

Pilot Green Transport Fund

Interim Report

On

Trial of Single-deck Electric Bus for Coach Hiring Service
(Tai On Investment Limited)

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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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(Tai On Investment Limited)**

**Interim Report
(Trial Period: 1 September 2019 – 31 August 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. Tai On Investment Limited (Tai On) was approved under the Fund for trial of one single-deck electric bus for coach hiring service. Through the tendering procedures stipulated in the Subsidy Agreement signed with the Government, Tai On procured one BYD C9R single-deck electric bus (EV) for trial.

1.2 The PolyU Technology and Consultancy Company Limited has been engaged by the Environmental Protection Department (EPD) as an independent third party assessor (the Assessor) to monitor the trial and evaluate the performance of the trial vehicle. Tai On assigned a single-deck diesel bus (DV) providing same service as the conventional counterpart for comparison.

1.3 This Interim Report summarizes the performance of the EV in the first twelve months of the trial as compared with its conventional counterpart.

2. Trial and Conventional Vehicles

2.1 The trial EV, BYD C9R single-deck electric bus, has a gross vehicle weight (GVW) of 18,000 kg capable of carrying a driver and 65 passengers, and it is equipped with a 324 kWh lithium iron phosphate battery pack. It has a driving range of 250 km with air-conditioning off. No designated driver was assigned to drive the EV.

2.2 Tai On assigned an Isuzu single-deck diesel bus (DV1) which has a GVW of 14,800 kg capable of carrying a driver and 66 passengers and a cylinder capacity of 7,790 c.c. for comparison purpose. DV1 was in operation from 1 September 2019 to 10 October 2019. Due to the business operation arrangement, Tai On assigned a Scania single-deck diesel bus (DV2) with a GVW of 16,000 kg capable of carrying a driver and 65 passengers and a cylinder capacity of 9,290 c.c. to replace DV1 for comparison with the EV from 30 October 2019 onward.

2.3 The vehicles are mainly used to provide shuttle bus service for Next Digital Limited for 24 hours every day. The service route is a fixed round-trip route. From hours 06:50 to 24:00, they provide service between Tseung Kwan O Industrial Estate and the Tiu Keng Leng MTR station; while from hours 00:00 to 06:15, they provide service between Tseung Kwan O Industrial Estate and Tseung Kwan O, Kwun Tong and Mong Kok.

2.4 Tai On rents a designated 80 kW, 3-phase AC quick charger for charging the EV from BYD at its own cost and it takes around 4 ~ 5 hours for fully charging the EV. Key features of the EV, charging facility and the DV are in Appendix 1 and their photos are shown in Appendix 2.

3. Trial Information

3.1 The trial commenced on 1 September 2019 and would last for 24 months. Tai On 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 maintenances of the EV. Similar data of the DV were also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the drivers and Tai On 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.

Table 1: Key operation statistics of each vehicle (1 September 2019 – 31 August 2020)

		EV	DV ^{[1][2]}
Total distance traveled (km)		77,281	108,485
Average daily distance traveled (km/day)		213	314 ^[2]
Average fuel economy	(km/kWh)	0.99	-
	(km/litre)	-	3.59
	(km/MJ)	0.28	0.10 ^[3]
Average fuel cost (HK\$/km) ^[4]		1.21	3.99
Average total operating cost per km (HK\$/km)		1.26	3.99
Downtime (working day) ^[5]		3	0

^[1] DV1 provided shuttle bus service from 1 September 2019 to 10 October 2019.

^[2] Due to Tai On's business operation arrangement, DV1 ceased to provide shuttle bus service on 10 October 2019 and was replaced by DV2 from 30 October 2019 onward. DV1 and DV2 had not provided any service for 20 days in October 2019.

^[3] Assuming lower heating value of 36.13 MJ/litre for diesel fuel.

^[4] The market fuel price was used for calculation.

^[5] 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.

4.2 During the first twelve months of the trial, the total distance traveled and the average daily distance traveled of the EV were 77,281 km and 213 km/day, respectively while those of the DV were 108,485 km and 314 km/day, respectively.

4.3 The average fuel cost of the EV was HK\$2.78/km (i.e., 70%) lower than that of the DV. The EV had undergone a scheduled maintenance resulting in 3 working days downtime while the DV had no scheduled or unscheduled maintenance. The average total operating cost of the EV was HK\$2.73/km (i.e., 68%) lower than that of the DV. The data showed the EV incurred lower fuel cost per km and total operating cost per km compared with its conventional counterpart. The economic advantage of the EV is obvious.

4.4 In the reporting period, there were 366 and 346 working days for the EV and the DV, respectively. The utilization rate of the EV was 99% while that of the DV was 100%.

5. Summary

5.1 In the first twelve months of the trial, the average daily distance travelled of the EV was 213 km/day while that of the DV was 314 km/day. The average fuel cost of the EV was HK\$2.78/km (i.e., 70%) lower than that of the DV, while the average total operating cost of the EV was HK\$2.73/km (i.e., 68%) lower than that of the DV.

5.2 The utilization rate of the EV was 99% while that of the DV was 100%.

5.3 The drivers had no problem in operating the EV and considered it was clean and quiet. Passengers also have positive feedback on the EV. Tai On was satisfied with the EV performance in general.

5.4 The findings only reflect the performance of the EV in the first twelve months of the trial. The performance and reliability of the EV will be continuously monitored in the 24 months of the trial.

Appendix 1: Key Features of Vehicles and Charging Facility

1. Trial EV and Charging Facility

EV

Registration mark	WG4658
Make:	BYD
Model:	C9R
Class:	Public bus
Gross vehicle weight:	18,000 kg
Seating capacity:	driver + 65 passengers
Rated power:	300 kW
Travel range:	250 km (air conditioning off)
Maximum speed:	100 km/h
Battery material:	Lithium iron phosphate
Battery capacity:	324 kWh
Year of manufacture:	2018

Charging Facility (rent from BYD)

Make:	BYD
Model:	EVA080KG/01
Power:	80 kW, 3-phase AC
Charging standard:	GB mode
Weight:	30 kg
Year of manufacture:	2018

2. DV Used for Comparison

	1 Sep 2019 to 10 Oct 2019	30 Oct 2019 onward
Registration mark:	DV1 : UM8716 ^[1]	DV2: SS5402 ^[2]
Make:	Isuzu	Scania
Model:	LT434PF-6S-V	K280IB4X2NB
Class:	Public bus	Public bus
Gross vehicle weight:	14,800 kg	16,000 kg
Seating capacity:	driver + 66 passengers	driver + 65 passengers
Cylinder capacity:	7,790 cc	9,290 cc
Year of manufacture:	2015	2013

^[1] DV1 (UM8716) provided shuttle bus service from 1 Sep 2019 to 10 Oct 2019.

^[2] Due to Tai On's business operation arrangement, DV1 (UM8716) ceased to provide shuttle bus service on 10 Oct 2019 and was replaced by DV2 (SS5402) from 30 Oct 2019 onward.

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV and Charging Facility

	
Front view of the EV	Rear view of the EV
	
Left side view of the EV	Right side view of the EV
 <p>80 kW, 3-phase AC quick charger (rented from BYD)</p>	

DV for Comparison

DV1 : UM8716 (1 Sep 2019 to 10 Oct 2019)



Front view of DV1



Rear view of DV1







Left side view of DV1



Right side view of DV1

DV2: SS5402 (from 30 Oct 2019 onward)

 <p>A front-facing view of a white bus with 'Mr. Bus 巴士先生' and 'SS 5402' on the front. The license plate is SS 5402. A timestamp '09/09/2020 15:53' is visible in the bottom right corner.</p>	 <p>A rear-facing view of the bus showing 'Mr. Bus 巴士先生' and 'SS 5402' on the back. A rental service phone number is visible above the logo. A timestamp '09/09/2020 15:54' is visible in the bottom right corner.</p>
Front view of DV2	Rear view of DV2
 <p>A side view of the bus from the left, showing 'Mr. Bus 巴士先生' and 'SS 5402' on the side. A timestamp '09/09/2020 15:54' is visible in the bottom right corner.</p>	 <p>A side view of the bus from the right, showing 'Mr. Bus 巴士先生' and 'SS 5402' on the side. A timestamp '09/09/2020 15:55' is visible in the bottom right corner.</p>
Left side view of DV2	Right side view of DV2