

**Pilot Green Transport Fund**

**Final Report On**  
**Trial of Electric Light Goods Vehicle**  
**for Vegetable Delivery**  
**(Vegetable Marketing Organization)**

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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 Vegetable Delivery**  
**(Vegetable Marketing Organization)**

**Final Report**  
**(Trial Period: 1 January 2015 – 31 December 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. Vegetable Marketing Organization (VMO) was approved under the Fund for trial of one electric light goods vehicle for vegetable delivery service. Through the tendering procedures stipulated in the Subsidy Agreement, VMO procured one Renault Kangoo Z.E. light goods vehicle (EV) for trial.

1.2 The Hong Kong Institute Vocational Education (Tsing Yi) (IVE(TY)) has 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 vehicle. VMO assigned one diesel light goods vehicle providing the same type of service as the conventional vehicle 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 and Conventional Vehicles**

2.1 VMO procured one Renault Kangoo Z.E. light goods vehicle (i.e. the 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. The EV was used for vegetable delivery.

2.2 VMO assigned a Toyota HiAce diesel light goods vehicle (namely the DV), which has a GVW of 2,800 kg for comparison with the EV in the trial.

2.3 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 started on 1 January 2015 and lasted for 24 months. VMO 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 VMO 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\$1.33/km (about 80%) lower than that of the DV. The average total operating cost of EV was HK\$1.39/km (about 74%) lower than that of DV.

Table 1: Key operation statistics of each vehicle (January 2015 – December 2016)

		<b>EV</b>	<b>DV</b>
Total distance travelled (km)		36,833	50,990
Average fuel economy	(km/kWh)	3.41	-
	(km/litre)	-	6.50
	(km/MJ)	0.95	0.18 <sup>[1]</sup>
Average fuel cost (HK\$/km) <sup>[2]</sup>		0.33	1.66
Average total operating cost (HK\$/km)		0.50	1.89
Downtime (working day) <sup>[3]</sup> <sup>[4]</sup>		3	3

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

[2] The market electricity and fuel prices were 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 During the trial, the EV and the DV had three days of operation downtime each, thus the utilization rates of the EV and the DV were both 99%.

4.3 The driver found no problem in operating the EV and felt the EV was quiet and environmentally friendly. However, he commented on the uphill driving performance and the driving range of the EV that they were lower than those of a conventional vehicle.

4.4 VMO agreed that in general, using the electric vehicle was good because it provided a greener and quieter environment compared with the diesel vehicle. The performance of the EV could meet their expectation on fuel cost saving and the operational requirements. However, VMO had to plan well the delivery routes as its driving range is limited.

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 12-month moving average fuel economy of the EV varied from 2.88 to 3.88 km/kWh (i.e. about 26% variation). During the 24-month trial period, there was a noticeable improvement in the 12-month moving average fuel economy of the EV as VMO gained experience in using it that made them able to better plan its utilisation and in turn achieved improved fuel economy results. The results indicate there was no evidence that the charging capacity of the EV batteries had deteriorated during the trial period.

4.6 Based on the total distance travelled by the EV in the trial, the carbon dioxide equivalent (CO<sub>2e</sub>) emissions from the EV and the DV were 5,836 kg and 15,705 kg, respectively. Hence the total CO<sub>2e</sub> emission reduction was 9,869 kg (about 63%) by using the EV in this trial.

## **5. Summary**

5.1 The EV driver was able to adapt to operating the EV. With careful planning, the EV was able to cope with its assigned duties for supporting their daily work. However, he commented on the uphill driving performance and the driving range of the EV that they were lower than those of a conventional vehicle. From the view of VMO, the performance of the EV could meet their expectation on fuel cost saving and the operational requirements. However, VMO had to plan well the delivery routes as the driving range is limited.

5.2 During the 24 months of the trial, the average fuel cost of EV was about 80% (i.e. HK\$1.33/km) lower than that of the DV, while the average total operating cost of the EV was about 74% (i.e. HK\$1.39/km) lower than that of the DV taking the maintenance costs into account. The usage of the EV was on the lower side as reflected by the difference in the total mileage travelled between the EV (36,833 km) and the DV (50,990 km) in the 24 months of trial.

5.3 During the trial, both the EV and the DV had three days of operation downtime, thus the utilization rates of the EV and the DV were both 99%. There was no indication on deterioration of the charging capacity of the EV batteries during the trial period.

5.4 There is a reduction of about 9,869 kg CO<sub>2</sub>e emission (which is about 63% reduction) by using the EV in the trial.

## **Appendix 1: Key Features of Vehicles and Charging Facility Involved in the Trial**

### **1. Trial EV**

<b>Registration Mark</b>	TB 2597
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, no load)
Maximum speed:	130 km/h
Battery material:	Lithium ion
Batteries capacity:	22 kWh
Charging time:	8 hours
Payload:	650 kg
Year of manufacture:	2014

### **2. EV Charging Facility**

Charging Standard:	IEC62196
Charging Mode:	340V / 32A, A/C

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

<b>Registration Mark</b>	SG 4115
Make:	TOYOTA
Model:	Hi-Ace
Class:	Light goods vehicle
Seating capacity:	driver + 2 passengers
Gross vehicle weight:	2,800 kg
Engine capacity:	2,982 c.c.
Year of manufacture:	2013

## 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- left side view</p>	<p>EV- right side view</p>
	
<p>Charger at the EV owner's office</p>	<p>Watt-hour meter for the charger</p>

## 2. DV for Comparison



DV – front view



DV – rear view



DV – left side view



DV – right side view