

Pilot Green Transport Fund

Final Report

On

Trial of Electric Light Good Vehicles

for Vehicle Maintenance Services

(Chun Tat Motor 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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**Pilot Green Transport Fund
Trial of Electric Light Goods Vehicles for Vehicle Maintenance Services
(Chun Tat Motor Limited)**

**Final Report
(Trial Period: 1 April 2019 – 31 March 2021)**

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. Chun Tat Motor Limited (Chun Tat) was approved under the Fund for trial of three electric light goods vehicles (EVs) to provide transportation services for vehicle parts, vehicle repair equipment and personnel among various locations, including its office & vehicle maintenance garage in Hung Shui Kiu. Through the tendering procedure stipulated in the Agreement signed with the Government, Chun Tat procured three electric light goods vehicles (EVs) of model DFSK EC35 (hereafter called EVs: EV-1, EV-2 and EV-3) for the trial.

1.2 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 3 trial vehicles. Chun Tat assigned 3 diesel light goods vehicles (DVs : DV-1, DV-2 and DV-3) which provide similar services, as the conventional counterparts for comparing with the EVs.

1.3 This Final Report summarizes the performance of the EVs in the 24 months of the trial as compared with their conventional counterparts, i.e. the DVs.

2. Trial and Conventional Vehicles

2.1 Chun Tat installed three 7kW EV charging facilities at its vehicle maintenance garage in Hung Shui Kiu at its own cost. Key features and photos of the EVs, the charging facilities, and the DVs are provided in Appendix 1 and Appendix 2, respectively. As the nature of the services, there were no fixed daily routes for the EVs and the DVs. In the 24 months of the trial, the average daily (working day) mileages of EV-1, EV-2 and EV-3 were 35.3 km, 82.6 km, and 47.9 km respectively while those of DV1, DV2, and DV3 were 129.3 km, 43.3 km, and 68.9 km respectively.

3. Trial Information

3.1 The trial commenced on 1 April 2019 and lasted for 24 months. Chun Tat was required to collect and provide trial information including the EVs' mileage reading before charging, amount of electricity consumed and time used in each charging, and operation downtime due to charging, cost and downtime associated with scheduled and unscheduled maintenances of the EVs. Similar data of the DVs were also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the drivers and Chun Tat were collected and provided to reflect any problems of the EVs.

4. Findings of Trial

4.1 The following table summarizes the statistical data of the EVs and the DVs.

Table 1: Key operation statistics of each vehicle (1 April 2019 to 31 March 2021)

	EVs			DVs			
	EV-1	EV-2	EV-3	DV-1	DV-2 ^[1]	DV-3	
Total distance travelled (km)	20,918	49,000	28,430	76,144	25,559	35,639	
Average daily distance travelled (km/day) ^[2]	35.3	82.6	47.9	129.3	43.3	68.9	
Average fuel economy	(km/kWh)	4.01 ^[3]	4.43	4.43	-	-	-
	(km/litre)	-	-	-	6.81	4.23	5.46
	(km/MJ)	1.11	1.23	1.23	0.19 ^[2]	0.12 ^[2]	0.15 ^[2]
Average fuel cost (HK\$/km)	0.30 ^[3]	0.27 ^[3]	0.27 ^[3]	2.12 ^[4]	3.41 ^[4]	2.65 ^[4]	
Fleet average fuel cost (HK\$/km)	0.28			2.73			
Average total operating cost (HK\$/km) ^[5]	0.30	0.27	0.27	2.37	3.68	3.64	
Fleet average total operating cost (HK\$/km)	0.28			3.23			
Downtime (working day) ^{[5][6]}	0	0	0	4	3	76	

^[1] VJ2698 was replaced by SR869 in October 2019. Both were Hiace van of Toyota. SR869 was again replaced by VR5013 on 26 March 2020. The reason of the two replacements was: beyond repairable, taking into account of age and insurance.

^[2] Assuming lower heating value of 36.13 MJ/litre for diesel fuel

^[3] Electricity cost is based on HK\$1.177/kWh in 2019 and HK\$1.218/kWh in 2020 & 2021

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

^[5] Maintenance due to incident not related to the performance of the vehicle was not included for comparing the performance.

^[6] 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 In the 24 months of the trial period, the average fuel cost of EV-1 was HK\$1.82/km (i.e., about 86%) lower than that of DV-1; the average fuel cost of EV-2 was HK\$3.14/km (i.e., about 92%) lower than that of DV-2; whilst the average fuel cost of EV-3 was HK\$2.38/km (i.e., about 90%) lower than that of DV-3. The fleet average fuel cost of all three EVs was HK\$2.45/km (i.e., about 90%) lower than that of the three DVs.

4.3 After taking into account the maintenance costs, the average total operating costs of EV-1, EV-2 and EV-3 were HK\$2.07/km (87%), HK\$3.41/km (93%) and HK\$3.37/km (93%) lower than those of DV-1, DV-2 and DV-3, respectively. The fleet average total operating cost of EVs was HK\$2.95/km (i.e., about 91%) lower than that of the DVs.

4.4 There were 593 working days in the 24-month trial period. All the three EVs had two scheduled maintenances each, involving government vehicle examinations, which resulted in zero loss of working day as the durations of maintenances were very short. The utilization rates were 100% for the three EVs. DV-1, DV-2 and DV-3 had 4 working days, 3 working days and 76 working days lost, respectively due to maintenance work. The utilization rates of DV-1, DV-2 and DV-3 were about 99.3%, 99.5% and 87.2%, respectively. There was no indication that the fuel economy and the batteries of the EVs had deteriorated during the trial period.

4.5 Compared with the carbon dioxide equivalent (CO₂e) emissions of the DVs (estimated based on the total mileages of the EVs), there were reductions of 5,271 kg, 24,375 kg and 9,934 kg CO₂e emissions by using EV-1, EV-2 and EV-3, respectively. Overall, there was a total reduction of 39,580 kg CO₂e emission (i.e., around 71%) in the trial by using the three EVs.

4.6 The drivers have no difficulty, in general, in operating the EVs and felt that the EVs performed satisfactorily. They have overcome the problem of driving range anxiety and now have more confidence in using the EVs for longer distance trips. Chun Tat was also satisfied with the performance of the EVs, especially on the saving of the fuel cost.

5. Summary

5.1 In the 24 months of the trial, the average fuel cost of the EV-1 was lower than that of the DV-1 by HK\$1.82/km (i.e. about 86%), while the average fuel cost of the EV-2 was lower than that of the DV-2 by HK\$3.14/km (i.e. about 92%) and the average fuel cost of the EV-3 was lower than that of the DV-3 by HK\$2.38/km (i.e. about 90%). The fleet average fuel cost of all three EVs was HK\$2.45/km (i.e. about 90%) lower than that of the three DVs.

5.2 After taking into account the maintenance costs, the average total operating cost of the EV-1 was lower than that of the DV-1 by HK\$2.07/km (i.e. about 87%), while the average total operating cost of the EV-2 was lower than that of the DV-2 by HK\$3.41/km (i.e. about 93%) and the average total operating cost of the EV-3 was lower than that of the DV-3 by HK\$3.37/km (i.e. about 93%). The fleet average total operation cost of the three EVs was HK\$2.95/km (i.e. about 91%) lower than that of the three DVs.

5.3 There were 593 working days in the 24 months of the trial. All the three EVs had no loss in working days, hence they had 100% utilization rate. DV-1, DV-2 and DV-3 lost 4 working days, 3 working days and 76 working days, respectively, due to maintenances, hence the utilization rates of DV-1, DV-2 and DV-3 were 99.3%, 99.5% and 87.2%, respectively. There was no indication that the fuel economy and the batteries of the EVs had deteriorated during the trial period.

5.4 There are reductions of 5,271 kg, 24,375 kg and 9,934 kg CO₂e emissions by using EV-1, EV-2 and EV-3, respectively. Overall, there was a total reduction of 39,580 kg CO₂e emission (i.e., around 71%) in the trial by using the three EVs.

5.5 The drivers had no problem in operating the EVs and have adapted well in driving the EVs. The drivers and Chun Tat was also satisfied with the performance of the EVs.

Appendix 1: Key Features of the Vehicles and Charging Facilities

1. Trial EVs and Charging Facilities

(a) EVs

Registration mark	WA3193 (EV-1), WA3979 (EV-2) and WA4044 (EV-3)
Make:	DFSK(東風小康)
Model:	EC35
Class:	Light Goods Vehicle
Gross vehicle weight:	2,330 kg
Seating capacity:	Driver + 4 passengers
Expected travel range:	300 km (air-conditioning off)
Battery material:	Lithium ion
Battery Capacity:	41.4 kWh
Maximum motor power :	30 kW
Year of manufacture:	2018

(b) Charging Facilities (Installed at Subsidy Recipient's own cost)

Charger-1

Make:	Hong Kong EV Power
Model:	EVC-32NK
Serial number:	EG3A508154
Date of manufacture:	09-02-2017
IP degree:	IP54
Rated voltage:	220V
Rated frequency:	50Hz
Rated current:	32A
Maximum Power	7kW
Socket:	IEC62196-2 Type2 (32A, 1Phase)

Charger-2 and Charger-3

Make:	Hofa Tech
Model:	HF-A4
IP degree:	IP55
Phase:	Single-phase
Rated voltage:	220V
Rated frequency:	50Hz
Rated current:	32A
Maximum Power	7kW
Socket:	Type2 Universal Socket

2. DVs Used for Comparison

DV-1

Registration mark PY1269
Make: Toyota Hiace
Model: KDH201RSSPDY
Class: Light Goods Vehicle
Gross vehicle weight: 2,800 kg
Seating capacity: Driver + 4 passengers
Cylinder capacity: 2,982 cc
Year of manufacture: 2011

DV-2

Registration marks:	VJ2698 (Apr-Sept 2019)	SR869 (Oct 2019 - Mar 2020)	VR5013 (Mar -Apr 2020)
Make:	Toyota	Toyota	ISUZU
Model:	KDH200RSSMDY	KDH201RSSPDY	TFR86JS-V
Class:	Light Goods Vehicle	Light Goods Vehicle	Light Goods Vehicle
Gross vehicle weight:	2,800kg	2,800kg	2,900 kg
Engine capacity:	2,494 c.c.	2,982 c.c.	2,499 c.c.
Seating capacity:	Driver + 5 passengers	Driver + 5 passengers	Driver + 1 passengers
Year of manufacture	2005	2009	2014

DV-3

Registration mark SC1556
Make: Hyundai
Model: H1 VAN AT EURO 5
Class: Light Goods Vehicle
Gross vehicle weight: 3,230 kg
Seating capacity: Driver + 4 passengers
Cylinder capacity: 2,497 cc
Year of manufacture: 2013

Appendix 2: Photos of Vehicles and EV Charging Facilities

1. Trial EV and Charging Facilities

(a) EV-1



(b) EV-2



Front view



Rear view



Right side view



Left side view

(c) EV-3



Front view



Rear view



Right side view



Left side view

(d) EV Charging Facilities (Installed at Subsidy Recipient's own cost)

 A close-up photograph of an EV charging station. The station is black and has 'EV POWER' printed at the top. A blue charging cable is plugged into the station. To the left, there is a blue and white charging handle.	 A photograph of an EV charging station mounted on a wall. The station is black and has a yellow warning sign with a lightning bolt symbol. A black charging cable is plugged into the station. To the right, there is a blue and white charging handle.
<p>Charger-1</p>	<p>Charger-2</p>
 A photograph of an EV charging station. The station is white and has a circular logo. A blue charging cable is plugged into the station. To the left, there is a blue and white charging handle.	
<p>Charger-3</p>	

2. DV for Comparison

(a) DV-1 (PY1269)



Front view



Rear view



Right side view



Left side view

(b) DV-2 (VJ2698) (Up to September 2019)



Front view



Rear view



Right side view



Left side view

DV-2 (SR 869) (Oct 2019 - 25 March 2020)



Front view



Rear view



Right side view



Left side view

DV-2 (VR5013) (After 26 March 2020)



Front view



Rear view



Right side view



Left side view

(c) DV-3 (SC1556)



Front view



Rear view



Right side view



Left side view