

Pilot Green Transport Fund

Final Report On Trial of Hybrid Light Goods Vehicles for Logistics Service (Atta-Trans Limited)

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The Monitoring and Evaluation Team's views expressed in this report do not necessarily reflect the views of the Environmental Protection Department, HKSAR.

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**Pilot Green Transport Fund
Trial of Hybrid Light Goods Vehicles for Logistics Service
(Atta-Trans Limited)**

**Final Report
(Trial Period: 1 February 2017 – 31 January 2019)**

Executive Summary

1. Introduction

1.1 The Pilot Green Transport Fund (the Fund) is set up to encourage transport operators to try out green innovative transport technologies, contributing to better air quality and public health for Hong Kong. The Fund has subsidized Atta-Trans Limited (Atta-Trans) to try out three hybrid light goods vehicles (HVs) for logistics service.

1.2 PolyU Technology and Consultancy Company Limited has been engaged by the Environmental Protection Department as an independent third party assessor (the assessor) to monitor this trial and evaluate the operational performance of the trial vehicles. The assessor regularly visited Atta-Trans to collect information for evaluating the performance of the three HVs as compared with the three conventional diesel light goods vehicles (DVs) which provided the same service in the same area and road conditions. The information collected included the said vehicles' operation data, fuel bills, maintenance records, reports on operation difficulties, and opinions of the HVs drivers from survey questionnaires.

1.3 This report summarizes the performance of the HVs for logistics service in the 24-month trial as compared with their respective conventional counterparts, i.e. the DVs.

2. Trial Vehicles

2.1 Atta-Trans procured three Hino 300 series hybrid light goods vehicles (HV-1, HV-2 and HV-3) each of 5,500 kg gross vehicle weight (GVW) and 4,009 cc cylinder capacity for trial.

2.2 Three Mitsubishi Fuso diesel light goods vehicles of 5,500 kg GVW, two of which of 2,998 cc cylinder capacity (DV-1 & DV-3) and the other one of 4,899 cc cylinder capacity (DV-2), were assigned for comparison with the HVs. All vehicles were equipped with air-conditioning units.

2.3 Key features and photos of the HVs and DVs are in Appendices 1 and 2 respectively.

3. Trial Information

3.1 The 24-month trial started on 1 February 2017. Two pairs of vehicles (HV-1 and DV-1; HV-2 and DV-2) operated from Kwai Chung Depot to deliver freight to Kowloon and Hong Kong Island areas; the third pair of vehicles (HV-3 and DV-3) operated from Kwai Chung Depot to

deliver freight to Tsuen Wan and Kwai Chung areas. There was no fixed route. The vehicles provided service every day from 8:00 am to 6:00 pm, except Sundays and public holidays.

4. Findings of Trial

4.1 Operating Costs

4.1.1 Table 1 shows a summary of the all key statistics for each vehicle. The average fuel costs of HV-1, HV-2 and HV-3 were lower than those of DV-1, DV-2 and DV-3 by 13%, 8% and 7%, respectively. The fleet average fuel cost of the three HVs was 9% (HK\$0.2/km) lower than that of the DVs.

4.1.2 The average total operating cost of HV-1, HV-2 and HV-3 were about 37%, 33% and 22% lower than those of DV-1, DV-2 and DV-3, respectively. The fleet average total operating cost of three HVs was about 32% (HK\$1.09/km) lower than that of the DVs.

Table 1: Key operation statistics of each vehicle (February 2017 –January 2019)

	HVs			DVs		
	HV-1	HV-2	HV-3	DV-1	DV-2	DV-3
Total mileage (km)	69,796	89,905	88,154	87,130	77,680	87,256
Average fuel economy (km/litre)	7.00	6.59	6.31	6.05	6.11	5.96
Average fuel cost (HK\$/km) ^[1]	1.84	1.94	2.01	2.12	2.12	2.15
Fleet average fuel cost (HK\$/km)	1.93			2.13		
Average total operating cost (HK\$/km)	2.34	2.36	2.41	3.73	3.53	3.11
Fleet average total operating cost (HK\$/km)	2.37			3.46		
Downtime (working day) ^{[2] [3]}	26	15	14	131	61	37

[1] The market rate was adopted for calculation.

[2] Downtime refers to the equivalent number of working days in which the vehicle is not in operation due to charging, and the period the vehicle is not in operation due to maintenance, counting from the first day it stops operation till the day it is returned to the operator.

[3] Maintenance due to incidents unrelated to the performance of the vehicle was not included for comparison.

4.2 Operating Cost Benefits

4.2.1 Besides fuel costs, maintenance cost and other costs associated with breakdowns, such as replacement of components and parts, were also accounted for in calculating the total operating cost. It should be noted that the maintenance cost of the HVs did not include labour cost as the vehicles were still under warranty, the labour cost was waived and only the parts to be replaced

were charged. The fleet average total operating cost of the HVs was about 32% lower than that of the DVs.

4.2.2 During the 24-month trial period, all three HVs had a scheduled maintenance for renewal of annual vehicle license each year. HV-1, HV-2 and HV-3 had seven, eight and seven additional scheduled maintenances respectively, involving vehicle washed and waxed as well as check-up and replacing of lubricating oil and filters. There were three unscheduled maintenances for HV-1, involving tyres puncture and worn out and gear lock failure. HV-2 had six unscheduled maintenances involving tyres puncture or worn out, front panel damages and windscreen crack. HV-3 had two unscheduled maintenances involving tyres worn out and tail lift platform malfunction. All unscheduled maintenances for HVs were unrelated to the vehicle performance and thus excluded from the comparison. Out of the 603 working days in the trial, there were 26 days, 15 days and 14 days of downtime for HV-1, HV-2 and HV-3 respectively, while DV-1, DV-2 and DV-3 had 131 days, 61 days and 37 days of downtime respectively, excluding the downtime unrelated to the vehicle performance. The utilization rates were 96%, 98% and 98% for HV-1, HV-2 and HV-3, and 78%, 90% and 94% for DV-1, DV-2 and DV-3 respectively.

4.3 Performance and Reliability

4.3.1 Atta-Trans had designated drivers for the HVs. The drivers found no problem in operating the HVs and in general felt the HVs were clean and less polluted. However, they reflected that the HVs responded slower and less powerful than DVs especially driving upslope.

4.3.2 Atta-Trans was satisfied with the HVs in general but would not consider replacing the entire vehicle fleet with hybrid vehicles at this stage because they are uncertain whether the hybrid vehicles are better performed than the conventional diesel vehicles in particular the fuel economy and power upslope.

4.3.3 To remove the effect of seasonal fluctuations, 12-month moving averages are used to evaluate the trend of the HV's fuel economy. The results show that fuel economy of the HVs fluctuated slightly over the 24-month trial period. It appears that the engines of the HVs were still in normal working conditions and the fuel economy could be maintained through proper maintenance.

4.3.4 The carbon dioxide equivalent (CO_{2e}) emissions from HV-1, HV-2 and HV-3 were 27,645 kg, 37,797 kg and 38,736 kg, respectively while those from the conventional vehicles DV-1, DV-2 and DV3 would be 31,975 kg, 40,798 kg and 40,986 kg respectively. There was thus a total reduction of 9,581 kg CO_{2e} emission (i.e., around 8%) in the trial by using the three HVs compared with the three DVs.

5. Summary

5.1 With a total of 603 working day in the 24-month trial period, the average daily mileages of HV-1, HV-2 and HV-3 are 116, 149 and 146 km respectively while that for DV-1, DV-2 and DV-3 are 144, 129 and 145 km respectively. The mileages of all vehicles are comparative. The three HVs had a better fuel economy than the three DVs. The fleet average fuel cost of the three HVs was 9% lower than that of the DVs. Including the maintenance costs, the fleet average total operating cost of the three HVs was 32% lower than that of the DVs. There was a total of 9,581 kg CO_{2e} reduction (i.e., 8%) by using HVs during the 24-month trial period as compared with DVs.

5.2 The three HVs and the three DVs had two scheduled annual examination and maintenance each for renewal of vehicle license in the 24-month trial period. HV-1, HV-2 and HV-3 had seven, eight and seven additional scheduled maintenances as well as three, six and two unscheduled maintenances respectively (excluding maintenances unrelated to vehicle performance). There were 26 days, 15 days and 14 days of downtime for HV-1, HV-2 and HV-3, and 131 days, 61 days and 37 days of downtime DV-1, DV-2 and DV-3 respectively, excluding those downtimes unrelated to the vehicle performance. The utilization rates were 96%, 98% and 98% for HV-1, HV-2 and HV-3, and 78%, 90% and 94% for DV-1, DV-2 and DV-3 respectively.

5.3 No deterioration in the performance of the HVs was observed during the trial period.

5.4 The drivers had no problem in operating the HVs except that the HVs responded slower than the DVs and had less power than the DVs especially when driving upslope. Atta-Trans was satisfied with the HVs but was hesitant to replace the entire vehicle fleet with the HVs because they are uncertain of the benefits of the HVs.

Appendix 1: Key Features of Vehicles

1. Trial HVs

Registration Mark JZ9370 (HV-1)

Make: Hino
Model: 300 Series Hybrid XKU720R-HKUQS3
Class: Light goods vehicle
Gross Vehicle Weight: 5,500 kg
Seating Capacity: driver + 2 passengers
Cylinder Capacity: 4,009 cc
Year of Manufacture: 2016

Registration Mark KA239 (HV-2)

Make: Hino
Model: 300 Series Hybrid XKU720R-HKUQS3
Class: Light goods vehicle
Gross Vehicle Weight: 5,500 kg
Seating Capacity: driver + 2 passengers
Cylinder Capacity: 4,009 cc
Year of Manufacture: 2016

Registration Mark MM2862 (HV-3)

Make: Hino
Model: 300 Series Hybrid XKU720R-HKUQS3
Class: Light goods vehicle
Gross Vehicle Weight: 5,500 kg
Seating Capacity: driver + 2 passengers
Cylinder Capacity: 4,009 cc
Year of Manufacture: 2016

2. DVs for comparison

Registration Mark HX1383 (DV-1)

Make: Mitsubishi Fuso
Model: FEC71GR3SDAD
Class: Light goods vehicle
Gross Vehicle Weight: 5,500 kg
Seating Capacity: driver + 2 passengers
Cylinder Capacity: 2,998 cc
Year of Manufacture: 2012

Registration Mark NR2003 (DV-2)

Make: Mitsubishi Fuso
Model: FE83DGZSRDAA
Class: Light goods vehicle
Gross Vehicle Weight: 5,500 kg
Seating Capacity: driver + 2 passengers
Cylinder Capacity: 4,899 cc
Year of Manufacture: 2010

Registration Mark RB1500 (DV-3)

Make: Mitsubishi Fuso
Model: FEC71GR4SDAD
Class: Light goods vehicle
Gross Vehicle Weight: 5,500 kg
Seating Capacity: driver + 2 passengers
Cylinder Capacity: 2,998 cc
Year of Manufacture: 2012

Appendix 2: Photos of the Trial Vehicles

1. Trial HVs

	
<p>Front view of JZ9370 (HV-1)</p>	<p>Side view of HV-1</p>
	
<p>Side view of HV-1</p>	<p>Rear view of HV-1</p>
	
<p>Front view of KA239 (HV-2)</p>	<p>Side view of HV-2</p>



Side view of HV-2



Rear view of HV-2



Front view of MM2862 (HV-3)



Side view of HV-3



Side view of HV-3



Rear view of HV-3

2. DVs for comparison



Front view of HX1383 (DV-1)



Front view of NR2003 (DV-2)



Front view of RB1500 (DV-3)