

Pilot Green Transport Fund

Final Report On
Trial of Hybrid Medium Goods Vehicle
for Gardening Service
(Wai Man Yuen Gardening & Engineering Co. Ltd)

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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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Final Report
(Trial Period: 1 June 2018 – 31 May 2020)

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. Wai Men Yuen Gardening & Engineering Co. Limited (Wai Men Yuen) was approved under the Fund for trial of one diesel-electric hybrid medium goods vehicle for gardening service. Through the tendering procedures stipulated in the Subsidy Agreement, Wai Man Yuen procured one Hino 300 series diesel-electric hybrid medium goods vehicle (HV) for trial.

1.2 Hong Kong Institute of Vocational Education (Tsing Yi) has been engaged by the Environmental Protection Department (EPD) as an independent third-party assessor to monitor and evaluate the performance of the trial vehicle. Wai Men Yuen assigned an Isuzu diesel medium goods vehicle (DV) providing similar type of service as the conventional vehicle for comparing with the HV.

1.3 This report summarizes the performance of the HV in 24 months of the trial in the period of 1 June 2018 to 31 May 2020, and compared it with the DV's performance. Since the DV was scrapped on 31 November 2019, 6 monthly data (from 1 December 2017 to 31 May 2018) of the DV prior to the trial are adopted to compensate for data from 1 December 2019 to 31 May 2020 for comparison purpose.

2 Trial and Conventional Vehicles

2.1 The HV has a gross vehicle weight (GVW) of 8,500 kg and a cylinder capacity of 4,009 c.c. The DV has a GVW of 9,000 kg and a cylinder capacity of 4,751 c.c. The vehicles were used for gardening service.

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

3 Trial Information

3.1 The trial commenced on 1 June 2018 and lasted for 24 months. Wai Men Yuen was required to collect and provide trial information including the HV odometer reading before refueling, the date of refueling, the refueled amount, costs and operation downtime associated with scheduled and unscheduled maintenance of the HV. Similar monthly data from the DV were also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the driver and Wai Men Yuen were also collected to reflect any problems of the HV.

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\$0.12/km (5%) higher than that of the DV. However, the average total operating cost of the HV was HK\$0.63/km (18%) lower than that of the DV. Since the HV was not used frequently and the total mileage of the HV was about 24% less than that of the DV in the trial period. The batteries of the HV naturally lose their charge little by little over time, they need to be charged up when the HV operate in the normal situation. Thus, the average fuel cost per kilometer of the HV was higher than the DV during the reporting period.

Table 1: Key Operation Statistics of Each Vehicle (June 2018 – May 2020)

	HV	DV ^[4]
Total mileage (km)	4,673	6,125
Average fuel economy (km/litre)	5.83	5.92
Average fuel cost (HK\$/km) ^[1]	2.41	2.29
Average total operating cost (HK\$/km)	2.95	3.58
Downtime (working day) ^{[2] [3]}	3	9

^[1] Market rate was adopted for calculation.

^[2] Maintenance due to incidents unrelated to the performance of the vehicle was not included for comparison.

^[3] Downtime refers to the equivalent number of working days in which the vehicle was not in operation due to maintenance, counting from the first day it stopped operation till the day it was returned to the operator. For incidents with operation downtime less than 1 hour, the no. of working days for the vehicle out of service would be counted as 0.

^[4] Since the DV was scrapped on 31 November 2019, 6 monthly data (from 1 December 2017 to 31 May 2018) of the DV prior to the trial are adopted to compensate for data from 1 December 2019 to 31 May 2020 for comparison purpose.

4.2 There were three scheduled maintenances for the HV and one for the DV, and no unscheduled maintenance for the HV but one for and the DV in this reporting period, leading to 3 days and 9 days of operational downtime for the HV and the DV respectively. There were 707 and 706 working days for HV and DV respectively in the trial period, the utilization rates of the HV and the DV were 99.6% and 98.7% respectively.

4.3 The driver felt that the HV ran quieter than the DV. However, he was not satisfied with the performance of automatic gearbox because the response time of the automatic gearbox was very slow, and expressed that the HV had comparatively lower power when driving uphill and at start up.

4.4 Wai Man Yuen considered the performance of HV could meet the operational requirements, but was only fairly satisfied with its performance.

4.5 To eliminate the effect of seasonal fluctuations, 12-month moving averages were used to evaluate the trend of the HV's fuel economy. The fuel economy of the HV varied between 5.80 and 6.48 km/kWh (i.e. about 10% variation). During the 24-month trial period, there was a slight deterioration of the HV's fuel economy.

4.6 Based on the total distance travelled by the HV in the trial, the relative carbon dioxide equivalent (CO_{2e}) emission from the DV could be evaluated based on the CO_{2e} emission per litre of diesel consumed. The CO_{2e} emission from the HV was 2,116 kg while that from the DV was 2,083 kg. There was about 2% increase in CO_{2e} emission by using the HV. The environmental benefit of the HV was unobvious.

5 Summary

5.1 In the 24 months of the trial, the average fuel cost of the HV was HK\$0.12/km (5%) higher than that of the DV. The average total operating cost of the HV was however HK\$0.63/km (18%) lower than that of the DV.

5.2 The utilization rates of the HV and the DV were 99.6% and 98.7% respectively. However, there was a slight deterioration of the HV's fuel economy and the CO_{2e} emission from the HV was about 2% more than that from the DV. Therefore, the environmental benefit of the HV was unobvious.

5.3 As shown in driver feedback questionnaires, the driver felt that the HV ran quieter than the DV. However, he was not satisfied with the slow response time of its automatic gearbox and comparatively lower power for driving uphill and start up. Wai Man Yuen considered the performance of HV could meet the operational requirements, but was only fairly satisfied with its performance.

Appendix 1: Key Features of Vehicles

1. Trial HV

Registration mark	PL6188
Make:	Hino
Model:	300 Series Hybrid XKU730R-HKUTS3
Class:	Medium Goods Vehicle
Gross vehicle weight:	8,500 kg
Seating capacity:	Driver + 5 passengers
Engine capacity:	4,009 c.c.
Maximum output (ps/rpm):	150/2,500
Battery type:	Nickel-Metal Hydride Battery
Year of manufacture:	2018

2. DV for comparison

Registration mark	LT3289
Make:	Isuzu
Model:	NQR70PU-5NM
Class:	Medium Goods Vehicle
Gross vehicle weight:	9,000 kg
Seating capacity:	Driver + 5 passengers
Engine capacity:	4,751 c.c.
Year of manufacture:	2004

Appendix 2: Photos of Vehicles

1. HV



Front view of HV



Rear view of HV



Left side view of HV



Right side view of HV

2. DV



Front view of DV



Rear view of DV



Left side view of DV



Right side view of DV