

Pilot Green Transport Fund

Interim Report On Trial of Electric Light Goods Vehicles for Aviation Maintenance Products Delivery (Pan Asia Pacific Aviation Services Limited)

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The Monitoring and Evaluation Team's views expressed in this report do not necessarily reflect the views of the Environmental Protection Department, HKSAR.

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**Pilot Green Transport Fund
Trial of Electric Light Goods Vehicles for Aviation Maintenance Products Delivery
(Pan Asia Pacific Aviation Services Limited)**

**Interim Report
(Reporting Period: 1 August 2019 – 31 July 2020)**

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. Pan Asia Pacific Aviation Services Limited (PAPAS) was approved under the Fund for trial of three electric light goods vehicles for aviation maintenance products delivery. PAPAS, through the tendering procedures stipulated in the Agreement entered into with the Government, procured three Nissan e-NV200 electric light goods vehicles (EVs) for trial. According to the manufacturer, the EV has a travel range of 317 km with its battery fully charged and air-conditioning off.

1.2 PolyU Technology and Consultancy Company Limited has been engaged by the Environmental Protection Department (EPD) as an independent third party assessor to monitor the trial and evaluate the performance of the trial vehicles. PAPAS assigned three diesel light goods vehicles (DVs) providing the same service as the conventional counterparts for comparison.

1.3 This Interim Report summarizes the performance of the EVs in the first twelve months of the trial as compared with their conventional counterparts i.e. the DVs.

2. Trial and Conventional Vehicles

2.1 Key features of the EVs, the charging facilities and the DVs are in Appendix 1 and photos of the vehicles and the charging facilities are in Appendix 2. The EVs were stationed inside the airport usually. They were mainly used for the delivery of aviation maintenance products within the airport and would also travel outside the airport.

2.2 The EVs were charged using charging facilities installed within the airport provided by the Airport Authority Hong Kong. The EVs used whichever charger was available for charging rather than had a specific charger for each. The amount of electricity charged could be reflected by the meter on each EV which indicated the percentage of electricity available at the commencement of charging and at the end of charging.

3. Trial Information

3.1 The trial commenced on 1 August 2019 and would last for 24 months. PAPAS was required to collect and provide trial information including the EV 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 EVs. Similar sets of data of the DVs were also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the drivers and PAPAS were collected to reflect any problems of the EVs.

4. Findings of Trial

4.1 The following table summarizes the statistical data of the EVs and the DVs. The fleet average fuel cost of the three EVs was HK\$1.76/km (85%) lower than that of the three DVs. The fleet average total operating cost of the three EVs was HK\$2.34/km (86%) lower than that of the three DVs.

Table 1: Key operation statistics of each vehicle, 1 August 2019 – 31 July 2020

	EVs			DVs			
	EV-1	EV-2	EV-3	DV-1	DV-2	DV-3	
Total distance travelled (km)	12501	13951	15837	15174	3930	25913	
Average distance travelled per working day (km/day)	34.3	38.3	43.6	41.6	10.8	70.8	
Average fuel economy	km/kWh	3.42	4.24	3.63			
	km/litre				7.17	6.42	7.13
	km/MJ	0.95	1.18	1.01	0.198 ^[1]	0.178 ^[1]	0.197 ^[1]
Fleet Average Fuel Economy	3.76 km/kWh			6.91 km/litre			
Average Fuel Cost (HK\$/km)	0.349 ^[2]	0.283 ^[2]	0.33 ^[2]	2.01 ^[3]	2.23 ^[3]	2.00 ^[3]	
Average Total Operating Cost (HK\$/km) ^[5]	0.349 ^[2]	0.431 ^[2]	0.395 ^[2]	2.01 ^[3]	4.18 ^[3]	2.00 ^[3]	
Fleet average fuel cost (HK\$/km)	0.321 ^[2]			2.08 ^[3]			
Fleet average total operating cost (HK\$/km)	0.392			2.73			
Downtime (Day) ^{[4][5]}	1 ^[5]	2	2	0	2 ^[5]	0	

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

^[2] Electricity bills not provided, electricity cost was based on HK\$1.177/kWh for 2019 and HK\$1.218 kWh for 2020

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

^[4] Downtime refers to the working days the vehicle is not in operation, which counted from the first day it stops operation till the day it is returned to the operator.

^[5] Maintenance not related to the performance of the vehicle technology was not included for comparing the performance of the vehicles.

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 EVs are also included in Table 1. In the first twelve months of the trial, EV-1 had one scheduled maintenance and two unscheduled maintenances, but the unscheduled maintenances were due to repair of damaged door and replacement of lamp which were not related to EV technology. It is noted that there was a long waiting time for replacement parts for the EV-1, which was not related to the performance of the EV technology and hence not included for evaluating the utilization rate. EV-2 has two scheduled maintenances and one unscheduled maintenance, and EV-3 had two scheduled maintenances but no unscheduled maintenance. DV-1 had one scheduled maintenance but no unscheduled maintenance. DV-2 had one scheduled maintenance and two unscheduled maintenances, but the unscheduled maintenances were due to the tail lift damage and replacement which were not related to the diesel vehicle technology. Hence, they were not included for evaluating the utilization rate. DV-3 did not have any scheduled and unscheduled maintenances.

4.3 EV-1 had 1 day of downtime. EV-2, EV-3 and DV-2 each had 2 days of downtime. DV-1 and DV-3 did not have downtime. The utilization rates were over 99% for the three EVs and the three DVs. The average daily mileages of EV-1, EV-2 and EV-3 were 34.3 km, 38.3 km and 43.6 km respectively, compared with 41.6 km, 10.8 km and 70.8 km for DV-1, DV-2 and DV-3 respectively.

5. Summary

5.1 The fleet average fuel cost of the EVs was about 85% (HK\$1.76/km) lower than that of the DVs. The fleet average total operating cost of the EVs was about 86% (HK\$2.34/km) lower than that of the DVs. The utilization rates of the three EVs and the three DVs were over 99%.

5.2 In general, the drivers had no problem in operating the EVs and were satisfied with the performance of the EVs. However, some of them opined that the power of the EVs was not as good as the DVs on uphill driving.

5.3 Overall, PAPAS agreed that using the EVs is good because they can provide a greener and quiet environment as well as EVs have a lower fuel cost. However, PAPAS did not consider that it was easier and cheaper to maintain the EVs if the supplier could not keep sufficient spare parts to support the maintenance service locally.

5.4 The findings only reflect the performance of the EVs in the first twelve months of the trial. More time is therefore needed to test the performance and reliability of the EVs.

Appendix 1: Key Features of the Vehicles and Charging Facilities

1. Trial EVs

Registration mark	WC7729 (EV-1), WC8007 (EV-2), WC8087 (EV-3)
Make:	Nissan
Model:	e-NV200
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 material:	lithium-ion
Battery capacity:	40 kWh
Year of manufacture:	2018

2. Charging Facilities (installed within airport by Airport Authority Hong Kong)

Maker:	Schneider Electric
Model:	EVLink
Output:	380-415V 3-phase / 32A (22 kW) AC
Charging Standard:	IEC62196 Type 2A

3. DVs Used for Comparison

Registration mark	SR869 (DV-1) (scrapped in March 2020)	VR5013 (DV-1) (starting from April 2020)
Make:	Toyota	Isuzu
Model:	KDH201RSSPDY	TFR86JS-V
Class:	Light Goods Vehicle	Light Goods Vehicle
Seating capacity:	Driver+5 passengers	Driver+1 passenger
Gross vehicle weight:	2,800 kg	2,900 kg
Cylinder capacity:	2,982 cc	2,499 cc
Year of manufacture:	2009	2014

Registration mark	TX5412 (DV-2)	VJ2698 (DV-3) (scrapped in October 2019)	SF6857 (DV-3) (starting from October 2019)
Make:	IVECO	Toyota	Toyota
Model:	New Daily	KDH200RSSMDY	HIACE Diesel LWB
Class:	Light Goods Vehicle	Light Goods Vehicle	Light Goods Vehicle
Seating capacity:	Driver+2 passengers	Driver+5 passengers	Driver+5 passengers
Gross vehicle weight:	5,200 kg	2,800 kg	2,800 kg
Cylinder capacity:	2,998 cc	2,494 cc	2,982 cc
Year of manufacture:	2015	2005	2013

Appendix 2: Photos of Vehicles and Charging Facilities

1. Trial EVs and Charging Facilities



EV-1 (WC7729) – front view



EV-1 – rear view



EV-1 – right side view



EV-1 – left side view



EV-2 (WC8007) – front view



EV-2 – rear view



EV-2 – right side view



EV-2 – left side view



EV-3 (WC8087) – front view



EV-3 – rear view



EV-3 – right side view



EV-3 – left side view



Charging facilities (installed within airport by Airport Authority Hong Kong)

2. Diesel Vehicles (DVs) for Comparison



DV-1 (SR869) Front View (scrapped in March 2020)



DV-1 (VR5013) Front View (starting from April 2020)



DV-2 (TX5412) Front View



DV-3 (VJ2698) Front View (scrapped in October 2019)



DV-3 (SF6857) Front View (starting from October 2019)