

Pilot Green Transport Fund

Final Report On
Trial of Electric New Territories Taxi
(Shu Sang Taxi)

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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 (Shu Sang Taxi)**

**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 and innovative transport technologies, contributing to better air quality and public health for Hong Kong. Shu Sang Taxi Company (Shu Sang) 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 Shu Sang entered into with the Government, Shu Sang 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 and innovative transport technologies under trial as compared with their conventional counterparts. Shu Sang 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 often operates from 6 a.m. to around 8 p.m., (apart from 1 hour lunch break, 13 working hours a day including 2 hours of charging). The CV operates 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 in Lantau Island. This EV was usually charged once per day at Yuen Long (Fu Tai Shopping Centre) either during lunch time or after end of shift at night.

3. Trial Information

3.1 The trial started on 1 June 2014 and last for 24 months. The EV operation data to be provided by Shu Sang 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 operation statistics of the EV and the CV. Shu Sang 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. The contract was renewed for another year to cover the trial period. The fuel cost of the EV was \$0.611/km which was \$0.151/km (33%) higher than that of the CV. Had the amount of electricity consumed been charged at market rate, the fuel cost would be lowered to \$0.322/km which would be \$0.138/km (30%) lower than that of the CV. The flat rate led to higher fuel cost per km because the EV's mileage was too low to take advantage of the flat rate.

Table 1: Key operation statistics of each vehicle

		EV	CV
Total mileage/km		56,499 ^[2]	285,857 ^[1]
Average fuel economy	(km/kWh)	3.826	
	(km/litre)		6.401
	(km/MJ)	1.063	0.270 ^[3]
Average fuel cost/(\$/km) ^[4]		0.611	0.460
Total operating cost/\$		57,461	144,915
Average total operating cost/(\$/km)		1.017	0.507 ^[5]
Average downtime ^[6] /day		62 ^[7]	4

^[1] June to September 2014 mileage were not available

^[2] June 2014 mileage were not available

^[3] Assuming lower heating value of 23.6728 MJ/litre for LPG

^[4] Had the amount of electricity consumed been charged at market rate, the fuel cost would be lowered to \$0.322/km

^[5] Maintenance information was not available until January 2015

^[6] 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 returned to the operator.

^[7] Including charging downtime 1 hour every day; 13 work hours per day (6 a.m. to 8 p.m. less 1 hour lunch break) excluding charging downtime in June 2014 due to incomplete data recorded.

3.3 Apart from the fuel costs, the table also shows that average total operating cost which may include maintenance and other indirect costs such as parking fee, towing fee and vehicle replacement fee. In this report, the EV maintenance was free in the first year since it was still under warranty. Indirect cost for the EV included towing fee and parking fee - the charging station was in a fee-paying car park. Maintenance cost of the CV was unavailable until January 2015.

3.4 The utilization rate of the EV was 91.6% compared to 99.5% of the CV.

4. Conclusion

4.1 The 24-month trial showed that the EV had lower fuel cost as compared with the CV, with an average saving of \$0.138/km or 30% if the electricity was on market price. There was a total reduction of 6082 kg (45%) CO₂ emission. The utilization rate of EV was 91.6% compared to 99.5% of the CV.

4.2 The owner driver had no problem operating the EV. He opined that the power and drivability of the vehicle was good. He also opined that the charging time, up to 2 hours to fully charge the battery, was too long. Charging infrastructure was inadequate so he had to travel more than 10 km to recharge the EV from time to time. The average fuel economy of the EV indicated a steady deterioration in its performance of the batteries.

4.3 Shu Sang agreed that, in general, using electric vehicle was good because it provided a greener environment compared with the CV. However, the charging time of the EV was too long and thus the operating hour was shorter than the CV, generating less income than the CV. Shu Sang could not find any driver would rent the EV since the cost was similar to renting the CV. Shu Sang did not think the EV could meet the operational requirement of a taxi in Hong Kong.

4.4 All passengers in the forty four returns were impressed by the EV. The score given to “EV could help improve our roadside air quality and the EV was quieter” was 4.91 out of 5. They supported replacing the existing LPG taxis by electric vehicles (score 4.6 out of 5).

Appendix 1: Key Features of Vehicles Involved in the Trial

1. Trial EV

Registration Mark:	SS6455
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:	JU8333
Make:	Toyota
Model:	YXSIORAESBN
Class:	Taxi (NT)
Body Type:	Saloon
Seating Capacity:	driver + 5 passengers
Cylinder capacity:	1,998 cc
Year of manufacture:	2002

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