

Pilot Green Transport Fund

Final Report On
Trial of Electric Light Goods Vehicle
for Construction Industry
(Chun Dak Engineering (HK – Macau)
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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Final Report
(Trial Period: 1 April 2014 – 31 March 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 and innovative transport technologies, contributing to better air quality and public health for Hong Kong. Chun Dak Engineering (HK – Macau) Company Limited (Chun Dak) was approved under the Fund for trial of one electric light goods vehicle (EV) for construction industry.

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

1.3 The final 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 that Chun Dak entered into with the Government, Chun Dak procured one Renault Kangoo Z.E. light goods vehicle 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 tools and staff for construction projects around New Territories. According to the EV's manufacturer, the model's 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 Chun Dak has set up one dedicated 20A charger at the parking lot outside its office in Pat Heung. 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 in the morning from 8 a.m. to 12 noon.

3 Trial Information

3.1 The trial started on 1 April 2014 and lasted for 24 months. Chun Dak 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 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 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\$0.91/km (59%) lower than the DV. The average fuel cost of the EV is HK\$1.17/km (87%) lower than the DV.

Table 1: Key operation statistics of each vehicle (April 2014 – March 2016)

		EV	DV
Total mileage (km)		34,549	29,477
Average fuel economy ^[1]	(km/kWh)	5.93	-
	(km/litre)	-	8.41
	(km/MJ)	1.65	0.23
Average fuel cost (HK\$/km) ^[2]		0.18	1.35
Average total operating cost (HK\$/km)		0.64	1.55
Downtime (working day) ^[3] ^[4]		13	2

[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 and lead to 13 days and 2 days of operational downtime respectively. There were 595 working days in this reporting period, the utilization rates of EV and the DV were 97.8% and 99.7% respectively.

4.3 The driver of EV consistently expressed satisfaction with the operation and performance of the vehicle. The driver found no problem in operating the EV and felt the EV was quiet and environmentally friendly.

4.4 Chun Dak agreed that, in general, using electric vehicle was good because it provided a greener and quieter environment compared with the diesel vehicle. However, Chun Dak was not satisfied with the driving range of the EV.

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 broadly from 5.71 to 6.05 km/kWh for EV. There is no indication that the battery charge capacity had deteriorated in the trial period.

4.6 The carbon dioxide equivalent (CO_{2e}) emissions from the EV and the DV are 3,349 kg and 11,397 kg, respectively, and hence there is a reduction of 8,048 kg CO_{2e} emission, which is about 71% reduction, in the trial.

5 Summary

5.1 The EV driver had no problem in operating the EV. The EV was able to cope with its assigned duties for support their work. The utilization rates of EV and DV were 97.8 % and 99.7% respectively. There is a total reduction of 8,048 kg (i.e. 71%) CO_{2e} emission by using EV in the trial.

5.2 However, the usage of the EV was on the higher side as reflected by the difference in the total mileage travelled between the EV (34,549 km i.e. an average of 59.36 km between daily recharging) and the DV (29,477 km, i.e. an average of 49.71 km per working day) in the trial.

5.3 The fuel cost of the EV was significantly lower than that of the DV. The 12-month moving average fuel economy figures suggest there is no significant deterioration in the fuel economy of the EV towards the end of the trial period. Also, there is no indication that the battery charge capacity had deteriorated either in the trial period.

5.4 At present, the price of electric vehicle is higher than that of a conventional vehicle, so the accumulated fuel saving may not be able to offset the higher vehicle cost shortly. However, 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 Involved in the Trial

1. Trial EV







Registration Mark	SP 3149 / KA 1823
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
Charging time:	8 hours (Max. current input 20A)
Payload:	650kg
Year of manufacture:	2013

2. DV used for comparison

Registration Mark	PW 3931
Make:	HYUNDAI
Model:	H1 VAN Standard
Class:	Light goods vehicle
Seating capacity:	driver + 5 passengers
Gross vehicle weight:	3.23 tonnes
Engine capacity:	2497 c.c.
Payload:	1100 kg
Year of manufacture:	2011

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV and charging facility

	
<p>EV – front view</p>	<p>EV – rear view</p>
	
<p>EV – side view 1</p>	<p>EV – side view 2</p>
	
<p>Charging station</p>	<p>Electricity meter</p>

DV used for comparison



DV- front view



DV – rear view



DV – side view 1



DV – side view 2