New Energy Transport Fund

Final Report
On
Trial of Electric Light Goods Vehicle for Civil Engineering Industry
(Ah Ngau Engineering Limited)

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(Reporting Period: 1 January 2022 – 31 December 2022)

Executive Summary

1. Introduction

1.1 The New Energy 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. Ah Ngau Engineering Limited (Ah Ngau) was approved under the Fund for trial of one electric light goods vehicle for civil engineering industry. Ah Ngau, through the tendering procedures stipulated in the Agreement entered into with the Government, procured a Joylong EW5 electric light goods vehicle (EV) for trial.

1.2 Hong Kong Productivity Council has been commissioned by the Environmental Protection Department (EPD) [1] as an independent third party assessor (the Assessor) to monitor the trial and evaluate the performance of the trial vehicle. Ah Ngau assigned a Toyota Hiace Diesel LWB diesel light goods vehicle (DV) providing same services as the conventional counterpart for comparison.

1.3 This Final Report summarises the performance of the EV in the 12 months of the trial as compared with its conventional counterpart, i.e. the DV.

2. Trial and Conventional Vehicles

2.1 The trial EV, Joylong EW5 electric light goods vehicle, has a gross vehicle weight of 4,300 kg capable of carrying a driver with four passengers and goods. It has a 73.4 kWh lithium-ion battery pack and a driving range of 330 km with its battery fully charged and air-conditioning off. The DV, Toyota Hiace Diesel LWB diesel light goods vehicle with a gross vehicle weight of 2,800 kg and a diesel engine with a cylinder capacity of 2,982 c.c., was used as the conventional counterpart for comparison in this trial. The EV and the DV were used for the delivering construction tools and materials to construction sites in CLP's power stations at Lung Kwu Tan.

2.2 Ah Ngau installed a designated 30 kW DC charging facility at the office in Lung Kwu Tan for charging and recording the amount of electricity charged. Key features of the EV, the charging facility and the DV are detailed in Appendix 1 and photos of the vehicles and the charging facility are shown in Appendix 2.

[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.

3. Trial Information

3.1 The trial commenced on 1 January 2022 and lasted for 12 months. Ah Ngau was required to collect and provide trial information including the EV's mileage reading before charging, amount of electricity consumed and time used in each charging, operation downtime due to charging, and cost and downtime associated with scheduled and unscheduled maintenances of the EV and the charging facility. 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 Ah Ngau were collected to reflect any problems of the EV.

4. Findings of Trial

4.1 The following table summarises the statistical data of the EV and the DV. Both the average fuel cost and the average total operating cost of the EV were HK$1.59/km (about 76%) lower than those of the DV.

Table 1: Key operation statistics of each vehicle (1 January 2022 – 31 December 2022)

		EV	**DV**
Total distance travelled (km)		6,522	28,457
Average daily mileage (km/working day)		22	96
Average fuel economy	(km/kWh)	2.72	-
	(km/litre)	-	10.00
	(km/MJ)	0.76	0.28 [1]
Average fuel cost (HK$/km)		0.49 [2]	2.08 [3]
Average total operating cost (HK$/km) [4]		0.49	2.08
Downtime (working day) [4][5]		0	0

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

[2] The electricity cost was calculated using average electricity tariff rates of HK$1.289/kWh (Jan 2022 – Oct 2022); and HK$1.451/kWh (Nov 2022 – Dec 2022) as claimed by CLP.

[3] The market fuel price was used for calculation.

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

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

4.2 Apart from the fuel cost, maintenance cost and other indirect costs which may include parking fee, towing fee, vehicle replacement fee and cost of operation downtime due to charging and maintenance of the EV are also included in Table 1. Both the EV and the DV had one scheduled maintenance in the 12 months of the trial. There was no unscheduled maintenance for the EV or the DV. The scheduled maintenance of the EV and the DV included the government annual vehicle inspection.

4.3 Neither the EV nor the DV had maintenance downtime. Hence, the utilisation rates of both the EV and the DV were 100%. Based on the above, the average daily driving distances of the EV and the DV were 22 km/day and 96 km/day, respectively.

4.4 The drivers of the EV liked driving the EV and had no problem in operating the EV. They agreed that the EV is quieter and the air inside the EV is cleaner. Overall, they were satisfied with the performance of the EV and would like to promote the EV to other drivers.

Ah Ngau was satisfied with the EV since the EV could meet the operational requirements and save the operation cost. Ah Ngau agreed that it was easier and cheaper to maintain the EV. Thus, given the opportunity, Ah Ngau would consider replacing all existing conventional vehicles with EVs and encourage other transport operators to try the EVs.

4.5 The results showed that there was a decreasing trend in the driving range of a full charge in the 12 months of the trial period. Since there was no designated driver assigned to drive the EV, the difference in driving habit might account for the fluctuation of the estimated driving range. Nevertheless, after the 12-month trial period, a full charging operation could be maintained at the level of 73.4 kWh. Thus, the deterioration in battery capacity within the 12-month trial period was insignificant, if any.

4.6 Based on the total mileage of the EV and the fuel economy of the DV, the equivalent carbon dioxide (CO_2e) emission from the DV could be estimated for comparison purpose. In the 12-month trial period, the CO_2e emission from the EV and the DV were 936 kg and 1,808 kg respectively. Hence, there was 872 kg (about 48%) reduction of CO_2e, with the replacement of the DV by the EV in the trial.

5. Summary

5.1 Both the average fuel cost and the average total operating cost of the EV were HK$1.59/km (about 76%) lower than that of the DV. The utilisation rates of both the EV and the DV were 100%. There was 872 kg (about 48%) reduction of CO_2e, with the replacement of the DV by the EV in the trial.

5.2 After the 12-month trial period, a full charging operation could be maintained at the level of 73.4 kWh. Thus, the deterioration in battery capacity within the 12-month trial period was insignificant, if any.

5.3 The drivers of the EV liked driving the EV and had no problem in operating the EV. Overall, they were satisfied with the performance of the EV and would like to promote the EV to other drivers. Ah Ngau was satisfied with the EV since the EV could meet the operational requirements and save the operation cost. Thus, given the opportunity, Ah Ngau would consider replacing all existing conventional vehicles with EVs and encourage other transport operators to try the EVs.

5.4 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 Vehicles and Charging Facility

1. Trial EV and Charging Facility

EV

Registration mark:	**XH1972**
Make:	Joylong
Model:	EW5
Class:	Light goods vehicle
Gross vehicle weight:	4,300 kg
Payload:	1,300 kg
Seating capacity:	Driver + 4 passengers
Rated power:	100 kW
Driving range:	330 km (air conditioning off)
Battery material:	Lithium-ion
Battery capacity:	73.4 kWh
Year of manufacture:	2019

EV Charging Facility

Make:	Only Power Supply
Model:	ANDC5-500V/60A-1
Power:	30 kW, 500V DC / max 60A
Charging standard:	GB mode

2. DV Used for Comparison

Registration mark:	**UN3132**
Make:	Toyota
Model:	Hiace Diesel LWB
Class:	Light goods vehicle
Gross vehicle weight:	2,800 kg
Payload:	850 kg
Seating capacity:	Driver + 5 passengers
Cylinder capacity:	2,982 c.c.
Year of manufacture:	2016

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV (XH1972) and Charging Facility

	
Front view of EV	Rear view of EV
	
Left side view of EV	Right side view of EV
	
30kW DC charging facility	

2. DV (UN3132) Used for Comparison

	
Front view of DV	Rear view of DV
	
Left side view of DV	Right side view of DV