

# **Pilot Green Transport Fund**

## **Final Report On Trial of Electric Light Goods Vehicle for Cleaning Service (New Method Cleaning Services Limited)**

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PREPARED BY:

Joe K.W. LO  
Bruce Organ

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**

**Dr. Joe K.W. LO (Team Leader)**

Project Manager

Jockey Club Heavy Vehicle Emissions Testing and Research Centre

Hong Kong Institute of Vocational Education (Tsing Yi)

**Mr. Bruce Organ (Team Member)**

Emission Manager

Jockey Club Heavy Vehicle Emissions Testing and Research Centre

Hong Kong Institute of Vocational Education (Tsing Yi)

**Pilot Green Transport Fund  
Trial of Electric Light Goods Vehicle for Cleaning Service  
(New Method Cleaning Services Limited)**

**Final Report  
(Trial Period: 1 August 2014 – 31 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 (the green innovative technology), contributing to better air quality and public health for Hong Kong. New Method Cleaning Services Limited (NMC) was approved under the Fund for trial of a Renault Z.E. electric light goods vehicle (EV) for their cleaning services.

1.2 The Hong Kong Institute of Vocational Education (Tsing Yi) (IVE) has been engaged by the Environmental Protection Department (EPD) as an independent third party assessor to monitor the trials and evaluate the performance of the trial vehicle. NMC assigned one diesel light goods vehicle (DV) providing similar services for comparison.

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

### **2. Trial and Conventional 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, tools and staff for cleaning service around Hong Kong. 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.

2.2 NMC has set up one dedicated 20A charger at their office in August 2014. The EV was mainly charged using this charger. It takes about 8 hours to fully charge the batteries. The EV was mostly charged once a day, usually from 10 p.m. to 7 a.m. next morning.

### **3. Trial Information**

3.1 The trial started on 1 August 2014 and lasted for 24 months. NMC 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 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 NMC were collected to reflect any problems of the EV.

#### 4. Findings of Trial

4.1 Table 1 below summarises the key operation statistics of the EV and DV. The average fuel cost of the EV was HK\$1.16/km (about 85%) lower than that of the DV while the average total operating cost of the EV was HK\$1.11/km (about 81%) lower than that of the DV.

Table 1: Summary of the key operation statistics (1 August 2014 – 31 July 2016)

|  | <b>EV</b>  | <b>DV</b>           |
|--|------------|---------------------|
| Total distance traveled (km)               | 48,348     | 54,327              |
| Average fuel economy                       | (km/kWh)   | 5.46                |
|  | (km/litre) | -                   |
|  | (km/MJ)    | 7.93                |
| Average fuel cost (HK\$/km) <sup>[2]</sup> | 1.52       | 0.34 <sup>[1]</sup> |
| Average total operating cost (HK\$/km)     | 0.21       | 1.37                |
| Downtime (working day) <sup>[3]</sup>      | 0.26       | 1.37                |
|  | 2          | 0                   |

[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.

4.2 Both the EV and the DV did not have any unscheduled maintenance in the trial period. There was one scheduled maintenance for the EV, but none for the DV. This led to 2 days of operational downtime for the EV. There were 591 working days in this trial period, the utilization rates of EV and the DV were therefore 99.7% and 100%, respectively.

4.3 The EV driver consistently expressed satisfaction with the operation and performance of the vehicle. He found no problem in operating the EV and felt the EV was quiet and environment-friendly. However, he found the steering of the EV could not rotate for its full range of movement. Also he felt that the EV did not have sufficient power when going uphill and the battery capacity/power was consumed quickly and the vehicle required more charging.

4.4 NMC agreed that, in general, using the EV was good because it provided a greener and quieter environment compared with the DV. However, NMC was not satisfied with the limited travel 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 of the EV varied from 5.46 to 5.62 km/kWh (i.e. about 2.8% variation). There was no evidence that the charging capacity of the EV batteries had decreased during the trial period.

4.6 Based on the total distance traveled by the EV, the relative carbon dioxide equivalent (CO<sub>2e</sub>) emission from the DV can be evaluated based on the CO<sub>2e</sub> emission per litre of fuel consumed. The CO<sub>2e</sub> emission from the EV and the DV were 4,973 kg and 16,896 kg respectively and hence there was a reduction of 11,924 kg CO<sub>2e</sub> emission, which is 71% reduction by using EV compared with the DV during the trial period.

## 5. Summary

5.1 Both NMC and the driver felt that the EV was quiet and environment-friendly. However, NMC was not satisfied with the limited travel range of the EV. The EV driver expressed satisfaction with the operation and performance of the vehicle. However, he found the steering of the EV could not rotate for its full range of movement. Also, he felt that the EV did not have sufficient power when going uphill and the battery capacity/power was consumed quickly and the vehicle required more charging.

5.2 There were 2 days of operational downtime for the EV and the DV had no downtime, therefore, the utilization rates of the EV and DV were 99.7 % and 100% respectively during the trial period. However, the usage of the EV was relatively lower as reflected by the difference in the total mileage travelled between the EV (48,348 km i.e. a daily average of 81.8 km per working day) and the DV (54,327 km, i.e. the daily average of 91.9 km 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\$1.16/km (about 85%) lower than that of the DV while the average total operating cost of the EV was HK\$1.11/km (about 81%) lower than that of the DV. There was a total reduction of 11,924 kg (about 71%) CO<sub>2</sub>e emission by using EV in the trial. In addition, there was no evidence that the charging capacity of the EV batteries had decreased during the trial period.

5.4 At present, the price of electric light goods vehicle is higher than that of a diesel light goods vehicle, so the accumulated fuel saving may not be able to offset the higher vehicle cost in a few years of operation. 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 will be more affordable to the transport trade in future.

## **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>MC 3886</b>                |
| 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                       |
| Payload:                 | 650 kg                        |
| 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>RY 2870</b>      |
| Make:                    | NISSAN              |
| Model:                   | URVAN 2.5L          |
| Class:                   | Light goods vehicle |
| Seating capacity:        | 5 seats             |
| Gross vehicle weight:    | 3,300 kg            |
| Engine capacity:         | 2,488 c.c.          |
| Year of manufacture:     | 2013                |

## Appendix 2: Photos of Vehicles and Charging Facility

### 1. Trial EV and Charging Facility



EV - front view



EV - rear view



EV – right side view



EV – left 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