New Energy Transport Fund

Final Report
On
Trial of Electric Light Goods Vehicle for Mechanical Engineering Industry (Grandasy Engineering Company Limited)

(15 February 2024)

PREPARED BY:
Dr. Rick MO

List of Monitoring and Evaluation Team Members

Dr. Rick MO (Team Leader)
Smart City Division
Hong Kong Productivity Council

Ms. Rachel CHAN
Smart City Division
Hong Kong Productivity Council

Mr. Michael WU
Smart City Division
Hong Kong Productivity Council

Mr. K.S. LI
Smart City Division
Hong Kong Productivity Council

New Energy Transport Fund
Trial of Electric Light Goods Vehicle for Mechanical Engineering Industry
(Grandasy Engineering Company Limited)

Final Report
(Reporting Period: 1 January 2022 – 31 December 2022)

Executive Summary

1. Introduction

1.1 The New Energy 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. Grandasy Engineering Company Limited (Grandasy) was approved under the Fund for trial of one electric light goods vehicle for mechanical engineering industry. Grandasy, through the tendering procedures stipulated in the Agreement entered into with the Government, procured a Joylong EW5 electric light goods vehicle (EV) for trial.

1.2 Hong Kong Productivity Council has been commissioned by the Environmental Protection Department[1] as an independent third party assessor (the Assessor) to monitor the trial and evaluate the performance of the trial vehicle. Grandasy assigned an Isuzu TFS86JD-V-AT diesel light goods vehicle (DV) providing same services as the conventional counterpart for comparison.

1.3 This Final Report summarizes the performance of the EV in the 12 months of the trial as compared with its conventional counterpart, i.e. the DV.

2. Trial and Conventional Vehicles

2.1 The trial EV, Joylong EW5 electric light goods vehicle, has a gross vehicle weight of 4,300 kg capable of carrying a driver with four passengers and goods. It has a 73.4 kWh lithium-ion battery pack and a driving range of 330 km with its battery fully charged and air-conditioning off. The DV, Isuzu TFS86JD-V-AT diesel light goods vehicle with a gross vehicle weight of 3,000 kg and a diesel engine with a cylinder capacity of 2,499 c.c., was used as the conventional counterpart for comparison in this trial. The EV and the DV were used for the delivering maintenance tools to different construction sites in Hong Kong.

2.2 Grandasy installed a designated 30 kW DC charging facility at the office in Fung Kat Heung for charging and recording the amount of electricity charged. Key features of the EV, the charging facility and the DV are detailed in Appendix 1 and photos of the vehicles and the charging facility are shown in Appendix 2.

[1] The Administration of the New Energy Transport Fund was migrated to the Environment Branch of the Environment and Ecology Bureau [EEB (Environment Branch)] since 1 January 2023 after internal re-organisation of EEB (Environment Branch) and EPD.

3. Trial Information

3.1 The trial commenced on 1 January 2022 and lasted for 12 months. Grandasy was required to collect and provide trial information including the EV's mileage reading before charging, amount of electricity consumed and time used in each charging, operation downtime due to charging, and cost and downtime associated with scheduled and unscheduled maintenance of the EV and the charging facility. Similar data of the DV were also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the driver and Grandasy were collected to reflect any problems of the EV.

4. Findings of Trial

4.1 The following table summarizes the statistical data of the EV and the DV. The average fuel cost of the EV was HK$1.80/km (83%) lower than that of the DV. The average total operating cost of the EV was HK$1.39/km (58%) lower than that of the DV taking the maintenance cost into account.

Table 1: Key operation statistics of each vehicle (1 January 2022 – 31 December 2022)

		EV	**DV**
Total distance travelled (km)		6,457	30,053
Average daily mileage (km/working day)		22	102
Average fuel economy	(km/kWh)	3.40	-
	(km/litre)	-	9.57
	(km/MJ)	0.94	0.26 [1]
Average fuel cost (HK$/km)		0.38 [2]	2.18 [3]
Average total operating cost (HK$/km) [4]		1.00	2.39
Downtime (working day) [4][5]		2	2

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

[2] The electricity cost was calculated using average electricity tariff rates of HK$1.289/kWh (Jan 2022 – Oct 2022); and HK$1.451/kWh (Nov 2022 – Dec 2022) as claimed by CLP.

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

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

[5] Downtime refers to the working days the vehicle is not in operation, which is counted from the first day it stops operation till the day it is returned to the operator.

4.2 Apart from the fuel cost, maintenance cost and other indirect costs which may include parking fee, towing fee, vehicle replacement fee and cost of operation downtime due to charging and maintenance of the EV are also included in Table 1. There were one scheduled maintenance and two unscheduled maintenances for the EV while there was one scheduled maintenance for the DV in the 12 months of the trial. The scheduled maintenance of the EV was the service for the annual inspection. The unscheduled maintenance of the EV included body repair, replacement of ABS sensor, body repaint, and replacement of rear light. The scheduled maintenance of the DV was the service for the annual inspection.

4.3 Both the EV and the DV had 2 days of maintenance downtime related to vehicle performance. Hence, the utilization rates of the EV and the DV were both 99.3%. Based on the above, the average daily driving distances of the EV and the DV were 22 km/day and 102 km/day, respectively.

4.4 The driver of the EV had no problem in operating the EV. He agreed that the EV is quieter and the air inside the EV is cleaner. However, the driver stated that the power of the EV is not adequate on uphill, and the mileage for each recharge of the EV was not sufficient for daily operation. Grandasy was satisfied with the EV since the EV could save the operation cost, and could help improve the roadside air quality. Thus, given the opportunity, Grandasy would consider replacing all existing conventional vehicles with EVs and encourage other transport operators to try the EVs.

4.5 After the 12-month trial period, it is observed that the amount of electricity stored in the battery after a full charging operation could be maintained at the level of 72.7 kWh. Thus, the deterioration in battery capacity within the 12-month trial period was insignificant, if any.

4.6 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. In the 12-month trial period, the CO_2e emission from the EV and the DV were 742 kg and 1,870 kg respectively. Hence, there was a 1,128 kg (about 60%) reduction of CO_2e, with the replacement of the DV by the EV in the trial.

5. Summary

5.1 The average fuel cost of the EV was HK$1.80/km (about 83%) lower than that of the DV. The average total operating cost of the EV was HK$1.39/km (about 58%) lower than that of the DV. The utilization rates of the EV and the DV were both 99.3%. There was a 1,128 kg (about 60%) reduction of CO_2e, with the replacement of the DV by the EV in the trial.

5.2 After the 12-month trial period, it is observed that the amount of electricity stored in the battery after a full charging operation could be maintained at the level of 72.7 kWh. Thus, the deterioration in battery capacity within the 12-month trial period was insignificant, if any.

5.3 The driver of the EV had no problem in operating the EV but he stated that the power of the EV is not adequate on uphill, and the mileage for each recharge of the EV was not sufficient for daily operation. Grandasy was satisfied with the EV since the EV could save the operation cost and could help improve the roadside air quality. Thus, given the opportunity, Grandasy would consider replacing all existing conventional vehicles with EVs.

5.4 The findings showed electric light goods vehicles are becoming more affordable and feasible to the transport trade for saving operating cost and reducing CO_2e emissions, provided that the vehicles can get easy access to charging facilities.

Appendix 1: Key Features of Vehicles and Charging Facility

1. Trial EV and Charging Facility

EV

Registration mark:	**RE923**
Make:	Joylong
Model:	EW5
Class:	Light goods vehicle
Gross vehicle weight:	4,300 kg
Payload:	1,300 kg
Seating capacity:	Driver + 4 passengers
Rated power:	100 kW
Driving range:	330 km (air conditioning off)
Battery material:	Lithium-ion
Battery capacity:	73.4 kWh
Year of manufacture:	2019

EV Charging Facility

Make:	Only Power Supply
Model:	ANDC5-500V/60A-1
Power:	30 kW, 500V DC / max 60A
Charging standard:	GB mode

2. DV Used for Comparison

Registration mark:	**SS8021**
Make:	Isuzu
Model:	TFS86JD-V-AT
Class:	Light goods vehicle
Gross vehicle weight:	3,000 kg
Payload:	1,200 kg
Seating capacity:	Driver + 4 passengers
Cylinder capacity:	2,499 c.c.
Year of manufacture:	2014

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV (RE923) and Charging Facility

	
Front view of EV	Rear view of EV
	
Left side view of EV	Right side view of EV
	
30 kW DC charging facility	

2. DV (SS8021) used for Comparison

	
Front view of DV	Rear view of DV
	
Left side view of DV	Right side view of DV