Fuel efficiency and emission reduction trial at a NSW Surface Mine while using FTC/FPC Combustion Catalyst

FINAL REPORT 2019

Australian Made & Owned
Established 1984

Cost Effective Maintenance

Contents

Appendices

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.

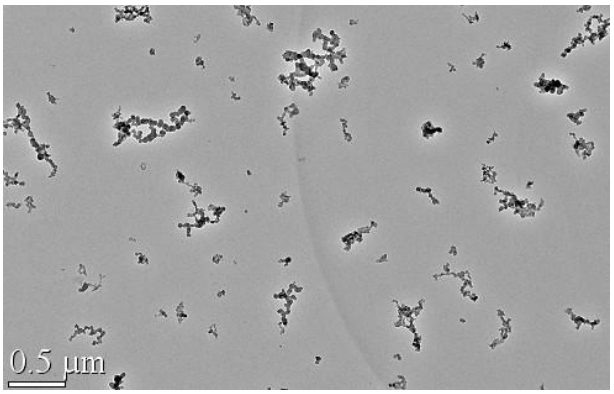
More recently, the most comprehensive independent study ever conducted on FTC/FPC was completed. This rigorous four-year study was conducted at the University of Western Australia - Centre for Energy and was predominantly funded by the Australia Research Council. World renowned expert in the field of 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

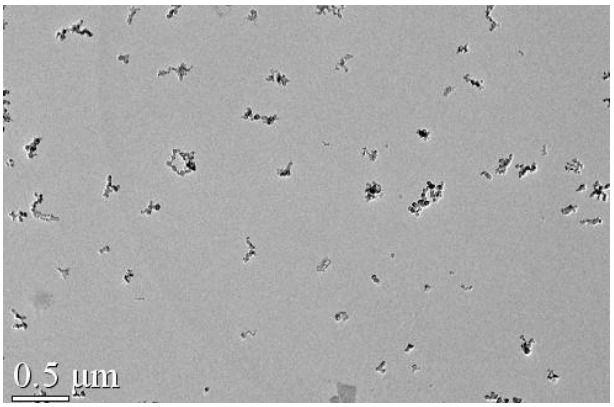
Baseline fuel efficiency tests were conducted on three haul trucks. Test methods included Carbon Mass Balance (CMB) and Diesel Particulate Matter (DPM) testing. Following baseline tests, a trial purpose fuel tank was provided with an automated dosing system installed allowing FPC treatment of the three 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 to the MDG 29 procedure which entails measuring DPM at 20 seconds idle, 20 seconds full throttle and return to idle for 20 seconds.

Test Results

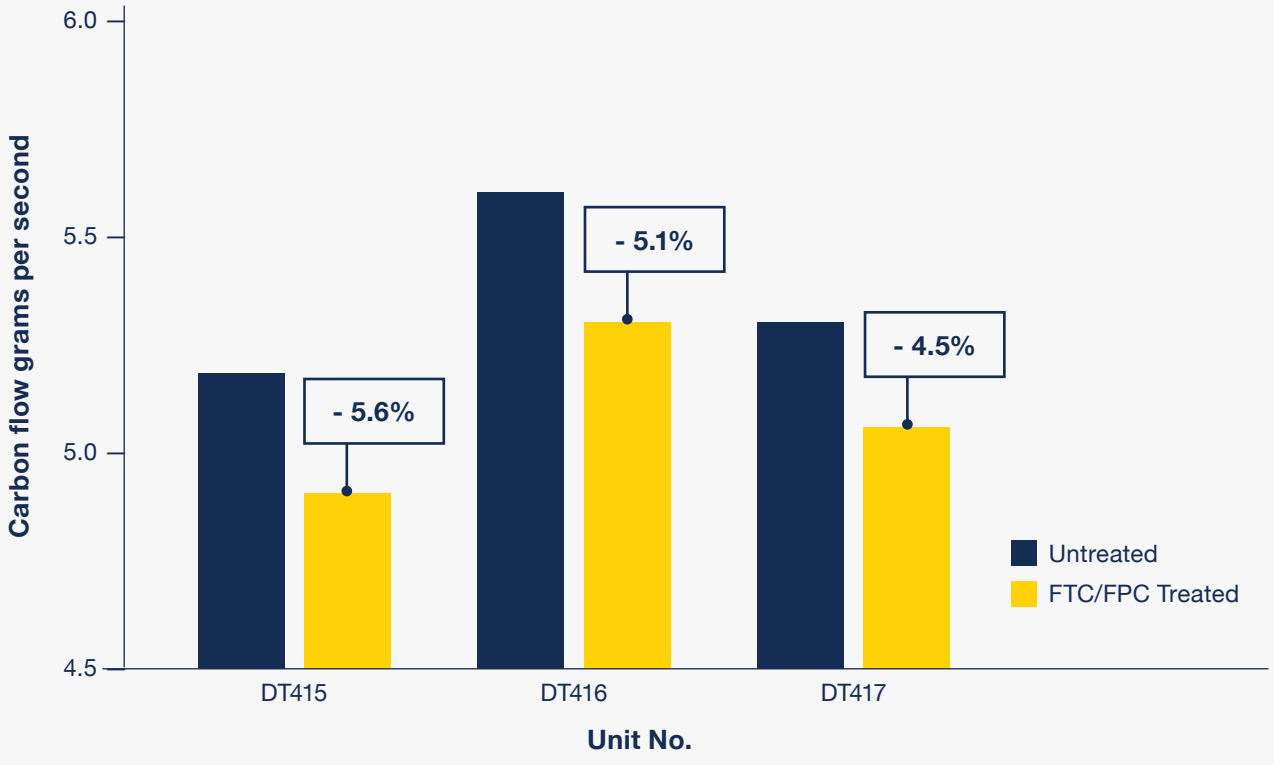
CMB Test Results – Haul Trucks

Unit No.	Baseline Carbon Flow Rate grams/sec	Final Carbon Flow Rate grams/sec	Variation
DT415	5.214	4.924	**- 5.6%**
DT416	5.605	5.316	**- 5.1%**
DT417	5.384	5.141	**- 4.5%**

Table 1: CMB Test Results — Haul Trucks

Average efficiency variation over the 3 haul trucks was a **5.07% reduction** in grams/second flow of carbon which equates to a 5.07% reduction in fuel consumption at same engine load.

Graph 1: Haul Trucks Carbon Flow g/s



Result: Average 5.07% reduction achieved

Test Results

DT415 Haul Truck – CMB Results

BASELINE TEST		DATE:	29/05/2019
ENG. HOURS		ENG. RPM	1800
AMB. TEMP (˚C)	11.3	STACK (mm)	200
BAROMETRIC (mb)	981	LOAD	High Idle
PRES DIFF (Pa)	228.256		
EXHST TEMP (˚C)	126.244		
HC (ppm)	0.000		
CO (%)	0.000		
CO_2 (%)	2.496		
O_2 (%)	17.510		
Carb Flow (g/s)	**5.214**		
Reynolds NR.	0.00E+00		

TREATED TEST		DATE:	15/11/2019
ENG. HOURS		ENG. RPM	1800
AMB. TEMP (˚C)	30.9	STACK (mm)	200
BAROMETRIC (mb)	982	LOAD	High Idle
PRES DIFF (Pa)	226.595		
EXHST TEMP (˚C)	148.861		
HC (ppm)	0.000		
CO (%)	0.000		
CO_2 (%)	2.430		
O_2 (%)	17.133		
Carb Flow (g/s)	**4.924**		
Reynolds NR.	0.00E+00		

Result: Percentage change in fuel consumption -5.6%
((Treated-Base)/Base*100)

Test Results

DPM Test Results – Haul Trucks

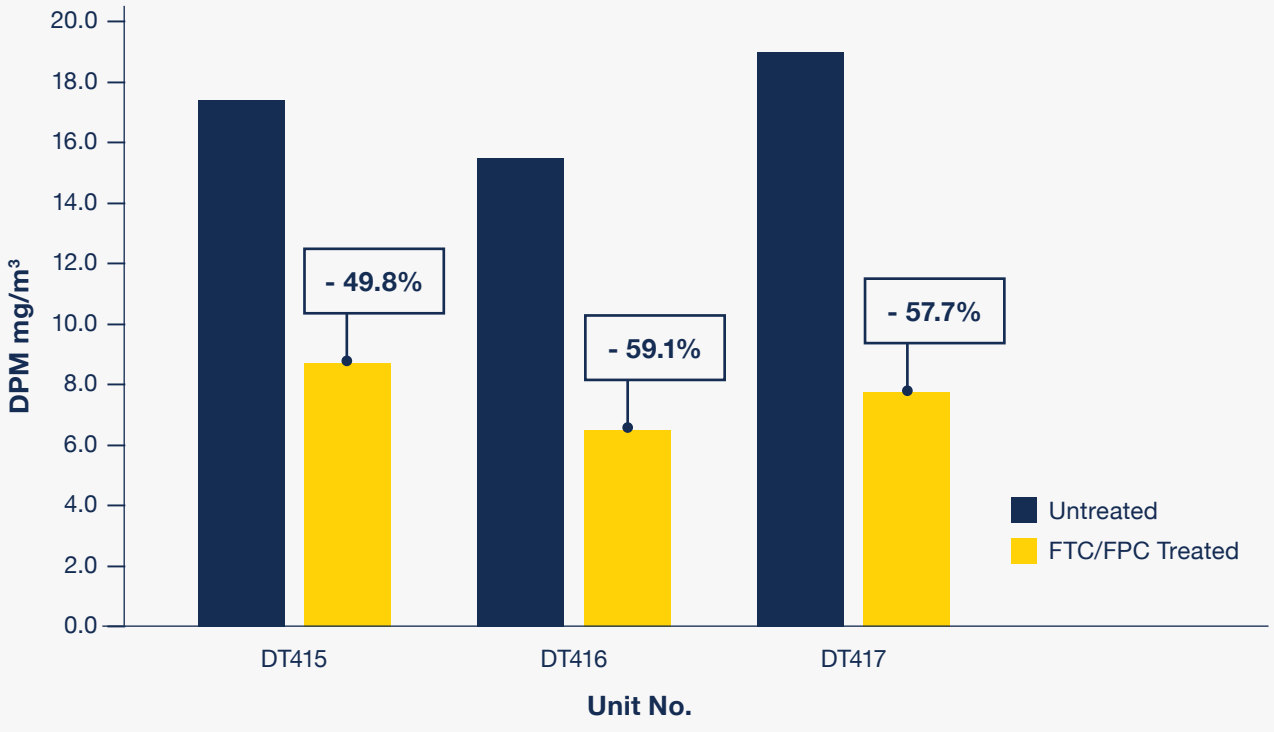
Independent scientific testing has proven large reductions in DPM following FTC/FPC treatment of diesel. Tests conducted on the three tests trucks confirms that these significant reductions are also provided in the field applying MDG 29 test procedure.

Unit No.	Baseline Carbon Flow Rate grams/sec	Final Carbon Flow Rate grams/sec	Variation
DT415	17.738	8.728	**- 49.8%**
DT416	15.775	6.45	**- 59.1%**
DT417	18.886	7.984	**- 57.7%**

Table 2: DPM Test Results — Haul Trucks

Average reduction in DPM over the 3 haul trucks was **-55.53%**

Graph 2: Haul Trucks DPM



Result: Average 55.53% reduction achieved

Conclusion

These engineering standard tests conducted on three haul trucks provides evidence of an overall average **fuel consumption reduction of 5.07%** and average **reduction in harmful diesel particulates of 55.53%.**

This equates to significant financial savings in fuel consumption, reduced carbon emissions and diesel particulates, while also providing ongoing maintenance benefits due to a cleaner, more complete combustion. Maintenance benefits equate to less equipment downtime, also adding to the ongoing financial savings.

Thank you, for more information please contact:

Cost Effective Maintenance

ABN 59 635 953 301
2/18 Boron St, Sumner QLD 4074
tel. +61 7 3376 6188
email. sales@costeffective.com.au

costeffective.com.au

Cost Effective Maintenance