

Pilot Green Transport Fund

Final Report

On

Trial of Electric Light Goods Vehicle for University II (The Hong Kong University of Science and Technology)

(30 July 2019)

PREPARED BY:

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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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(Trial Period: 1 March 2017 – 28 February 2019)

Executive Summary

1. Introduction

1.1 The Pilot Green Transport Fund (the Fund) is set up to encourage transport operators to try out green and innovative transport technologies, contributing to better air quality and public health for Hong Kong. The Hong Kong University of Science and Technology (HKUST) was approved under the Fund for trial. Through the tendering procedures stipulated in the Subsidy Agreement, HKUST procured one Nissan e-NV200 electric light goods vehicle (EV) for trial. According to the manufacturer, it has a driving range of 165 km with battery fully charged and air-conditioning off.

1.2 PolyU Technology and Consultancy Company Limited (PTeC) have 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. HKUST assigned a diesel light goods vehicle (DV) providing same service as the conventional counterpart for comparing with the EV.

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

2. Trial Vehicles

2.1 The trial EV – a Nissan e-NV200 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 24 kWh lithium-ion battery pack and the driving range is 165 km with air-conditioning off. No designated driver used the EV. The DV – Nissan 2,953c.c. diesel light goods vehicle – was used as the conventional counterpart for comparison in this trial. The vehicles were used mainly for providing goods delivery service for HKUST facility management. In the 24-month of the trial period, the average daily distance traveled of the EV was around 40 km. Key features of the EV and DV and photos of them are provided in Appendix 1 and Appendix 2, respectively.

2.2 HKUST has installed a standard charging facility (limited by 10-ampere) at its own cost at LG 5 indoor car park on-campus to charge the batteries of the EV as well as to record the electricity consumed for EV charging. The EV was charged overnight every day (from 17:00 to 08:00 on the next day).

3. Trial Information

3.1 The trial commenced on 1 March 2017 and lasted for 24 months. HKUST was required to collect and provide trial information including the EV 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 maintenance of the EV. 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 were collected and provided to reflect any problems of the EV.

4. Findings of Trial

4.1 The following table summarizes the statistical data of the EV and the DV.

Table 1: Key operation statistics of each vehicle (1 March 2017 – 28 February 2019)

		EV	DV
Total distance travelled (km)		19,188	10,928
Average daily distance travelled (km/day)		40	22
Fuel cost (HK\$)		6,104.6	29,224.2
Average fuel economy	(km/kWh)	3.60	-
	(km/litre)	-	4.81
	(km/MJ)	1.00	0.13 ^[1]
Average fuel cost (HK\$/km) ^[2]		0.32	2.67
Maintenance cost (HK\$)		6,682	9,300
Other cost (HK\$)		0	0
Average total operating cost (HK\$/km)		0.67	3.53
Downtime (working day) ^[3]		20	4

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

^[2] The market fuel price was used for calculation

^[3] 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 During the 24 months of the trial, the total distance traveled and the average daily distance traveled of the EV were 19,188 km and 40 km/day, respectively while those of the DV were 10,928 km and 22 km/day, respectively. The average fuel cost of the EV was HK\$2.35/km (i.e. about 88%) lower than that of the DV. The average total operating cost of the EV was HK\$2.86/km (i.e. about 81%) lower than that of the DV taking into account the maintenance required.

4.3 The EV had undergone 4 scheduled maintenances and 2 unscheduled maintenances resulting in 20 working days downtime and its utilization rate was therefore 96%. The DV had undergone 2 scheduled maintenances but no unscheduled maintenance resulting in 4 working days downtime and its utilization rate was 99%. The total maintenance cost of the EV was HK\$6,682 which is lower than that of the DV (i.e. HK\$9,300).

4.4 To remove the effect of seasonal fluctuations, 12-month moving averages were used to evaluate the trend of the EV's fuel economy. The 12-month moving average varied narrowly from 3.53 to 3.76 km/kWh. The fuel economy trend shows a very slight improvement of fuel economy of the EV from 3.53 km/kWh for the first 12 months to 3.70 km/kWh for the last 12 months. The result shows no deterioration in fuel economy and the drivers could get familiar with the EV driving techniques in the 24-month trial period.

4.5 The equivalent carbon dioxide (CO₂e) emissions from the EV and DV were 2,715 kg and 11,048 kg, respectively and hence the EV emitted 8,333 kg CO₂e (about 75%) less than the DV in the trial.

5. Summary

5.1 During the 24 months of the trial, the average fuel cost of the EV was about 88% (i.e., HK\$2.35/km) lower than that of the DV and the average operating cost of the EV was about 81% (ie, HK\$2.86/km) lower than that of the DV. The utilization rate of the EV was 96% due to 20-day downtime for scheduled and unscheduled maintenances. The utilization rate of the DV was 99% due to 4-day downtime for scheduled maintenances.

5.2 The EV drivers had no problem in operating the EV and both representative of HKUST and the drivers were satisfied with its performance.

5.3 The fuel cost of the EV was significantly lower that of the DV. There is no indication that the fuel economy of the EV has significantly deterioration in the trial period.

5.4 The trial results showed that under local operating conditions where air-conditioning is essential, the Nissan e-NV200 electric light goods vehicle could meet HKUST's daily mileage requirements.

Appendix 1: Key Features of the Vehicles Involved in the Trial

1. Trial EV

Registration mark:	UN7292
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:	165 km (air conditioning off)
Maximum speed:	over 120 km/h
Battery material:	lithium-ion
Battery capacity:	24 kWh
Year of manufacture:	2015

2. DV Used for Comparison

Registration mark:	PT8453
Make:	Nissan
Model:	URVAN 3.0L DIESEL M/T HPV
Class:	Light Goods Vehicle
Gross vehicle weight:	3,300 kg
Seating capacity:	driver + 5 passengers
Cylinder capacity:	2,953 cc
Year of manufacture:	2011

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV and Charging Facility

 <p>14/03/2019 16:23</p>	 <p>14/03/2019 16:23</p>
<p>UN7292 – front view</p>	<p>UN7292 – rear view</p>
 <p>14/03/2019 16:23</p>	 <p>14/03/2019 16:24</p>
<p>UN7292 – side view 1</p>	<p>UN7292 – side view 2</p>
 <p>14/03/2019 16:31</p>	
<p>Battery charger with watt-hour meter (HKUST installed at its own cost)</p>	

2. DV for Comparison

 <p>14/03/2019 16:20</p>	 <p>14/03/2019 16:21</p>
<p>PT8453 – front view</p>	<p>PT8453 – rear view</p>
 <p>14/03/2019 16:20</p>	 <p>14/03/2019 16:21</p>
<p>PT8453 – side view 1</p>	<p>PT8453 – side view 2</p>