

Pilot Green Transport Fund

Final Report On Trial of Electric Medium Goods Vehicle for Logistics Services (Regal Transportation Services (Asia) Limited)

(20 June 2022)

PREPARED BY:
Dr. W.T. Hung

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. C.S. CHEUNG (Team Leader)

Department of Mechanical Engineering
The Hong Kong Polytechnic University

Dr. C. NG

Department of Mechanical Engineering
The Hong Kong Polytechnic University

Mr. KS TSANG

Department of Mechanical Engineering
The Hong Kong Polytechnic University

Dr. Edward WC LO

Department of Electrical Engineering
The Hong Kong Polytechnic University

Dr. W.T. HUNG

PolyU Technology and Consultancy Company Limited
The Hong Kong Polytechnic University

Pilot Green Transport Fund
Trial of Electric Medium Goods Vehicle for Logistics Services
(Regal Transportation Services (Asia) Limited)

Final Report
(Trial Period: 1 April 2020 – 31 March 2022)

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. Regal Transportation Services (Asia) Ltd (Regal) was approved under the Fund for trial of one electric medium goods vehicle for logistics services. Through the tendering procedure stipulated in the Subsidy Agreement signed with the Government, Regal procured a BYD Q1R electric medium goods vehicle (tractor) (hereafter called EV) for trial.

1.2 PolyU Technology and Consultancy Company Limited (PTeC) has been engaged by the Environmental Protection Department (EPD) as an independent third party assessor to monitor the trial and evaluate the performance of the trial vehicle. Regal assigned a SCANIA diesel medium goods vehicle (tractor) (hereafter called DV) providing the same services as the conventional counterpart for comparing with the EV.

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

2. Trial and Conventional Vehicles

2.1 The trial EV, BYD Q1R electric medium goods vehicle (tractor) has a gross vehicle weight (GVW) of 16,000 kg with capacity of carrying a driver with one passenger and a container. It has a 217 kWh lithium-ion phosphate battery pack and a driving range of 150 km with air conditioning off. The EV had a designated charging station in the Tsing Yi Container Terminal 9.

2.2 Regal assigned a 16,000 kg GVW SCANIA diesel medium goods vehicle (tractor) with a cylinder capacity of 12,742 cc for comparison with the EV.

2.3 The vehicles were used for carrying container boxes inside the Tsing Yi Container Terminal 9 and in Kwai Tsing district.

2.4 Key features of the EV, its charging facility and the DV are shown in Appendix 1 and their photos are shown in Appendix 2.

3. Trial Information

3.1 The trial started on 1 April 2020 and lasted for 24 months. Regal was required to collect and provide trial information including the EV mileage reading 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 maintenance of the EV and the charging facility. A similar set of data from the DV was also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the driver and Regal were collected and provided to reflect any problems of the EV.

4. Findings of Trial

4.1 Table 1 summarizes the statistical data of the EV and the DV.

Table 1: Key operation statistics of each vehicle (1 April 2020 – 31 March 2022)

	EV	DV
Total distance travelled (km)	40,046	67,767
Average daily distance traveled per working day (km/day)	59	97
Average fuel economy	(km/kWh)	0.45
	(km/litre)	-
	(km/MJ)	0.03 ^[1]
Average fuel cost (HK\$/km)	2.73	15.14
Average total operating cost (HK\$/km) ^[2]	2.73	16.03
Downtime (working day) ^{[2][3]}	53.5	30.5

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

^[2] Maintenance due to incident not related to the performance of the vehicle was not included for comparing the performance.

^[3] Downtime refers to the equivalent number of working days in which the vehicle is not in operation due to charging and maintenance, counting from the first day it stops operation till the day it is returned to the operator.

4.2 During the 24 months trial, there were 730 working days. The total mileage and the average daily mileage of the EV were 40,046 km and 59 km/day, respectively while those of the DV were 67,767 km and 97 km/day, respectively. The average fuel cost of EV was HK\$12.41/km (i.e., about 82%) lower than that of the DV. Including maintenance costs incurred, the average total operating costs of the EV was HK\$13.30/km (i.e., about 83%) lower than that of the DV.

4.3 Excluding non-performance related maintenance, the utilization rates were 93% and 96% for the EV and the DV, respectively.

4.4 To remove the effect of seasonal fluctuations, the 12-month moving average were used to evaluate the trend of the EV's fuel economy. The 12-month moving average fuel economy varied from 3.43 to 3.77 km/kWh. There was no sign of the deterioration in fuel economy over the trial period.

4.5 Based on the total mileage of the EV and the fuel economy of the DV, the equivalent carbon dioxide (CO_{2e}) emission from the DV could be estimated for comparison purpose. The CO_{2e} emission from the EV and DV were 34,041 kg and 100,022 kg, respectively and hence the EV emitted 65,982 kg CO_{2e} (i.e., about 66%) less than the DV in this trial.

4.6 The operation of the EV was smooth. The EV drivers had no problem in operating the EV and considered it was clean and quiet. Regal was satisfied with the EV performance in that it met with the operational requirement and had significant savings in fuel costs.

5. Summary

5.1 In this trial, the average daily mileages of EV and DV were 59 km and 97 km, respectively.

5.2 The EV had lower fuel cost than the DV, with an average fuel saving of about 82%. Accounting the maintenance costs incurred for both the EV and the DV, the average total operating cost of the EV was about 83% lower than that of the DV.

5.3 The utilization rates of the EV and the DV were 93% and 96%, respectively. In the trial period, there was no sign of deterioration in fuel economy of the EV.

5.4 The EV had CO_{2e} emission of about 66% less than the DV in this trial.

5.5 The EV drivers had no problem in operating the EV and felt the EV was clean and quiet. Regal was satisfied with the performance of the EV as it had significant fuel cost saving and contributed to better air quality.

Appendix 1: Key Features of Vehicles and Charging Facility

1. Trial EV and Charging Facility

(a) Trial EV

Registration Mark:	WR1399
Make:	BYD
Model:	Q1R
Class:	Medium goods vehicle
Gross vehicle weight:	16,000 kg
Seating Capacity:	driver + 1 passenger
Rated Power:	150 kW
Travel range:	150 km (air conditioning off)
Battery type	Lithium-ion phosphate
Battery capacity:	217 kWh
Year of manufacture:	2019

(b) Charging Facility

No. of charging facility:	1
Make:	BYD
Model:	EVH150KG/04
Charging Standard:	GB mode
Charging Mode:	Direct Current, DC (max 250A)

2. DV used for comparison

Registration Mark:	UZ8970
Make:	SCANIA
Model:	P370LA4X2MSZ
Class:	Medium goods vehicle
Gross vehicle weight:	16,000 kg
Seating Capacity:	driver + 1 passenger
Cylinder capacity:	12,742 cc
Year of manufacture:	2016

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV and Charging Facility

(a) Trial EV (WR1399)



Front view



Left side view

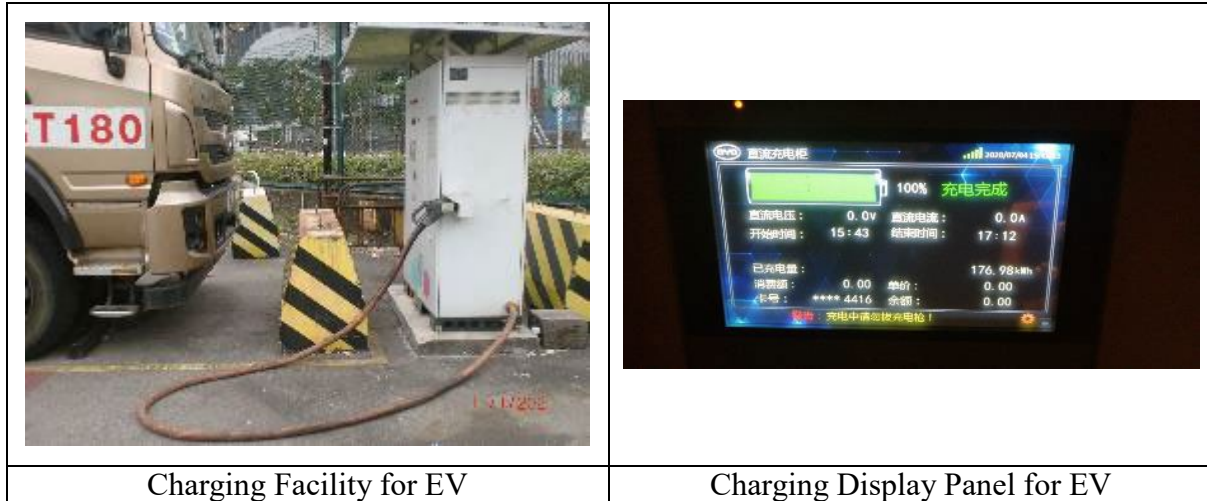


Right side view



Rear view

(b) Charging Facility



2. DV used for comparison

DV (UZ8970)

