Pilot Green Transport Fund

Final Report
On
Trial of Electric Light Goods Vehicle for Civil Engineering Industry
(Vast Profit Construction Engineering Limited)

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PREPARED BY:
Dr. C.S. Cheung

List of Monitoring and Evaluation Team Members

Dr. C.S. Cheung (Team Leader)
Department of Mechanical Engineering
The Hong Kong Polytechnic University

Ir. Dr. C. Ng
Department of Mechanical Engineering
The Hong Kong Polytechnic University

Mr. K.S. Tsang
Department of Mechanical Engineering
The Hong Kong Polytechnic University

Dr. Edward W.C. Lo
Department of Electrical Engineering
The Hong Kong Polytechnic University

Dr. W.T. Hung
PolyU Technology and Consultancy Company Limited
The Hong Kong Polytechnic University

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(Vast Profit Construction Engineering Limited)

Final Report
(Reporting Period: 1 December 2021 – 30 November 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. Vast Profit Construction Engineering Limited (Vast Profit) was approved under the Fund for trial of an electric light goods vehicle. Vast Profit, through the tendering procedures stipulated in the Agreement entered into with the Government, procured a Joylong EW4 electric light goods vehicle (EV) 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 vehicle. Vast Profit assigned a Toyota diesel light goods vehicle (DV) providing the same service as the conventional counterpart for comparison.

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

2. Trial and Conventional Vehicles

2.1 The trial EV – Joylong EW4 electric light goods vehicle – has a gross vehicle weight (GVW) of 3,700 kg, capable of carrying a driver with five passengers and goods. It has a 73.4 kWh lithium-ion battery pack and has a travel range of 300 km with air-conditioning off. The DV used for comparison in this trial is a TOYOTA HIACE diesel light goods vehicle with a GVW of 3,300 kg and an engine with a cylinder capacity of 2,755 c.c.. The EV and the DV were used for visit of construction sites in the north New Territories region.

[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.

2.2 Vast Profit installed a designated 30 kW DC charging facility for charging and recording the amount of electricity charged. The EV was not charged every day, and was charged when it was not in use.

2.3 Key features of the EV, the charging facility and the DV are in Appendix 1 and their photos are in Appendix 2.

3. Trial Information

3.1 The trial commenced on 1 December 2021 and lasted for 24 months. Vast Profit 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, and operation downtime due to charging, 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, opinions of the drivers and Vast Profit were collected 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 December 2021 – 30 November 2023)

		EV [1]	**DV**
Total distance traveled (km)		24,502	45,845
Average daily mileage (km per working day)		43	78
Average fuel economy	(km/kWh)	4.44	-
	(km/litre)	-	7.47
	(km/MJ)	1.23	0.21 [2]
Average fuel cost (HK$/km)		0.32 [3]	2.81 [4]
Average total operating cost (HK$/km)		0.67	2.98
Downtime (working day) [5]		2	3

[1] Vast Profit employed the vehicle supplier to provide remote logging of data which started in January 2022. The distance traveled and the fuel consumption data for the EV are based on data recorded from January 2022 to November 2023 with a total of 567 working days for this period.

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

[3] 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$1.522/kWh for March to April 2023, HK$1.565/kWh for May 2023, HK$1.559/kWh for June 2023, HK$1.535/kWh for July 2023, HK$1.508/kWh for August 2023, HK$1.482/kWh for September 2023, HK$1.459/kWh for October and HK$1.442/kWh for November 2023

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

[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 There were 592 working days in the trial period. The EV and the DV each had two scheduled maintenances but no unscheduled maintenances. The scheduled maintenances were for conducting annual examinations and related maintenance work. In early May 2023, the original battery charger was not working and was replaced with a new one having the same specifications. No cost was involved as the battery charger was under warranty. The EV and the DV had 2 days and 3 days of downtime for maintenance, respectively. The utilization rates were therefore 99.7% for the EV and 99.5% for the DV.

4.3 In the 24 months of the trial, the total and daily mileages of the EV were 24,502 km and 43 km, respectively; while the total and daily mileages of the DV were 45,845 km and 78 km, respectively. The average fuel cost of the EV was HK$2.49/km (89%) less than that of the DV. The average total operating cost of the EV was HK$2.31/km (78%) lower than that of the DV.

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 EV. Based on the evaluation of the 12-month moving average fuel economy, the fuel economy of the EV increased by 2% in the 24-month trial period. The deterioration in battery capacity of the EV within the 24-month trial period is negligible, if any.

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 the EV was 2,154 kg while the CO_2e emission from the DV was 9,094 kg. Hence, there was a 6,940 kg (i.e., about 76%) reduction of CO_2e if the DV was replaced by the EV in the trial.

4.6 The drivers had no problem in operating the EV and were satisfied with its performance. Vast Profit considered that using the EV is good because it can provide a greener and quieter environment as well as EV has a lower fuel cost. Vast Profit will consider replacing all existing conventional vehicles with EVs.

5. Summary

5.1 In this trial, the daily mileages of the EV and the DV were 43 and 78 km, respectively. The average fuel cost of the EV was HK$2.49/km (89%) less than that of the DV. The average total operating cost of the EV was HK$2.31/km (78%) lower than that of the DV.

5.2 The utilization rates of the EV and the DV were 99.7% and 99.5%, respectively. There was a 2% increase in the fuel economy of the EV in the trial period. There was no indication that the battery capacity of the EV had deteriorated.

5.3 There was a 6,940 kg (i.e., about 76%) reduction of CO_2e if the DV was replaced by the EV.

5.4 The drivers of the EV had no problem in operating the EV and were satisfied with its performance. Overall, Vast Profit considered that using the EV is good because it can provide a greener and quieter environment as well as the EV has lower fuel cost. Vast Profit will consider replacing all existing conventional vehicles with EVs.

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 EV Charging Facility

1. Trial EV and Charging Facility

EV

Registration mark	**FW783**
Make:	JOYLONG
Model:	EW4
Class:	Light goods vehicle
Gross vehicle weight:	3,700 kg
Seating capacity:	Driver + 5 passengers
Rated power:	50 kW
Travel range:	300 km (air conditioning off)
Battery material:	lithium-ion
Battery capacity:	73.4 kWh
Year of manufacture:	2021

Charging Facility

Make:	Hangzhou AoNeng Power Supply Equipment Co. Ltd
Model:	ANDC5-500V/60A-1
Power:	30 kW, DC (max 500V / 60A)
Charging Standard:	GB mode

2. DV Used for Comparison

Registration mark	**WG6979**
Make:	TOYOTA
Model:	HIACE
Class:	Light goods vehicle
Seating capacity:	Driver + 5 passengers
Gross vehicle weight:	3,300 kg
Cylinder capacity:	2,755 cc
Year of manufacture:	2019

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV and EV Charging Facility

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<tr><td>  </td><td>  </td></tr>
<tr><td>EV – Front view</td><td>EV – Rear view</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>EV – Right side view</td><td>EV – Left side view</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>30kW DC EV charging facility</td><td></td></tr>
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2. Diesel Vehicle (DV) for Comparison

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