

Pilot Green Transport Fund

Final Report On Trial of Electric Light Goods Vehicle for Catering Service (Gate Gourmet Hong Kong 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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**Pilot Green Transport Fund
Trial of Electric Light Goods Vehicle for Catering Service
(Gate Gourmet Hong Kong Limited)**

**Final Report
(Trial Period: 1 July 2014 – 30 June 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. Gate Gourmet Hong Kong Limited (Gate Gourmet) was approved under the Fund for trial of one electric light goods vehicle (EV) for catering service.

1.2 Hong Kong Institute of Vocational Education (Tsing Yi) have been engaged by the Environmental Protection Department as an independent third party assessor to monitor the trial and evaluate the performance of the trial vehicle. Gate Gourmet assigned one diesel light goods vehicle (DV) providing similar services as the conventional vehicle for comparing with the EV.

1.3 The final report summarizes the performance of the EV in the 24 months of the trial as compared with its conventional diesel counterpart.

2 Trial Vehicle

2.1 Through the tendering procedures stipulated in the Subsidy Agreement Gate Gourmet entered into with the Government, Gate Gourmet procured one Mitsubishi Minicab MiEV electric light goods vehicle (EV) for trial

2.2 Key features of the EV and DV, as well as the charging facility, are in Appendix 1 and photos of the vehicles and the charging facility are in Appendix 2. The vehicles were used for catering service transportation around Hong Kong International Airport. According to the manufacturer, the EV's maximum payload is limited to 350 kg and it has a travel range of 150 km under no load condition with its battery fully charged and air-conditioning off.

2.3 The EV was charged regularly overnight after work. Gate Gourmet has their existing standard EV charger at the parking space and also set up one dedicated quick charger for EV at their office in August 2014. The EV was mainly charged at the parking space outside their office. It takes around 7 hours to fully charge the battery with the standard charger. The quick charger is mainly used when recharging is needed in short time., It takes around 40 minutes to fully charge the battery.

3 Trial Information

3.1 The trial started on 1 July 2014 and lasted for 24 months. Gate Gourmet was required to collect and provide trial information including the EV mileage reading before charging, amount

of electricity consumed and time used in each charging, downtime due to charging, cost and operation downtime associated with scheduled and unscheduled maintenance of the EV and the charging facilities. Similar monthly data from the DV was also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the drivers and Gate Gourmet were collected to reflect any problems of the EV.

4 Findings of Trial

4.1 Table 1 below summarizes the total operating costs of the EV and the DV. The average total operating cost of the EV was about HK\$1.74 (about 84%) lower than that of the DV. The average fuel cost of the EV is HK\$1.74 (about 90%) lower than the DV.

Table 1: Key Operation Statistics of each Vehicle (July 2014 – June 2016)

		EV	DV
Total distance traveled (km)		30,292	48,794
Average fuel economy	(km/kWh)	5.47	-
	(km/litre)	-	5.76
	(km/MJ)	1.52	0.16 ^[1]
Average fuel cost (HK\$/km) [2]		0.21	1.95
Average total operating cost (HK\$/km)		0.34	2.08
Downtime (working day) ^{[3] [4]}		33	5

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

[2] The market fuel price was used for calculation.

[3] Downtime refers to the equivalent number of working days in which the vehicle is not in operation due to charging, and the period 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.

[4] Maintenance due to incidents unrelated to the performance of the vehicle was not included for comparison.

4.2 There were scheduled maintenance for both EV and DV and unscheduled maintenance for EV in the trial period and lead to 33 days and 5 days of operational downtime, respectively. There were 730 working days in the trial period, the utilization rates of EV and the DV were thus 95% and 99%, respectively.

4.3 The EV driver had no problem in operating the EV and felt the EV was quiet and environmentally friendly.

4.4 Gate Gourmet agreed that using electric vehicle was good because it provided a greener and quieter environment compared with the diesel vehicle. However, they commented that the driving range of the EV was insufficient to support their work outside the Airport zone. The service scopes of the EV were hence restricted.

4.5 To eliminate the effect of seasonal fluctuations, 12-month moving averages were used to evaluate the trend of the EV's fuel economy. The fuel economy varied from 5.47 to 5.76 km/kWh (i.e., about 5% drop) for the EV. During the 24-month trial period, the variation in fuel economy of the EVs is insignificant and hence there is no indication that the fuel economy and the batteries have deteriorated during the trial period.

4.6 The carbon dioxide equivalent (CO₂e) emissions from the EV and the DV are 3,145 kg and 14,590 kg, respectively, and hence there is a reduction of 11,445 kg CO₂e emission, which is about 78 % reduction, in the trial.

5 Summary

5.1 The EV driver had no problem in operating the EV and felt the EV was quiet and environmentally friendly. However, he commented that the driving range of the EV was not able to support their work outside the Airport zone.

5.2 The utilization rates of the EV and the DV were 95% and 99% respectively. However, the usage of the EV was on the low side as reflected by the difference in the total mileage travelled between the EV (30,292 km, i.e. an average of 41.5 km between daily recharging) and the DV (48,794 km, i.e. an average of 66.8 km per working day) in the 24 months of trial.

5.3 The trial showed that the EV had lower fuel cost as compared with its conventional diesel counterpart, with a saving of HK\$1.74/km or about 90%. The average total operating cost of the EV was HK\$1.74 (about 84%) lower than that of the DV. The 12-month moving average fuel economy figures suggest there is no deterioration in the fuel economy of the EV in the trial period. Also, the EV had 78% CO_{2e} emission less than the DV.

5.4 At present, the price of EV is much higher than that of conventional vehicle, the accumulated fuel saving may not be able to offset the higher EV cost within a few years of operation. Since electric vehicle market is expanding and electric vehicle technology is improving, the price difference between electric vehicle and conventional vehicle is narrowing down and more affordable to the transport trade.

Appendix 1: Key Features of Vehicles.

1. Trial EV and Charging Facility

a) Trial EV

Registration Mark	SS 3257
Make:	MITSUBISHI
Model:	Minicab MiEV
Class:	Light goods vehicle
Gross vehicle weight:	1,660 kg
Seating capacity:	driver + 1 passenger
Rated power:	25 kW
Travel range:	150 km (air conditioning off)
Maximum speed:	130 km/h
Battery material:	Lithium ion
Batteries capacity:	16 kWh
Year of manufacture:	2013

b) Charging Facility

Charging standard: CHAdeMO-type fast charging
Charging mode: 500V / 100A, DC

2. DV used for comparison

Registration Mark	RV 1140
Make:	NISSAN
Model:	NV 350
Class:	Light goods vehicle
Seating capacity:	driver + 5 passengers
Gross vehicle weight:	3,300 kg
Engine capacity:	2,488 c.c.
Year of manufacture:	2012

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV and Charging Facility



Front view of EV



Rear view of EV



Left side view of EV



Right side view of EV



Quick Charging facility

2. DV for Comparison

 <p>07/07/2015 10:18</p>	 <p>07/07/2015 10:18</p>
<p>Front view of DV</p>	<p>Rear view of DV</p>
 <p>07/07/2015 10:19</p>	 <p>07/07/2015 10:19</p>
<p>Left side view of DV</p>	<p>Right side view of DV</p>