

Pilot Green Transport Fund

Final Report On Trial of Electric Light Goods Vehicle for Logistics Service (C&C Logistic Services 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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Trial of Electric Light Goods Vehicle for Logistic Service
(C&C Logistic Services Company Limited)

Final Report
(Trial Period: 1 June 2014 – 31 May 2016)

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. C&C Logistic Services Company Limited (C&C) was approved under the Fund for trial of one electric light goods vehicle (EV) for logistic services.

1.2 Hong Kong Institute of Vocational Education (Tsing Yi) has been engaged by the Environmental Protection Department as an independent third party assessor to monitor the trial and evaluate the performance of the trial vehicle. C&C assigned one diesel light goods vehicle (DV) providing similar services as the conventional vehicle for comparing with the EV.

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

2. Trial Vehicles

2.1 Through the tendering procedures stipulated in the Subsidy Agreement C&C entered into with the Government, C&C procured one Renault Kangoo Z.E. light goods vehicle (EV) for trial.

2.2 Key features of the EV and DV are in Appendix 1 and photos of the vehicles are in Appendix 2. The vehicles were used for transporting printed materials and confidential documents in New Territories and Kowloon. According to the EV's manufacturer, its maximum payload is limited to 650 kg and it has a travel range of 170 km under no load condition with its battery fully charged and air-conditioning off.

2.3 C&C has set up one dedicated 20A charger at the parking lot of its office in Tai Po. The EV was mainly charged using this charger. It took about 8 hours to fully charge the batteries. The EV was charged once a day, usually overnight after work.

3 Trial Information

3.1 The trial started on 1 June 2014 and lasted for 24 months. C&C 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, downtime due to charging, and cost and operation downtime associated with scheduled and unscheduled maintenance of

the EV and the charging facilities. Similar monthly 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 C&C were collected to reflect any problems of the EV.

4 Findings of Trial

4.1 Table 1 below summarizes the total operating costs of EV and DV. Average total operating cost of the EV was about HK\$1.46/km (70%) lower than the DV. The average fuel cost of the EV is HK\$1.08/km (81%) lower than the DV.

Table 1: Total operating costs (June 2014 – May 2016)

		EV	DV
Total mileage (km)		22,609	36,716
Average fuel economy	(km/kWh)	4.47	-
	(km/litre)	-	8.55
	(km/MJ)	1.24	0.24 ^[1]
Average fuel cost (HK\$/km) ^[2]		0.25	1.33
Average total operating cost (HK\$/km)		0.64	2.10
Downtime (working day) ^{[3] [4]}		13	6

[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 charging, and the period 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] Maintenance due to incidents unrelated to the performance of the vehicle was not included for comparison.

4.2 There were scheduled maintenance for both EV and DV and unscheduled maintenance for EV in this reporting period, leading to 13 days and 6 days of operational downtime respectively. There were 590 working days in this reporting period, the utilization rates of EV and the DV were 98% and 99% respectively.

4.3 The driver had no problem in operating the EV and felt the EV was quiet and environment friendly. However, the EV driver consistently expressed disappointment with the limited travel range of the EV and performance of EV in climbing hills.

4.4 C&C agreed that, in general, using electric vehicle was good because it provided a greener and quieter environment compared with the diesel vehicle. However, due to the limitation on the battery capacity, C&C is required to plan for the journey in advance and restrict the service locations for the EV. It would bring about less flexibility on the business operations. C&C expected that the battery capacity of electric vehicles and related technology could be improved in future.

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 3.94 to 5.21 km/kWh for EV. It can be observed that the fuel economy of EV had a steady fall during the trial period.

4.6 The carbon dioxide equivalent (CO_{2e}) emissions from the EV and the DV are 2,961 kg and 7,787 kg, respectively, and hence there is an emission reduction of 4,825 kg CO_{2e}, which is about 62% reduction, in the trial.

5. Summary

5.1 The EV driver had no problem in operating the EV. However, the EV driver consistently expressed disappointment with the limited travel range of the EV and performance of EV in climbing hills.

5.2 The utilization rates of EV and the DV were 98% and 99% respectively. However, the usage of the EV was on the low side as reflected by the difference in the total mileage travelled between the EV (22,609 km, i.e. 38.3 km on average per working day) and the DV (36,716 km, i.e. 62.2 km on average per working day) in the trial.

5.3 The trial showed that the EV had lower average fuel cost as compared with its conventional diesel counterpart, with a saving of HK\$1.08/km (81%). The average total operating cost of the EV was about HK\$1.46/km (70%) lower than that of the DV. Also, the EV had about 62% CO_{2e} emission less than the DV.

5.4 At present, the price of EV is higher than that of its conventional vehicle, the accumulated fuel saving may not be able to offset the higher EV cost within a few years of operation. Since electric vehicle market is expanding and electric vehicle technology is improving, the price difference between electric vehicle and conventional vehicle is narrowing down and more affordable to the transport trade.

Appendix 1: Key Features of Vehicles

1. Trial EV

Registration Mark	SS6445
Make:	Renault
Model:	Kangoo Z.E.
Class:	Light goods vehicle
Gross vehicle weight:	2,300 kg
Seating capacity:	driver + 4 passengers
Rated power:	44 kW
Travel range:	170 km (air-conditioning off)
Maximum speed:	130 km/h
Battery material:	Lithium ion
Batteries capacity:	22 kWh
Year of manufacture:	2013

EV Charging Facility

Charging standard:	IEC62196 Type 2
Charging mode:	220V / 20A, A/C

2. DV for comparison

Registration Mark	RR7794
Make:	KIA
Model:	K2900 CRDI
Class:	Light goods vehicle
Seating capacity:	driver + 1 passenger
Gross vehicle weight:	3,240 kg
Engine capacity:	2902 c.c.
Year of manufacture:	2011

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV and charging facility



EV - Front View



EV - Rear View



EV - Left Side View



EV - Right Side View



EV Charging Station

2. DV for comparison



DV – Front View



DV – Rear View



DV – Left Side View



DV – Right Side View