Pilot Green Transport Fund

Final Report
on
Trial of Electric Light Goods Vehicle for Civil Engineering Industry
(Shanghai Construction Overseas Engineering Limited)

(27 May 2024)

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(Shanghai Construction Overseas Engineering Limited)

Final Report
(Reporting Period: 1 January 2022 – 31 December 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. Shanghai Construction Overseas Engineering Limited (Shanghai Construction) was approved under the Fund for trial of one electric light goods vehicle. Shanghai Construction, 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 (EPD)[1] as an independent third party assessor to monitor the trial and evaluate the performance of the trial vehicle. Shanghai Construction assigned a Hyundai diesel light goods vehicle (DV) providing the same service as the conventional counterpart for comparing with the EV. However, the Hyundai diesel light goods vehicle was damaged in June 2022 and its role was replaced by an Isuzu diesel light goods vehicle since July 2022.

1.3 This Final Report summarizes the performance of the EV in the 24 months of the trial as compared with its conventional counterpart, i.e. the DV.

[1] The Administration of the New Energy Transport Fund (previously named Pilot Green 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 – 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 with a travel range of 300 km with its battery fully charged and air-conditioning off. The DV used for comparison in this trial was a Hyundai diesel light goods vehicle with a GVW of 3,230 kg and an engine with a cylinder capacity of 2,497 c.c.. The EV was used for the delivery of tools and material to construction sites in Tai Po region. The Hyundai diesel light goods vehicle was scrapped after a traffic accident on 14 June 2022. Shanghai Construction arranged an Isuzu diesel light goods with a GVW of 5,500 kg and an engine with a cylinder capacity of 5,193 c.c. for replacement.

2.2 Shanghai Construction installed a 22 kW charging facility at its own cost for charging the EV. The EV was charged almost on each working day.

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 January 2022 and lasted for 24 months. Shanghai Construction 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 and opinions of the drivers and Shanghai Construction 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 January 2022 – 31 December 2023)

		EV	DV
Total distance traveled (km)		28,232	54,267
Average daily mileage (km per working day)		59	112
Average fuel economy	(km/kWh)	2.42	-
	(km/litre)	-	5.49 [4][5]
	(km/MJ)	0.67	0.15 [1]
Average fuel cost (HK$/km)		0.57 [2]	3.87 [3][4][5]
Average total operating cost (HK$/km)		0.82	4.35 [3][4][5]
Downtime (working day) [6]		10	8

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

[2] Electricity cost was based on 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 and 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 2023, HK$1.442/kWh for November 2023 and HK$1.431/kWh for December 2023

[3] The market fuel price was used for calculation

[4] The mileage reading reported by Shanghai Construction in February and March 2022 had been adjusted

[5] The fuel consumption was abnormally high in August 2022. Hence, data in August 2022 were not included in the calculation of the average fuel economy, average fuel cost and the average total operating cost

[6] 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 492 working days in the trial period. The total distance traveled and the average daily distance traveled of the EV were 28,232 km and 59 km/day, respectively, while those of the DV were 54,267 km and 112 km/day, respectively. The average fuel cost of the EV was HK$3.3/km (85%) lower than that of the DV. The average total operating cost of the EV was HK$3.59/km (81%) lower than that of the DV.

4.3 The EV had two scheduled and one unscheduled maintenances while the DV had two scheduled maintenances only in the 24 months of the trial. Scheduled maintenances of the EV and the DV were for annual examination and related maintenance. Unscheduled maintenance of the EV was for the replacement of the compressor of the air conditioning system. The EV and the DV had 10 days and 8 days of downtime for maintenance, respectively. The utilization rates were 98% for the EV and 98.4% for the DV. The initially assigned DV for comparison was scrapped after a traffic accident on 14 June 2022 but no maintenance cost was involved.

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 decreased by 7% 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 4,549 kg while the CO_2e emission from the DV was 14,265 kg. Hence, there was a 9,716 kg (i.e., about 68%) 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. Overall, Shanghai Construction 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.

5. Summary

5.1 In this trial, the daily mileages of the EV and the DV were 59 and 112 km, respectively. The average fuel cost of the EV was HK$3.3/km (85%) less than that of the DV. The average total operating cost of the EV was HK$3.59/km (81%) lower than that of the DV.

5.2 The utilization rates of the EV and the DV were 98% and 98.4%, respectively. There was a 7% 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 9,716 kg (i.e., about 68%) 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, Shanghai Construction 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.

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 Facility

1. Trial EV and Charging Facility

(a) EV

Registration mark	**XN7460**
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

(b) Charging Facility (At the Subsidy Recipient's Own Cost)

Make:	Hangzhou AoNeng Power Supply Equipment Co. Ltd
Model:	ANACE11-400V/32A-1
Power:	22 kW, AC (max 400V / 32A)
Charging Standard:	GB mode

2. DV Used for Comparison (UT5563 from Jan 2022 to June 2022; WG8494 since July 2022)

Registration mark	**UT5563**	**WG8494**
Make:	Hyundai	Isuzu
Model:	HI VAN STANDARD EURO 5	NPR75FH-VI-C
Class:	Light goods vehicle	Light goods vehicle
Seating capacity	Driver + 5 passengers	Driver + 2 passengers
Gross vehicle weight:	3,230 kg	5,500 kg
Cylinder capacity:	2,497 cc	5,193 cc
Year of manufacture:	2012	2019

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV and Charging Facility

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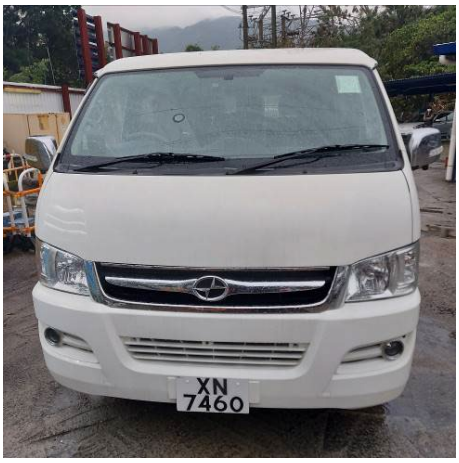
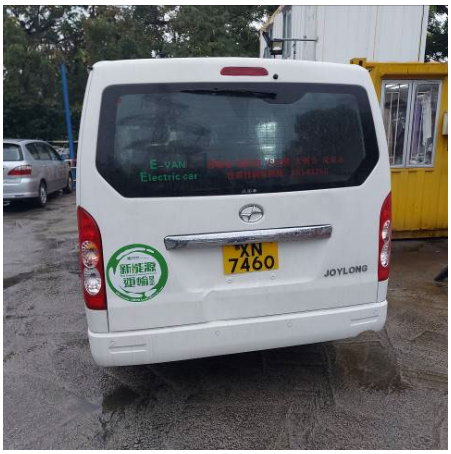
<tr><td> 
</td><td> 
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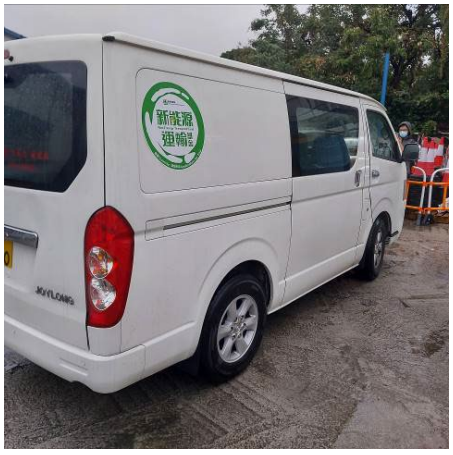
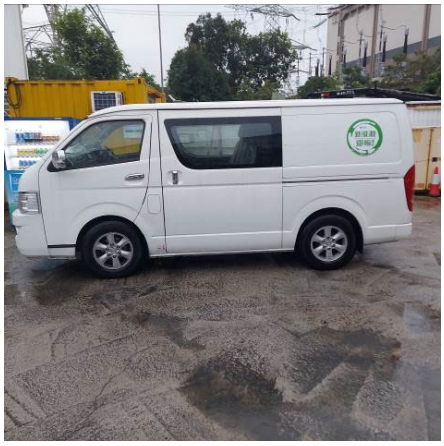
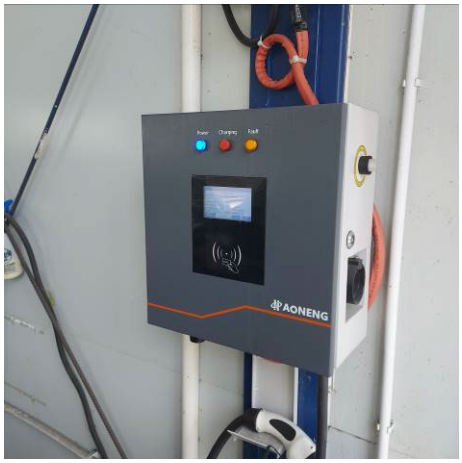
<tr><td>EV – front view</td><td>EV – end view</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>EV – right side view</td><td>EV – left side view</td></tr>
<tr><td> 
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<tr><td>22 kW AC charging facility</td><td></td></tr>
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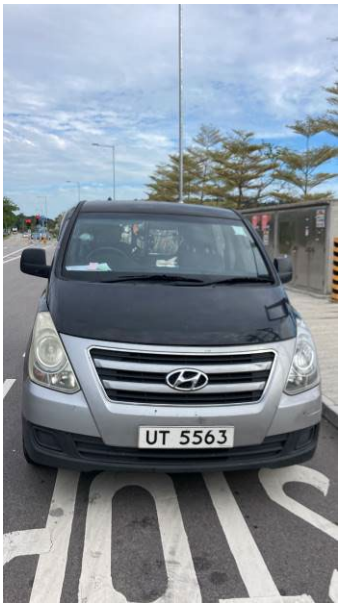
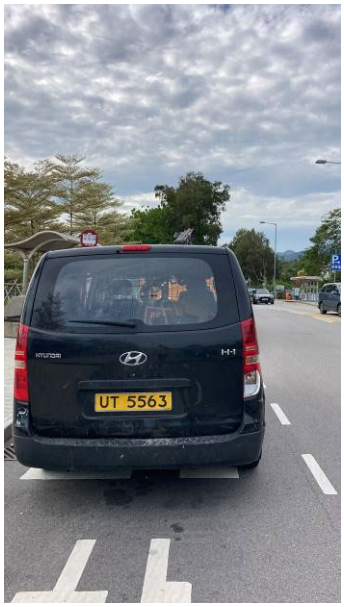
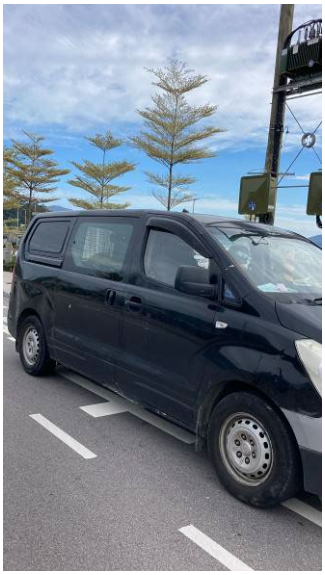
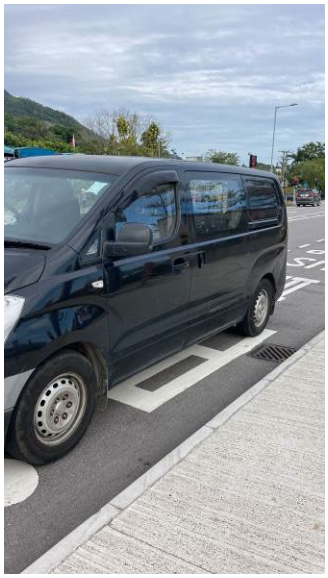
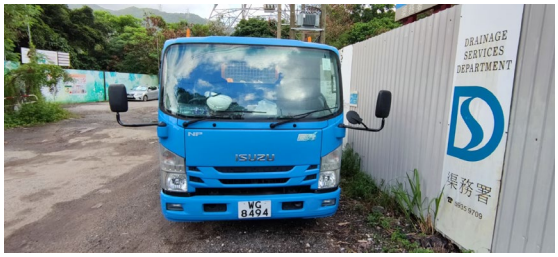
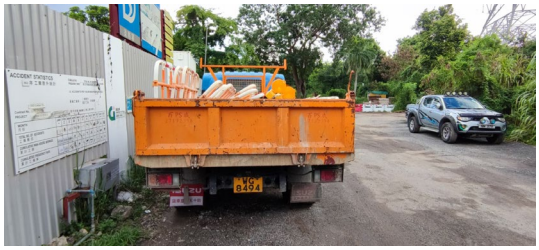
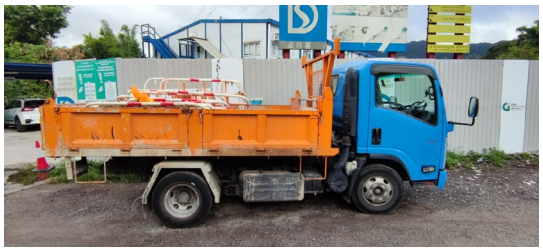
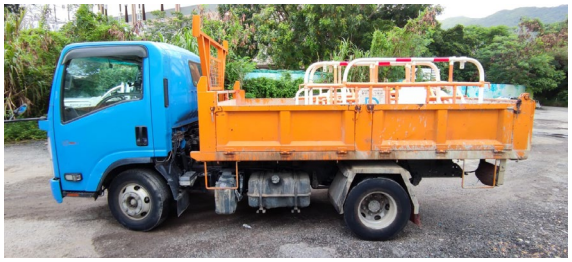
2. Diesel Vehicle (DV) for Comparison (UT5563 from Jan 2022 to June 2022; WG8494 since July 2022)

DV UT5563

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

DV WG8494

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