

Pilot Green Transport Fund

Final Report On Trial of Hybrid Light Goods Vehicle for Moving Service (K.C. Dat Limited)

(26 August 2020)

PREPARED BY:

Dr. Joe K. W. LO
Mr. Bruce ORGAN

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

List of Monitoring and Evaluation Team Members

Dr. Joe K.W. LO (Team Leader)

Centre Manager

Jockey Club Heavy Vehicle Emissions Testing and Research Centre

Hong Kong Institute of Vocational Education (Tsing Yi)

Mr. Bruce Organ (Team Member)

Emission Manager

Jockey Club Heavy Vehicle Emissions Testing and Research Centre

Hong Kong Institute of Vocational Education (Tsing Yi)

**Pilot Green Transport Fund
Trial of Hybrid Light Goods Vehicle for Moving Service
(K.C. Dat Limited)**

**Final Report
(Trial Period: 1 December 2015 – 30 November 2017)**

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. K.C. Dat Limited (KC Dat) was approved under the Fund for trial of one diesel-electric hybrid light goods vehicle (LGV) for moving service. Through the tendering procedures stipulated in the Subsidy Agreement, KC Dat procured one Mitsubishi Fuso Canter Eco Hybrid 5,500 kg diesel-electric hybrid LGV (HV) for trial.

1.2 Hong Kong Institute of Vocational Education (Tsing Yi) has been engaged by the Environmental Protection Department as an independent third party assessor to monitor the trial and evaluate the performance of the trial vehicle. KC Dat assigned a 5,500 kg diesel LGV providing the same type of service as the conventional vehicle for comparing with the HV.

1.3 This report summarizes the performance of the HV in the 24 months of the trial as compared with its conventional diesel counterpart.

2 Trial and Conventional Vehicles

2.1 KC Dat procured one Mitsubishi Fuso Canter Eco Hybrid LGV (i.e. HV) with a gross vehicle weight (GVW) of 5,500 kg and cylinder capacity of 2,998 c.c. The HV was used to provide moving service.

2.2 One Hino 300 series diesel LGV (DV) with a GVW of 5,500 kg and cylinder capacity of 4,009 c.c. was assigned for comparison with the HV in this trial. The HV and DV were used for moving service across all areas of Hong Kong.

2.2 Key features of the HV and the DV are shown in Appendix 1 and their photos are shown in Appendix 2.

3. Trial Information

The trial started on 1 December 2015 and lasted for 24 months. KC Dat was required to collect and provide trial information including the HV odometer reading at refueling, the date of refueling, the refueled amount, cost and operation downtime associated with scheduled and unscheduled maintenance of the HV. Similar set of data from the DV was also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the driver and KC Dat were also collected to reflect any problems of the HV. The service hours of the vehicles are from 07:30 to 19:30 from Monday to Saturday.

4. Findings of Trial

4.1 Table 1 summarizes the key operation statistics of the HV and the DV. The average fuel cost of the HV was HK\$0.63/km (about 25%) lower than that of the DV. The average total operating cost of the HV was HK\$0.54/km (about 21%) lower than that of the DV.

Table 1: Key operation statistic of each vehicle (December 2015 – November 2017)

	HV	DV
Total mileage (km)	45,309	37,124
Average fuel economy (km/litre)	5.87	4.42
Average fuel cost (HK\$/km) ^[1]	1.91	2.54
Average total operating cost/ (HK\$/km)	2.00	2.54
Downtime (working day) ^{[2][3]}	19	4

^[1] 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 maintenance, counting from the first day it stops operation till the day it is returned to the operator.

^[3] Unscheduled maintenance due to incidents unrelated to the performance of the vehicle were not included for comparison.

4.2 During the trial period, the HV had 6 scheduled maintenances and 3 unscheduled maintenances, resulting in 19 days of operation downtime. The DV had 1 scheduled maintenance, resulting in 4 days of operational downtime. There was no unscheduled maintenance for the DV. The utilization rates of the HV and DV were 97%, and 99% respectively.

4.3 Although the driver had adapted to the HV operation, he felt that the HV was lacking driving power while going uphill with full load and feared that there might be a serious hazard if the vehicle stalled. The driver also thought that the slow response time of gear shifting for the HV increased the difficulties for driving and the risk of accident.

4.4 Overall, KC Dat considered that the performance of the HV could meet their expectation on fuel cost saving and the operational requirements.

4.5 To eliminate the effect of seasonal fluctuation, 12-month moving averages were used to evaluate the trend of the HV's fuel economy. The fuel economy varied between 5.81 and 5.93 km/litre (i.e. about 2% variation) for the HV. During the 24-month trial period, the variation of fuel economy of the HV was not significant, indicating that there was no significant deterioration of the HV during the trial period.

4.6 Based on the mileage of the HV, the equivalent fuel consumption by the DV in the trial and hence the associated carbon dioxide (CO_{2e}) emission can be evaluated based on the CO_{2e} emission per litre of fuel consumed. The CO_{2e} emissions from the HV was 21,383 kg, while that from the DV was 28,445 kg. Hence, the CO_{2e} emission from the HV was 7,062 kg (about 25%) lower than that from the DV during the trial period.

5. Summary

5.1 Although the driver adapted to the HV operation, he felt that the HV was lacking driving power while going uphill with full load and feared that there might be a serious hazard if the vehicle stalled. The driver also thought that the slow response time of gear shifting for the HV increased the difficulties for driving and the risk of accident. From the view of KC Dat, the performance of the HV could meet their expectation on fuel cost saving and the operational requirements.

5.2 The utilization rates of the HV and DV were 97% and 99% respectively. During the 24-month trial period, the variation of fuel economy of the HV was not significant, indicating that there was no significant deterioration of the HV. The usage of the HV was on the high side as reflected in the difference in the total mileage travelled between the HV (45,309 km) and the DV (37,124 km).

5.3 The HV incurred a lower average fuel cost of HK\$0.63/km (about 25%) compared to the DV. Taking into account the maintenance costs, the average total operating cost of the HV was about HK\$0.54/km (about 21%) lower than that of the DV. The CO_{2e} emission from the HV was 7,062 kg (about 25%) lower than that from the DV during the trial period.

Appendix 1: Key Features of Vehicles

1. Trial HV

Registration Mark	TS9571
Make:	Mitsubishi Fuso Canter Eco Hybrid
Model:	FEB74GR3SDAL
Class:	Light Goods Vehicle
Gross vehicle weight:	5,500 kg
Seating capacity:	Driver + 5 passengers
Year of manufacture:	2014
Cylinder Capacity:	2,998 c.c.

2. DV for comparison

Registration Mark	TL3055
Make:	Hino
Model:	300 Series XZU720R-HKTQS3
Class:	Light Goods Vehicle
Gross vehicle weight:	5,500 kg
Seating capacity:	Driver + 2 passengers
Year of manufacture:	2015
Cylinder Capacity:	4,009 c.c.

Appendix 2: Photos of Vehicles

1. Trial HV



2. DV for comparison



Front view of DV



Rear view of DV



Left side view of DV



Right side view of DV