

Pilot Green Transport Fund

Final Report

On

Trial of Hybrid Public Light Bus for

Green Minibus Service

(Hoi Ying Company)

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The Monitoring and Evaluation Team's views expressed in this report do not necessarily reflect the views of the Environment and Ecology Bureau (Environment Branch), HKSAR.

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Trial of Hybrid Public Light Bus for Green Minibus Services
(Hoi Ying Company)**

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(Trial Period: 1 April 2021 – 31 March 2023)

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. The Fund has subsidized Hoi Ying Company (Hoi Ying) to trial out a hybrid public light bus (HV) for green minibus services.

1.2 PolyU Technology and Consultancy Company Limited has been engaged by the Environmental Protection Department¹ as an independent third party assessor to monitor the trial and evaluate the performance of the trial vehicle. The Assessor regularly visited Hoi Ying to collect information for evaluating the performance of the HV and compared it with the performance of a LPG vehicle (GV) which provided the same service in the same areas. The information collected included the said vehicles' operation data, fuel bills, maintenance records, reports on operation difficulties, and opinions of the HV driver, the public light bus passengers and Hoi Ying through survey questionnaires.

1.3 This Final Report summarizes the performance of the HV for green minibus services in the 24- months trial as compared with the GV.

2. Trial and Conventional Vehicles

2.1 Hoi Ying procured one GMI Gemini 19-seats diesel-electric hybrid public light bus (i.e., HV) with gross vehicle weight (GVW) 7,000 kg and cylinder capacity 2,800 cc for trial. One Toyota 16-seats LPG public light bus (i.e., GV) of GVW 4,350 kg cylinder capacity 4,104 c.c. operating in the same service areas was assigned for comparison with the HV.

2.2 Both HV and GV were used for green minibus services serving a fixed route 22M between Kwun Tong MTR station and Lok Wah South Estate. They provided services 24 hours everyday,

¹ The Administration of the New Energy Transport Fund was migrated to the Environment Branch of the Environment and Ecology Bureau [EEB (Environment Branch)] since 1 January 2023 after internal re-organisation of EEB (Environment Branch) and EPD.

365 days per year.

2.3 Key features and photos of the HV and GV are in Appendix 1 and Appendix 2 respectively.

3. Trial Information

3.1 The trial started on 1 April 2021 and lasted for 24 months. Hoi Ying was required to collect and provide trial information including the distance travelled, fuel consumed, fuel cost as well as costs and downtime associated with scheduled and unscheduled maintenances of the HV. A similar set of data from the GV was also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the driver, passengers and Hoi Ying were collected to reflect any problems of the HV.

4. Findings of Trial

4.1 Table 1 summarizes the statistical data of the HV and GV. The average fuel economy of the HV was 0.009km/MJ (15%) higher than that of the GV. However, since the market fuel price of diesel was higher than that of LPG and the HV carried 3 more passengers than the GV; hence with a higher loading, the average fuel cost of the HV was higher than that of the GV by HK\$4.91/km (159%). When the fuel price discount² were taken into account, the average fuel cost of the HV would be about 33% higher than that of the GV. There were two scheduled maintenances, but no cost incurred under warranty for the HV. The GV also had two scheduled maintenances. The average total operating cost of the HV was higher than that of the GV by HK\$4.56/km (133%).

Table 1: Key operation statistics of each vehicle (1 April 2021 – 31 March 2023)

	HV	GV	
Total mileage(km)	67,991	90,417	
Average daily mileage (km/working day)	94	125	
Average fuel economy	(km/litre)	2.41	1.38
	(km/MJ) ^[1]	0.067	0.058
Average fuel cost (HK\$/km) ^[2]	7.99	3.09	
Average total operating cost (HK\$/km) ^[3]	7.99	3.44	
Downtime (working day) ^[3] ^[4]	10	5	

[1] Assuming lower heating value of 36.13 MJ/litre for diesel fuel and 23.67 MJ/litre for LPG

[2] The market fuel price was used for calculation.

[3] Maintenance due to incident not related to the performance of the vehicle was not included for comparing the performance.

[4] Downtime refers to the equivalent number of working days in which 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.

² Hoi Ying obtained discounted rates for diesel from the suppliers throughout the trial period and reduced LPG rates from Government from 1 May to 31 December 2022.

4.2 HV and GV each had two scheduled maintenances incurring 10 and 5 days of downtime respectively, the utilization rate of the HV was 98.6% and the GV was 99.3%.

4.3 To remove the effect of seasonal fluctuations, 12-month moving averages are used to evaluate the trend of the HV's fuel economy. The results show that fuel economy of the HV had a slight deterioration (4%). This may relate to driving behaviour or battery deterioration.

4.4 The carbon dioxide equivalent (CO_{2e}) emission from HV was 78,104 kg while that from GV on HV mileage would be 83,234 kg. There are reductions of 5,130 kg CO_{2e} emissions (6%) by using HV. Therefore, the adoption of HV had environmental benefit in this trial.

4.5 The HV drivers had no problem in operating the HV and felt the HV was more environmentally friendly compared to the GV. The passenger felt that the air was cleaner within the HV. Hoi Ying was satisfied with the performance of the HV and did not detect any deterioration in the performance of the HV.

5. Summary

5.1 In the 24-month trial period, the average daily mileage of the HV was 94 km, while that of the GV was 125 km. Taking the fuel price discount into account, the average fuel cost of the 19-seat HV was about 33% higher than that of the 16-seat GV, but the HV had 15% higher average fuel economy than that of the GV and carrying 3 more passengers. There was 5,130 kg CO_{2e} emissions (6%) reduction by using HV as compared with the GV.

5.2 Excluding the downtime of vehicles unrelated to the performance due to the scheduled and unscheduled maintenances, the HV had 10 days downtime while the GV had 5 days downtime in the 24-month trial period, the utilization rates of the HV and the GV were 98.6% and 99.3% respectively.

5.3 A slight deterioration in the fuel economy of the HV was observed in the trial.

5.4 In the 24-month trial period, the operation of the HV was smooth. The HV drivers, passengers and Hoi Ying were satisfied with the performance of the HV and felt that it was more environmentally friendly.

Appendix 1: Key Features of Vehicles

1. Trial HV

Registration Mark:	XC8774
Make:	GMI
Model:	GEMINI
Class:	Public Light Bus
Gross vehicle weight:	7,000 kg
Seating capacity:	driver + 19 passengers
Cylinder capacity:	2,800 cc (diesel)
Year of manufacture:	2018

2. GV for comparison

Registration Mark:	GB914
Make:	TOYOTA
Model:	BZB40RZCMSCYY
Class:	Public Light Bus
Gross vehicle weight:	4,350 kg
Seating capacity:	driver +16 passengers
Cylinder capacity:	4,104 cc (LPG)
Year of manufacture:	2005

Appendix 2: Photos of Vehicles

1. Trial HV



2. GV for comparison



Front view



Right side view



Left side view



Rear view