Pilot Green Transport Fund

Final Report
On
Trial of Hybrid Light Goods Vehicles for Transportation Industry (MTR)

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Trial of Hybrid Light Goods Vehicles for Transportation Industry
(MTR)

Final Report
(Trial Period: 1 April 2013 – 31 March 2015)

Executive Summary

1. Introduction

1.1 The Pilot Green Transport Fund (the Fund) is set up to encourage transport operators to try out green and innovative transport technologies, contributing to better air quality and public health for Hong Kong. MTR Corporation Limited (MTR) was approved under the Fund for trial of one hybrid light goods vehicle for services in the transportation industry. Through the tendering procedures stipulated in the Agreement, MTR procured one Mitsubishi FUSO Canter Eco Hybrid light goods vehicle for trial. It is referred to as HV, in this report.

1.2 PolyU Technology and Consultancy Company Limited (PolyU) has been engaged by the Environmental Protection Department (EPD) as an independent third-party assessor to monitor the trials and evaluate the performance of the green innovative transport technologies under trial as compared with their conventional counterparts. In this trial, MTR assigned one diesel light goods vehicle (DV) providing similar services in the similar areas and road conditions as the conventional vehicle for comparing with the HV. The information collected includes the said vehicle's operation data, fuel bills, maintenance records, reports on operation difficulties, and opinions of the HV drivers from survey questionnaires.

1.3 This Final Report summarizes the performance of the HV in the 24-month trial as compared with their conventional counterpart, i.e. the DV.

2. Trial Vehicle

2.1 MTR procured one 5.5 tonnes GVW Mitsubishi FUSO Canter Eco Hybrid light goods vehicle (HV) of 2998 cc cylinder capacity for trial. The HV was used for delivering spare parts and other materials from Kowloon Bay depot to other MTR stations and MTR-owned land properties.

2.2 One 5.5 tonnes GVW Hino diesel light goods vehicle (DV) of 4009 cc cylinder capacity was assigned for comparing with the HV.

2.3 Key features and photos of the HV and the DV are in Appendices 1 and 2 respectively.

3. Trial Information

3.1 The 24-month trial started on 1 April 2013. Both HV and DV were stationed at the depot of MTR in Kowloon Bay. The vehicles operated from Monday to Saturday on need basis and the service routes were random.

4. Findings of Trial

4.1 Operating Costs

4.1.1 Table 1 below summarizes the fuel cost data of the HV and the DV. The average fuel cost of the HV was about 8% lower than that of the DV.

Table 1: Key operation statistics of each vehicle (from April 2013 to March 2015)

	Hybrid Light Goods Vehicle (HV)	**Diesel Light Goods Vehicle (DV)**
Total distance travelled (km)	26,393	27,812
Average fuel economy (km/litre)	6.96	6.42
Average fuel cost (HK$/km) [1]	1.77	1.92
Total operating cost (HK$) [2]	63,649.4 [4]	75,749.8
Average total operating cost (HK$/km)	2.41	2.72
Downtime (working days) [3]	18	10

[1] The market fuel price is used for calculation.
[2] Cost of maintenance due to incident not related to the performance of the vehicle or major overhauls, exceptional incidents due to the old age of the vehicle were excluded in comparison
[3] Downtime refers to the period the vehicle is not in operation, which is counted from the first day it stopped operation till the day it returned to operation
[4] The labor cost was waived in the first two scheduled maintenance and only the parts to be replaced were charged.

4.1.2 In fact, the vehicle operating conditions and the drivers' driving habit would affect its fuel saving performance. According to the manufacturer's information, the trial vehicle could save up to about 20% fuel per km as compared with its diesel counterpart if it travels in urban areas at an average speed of 20 km/h with frequent start-stops. If it travels in suburban areas or on highways at an average speed of 44 km/h, the fuel saving performance will however be reduced to about 12% because the energy recovered by the electric generator at start-stops is much reduced. On average, the HV saved 8% fuel as compared to the DV, a possible explanation for the lower fuel saving performance is that the trial HV travelled part of its journeys on suburban and highways, and hence it was unable to achieve the best fuel saving performance according to the manufacturer because of less start-stops to recover the energy by the electric generator as compared to traveling in urban areas. Therefore, the trial HV was unable to achieve the best fuel saving performance.

4.1.3 During the reporting period, the HV had undergone four scheduled maintenances and two unscheduled maintenances due to a failure in starting the engine and another due to damages in structural components and vehicle door. The total maintenance cost was HK$16,899.8. It should be noted that in the first two scheduled maintenances of the hybrid vehicle, the labor cost was waived and only the parts to be replaced were charged. The utilization rate of the HV was 97%.

4.1.4 The average total operating cost included maintenance costs and other indirect costs such as towing fee, vehicle replacement fee. The HV and the DV incurred only fuel and maintenance fees in this trial. The average total operating cost of the HV was 11% lower than that of the DV.

4.2 Performance and Reliability

4.2.1 MTR had no designated driver for the HV. All the HV drivers had no problem in operating the HV. They reflected that the HV lacked power in going uphill and slower reaction as compared with the DV

4.2.2 Overall, MTR was satisfied with the performance of the HV. MTR agreed that using hybrid vehicle is good because it can provide a greener environment.

4.2.3 To remove the effect of seasonal fluctuations, 12-month moving averages are used to evaluate the trend of the HV's fuel economy. For the HV, the fuel economy varied from 6.85 km/litre to 7.57 km/litre. There is no indication of deteriorating fuel economy. It appears that the engine of the HV was still in normal working conditions and the fuel economy could be maintained through proper maintenance.

4.2.4 The equivalent carbon dioxide (CO_2) emission from the HV was 10,507 kg, while that from the DV was 11,406 kg. Therefore, there is a total reduction of 899 kg (7.9%) CO_2 emission in the trial.

5. Summary of Findings

5.1 The vehicle operating conditions and the drivers' driving habit would affect the fuel saving performance of the hybrid vehicle. The trial HV travelled part of its journeys on suburban and highways, and hence it was unable to achieve the best fuel saving performance according to the manufacturer. Nevertheless, the HV in general has better fuel economy than the DV. The HV saved an average of 8% of fuel when traveling on suburban and highways as compared to the DV.

5.2 The HV drivers reflected that it took time to familiarize with the operation of the HV, especially in the automatic switch of gear ratio when going uphill or when the vehicle was travelling at low speed. They reflected that the HV lacked power in going uphill as compared with the DV. According to the supplier, one of the factors contributing to the feeling of being less

powerful is that the HV have a less powerful engine than conventional one. Overall, the drivers were satisfied with the performance of the HV.

5.3 The HV had regular scheduled maintenance similar to the DV. There were 596 working days in the 24-month trial period and the HV had lost 18 days. The utilization rate of the HV was 97%. The DV had lost 10 days and its utilization rate was 98%.

5.4 No deterioration in the performance of the HV was observed during the trial period.

5.5 The total reduction of CO_2 emission in the trial was 899 kg, about 8% lower than the emission of the DV.

Appendix 1: Key Features of Vehicles

1. Hybrid light goods vehicle under trial (HV)

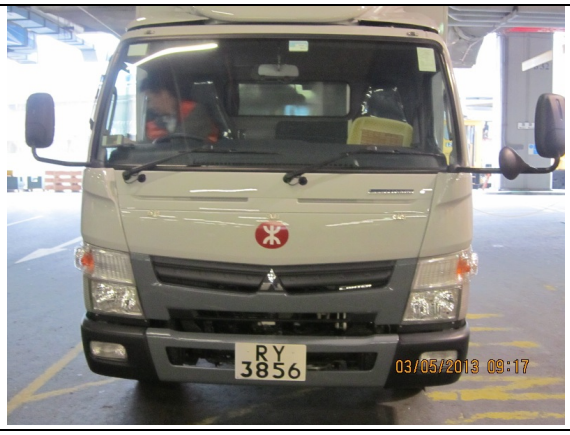
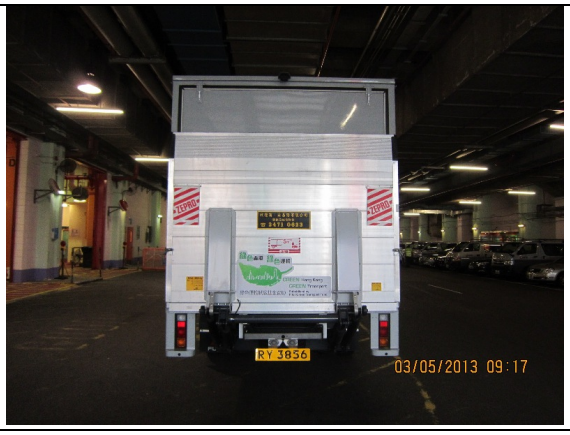
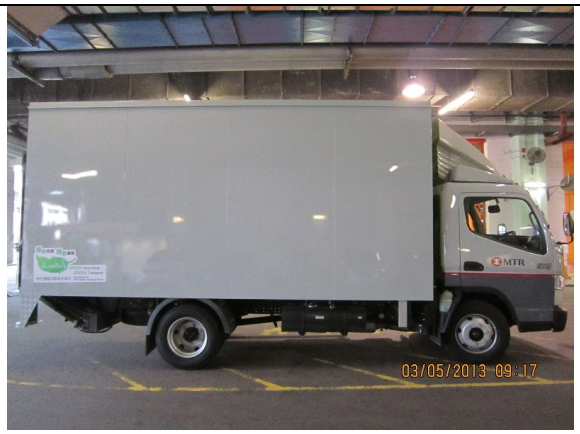
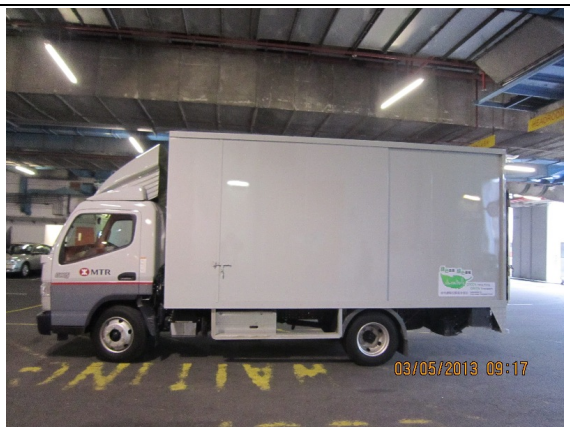
Registration Mark:	**RY3856**
Make:	Mitsubishi Fuso
Model:	FEB74ER3SDAC
Class:	Light goods vehicle
Gross vehicle weight:	5500 kg
Seating Capacity:	3 (including driver)
Cylinder Capacity:	2998 cc
Year of manufacture:	2012

2. Diesel light goods vehicle used for comparison (DV)

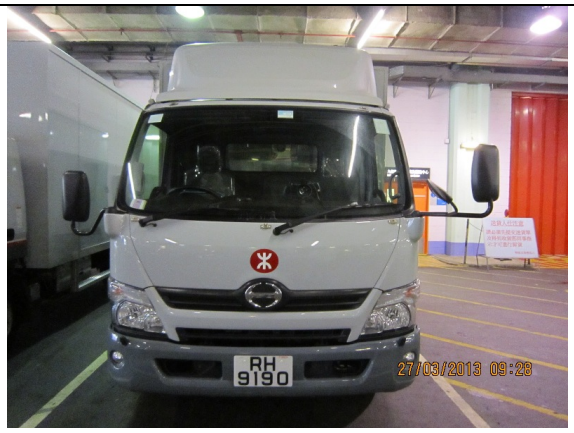
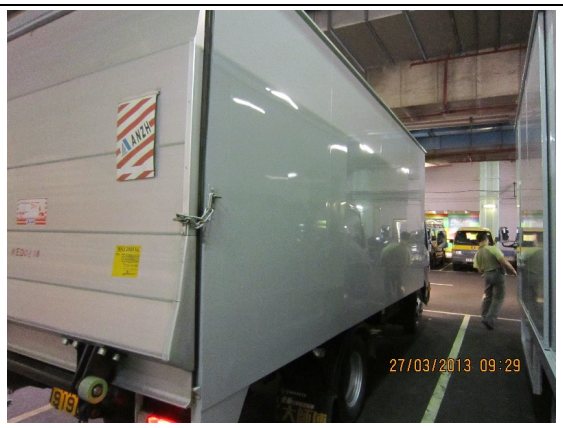
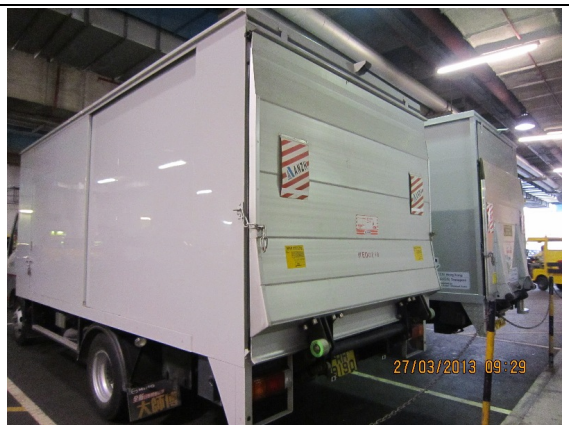
Registration Mark:	**RH9190**
Make:	Hino
Model:	XZU710RHKFQT3
Class:	Light goods vehicle
Gross vehicle weight:	5500 kg
Seating Capacity:	3 (including driver)
Cylinder capacity:	4009 cc
Year of manufacture:	2011

Appendix 2: Photos of Vehicles

1. Trial hybrid light goods vehicle (HV)

	
HV (RY3856) (front view)	HV (RY3856) (end view)
	
HV (RY3856) (side view 1)	HV (RY3856) (side view 2)

2. Diesel light good vehicle used for comparison (DV)

	
DV (RH9190) (front view)	DV (RH9190) (end view)
	
DV (RH9190) (side view 1)	DV (RH9190) (side view 2)