

**Project**  
**BIO-FUEL TESTING**

BY 2010, 30% OF FUEL NEEDS FOR LAND TRANSPORTATION SHALL  
BE BIO-FUEL OR ENVIRONMENT ALLY FRIENDLY ALTERATIVE  
FUELS SUCH AS LPG AND LNG



**To : CEO**

**CC : GMSC; GMBD**

**From : John Lee**

**Subject : “Preliminary Coco Diesel Summary Report”**

**Date : 27<sup>th</sup> April 2007**

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## **1. Introduction**

The coco diesel 2% blending trails commenced mid January 2007.

To date, out of the 18 participants, coco diesel blending trails data have been received from 13 candidates while the remaining 5 candidates, data is yet to be received.

The vehicles tested ranged from buses, taxis, container haulage trucks and 4WDs. The tests will continue for a period of 90 days.

The commencing of the blending trails for each vehicle vary and a few vehicles have not started yet with the 2% coco diesel because insufficient data was available for the litres of diesel fuel and odometer reading, they will start by the end of April 2007.

The results collated have positive and negative influence on vehicle efficiencies while smoke emission tests have shown remarkable improvements.

The blending test continues and few vehicles will complete the 90 days testing period by the end of April 2007. Other vehicles will continue the test and complete the course in June- July 2007.

## **2. Project Phases**

The Project “**BIO-FUEL TESTING**” was conducted in phases, phase1 and phase2. Phase 1 measures diesel fuel efficiencies and Phase 2 measures coco diesel fuel efficiencies.

### **2.1. Phase 1**

A total of 32 vehicles participated in the initial program. During this period, participants have been asked to record the amount of litres of diesel filled into the tank to full tank and odometer (mileage) readings noted.

In mid September 2007, participants started noting down the required data for a period of 2 months. Few vehicles were disqualified for inaccurate data gathering and therefore new candidates joined in for replacement.

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The data collected from phase1 will be used as a baseline. The data will be used to determine the vehicle efficiency (Km/L) which is a measurement of distance traveled in kilometers (Km) to one litre (L) of diesel fuel consumed.

Vehicles were also tested for smoke emissions. The smoke test results known as the “% Opacity Level” is a measure of exhaust smoke thickness. A smoke level of 70% and below is considered good.

## **2.2 Phase 2**

This phase is the actual test of the new alternate fuel known as coco-diesel. Coco diesel is diesel made from coconut oil.

The blending of coco diesel is 2% relative to the amount of diesel filled in the vehicle to full tank. For example, for 100 litres of diesel the corresponding coco diesel to blend with the diesel is 2 litres.

For successful blending of the two fuels, diesel and coco diesel, the drivers after gaining experience will be able to make a rough estimation on the amount of diesel to be filled.

Therefore, an estimated coco diesel is filled into the tank before the diesel is filled. After doing so, diesel is filled to the top of the tank below the neck of the tank.

If the diesel fuel filled requires additional coco diesel, the balance is calculated and coco-diesel is filled to complete the blending of 2% coco diesel.

Smoke emission tests were also conducted on coco diesel fuel vehicles. Results from the test have shown improvements when compared to the same vehicles using 100% diesel fuel.

## **3. Participating Candidates**

Vehicles that were taken in to participate in the test were vehicles that traveled long distances per day and would require daily fueling.

Such vehicles that required daily refueling were buses and taxis whereas other vehicles refueled every second day or twice a week.

As mentioned earlier, 32 vehicles took part in the initial phase1 of the test and they are shown in table 1 below.

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Buses	Taxis	Container Trucks	4WD's	Vans
Shore Buses	Vesi Taxis (2)	Carpenters (3)	LTA (2)	W & G
Tebara Transport	Regent Taxis	W & G (2)	FEA	Wing Lee
Central Transport	Sanyo Cabs (2)	STFL	SOPAC (2)	
Citiline	Flagstaff Taxis			
Island Buses	Bureta Cabs			
Dee Cee's	Matua Taxis(2)			
Nadera Transport				
Nasee Buses				
Nairs Transport				
KR Latchan				
<b>Total</b>	<b>10</b>	<b>Total 9</b>	<b>Total 6</b>	<b>Total 5</b>
			<b>Total 5</b>	<b>Total 2</b>

**Table 1**

Looking at table1, 10 vehicles were buses, 9 taxis, 6 container trucks, 5 of 4WD's and 2 vans. To date, only 18 vehicles remain taking part in the second phase of the test.

The vehicles remaining to continue the tests and vehicles eliminated or have discontinued the test on their own accord is shown in Table 2.

Buses	Taxis	Container Trucks	4WD's	Vans
<b>Vehicles Remaining for Phase 2 Tests</b>				
Shore Buses	Regent Taxis	W & G (2)	LTA (2)	Wing Lee
Tebara Transport	Sanyo Cabs	STFL	FEA	
Dee Cee's	Flagstaff Taxis		SOPAC (2)	
Nasee Buses	Bureta Cabs			
Island Buses				
<b>Total</b>	<b>5</b>	<b>Total 4</b>	<b>Total 3</b>	<b>Total 5</b>
			<b>Total 5</b>	<b>Total 1</b>
<b>Vehicles Eliminated or Discontinued Phase 2 Tests</b>				
Nadera Transport	Matua Taxis(2)	Carpenters (3)		W & G
Nairs Transport	Vesi Taxis (2)			
KR Latchan	Sanyo Cabs			
Central Transport				
Citiline				
<b>Total</b>	<b>5</b>	<b>Total 5</b>	<b>Total 3</b>	<b>Total 0</b>
			<b>Total 0</b>	<b>Total 1</b>

**Table 2**

#### **4. Diesel and Coco Diesel Blending Procedure**

Vehicles taking part in the bio fuel testing project were issued facilities to assist in the blending of diesel and coco diesel.

##### **4.1. Blending Facilities**

The facilities were issued to each participating vehicles with the following items

- (1) 4 Litres Plastic Container
- (2) 20 Litres Plastic Container
- (3) Maspion fuel pump
- (4) 500 millilitres measuring flask
- (5) Funnel

##### **4.2. Blending Example**

The ratio or the amount of Coconut Methyl Ester (CME) to blend with diesel is 2% of the amount of diesel filled. A guide is produced herein and in all logbooks to assist in the amount of CME to be filled relative to the amount of diesel filled.

A vehicle goes to a service station and fills 75 Litres of diesel, looking at **Chart 1** below, the corresponding millilitres of CME to be filled is 1500mls.

The second example is quite tricky; a vehicle goes to a service station and fills 78 Litres of diesel, looking at the chart highlighted in yellow, the 75litres of diesel plus 3 litres of diesel give a total 78 litres and the corresponding CME to be filled is  $1500+60 = 1560$ ml of CME.

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<b>Guide to the amount of CME to be filled relative to Diesel filled in Litres</b>								
<b>Litres of Diesel Filled</b>	<b>0.5</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>10</b>	<b>15</b>
Millilitres of CME to be filled	10	20	40	60	80	100	200	300
<b>Litres of Diesel Filled</b>	<b>20</b>	<b>25</b>	<b>30</b>	<b>35</b>	<b>40</b>	<b>45</b>	<b>50</b>	<b>55</b>
Millilitres of CME to be filled	400	500	600	700	800	900	1000	1100
<b>Litres of Diesel Filled</b>	<b>60</b>	<b>65</b>	<b>70</b>	<b>75</b>	<b>80</b>	<b>85</b>	<b>90</b>	<b>95</b>
Millilitres of CME to be filled	1200	1300	1400	1500	1600	1700	1800	1900
<b>Litres of Diesel Filled</b>	<b>100</b>	<b>105</b>	<b>110</b>	<b>115</b>	<b>120</b>	<b>125</b>	<b>130</b>	<b>135</b>
Millilitres of CME to be filled	2000	2100	2200	2300	2400	2500	2600	2700
<b>Litres of Diesel Filled</b>	<b>140</b>	<b>145</b>	<b>150</b>	<b>155</b>	<b>160</b>	<b>165</b>	<b>170</b>	<b>175</b>
Millilitres of CME to be filled	2800	2900	3000	3100	3200	3300	3400	3500

**CHART 1****4.3. Recording**

A logbook was given to all participating in the Bio-fuel Project. Data entered on to the logbook is when the vehicle is in the service station filling diesel fuel. When filling diesel fuel, it is recommended that the fuel is filled to full tank and just below the neck to allow space for CME filled.

A **LOGBOOK SHEET** is shown below.

For the example of 78 Litres of diesel filled, the following information must be filled as shown in the logbook sheet.

**BIO-FUEL PROJECT**  
**CME/DIESEL BLEND FUEL SHEET**

Company: **Mikes Transport** Fuel Type: **Diesel** Vehicle Reg. No: **AXX123**

No.	Date	Mileage Gauge Reading when filling Diesel	Amount of Diesel filled to Full Tank in Litres	Amount of CME filled (2% of Diesel Filled in ml)	Driver Signature
1	12/12/06	450892	78	1560	Mike
2					
3					
4					
5					
6					
7					
8					
9					
10					

**LOGBOOK SHEET**

**4.4. Distribution Of CME**

The Authority distributed the additives to all candidates and the Authority will be monitoring the additives for refills.

Each candidate will be issued for the first time 20 Litres of CME in a 20L plastic container and of this 1000L of diesel will blend with 20L CME. The 4L plastic container and the fuel pump can be used to fill the 500ml measuring flask.

The measuring flask must be used at all times to measure amount of CME to be poured relative to the amount of diesel filled into the tank.

**4.5. The First Blending**

The Authority and the participating candidate will together do the first diesel and CME blending. The blending will take place when the candidate is ready for refueling.

The first blending experience will enable to solve any difficulties faced.



## 5. Storage Of Coco Diesel

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The storage area for coco diesel was carefully thought of in terms of safety and compliance to OHS standards.

Sixteen drums of 200 litres of Bioactive BD100 coco diesel fuel was purchased from Manila, Philippines.

The drums are stored at the Land Transport Authority head quarters in Valelevu. Two carports were sealed off to accommodate the coco diesel.

### 5.1. Quantity Delivered

Refueling of the 20 litres container was done inside a tray to avoid or minimise oil spillage.

The litres of coco diesel dispensed to all participants are noted on the CME register.

As of mid April 2007, five drums of bio diesel have been dispatched to participants.

Shore Buses and Tebara Transport were issued the highest litres of coco diesel amounting to 124 litres as shown in Table 3.

The blending of coco diesel with diesel was within the  $\pm 2\%$  blending ratio that were between 1.8% and 2.2%.

Company	Vehicle Model	Date Started on coco diesel	QTY Deliver (L)	QTY Used (L)	Blending %
FEA	Toyota	6/02/07	44	17.00	2.0
LTA-EP224	Nissan	7/02/07	24	8.20	1.9
Jan Cloin *	Toyota	25/01/07	24	7.53	2.0
SOPAC 1	Ford	2/02/07	24		
Dee Cee's *	Albion	23/01/07	84	58.80	1.9
Island Buses *	Hino	24/01/07	104	95.42	2.1
Nadera Transport	Nissan	5/03/07	64	40.80	1.8
Nairs transport	Scania	24/01/07	44	14.10	
Nasese Buses	Albion	11/04/07	24	10.80	2.0
Shore Buses *	Isuzu	26/01/07	124	81.96	1.9
Tebara Transport *	Nissan	25/01/07	124	118.30	1.9
STFL *	Nissan	26/01/07	64	43.20	2.1
WG-DE536	Volvo	14/02/07	44		
WG-DZ134	Mitsubishi	14/02/07	44		
WG-DP276	Mitsubishi	13/02/07	24		

Bureta Cabs	Toyota	2/03/07	24	6.57	2.2	10
Flagstaff Taxis	Toyota	23/02/07	8	6.30	1.9	
Matua Taxis	Toyota	26/02/07	8	2.30		
Regent Taxis *	Toyota	26/01/07	68	39.44	1.9	
Sanyo Cabs *	Toyota	24/01/07	36	16.86	2.0	
		<b>Total</b>	1004 Litres			

Note – Vehicles marked with an **asterisk** \* will complete 90 days of testing by the end of April 2007.

### **Table 3**

#### **6. Coco Diesel Test Results**

Test results for eight vehicles will complete the 90 days test period by the end of April 2007. The vehicles include 4 buses, 2 taxis, 1 4WD and 1 container truck.

Out of the prominent participants that are on course with the coco diesel tests, 75% of the vehicles had demonstrated improvements in efficiencies and reduction in smoke emissions.

It is appropriate to consider vehicles that are almost completing the test by the end of April. Therefore, the results will focus on these vehicles and will briefly look at the other vehicles completing the test in May.

In May 2007, five vehicles will complete the 90 days test. Of these two are container trucks, one taxi and two 4 Wheel Drives.

By June 2007, two vehicles will complete the test, a taxi and a 4WD.

A good performance indicator on efficiencies is to capture the percent increase or decrease of coco diesel per the day.

A consistent data can be obtained by analysing the percent increase or decrease in coco diesel consumption per the day.

The data is the comparison of diesel fuel to diesel/coco diesel blended fuel.

## 7. Test Results - Buses

Seven buses were in use of the coco diesel.

Unfortunately, Nairs Transport and Nadera Transport discontinued the coco diesel test on their own accord.

Both bus companies stopped the coco diesel test after 4 weeks of use.

Nadera Transport had two burst oil filters after two weeks of operation. It also faced low power especially when climbing up hill.

And so as Nairs Transport, have decided to pull out of the testing program because of a mechanical failure.

Nasese Buses continues the test and will complete the test in July.

As for the four buses completing tests end of April, two of them have shown improvement in fuel efficiencies while the other two buses not so well.

Table 4 shows the results of the four vehicles.

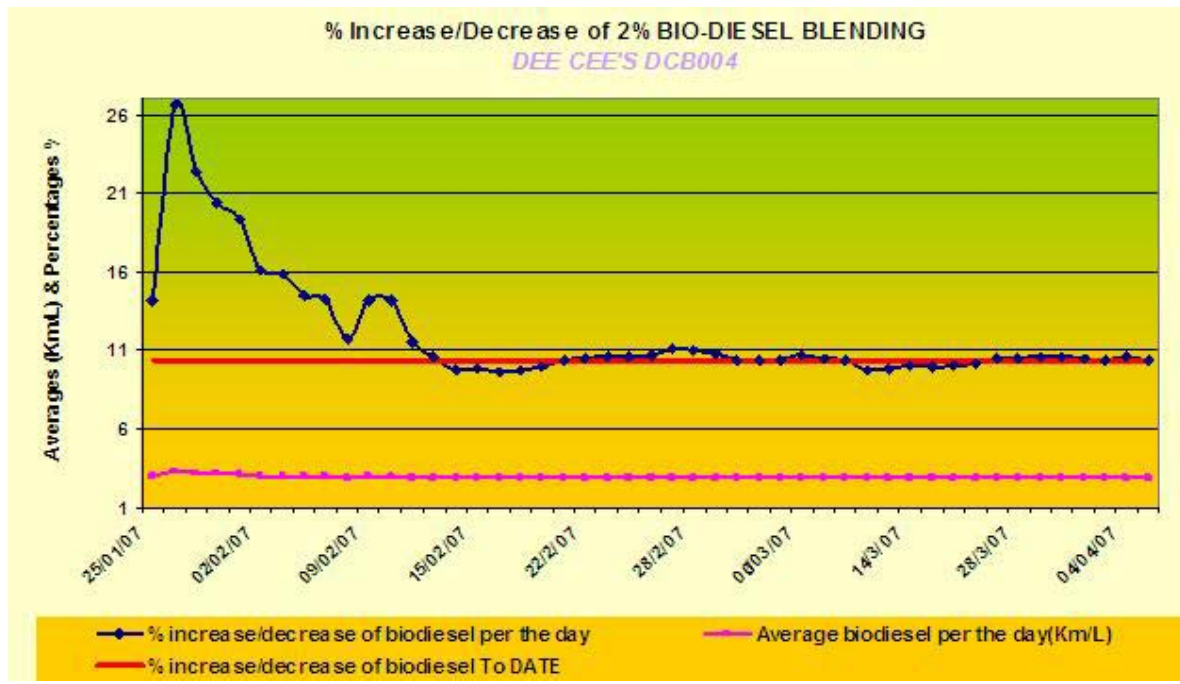
COMPANIES	Av Diesel (Km/L)	Av Bio Diesel (Km/L)	Diff D/BioD (Km/L)	% incre or decre	Total Diesel Used (Litres)	Total CME Used (Litres)	Total Blending Used (Litres)	% Blend
Shore Buses	1.856	1.704	(0.153)	(8.23)	4321.00	81.96	4402.96	1.9%
Tebara Transport	2.342	2.260	(0.083)	(3.52)	6077.00	118.30	6195.30	1.9%
Island Buses	2.860	2.974	0.114	3.98	4513.80	95.42	4609.22	2.1%
Dee Cees	2.628	2.902	0.273	10.39	3136.76	58.80	3195.56	1.9%

**Table 4**

Dee Cee Transport and Island Buses have shown improvements in efficiencies while Shore Buses and Tebara Transport had shown otherwise.

### 7.1. Dee Cee's

A graph of Dee Cee bus shows an improvement in efficiency of 10.39%.



**GRAPH 1**

Looking at the above graph, the % increase of coco diesel to that of diesel is consistent after three weeks. Therefore we can come to a conclusion for Dee Cee's coco diesel efficiency is around 10% improvement compared to diesel efficiency.

### **7.1.1. Dee Cee's Fuel Consumption Cost**

The cost of coco diesel taking into account the purchase of the coco diesel from the Philippines plus vat and duty amounts to \$2.93 per litre.

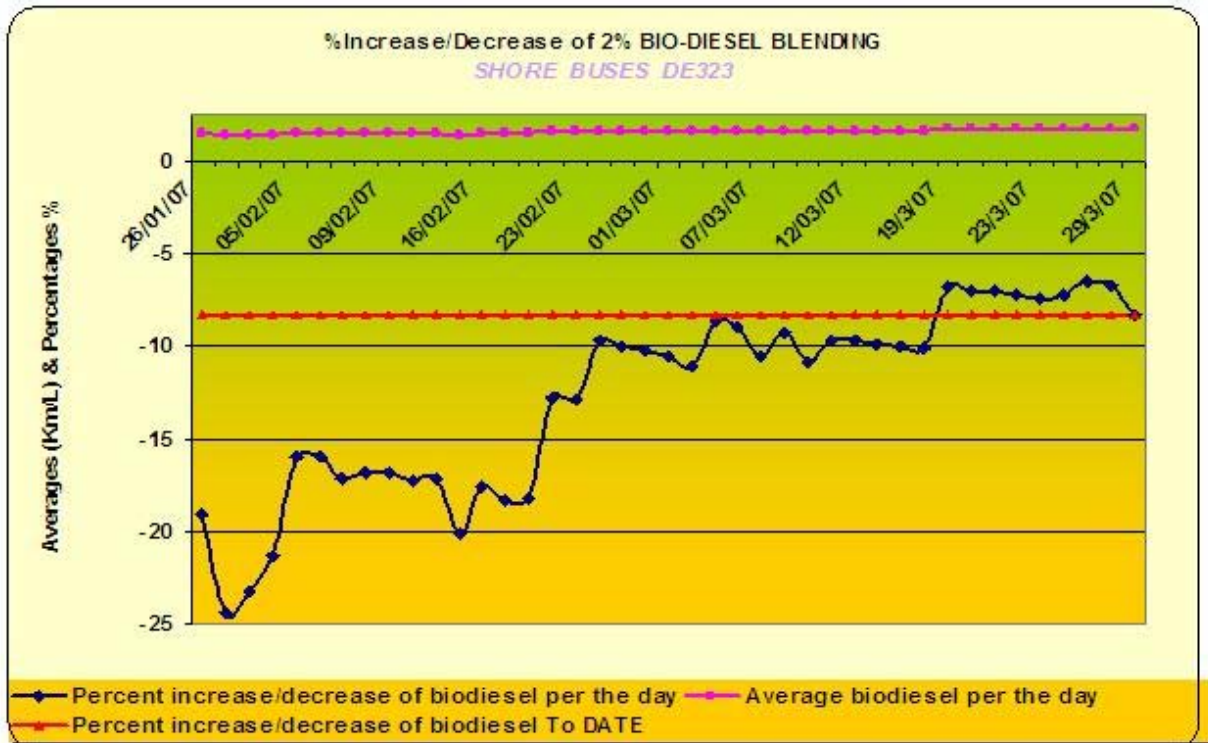
The savings achieved using coco diesel is \$0.04 to travel a distance of 1 kilometer. This figure's is shown in Table 5.

Total Diesel Consumed (L)	3136.76	Diesel Cost/Litre	\$1.39
Total CME Consumed (L)	58.80	CME Cost/Litre	\$2.93
Total Biofuel Blending (L)	3195.56	Biofuel Cost/Litre	\$1.42
Total Diesel Cost	\$4,360.10	Cost of Diesel to Travel 1Km	\$0.529
Total CME Cost	\$172.28	Cost of Biofuel to Travel Km	\$0.489
Total Biofuel Cost	\$4,532.38	Loss/savings	\$0.040
Total distance traveled in 3 months (Km)	11091.6		
Loss/savings for 3 months with coco diesel	\$443.90		
Loss/savings in 1 year with coco diesel	\$1,775.62		

**Table 5**

The savings that can be accomplished in one year with the use of coco diesel is approximately \$1800.

Coco diesel fuel had a negative impact on Shore Buses fuel efficiencies. Results have shown a decrease in efficiency of -8.23%.



**GRAPH 2**

Even though the efficiency does not look favorable, Graph 2 shows the percent increase or decrease in coco diesel per the day creeping towards a positive direction.

Shore Buses (engine model Isuzu) did not discontinue the test but kept on with the coco diesel test even though it was running at a loss on fuel consumption.

After few weeks on the test, fuel filters were changed. The old filters were black and murky.

Also the engine was over hauled in early April where parts were replaced such as cylinder liners.

But smoke emission test on coco diesel has shown a significant improvement of 20.16% compared to diesel smoke emission test.

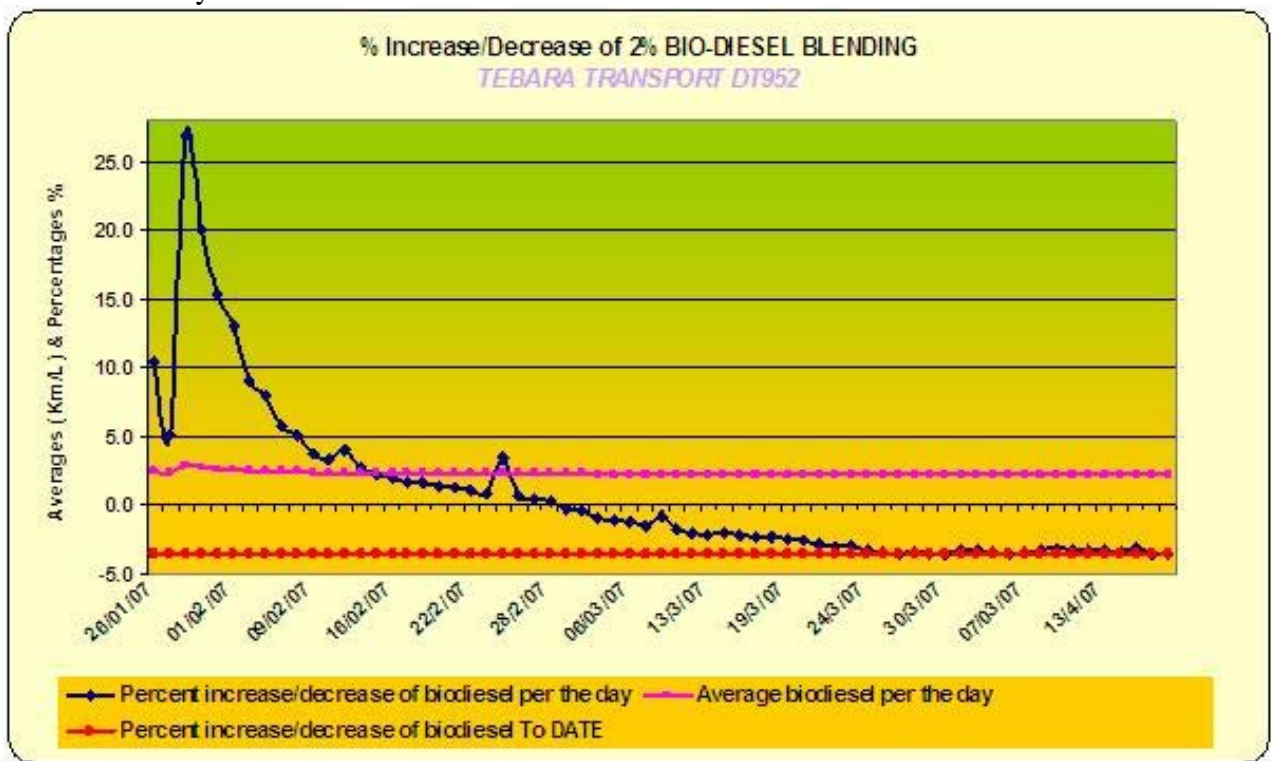
**7.3. Tebara Transport**

Tebara Transport also had a negative efficiency of -3.52%. Old fuel filters were changed during servicing.

After two months with the use of coco diesel, there is consistency in the % increase or decrease in coco diesel per the day. This is evident on Graph 3.

They too have continued with the test despite losses on fuel consumption.

A smoke test on the coco diesel is yet to be done which is required for comparison with the diesel fuel smoke % opacity test staggering at 80.5% which is way above the 70% limit zone.



**GRAPH 3**

**7.4. Island Buses**

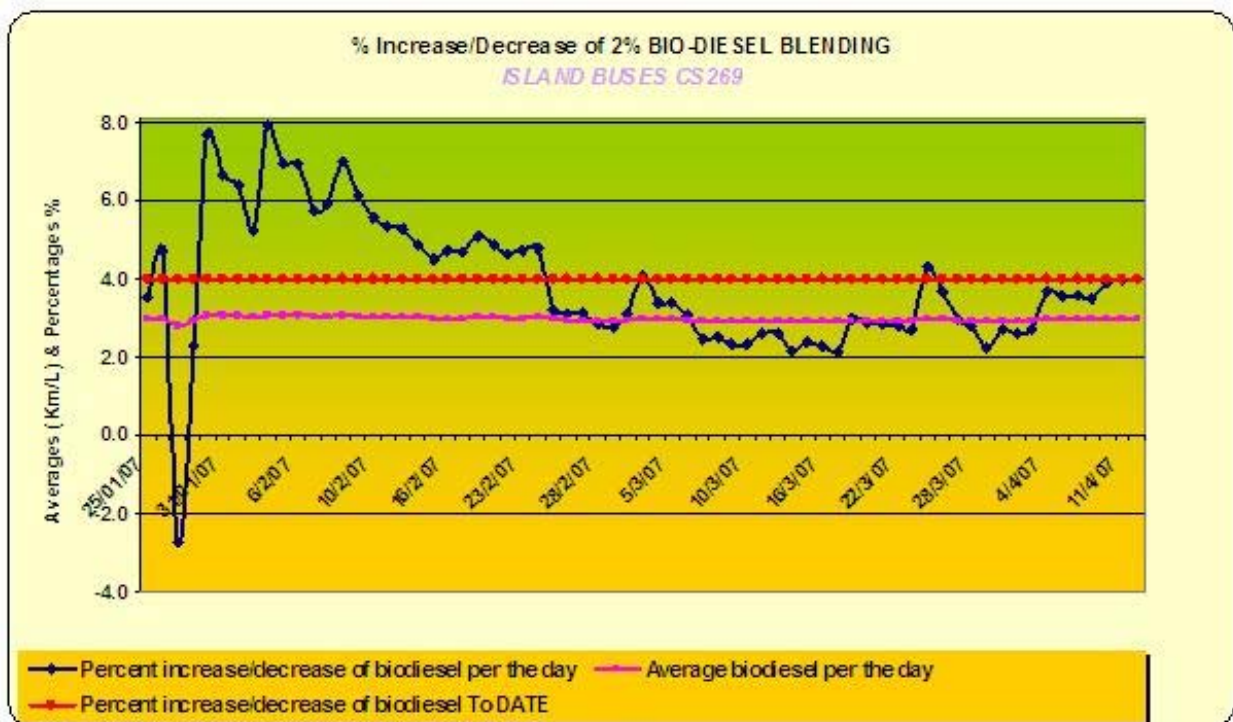
As for Island Buses, shows a marginal improvement in the coco diesel efficiency.

Whereas the smoke test for coco diesel have shown an increase of 64.8% compared to diesel % opacity test of 54.2%.

Never the less, the opacity test for coco diesel is below the threshold of 70% opacity level.

A second coco diesel test will be conducted in due course to see whether or not an improvement is reached compared to the first coco diesel smoke test.

After 4 weeks on the coco diesel, the percent increase or decrease of coco diesel per the day is between a bandwidth of 2% and 4%. This reflects a consistency in coco diesel fuel efficiency.



**GRAPH 4**

### 7.5. Summary Bus Tests

To summate the results of the buses that are continuing the coco diesel tests, two buses are in the green while the other two are in the red in terms of coco diesel fuel efficiencies.

The savings incurred for Dee Cee and Island Buses to travel a distance of 1 kilometer are 4cents and 1cent respectively.

The losses incurred for Tebara Transport and Shore Buses to travel a distance of 1 kilometer are 4cents and 10cent respectively.

Despite the losses of the two buses in fuel consumption, they continue to participate in the coco diesel fuel test.

Company	Cost of Diesel to Travel 1Km	Cost of Biofuel to Travel 1Km	Loss/savings Cost of Biofuel to travel 1Km	% Increase or Decrease in coco diesel Efficiency	Diesel % Opacity Average	Biodiesel % Opacity Average
Dee Cee	\$0.529	\$0.489	\$0.040	10.39	77.1	9.0
Island Buses	\$0.486	\$0.476	\$0.008	3.98	54.2	64.8
Tebara Transport	\$0.593	\$0.628	(\$0.036)	(3.52)	80.5	Yet to be done
Shore Buses	\$0.749	\$0.833	(\$0.088)	(8.23)	68.7	54.9

**Table 5**

The three buses that have been tested for coco diesel opacity test have shown improvement in reducing the % opacity level below the threshold of 70%.

A second test will be conducted to see whether an improvement in opacity level can be reached below the first coco diesel smoke test. Tebara Transport coco diesel opacity test is yet to be done.



## 8. Test Results – Taxis

Taxis have shown a remarkable improvement when fueling the 2% coco diesel blending. These taxis are of the Toyota Caldina model.

Two taxis will complete the test by the end of April while the other two will complete in May and June 2007. Over 80% of taxis had over the required % opacity level of 70% with the diesel fossil fuel.

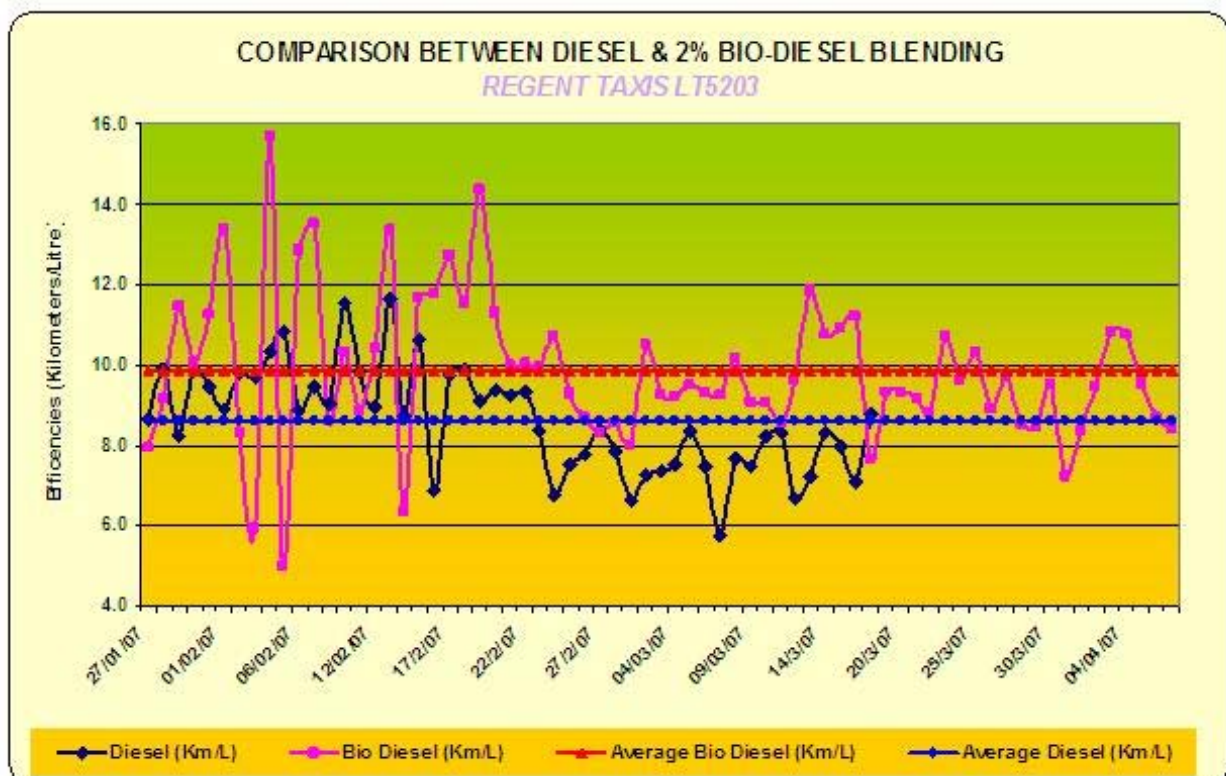
With coco diesel, the opacity test for the two taxis had reduced considerably with an improvement of 46% and 55%.

### 8.1. Regent Taxis

The Regent Toyota Caldina Taxi has done very well with the coco diesel fuel.

It has gained a fuel efficiency of 1.339 Kilometres to a litre of coco diesel when compared to 100% diesel fuel. The average efficiency of coco diesel is 9.873 Km/L compared to diesel fuel of 8.634 Km/L.

Also a great improvement in smoke emission level from diesel 81% to coco diesel 37% which gives an improvement in smoke emission of 55%.

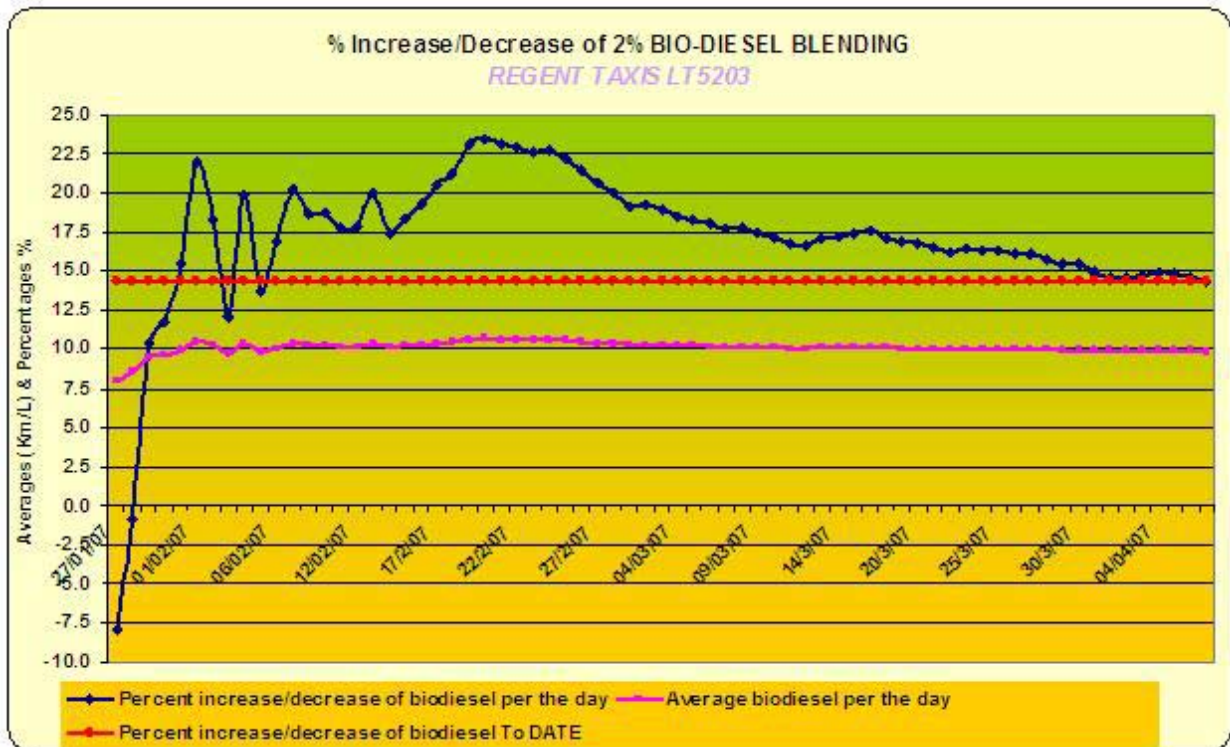


**GRAPH 5**

Graph 5 shows a typical example of coco diesel and diesel fuel efficiencies and the averages of both fuel types.

Abnormalities can be detected from this type of graphs. High and low inconsistent peaks can determine, for example inconsistency in data entry for one or excess idling time and slow traffic to name a few.

Also long trips at the right speed will gain better fuel efficiencies.



**GRAPH 6**

The percent increase of coco diesel has been above the 14% mark. It took only a short period of one week to be above this percentage and is maintained to date. Also notice the average bio diesel per the day is consistent around the 10Km/L after one week.

**8.1.1. Regent Taxi Fuel Consumption Cost**

The savings gained when using coco diesel fuel to travel a distance of 1 kilometer is two cents.

This savings gained will depend on the kilometers traveled. With the data collected, Regent taxi traveled a distance of approximately 22,176 kilometers in three months.

And the savings for fueling coco diesel is roughly \$1,500 for a period of one year.

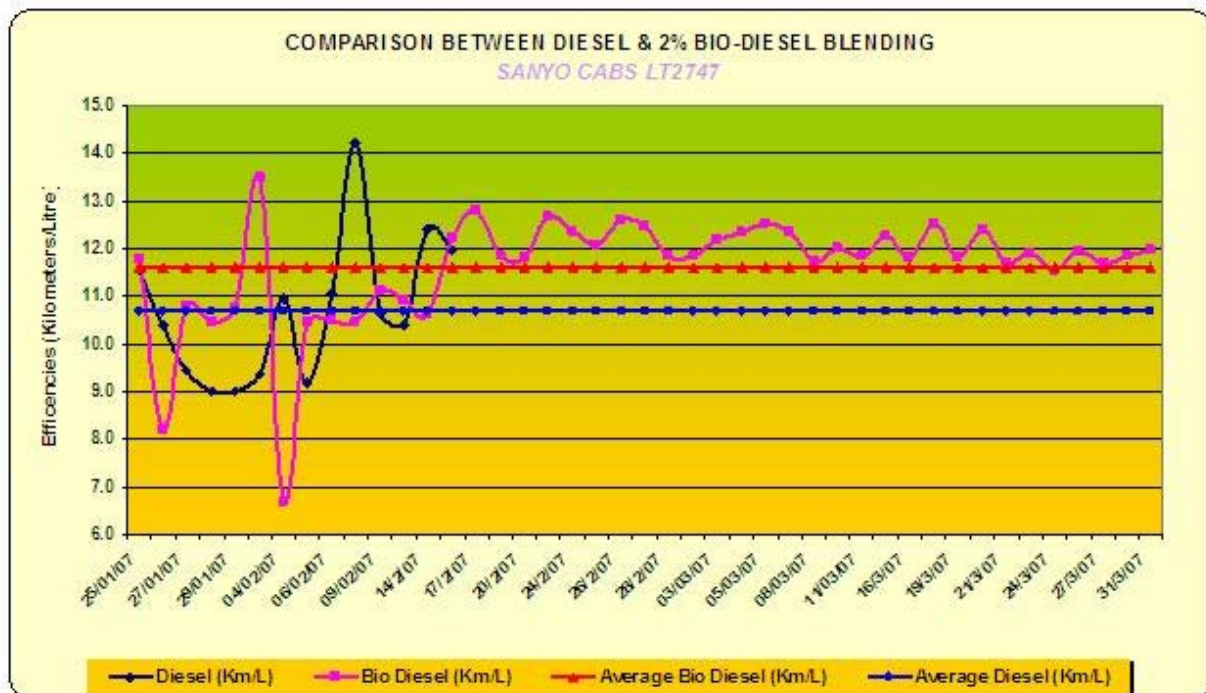
Table 6 below shows a summarised detail of fuel consumption cost for Regent Taxi.

Total Diesel Consumed (L)	2023.35	Diesel Cost/Litre	\$1.39
Total CME Consumed (L)	39.44	CME Cost/Litre	\$2.93
Total Biofuel Blending (L)	2062.79	Biofuel Cost/Litre	\$1.42
Total Diesel Cost	\$2,812.46	Cost of Diesel to Travel 1Km	\$0.161
Total CME Cost	\$115.56	Cost of Biofuel to Travel 1Km	\$0.144
Total Biofuel Cost	\$2,928.02	Loss/savings	\$0.017
Total distance traveled in 3 months (Km)	22176		
Loss/savings for 3 months	\$381.92		
Loss/savings in 1 year	\$1,527.67		

**Table 6**

## 8.2. Sanyo Cabs

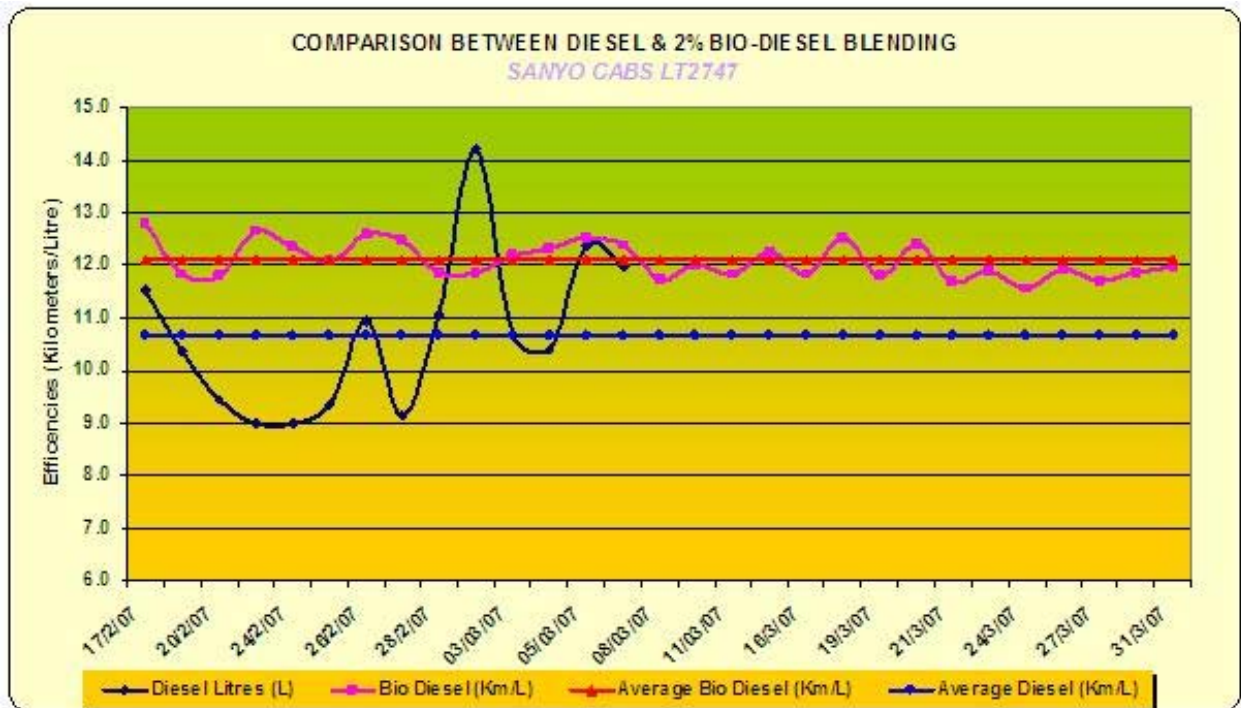
Sanyo cabs had experienced in the first three weeks low engine power and coco diesel fuel efficiency lower than that of diesel fuel. This is evident on Graph 7.



**GRAPH 7**

A fuel filter change after three weeks has made dramatic changes to Sanyo Cabs performance. Improved engine performance, more power and efficiency gain.

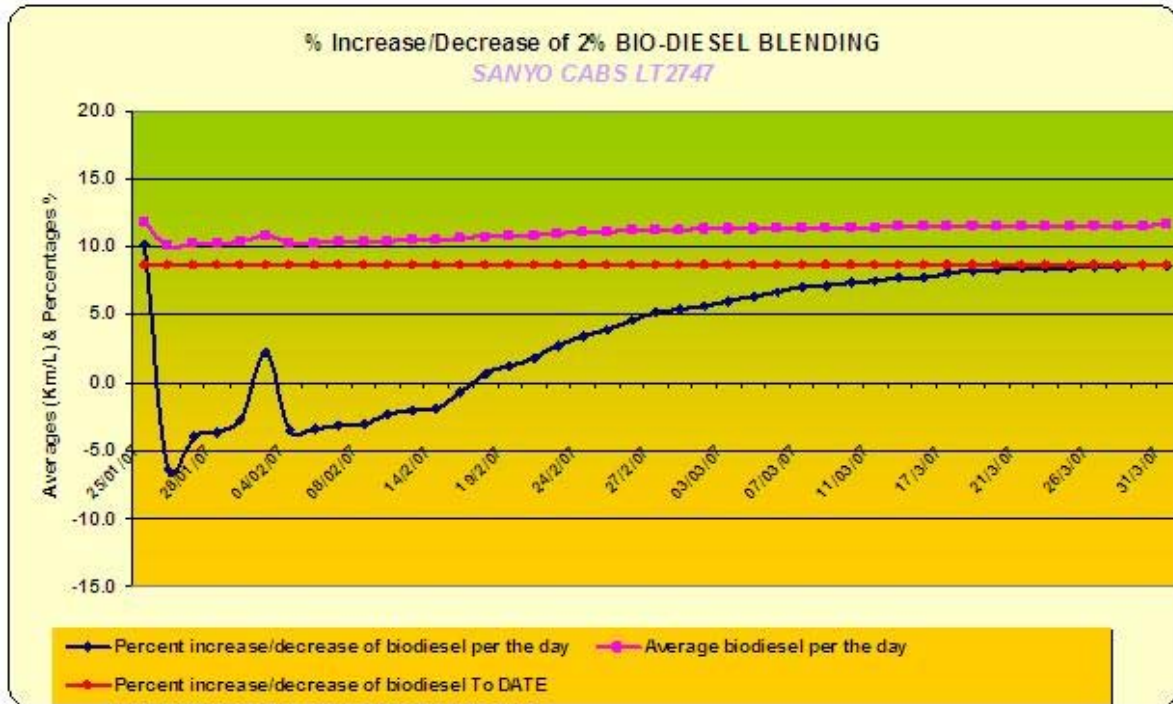
The gain in efficiency to the litre of coco diesel fuel increased the traveling distance to 928 meters.



**GRAPH 8**

If the first three weeks, prior to the fuel filter change is taken as the transition period, the change from diesel fuel to coco diesel fuel, than a remarkable improvement in efficiency is gained, that is an extra 1.5 Kilometers in traveling distance compared to diesel fuel.

That is coco diesel average efficiency of 12.2 Km/L compared to diesel fuel average of 10.7 Km/L.



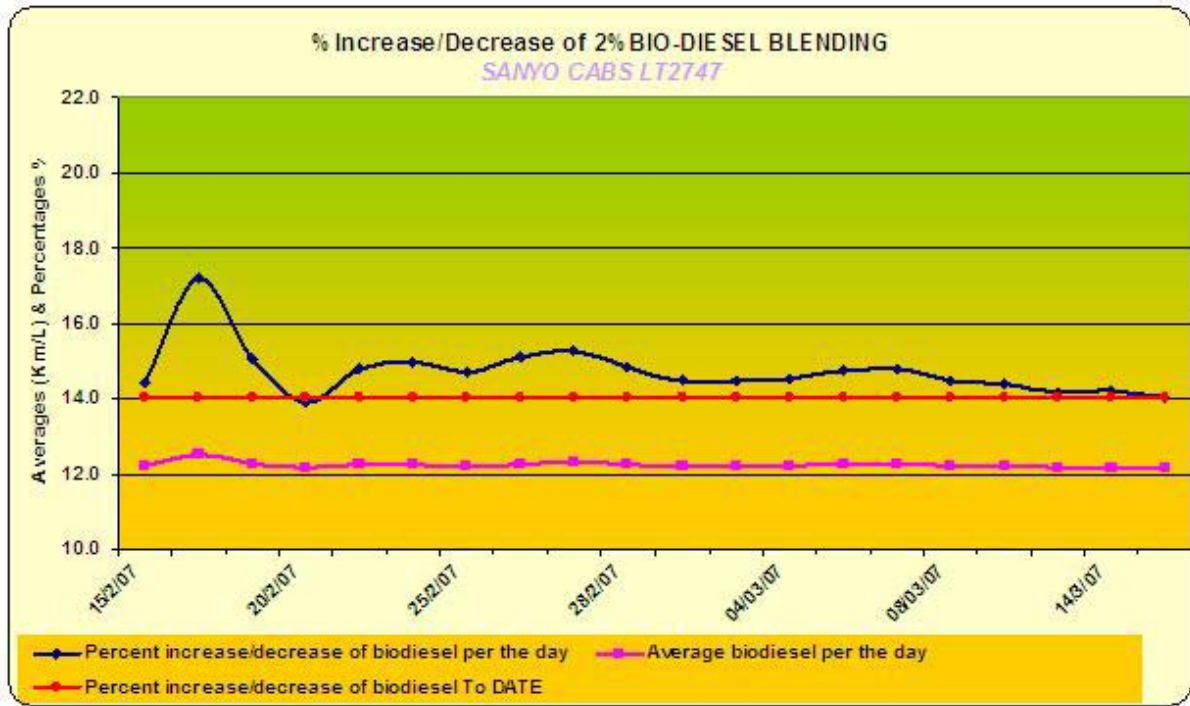
**GRAPH 9**

The percent increase or decrease of coco diesel on Graphs 9 and 10 shows two scenarios.

Data on Graph 9 shows before and after the fuel filter change. After the fuel change on the 14<sup>th</sup> of February, the % increase had a positive upward trend.

The fuel efficiency improved by 8.7%





**GRAPH 10**

Whereas Graph 10, shows data after the fuel filter change. Here the coco diesel fuel efficiency improved by 14.1%.

Also a great improvement in smoke emission level from diesel 63% to coco diesel 34% which gives an improvement in smoke emission of 46%.

**8.2.1. Sanyo Cabs Fuel Consumption Cost**

Total Diesel Consumed (L)	342.39	Diesel Cost/Litre	\$1.39
Total CME Consumed (L)	6.86	CME Cost/Litre	\$2.93
Total Biofuel Blending (L)	349.25	Biofuel Cost/Litre	\$1.42
Total Diesel Cost	\$475.92	Cost of Diesel to Travel 1Km	\$0.130
Total CME Cost	\$20.10	Cost of Biofuel to Travel 1Km	\$0.117
Total Biofuel Cost	\$496.02	Loss/savings	\$0.014
Total distance traveled in 1 months (Km)	4237		
Loss/savings for 1 months	\$57.43		
Loss/savings in 1 year	\$689.20		

**Table 7**

The savings gained when using coco diesel fuel to travel a distance of 1 kilometer is one cent.

This savings gained will depend on the kilometers traveled. With the data collected, Regent taxi traveled a distance of approximately 4,237 kilometers in one month.

And the savings for fueling coco diesel is roughly \$689 for a period of one year.

Table 7 above shows a summarised detail of fuel consumption cost for Regent Taxi.

### **8.3. Summary Taxi Results**

The coco diesel fuel test on the two taxis had shown a remarkable improvement.

Both vehicles have demonstrated that coco diesel is the way forward to improve both fuel efficiency and reduction in smoke emissions.

Comparing the saving between Regent and Sanyo taxis, in terms of yearly saving, Regent shows a saving of around \$1,500 to that of Sanyo Cabs \$689.

This is due to the distance traveled. Regent traveled more kilometers than that of Sanyo Cabs.

Company	Cost of Diesel to Travel 1Km	Cost of Biofuel to Travel 1Km	Loss/savings Cost of Biofuel to travel 1Km	% Increase or Decrease in coco diesel Efficiency	Diesel % Opacity Average	Biodiesel % Opacity Average
Regent Taxis	\$0.161	\$0.144	\$0.017	14.35	81.3	36.6
Sanyo Cabs	\$0.130	\$0.117	\$0.014	14.05	63.2	34.1

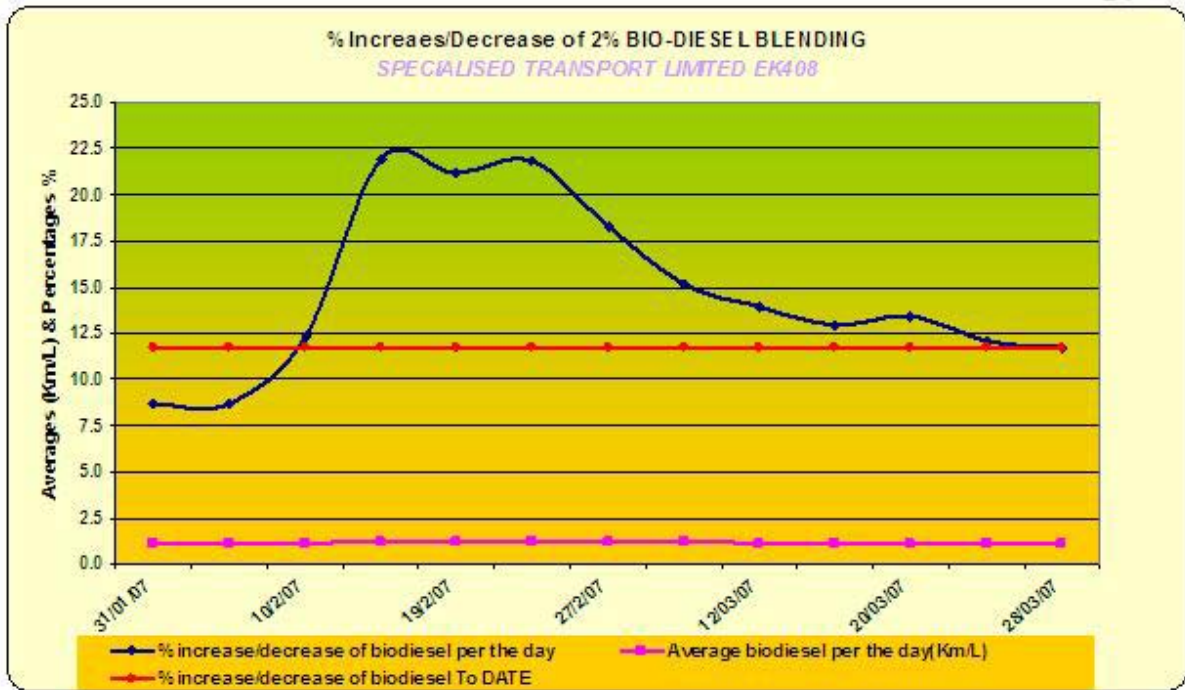
**Table 8**

A second smoke emission test will be conducted to see if there will be a further reduction in smoke emissions.

The two taxis continue using the coco diesel fuel.

### **8.4. Test Results – Container Trucks**

The container truck from Specialised Transport Fiji Limited had shown improvements in both coco diesel efficiency and smoke emission.



**GRAPH 11**

Graph above shows a few data around the 20% region and then decline in a consistent manner towards 12% region.

This may be due to carrying heavier loads but nevertheless the % increase has always been above 7%.

Smoke test also has improved dramatically from diesel smoke test acquired 63.7% and coco diesel smoke test of 38.4%.

This improvement in smoke test constitutes an improvement of 40%.

**8.4.1. STFL Fuel Consumption Cost**

The savings gained using coco diesel fuel is approximately \$1,370.

Total Diesel Consumed (L)	1709.29	Diesel Cost/Litre	\$1.39
Total CME Consumed (L)	36.20	CME Cost/Litre	\$2.93
Total Biofuel Blending (L)	1745.49	Biofuel Cost/Litre	\$1.42
Total Diesel Cost	\$2,375.91	Cost of Diesel to Travel 1Km	\$1.382
Total CME Cost	\$106.07	Cost of Biofuel to Travel 1Km	\$1.265
Total Biofuel Cost	\$2,481.98	Loss/savings	\$0.117
Total distance traveled in 2 months (Km)	1959.2		
Loss/savings for 2 months	\$228.37		
Loss/savings in 1 year	\$1,370.24		

**Table 9**



Summarising the results for the STFL container truck, coco diesel has made a good impression in both fuel efficiency and smoke emission.

### **8.5. Test Results – 4WD’s**

Jan Cloin of SOPAC had his vehicle a 4WD Surf tested with coco diesel fuel. The fuel used prior to coco diesel is a mixture of coconut oil, diesel and kerosene.

The mixed fuel had an average fuel efficiency of 6.85 Km/L while coco diesel had an average of 7.04 Km/L.

Total Diesel Consumed (L)	376.09	Diesel Cost/Litre	\$1.39
Total CME Consumed (L)	7.53	CME Cost/Litre	\$2.93
Total Biofuel Blending (L)	383.62	Biofuel Cost/Litre	\$1.42
Total Diesel Cost	\$522.77	Cost of Diesel to Travel 1Km	\$0.203
Total CME Cost	\$22.05	Cost of Biofuel to Travel 1Km	\$0.202
Total Biofuel Cost	\$544.81	Loss/savings	\$0.001
Total distance traveled in 1 months (Km)	2587		
Loss/savings for 2.5 months	\$3.35		
Loss/savings in 1 year	\$16.06		

**Table 10**

The improvement of coco diesel to that of mixed fuel is equivalent to a gain of 190 metres. The estimated yearly savings is a minimal because of very low distance traveled.

More data is required to give a realistic estimation of coco diesel fuel efficiency.

The mixed fuel had an opacity level of 50% and yet to measure coco diesel opacity test.

## **9. Vehicles Completing Test In May**

Vehicles completing the test in May consist of two container trucks from Williams and Gosling, one Taxi from Flagstaff Taxis and two 4WD’s, one each from Land Transport Authority and the Fiji Electricity Authority.

It is inappropriate to analyse available data from these vehicles because data received is only for a short duration of one month.

But out of these vehicles, the vehicle from The Fiji Electricity Authority shows a marginal positive sign of improvement of 0.9%.

The rest of the vehicles show negative signs and it is appropriate to have more data<sup>26</sup> that could be analysed accurately.

As for coco diesel smoke tests on the Fiji Electricity Authority Vehicle, the % opacity level is 17 %.

The % opacity on the remaining vehicles will be done in the new future.

## 10. Summary

If we consider the results of vehicles that are completing the test by the end of April, then 75% of the vehicles have shown improvements using coco diesel as fuel.

If we then look at all the vehicles having coco diesel data, then 62% of the vehicles have shown improvements using coco diesel as fuel. This includes vehicles completing the coco diesel test in May, June and July.

For the two buses completing the test in April, Tebara Transport and Shore Buses, had coco diesel fuel efficiencies below the diesel efficiencies.

The two buses do not have signs of even getting closer to the breakeven efficiency point. This test has demonstrated that not all vehicles will have a positive outcome. All was done to try and improve the buses coco diesel performance by changing fuel filters and servicing.

The engines of the buses are Nissan (Tebara Transport) and Isuzu (Shore Buses).

The Toyota Caldina Taxis have demonstrated excellent fuel efficiencies using coco diesel fuel. And also the container truck from Specialised Transport Fiji Limited.

But definitely, coco diesel fuel improves smoke emissions. Summarised results are shown on Table 11 below.

COMPANIES	Complete test on Month Of	Average Diesel (Km/L)	Average Bio Diesel (Km/L)	Diff (Km/L)	Percent increase / decrease	loss/saving on coco diesel in a yr	Diesel %Opacity Test	Biofuel Smoke Test	% Blend
Regent Taxis	April	8.63	9.87	1.24	14.35	\$1,527.67	81.3	36.6	1.9
STFL	April	1.01	1.12	0.12	11.72	\$1,370.24	63.7	38.4	2.1
Dee Cees	April	2.63	2.90	0.27	10.39	\$1,775.62	77.1	9.0	1.9
Sanyo Cabs	April	10.68	12.18	1.50	14.05	\$689.20	63.2	34.1	2
Bureta Cabs	June	10.66	11.35	0.69	6.49	\$450.37	93.1		2.2
Island Buses	April	2.86	2.98	0.12	4.29	\$591.26	54.2	64.8	2.1
SOPAC-EH276	April	6.85	7.04	0.19	2.83	\$16.06	49.7		2
FEA	May	6.53	6.58	0.06	0.86	(\$164.93)		17.2	2
LTA-EP224	May	8.92	8.88	(0.04)	(0.42)	(\$182.26)	30.4		1.9
Nasese Buses	July	2.85	2.82	(0.03)	(1.16)	(\$1,192.00)	96.4		2
Tebara Trans	April	2.34	2.26	(0.08)	(3.34)	(\$2,010.68)	80.5		1.9
Flagstaff Taxis	May	13.49	12.87	(0.62)	(4.57)	(\$122.47)	74.4		1.9
Shore Buses	April	1.86	1.72	(0.13)	(7.19)	(\$3,264.15)	68.7	54.9	1.9
WG-DZ134	May	1.43					22.1		
WG-DE536	May	1.87					56.8		
Wing Lee	July								
LTA-FA188	July								
SOPAC 1	June						2.2		

Vehicles eliminated or discontinued coco diesel test	Discontinue Test on	Average Diesel (Km/L)	Average Bio Diesel (Km/L)	Diff (Km/L)	Percent increase / decrease	loss/saving on coco diesel in a yr	Diesel %Opacity Test	Biofuel Smoke Test	% Blend
Nairs Transport	Feb	2.48	2.45	(0.03)	(1.22)	(\$1,412.42)	38.0		1.4
Nadera Transport	April	2.32	2.27	(0.04)	(1.88)	(\$1,567.79)	45.4		1.8
Matua Taxis	Mar	3.07	2.82	(0.25)	(8.08)	(\$474.86)	92.5		1.5
WG-DP276	Mar	9.78	12.47	2.69	27.46	\$1,560.88			2.2

**Table 11**

## **11. Recommendations**

Two vehicles have failed the 2% coco diesel / 98% diesel fuel test.

The 2% coco diesel blend is a trail and the blending percentage could be increased.

A recommendation is to increase the blending percentage for vehicles completing tests ending on April.

A blending percentage of 5% would be adequate to have new findings in efficiencies and smoke emissions.