# Pilot Green Transport Fund

# Final Report
# On
# Trial of Hybrid Light Goods Vehicles
# For Logistics Services
# (Shing Wah Trading (Hong Kong) Limited)

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**Pilot Green Transport Fund**
**Trial of Hybrid Light Goods Vehicles for Logistics Services**
**(Shing Wah Trading (Hong Kong) Limited)**

**Final Report**
**(Trial Period: 1 November 2018 – 31 October 2020)**

## 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. Shing Wah Trading (Hong Kong) Limited (Shing Wah) was approved under the Fund for trial of two diesel-electric hybrid light goods vehicles (HVs) for delivering frozen food to its clients by its subsidiary, Hop Lee Frozen Meat Company Limited.

1.2 PolyU Technology and Consultancy Company Limited has been engaged by the Environmental Protection Department as an independent third party assessor (the Assessor) to monitor this trial and evaluate the operational performance of the trial vehicles. The Assessor regularly visited Shing Wah to collect information for evaluating the performance of the two HVs as compared with the two conventional diesel light goods vehicles (DVs) which provided the same service. The information collected included the said vehicles' operation data, fuel bills, maintenance records, reports on operation difficulties, and opinions of the HVs drivers and Shing Wah from survey questionnaires.

1.3 This Final report summarizes the performance of the HVs for logistics service in the 24-month trial as compared with their respective conventional counterparts, i.e. the DVs.

## 2. Trial and Conventional Vehicles

2.1 Shing Wah procured two HINO 300 series diesel-electric hybrid light goods vehicles (HV-1 and HV-2) each of 5,500 kg gross vehicle weight (GVW) and 4,009 cc cylinder capacity for trial.

2.2 Shing Wah assigned two 5,500 kg GVW diesel light goods vehicles (DVs) (i.e., one HINO 300 Series DV (DV-1) with cylinder capacity of 4,009 cc and one ISUZU DV (DV-2) with cylinder capacity of 5,193 cc) for comparison with the HVs. All vehicles were equipped with air-conditioning units.

2.3 Key features and photos of the HVs and DVs are in Appendix 1 and Appendix 2, respectively

## 3. Trial Information

3.1 The 24-month trial started on 1 November 2018. All the HVs and DVs are stationed at the depot of Shing Wah's subsidiary, Hop Lee Frozen Meat Company Limited's depot in Tsuen Wan. Each HV shares the same service areas with its diesel counterpart. The vehicles provide service from 7:30 am to 6:30 pm all year round, including Sundays and public holidays.

3.2 During this 24-month trial period, the average daily mileages of HV-1 and HV-2 were 75 km and 89 km respectively while those for DV-1 and DV-2 were 102 km and 97 km, respectively.

## 4. Findings of Trial

4.1 Table 1 shows a summary of all the key operation statistics for each vehicle. The average fuel economy of HV-1 was lower than that of DV-1 by 0.25 km/litre (i.e., about 6%). The average fuel economy of HV-2 was higher than that of DV-2 by 0.13 km/litre (i.e., about 3%). The average fuel cost of HV-1 was higher than that of DV-1 by HK$0.19/km (i.e., about 6%). The average fuel cost of HV-2 was lower than that of DV-2 by HK$0.1/km (i.e., about 3%). The fleet average fuel economy of the HVs was 0.06 km/litre (i.e., about 1%) lower than that of the DVs and the fleet average fuel cost of all HVs was higher than that of all DVs by HK$0.04/km (i.e., about 1%).

4.2 The average total operating costs of HV-1 and HV-2 were HK$0. 03/km (about 1%) lower and HK$0.45/km (about 12%) lower than those of DV-1 and DV-2, respectively. The fleet average total operating cost of the HVs was HK$0.24 /km (i.e. about 6%) lower than that of the DVs.

Table 1: Key operation statistics of each vehicle (1 November 2018 – 31 October 2020)

| | **HVs** | | **DVs** | |
|---|---|---|---|---|
| | **HV-1** | **HV-2** | **DV-1** | **DV-2** |
| Total distance traveled (km) | 53,930 | 61,021 | 72,425 | 69,465 |
| Average daily distance traveled (km/day) | 75 | 89 | 102 | 97 |
| Average fuel economy (km/litre) | 4.15 | 4.32 | 4.40 | 4.19 |
| Fleet average fuel economy (km/litre) | 4.24 | | 4.30 | |
| Average fuel cost (HK$/km) [1] | 3.42 | 3.28 | 3.23 | 3.38 |
| Fleet average fuel cost (HK$/km) | 3.35 | | 3.31 | |
| Average total operating cost (HK$/km) [2] | 3.56 | 3.41 | 3.59 | 3.86 |
| Fleet average total operation cost (HK$/km) | 3.49 | | 3.73 | |
| Downtime (working day) [2][3] | 16 | 45 | 24 | 14 |

[1] The market fuel price was used for calculation

[2] Maintenance due to incident not related to the performance of the vehicles was not included for comparing the performance
[3] Downtime refers to the equivalent number of working days in which the vehicle was not in operation due to maintenance, counting from the first day it stopped operation till the day it was returned to the operator.

4.3 Excluding the downtime of vehicles un-related to their performance due to the scheduled and unscheduled maintenances, HV-1 and HV-2 had 16 days and 45 days downtime respectively while DV-1 and DV-2 had 24 days and 14 days downtime respectively. The utilization rates of HV-1 and HV-2 were 98% and 94% respectively while that of DV-1 and DV-2 were 97% and 98% respectively.

4.4 Shing Wah had designated drivers for the HVs. The drivers found no problem in operating the HVs and in general felt the HVs were clean and less polluted. However, they reflected that the HVs responded slower and less powerful than the DVs, especially on uphill operation.

4.5 To remove the effect of seasonal fluctuations, 12-month moving averages are used to evaluate the trend of the HV's fuel economy. The results show that fuel economy of the HVs appeared to improve slightly towards the end of the trial. It appears that the engines of the HVs were still in normal working conditions and the fuel economy could be maintained through proper maintenance.

4.6 The carbon dioxide equivalent ($CO_2e$) emissions from HV-1 and HV-2 were 36,032 kg and 39,195 kg respectively while those from DV-1 and DV2 on the respective HV mileages were 33,980 kg and 40,375 kg respectively. Overall, there was a total increase of 2,052 kg and decrease of 1,180 kg $CO_2e$ emission (i.e., around 6% and -3% changes) in the trial by using HV-1 and HV-2 respectively. Overall, there was a total of 872 kg $CO_2e$ (i.e., around 1%) increase by using the two HVs. This can probably be explained that the HVs and DVs were used to transport frozen food and the freezers must be operating all the time. The diesel engines had to be running non-stop and thus could not take advantage of the fuel-saving design benefits of the hybrid vehicles. Besides, the HVs had a smaller cylinder capacity and were less efficient. Therefore, the adoption of HVs in this trial could not provide obvious environmental benefits.

## 5. Summary

5.1 With a total of 731 working days in the 24-month trial period, the average daily mileages of HV-1 and HV-2 were 75 km and 89 km respectively while those for DV-1 and DV-2 were 102 km and 97 km, respectively. The mileages of all vehicles are comparative. The fleet average fuel costs of the two HVs was about 1% higher than that of the DVs. Including the maintenance costs, the fleet average total operating cost of the two HVs was about 6% lower than that of the two DVs. There was 1% increase in $CO_2e$ emission by using the two HVs during the 24-month trial period as compared with the DVs.

5.2 Excluding the downtime of vehicles unrelated to their performance due to the scheduled and unscheduled maintenances, HV-1 and HV-2 had 16 days and 45 days downtime respectively while DV-1 and DV-2 had 24 days and 14 days downtime respectively in the 24-month trial period. The utilization rates of HV-1 and HV-2 were therefore 98% and 94% respectively while those of DV-1 and DV-2 were 97% and 98% respectively.

5.3 No deterioration in the performance of the HVs was observed during the trial period.

5.4 The drivers had no problem in operating the HVs, except that the HVs responded slower than the DVs and had less power than the DVs especially when driving upslope. Shing Wah was satisfied with the performance of the HVs.

## Appendix 1: Key Features of Vehicles

### 1. Trial HV

| | |
|---|---|
| **Registration Mark:** | **LM8239 (HV-1)** |
| Make: | HINO |
| Model: | 300 Series Hybrid XKU710R-HKUQS3 |
| Class: | Light goods vehicle |
| Gross vehicle weight: | 5,500 kg |
| Seating Capacity: | driver + 2 passengers |
| Cylinder Capacity: | 4,009 cc |
| Year of manufacture: | 2018 |

| | |
|---|---|
| **Registration Mark:** | **VS537 (HV-2)** |
| Make: | HINO |
| Model: | 300 Series Hybrid XKU710R-HKUQS3 |
| Class: | Light goods vehicle |
| Gross vehicle weight: | 5,500 kg |
| Seating Capacity: | driver + 2 passengers |
| Cylinder Capacity: | 4,009 cc |
| Year of manufacture: | 2018 |

### 2. DV used for comparison

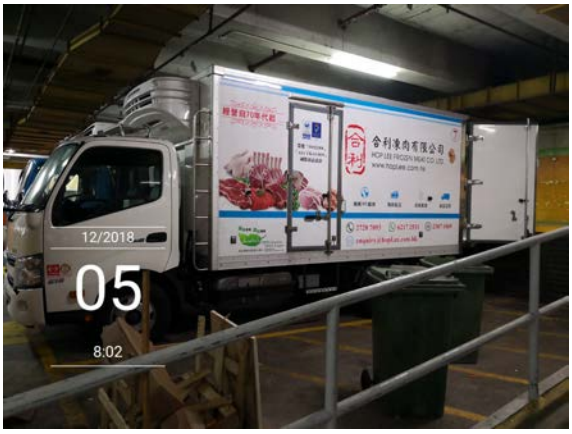
| | |
|---|---|
| **Registration Mark:** | **JG227 (DV-1)** |
| Make: | HINO |
| Model: | 300 Series XZU710R-HKFQT3 |
| Class: | Light goods vehicle |
| Gross vehicle weight: | 5,500 kg |
| Seating capacity: | driver + 2 passengers |
| Cylinder capacity: | 4,009 cc |
| Year of manufacture: | 2015 |

| | |
|---|---|
| **Registration Mark:** | **DH3033 (DV-2)** |
| Make: | ISUZU |
| Model: | NPR75HH |
| Class: | Light goods vehicle |
| Gross vehicle weight: | 5,500 kg |
| Seating Capacity: | driver + 2 passengers |
| Cylinder capacity: | 5,193 cc |
| Year of manufacture: | 2012 |

## Appendix 2: Photos of Vehicles

### 1. Trial HVs

**HV-1**

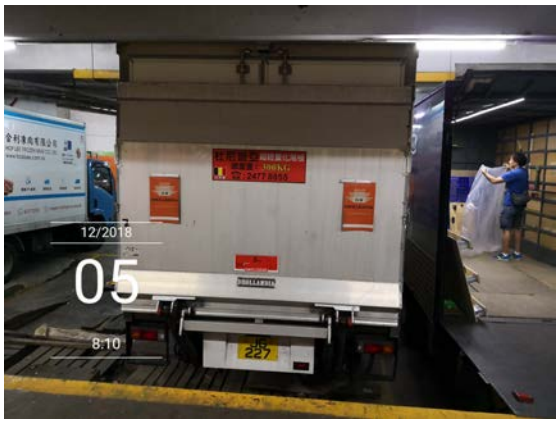
| | |
|---|---|
|  |  |
| HV-1 (LM8239) (front view) | HV-1 (LM8239) (rear view) |
|  |  |
| HV-1 (LM8239) (right side view) | HV-1 (LM8239) (left side view) |

**HV-2**

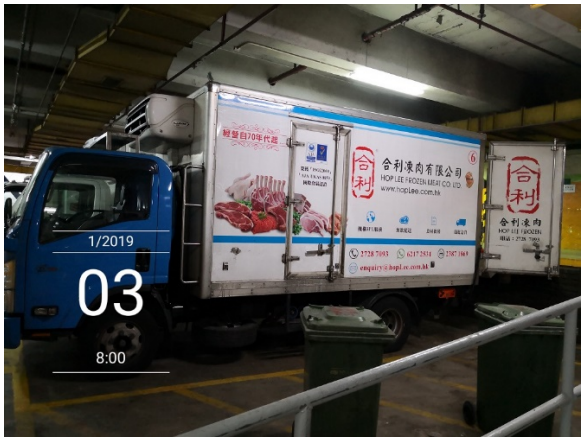
| | |
|---|---|
|  |  |
| HV-2 (VS537) (front view) | HV-2 (VS537) (rear view) |
|  |  |
| HV-2 (VS537) (right side view) | HV-2 (VS537) (left side view) |

**DVs used for comparison**

**DV-1**

| | |
|---|---|
|  |  |
| DV-1 (JG227) (front view) | DV-1 (JG227) (rear view) |
|  |  |
| DV-1 (JG227) (right side view) | DV-1 (JG227) (left side view) |

**DV-2**

| | |
|---|---|
|  |  |
| DV-2 (DH3033) (front view) | DV-2 (DH3033) (rear view) |
|  |  |
| DV-2 (DH3033) (right sideview) | DV-2 (DH3033) (left side view) |