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ESPERANCE PORT AUTHORITY

Evaluation of FTC Combustion Catalyst as a means of reducing diesel fuel costs In Power Generation Facility

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C O N T E N T S

Appendix

EXECUTIVE SUMMARY

The FTC/FPC Combustion Catalysts manufactured and marketed by Fuel Technology Pty Ltd have proven in laboratory and field trials to significantly reduce fuel consumption under comparable load conditions and to also substantially reduce carbon emissions.

Following meetings with Esperance Port Authority Electrical Supervisor, Brant Grundy, it was agreed that a fuel efficiency study should be conducted on a selection of power generation engines applying the "Carbon Mass Balance" (CMB) test procedure which accurately measures fuel consumption and therefore identifies savings produced by the introduction of FTC/FPC Combustion Catalyst to fuel supply.

The net average efficiency gain (reduction in fuel consumption) measured by the CMB test methods was **3.2%**.

BACKGROUND

The FTC Combustion Catalyst is the only fuel chemical yet proven by the world's leading testing authority, Southwest Research Institute, San Antonio, Texas (SwRI) 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 following catalyst treatment of fuel.

These findings have been verified by countless field studies in diverse applications which have confirmed efficiency benefits for diesel powered generation. Maintenance benefits documented include reduced wear metal profiles in lubricating oil and reduced 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 promote 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. For engines that run at reduced loads where glazing can occur FTC has proven to be beneficial.

INTRODUCTION

Equipment provided for this fuel efficiency evaluation comprised of four Detroit 60 series power generation engines, one Caterpillar 3512 and one Caterpillar 3406 power generation engines.

Fuel Technology Pty Ltd supplied, on loan, an FTC catalyst dosing system that allowed fuel to be FTC treated at time of fuel delivery.

Baseline (untreated) tests were conducted on the 5th July 2001 after which fuel in storage was FTC treated and dosing system set up for FTC treatment of all further fuel deliveries. Treated tests were then conducted on the 16th August 2001.

TEST METHOD

The Carbon Mass Balance (CMB) is a procedure whereby the mass of carbon in the exhaust is calculated as a measure of the fuel being burned. The elements measured in this test include the exhaust gas composition, (HC, CO, CO_2 and O_2) temperature and the gas flow rate calculated from the differential pressure and exhaust stack cross sectional area.

This is an engineering standard test (AS2077-1982) and has been used by the US EPA since 1974 as the "Standard Federal Test Procedure" for fuel economy and emission testing.

The CMB test probe was positioned in the generator exhausts independently. The kWs produced and exhaust gas composition were recorded along with Bosch smoke measurements.

TEST RESULTS

A summary of the CMB fuel efficiency results achieved in this test program is provided in the following table. Treated tests on Power Generation unit No. 1 were not conducted due to enormous load swings.

TABLE 1
Carbon Balance Fuel Consumption Test Results

Unit No. 2 Caterpillar 3512	**Untreated 5/7/01**	**Treated 16/8/01**	**Variation**
Carbon Flow g/s	37.098	37.883	
Average Load/kW	740	785	
kg/kWh	**0.1805**	**0.1737**	**-3.7%**

Unit No. 6 Detroit 60 Series	**Untreated 5/7/01**	**Treated 16/8/01**	**Variation**
Carbon Flow g/s	7.106	6.955	
Average Load/kW	147.5	147.5	
kg/kWh	**0.1734**	**0.1697**	**-2.1%**

Unit No. 9 Detroit 60 Series	**Untreated 5/7/01**	**Treated 16/8/01**	**Variation**
Carbon Flow g/s	7.425	7.277	
Average Load/kW	135	137.5	
kg/kWh	**0.1980**	**0.1905**	**-3.8%**

Unit No. 14 Detroit 60 Series	**Untreated 5/7/01**	**Treated 16/8/01**	**Variation**
Carbon Flow g/s	7.295	7.750	
Average Load/kW	172.5	172.5	
kg/kWh	**0.1522**	**0.1617**	**+6.2%**

Unit No. 17 Detroit 60 Series	**Untreated 5/7/01**	**Treated 16/8/01**	**Variation**
Carbon Flow g/s	5.897	5.742	
Average Load/kW	137.5	137.5	
kg/kWh	**0.1544**	**0.1503**	**-2.6%**

AVERAGE kg/kWh EXCLUDING # 14	**0.1766**	**0.1710**	**-3.2%**

The CMB test procedure provides confirmation that addition of the Catalyst to the fuel supply has resulted in a reduction in carbon flow (fuel consumption) of **3.2%** excluding Generation Unit No. 14. We believe that fluctuation in load during Baseline tests may have resulted in inaccurate load being recorded at time of testing Power Generation Unit No. 14. The computer printouts of results and raw data sheets are contained in the *Appendix*.

Following is photograph showing CMB instruments.

BOSCH SMOKE MEASUREMENTS

A Bosch smoke test is also undertaken during conduct of the CMB test and the results are shown in Table 2. The Bosch smoke meter reads from 0.0 being clean or no soot to 9.9 being black or heavily impregnated with soot. Smoke patches in *Appendix*.

TABLE 2
Bosch Smoke Results

Generator No.	Untreated 5/7/01	Treated 16/8/01	Variation
2	1.9	1.2	
6	0.1	0.1	
9	0.1	0.1	
14	0.1	0.1	
17	0.1	0.1	
AVERAGE	**0.46**	**0.32**	**-30%**

Following are photographs showing Bosch Smoke Pump & Meter.

GREENHOUSE GAS REDUCTION

A gross reduction of **3.2%** of the current estimated annual fuel consumption of 2,500 KL translates to a **231 tonnes per annum** reduction in CO_2 emissions, based on the formula outlined in Worksheet 1 of the "Electricity Supply Business Greenhouse Change Workbook". Our estimate is based on the following calculations:-

(2,500 KL x 38.6 x 74.9) ÷ 1000 = 7,228 tonnes CO_2 per annum

- 3.2% (2,420 KL x 38.6 x 74.9) ÷ 1000 = 6,997 tonnes CO_2 per annum

CO_2 reduction by application FTC Catalyst
7,228 – 6,997 = 231 tonnes

CONCLUSION

These carefully controlled engineering standard test procedures conducted on a selection of Esperance Port Authority Power Generation engines provide clear evidence of average reduced fuel consumption of **3.2%**.

A fuel efficiency gain of **3.2%,** as measured by the Australian Standards (AS2077) CMB test method, if applied to the total fuel currently consumed by Esperance Port Authority Power Generation Facility will result in a **net** saving in excess of **$49,000 per annum.**

Additional to the fuel economy benefits measured is a reduction in greenhouse gas emissions of 231 tonnes per annum due to more complete combustion of the fuel. Further, the more complete combustion will translate to significant reductions over time in engine maintenance costs due to elimination of bore glazing and reduced soot contamination of engine oil. FTC/FPC also acts as an effective biocide.

Appendix “C”

Raw Data