

Pilot Green Transport Fund

Final Report

On

**Trial of Hybrid Medium Goods Vehicle for Zipper
Delivery (YKK Hong Kong Limited)**

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PREPARED BY:

Dr. C.S. Cheung

Dr. W.T. Hung

Ir Dr. C. Ng

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. C.S. Cheung (Team Leader)

Professor

Department of Mechanical Engineering

The Hong Kong Polytechnic University

Dr. W.T. Hung (Deputy Team Leader)

PolyU Technology and Consultancy Company Limited

The Hong Kong Polytechnic University

Ir Dr. C. NG

Senior Technical Officer

Department of Mechanical Engineering

The Hong Kong Polytechnic University

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(YKK Hong Kong Limited)**

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(Trial Period: 1 March 2016 – 28 February 2018)**

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. YKK Hong Kong Limited (YKK) was approved under the Fund for trial of one hybrid medium goods vehicle for zipper delivery service.

1.2 PolyU Technology and Consultancy Company Limited has been engaged by Environmental Protection Department as an independent third party assessor (the assessor) to monitor the trial and evaluate the operational performance of the trial vehicles. The assessor regularly visited YKK to collect information for evaluating the performance of the hybrid medium goods vehicle (HV) as compared with the diesel medium goods vehicle (DV) which provided the same service in the same areas and 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 Final Report summarizes the performance of the HV for delivery service in the twenty-four months of the trial as compared with its conventional diesel counterpart, i.e. the DV.

2. Trial Vehicles

2.1 YKK procured one Mitsubishi Fuso hybrid medium goods vehicle (HV) of 7,500 kg gross vehicle weight (GVW) and a cylinder capacity of 2,998 cc for trial.

2.2 One Mitsubishi Fuso diesel medium goods vehicle (DV) of 9,000 kg GVW and a cylinder capacity of 2,998 cc was assigned for comparison with the HV. Both vehicles were equipped with air-conditioning.

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

3. Trial Information

3.1 The 24-month trial started on 1 March 2016. Both vehicles provided delivery services from Tuen Mun to various districts in Hong Kong. There was no fixed route. The vehicles provided service from 8:00 am to 5:00 pm every day, except Saturday, Sunday and public holidays.

4. Findings of Trial

4.1 Operating Costs

4.1.1 During this 24-month trial period, the HV travelled 30,230 km whereas the DV travelled 40,639 km. The performance of the HV and its average total operating costs compared with the DV is summarized below:

Table 1: Operational costs of each vehicle

	Hybrid Medium Goods Vehicle	Diesel Medium Goods Vehicle
	HV	DV
Average fuel economy, km/litre	6.25	5.46
Average fuel cost, HK\$/km ^[1]	1.87	2.11
Average total operating cost, HK\$/km ^{[1],[2]}	2.53	3.24

^[1] The market fuel price was used for calculation

^[2] Including costs incurred from maintenance.

4.1.2 The average fuel cost of the HV was lower than that of the DV by 11.3%. In fact, the vehicle operating conditions and the drivers' driving habit would affect its fuel saving performance. It is worth to note that the HV in this trial has a 7,500 kg GVW while the DV has a 9,000 kg GVW.

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 calculating the total operating cost. It should be noted that the maintenance cost of the HV did not include labour cost for the first twelve months as the vehicle was under warranty, the labour cost was waived and only the parts to be replaced were charged. The HV was then put under an annual maintenance package similar with the DV. The average total operating cost of the HV was 21.9% lower than the DV.

4.2.2 During the 24-month trial period, the HV had undergone four scheduled and nine unscheduled maintenances. The HV involved in a crash with another vehicle on 17 May 2016 and

took more than three months for it to be repaired. It resumed operation on 12 September 2016. However, this unscheduled maintenance was unrelated to the performance of HV and hence excluded in the comparison. The other eight unscheduled maintenance were refilling of urea solution required for the de-NOx process of the Euro VI engine. Out of the 496 working days in the trial, the total operation downtime for the HV was 10 days while that for the DV was 13 days. The utilization rate of the HV was 98% (excluding the downtime unrelated to its performance), which was more or less the same as the DV (97%).

4.3 Performance and Reliability

4.3.1 The HV driver reflected that he had no problem operating the vehicle. He felt that the HV was cleaner and less polluted. However, he reflected that the HV could not accelerate as fast as the DV and was less powerful than the DV especially when driving upslope.

4.3.2 YKK was satisfied with the performance of the HV and agreed that the technology could provide a greener environment. YKK would consider using more hybrid vehicles in its vehicle fleet.

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. It is shown that there was 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.

4.3.4 The carbon dioxide (CO₂) equivalent emissions reduction from using the HV compared to the DV on same mileage (30,230 km) in this trial was 1,864 kg (around 12.7%).

5. Summary

5.1 The HV had a better fuel economy than the DV. On the average, the HV had 11.3% fuel cost saving as compared to the DV. Including the maintenance costs, the average total operating cost of the HV was 21.9% lower than that of the DV. There was 1,864 kg (around 12.7%) CO₂ equivalent reduction during the 24-month trial period.

5.2 The HV had regular scheduled maintenance similar to the DV. The HV and the DV had 10 days and 13 days of downtime respectively out of the 496 working days in the 24-month trial period. The utilization rate of the HV was 98% which is more or less the same as that of the DV (97%).

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

Appendix 1: Key Features of Vehicles

1. Trial HV

Registration Mark	TX2353 (HV)
Make:	Mitsubishi Fuso
Model:	FEB74GR3SDAP
Class:	Medium goods vehicle
Gross vehicle weight:	7,500 kg
Seating capacity:	driver + 2 passengers
Cylinder capacity:	2,998 cc
Year of manufacture:	2014

2. DV used for comparison

Registration Mark	SN9013 (DV)
Make:	Mitsubishi Fuso
Model:	FEC91GR4SDAD
Class:	Medium goods vehicle
Gross vehicle weight:	9,000 kg
Seating capacity:	driver + 2 passengers
Cylinder capacity:	2,998 cc
Year of manufacture:	2013

Appendix 2: Photos of Vehicles

1. Trial HV



HV (TX2353) (front view)



HV (TX2353) (side)



HV (TX2353) (side)



HV (TX2353) (end view)

2. DV used for comparison



DV(SN9013) (front view)



DV(SN9013) (side view)