Pilot Green Transport Fund

Final Report
On
Trial of Electric Light Goods Vehicles for Telecom Maintenance Services (Hong Kong Telecommunications (HKT) Limited)

(31 May 2022)

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(Trial Period: 1 November 2019 – 31 October 2021)

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. Hong Kong Telecommunications Limited (HKT) was approved under the Fund for trial of two electric light goods vehicles for providing telecom installation and maintenance services in the territory. Through the tendering procedure stipulated in the Subsidy Agreement, HKT procured two NISSAN e-NV200 light goods vehicles (EVs: EV-1 and EV-2) for trial.

1.2 PolyU Technology and Consultancy Company Limited has been engaged by the Environmental Protection Department (EPD) as an independent third party assessor (Assessor) to monitor the trial and evaluate the performance of the trial vehicles. HKT assigned two diesel light goods vehicles (DVs: DV-1 and DV-2) providing the same type of services for comparing with the EVs.

1.3 This Final Report summarizes the performance of the EVs in the 24-months trial as compared with their conventional counterparts, i.e. the DVs.

2. Trial and Conventional Vehicles

2.1 Key features of the EVs, DVs and charging facilities are provided in Appendix 1 and their photos are provided in Appendix 2. According to the EV's manufacturer, the EV has a gross vehicle weight of 2,250 kg, equipped with a 40 kWh lithium-ion battery pack and has a driving range of 317 km (air conditioning off). All the vehicles were used for telecom installation and maintenance services. They served the Hong Kong Island, Kowloon and the New Territories and were stationed at HKT's Ngau Tau Kok depot. When DV-2 was retired and replaced in January 2021, DV-2 was stationed at the Mei Foo depot.

2.2 HKT has set up two dedicated 7 kW/ 32A max, single phase AC chargers of IEC standard, at its own cost, for the two EVs at their office carpark in Ngau Tau Kok depot. The EVs were usually charged after work at night sharing the two chargers which were each linked with a power meter recording the amount of electricity charged.

3. Trial Information

3.1 The trial started on 1 November 2019 and lasted for 24 months. HKT was required to collect and provide trial information including the EVs mileage reading before charging, amount of electricity consumed in each charging, time taken for charging, operation downtime due to charging, cost and downtime associated with scheduled and unscheduled maintenances of the EVs and the charging facilities. A similar set of data from the DVs was also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the drivers and HKT were collected and provided to reflect any problems of the EVs.

4. Findings of Trial

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

Table 1: Key operation statistics of each vehicle (1 November 2019 – 31 October 2021)

		EV-1	**EV-2**	**DV-1**	**DV-2**
Total distance travelled (km)		37,424	34,134	16,529	14,444
Average daily distance traveled (km/day)		76	70	34	30
Average fuel economy	(km/kWh)	3.90	3.95		
	(km/litre)			6.47	7.51
	(km/MJ)	1.08	1.10	0.18 [1]	0.21 [1]
Fleet average fuel economy (km/MJ)		1.09		0.20	
Average fuel cost (HK$/km) [2]		0.31	0.31	2.37	2.02
Fleet average fuel cost (HK$/km)		0.31		2.20	
Average total operating cost (HK$/km) [3]		0.57	0.59	3.69	2.56
Fleet average total operating cost (HK$/km)		0.58		3.13	
Downtime (working day) [3] [4]		5	5	10	6

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

[2] The market fuel price was used for calculation

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

[4] Downtime refers to the equivalent number of working days in which the vehicle is not in operation due to maintenance, counting from the first day it stops operation till the day it is returned to the operator.

4.2 In the 24 months of the trial period, the average fuel cost of EV-1 was HK$2.06/km (about 87%) lower than that of DV-1; the average fuel cost of EV-2 was HK$1.71/km (about 85%) lower than that of DV-2. The fleet average fuel cost of the two EVs was HK$1.89/km (about 86%) lower than that of the two DVs.

4.3 Taking into account the maintenance costs, the average total operating costs of EV-1 and EV-2 were HK$3.12/km (about 85%) and HK$1.97/km (about 77%) lower than those of DV-1 and DV-2 respectively. The fleet average total operating cost of EVs was HK$2.55/km (about 81%) lower than that of the DVs.

4.4 In the 24-month trial period, there were a total of 495 working days for all the vehicles. EV-1 and EV-2 had three scheduled maintenances but no unscheduled maintenances incurring 5 working days of downtime each. The utilization rates were both 99.0% for EV-1 and EV-2. DV-1 and DV-2 had three and one scheduled maintenances respectively but no unscheduled maintenances incurring 10 and 6 working days of downtime respectively. The utilization rates of DV-1 and DV-2 was 98.0% and 98.8% respectively.

4.5 To remove the seasonal fluctuations, 12-month moving averages were used in this report to evaluate the trend of the EVs' fuel economy. The results showed that the fuel economy improved with the drivers' familiarization of eco-driving and there was no indication that the fuel economy and the batteries of the EVs deteriorated during the trial period.

4.6 Compared with the carbon dioxide equivalent (CO_2e) emissions of the DVs (estimated based on the total mileages of the EVs), there were reductions of 12,408 kg and 9,339 kg CO_2e emissions by using EV-1 and EV-2 respectively. Overall, there was a total reduction of 21,747 kg CO_2e emission (about 76%) in the trial by using the two EVs.

4.7 The drivers of the EVs had no problem in operating the EVs, and felt the EVs were clean and quiet. HKT reckoned that the EVs served their operational need and was satisfied with the performance of the two EVs, especially on the saving of operating cost.

5. Summary

5.1 In the 24 months of the trial, the average fuel cost of the EV-1 was about 87% lower than that of the DV-1 and the average fuel cost of the EV-2 was about 85% lower than that of the DV-2. The fleet average fuel cost of the two EVs was about 86% lower than that of the two DVs.

5.2 Taking into account the maintenance costs, the average total operating cost of the EV-1 was 85% lower than that of the DV-1 and the average total operating cost of the EV-2 was 77% lower than that of the DV-2. The fleet average total operation cost of the two EVs was 81% lower than that of the two DVs.

5.3 The utilization rates were 99.0% for EV-1 and EV2 as well as 98.0% and 98.8 for DV-1 and DV-2 respectively. Based on the 12-month moving average fuel economy, there was no indication that the fuel economy and the batteries of the EVs had deteriorated.

5.4 Overall, there was 76% CO_2e emission reduction by using the two EVs in the trial.

5.5 The drivers of the EVs had no problem in operating the EVs and felt the vehicles clean and quiet. HKT was satisfied with the performance of the two EVs, especially on the saving of operating cost.

5.6 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 Facilities

1. Trial EVs and Charging Facilities

Trial EVs

Registration Mark:	**WD2483 (EV-1) and WD1906 (EV-2)**
Make:	NISSAN
Model:	E-NV200 Half Panel Van
Class:	Light goods vehicle
Gross vehicle weight:	2,250 kg
Seating Capacity:	driver + 4 passengers
Rated Power:	80 kW
Travel range:	317 km (air conditioning off)
Battery type	Lithium-ion
Battery capacity:	40 kWh
Year of manufacture:	2018

Charging Facilities

No. of charging facilities:	2
Make:	CORNERSTONE Smart Charge
Model:	SLATE 2
Charging Standard:	IEC 61851-1 and IEC61851-22
Charging Mode:	7 kW, 32A max 1-phase

2. DVs used for comparison

Registration Mark:	**NG4854 (DV-1) and NG4861 (DV-2)**
Make:	NISSAN
Model:	URVAN 3.0 Diesel M/T HPV STD
Class:	Light goods vehicle
Gross vehicle weight:	3,300 kg
Seating Capacity:	driver + 5 passengers
Cylinder capacity:	2,953 cc
Year of manufacture:	2008

Registration Mark:	**VZ7664 (DV-2)***
Make:	TOYOTA
Model:	HIACE DIESEL LWB
Class:	Light goods vehicle
Gross vehicle weight:	2,800 kg
Seating Capacity:	driver + 5 passengers
Cylinder capacity:	2,755 cc
Year of manufacture:	2018

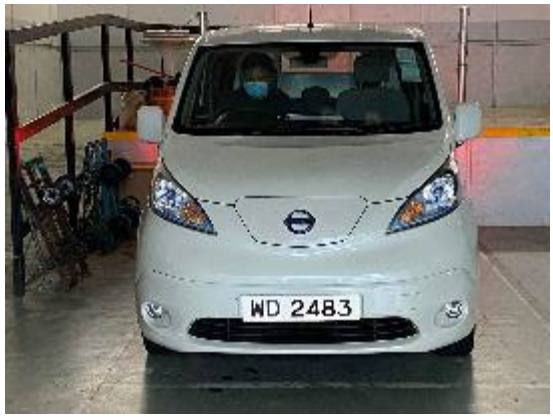
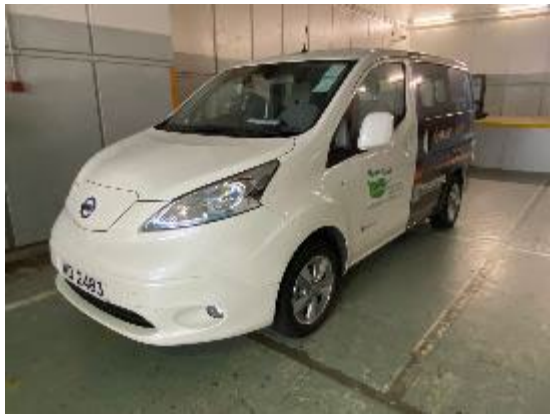
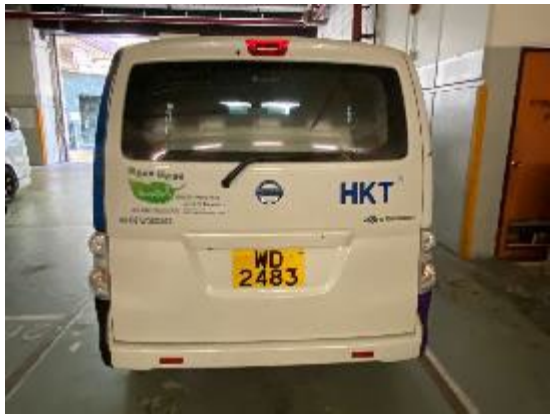
*NG4861 was replaced by VZ7664 with effective from 28 Jan 2021

Appendix 2: Photos of the Trial Vehicles and Charging Facilities

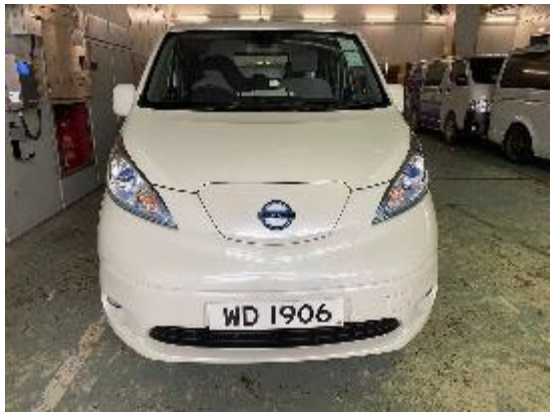
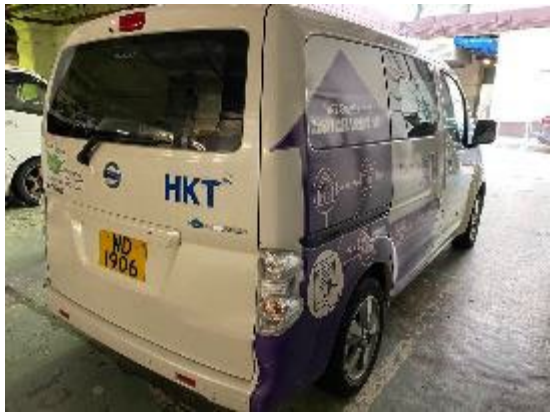
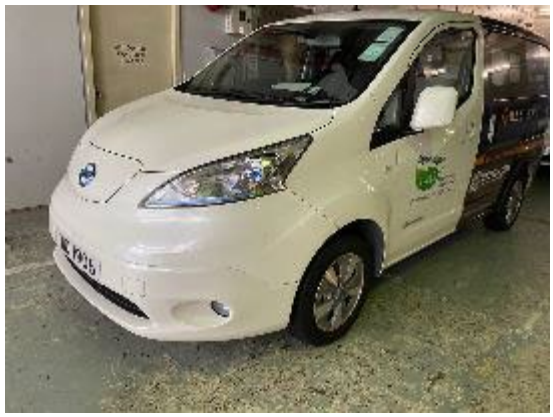
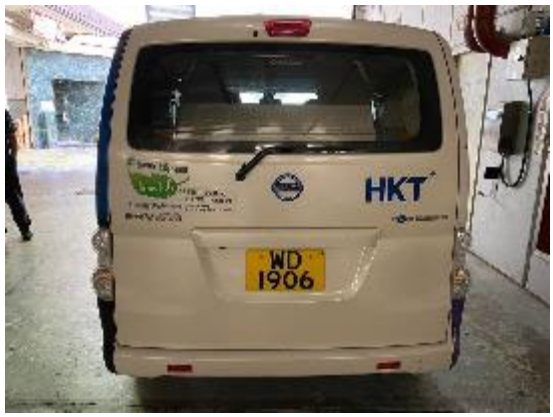
1. Trial EVs and Charging Facilities

Trial EVs

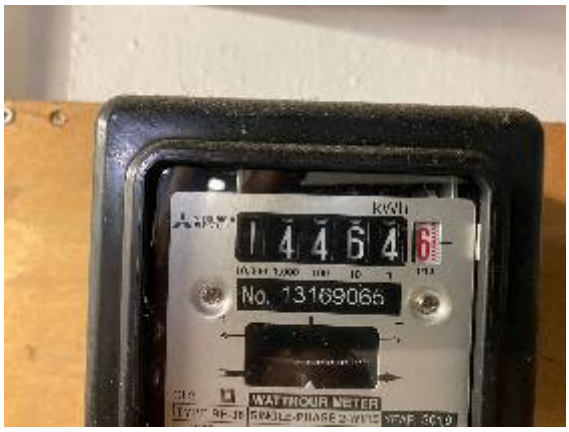
EV-1(WD2483)

	
Front view of EV-1	Left side view of EV-1
	
Right side view of EV-1	Rear view of EV-1

EV-2 (WD1906)

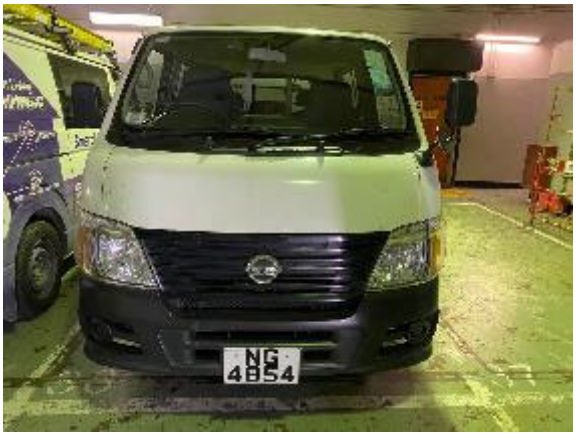
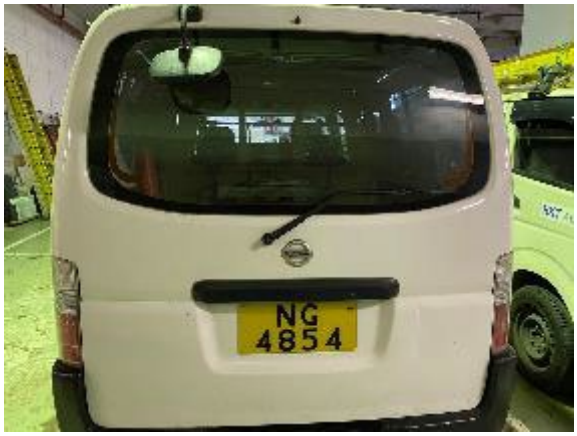
	
Front view of EV-2	Right side view of EV-2
	
Left side view of EV-2	Rear view of EV-2

Charging Facilities for EVs

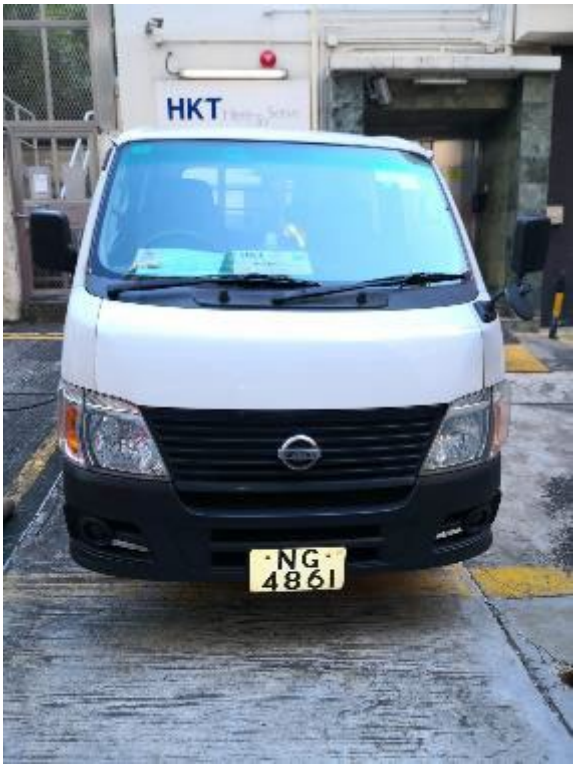
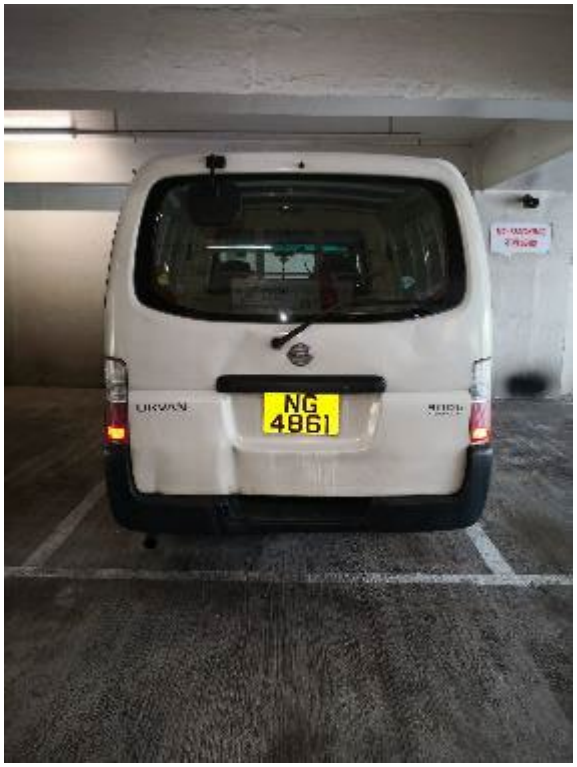
	
The Charging Facility 1	Electricity Meter
	
The Charging Facility 2	Electricity Meter

2. DVs used for comparison

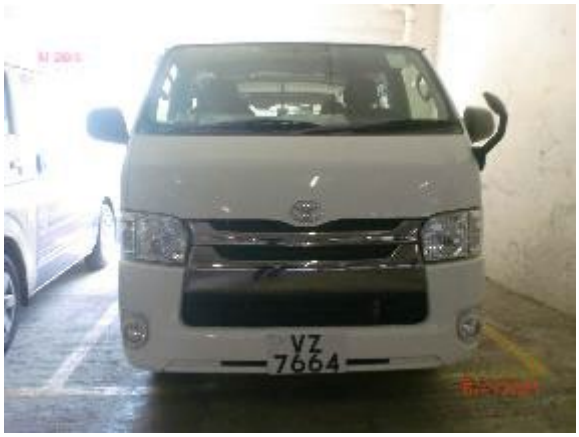
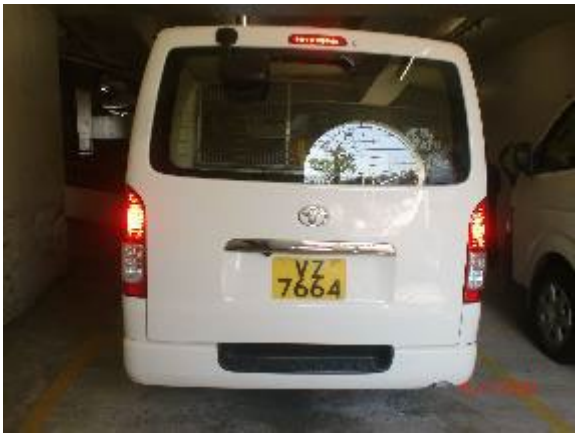
DV-1 (NG4854)

	
Front view of DV-1	Rear view of DV-1

DV-2 (NG4861)

	
Front view of DV-2	Rear view of DV-2

DV-2 (VZ7664)

	
Front view of DV-2	Rear view of DV-2