Pilot Green Transport Fund

Final Report On
Trial of Electric Light Goods Vehicles for Oil Fuel and Lubricant Delivery
(Tak Cheong Loong Company 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 Vehicle for Oil Fuel and Lubricant Delivery
(Tak Cheong Loong Company Limited)

Final Report
(Trial Period: 1 October 2015 – 30 September 2017)

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. Tak Cheong Loong Company Limited (Tak Cheong Loong) was approved under the Fund for trial of one electric light goods vehicle for oil fuel and lubricant delivery service. Through the tendering procedures stipulated in the Agreement, Tak Cheong Loong procured one electric light goods vehicle (EV) for trial.

1.2 The Hong Kong Institute Vocational Education (Tsing Yi) (IVE(TY)) was engaged by the Environmental Protection Department (EPD) as an independent third party assessor to monitor the trial and evaluate the performance of the trial vehicle. A diesel light goods vehicle serving the same purpose was assigned as the conventional vehicle for comparing.

1.3 This final report summarizes the performance of the EV in the 24 months of the trial as compared with its conventional diesel counterpart.

2 Trial and Conventional Vehicles

2.1 Tak Cheong Loong procured one Nissan e-NV200 electric light goods vehicle (EV) with 2,250 kg gross vehicle weight (GVW) and 80 kW rated power for the trial. The EV was regularly charged overnight after work, using a conventional 13A power outlet located at the parking lot of the company in Shatin. It has three designated drivers.

2.2 One Nissan Urvan diesel light goods vehicle (DV) with 3,300 kg GVW was assigned for comparison with the EV in the trial. The EV and DV were used for delivery of lubricants and tools in Hong Kong.

2.3 The service hours of the vehicles were from 9:00 am to 7:00 pm Monday to Saturday, except Sunday and public holiday. Key features of the EV, DV and the charging facility are shown in Appendix 1 and their photos are shown in Appendix 2.

3 Trial Information

3.1 The trial started on 1 October 2015 and lasted for 24 months. Tak Cheong Loong was required to collect and provide trial information including the EV's mileage reading at recharging, date of recharging and recharge amount, costs and operation downtime associated with scheduled and unscheduled maintenances of the EV. Similar set of data from the DV was also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the drivers and Tak Cheong Loong were collected to reflect any problems of the EV.

4 Findings of Trial

4.1 Table 1 summarises the key operation statistics of the EV and DV. The average fuel cost of EV was HK$0.93/km (80%) lower than that of the DV. This shows that the EV has a major fuel cost saving compared to the DV. The average total operating cost of the EV was HK$0.95/km (81%) lower than that of the DV.

Table 1: Key operation statistics of each vehicle (October 2015 - September 2017)

		EV	**DV**
Total mileage (km)		24,173	40,532
Average fuel economy	(km/kWh)	4.95	-
	(km/litre)	-	9.33
	(km/MJ)	1.38	0.26 [2]
Average fuel cost (HK$/km) [1]		0.23	1.16
Average total operating cost (HK$/km)		0.23	1.18
Downtime (working day) [3] [4]		2	2

[1] The market price was used for calculation.

[2] Assuming lower heating value of 36.13 MJ/litre for diesel.

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

[4] Maintenance due to traffic accident or incident unrelated to the performance of the vehicle was not included for comparison.

4.2 During the trial period, the EV had one scheduled maintenance and two unscheduled maintenances while the DV had two scheduled maintenances and one unscheduled maintenance. Both the EV and DV had two days of downtime. The utilization rates of the EV and DV were both 99%.

4.3 Tak Cheong Loong had three designated drivers for the EV. The drivers found no problem in operating the EV and felt the EV was quiet and environmentally friendly. However, they thought that the driving range of the EV did affect their operation as the mileage able to be travelled when the vehicle was fully charged was not enough for daily operation.

4.4 Overall, Tak Cheong Loong also agreed that using the EV was good because it provided a greener and quieter environment compared with the diesel counterpart. However, Tak Cheong Loong was concerned about the EV driving range and would not assign any duty requiring long distance travel. They suggested that the manufacturer should increase the EV driving range so that the vehicle could be able to support normal daily operation. They also considered that the EV cargo capacity was insufficient to support their daily operation.

4.5 To eliminate the effect of seasonal fluctuations, 12-month moving averages were used to evaluate the trend of the EV's fuel economy. The fuel economy varied from 4.82 to 5.06 km/kWh for the EV. There was no indication that the charging capacity of the EV batteries had decreased during the trial period.

4.6 Based on the total mileage of the EV in the trial period and the fuel economy of the DV, the relative CO_2e emission from the DV could be evaluated for comparison purpose. The carbon dioxide equivalent (CO_2e) emission from the EV was 2,630 kg while that from the DV was 7,187 kg. Overall, there was a total reduction of 4,557 kg (63%) CO_2e emission by using the EV during the trial period.

5 Summary

5.1 The drivers found no problem in operating the EV and felt the EV was quiet and environmentally friendly. However, they thought that the driving range of the EV did affect their operation as the mileage able to be travelled when the vehicle was fully charged was not enough for daily operation

5.2 From the point of view of Tak Cheong Loong, they agreed that using the EV was good because it provided a greener and quieter environment compared with the diesel vehicle. However, the trial showed that the EV could only meet Tak Cheong Loong's daily operation requirements if it was not assigned to any long distance driving duties. Tak Cheong Loong was concerned about the EV driving range and suggested that the manufacturer should increase the EV driving range so that the vehicle could be able to support normal its daily operation. They also considered that its cargo capacity was insufficient to support their daily operation.

5.3 The EV incurred a lower average fuel cost of HK$0.93/km (80%) compared to the DV. Taking into account the scheduled and unscheduled maintenances, the average total operating cost of the EV was HK$0.95/km (81%) lower than that of the DV. Also, the total CO_2e emission from the EV was 4,557 kg (63%) lower than that from the DV. The utilisation rates of the EV and DV were both 99%.

5.4 During the 24-month trial, the variation in fuel economy of the EV was not significant, indicating that there was no significant deterioration of the EV.

Appendix 1: Key Features of Vehicles and Charging Facility

1. Trial EV

Registration Mark	**TR1900**
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:	120 km/h
Battery material:	Lithium ion
Batteries capacity:	24 kWh
Charging time:	8 hours (Max. current 13A)
Year of manufacture:	2014

2. EV Charging Facility

Charging Standard:	IEC62196
Charging Mode:	Single Phase 13A

3. DV for Comparison

Registration Mark	**SJ4972 (Oct 2015 to April 2016) & MT6200 (April 2016 to Sept 2017)**
Make:	Nissan
Model:	Urvan
Class:	Light Goods Vehicle
Seating capacity:	driver + 4 passengers
Gross vehicle weight:	3,300kg
Engine capacity:	2,953 cc
Year of manufacture:	2005 (SJ4972) & 2006 (MT6200)

Remark: SJ4972 experienced a major breakdown in April 2016 leading to scrapping of the vehicle. MT6200 was used as the DV thereafter.

Appendix 2: Photos of Vehicles and Charging Facility

1. EV and Charging Facility

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<tr><td>Front view of EV</td><td>Rear view of EV</td></tr>
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<tr><td>Left side view of EV</td><td>Right side view of EV</td></tr>
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<tr><td>EV Charging Facility</td><td></td></tr>
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2. DV for Comparison SJ4972 (October 2015 to April 2016)

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

3. DV for Comparison MT6200 (April 2016 to September 2017)

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