Pilot Green Transport Fund

Final Report
On
Trial of Electric Light Goods Vehicles for Decoration and Construction Engineering Service (Bassey Holdings Limited)

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(Bassey Holdings Limited)

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(Reporting Period: 1 June 2021 – 31 May 2023)

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. Bassey Holdings Limited (Bassey) was approved under the Fund for trial of two electric light goods vehicles for decoration and construction engineering. Bassey, through the tendering procedures stipulated in the Agreement entered into with the Government, procured two electric light goods vehicles (EVs), a Nissan e-NV200 electric light goods vehicle (EV-1) and a Joylong EW5 electric light goods vehicle (EV-2) for trial.

1.2 PolyU Technology and Consultancy Company Limited has been engaged by the Environmental Protection Department[1] as an independent third party assessor to monitor the trial and evaluate the performance of the trial vehicles. Bassey assigned two diesel light goods vehicles (DVs: DV-1 and DV-2) which provided similar service as the conventional counterparts for comparison.

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

[1] The Administration of the New Energy Transport Fund was migrated to the Environment Branch of the Environment and Ecology Bureau [EEB (Environment Branch)] since 1 January 2023 after internal re-organisation of EEB (Environment Branch) and EPD.

2. Trial and Conventional Vehicles

2.1 The trial EV-1 – Nissan e-NV200 electric light goods vehicle – has a gross vehicle weight (GVW) of 2,250 kg, capable of carrying a driver with four passengers and goods. The Nissan e-NV200 EV has a 40 kWh lithium-ion battery pack and has a travel range of 317 km with air-conditioning off. The trial EV-2 – Joylong EW5 electric light goods vehicle – has a gross vehicle weight (GVW) of 4,300 kg, capable of carrying a driver with one passenger and goods. The Joylong EW5 EV has a 73.4 kWh lithium-ion battery pack and it has a travel range of 330 km with air-conditioning off.

2.2 In this trial, Bassey arranged a Nissan diesel light goods vehicle (DV-1) with a GVW of 3,300 kg and a cylinder capacity of 2,488 c.c. for comparison with EV-1; and an Isuzu diesel light goods vehicle (DV-2) with a GVW of 5,200 kg and a cylinder capacity of 2,999 c.c. for comparison with EV-2, up to August 2022. Starting from September 2022, another Nissan diesel light goods vehicle having the same model as DV-1 replaced the Isuzu diesel goods vehicle for comparison with EV-2.

2.3 EV-1 was used for the delivery of tools and materials for construction and decoration from San Tin to different sites in Kowloon. EV-2 was used for the delivery of frozen food from San Tin to Tung Chung from June 2021 to August 2022 and served similar services as EV-1 from September 2022 to May 2023. EV-2 and the Isuzu DV-2 are refrigerated for carrying frozen food with a temperature setting of -4oC. The Nissan DV-2 is not refrigerated.

2.4 Bassey installed two sets of charging facilities outside its office at Siu Hum Tsuen: a 7 kW AC charging facility for charging and recording the amount of electricity charged for EV-1 and a 30 kW DC charging facility for charging and recording the amount of electricity charged for EV-2. The 7 kW AC charger is owned by Bassey while the 30 kW DC is subsidized by the Pilot Green Transport Fund. The EVs were normally charged when their services were not required. The original battery charger for EV-1 has not been working since 5/10/2021. Bassey has another 32-ampere battery charger and has used it for charging EV-1 since 5/10/2021. Key features of the EVs (EV-1 and EV-2), the charging facilities, and the DVs (DV-1 and DV-2s) are in Appendix 1 and their photos are in Appendix 2.

3. Trial Information

3.1 The trial commenced on 1 June 2021 and lasted for 24 months. Bassey 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 Bassey were collected to reflect any problems of the EVs.

4. Findings of Trial

4.1 Table 1 summarizes the statistical data of the EVs and the DVs.

Table 1: Key operation statistics of each vehicle (1 June 2021 –31 May 2023)

		EV-1	EV-2	DV-1	DV-2
Total mileage (km)		45,963	64,799	14,445	124,754
Average daily mileage (km/working day)		110	93	29	229
Average fuel economy	(km/kWh)	4.59	2.96	-	-
	(km/litre)	-	-	3.98	6.13
	(km/MJ)	1.27	0.82	0.11 [1]	0.17 [1]
Average fuel cost (HK$/km)		0.285 [2]	0.434 [2]	4.93 [3]	3.07 [3]
Fleet Average fuel cost (HK$/km)		0.36		4.00	
Average total operating cost (HK$/km) [4]		0.34	0.53	5.22	3.18
Fleet average total operating cost (HK$/km)		0.43		4.20	
Downtime (working day) [4][5]		5	26	1	181

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

[2] Electricity cost was based on HK$1.218/kWh for 2021, HK$1.289/kWh for January to October 2022, HK$1.451/kWh for November to December 2022, HK$1.544/kWh for January to February 2023, HK$1.552/kWh for March to April 2023, and HK$1.565/kWh for May 2023

[3] The market fuel price was used for calculation

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

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

4.2 In the 24-month trial period, there were 493 working days for EV-1 and DV-1 and 726 working days for EV-2 and DV-2. There were two scheduled and three unscheduled maintenances for EV-1, with 76 days of downtime but 71 of which were not related to the performance of the EV; two scheduled and three unscheduled maintenances for EV-2, with 26 days of downtime; two scheduled maintenance for DV-1 with one day of downtime; and one scheduled and three unscheduled maintenances for DV-2 with 181 days of downtime. The utilization rates were 98.8%, 96.4%, 99.8% and 75.1% for EV-1, EV-2, DV-1 and DV-2, respectively.

4.3 In the 24 months of the trial, the total and daily mileages of EV-1 were 45,963 km and 110 km, the total and daily mileages of EV-2 were 64,799 km and 93 km, the total and daily mileages of DV-1 were 14,445 km and 29 km, the total and daily mileages of DV-2 were 124,754 km and 229 km. The fleet average fuel cost of the EVs was HK$3.64/km (91%) less than that of the DVs. The fleet average total operating cost of the EVs was HK$3.77/km (89.8%) lower than that of the DVs. EV-2 has higher fuel costs than EV-1 because it has higher gross vehicle weight and energy is required for operating the refrigeration system.

4.4 To eliminate the seasonal effect, a 12-month moving average is used in this report to evaluate the trend of the fuel economy of the EVs. Based on the evaluation of the 12-month moving average fuel economy, the fuel economy of EV-1 and EV-2 decreased by 10% and 27% respectively in the 24-month trial period. Bassey noticed that EV-2 travelled shorter distance after a full charging and hence returned the EV to the supplier for maintenance of the battery pack in August 2022. However, no improvement in the fuel economy was observed after the maintenance. The reasons leading to the decrease in fuel economy of EV-2 could not be identified. There was no indication of deterioration in the battery capacity of EV-1. For EV-2, analysis of the charging records indicates that there are problems in the charging records from July 2022 to May 2023. Hence, it could not be concluded if there is deterioration in the battery capacity of EV-2 or not.

4.5 For comparison purpose, the carbon dioxide equivalent (CO_2e) emission of a DV can be evaluated based on the mileage of the EV and the fuel economy of the DV. In the 24-month of the trial, the carbon dioxide equivalent (CO_2e) emission from EV-1 was 3,909 kg while the CO_2e emission from DV-1 was 32,026 kg. Hence, there was a 28,117 kg (i.e., about 88%) reduction of CO_2e if DV-1 was replaced by EV-1 in the trial. The CO_2e emission from EV-2 was 8,513 kg while the CO_2e emission from DV-2 was 29,330 kg. Hence, there was a 20,798 kg (i.e., about 71%) reduction of CO_2e if DV-2 was replaced by EV-2 in the trial.

4.6 The driver of EV-1 had no problem in operating the EV and was satisfied with its performance. The driver of EV-2 did not like driving the EV because of its lower power and lower travel range in comparison with a DV. Overall, Bassey considered that using the EVs is good because they can provide a greener and quieter environment as well as EVs have lower fuel cost.

5. Summary

5.1 In this trial, the daily mileages of EV-1, EV-2, DV-1 and DV-2 were 110 km, 93 km, 29 km and 229 km, respectively. The fleet average fuel cost of the EVs was HK$3.64/km (91%) less than that of the DVs. The fleet average total operating cost of the EVs was HK$3.77/km (89.8%) lower than that of the DVs.

5.2 The utilization rates of EV-1, EV-2, DV-1 and DV-2 were 98.8%, 96.4%, 99.8% and 75.1%, respectively. There was a 10% decrease in the fuel economy of EV-1 and a 27% decrease in the fuel economy of EV-2, in the trial period. Reasons for the decrease in fuel economy of EV-2 could not be identified. There was no indication that the battery capacity of EV-1 had deteriorated while it could not be judged if the battery capacity of EV-2 had deteriorated or not.

5.3 There was a 28,117 kg (i.e., about 88%) reduction of CO_2e if DV-1 was replaced by EV-1; and a 20,798 kg (i.e., about 71%) reduction of CO_2e if DV-2 was replaced by EV-2. EV-2 has higher fuel costs than EV-1 because it has higher gross vehicle weight and energy is required for operating the refrigeration system.

5.4 The driver of EV-1 had no problem in operating the EV and was satisfied with its performance. The driver of EV-2 did not like driving the EV because of its lower power and lower travel range in comparison with a DV. Overall, Bassey considered that using the EVs is good because they can provide a greener and quieter environment as well as EVs have lower fuel cost.

5.5 The findings showed electric light goods vehicles are becoming more affordable and feasible to the transport trade for saving operating cost and reducing CO_2e emissions, provided that the vehicles can get easy access to charging facilities.

Appendix 1: Key Features of the Vehicles and Charging Facilities

1. Trial EVs

Registration mark	**WW9212 (EV-1)**	**XC7540 (EV-2)**
Make:	Nissan	Joylong
Model:	e-NV200 Half Panel Van	EW5
Class:	Light goods vehicle	Light goods vehicle, refrigerated
Gross vehicle weight:	2,250 kg	4,300 kg
Seating capacity:	Driver + 4 passengers	Driver + 1 passenger
Rated power:	80 kW	100 kW
Travel range:	317 km (air conditioning off)	330 km (air conditioning off)
Battery material:	lithium-ion	lithium-ion
Battery capacity:	40 kWh	73.4 kWh
Year of manufacture:	2019	2020

Charging Facilities

Make:	Shun Hing Electric Services Supply Centre Limited [1]	Hangzhou AoNeng Power Equipment Co. Ltd.
Model:	DH-AC0070XG57-Y	ANDC5-500V/60A-1
Power:	7 kW, single phase, 220V, 32A	3-phase, 380V, movable type 30 kW, DC (max 500V/60A)
Charging Standard:	GB	GB
Make:	EV Power [2]	
Model:	EVC-32NK	
Output:	220V AC / max 32A	
Charging Standard:	IEC62196-2 Type 2	

[1] Charger owned by Bassey, not working since 5/10/2021
[2] Charger owned by Bassey, in use as a temporary charger since 5/10/2021

2. DVs for Comparison

Registration mark	**UZ5786 (DV-1)**	**VN2829 (DV-2, 6/2021-8/2022)**
Make:	Nissan	Isuzu
Model:	NV350 Urvan 2.5L diesel	NMR85E-V
Class:	Light goods vehicle	Light goods vehicle, refrigerated
Seating capacity:	Driver + 5 passengers	Driver + 2 passengers
Gross vehicle weight:	3,300 kg	5,200 kg
Cylinder capacity:	2,488 cc	2,999 cc
Year of manufacture:	2017	2017

Registration mark	**PZ250 (DV-2, 9/2022-5/2023)**
Make:	Nissan
Model:	NV350 Urvan 2.5L diesel
Class:	Light goods vehicle
Seating capacity:	Driver + 5 passengers
Gross vehicle weight:	3,300 kg
Cylinder capacity:	2,488 cc
Year of manufacture:	2014

Appendix 2: Photos of Vehicles and Charging Facilities

1. Trial EVs and Charging Facilities

EV-1 (WW9212) & its charging facility

<table>
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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>
<tr><td>  </td><td>  </td></tr>
<tr><td>EV-1 – Watt-hour meter</td><td>EV-1 – EV charger (up to 5/10/2021)</td></tr>
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EV-1 – EV charger (since 5/10/2021)	

EV-2 (XC7540) & its charging facility

	
EV-2 – Front view	EV-2 – Rear view
	
EV-2 – Right side view	EV-2 – Left side view
	
EV-2 – EV charger	

2. DVs for Comparison

DV-1 UZ5786

	
DV-1 – Front view	DV-1 – Rear view
	
DV-1 – Right side view	DV-1 – Left side view

DV-2 VN2829 (6/2021-8/2022)

	
DV-2 – Front view	DV-2 – Rear view
	
DV-2 – Right side view	DV-2 – Left side view

DV-2 PZ250 (9/2022 - 5/2023)

	
DV-2 – Front view	DV-2 – Rear view
	
DV-2 – Right side view	DV-2 – Left side view