	Baseline	Treated	% Change	Engine Duty Cycle
RD 4 Loaded Up Ramp	**17.066**	**18.563**	**+8.8%**	**100%**
RD 4 Empty	**27.085**	**29.7799**	**+9.9%**	**87%**
RD 6 Loaded Up Ramp	**17.375**	**17.9825**	**+3.5%**	**100%**
RD 6 Empty	**29.860**	**30.6338**	**+2.6%**	**87%**
AVERAGE			**+6.2%**	

Graphical representation of the data follows.




Tarong 4 Loaded
Untreated
FTC Treated
+8.8%
Tonne.km/kg fuel
Run No
20.0000
19.0000
18.0000
17.0000
16.0000
15.0000
14.0000
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33


Tarong 6 Empty
UNTREATED
FTC TREATED
+2.6%
Tonne.km/kg fuel
Run No
26.0000
25.5000
25.0000
24.5000
24.0000
23.5000
23.0000
22.5000
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34


Tarong 6 Loaded
Untreated
FTC Treated
+3.5%
Tonne.km/kg fuel
Run No
20.0000
19.0000
18.0000
17.0000
16.0000
15.0000
14.0000
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

DISCUSSION

The measurements for RD 4 and RD 6 were tightly controlled and accurately performed. The measurements confirm an average fuel efficiency improvement of 6.2%, and this is within our expectations (5-8%) for fleets with this type of equipment and operating conditions. Based on a maximum fuel consumption of approximately 340L/hr for an 1875HP engine, the duty cycles were about 87% and 100% for empty and loaded legs respectively. This reflects the important components of normal operating conditions for the Tarong Coal truck fleet. By comparison, the components of the haul cycle that could not be reliably measured, ie downhill empty into the pit, and downhill loaded to the ROM, account for a small percentage of fuel usage, at a very low duty cycle, with a high percentage of brake retarder use.

The efficiency gain for RD 6 is smaller than our expectations. It should be noted that smoke emissions appeared noticeable higher on the treated occasion (subjective observation). This is unusual and suggests some instability that may be associated with in adequate conditioning of the engine. While both engines had just accumulated the **minimum** hours on treated fuel, RD 6 appears to have responded more slowly. Further conditioning time should provide additional efficiency benefit.

At a saving of 6.2%,use of the FTC-3 Combustion Catalyst is economic above a fuel cost of 9.1 cents/L, and would provide an annual (net) return of over $220,000 (or $600/day) based on current estimations of fuel cost and consumption. This is equivalent to a fuel discount of approximately 2.2cents/L. (FTC-3 @ $18/L for a 1:3200 mix strength).

There are two options for treating fuel at Tarong Coal, both using an automatic metering system…

1. Treat fuel as it is unloaded from road tanker to the main bulk tanks.
2. Treat fuel leaving the bulk tanks as it is pumped to the service bay.

A more detailed investigation of the requirements will be required to fully specify and cost the system. Generally, these systems cost $4000-6000.