

Pilot Green Transport Fund

Final Report On
Trial of Electric Light Bus
for University
(The Hong Kong Polytechnic University)

(21 May 2020)

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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 Electric Light Bus for University
(The Hong Kong Polytechnic University)**

**Final Report
(Trial Period: 1 December 2017 – 30 November 2019)**

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 Hong Kong Polytechnic University (PolyU) was approved under the Fund for trial of one electric light bus (EV) for university guest service.

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 The final report summarizes the performance of the EV in the 24 months of trial period as compared to a conventional diesel light bus (DV).

2 Trial Vehicles

2.1 Through the tendering procedures stipulated in the Subsidy Agreement, PolyU procured one King Long EV for the trial and a DV serving the same purpose was used for comparison.

2.2 The vehicles were used mainly for providing transportation service to university guests and it had no fixed route. The EV has a seating capacity for 16 passengers (excluding driver). According to the manufacturer, the EV has a travel range of 180 km with fully charged batteries and the air-conditioning off. Key features and photos of the EV and the charging facilities are in Appendix 1 and Appendix 2 respectively.

2.3 PolyU has set up one dedicated charger for the EV at its car park in Hung Hom. The EV was charged after each use.

3 Trial Information

3.1 The trial started on 1 December 2017 and lasted for 24 months. PolyU was required to collect and provide trial information including the EV mileage reading before charging, amount of electricity consumed in each charging, time taken for charging, operation downtime due to charging, cost and downtime associated with scheduled and unscheduled maintenance of the EV and the charging facilities. Similar sets of data from the DV were also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the drivers and PolyU were collected and provided to reflect any problems of the EV.

4 Findings of Trial

4.1 Table 1 summarizes the statistical data of the EV and the DV. The average fuel cost of EV was HK\$1.77/km (70%) lower than that of the DV.

Table 1: Key operation statistics of each vehicle (December 2017 to November 2019)

		EV	DV ^[5] (Historical data)
Total mileage (km)		3,599	7,084
Average fuel economy ^[1]	(km/kWh)	1.53	-
	(km/litre)	-	5.42
	(km/MJ)	0.43	0.15
Average fuel cost (HK\$/km) ^[2]		0.76	2.53 ^[6]
Average total operating cost (HK\$/km)		0.76	8.00
Downtime (working day) ^{[3] [4]}		30	15 ^[7]

[1] Assuming lower heating value of 36.13MJ/litre for diesel fuel.

[2] The market rate was adopted for calculation.

[3] 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.

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

[5] Historical data from Mar 2016 to Nov 2017 were used for calculation due to extremely low usage of the DV from Mar 2018 onward.

[6] The average fuel cost of DV was calculated from historical data based on average market fuel unit price from Dec 2017 to Sep 2019.

[7] Downtime of the DV in 2 years.

4.2 During the trial period, the EV had five scheduled maintenances resulting in a downtime of 22 working days, and there was one unscheduled maintenance for the EV resulting in a downtime of 8 working days, making a total downtime of 30 days.

4.3 From December 2018 to February 2019, the DV had one scheduled maintenance resulting in a downtime for 1 working day. There was no unscheduled maintenance for the DV. While adding the historical data for calculation, the DV had 15 days of downtime in 2 years for this comparison.

4.4 In the 24 months of trial period, there were 449 working days. The utilization rates of the EV and the DV were 93% and 97% respectively.

4.5 To eliminate the effect of seasonal fluctuations, 12-month moving averages were used to evaluate the trend of the EV's fuel economy. The fuel economy varied from 1.40 to 1.59 km/kWh (i.e. about 12% drop) for the EV.

4.6 The carbon dioxide equivalent (CO_{2e}) emission from the EV was 1,187 kg while that from the DV was 1,841 kg. Therefore, there is for the EV a 654 kg or 36% decrease of the respective CO_{2e} emissions from the EV during the trial period.

5 Summary

5.1 Due to the nature of PolyU's transportation service, both the vehicles were not used frequently. Owing to the special event in PolyU, there was no operation data of the EV from October to November 2019. In the 24 months of the trial, the average daily mileages of the EV and the DV were around 9 km and 16 km respectively.

5.2 The EV incurred a lower average fuel cost per km which was HK\$1.77/km (70%) less than the DV. The average total operating cost of the EV was \$7.24/km (91%) lower than the DV. The utilization rates of EV and DV were 93% and 97% respectively.

5.3 PolyU had a designated EV driver for each month. The EV drivers shared the view that the EV was quiet and environmentally friendly. The air was cleaner inside the EV than the DV. Moreover, the driver using the EV in February 2018 expressed that he liked driving the EV more than the DV after a period of adaptation. The passengers expressed that the EV produced less air pollutants than the DV, and they would support replacing all existing diesel vehicles with the electric vehicles. In general, PolyU and the drivers were satisfied with the performance of the EV.

5.4 The EV had a better fuel economy than the DV. The average fuel cost of EV was HK\$1.77/km (70%) lower than DV. The CO₂e emissions reduction from using the EV compared to the DV on same mileage (3,599 km) in this trial was 654 kg (around 36%). It shows that the impact of electric vehicle technology on saving fuel costs and reducing CO₂e emissions were obvious.

Appendix 1: Key Features of Vehicles and Charging Facility

1. Trial EV

Registration Mark	UY7882
Make:	King Long
Model:	XMQ6706CYBEVS
Class:	Private Light Bus
Gross vehicle weight:	7,000 kg
Seating capacity:	Driver + 16 passengers
Rated Power:	60 kW
Travel Range:	180 km (air-conditioning off)
Maximum speed:	over 80 km/h
Battery Type:	Lithium ion
Battery Capacity:	100.3 kWh
Year of manufacture:	2017

Charging facility

Make:	Robinson
Charging Standard:	GB/T 20234.3-2011
Charging Mode:	380V / 80A

2. DV for comparison

Registration Mark	DY3750
Make:	Toyota
Model:	BB43RZCMSWHH
Class:	Private Light Bus
Seating capacity:	Driver + 16 passengers
Gross vehicle weight:	4,000 kg
Engine capacity:	4104 c.c.
Year of manufacture:	1999

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV and charging facility



Front view of EV



Rear view of EV



Left Side view of EV



Right Side view of EV



Charging Station 80A



Display panel of Charging Station

2. DV for comparison



Front view of DV



Rear view of DV



Left Side view of DV



Right Side view of DV