

# **Pilot Green Transport Fund**

## **Final Report On Trial of Electric Light Goods Vehicle for Exhibition Production and Stage Decoration Services (Ray Ray 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  
Exhibition Production and Stage Decoration Services  
(Ray Ray Limited)**

**Final Report  
(Trial Period: 1<sup>st</sup> August 2014 – 31<sup>st</sup> July 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. Ray Ray Limited (RRL) was approved under the Fund for trial of one electric light goods vehicle (EV) for transporting materials and staff for the exhibition production, stage decoration and trade fairs-booth installation services.

1.2 The Hong Kong Institute of Vocational Education (Tsing Yi) (IVE) 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. RRL assigned one diesel light goods vehicle (DV) providing the same type of service as the conventional vehicle.

1.3 This report summarizes the performance of the EV in the 24 months of the trial and the comparison with its conventional counterpart.

### **2. Trial Vehicles**

2.1 Key features of the EV, the DV and the charging facility are shown in Appendix 1 and their photos are shown in Appendix 2. Both the EV and the DV were used for transporting materials and staff for the exhibition production, stage decoration and trade fairs-booth installation services. 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 with its battery fully charged and air-conditioning off.

2.2 Ray Ray has set up one 20A dedicated charger at their office in Fanling.

### **3. Trial Information**

3.1 The trial started on the 1<sup>st</sup> of August 2014 and lasted for 24 months. RRL 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 were 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 summarises the total operating costs of the EV and the DV. The average total operating cost of the EV was HK\$1.18/km (about 83%) lower than the DV. The average fuel cost of the EV was HK\$1.18/km (about 83%) lower than the DV.

Table 1: Key operation statistics of each vehicle (1 August 2014 – 31 July 2016)

		<b>EV</b>	<b>DV</b>
Total distance travelled (km)		7,597	47,126
Average fuel economy <sup>[1]</sup>	(km/kWh)	4.74	-
	(km/litre)	-	7.82
	(km/MJ)	1.32	0.22 <sup>[1]</sup>
Average fuel cost (HK\$/km) <sup>[2]</sup>		0.24	1.42
Average total operating cost (HK\$/km)		0.24	1.42
Downtime (working day) <sup>[3] [4]</sup>		0	1

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

<sup>[2]</sup> The market fuel price was used for calculation.

<sup>[3]</sup> Maintenance due to incidents unrelated to the performance of the vehicle was not included for comparison.

<sup>[4]</sup> 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.

4.2 There was no performance related maintenance for the EV; however, there was a scheduled maintenance for the DV leading to 1 day of downtime in the trial period. There were 731 working days in the trial period, the utilization rates of EV and the DV were 100% and 99.9%, respectively.

4.3 The driver found no problem in operating the EV and felt the EV was quiet and environment friendly. However, he consistently expressed dissatisfaction with the limited driving range of the EV.

4.4 RRL was in general not satisfied with the limited driving range of the EV. They claimed that they had to plan every trip and calculate the required mileage to determine whether the EV could do the job. The EV only could just serve a round trip on HK Island and needed to be recharged before it could be used again. It caused inconvenience to RRL and made RRL hesitate to use the EV. RRL had no longer regularly use the EV since June 2015. RRL used the EV with a total of 420 km over the remaining 14 months of the trial period.

4.5 To eliminate the effect of seasonal fluctuations, 12 month moving averages were used to evaluate the trend of the EVs fuel economy. The 12-month moving average fuel economy of the EV varied from 3.78 to 5.48 km/kWh (i.e. about 31% variation). The significant reduction in fuel economy is hence due in part to the last 14 months of the trial period at which the vehicle was idle or seldom used. If it was used regularly, the variation in fuel economy range would be much smaller.

4.6 The carbon dioxide equivalent (CO<sub>2</sub>e) emissions from the EV and the DV were 978 kg and 2,695 kg, respectively and hence there was a reduction of 1,717 kg CO<sub>2</sub>e emissions which is about 64% compared with the DV during the trial period.

## 5. Summary

5.1 The driver adapted to the EV operation. However, he and RRL were unsatisfied with the limited driving range of the EV. The EV was not able to cope with its assigned duties.

5.2 The utilization rates of EV and DV were 100 % and 99.9%, respectively. The usage of the EV was lower as reflected by the difference in the total mileage travelled between the EV (7,597 km i.e. 10.4 km on average per working day) and the DV (47,126 km, i.e. 64.5 km on average per working day) in the trial.

5.3 The fuel cost of the EV was significantly lower than that of the DV. The average fuel cost of the EV was HK\$1.18/km (about 83%) lower than that of the DV. The average total operating cost of the EV was also HK\$1.18/km (about 83%) lower than that of the DV. There is a total reduction of 1,717 kg (i.e. 64%) CO<sub>2</sub>e emission by using EV in the trial.

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 and Charging Facility Involved in the Trial**

### **1. Trial EV and Charging Facility**

#### **(a) Trial EV**

<b>Registration Mark</b>	<b>AJ9111</b>
Make:	Renault
Model:	Kangoo Van ZE.
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
Battery material:	Lithium iron phosphate
Batteries capacity:	22 kWh
Charging time:	8 hours (Max. current 20A)
Payload:	650kg
Year of manufacture:	2014

#### **(b) Charging Facility**

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

### **2. DV used for comparison**

<b>Registration Mark</b>	<b>RV3112</b>
Make:	MITSUBISHI
Model:	FUSO
Class:	Light Goods Vehicle
Seating capacity:	2 seats
Gross vehicle weight:	3,800 kg
Engine capacity:	2,998 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



Charger at the EV owner's office



Watt-hour meter for the charger

2. DV for Comparison



DV front view



DV rear view



DV left side view



DV right side view