

Pilot Green Transport Fund

Final Report On
Trial of Electric New Territories Taxi
(Lai Sun Motors)

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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 New Territories Taxi (Lai Sun Motors)**

**Final Report
(Trial Period: 1 June 2014 – 31 May 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 innovative transport technologies, contributing to better air quality and public health for Hong Kong. Lai Sun Motors Company Limited (Lai Sun) was approved under the Fund for trial of one electric vehicle for taxi service with the associated charging facilities. Through the tendering procedures stipulated in the Subsidy Agreement Lai Sun entered into with the Government, Lai Sun procured one BYD e6 electric vehicle (EV) for trial.

1.2 PolyU Technology and Consultancy Company Limited had been engaged by the Environmental Protection Department as an independent third party assessor to monitor the trials and evaluate the performance of the green innovative transport technologies under trial as compared with their conventional counterparts. Lai Sun assigned one LPG taxi (CV) as the conventional vehicle for comparing with the EV.

1.3 This Final Report summarizes the performance of the EV in the twenty four months of the trial and compares it with its conventional counterpart.

2. Trial Vehicles

2.1 Key features of the EV and CV are in Appendix 1 and photos of the vehicles are in Appendix 2. These vehicles were used for taxi service in the New Territories. According to the manufacturer, the EV has a travel range of 300 km with its batteries fully charged and air-conditioning off. All the data recorded in this report was under air-conditioning on. Both vehicles provide service every day including public holidays. The EV operates from 6 a.m. to around 10 p.m., (apart from 2 hours meal break, 14 working hours a day including 2 hours of charging). At the end of shift, the driver would charge the EV until its battery is full before driving it away from the charging location. The CV operates 24 hours in two shifts (apart from 1 hour lunch break, 23 working hours a day including 1 hour refuel of gas).

2.2 The EV was charged at stations set up by the EV's manufacturer. There were five such stations in the New Territories and two on Lantau Island. During this 24-month trial period, the EV was charged at Chung On Shopping Centre in Ma On Shan and at Fu Shin Estate Car Park in Tai Po,

depends on which driver was operating the EV. It was charged at least twice a day, often at lunch time and after business hours.

3. Trial Information

3.1 The trial started on 1 June 2014 and lasted for 24 months. EV operation data provided by Lai Sun included mileage reading before charging, amount of electricity consumed and time used in each charging and operation downtime due to charging. Maintenance records included cost and downtime associated with scheduled and unscheduled maintenance of the EV. Similar data of the CV were also required. In addition, reports on maintenance work, operational difficulties and opinions of the driver and passengers were collected to reflect any problems of the EV.

3.2 The following table summarizes the statistical data of the EV and CV. Lai Sun had a 12-month contract with the vehicle supplier allowing the EV to be charged at designated charging stations for a fixed rate of \$1,500 per month for the first year starting from June 2014 to May 2015. The contract was renewed for another year with a fixed rate of \$3,000 per month from June 2015 till the trial ended. The fuel cost of the EV was \$0.134/km (31%) lower than the CV.

Table 1: Average fuel economy and average fuel cost of each vehicle (June 2014 to May 2016)

		EV ^[1]	CV ^[1]
Total mileage/km		162,197	299,944
Average fuel economy	(km/kWh)	3.74	
	(km/litre)		7.35
	(km/MJ)	1.04	0.311 ^[2]
Average fuel cost/(\$/km)		0.305	0.439
Total operating cost/\$		88,747	150,819
Average total operating/(\$/km)		0.547	0.503
Average downtime ^[3] /day		54 ^[4]	8.5

^[1] Lai Sun encountered problems in collecting complete operation data from the driver who rented the taxis in certain months. Thus, data of September, November and December 2014 were excluded due to incomplete data recorded. For the CV, data of December 2014 was also incomplete and the CV was retired in May 2016, thus, data of these 2 months also excluded.

^[2] Assuming lower heating value of 23.67 MJ/litre for LPG

^[3] Downtime refers to the period the vehicle is not in operation, which counted from the first day it stops operation till the day it is discharged from the repair garage to the operator.

^[4] Including charging downtime 1 hour every day; 14 work hours per day (6 a.m. to 10 p.m. excluding 2 hours for meal breaks)

3.3 Apart from the fuel costs, the table also shows that average total operating cost which includes maintenance and other indirect costs such as parking fee, towing fee, vehicle replacement fee. In this report, the EV incurred parking fee for charging as the charging stations were in fee-paying car parks.

3.4 The utilization rate of EV was 93% and that of CV was 99%.

4. Conclusion

4.1 The 24-month trial showed that the average fuel cost of EV was 31% (\$0.134/km) less than the CV. Their utilization rates were comparable, 93% and 99%. There was a total reduction of 13,209 kg (35.6 %) CO₂ emission in using EV.

4.2 All the three drivers had no problem operating the EV. One driver opined that the power and drivability of the vehicle was good but the cabin design was not as good as the conventional LPG taxi; elderly and people with disability had difficulties getting on and off the EV. Another driver opined that the responses of the “drive (D)” and the “reverse (R)” buttons were too slow compared to the conventional LPG taxi. Two drivers opined that the charging time, up to 2 hours to fully charge the battery, was too long. Charging infrastructure was inadequate and they had to drive some distance to reach the charging stations. The third driver was very satisfied with the EV. The charging frequency as well as average fuel economy of the EV did not indicate any deterioration in its performance or the batteries.

4.3 Lai Sun agreed that, in general, using electric vehicle was good because it provided a greener environment compared with the CV. However, the charging time was too long and the EV could only operate one long shift per day, generating less income than the CV. Lai Sun did not think the EV could meet the operational requirement of a taxi in Hong Kong.

4.4 35 passengers gave a score of 4.78 out of 5 for “The vehicle can help improve our roadside air quality and quieter”. The score for “I support replacing all existing vehicles to this green vehicle” was 4.56 out of 5 indicating a strong support for replacing the existing LPG taxis by electric vehicles.

4.5 The trial showed that BYD e6 could be used in taxi operations to serve the New Territories. If the charging time required could be shortened and the number of charging stations could be increased in the serving area, more drivers would willing to use electric vehicle as taxis in the New Territories.

Appendix 1: Key Features of Vehicles Involved in the Trial

1. Trial EV




Registration Mark:	SS3547
Make:	BYD
Model:	e6
Class:	Taxi (NT)
Seating Capacity:	driver + 4 passengers
Rated Power:	90 kW
Travel range:	300 km on full charge with air-conditioning off on flat road conditions
Maximum speed:	140 km/h
Battery material:	Lithium iron phosphate
Batteries capacity:	61.4 kWh
Charging time:	2 hours [63A]
Year of Manufacture:	2014

2. CV used for comparison

Registration Mark:	PL6016
Make:	Toyota
Model:	TSS10RAEPBC
Class:	Taxi (NT)
Body Type:	Saloon
Seating Capacity:	driver + 5 passengers
Cylinder capacity:	1,998 cc
Year of manufacture:	2010

Appendix 2: Photos of Vehicles

1. Trial Electric Taxi

	
EV - Front view	EV - Side view
	
EV - Rear view	

2. Conventional LPG Taxi for Comparison

	
CV - Front view	