

Pilot Green Transport Fund

**Interim Report On
Trial of Hybrid Public Light Bus for
Green Minibus Services
(Big Three)**

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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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**Pilot Green Transport Fund
Trial of Hybrid Public Light Bus for Green Minibus Services (Big Three)**

**Interim Report
(Trial Period: 1 August 2015 – 31 January 2016)**

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 (the innovative green technology), contributing to better air quality and public health for Hong Kong. Big Three Limited (Big Three) was approved under the Fund for trial of one hybrid public light bus.

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 vehicles.

1.3 This Interim Report summarizes the performance of the HV in the first six months of the trial as compared with its conventional diesel counterpart.

2 Trial Vehicles

2.1 Through the tendering procedures stipulated in the Agreement, Big Three procured one Dongfeng Gemini hybrid light bus (HV) for trial. One diesel mini-bus (DV) serving the same purpose was assigned as the conventional vehicle for comparing with the HV. .

2.2 Key features of the HV and the DV are listed in Appendix 1 and photos of the vehicles are shown in Appendix 2. The vehicles were used for green minibus service in route No. 39M from Yu On Court to Tin Hau Bus Terminal.

3. Trial Information

3.1 The trial started on 1 August 2015 and would last for 24 months. Big Three was required to collect and provide trial information including the HV odometer reading, the date of refueling, the refueled amount, cost and operation downtime associated with scheduled and unscheduled maintenance of the HV. Similar data from the DV was also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the drivers and passengers were also collected to reflect any problems of the HV.

3.2 The following table summarizes the statistical data of the HV and the DV. The average fuel cost of the HV is \$0.20/km (9.48%) higher than the DV.

Table 1: Key operation statistics of each vehicle (August 2015 - January 2016)

		Hybrid Light Bus	Diesel Light Bus
		HV	DV
Total mileage	(km)	24,693	47,538
Average fuel economy	(km/litre)	4.52	4.98
Average fuel cost (\$/km) ^[1]		2.31	2.11
Average total operating cost/ (\$/km)		3.15	2.66
Downtime/ day ^[2]		53 ^[3]	14 ^[3]

^[1] 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 maintenance, counting from the first day it stops operation till the day it is returned to the operator.

^[3] Unscheduled maintenance due to incidents unrelated to the performance of the vehicle were not included for comparison.

3.3 Apart from the maintenance cost, other indirect costs might include towing fee, vehicle replacement fee and cost of operation downtime due to maintenance of the HV.

3.4 There were 53 days of operation downtime for HV and 14 days of operation downtime for DV due to maintenance in the reporting period. Utilization rate of HV and DV were 71% and 92% respectively.

4. Summary

4.1 The average fuel cost of the HV was 9.48% (\$0.20/km) higher than the DV. In terms of the average operating cost per km, the HV was 18.4% (\$0.49/km) higher than the DV in the recent 6 months. The HV incurred higher average fuel cost per km and operating cost as compared to the DV due to the temperature effect on the battery charging system during the summer time. The fuel consumption of HV will be higher due to the additional weight of the battery and motor. The gross vehicle weight of the HV and the DV were 7 tonnes and 4.8 tonnes respectively.

4.2 Utilization rate of HV and DV were 71% and 92% respectively. The difference in the utilization rate was mainly due to the unstable performance and subsequent maintenance requirements of the charging system and battery unit for the HV in October 2015.

4.3 HV had lower fuel economy in summer while higher fuel economy in winter. According to supplier of the HV, the temperature of the batteries of the HV usually reached 50°C or above during the summer period, and the battery cooling system was not able to effectively lower down its temperature. While the battery management system limited the charging current when the batteries were under high temperature, the engines were still operating as usual to generate power. Therefore the charging efficiency was lower at high temperature and the fuel economy of the HV was obviously lower in summer days. Hence, the fuel consumption in summer time would be higher than that in winter time.

4.4 The driving habits would also be one of the possible reasons affecting the fuel economy and HV performance.

4.5 Big Three was not satisfied with the performance of HV since the battery system and the air compressor was not stable causing relatively long operation downtime. Also, the HV was less than expected in terms of fuel cost.

4.6 Although the driver had already adapted with the HV operation, he was disappointed with the acceleration and the throttle response time of the HV when compared with the DV.

4.7 The findings only reflect the performance of the HV in the first six months of the trial. More time is needed to test the fuel saving performance and the reliability of the HV.

Appendix 1: Key Features of Vehicles

1. Trial HV

Registration Mark	TM7916
Make:	DongFeng
Model:	Gemini
Class:	Public Light Bus
Gross vehicle weight:	7 tonnes
Seating capacity:	driver + 16 passengers
Rated Power:	150 kW
Battery type:	Lithium iron phosphate battery
Year of manufacture:	2014

2. DV used for comparison

Registration Mark	KX2347
Make:	TOYOTA
Model:	BB50RZEMQZHH
Class:	Public Light Bus
Seating capacity:	driver + 16 passengers
Gross vehicle weight:	4.8 tonnes
Cylinder capacity:	4104 cc
Year of manufacture:	2002

Appendix 2: Photos of Vehicles

1. Trial HV



Front view of HV



Rear view of HV



Side view of HV (Left Side)



Side view of HV (Right Side)

2. DV for Comparison

	
<p>Front view of DV</p>	<p>Rear view of DV</p>
	
<p>Side view of DV (Left Side)</p>	<p>Side view of DV (Right Side)</p>