

Pilot Green Transport Fund

Final Report

On

Trial of Hybrid Public Light Bus for

Green Minibus Services

(Double Winner Corporation Limited)

(4 December 2023)

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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
(Double Winner Corporation Limited)**

**Final Report
(Trial Period: 1 November 2021 – 31 October 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. Double Winner Corporation Limited (Double Winner) was approved under the Fund for trial a hybrid light bus for green minibus services. Through the tendering procedures stipulated in the Subsidy Agreement signed with the Government, Double Winner procured a GMI Gemini electric-diesel hybrid 19-seat public light bus (HV) for trial.

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. Double Winner assigned a Toyota LPG 16-seat public light bus (GV) as the conventional counterpart for comparison with the HV.

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

2. Trial and Conventional Vehicles

2.1 Key features of the HV and GV are in Appendix 1 and their photos are provided in Appendix 2. The two vehicles were used for public light bus services serving a fixed route 86 between Telford Garden Bus Terminal and Kai Tak Cruise Terminal. The HV's gross vehicle weight (GVW) is 7,000 kg with 2,776 c.c. cylinder capacity. The GV's GVW is 4,350 kg with 4,104 c.c. cylinder capacity.

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.

3. Trial Information

3.1 The trial commenced on 1 November 2021 and lasted for 24 months. Double Winner 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 maintenance 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 drivers, passengers and Double Winner were collected and provided 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 3% lower than that of the GV in terms of km/MJ. 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\$3.73/km (about 223%). If the fuel price discount was taken into account, the average fuel cost of the HV would be about 65% higher than that of the GV. Both the HV and GV had undergone two scheduled maintenances, but they had no unscheduled maintenance, the average total operating cost of the HV was higher than that of the GV by HK\$3.34/km (about 162%).

Table 1: Key operation statistics of each vehicle (1 November 2021 – 31 October 2023)

	HV	GV	
Total mileage (km)	102,725	72,927	
Average daily mileage (km/working day)	142	101	
Average fuel economy	(km/litre)	3.86	2.60
	(km/MJ) ^[1]	0.107	0.110
Average fuel cost (HK\$/km) ^[2]	5.40	1.67	
Average total operating cost (HK\$/km) ^[3]	5.40	2.06	
Downtime (working day) ^{[3] [4]}	8	8	

^[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 working days that 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.

4.2. During the 24 months of the trial, both the HV and GV had undergone two scheduled maintenances, resulting in downtime of 8 working days. The utilization rates of the HV and GV were both 98.9%.

4.3 To remove the effect of seasonal fluctuations, the 12-month moving average was used to evaluate the trend of the HV's fuel economy. The 12-month moving average fuel economy varied narrowly from 3.73 to 3.98 km/L. There was no sign of the deterioration in fuel economy over the trial period.

4.4 Based on the total mileage of the HV and the fuel economy of the GV, the equivalent carbon dioxide (CO_{2e}) emission from the GV could be estimated for comparison purpose. The CO_{2e} emission from the HV and GV were 73,824 kg and 66,434 kg, respectively. The CO_{2e} emission increased 7,390 kg (about 11.1%) by using the 19-seat HV to replace the 16-seat GV in this trial.

4.5 The HV drivers had no problem in operating the HV. The drivers in general liked to drive the HV as the vehicle was new. However, the driver pointed out that the passenger windows of the HV cannot be opened, which is inconvenient for their operation. The passengers were in general satisfied with the HV, but they pointed out the HV was noisy. Double Winner hesitated with the HV performance, as there was no fuel economic advantage of the HV in the trial.

5. Summary

5.1 In this trial, the average daily mileage of the HV was 142 km, while that of the GV was 101 km. The average fuel cost of the HV was HK\$3.73/km (about 223%) higher than that of the GV mainly because the price of diesel was much higher than that of the LPG. The average total operating cost of HV was about HK\$3.34/km (about 162%) higher than that of GV. Economic benefit of the HV was not obvious as far as fuel cost was concerned. The fuel cost difference was reduced to about 65% (HV higher than GV) with the discounted fuel rates.

5.2 The utilization rates of the HV and GV were both 98.9%. There was no indication of deterioration in the HV performance.

5.3 Compared with the GV, the CO_{2e} emission increased 7,390 kg (about 11.1%) by using the 19-seat HV to replace the 16-seat GV.

5.4 The drivers of the HV had no problem in operating the vehicle and were satisfied with its performance. However, the recipient expressed concern in using the HV for the poor fuel economy and no environmental benefits as comparing with the GV.

Appendix 1: Key Features of Vehicles

1. Trial HV

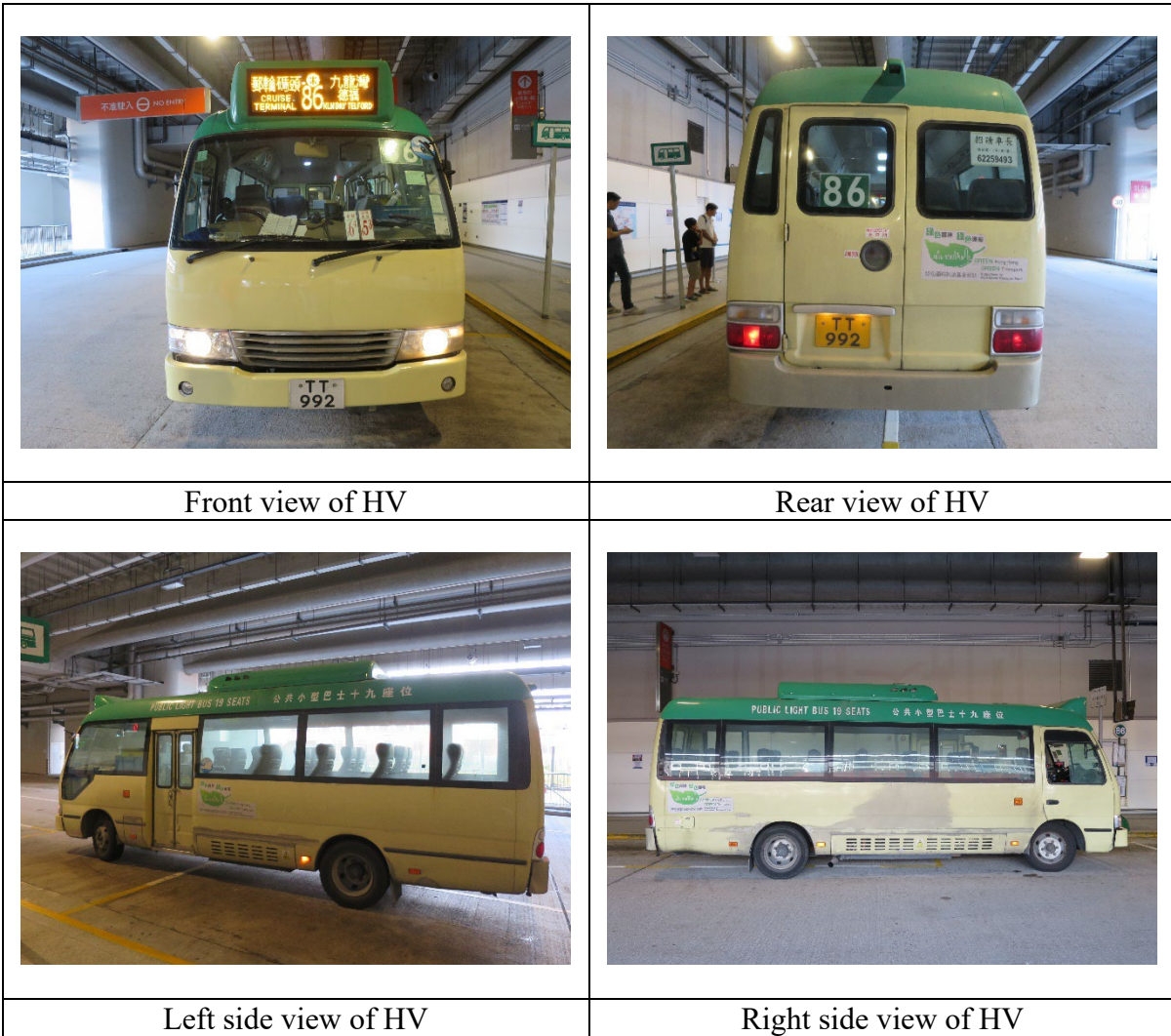
Registration mark:	TT992
Make:	GMI
Model:	Gemini
Class:	Public Light Bus
Gross vehicle weight:	7,000 kg
Seating capacity:	Driver + 19 passengers
Cylinder capacity:	2,776 cc (diesel)
Year of manufacture:	2020

2. GV for Comparison

Registration mark	PP992
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:	2010

Appendix 2: Photos of Vehicles

1. Trial HV



2. GV for Comparison



Front view of GV



Rear view of GV



Left side view of GV



Right side view of GV