

Pilot Green Transport Fund

Final Report On
Trial of Single-deck Hybrid Bus for
Coach Rental Service
(Wah Kwok Transportation Company Limited)

(30 April 2020)

PREPARED BY:

Dr. Joe LO Ka Wah
Mr. Elvin NG Cheuk Yin
Mr. CHAN Ka Chun
Mr. Ricky CHONG Ka Ho

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. Elvin C. Y. NG (Team Member)

Test Engineer

Jockey Club Heavy Vehicle Emissions Testing and Research Centre
Hong Kong Institute of Vocational Education (Tsing Yi)

Mr. K. C. CHAN (Team Member)

Technician

Jockey Club Heavy Vehicle Emissions Testing and Research Centre
Hong Kong Institute of Vocational Education (Tsing Yi)

Mr. Ricky K. H. CHONG (Team Member)

Executive Assistant

Jockey Club Heavy Vehicle Emissions Testing and Research Centre
Hong Kong Institute of Vocational Education (Tsing Yi)

Pilot Green Transport Fund
Trial of Single-deck Hybrid Bus for Coach Rental Service
(Wah Kwok Transportation Company Limited)
Final Report
(Trial Period: 1 February 2018 – 31 January 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. Wah Kwok Transportation Company Limited (Wah Kwok) was approved under the Fund for trial of one single-deck hybrid bus (hereafter called HV) for coach rental service. Through the tendering procedures stipulated in the Subsidy Agreement, Wah Kwok procured one SAIC single-deck hybrid bus 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. One Volvo single-deck diesel bus (DV) providing the same service was assigned as the conventional vehicle for comparing with the HV.

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

2 Trial Vehicle

2.1 The HV has a gross vehicle weight (GVW) of 17,500 kg and a seating capacity is 65 passengers. The DV has a GVW of 16,000 kg and a seating capacity of 65 passengers. Both the HV and the DV serve the same circular route between Hong Kong Garden and Tsuen Wan MTR Station every day.

2.2 Key features of the HV and the DV are in Appendix 1 and photos of the vehicles are in Appendix 2. The vehicles were used for coach rental service.

3 Trial Information

3.1 The trial started on 1 February 2018 and lasted for 24 months. Wah Kwok was required to collect and provide trial information including the HV odometer reading before 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 Wah Kwok were also collected to reflect any problems of the HV.

4 Findings of Trial

4.1 Table 1 summarizes the statistical data of the HV and the DV. The average fuel cost of the HV was HK\$0.72/km (13%) lower than that of the DV and the average total operating cost of the HV was HK\$0.98/km (17%) lower than that of the DV.

Table 1: Key Operation Statistics of Each Vehicle (February 2018 – January 2020)

		HV	DV
Total mileage	(km)	142,879	152,924
Average fuel economy	(km/litre)	2.89	2.52
Average fuel cost (HK\$/km) ^[1]		4.83	5.55
Average total operating cost (HK\$/km)		4.88	5.86
Downtime (working day) ^{[2] [3]}		11	10

[1] The 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 charging, and the period 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] Maintenance due to incidents unrelated to the performance of the vehicle was not included for comparison.

4.2 During the 24 months of the trial, the HV had four scheduled maintenances resulting in a downtime of 9 working days while the DV has three scheduled maintenances resulting in a downtime of 7 working days.

4.3 Also, the HV had two unscheduled maintenances resulting in a downtime of 2 working days. The DV had three unscheduled maintenances resulting in a downtime of 3 working days. One of the unscheduled maintenance for the DV was not related to the vehicle performance and is therefore excluded for comparison.

4.4 In the 24 months of the trial, the utilization rates of HV and DV were 98.5% and 98.6% respectively.

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 varied between 2.93 km/litre and 2.85 km/litre for the HV in the reporting period. The result appears that the HV was still in normal working conditions and the fuel economy could be maintained through proper maintenance.

4.6 In the 24 months of the trial, the carbon dioxide equivalent (CO₂e) emission from the HV was 130,488 kg while that from the DV was 149,647 kg. Hence, there is a reduction of 19,159 kg (about 12.8 %) CO₂e emission.

5 Summary

5.1 In the 24 months of the trial, the average daily mileage of the HV was 199 km, while that of the DV was 212 km. The HV incurred a lower average fuel cost which was HK\$0.72/km (13%) lower than that of the DV, and the average total operating cost of the HV was HK\$0.98/km (17%) lower than that of the DV. The utilization rates of the HV and the DV were 98.5% and 98.6% respectively in this reporting period.

5.2 Wah Kwok had a designated driver for the HV. The HV driver expressed that the HV could save fuel. The HV driver also expressed that although the HV had comparatively lower power and was noisy when climbing uphill, he had been accustomed to driving the HV. The response of the passengers is generally positive. The passengers expressed that the HV ran quieter than the DV. Also, it produced less air pollutants and helped to improve roadside air quality. The passengers liked the HV and supported on replacing the existing diesel vehicles with hybrid vehicles.

5.3 Wah Kwok expressed that the HV could meet their operational requirements and helped save their operating costs. Wah Kwok indicated that they will actively consider replacing all existing diesel buses with the hybrid buses. In general, Wah Kwok and the driver were satisfied with the performance of the HV.

5.4 In the 24 months of the trial, the carbon dioxide equivalent (CO₂e) emission from the HV was 130,488 kg while that from the DV was 149,647 kg. Hence, there is a reduction of 19,159 kg (about 12.8 %) CO₂e emission.

5.5 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	FG9698
Make:	SAIC
Model:	SK6110H
Class:	Single deck public bus
Gross vehicle weight:	17,500 kg
Seating capacity:	Driver + 65 passengers
Cylinder capacity:	6,692 c.c.
Maximum Output(ps/rpm):	245/2,300
Battery Type:	Lithium Manganese Oxide battery
Year of manufacture:	2016

2. DV for comparison

Registration Mark	DD3331
Make:	Volvo
Model:	B7R MKIII EEV
Class:	Single deck public bus
Gross vehicle weight:	16,000 kg
Seating capacity:	Driver + 65 passengers
Cylinder capacity:	7,146 c.c.
Year of manufacture:	2014

Appendix 2: Photos of Vehicles

1. Trial HV



HV Front View



HV Rear View



HV Side View 1



HV Side View 2

2. DV for comparison



DV Front View



DV Rear View



DV Side View 1



DV Side View 2