Pilot Green Transport Fund

Final Report
On
Trial of Hybrid Light Goods Vehicles for Logistics Service (Shun Hing)

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Final Report
(Trial Period: 1 December 2012 – 30 November 2014)

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. Shun Hing Logistics Company Limited (Shun Hing) was approved under the Fund for trial of two hybrid light goods vehicles for logistics service. Through the tendering procedures stipulated in the Agreement, Kwai Bon procured two Mitsubishi FUSO Canter Eco Hybrid light goods vehicles (HVs) for trial.

1.2 PolyU Technology and Consultancy Company Limited (PolyU) has been engaged by Environmental Protection Department as an independent third party assessor to monitor the trials and evaluate the operational performance of the trial vehicles. PolyU regularly visited Shun Hing to collect information for evaluating the performance of the hybrid light goods vehicles as compared with the diesel light goods vehicles (DVs) which provided the same service in similar areas or with similar road conditions. The information collected includes the said vehicles' operation data, fuel bills, maintenance records, reports on operation difficulties, and opinions of the HV drivers from survey questionnaires.

1.3 This report summarizes the performance of the HVs in the 24-month trial as compared with their conventional counterparts.

2. Trial Vehicles

2.1 Shun Hing procured two 5.5 tonnes GVW Mitsubishi FUSO Canter Eco Hybrid light goods vehicles (HV-1 and HV-2) of 2988 cc cylinder capacity for trial.

2.2 Two 5.5 tonnes GVW Mitsubishi FUSO Canter diesel light goods vehicles (DV-1 and DV-2) of 4899 cc cylinder capacity and of similar service areas or with similar road conditions were assigned for comparison with the two HVs.

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 December 2012. Both HVs and DVs are stationed at the depot of the company's headquarter, Shun Hing Centre, in Kwai Fong. The vehicles operate from Monday to Saturday between 8:30 am and 5:30 pm. Shun Hing could only find a conventional vehicle (i.e. DV-1) that operates on the same route for HV-1 but not for HV-2. Despite operating in different routes, DV-2 is still considered acceptable control vehicle for HV-2 because it also travelled in areas with traffic conditions similar to that of HV-2.

4. Findings of Trial

4.1 Operating Costs

4.1.1 Table 1 below summarizes the fuel cost data of the HVs and the DVs. The average fuel costs of HV-1 and HV-2 were lower than their conventional counterparts by 4%, and 7% respectively.

Table 1: Key operation statistics of each vehicle

	Hybrid Light Goods Vehicle		**Diesel Light Goods Vehicle**	
	HV-1	**HV-2**	**DV-1**	**DV-2**
Total distance travelled (km)	40,865	44,859	48,564	44,649
Average fuel economy (km/litre)	5.46	5.07	5.25	4.70
Average fuel cost ($/km) [1]	2.30	2.47	2.39	2.67

[1] The market fuel price was used for calculation

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 would however be reduced to about 12% because the energy recovered by the electric generator at start-stops is much reduced. The HVs, as well as the DVs, travelled partly on suburban and highways, and hence the trial HVs were 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. The HVs in general have better fuel economy than the DVs. The HVs saved an average of 6% of fuel when traveling on suburban and highways as compared to the DVs.

4.1.3 During the report period, HV-1 had undergone six scheduled maintenance and two unscheduled maintenance. One unscheduled maintenance was due to Test/Maintenance (T/M) warning light on and the other was due to the locking of the braking system. The total maintenance cost was $22,186.0. HV-2 had undergone seven scheduled maintenance and two unscheduled maintenance. One unscheduled maintenance was due to a minor traffic accident, the cause of which was unrelated to the performance of the vehicle. Therefore, this unscheduled maintenance was not included for comparing the performance of the HVs with the diesel counterparts. The other was due to the non-smooth operation of the vehicle. The total maintenance cost was $32,873.4. It should be noted that in the first two scheduled maintenance of the hybrid vehicles, the labour cost was waived and only the parts to be replaced were charged. The utilization rate of HV-1 and HV-2 were both 99%

4.1.4 Table 2 below summarizes the operating cost data of the HVs and the DVs. The average total operating costs include maintenance costs and other indirect costs such as towing fee and vehicle replacement fee. The HVs and the DVs incurred only fuel, maintenance and towing fees in this trial, a towing fee of $720 was charged to HV-1 in one of its unscheduled maintenance. The average total operating cost of HV-1 and HV-2 were 9% and 7% lower than DV-1 and DV-2 respectively.

Table 2: Average total operating cost and downtime of each vehicle

	Hybrid Vehicles		**Conventional Vehicles**	
	HV-1	**HV-2**	**DV-1**	**DV-2**
Total operating cost ($) [1] [2]	116,951.1	143,851.1	153,308.1	155,060.7
Average total operating cost ($/km)	2.86	3.21	3.16	3.47
Downtime (working days) [3]	4 days	4 days	4 days	4 days

[1] The labor cost was waived in the first two scheduled maintenance and only the parts to be replaced were charged.

[2] Cost of maintenance due to incident not related to the performance of the vehicle or major overhauls 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

4.2 Performance and Reliability

4.2.1 The HV drivers had no problem in operating the HVs but reflected that the HVs had less power in going uphill as compared with the DVs.

4.2.2 Overall, Shun Hing was satisfied with the performance of the HVs. Shun Hing 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 HVs' fuel economy. For HV-1, the fuel economy varied from 5.39 km/litre to 5.60 km/litre. For HV-2, the fuel economy varied from 4.86 km/litre to 5.21 km/litre. There is no indication of deteriorating fuel economy. It appears that the engines of the HVs were still in normal working conditions and the fuel economy could be maintained through proper maintenance.

5. Summary of Findings

5.1 The vehicle operating conditions and the drivers' driving habit would affect the fuel saving performance of the hybrid vehicles. The HVs travelled partly on suburban and highways, and hence they were unable to achieve the best fuel saving performance according to the manufacturer. Nevertheless, the HVs in general have better fuel economy than the DVs. On an average, the HVs saved 6% fuel cost when traveling on suburban/highways as compared to the DVs.

5.2 The HV drivers reflected that it took time to familiarize with the operation of the HVs, especially in the automatic switch of gear ratio when going uphill or when the vehicle was travelling at low speed. They reflected that the HVs were less powerful than the DVs in going uphill. According to the supplier, one of the factors contributing to the feeling of being less powerful is that the HVs have a less powerful engine than conventional ones.

5.3 The HVs had regular scheduled maintenance similar to the DVs. The HVs seldom had any failure and out of the 599 working days in the 24 month trial period, HV-1 and HV-2 had lost 4 days only and the utilization rate were both 99%.

5.4 No deterioration in the performance of the HVs was observed from the reported data.

Appendix 1: Key Features of Vehicles

1. Trial HV

Registration Mark:	**RU2169, RT8798 (HV-1, HV-2)**
Make:	Mitsubishi Fuso
Model:	Canter Eco Hybrid FEB74ER3SDAC
Class:	Light goods vehicle
Gross vehicle weight:	5500 kg
Seating Capacity:	2
Cylinder Capacity:	2998 cc
Year of manufacture:	2012

2. DV used for comparison

Registration Mark:	**PX950 (DV-1)**
Make:	Mitsubishi Fuso
Model:	Canter 5.5t FE83DEWSRDAA
Class:	Light goods vehicle
Gross vehicle weight:	5500 kg
Seating Capacity:	5
Cylinder capacity:	4899 cc
Year of manufacture:	2011

Registration Mark:	**PH3467 (DV-2)**
Make:	Mitsubishi Fuso
Model:	Canter 5.5t FE83DEWSRDAA
Class:	Light goods vehicle
Gross vehicle weight:	5500 kg
Seating Capacity:	5
Cylinder capacity:	4899 cc
Year of manufacture:	2010

Appendix 2: Photos of Vehicles

1. HVs

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<tr><td>HV-1 (RU2169) (front view)</td><td>HV-1 (RU2169) (end view)</td></tr>
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<tr><td>HV-1 (RU2169) (side view)</td><td>HV-1 (RU2169) (side view)</td></tr>
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<tr><td>HV-2 (RT8798) (front view)</td><td>HV-2 (RT8798) (end view)</td></tr>
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HV-2 (RT8798) (side view)	HV-2 (RT8798) (side view)

2. DVs used for comparison

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<tr><td>DV-1 (PX950) (front view)</td><td>DV-1 (PX950) (end view)</td></tr>
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<tr><td>DV-1 (PX950) (side view)</td><td></td></tr>
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<tr><td>DV-2 (PH3467) (front view)</td><td>DV-2 (PH3467) (end view)</td></tr>
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DV-2 (PH3467) (side view)	