

New Energy Transport Fund

Final Report
On
Trial of Electric Light Goods Vehicle for
Container Terminal Operation
(Hongkong International Terminals Limited II)

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The Monitoring and Evaluation Team's views expressed in this report do not necessarily reflect the views of the Environment and Ecology Bureau (Environment Branch), HKSAR.

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(Reporting Period: 1 May 2023 – 30 April 2024)

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. Hongkong International Terminals Limited II (HIT II) was approved under the Fund for trial of one electric light goods vehicle for container terminal operation. HIT II, through the tendering procedures stipulated in the Agreement entered into with the Government, procured a BYD T3 electric light goods vehicle (EV) for trial.

1.2 Hong Kong Productivity Council has been commissioned by the Environment and Ecology Bureau (Environment Branch) (EEB) as an independent third-party assessor (the Assessor) to monitor the trial and evaluate the performance of the trial vehicle. HIT II assigned a Toyota Hiace Diesel LWB diesel light goods vehicle (DV) providing same services as the conventional counterpart for comparison.

1.3 This Final Report summarises 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, BYD T3 electric light goods vehicle, has a gross vehicle weight of 2,420 kg capable of carrying a driver with four passengers and goods. It has a 44.9 kWh lithium iron phosphate battery pack and a driving range of 300 km under NEDC conditions. The DV, Toyota Hiace Diesel LWB diesel light goods vehicle with a gross vehicle weight of 2,800 kg and a diesel engine with a cylinder capacity of 2,982 c.c., was used as the conventional counterpart for comparison in this trial. The EV and the DV were used for patrolling within the Container Terminal 4. There was no designated driver assigned to drive the EV or the DV.

2.2 HIT II installed a designated 22 kW three-phase AC charging facility at Container Terminal 4 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.

3. Trial Information

3.1 The trial commenced on 1 May 2023 and lasted for 12 months. HIT II 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 maintenances 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 drivers and HIT II were collected to reflect any problems of the EV.

4. Findings of Trial

4.1 The following table summarises the statistical data of the EV and the DV. The average fuel cost of the EV was HK\$2.86/km (about 87%) lower than that of the DV. Taking the maintenance fee and other costs into account, the average total operating cost of the EV was HK\$4.09/km (about 91%) lower than that of the DV in the 12 months of the trial.

Table 1: Key operation statistics of each vehicle (1 May 2023 – 30 April 2024)

	EV	DV
Total distance travelled (km)	5,956	6,693
Average daily mileage (km/working day)	16	19
Average fuel economy	(km/kWh)	3.56
	(km/litre)	-
	(km/MJ)	0.19 ^[1]
Average fuel cost (HK\$/km)	0.42 ^[2]	3.28 ^[3]
Average total operating cost (HK\$/km) ^[4]	0.42	4.51
Downtime (working day) ^{[4][5]}	2	5

^[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\$1.565/kWh (May 2023); HK\$1.559/kWh (Jun 2023); HK\$1.535/kWh (Jul 2023); HK\$1.508/kWh (Aug 2023); HK\$1.482/kWh (Sep 2023); HK\$1.459/kWh (Oct 2023); HK\$1.442/kWh (Nov 2023); HK\$1.431/kWh (Dec 2023); HK\$1.523/kWh (Jan 2024 – Feb 2024); HK\$1.513/kWh (Mar 2024) and; HK\$1.507/kWh (Apr 2024) as reported 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 that the vehicle is not in operation due to charging or maintenance, 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. Both the EV and the DV had one scheduled maintenance in the 12 months of the trial period.

4.3 In the 12 months of the trial period, the EV had 2 days of downtime while the DV had 5 days of downtime. Hence, the utilisation rates of the EV and the DV were 99.5% and 98.6%, respectively. Based on the above, the average daily driving distances of the EV and the DV were 16 km and 19 km, respectively.

4.4 The drivers of the EV liked driving the EV and had no operation difficulties in driving the EV. Overall, they were satisfied with the performance of the EV. HIT II was satisfied with the EV since the EV could meet the operational requirements and save the operation cost. Given the opportunity, HIT II would encourage other transport operators to try the EVs.

4.5 It is observed that the amount of electricity stored in the battery after a full charging operation could be maintained at the level of 44.9 kWh after the 12-month trial period. 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 652 kg and 2,399 kg respectively. Hence, there was a 1,747 kg (about 73%) 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\$2.86/km (about 87%) lower than that of the DV. Taking the maintenance fee and other costs into account, the average total operating cost of the EV was HK\$4.09/km (about 91%) lower than that of the DV. The utilisation rates of the EV and the DV were 99.5% and 98.6%, respectively. There was a 1,747 kg (about 73%) reduction of CO_{2e}, with the replacement of the DV by the EV in the trial.

5.2 It is observed that the amount of electricity stored in the battery after a full charging operation could be maintained at the level of 44.9 kWh after the 12-month trial period. Thus, the deterioration in battery capacity within the 12-month trial period was insignificant, if any.

5.3 The drivers of the EV liked driving the EV and had no operation difficulties in driving the EV. Overall, they were satisfied with the performance of the EV. HIT II was satisfied with the EV since the EV could meet the operational requirements and save the operation cost. Given the opportunity, HIT II would encourage other transport operators to try the 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

(a) Trial EV

Registration mark:	YK2673
Make:	BYD
Model:	T3
Class:	Light goods vehicle
Gross vehicle weight:	2,420 kg
Payload:	711 kg
Seating capacity:	Driver + 4 passengers
Rated power:	35 kW
Driving range:	300 km (under NEDC conditions)
Battery material:	Lithium iron phosphate
Battery capacity:	44.9 kWh
Year of manufacture:	2022

(b) EV Charging Facility

Make:	Cornerstone Technologies
Model:	Slate CGWMSL1
Power:	22 kW, 380V AC / max. 32A three-phase
Charging standard:	IEC62196-2 Type 2

2. DV Used for Comparison

Registration mark:	SD7603
Make:	Toyota
Model:	Hiace Diesel LWB
Class:	Light goods vehicle
Gross vehicle weight:	2,800 kg
Payload:	850 kg
Seating capacity:	Driver + 5 passengers
Cylinder capacity:	2,982 c.c.
Year of manufacture:	2013

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EV (YK2673) and Charging Facility

	
<p>Front view of EV</p>	<p>Rear view of EV</p>
	
<p>Left side view of EV</p>	<p>Right side view of EV</p>
	
<p>22 kW three-phase AC charging facility</p>	

2. DV (SD7603) Used for Comparison



Front view of DV



Rear view of DV



Left side view of DV



Right side view of DV