

Pilot Green Transport Fund

Final Report On Trial of Electric Light Goods Vehicle for Frozen Food Distribution Service (Tai Po Frozen Meats Co.)

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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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Pilot Green Transport Fund
Trial of Electric Light Goods Vehicle for Frozen Food Distribution Service
(Tai Po Frozen Meats Co.)

Final Report
(Reporting Period: 1 January 2020 – 31 December 2021)

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. Tai Po Frozen Meats Co. (Tai Po Frozen Meats) was approved under the Fund for trial of one electric light goods vehicle for frozen food distribution service. Tai Po Frozen Meats, through the tendering procedures stipulated in the Agreement entered into with the Government, procured one Renault Kangoo Z.E. 33 electric light goods vehicle (EV) for trial. According to the manufacturer, the EV has a gross vehicle weight (GVW) of 2,270 kg and a travel range of 270 km with its battery fully charged and air-conditioning off.

1.2 PolyU Technology and Consultancy Company Limited 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. Tai Po Frozen Meats assigned a Peugeot diesel light goods vehicle with a GVW of 2,810 kg and 1,997 c.c. engine and provided similar service as the conventional counterpart of the EV for comparison.

1.3 This Final Report summarizes the performance of the EV in the 24 months of the trial as compared with its conventional counterpart i.e. the DV.

2. Trial and Conventional Vehicles

2.1 Key features of the EV, the charging facility and the DV are in Appendix 1 and photos of the vehicles and the charging facility are in Appendix 2. The EV was normally parked at night in a car park in Sheung Shui. The EV was used for the distribution of frozen food in Sheung Shui, Fanling and Tai Po.

2.2 Tai Po Frozen Meats installed its own 32-ampere AC charger inside the car park in Sheung Shui for charging the EV and recording the amount of electricity charged. Since June 2021, Tai Po Frozen Meats have switched to use a 13-ampere charger. Since the charger cannot record electricity usage, the electricity consumption by the EV is estimated base on the percentage of battery charge before and after charging shown on the EV panel. The EV was not charged every day due to the low travel distance involved each day.

3. Trial Information

3.1 The trial commenced on 1 January 2020 and lasted for 24 months. Tai Po Frozen Meats was required to collect and provide trial information including the EV's mileage reading at charging, amount of electricity consumed and time used in each charging, and operation downtime due to charging, cost and downtime associated with scheduled and unscheduled maintenances of the EV and the charging facility. Similar set of data of the DV was also required. In addition to the cost information, reports on maintenance work and operational difficulties and opinions of the driver and Tai Po Frozen Meats were collected to reflect any problem of the EV.

4. Findings of Trial

4.1 Table 1 summarizes the statistical data of the EV and the DV. The average fuel cost of the EV was HK\$1.14/km (i.e., about 84%) lower than that of the DV. The average total operating cost of the EV was also HK\$1.14/km (i.e., about 84%) lower than that of the DV.

Table 1: Key operation statistics of each vehicle, 1 January 2020 – 31 December 2021

| | | EV | DV |
|--|------------|---------------------|----------------------|
| Total distance travelled (km) | | 34,562 | 57,141 |
| Average daily mileage (km/working day) | | 58 | 96 |
| Average fuel economy | (km/kWh) | 5.48 | - |
| | (km/litre) | - | 10.79 |
| | (km/MJ) | 1.52 | 0.299 ^[1] |
| Average fuel cost (HK\$/km) | | 0.22 ^[2] | 1.36 ^[3] |
| Average total operating cost (HK\$/km) | | 0.22 | 1.36 |
| Downtime (working day) ^[4] | | 0 | 0 |

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

^[2] Electricity cost was based on HK\$1.218/kWh for 2020 and 2021

^[3] The market fuel price was used for calculation

^[4] Downtime refers to the working days the vehicle is not in operation, which counted from the first day it stops operation till the day it is returned to the operator.

4.2 The EV and the DV each had two scheduled maintenances in the 24 months of the trial. The scheduled maintenances were for the annual examinations of the EV and the DV, but no downtime nor maintenance cost was involved. The utilization rates were 100% for the EV and the DV. Based on the above, the average daily mileages of the EV and the DV were 58 km/day and 96 km/day respectively.

4.3 The driver of the EV had no problem in operating the EV and was satisfied with the performance of the EV. Tai Po Frozen Meats agreed that using the EV is good because it can provide a greener and quieter environment as well as EV has a lower fuel cost. Tai Po Frozen Meats would encourage other transport operators to try out and replace the existing conventional vehicles with the electric light goods vehicles.

4.4 Based on the 12-month moving average fuel economy, the fuel economy of the EV increased by 35% in the 24-month trial period. It could be attributed to that the EV carried less cargo and was operated at higher vehicle speed with less start and stop operations in the second year of the trial. It could also be partially associated with the difference in charging facility used for battery charging in the last seven months of the trial. In fact, if the results of the last seven months were neglected, the increase of fuel economy is less than 10%. There was no indication of obvious deterioration in the battery capacity of the EV.

4.5 In the 24-month of the trial, the total carbon dioxide equivalent (CO_{2e}) emission from the EV was 2,332 kg. For comparison purpose, based on the mileage of the EV and the fuel economy of the DV, the total CO_{2e} emission from the DV was 8,881 kg. Hence, there was a 6,549 kg (i.e., about 74%) reduction of CO_{2e}, with the replacement of DV by EV in the trial.

5. Summary

5.1 The average fuel cost of the EV was HK\$1.14/km (i.e., about 84%) lower than that of the DV. The average total operating cost of the EV was also HK\$1.14/km (i.e., about 84%) lower than that of the DV. The utilization rates were 100% for the EV and the DV. There was a 6,549 kg (i.e., about 74%) reduction of CO_{2e}, with the replacement of DV by EV in the trial.

5.2 Based on the 12-month moving average fuel economy, there was 35% increase in the fuel economy of the EV in the 24-month trial. The increase in fuel economy could be attributed to that the EV carried less cargo and was operated at higher vehicle speed with less start and stop operations in the second year of the trial. It could be partially associated with the difference in charging facility used for battery charging in the last seven months of the trial. In fact, if the results of the last seven months were neglected, the increase is less than 10%. However, there was no indication that the battery charge capacity had deteriorated in the trial period.

5.3 The driver of the EV had no problem in operating the EV and was satisfied with the performance of the EV. Tai Po Frozen Meats agreed that using the EV is good because it can provide a greener and quieter environment as well as EV has a lower fuel cost. Tai Po Frozen Meats would encourage other transport operators to try out and replace the existing conventional vehicles with the electric light goods vehicles.

5.4 The findings showed electric light goods vehicles are becoming more affordable and feasible to the transport trade for saving operating cost and reducing CO_{2e} emissions, provided that the vehicles can get easy access to charging facilities.

Appendix 1: Key Features of Vehicles and Charging Facility

1. Trial EV and Charging Facility

Trial EV

| | |
|--------------------------|-------------------------------|
| Registration mark | WL9501 |
| Make: | Renault |
| Model: | Kangoo Z.E. 33 |
| Class: | Light goods vehicle |
| Gross vehicle weight: | 2,270 kg |
| Seating capacity: | Driver + 4 passengers |
| Rated power: | 44 kW |
| Travel range: | 270 km (air conditioning off) |
| Battery material: | lithium-ion |
| Battery capacity: | 33 kWh |
| Year of manufacture: | 2018 |

Charging Facility (At Recipient's own cost)

| | |
|--------------------|----------------------------------|
| Make: | Cornerstone Technologies Limited |
| Model: | Slate CGWMSL2 |
| Power Output: | 220V, 1-phase, 32A AC, 50/60 Hz |
| Charging Standard: | IEC61851-1/22 |

2. DV Used for Comparison

| | |
|--------------------------|------------------------|
| Registration mark | JD4493 |
| Make: | PEUGEOT |
| Model: | EXPERT 6-seater Deluxe |
| Class: | Light goods vehicle |
| Seating capacity: | Driver + 5 passengers |
| Gross vehicle weight: | 2,810 kg |
| Cylinder capacity: | 1,997 c.c. |
| Year of manufacture: | 2012 |

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 |



EV – battery charger



EV – watt-hour meter

2. Diesel Vehicle (DV) for Comparison



DV – Front view



DV – Rear view