Pilot Green Transport Fund

Final Report
On
Trial of Electric Light Goods Vehicles for Logistics Service
(Ferrari Logistics (Asia) Limited)

(20 September 2021)

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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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Trial of Electric Light Goods Vehicles for Logistics Service
(Ferrari Logistics (Asia) Limited)

Final Report
(Reporting Period: 1 May 2019 – 30 April 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. Ferrari Logistics (Asia) Limited (Ferrari Logistics) was approved under the Fund for trial of two electric light goods vehicles for logistics service. Ferrari Logistics, through the tendering procedures stipulated in the Agreement entered into with the Government, procured two Nissan e-NV200 electric light goods vehicles (EVs: EV-1 and EV-2) for trial. According to the manufacturer, the EVs have a travel range of 317 km with battery fully charged and air-conditioning off.

1.2 PolyU Technology and Consultancy Company Limited 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. Ferrari Logistics assigned two Hyundai diesel light goods vehicles (DVs: DV-1 and DV-2) each with a GVW of 3,230 kg and a cylinder capacity of 2,497 c.c. and provided similar service as the conventional counterparts for comparison.

1.3 This Final Report summarizes the performance of the EVs in the 24-month trial period as compared with the DVs.

2. Trial and Conventional Vehicles

2.1 Key features of the EVs, the charging facilities and the DVs are in Appendix 1 and photos of the vehicles and the charging facilities are in Appendix 2. The EVs were used for the delivery of goods from Kwai Chung to different parts of Hong Kong Island, Kowloon and the New Territories.

2.2 Ferrari Logistics installed two 7kW AC charging facilities for charging and recording the amount of electricity charged, one for each EV. The EVs were normally charged overnight. However, the EVs sometimes had to be maintained in operational state for a whole day, so the electricity of the batteries was more consumed on such operation than actual travel. Hence, the EVs were required to have opportunity charging

using public chargers occasionally.

3. Trial Information

3.1 The trial commenced on 1 May 2019 and lasted for 24 months. Ferrari Logistics 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 and the charging facilities. 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 Ferrari Logistics were collected 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. The fleet average fuel cost of the EVs was HK$1.54/km (86%) lower than that of the DVs. The fleet average total operating cost of the EVs was HK$1.84/km (79%) lower than that of the DVs.

Table 1: Key operation statistics of each vehicle (1 May 2019 – 30 April 2021)

		EVs		**DVs**	
		EV-1	**EV-2**	**DV-1**	**DV-2**
Total mileage (km)		55,273	45,823	49,284	58,171
Average daily mileage (km/working day)		125	93	101	118
Average fuel economy	(km/kWh)	4.81	4.61	-	-
	(km/litre)	-	-	7.64	8.63
	(km/MJ)	1.33	1.28	0.21[1]	0.24[1]
Average fuel cost (HK$/km)		0.25[2]	0.26[2]	1.91[3]	1.69[3]
Fleet Average fuel cost (HK$/km)		0.26		1.80	
Average total operating cost (HK$/km) [4]		0.450	0. 516	2.56	2.07
Fleet average total operating cost (HK$/km)		0.48		2.32	
Downtime (working day) [4][5]		55	5	6.5	3.5

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

[2] Electricity cost is based on HK$1.177/kWh for 2019 and HK$1.218/kWh for 2020 and 2021

[3] The market fuel price was used for calculation

[4] Maintenance unrelated to the performance of the vehicle was not included for comparison. Parking fees paid for opportunity charging occasionally at public carparks were included. During the trial period, charging with public charger in government carpark was free of charge.

[5] Downtime refers to the working days the vehicle is not in operation, which is counted from the first day it stops operation till the day it is returned to the operator.

4.2 EV-1 had 55 days of downtime mainly due to the long waiting time for repair parts of the braking system in an unscheduled maintenance, while EV-2 had 5 days of downtime. DV-1 had 6.5 days of downtime while DV-2 had 3.5 days of downtime. The

utilization rates were 89% for EV-1 and 99% for EV-2, DV-1 and DV-2. Based on the above, the average daily mileages of EV-1 and EV-2 were 125 km/day and 93 km/day respectively while the average daily mileages of DV-1 and DV-2 were 101 km/day and 118 km/day respectively.

4.3 In general, the drivers of the EVs had no problem in operating the EVs and were satisfied with their performance. The EVs were able to cope with the daily mileage requirement. However, as the EVs sometimes had to be maintained in operational state after parking, so the electricity of the batteries was more consumed on such operation than actual travel. As a result, the electricity of the EV batteries was more consumed on such operation than actual travel. Hence, the EVs were required to have opportunity charging using public chargers occasionally. The drivers stated that there were insufficient public chargers for charging the EVs when opportunity charging was required.

4.4 Ferrari Logistics agreed that using the EVs was good because they could provide a greener and quieter environment with lower fuel cost. Ferrari Logistics will consider using more EVs if more public charging stations are available in Hong Kong and the charging time can be shortened.

4.5 To remove the seasonal fluctuations, 12-month moving averages were used in this report to evaluate the trend of the EVs' fuel economy. The results showed that there was a slight increase in the fuel economy of the two EVs in the 24-month trial period. Thus, there was no indication of deterioration in the performance of the two EVs.

4.6 In the 24 months trial period, the carbon dioxide equivalent (CO_2e) emissions from EV-1 and EV-2 were 4,656 kg and 4,064 kg respectively, while those from DV-1 and DV-2 base on the same total mileages of the corresponding EVs were 20,064 kg and 14,719 kg respectively. Hence, there was a 26,063 kg (75%) reduction of CO_2e, with the replacement of DVs by EVs in the trial.

5. Summary

5.1 The fleet average fuel cost of the EVs was HK$1.54/km (86%) lower than that of the DVs. The fleet average total operating cost of the EVs was HK$1.84/km (79%) lower than that of the DVs. The utilization rates were 89% for EV-1 mainly due to long awaiting time for the replacement parts in an unscheduled maintenance, and 99% for EV-2, DV-1 and DV-2. There was a 26,063 kg (75%) reduction of CO_2e, with the replacement of DVs by EVs in the trial.

5.2 Based on the 12-month moving average fuel economy, there was no indication of deterioration in the performance of the two EVs.

5.3 The drivers had no problem in operating the EVs and were satisfied with their performance. The EVs were able to cope with the daily mileage requirement. However,

as the EVs sometimes had to be maintained in operational state after parking for operational need, opportunity charging at public charging stations was required occasionally. The drivers appeal for more public charging stations. Ferrari Logistics agreed that using the EVs is good because they could provide a greener and quieter environment with lower fuel cost. Ferrari Logistics will consider using more EVs if more public charging stations are available and the charging time can be shortened.

5.4 As electric vehicle market is expanding and technology is improving, the capital cost of electric light goods vehicle has dropped in recent years. The price difference between electric light goods vehicle and diesel light goods vehicle will narrow down.

Appendix 1: Key Features of Vehicles and Charging Facilities

1. Trial EVs

Registration mark	**VY2760 (EV-1), VY2984 (EV-2)**
Make:	Nissan
Model:	e-NV200
Class:	Light goods vehicle
Gross vehicle weight:	2,240 kg
Seating capacity:	Driver + 1 passenger
Rated power:	80 kW
Travel range:	317 km (air conditioning off)
Battery material:	lithium-ion
Battery capacity:	40 kWh
Year of manufacture:	2018

Charging Facilities

Maker:	EV Power
Model:	EVC-32NK
Output:	7 kW, 220V AC / max 32A
Charging Standard:	IEC62196-2 Type 2

2. DVs for Comparison

Registration mark	**SC6679 (DV-1), SC7180 (DV-2)**
Make:	Hyundai
Model:	H1 Van Standard Euro 5
Class:	Light Goods Vehicle
Seating capacity:	Driver + 5 passengers
Gross vehicle weight:	3,230 kg
Cylinder capacity:	2,497 cc
Year of manufacture:	2013

Appendix 2: Photos of Vehicles and Charging Facilities

1. Trial EVs and Charging Facilities

EV-1 (VY2760) & its charging facility

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<tr><td>EV-1 – front view</td><td>EV-1 – rear view</td></tr>
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<tr><td>EV-1 – right side view</td><td>EV-1 – left side view</td></tr>
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<tr><td>EV-1 – watt-hour meter</td><td>EV-1 – EV charger</td></tr>
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EV-2 (VY2984) & its charging facility

	
EV-2 – front view	EV-2 – rear view
	
EV-2 – right side view	EV-2 – left side view
	
EV-2 – watt-hour meter	EV-2 – EV charger

2. DVs for Comparison

	
DV-1 (SC6679)	DV-2 (SC7180)