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Results of HCS Oil and Fuel Program Trial on Cement Mixer Trucks

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1. EXECUTIVE SUMMARY

HCS Hydrocarbon Solutions LLC (HCS) has been conducting trials of its **Oil and Fuel Program** on various vehicles owned by a concrete ready mix company for the past five (5) months. The results proved to be promising as the oil becomes cleaner the longer it is in used with our system, which increases the effectivity and life of the equipment.

Through the program, HCS is able to prevent possible equipment failures by pinpointing problems such as fuel dilution, dirty fuel lines, and contaminated gearbox oil among other things, on some of the equipment with HCS system installed on it.

The photos on the right shows a couple of dirty fuel cartridges after filtration using the HCS system. Wear particles were evident and such contamination could have caused excessive wear on the fuel injectors that could ultimately lead to equipment failure. The cause of this problem was found to be a broken fuel line as seen on the last photo.

New oil schedule has been implemented and we are working closely with our client to ensure it is followed for accurate results.

The benefits of the program are remarkable - from savings on maintenance costs to savings on direct oil costs. The following are the proven financial savings from direct oil cost:

- ✓ **Engine = 19%**
- ✓ **Generator = 40%**
- ✓ **Hydraulics = 80%**

HCS recognises the unique prospect of reducing the client's equipment cost and extend the life of equipment dramatically through the implementation of our program on the rest of the fleet of vehicles. Our goals that we have achieved for our client are:

- ✓ **20% reduction on direct oil costs**
- ✓ **substantially reduce maintenance costs**
- ✓ **longer oil and fuel life**
- ✓ **longer drain intervals**
- ✓ **a more reliable equipment**
- ✓ **greater availability of vehicles**

The cost of implementing the Oil and Fuel Program has very little impact on the budget as client will only pay for the piping and the program fee. The filtration housings are free of charge.

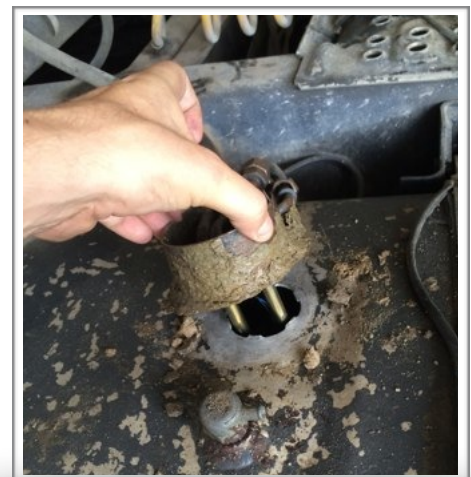
Our cost-effective program along with its financial and environmental benefits is a great opportunity for the Management and Staff of the client to lead the company towards a more profitable and environmentally-friendly future.



Dirty fuel cartridge



Wear particles present in the fuel



Dirt entry point on fuel system

2. HCS OIL AND FUEL PROGRAM

The client is a dynamic company that requires its vehicle and its components to be reliable and efficient all the time. A partnership with Hydrocarbon Solutions will help achieve the highest level of reliability, productivity and huge amount of financial savings for the company.

The HCS Oil and Fuel Program is dedicated to monitor the condition of our client's machineries and equipment through HCS filtration system and regular HCS oil diagnostics.

It is imperative for any company to keep on growing and be able to sustain such growth — this can be achieved by making the best out of the available resources while keeping the business profitable. In ready mix cement industry, oil and fuel are essential parts of the company's daily function and the cleanliness of these fluid systems are critical to have a trouble-free and cost-effective operation of a company. A smooth operation at minimal costs is necessary to the company's growth and Hydrocarbon Solutions provides the service that can assist you with that growth, manage it and turn our client into an even better leader in the industry.

2.1 OBJECTIVES

The following objectives are set for the HCS Oil and Fuel Program for the client's fleet of vehicles based on the trial performed on selected trucks owned by said company and on our discussion with Management:

- ✓ Savings on direct oil costs (i.e. service cost, oil change, and OEM filter change)
- ✓ Savings on maintenance costs
- ✓ Extend oil and fuel life meaning longer drain intervals
- ✓ Reduction in oil and fuel consumption
- ✓ Removal of water and contaminants in oil and fuel
- ✓ Greater vehicle availability and reliability

2.2 BENEFITS

Our program has delivered significant findings and excellent results during the trial period which brought various outstanding benefits to the client.

HCS was able to save the client huge maintenance costs by being able to identify problems on the equipment before it breaks down. HCS **prevents 70% of potential engine failures** and saves our client on maintenance costs as the vehicles spend less time in the workshop for service and oil change.

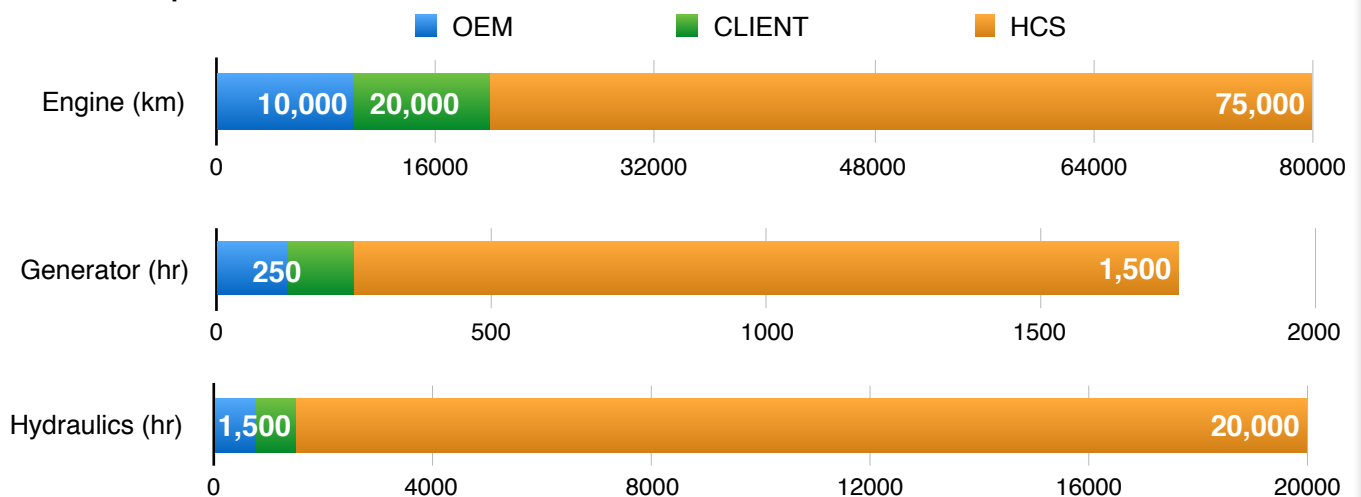
HCS was also able to **extend the oil change interval** of the vehicles with HCS system installed from a minimal 10,000kms up to an impressive

HCS Oil and Fuel Program is the best there is in the market at minimal cost with maximum benefits.

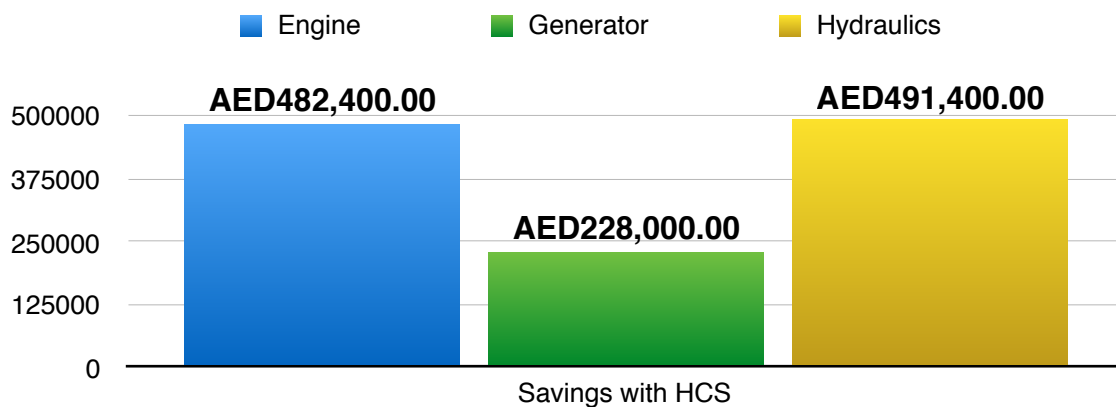
75,000kms. This ultimately results to **financial savings on the direct oil costs** (i.e. service cost, oil change, oem filter change) of the vehicles. The table and graph below presents the oil extension and savings on direct oil costs with HCS Oil and Fuel Program.

	SERVICE INTERVAL per vehicle			SERVICE COST per service interval per vehicle		
	OEM	CLIENT	HCS	OEM	CLIENT	HCS
Engine (km)	10,000	20,000	75,000	AED 3,440.00 per 80,000kms	AED 1,720.00 per 80,000kms	AED 1,430.00 per 80,000kms
Generator (hr)	250	250	1,500	AED 2,340.00 per 1,500hrs	AED 2,340.00 per 1,500hrs	AED 1,390.00 per 1,500hrs
Hydraulics (hr)	1500	1500	20,000	AED 25,200.00 per 20,000hrs	AED 25,200.00 per 20,000hrs	AED 7,000.00 per 20,000hrs

Oil extension per vehicle

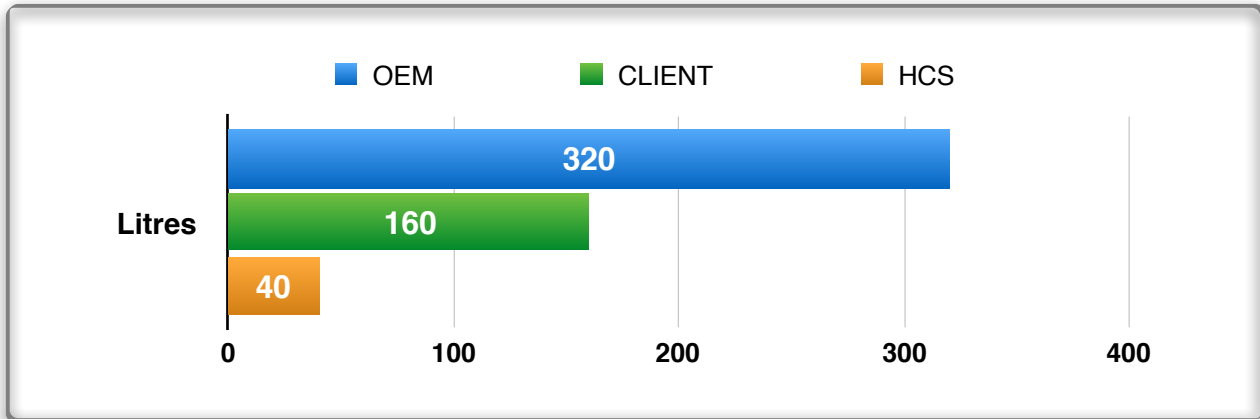


Projected savings on direct oil costs per 100 vehicles/equipment per year



i. Table and graph of HCS oil extension and savings on direct oil costs

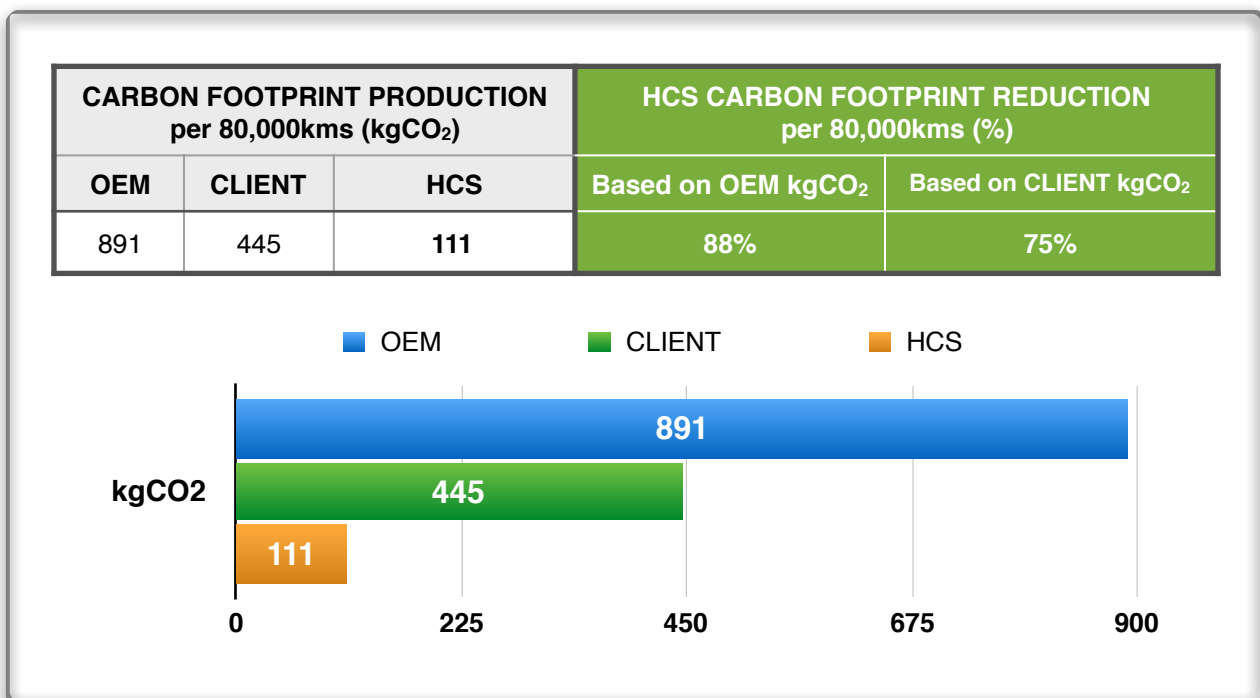
The graph below compares the amount of engine oil usage per 80,000kms. With HCS system installed, the amount of engine oil used in 80,00kms is significantly lesser than the standard OEM service. HCS uses only **40 litres of oil per 80,000kms**, which equates to **88% engine oil usage savings** based on OEM service and 75% engine oil usage savings based on client's service schedule.



ii. Graph of engine oil usage (litres) per 80,000kms

Aside from the savings discussed above, there is one more thing that HCS program helped the client to save on — carbon footprint. Our program results to lesser oil consumption and oil waste making your carbon footprint much lesser as well. The table and graph below shows the amount of carbon footprint a vehicle's engine produces based on 80,000kms as well as the amount of carbon footprint reduction HCS helped to achieve.

HCS **reduces the carbon footprint of the vehicle's engine up to 88%**. The OEM's carbon footprint of 891kgCO₂ would have taken about 40 fully green trees to absorb and convert into oxygen. Taking this amount of carbon dioxide emission out of the atmosphere per engine multiplied by client's entire fleet of vehicles would be a respectable contribution to the safekeeping of our environment.



ii. Graph of carbon footprint production per 80,000kms

3. OIL SAMPLE RESULTS

Part of our program is regular oil sampling based on HCS oil schedule complete with HCS oil diagnostics report provided based on the results of the oil samples. Below tables summarises the oil sampling HCS has performed on the vehicles that are part of the HCS Oil and Fuel Program trial. As expected, the results per vehicle varies. Problems were identified as early as first sampling.

a. VEHICLE NUMBER 1

VEHICLE NO. 1 - ENGINE					
No.	Sample Date	Sample No.	Running Kms	Oil in Service (kms)	Problem(s) Identified
1	Feb 19, 2014	D038463	955,957	0	-
2	Mar 29, 2014	D038439	977,402	21,445	-
3	Apr 28, 2014	D038454	987,831	31,874	Fuel dilution was detected. Advised to check fuel system for malfunction.
4	Jun 22, 2014	D039885	1,004,172	16,341	Oil was changed but fuel dilution was still evident. Advised to stop operation of this machine.
5	Aug 9, 2014	D038445	1,016,958	12,786	Oil was changed but fuel dilution was still evident. Advised to stop operation of this machine.
VEHICLE NO. 1 - GEARBOX					
1	Feb 20, 2014	D038462	966,957	0	-

HCS identified a fuel dilution in this vehicle's engine on the third, fourth and fifth oil sampling. Proper actions were suggested in order to fix this problem and prevent it from getting worse.

b. VEHICLE NUMBER 2

VEHICLE NO. 2 - ENGINE					
No.	Sample Date	Sample No.	Running Kms	Oil in Service (kms)	Problem(s) Identified
1	Feb 19, 2014	D038465	301,955	0	A light concentration of small wear particles was found in the oil.
2	Mar 31, 2014	D038438	315,346	13,391	-
3	Apr 29, 2014	D038458	323,519	21,564	-
VEHICLE NO. 2 - GEARBOX					
1	Feb 19, 2014	D038470	301,955	0	Oil is unfit for use due to light concentration of very small wear particles.

During the first oil sampling on this vehicle's engine and gearbox, a problem was immediately detected that would have led to a more serious damage if left unattended. Proper action was advised and performed. HCS was able to extend the life of oil of this engine to 21,500 kms after only three oil sampling.

c. VEHICLE NUMBER 3

VEHICLE NO. 3 - ENGINE					
No.	Sample Date	Sample No.	Running Kms	Oil in Service (kms)	Problem(s) Identified
1	Feb 22, 2014	D038466	263,319	0	-
2	Apr 7, 2014	D038437	268,807	5,488	-
3	May 1, 2014	D038452	272,098	8,779	-
4	Jul 25, 2014	D039869	290,612	27,293	-
VEHICLE NO. 3 - GEARBOX					
1	Feb 22, 2014	D038446	263,319	0	Oil is unfit for use due to heavy concentration of very small wear particles.

On the first oil sampling of this vehicle's gearbox, it was found out that the oil was contaminated making it unfit for use. If this problem was not identified as early as this stage, it would have caused severe damage on the component that would result to expensive repair and parts.

d. VEHICLE NUMBER 4

VEHICLE NO. 4 - ENGINE					
No.	Sample Date	Sample No.	Running Kms	Oil in Service (kms)	Problem(s) Identified
1	Feb 22, 2014	D038447	346,746	0	-
2	Apr 7, 2014	D038432	371,055	24,309	-
3	May 7, 2014	D038433	373,331	26,585	-
4	Jul 10, 2014	D039888	383,904	37,158	-
VEHICLE NO. 4 - GEARBOX					
1	Feb 23, 2014	D038467	346,746	0	Although wear rates are normal, there was evidence of coarse dirt ingress making the oil unfit for use.

Coarse dirt ingress was found in the oil of this vehicle's gearbox during the first oil sampling. This would have caused a breakdown in the health of the oil and would have caused wear which leads to component failure.

HCS was able to extend the life of engine oil to 37,000kms as of the fourth oil sampling.

e. VEHICLE NUMBER 5

VEHICLE NO. 5 - ENGINE (km)					
No.	Sample Date	Sample No.	Running Kms/Hrs	Oil in Service (km/hr)	Problem(s) Identified
1	Feb 28, 2014	D038443	524,250	0	-
2	Apr 7, 2014	D038434	554,500	30,250	-
3	May 10, 2014	D038459	580,050	55,800	-
4	Jun 22, 2014	D039890	602,650	78,400	-
5	Jul 10, 2014	D039866	614,929	90,679	-
VEHICLE NO. 5 - HYDRAULICS (hr)					
1	Feb 28, 2014	D038449	10,485	0	-
2	May 10, 2014	D038453	11,601	1,116	-
3	Jun 22, 2014	D039889	12,053	1,568	-
4	Jul 10, 2014	D039867	12,299	1,814	-
VEHICLE NO. 5 - GEARBOX (km)					
1	Feb 28, 2014	D038444	10,485	0	A light concentration of very small wear particles was found in the oil making it unfit for use.

Small wear particles were found in the gearbox oil during the first oil sampling. Proper actions were advised and performed, preventing a costly component failure.

HCS was able to extend the life of engine oil to 91,000kms and hydraulic oil to 1,800hrs after five oil sampling, which is a remarkable achievement considering there were no problems detected even after the fifth oil sample.

f. GENERATOR NUMBER 7

GENERATOR NO. 7 - ENGINE					
No.	Sample Date	Sample No.	Running Hrs	Oil in Service (hrs)	Problem(s) Identified
1	Feb 28, 2014	D038441	16,954	0	-
2	Apr 7, 2014	D038431	17,937	553	-
3	May 19, 2014	D038460	17,966	1,122	-
4	Jul 10, 2014	D039884	18,352	1,398	-
5	Jul 19, 2014	D039868	18,758	406	-

There were no problems identified in the generator based on the oil samples tested. Oil life was extended to 1,400 hours.