New Energy Transport Fund

Final Report
On
Trial of Electric Light Goods Vehicle for E&M Engineering Industry (Aplus Engineering Limited)

(22 February 2024)

PREPARED BY:

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Trial of Electric Light Goods Vehicle for E&M Engineering Industry
(Aplus Engineering Limited)

Final Report
(Reporting Period: 1 March 2022 – 28 February 2023)

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. Aplus Engineering Limited (Aplus) was approved under the Fund for trial of one electric light goods vehicle for E&M engineering industry. Aplus, through the tendering procedures stipulated in the Agreement entered into with the Government, procured a Nissan e-NV200 Half Panel Van electric light goods vehicle (EV) for trial.

1.2 Hong Kong Productivity Council has been commissioned by the Environmental Protection Department[1] as an independent third party assessor (the Assessor) to monitor the trial and evaluate the performance of the trial vehicle. Aplus assigned a Toyota Hiace 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, Nissan e-NV200 Half Panel Van electric light goods vehicle, has a gross vehicle weight of 2,250 kg capable of carrying a driver with four passengers and goods. It has a 40 kWh lithium-ion battery pack and a driving range of 317 km with its battery fully charged and air-conditioning off. The DV, Toyota Hiace diesel light goods vehicle with a gross vehicle weight of 2,800 kg and a diesel engine with a cylinder capacity of 2,755 c.c., was used as the conventional counterpart for comparison in this trial. The EV and the DV were used for the delivering tools and parts to different construction sites in Hong Kong.

2.2 Aplus installed a designated 7.4 kW single-phase AC charging facility in the car park at Yuen Kong Tsuen, Pat Heung 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 March 2022 and lasted for 12 months. Aplus 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 driver and Aplus 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. The average fuel cost of the EV was HK$2.01/km (about 86%) lower than that of the DV. The average total operating cost of the EV was also HK$2.01/km (about 86%) lower than that of the DV taking the maintenance cost into account.

Table 1: Key operation statistics of each vehicle (1 March 2022 – 28 February 2023)

		EV	**DV**
Total distance travelled (km)		15,351	8,769
Average daily mileage (km/working day)		52	30
Average fuel economy	(km/kWh)	3.98	-
	(km/litre)	-	9.02
	(km/MJ)	1.11	0.25 [1]
Average fuel cost (HK$/km)		0.34 [2]	2.35 [3]
Average total operating cost (HK$/km) [4]		0.34	2.35
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 (Mar 2022 – Oct 2022); HK$1.451/kWh (Nov 2022 – Dec 2022) and; HK$1.544/kWh (Jan 2023 – Feb 2023) 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. There was one scheduled maintenance for both the EV and the DV in the 12 months of the trial. Both scheduled maintenance of the EV and the DV were the government annual vehicle inspection.

4.3 Neither the EV nor the DV had downtime. Hence, the utilisation rates of the EV and the DV were both 100%. Based on the above, the average daily driving distances of the EV and the DV were 52 km/day and 30 km/day, respectively.

4.4 The driver of the EV liked driving the EV and had no problem in operating the EV. He agreed that the EV is quieter. Overall, he was satisfied with the performance of the EV and would like to promote the EV to other drivers. Aplus was satisfied with the EV since the EV could meet the operational requirements and save the operation cost. Aplus agreed that it was

easier and cheaper to maintain the EV. Thus, given the opportunity, Aplus would consider replacing all existing conventional vehicles with EVs and encourage other transport operators to try the EVs.

4.5 The amount of electricity stored in the battery after a full charging operation could be maintained at the level of 40 kWh after the 12-month trial. 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 1,504 kg and 4,716 kg respectively. Hence, there was a 3,212 kg (about 68%) 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$2.01/km (about 86%) lower than those of the DV. The utilisation rates of the EV and the DV were both 100%. There was a 3,212 kg (about 68%) reduction of CO_2e, with the replacement of the DV by the EV in the trial.

5.2 The amount of electricity stored in the battery after a full charging operation could be maintained at the level of 40 kWh after the 12-month trial. Thus, the deterioration in battery capacity within the 12-month trial period was insignificant, if any.

5.3 The driver of the EV liked driving the EV and had no problem in operating the EV. Overall, he was satisfied with the performance of the EV and would like to promote the EV to other drivers. Aplus was satisfied with the EV since the EV could meet the operational requirements and save the operation cost. Thus, given the opportunity, Aplus 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

(a) EV

Registration mark:	**UT1603**
Make:	Nissan
Model:	e-NV200 Half Panel Van
Class:	Light goods vehicle
Gross vehicle weight:	2,250 kg
Payload:	658 kg
Seating capacity:	Driver + 4 passengers
Rated power:	80 kW
Driving range:	317 km (air conditioning off)
Battery material:	Lithium-ion
Battery capacity:	40 kWh
Year of manufacture:	2020

(b) EV Charging Facility

Make:	Wallbox
Model:	Pulsar
Power:	7.4 kW, 220V AC / max 32 A single-phase
Charging standard:	SAE J1772 Type 1

2. DV Used for Comparison

Registration mark:	**PG1360**
Make:	Toyota
Model:	Hiace Diesel
Class:	Light goods vehicle
Gross vehicle weight:	2,800 kg
Payload:	850 kg
Seating capacity:	Driver + 5 passengers
Cylinder capacity:	2,755 c.c.
Year of manufacture:	2017

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV (UT1603) and Charging Facility

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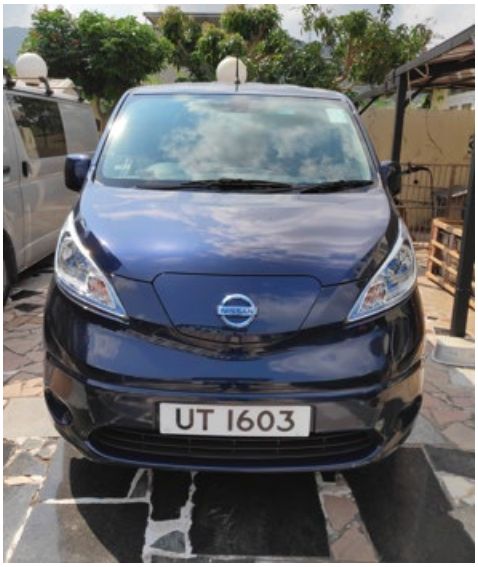
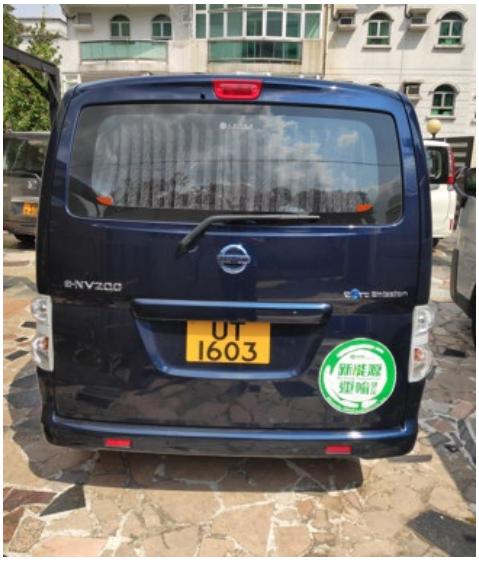
<tr><td> 
</td><td> 
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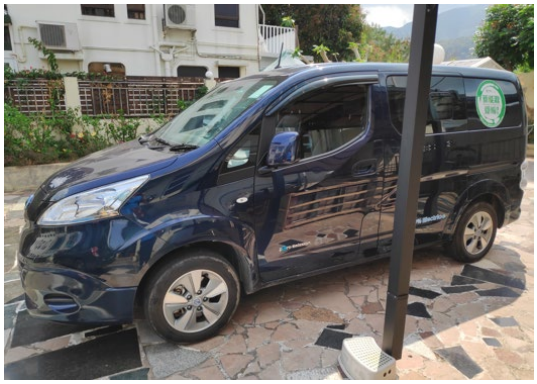
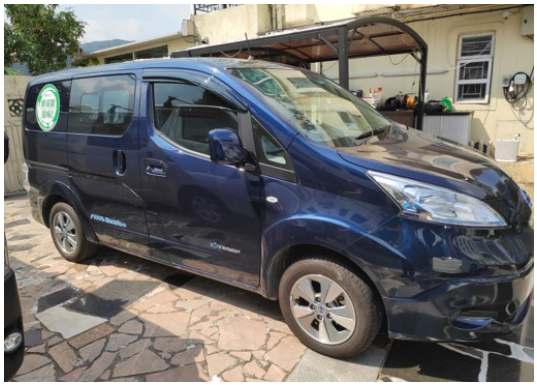
<tr><td>  </td><td>  </td></tr>
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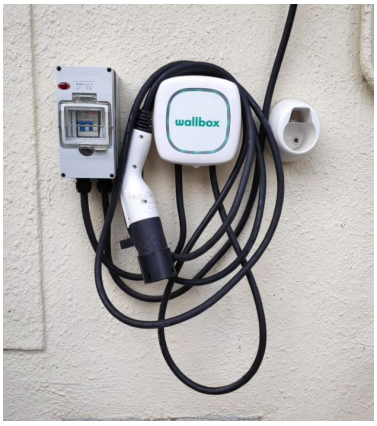
<tr><td> 
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<tr><td>7.4 kW single-phase AC charging facility</td><td></td></tr>
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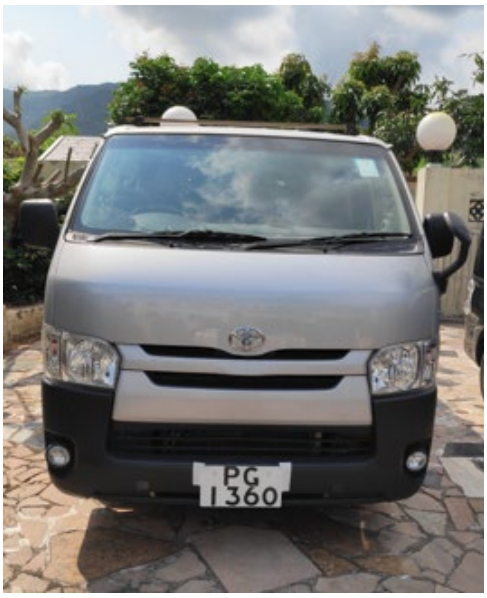
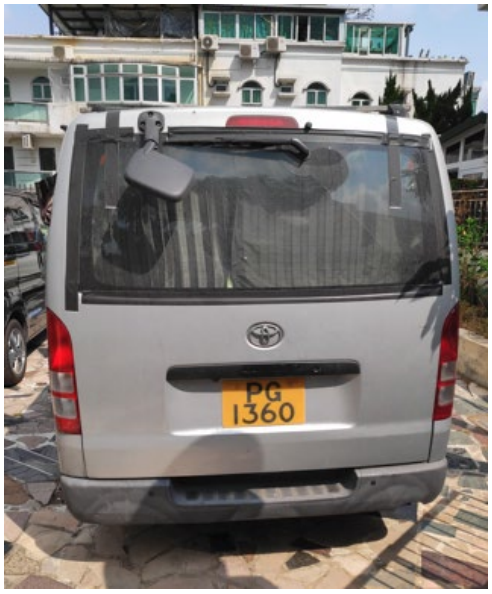
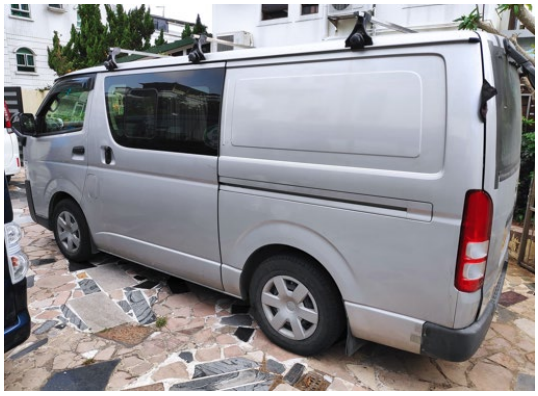
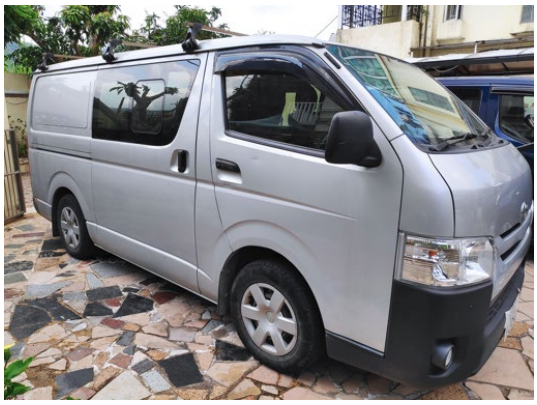
2. DV (PG1360) used for Comparison

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