

**Pilot Green Transport Fund**

**Final Report On**  
**Trial of Electric Light Goods Vehicle**  
**for Logistics Services**  
**(LF Logistics (Hong Kong) 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.

## **List of Monitoring and Evaluation Team Members**

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**Pilot Green Transport Fund  
Trial of Electric Light Goods Vehicle for Logistics Services  
(LF Logistics (Hong Kong) Limited)**

**Final Report  
(Trial Period: 1 December 2015 – 30 November 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 innovative transport technologies, contributing to better air quality and public health for Hong Kong. LF Logistics (Hong Kong) Limited (LF Logistics) was approved under the Fund for trial of one electric light goods vehicle for logistics services. Through the tendering procedures stipulated in the Subsidy Agreement, LF Logistics procured one Renault Kangoo Z.E. electric light goods vehicle (EV) for trial.

1.2 The 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. LF Logistics assigned one diesel light goods vehicle (DV) providing the same type of service as the conventional vehicle for comparing with the EV.

1.3 This 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 LF Logistics procured one Renault ZE Kangoo EV which has a gross vehicle weight (GVW) of 2,300 kg and a maximum payload of 650 kg. It has a travel range of 170 km with its batteries fully charged and air-conditioning off. LF Logistics installed a 3-Phase 32A medium speed charging facility at its office in Kwai Chung for charging the EV regularly overnight after work. LF Logistics assigned a Ford diesel light goods vehicle (the DV) which has a GVW of 3,330 kg with an engine capacity of 2,198 c.c as counterpart in this trial. Both vehicles were used for logistics services in Hong Kong.

2.2 Key features of the EV, the 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 commenced on 1 December 2015 and lasted for 24 months. LF Logistics 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 maintenance records associated with scheduled and unscheduled maintenance of the EV and the charging facility. Similar monthly data from the DV were also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the driver and LF Logistics were collected to reflect any problems of the EV

### 4. Findings of Trial

4.1 Table 1 summarizes the key operation statistics of the EV and the DV. The average fuel cost of the EV was HK\$0.92/km (76%) lower than that of the DV while the average total operating costs of the EV was HK\$0.58/km (43%) lower than that of the DV.

Table 1: Key operating statistic of each vehicle (December 2015 – November 2017)

		<b>EV</b>	<b>DV</b>
Total mileage (km)		25,406	70,244
Average fuel economy	(km/kWh)	3.84	-
	(km/litre)	-	9.26
	(km/MJ) <sup>[1]</sup>	1.07	0.26
Average fuel cost (HK\$/km) <sup>[2]</sup>		0.29	1.21
Average total operating cost (HK\$/km)		0.77	1.35
Downtime (working day) <sup>[3][4]</sup>		12	9

<sup>[1]</sup> Assuming lower heating value of 36.13MJ/litre for diesel

<sup>[2]</sup> The market rates of fuel and electricity consumption were adopted for calculation.

<sup>[3]</sup> Downtime refers to the equivalent number of working days in which the vehicle is not in operation due to charging, and the period that 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.

<sup>[4]</sup> Maintenance due to incidents unrelated to the performance of the vehicle were not included for comparison.

4.2 During the trial period, the EV had 5 scheduled maintenances resulting in 9 days of operation downtime. There were 3 unscheduled maintenances for the EV resulting in 3 days. The DV had no scheduled maintenance. There were 2 unscheduled maintenances for the DV, resulting in 9 day of operational downtime. These led to 12 and 9 days of operational downtime for the EV and DV respectively. The utilization rates of the EV and DV were 98% and 99% respectively.

4.3 LF Logistics had a designated driver for the EV. The driver had no problem in operating the EV and expressed that it was quiet and environmentally friendly. However, he felt that the EV was not as powerful as the DV when driving uphill.

4.4 LF Logistics was generally satisfied with the EV's performance as it was able to cope with the assigned duties, provided that the vehicle was not assigned for the duties requiring long travelling distance. As the EV was used for delivering household goods with relatively smaller size boxes, its cargo capacity was sufficient to accommodate the products they carried.

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 of the EV varied from 3.34 to 4.13 km/litre (about 19% variation). There was a slight increase in fuel economy of the EV over the 24-month trial period. This increase was likely a result of gaining experience using the EV, having improved knowledge of its performance characteristics and better planning of its usage accordingly. There was no evidence that the charging capacity of the EV batteries had decreased during the trial period.

4.6 Based on the total mileage of the EV, the carbon dioxide equivalent (CO<sub>2e</sub>) emission from the EV was 3,490 kg, while that from the DV it was 7,608 kg. Hence, there was a reduction of 4,118 kg (54%) CO<sub>2e</sub> emission by using the EV in the trial.

## 5. Summary

5.1 The EV driver had no problem in operating the EV and expressed that it was quiet and environmentally friendly. However, he felt that the EV was not as powerful as the DV when driving uphill. LF Logistics was generally satisfied with the EV performance as it was able to cope with the assigned duties, provided that the vehicle was not assigned for the duties requiring long travelling distance.

5.2 The utilization rates of the EV and 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 mileages between the EV (25,406 km, i.e. 43 km on average per working day) and the DV (70,244 km, i.e. 97 km on average per working day). During the 24-month trial period, there was a slight increase in fuel economy of the EV. This increase was likely a result of gaining experience using the EV, having improved knowledge of its performance characteristics and better planning of its usage accordingly. There was no evidence that the charging capacity of the EV batteries had decreased during the trial period.

5.3 The average fuel cost of the EV was HK\$0.92/km (76%) lower than that of the DV. Taking into account the maintenance costs, the average total operating cost of the EV was HK\$0.58/km (43%) lower than that of the DV. The CO<sub>2e</sub> emission from the EV was 4,118 kg (54%) lower than that from the DV in the trial.

## **Appendix 1: Key Features of Vehicles and Charging Facility**

### **1. Trial EV**

<b>Registration Mark</b>	<b>TR7687</b>
Make:	Renault
Model:	Kangoo Z.E.
Class:	Light goods vehicle
Gross vehicle weight:	2,300kg
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
Payload:	650kg
Year of manufacture:	2015

### **2. EV charging facility**

Charging Standard:	IEC62196
Charging Mode:	3-Phase 32A

### **3. DV for comparison**

<b>Registration Mark</b>	<b>TC2693</b>
Make:	Ford
Model:	Transit 2.2D LW LR B
Class:	Light goods vehicle
Seating capacity:	driver + 2 passengers
Gross vehicle weight:	3,330 kg
Engine capacity:	2,198 c.c.
Year of manufacture:	2014

## Appendix 2: Photos of Vehicles and Charging Facility

### 1. Trial EV and charging facility

 <p>AM 8:57 7/JUN/2016</p>	 <p>AM 8:58 7/JUN/2016</p>
<p>Front view of EV</p>	<p>Rear view of EV</p>
 <p>AM 8:58 7/JUN/2016</p>	 <p>AM 8:57 7/JUN/2016</p>
<p>Left side view of EV</p>	<p>Right side view of EV</p>
 <p>AM 9:20 7/JUN/2016</p>	 <p>08.04.2016 09:22</p>
<p>EV charger</p>	<p>Electricity meter</p>

2. DV for comparison



Front view of DV



Rear view of DV



Left side view of DV



Right side view of DV