Fuel efficiency and emission reduction trial at a Queensland Underground Gold Mine while using FTC/FPC Combustion Catalyst

FINAL REPORT 2017

Australian Made & Owned
Established 1984

Cost Effective Maintenance

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Introduction

FTC/FPC Combustion Catalyst, manufactured and supplied by Cost Effective Maintenance, has been tested and proven to reduce fuel consumption by up to 10% under varying load conditions while reducing carbon emissions and Diesel Particulate Matter (DPM). The addition of FTC/FPC results in improved combustion, allowing more of the energy from diesel to be converted to motive energy rather than being wasted as unburnt hydrocarbons exiting the exhaust or building up as abrasive hard carbon deposits within the engine.

Cost Effective Maintenance continues to subject FTC/FPC to independent scientific testing. While engine design advancements have resulted in improved efficiency, FTC/FPC still provides additional efficiencies. This is because it acts on the combustion process itself, by catalysing the series of combustion reactions. So, regardless of the age, size or type of engine, or the specifications of the fuel, FTC/FPC use always results in a reduction in both fuel consumption and emissions.

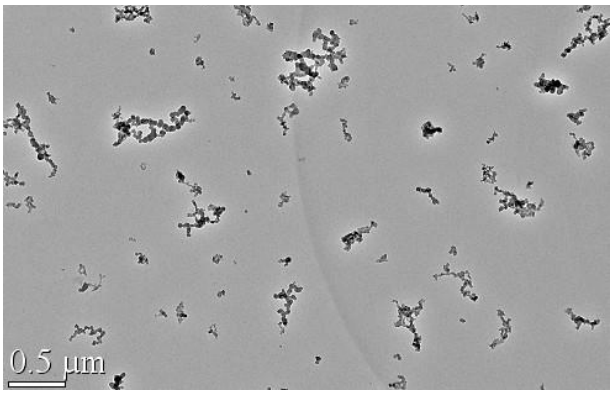
More recently, the most comprehensive independent study ever conducted on FTC/FPC was completed. This rigorous four-year study was conducted at the University of Western Australia - Centre for Energy and was predominantly funded by the Australia Research Council. World renowned expert in the field of combustion Professor Dongke Zhang was commissioned to investigate the potential of FTC/FPC in reducing the carbon footprint of Australian industries.

Results released by the Centre for Energy UWA following extensive Laboratory and Dynamometer tests provided further evidence of significant reductions in exhaust particulates by up to **39%** and reduced greenhouse gas emissions by up to **22%**. Reductions in fuel consumption in the region of **2.4% to 4.2%** at variable loads in as-new engines following the introduction of FTC/FPC to diesel fuel was also realised. Professor Zhang stated that as these tests were conducted on as-new engines under controlled conditions, greater savings can be expected in the field.

Tests

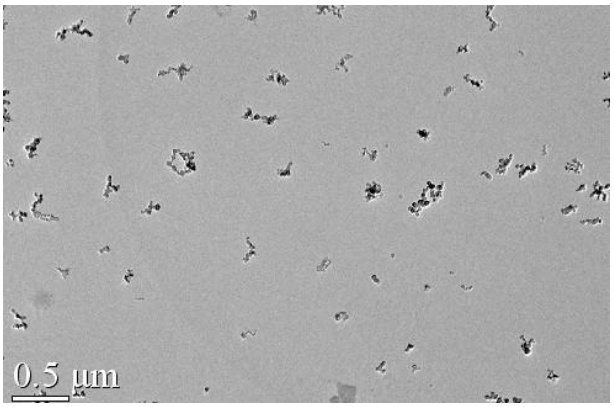
Baseline fuel efficiency tests were conducted on three underground haul trucks and three loaders. Test methods included Carbon Mass Balance (CMB) and Diesel Particulate Matter (DPM) testing. Following baseline tests, a trial purpose fuel tank was provided with an automated dosing system installed allowing FTC/FPC treatment of the three test trucks to commence. Treated tests were then conducted.

- **Baseline test**
- **Final test at 5 months**



Exhaust sample from an engine not using FPC/FTC

Visible engine emissions



FPC/FTC treated 1:10,000 ratio

A visible reduction in diesel smoke was recorded.

Test Methods

The Carbon Mass Balance Measurement (CMB)

CMB is a procedure whereby the mass of carbon exiting the exhaust is calculated as a measure of the fuel being burned. The elements measured via a TESTO five gas analyser include the exhaust gas composition, exhaust gas temperature, ambient temperature, exhaust pressure and barometric pressure. All readings together are entered into a calculation which produces a final reading in grams/per second flow of carbon exiting the exhaust.

This formula is derived from the international engineering standard test AS2077-1982 for measuring fuel efficiency. The CMB method is considered a reliable and accurate way to determine the efficiency of an engine, providing a percentage change figure of carbon exiting the engine which relates to carbon entering the engine in the form of fuel.

Diesel Particulate Matter (DPM) Test

DPM testing is conducted with a TSI AVT530 laser photometer instrument and provides a measurement showing mg/m^3 of particulate matter exiting the exhaust.

All tests were conducted with engines running at 1800 rpm.

Test Results

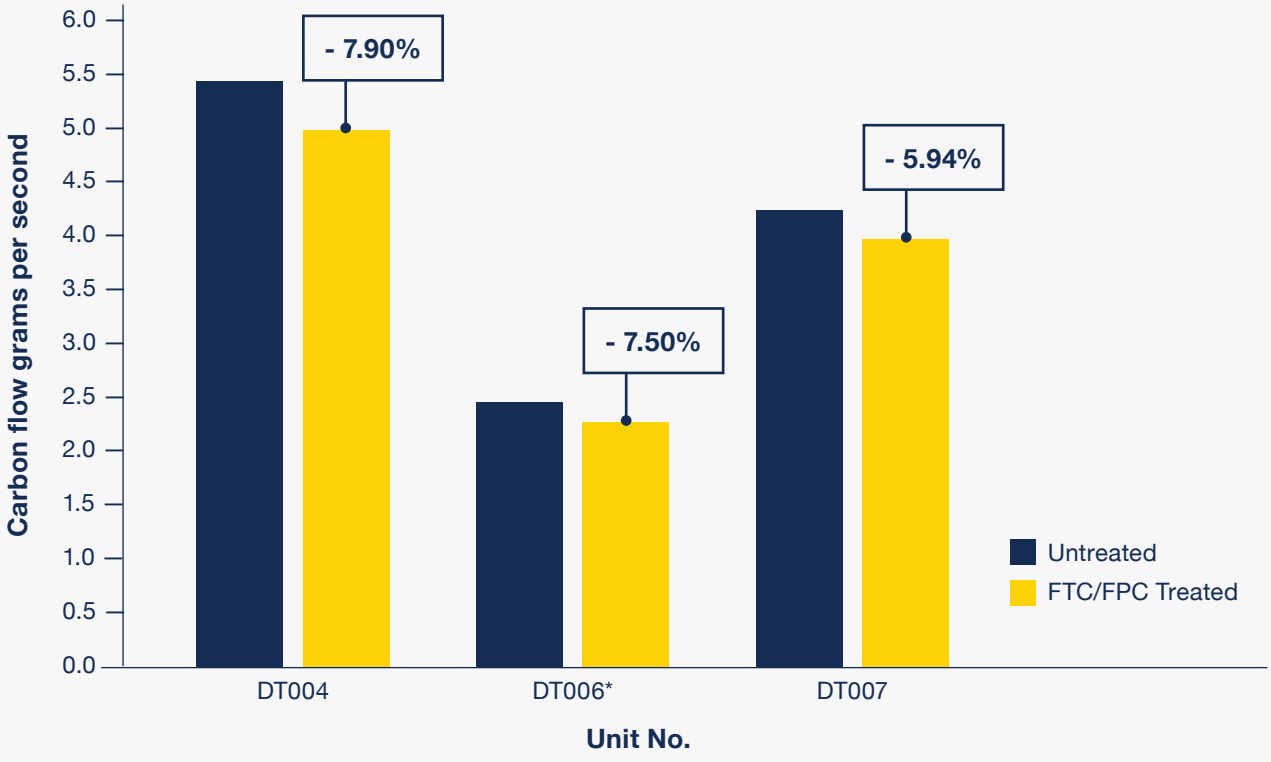
CMB Test Results – Haul Trucks

Unit No.	Baseline Carbon Flow Rate grams/sec	Final Carbon Flow Rate grams/sec	Variation
DT004	5.427	4.998	**- 7.90%**
DT006	2.478	2.292*	**- 7.50%**
DT007	4.246	3.994	**- 5.94%**

Table 1: CMB Test Results — Haul Trucks

Average efficiency variation over the three haul trucks was a **7.11% reduction** in grams/second flow of carbon.

Graph 1: Haul Trucks Carbon Flow g/s



Result: Average 7.11% reduction achieved

(Note: The difference in DT006 carbon flow is attributed to the different exhaust configuration of twin exhausts) *DT006 not tested in August - results shown are from interim test.

Test Results

DT004 Haul Truck – CMB Results

BASELINE TEST		DATE:	08/03/2017
ENG. HOURS	8959	ENG. RPM	1800
AMB. TEMP (˚C)	28.9	STACK (mm)	200
BAROMETRIC (mb)	973.000	LOAD	High Idle
PRES DIFF (Pa)	121.892		
EXHST TEMP (˚C)	218.543		
HC (ppm)	31.270		
CO (%)	0.000		
CO_2 (%)	3.940		
O_2 (%)	15.394		
Carb Flow (g/s)	**5.427**		
Reynolds NR.	0.00E+00		

TREATED TEST		DATE:	15/08/2017
ENG. HOURS	10990	ENG. RPM	1800
AMB. TEMP (˚C)	31.8	STACK (mm)	200
BAROMETRIC (mb)	975.000	LOAD	High Idle
PRES DIFF (Pa)	108.158		
EXHST TEMP (˚C)	302.805		
HC (ppm)	30.895		
CO (%)	0.000		
CO_2 (%)	4.165		
O_2 (%)	14.870		
Carb Flow (g/s)	**4.998**		
Reynolds NR.	0.00E+00		

Result: Percentage change in fuel consumption -7.9%
((Treated-Base)/Base*100)

Test Results

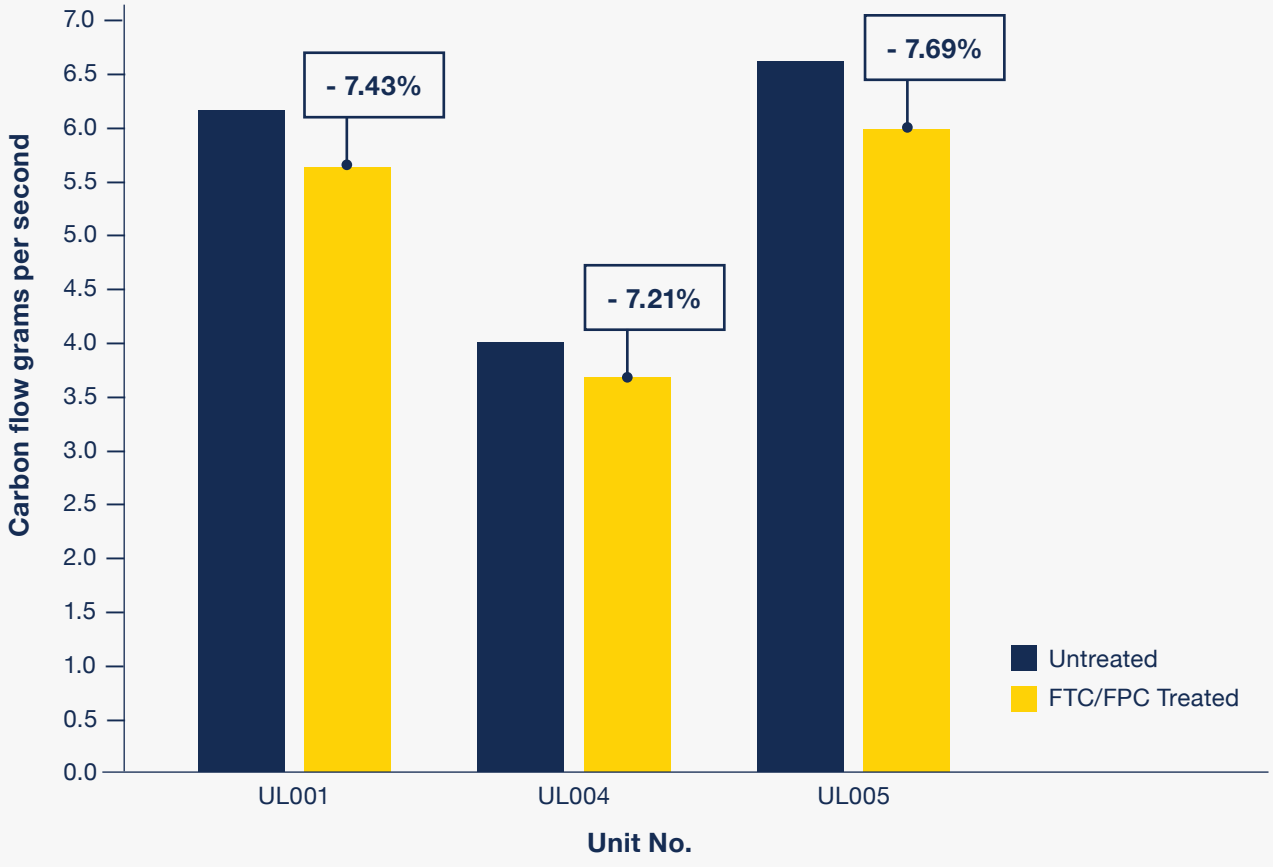
CMB Test Results – Loaders

Unit No.	Baseline Carbon Flow Rate grams/sec	Final Carbon Flow Rate grams/sec	Variation
UL001	6.172	5.713	**-7.43%**
UL004	4.003	3.714	**-7.21%**
UL005	6.584	6.078	**-7.69%**

Table 2: CMB Test Results – Loaders

Average efficiency variation over the three loaders was a **7.44% reduction** in grams/second flow of carbon.

Graph 2: Loaders Carbon Flow g/s



Result: Average 7.44% reduction achieved

Test Results

DPM Test Results – Haul Trucks

As expected, due to equipment being fitted with particulate filters, readings are too low to contain any real useable data. Past scientific testing has shown large reductions in DPM which in the case of equipment with particulate filters, will result in extended particulate filter life.

Unit No.	Baseline Diesel Particulates mg/m³	Final Diesel Particulates mg/m³	Variation
DT004	0.022	0.002	**N/A**
DT006	-0.038	-0.033	**N/A**
DT007	0.009	-0.002	**N/A**

Table 3: DPM Test Results – Haul Trucks

DPM Test Results – Loaders

Interestingly, the readings taken from loaders UL001 and UL004 show higher overall particulate levels to begin with, indicating lower engine efficiency or a difference in particulate filter efficiency. These readings allowed a variation to be seen with an average **16.75% reduction** in particulates on these two loaders after FTC/FPC treatment.

Unit No.	Baseline Diesel Particulates mg/m³	Final Diesel Particulates mg/m³	Variation
UL001	12.6	11.0	**-12.7%**
UL004	23.1	18.3	**-20.8%**

Table 4: DPM Test Results – Loaders

Result: Average 16.75% reduction achieved

Conclusion

The engineering standard tests conducted on three haul trucks and three loaders provided evidence of an overall **average fuel consumption reduction of 7.27%**.

This equates to significant financial savings, reduced carbon emissions and diesel particulates, while also providing ongoing maintenance benefits due to a cleaner, more complete combustion.

Thank you, for more information please contact:

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