

Pilot Green Transport Fund

Final Report

On

**Trial of Electric Light Goods Vehicles for
Vehicle Maintenance and Freight Services
(Wing Ming (Car Rental) Company 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.

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(Wing Ming (Car Rental) Company Limited)

Final Report
(Trial Period: 1 June 2019 – 31 May 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. Wing Ming (Car Rental) Company Limited (Wing Ming) was approved under the Fund for trial of two electric light goods vehicles for supporting vehicle maintenance and freight services. Through the tendering procedure stipulated in the Subsidy Agreement, Wing Ming procured two JOYLONG EW4-A electric light goods vehicles (hereafter called EVs – EV-1 and EV-2) for trial.

1.2 PolyU Technology and Consultancy Company Limited has been engaged by the Environmental Protection Department as an independent third party assessor (Assessor) to monitor the trial and evaluate the performance of the trial vehicles. Wing Ming assigned two diesel light goods vehicles (DVs – DV-1 and DV2) providing the same type of services for comparing with the EVs.

1.3 This Final Report summarizes the performance of the EVs in the 24 months of the trial as compared with their conventional counterparts, i.e., the DVs.

2. Trial and Conventional Vehicles

2.1 Key features of the EVs with the charging facilities and DVs are in Appendix 1 and their photos are in Appendix 2. Each of these four vehicles served different purposes depending on Wing Ming's business. EV-1 was operated by Wing Ming in the first five month of the trial and served to carry equipment to locations where maintenance for vehicles was needed, but it was deployed to the Tuen Mun River Trade Pier (TMRTP) to carry freight (mainly construction materials) starting from November 2019. EV-2 mainly served to carry freight (mainly construction materials) in TMRTP. According to the EV manufacturer, the EV model has a gross vehicle weight of 3,700 kg and a driving range of 260 km (air conditioning off).

2.2 Wing Ming has installed a 30kW movable charging facility for charging EV-1 at the Fotan depot where EV-1 was parked from June to October 2019. However, there was no independent power meter to record the amount of electricity consumed for EV-1. The electricity consumption was estimated with the percentage of battery charged and the battery capacity. Another same type of charging facility with an independent electricity meter was provided at TMRTP for charging EV-2, as well as EV-1 since it was deployed there in November 2019.

3. Trial Information

3.1 The trial started on 1 June 2019 and lasted for 24 months. Wing Ming was required to collect and provide trial information including the mileage reading of the EVs before charging, amount of electricity consumed in each charging, time taken for charging, operation downtime due to charging, cost and downtime associated with scheduled and unscheduled maintenances of the EVs and the charging facilities. Similar sets of data from the DVs were also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the drivers and Wing Ming were collected and provided to reflect any problems of the EVs.

4. Findings of Trial

4.1 Table 1 summarizes the statistical data of the EVs and DVs.

Table 1: Summary of operational statistics (1 June 2019 – 31 May 2021)

	EV-1	EV-2	DV-1	DV-2	
Total mileage (km)	16,490	46,961	82,586	104,289	
Average daily mileage (km/working day)	24	64	113	176	
Average fuel economy	(km/kWh)	2.04	1.82	-	-
	(km/litre)	-	-	8.80	8.84
	(km/MJ)	0.57	0.51	0.24 ^[3]	0.24 ^[3]
Fleet average fuel economy (km/MJ)	0.54		0.24		
Average fuel cost (HK\$/km)	0.60 ^[5]	0.66 ^[5]	1.68 ^[4]	1.66 ^[4]	
Fleet average fuel cost (HK\$/km)	0.63		1.67		
Average total operating cost (HK\$/km) ^[1]	0.77	0.74	2.21	1.93	
Fleet average total operating cost (HK\$/km)	0.76		2.07		
Downtime (working day) ^{[1][2]}	10	10	16	5	

^[1] Maintenance due to incident not relate to the performance of the vehicle was not included for comparing the performance.

^[2] Downtime refers to the equivalent number of working days in which 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.

^[3] Assuming lower heating value of 36.13 MJ/litre for diesel fuel

^[4] The market fuel price was used for calculation

^[5] Electricity cost is based on HK\$1.177/kWh in 2019 and HK\$1.218/kWh in 2020 & 2021

4.2 In the 24 months of the trial period, the average fuel cost of EV-1 was HK\$1.08/km (about 64%) lower than that of DV-1; the average fuel cost of EV-2 was HK\$1.00/km (about 60%) lower than that of DV-2. The fleet average fuel cost of the two EVs was HK\$1.04/km (about 62%) lower than that of the two DVs.

4.3 Taking into account the maintenance costs, the average total operating costs of EV-1 and EV-2 were HK\$1.44/km (about 65%) and HK\$1.19/km (about 62%) lower than those of DV-1 and DV-2 respectively. The fleet average total operating cost of EVs was HK\$1.31/km (about 63%) lower than that of the DVs.

4.4 In the 24-month trial period, there were a total of 690 working days and 731 working days for EV-1 and EV-2, respectively as well as 731 working days and 592 working days for DV-1 and DV-2, respectively. EV-1 had two scheduled and one unscheduled maintenance incurring 10 working days of downtime. EV-2 had two scheduled and one unscheduled maintenances related to vehicle performance incurring 10 working days of downtime. The utilization rates were both 98.6% for EV-1 and EV-2. DV-1 had two scheduled and two unscheduled maintenances incurring 16 working days of downtime while DV-2 had two scheduled maintenances but no unscheduled maintenance, incurring 5 working days of down time. The utilization rates of DV-1 and DV-2 were 97.8% and 99.2%, respectively.

4.5 To remove the seasonal fluctuations, 12-month moving averages were used in this report to evaluate the trend of the EVs' fuel economy. The results showed that there was no indication that the fuel economy and the batteries of the EVs had deteriorated during the trial period.

4.6 Compared with the carbon dioxide equivalent (CO₂e) emissions of the DVs (estimated based on the total mileages of the EVs), there were reductions of 2,082 kg and 4,182 kg CO₂e emissions by using EV-1 and EV-2 respectively. Overall, there was a total reduction of 6,264 kg CO₂e emission (about 32%) in the trial by using the two EVs.

4.7 The drivers of the EVs had no problem in operating the EVs, but felt that the anti-vibration system of the EVs might not be as good as the DVs'. Wing Ming was satisfied with the performance of the two EVs, especially on the saving of operating cost.

5. Summary

5.1 In the 24 months of the trial, the average fuel cost of the EV-1 was 64% lower than that of the DV-1 and the average fuel cost of the EV-2 was 60% lower than that of the DV-2. The fleet average fuel cost of the two EVs was 62% lower than that of the two DVs.

5.2 Taking into account the maintenance costs, the average total operating cost of the EV-1 was 65% lower than that of the DV-1 and the average total operating cost of the EV-2 was 62% lower than that of the DV-2. The fleet average total operation cost of the two EVs was 63% lower than that of the two DVs.

5.3 The utilization rates were 98.6% for EV-1 and EV2, as well as 97.8% and 99.2% for DV-1 and DV-2 respectively. Based on the 12-month moving average fuel economy, there was no indication that the fuel economy and the batteries of the EVs had deteriorated during the trial period.

5.4 Overall, there was 32% CO₂e emission reduction by using the two EVs in the trial.

5.5 The drivers of the EVs had no problem in operating the EVs, except that the anti-vibration system of the EVs might not be as good as the DVs'. Wing Ming was satisfied with the performance of the two EVs, especially on the saving of operating cost.

5.6 As electric vehicle market is expanding and technology is improving, the capital cost of electric light goods vehicle has dropped in recent years. The price difference between electric light goods vehicle and diesel light goods vehicle will narrow down.

Appendix 1: Key Features of Vehicles and Charging Facility

1. Trial EVs and Charging Facilities

Trial EVs

Registration Mark:	EV1: WB6695 EV2: WB7182/ OPN2 at the Tuen Mun River Trade
Terminal	
Make:	JOYLONG
Model:	EW4-A
Class:	Light goods vehicle
Gross vehicle weight:	3,700 kg
Seating capacity:	driver + 5 passengers
Rated power:	50 kW
Travel range:	260 km (air conditioning off)
Battery type	Lithium-ion
Battery capacity:	64.8 kWh
Year of manufacture:	2018

Charging Facilities

No. of charging facility:	2
Make:	Inovance
Model:	IDCH-T030AM
Charging mode:	30 kW, 3-phase, AC
Charging standard:	GB

2. DVs used for comparison

Registration Mark:	RY6428 (DV-1)
Make:	NISSAN
Model:	NV350 URVAN
Class:	Light goods vehicle
Gross vehicle weight:	3,300 kg
Seating capacity:	driver + 5 passengers
Cylinder capacity:	2,488 cc
Year of manufacture:	2013

Registration Mark:	SG1471 (DV-2)
Make:	TOYOTA
Model:	KDH201RSPNY
Class:	Light goods vehicle
Gross vehicle weight:	2,800 kg
Seating capacity:	driver + 5 passengers
Cylinder capacity:	2,982 cc
Year of manufacture:	2008

Appendix 2: Photos of the Trial Vehicles and Charging Facilities

1. Trial EVs and Charging Facilities

Trial EVs

(EV-1) – WB6695	
	
Front view of EV-1	Left side view of EV-1
	
Right side view of EV-1	Rear view of EV-1

(EV-2) – WB7182*



Front view of EV-2



Left side view of EV-2



Right Side view of EV-2



Rear view of EV-2

* EV-2 has a plate number OPN2 during operation at the Tuen Mun River Trade Terminal

Charging Facilities

Charging Facility for EV-1 (Jun 2019 – Oct 2019)



Charging Facility for EV-1



Charging facility for EV-1

Charging Facility for EV-2 (shared with EV-1 starting from Nov 2019)



Charging facility for EV-2



Electricity meter for EV-2

2. DVs used for comparison

DV-1 (RY6428)



Front view of DV-1



Odometer of DV-1

DV-2 (SG1471)



Front view of DV-2



Odometer of DV-2