New Energy Transport Fund

Final Report
On
Trial of Electric Light Goods Vehicles for Container Terminals Operation (Modern Terminals Limited)

(20 December 2024)

PREPARED BY:

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(Modern Terminals Limited)

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(Reporting Period: 1 September 2022 – 31 August 2023)

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. Modern Terminals Limited (MTL) was approved under the Fund for trial of two electric light goods vehicles for container terminals operation. MTL, through the tendering procedures stipulated in the Agreement entered into with the Government, procured two Nissan e-NV200 electric light goods vehicles (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. MTL assigned two Hyundai H-1 A/T Euro 6 diesel light goods vehicles (DV) providing same services as the conventional counterparts for comparison.

1.3 This Final Report summarises the performance of the EVs in the 12 months of the trial as compared with their conventional counterparts, i.e. the DVs.

2. Trial and Conventional Vehicles

2.1 The trial EV, Nissan e-NV200 electric light goods vehicle, has a gross vehicle weight of 2,250 kg capable of carrying a driver with four passengers and goods. It has a 40 kWh lithium-ion battery pack and a driving range of 317 km with its battery fully charged and air-conditioning off. The DV, Hyundai H-1 A/T Euro 6 diesel light goods vehicles with a gross vehicle weight of 3,200 kg and a diesel engine with a cylinder capacity of 2,497 c.c., were used as the conventional counterparts for comparison in this trial. The EVs and the DVs were used for patrolling within the container terminals.

2.2 MTL installed two designated 50 kW DC quick charging facility at Container Terminal 2 and at Container Terminal 9 (South) for charging and recording the amount of electricity charged. Key features of the EVs, the charging facility and the DVs 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 September 2022 and lasted for 12 months. MTL 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 DVs were also required. In addition to the cost information, reports on maintenance work, operational difficulties and opinions of the drivers and MTL were collected to reflect any problems of the EV.

4. Findings of Trial

4.1 The following table summarises the statistical data of the EVs and the DVs. The fleet average fuel cost of the EVs was HK$6.29/km (about 91%) lower than that of the DVs. The fleet average total operating cost of the EVs was HK$6.56/km (about 88%) lower than that of the DVs, taking the maintenance cost into account.

Table 1: Key operation statistics of each vehicle (1 September 2022 – 31 August 2023)

		EV		**DV**	
		EV-1	**EV-2**	**DV-1**	**DV-2**
Total distance travelled (km)		21,586	25,287	14,827	17,398
Average daily mileage (km/working day)		64	81	73	114
Average fuel economy	(km/kWh)	2.24	2.58	-	-
	(km/litre)	-	-	2.79	3.40
	(km/MJ)	0.62	0.72	0.077 [1]	0.094 [1]
Fleet average fuel economy (km/MJ)		0.67		0.086	
Average fuel cost (HK$/km)		0.66 [2]	0.58 [2]	7.63 [3]	6.18 [3]
Fleet average fuel cost (HK$/km)		0.62		6.91	
Average total operating cost (HK$/km) [4]		0.94	0.82	8.13	6.74
Fleet average total operating cost (HK$/km) [4]		0.88		7.44	
Downtime (working day) [4][5]		29	52	162	213

[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 (Sep 2022 – Oct 2022); HK$1.451/kWh (Nov 2022 – Dec 2022); HK$1.544/kWh (Jan 2023 – Feb 2023); HK$1.552/kWh (Mar 2023 – Apr 2023); HK$1.565/kWh (May 2023); HK$1.559/kWh (Jun 2023); HK$1.535/kWh (Jul 2023) and; HK$1.508/kWh (Aug 2023) 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 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 EVs are also included in Table 1. In the 12 months of the trial period, there were one scheduled maintenance and one unscheduled maintenance for the EV-1 while there were two scheduled maintenances and one unscheduled maintenance for the EV-2. In the same trial period, there were five unscheduled maintenances for DV-1 and three unscheduled maintenances for DV-2.

4.3 As the EVs operated 24 hours per day and had no off-duty time, the EV-1 had 26 days of charging-associated downtime while EV-2 had 45 days of charging-associated downtime in the 12 months of the trial period.

4.4 In the 12 months of the trial period. the maintenance related downtime was 3 days for EV-1, 7 days for EV-2, 162 days for DV-1 and 213 days for DV-2. Hence, the utilisation rates were 92.1% for EV-1, 85.8% for EV-2, 55.6% for DV-1 and 41.6% for DV-2. Based on the above, the average daily driving distances were 64 km for EV-1, 81 km for EV-2, 73 km for DV-1 and 114 km for DV-2.

4.5 Most of the drivers of the EVs liked driving the EV and had no problem in operating the EV. They agreed that the EV is quieter than the DV and its performance has not deteriorated. However, one of the drivers did not like driving the EV. Overall, most of the drivers were satisfied with the performance of the EV and would promote the EV to other drivers. MTL was satisfied with the EV since the EV could meet the operational requirements and save the operation cost. Given the opportunity, MTL would consider replacing all existing conventional vehicles with EVs and encourage other transport operators to try the EVs.

4.6 It is observed that the amount of electricity stored in the battery after a full charging operation could be maintained at the level of 40 kWh for both EVs after the 12-month trial. Thus, the deterioration in battery capacity within the 12-month trial period was insignificant, if any.

4.7 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 fleet CO_2e emission from the EVs and the DVs were 7,584 kg and 42,047 kg respectively. Hence, there was 34,463 kg (about 82%) reduction of CO_2e, with the replacement of the DVs by the EVs in the trial.

5. Summary

5.1 The fleet average fuel cost of the EVs was HK$6.29/km (about 91%) lower than that of the DVs. Taking the maintenance fee for both the EVs and the DVs into account, the fleet average total operating cost of the EVs was HK$6.56/km (about 88%) lower than that of the DVs. The utilisation rates were 92.1% for EV-1, 85.8% for EV-2, 55.6% for DV-1 and 41.6% for DV-2. There was 34,463 kg (about 82%) reduction of CO_2e, with the replacement of the DVs by the EVs 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 40 kWh for both EVs after the 12-month trial. Thus, the deterioration in battery capacity within the 12-month trial period was insignificant, if any.

5.3 The drivers of the EVs liked driving the EVs and had no problem in operating the EVs, but one of the drivers did not like driving the EV. Overall, most of the drivers were satisfied with the performance of the EV. MTL was satisfied with the EVs since the EVs could meet the operational requirements and save the operation cost. Given the opportunity, MTL would consider replacing all existing conventional vehicles with EVs and 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 EVs and Charging Facility

(a) EVs

Registration mark:	**CY68 (EV-1), CY69 (EV-2)**
Make:	Nissan
Model:	e-NV200
Class:	Light goods vehicle
Gross vehicle weight:	2,250 kg
Payload:	658 kg
Seating capacity:	Driver + 4 passengers
Rated power:	80 kW
Driving range:	317 km (air conditioning off)
Battery material:	Lithium-ion
Battery capacity:	40 kWh
Year of manufacture:	2021

(b) EV Charging Facility

No. of Charging Facility:	2
Make:	Lafon Technologies
Model:	Pulse QC50
Power:	Max. 50 kW
Charging standard:	CHAdeMO, IEC 62196-2, CCS Combo 2

2. DVs Used for Comparison

Registration mark:	**CY67 (DV-1)**
Make:	Hyundai
Model:	H-1 A/T Euro 6
Class:	Light goods vehicle
Gross vehicle weight:	3,200 kg
Payload:	1,060 kg
Seating capacity:	Driver + 5 passengers
Cylinder capacity:	2,497 c.c.
Year of manufacture:	2020

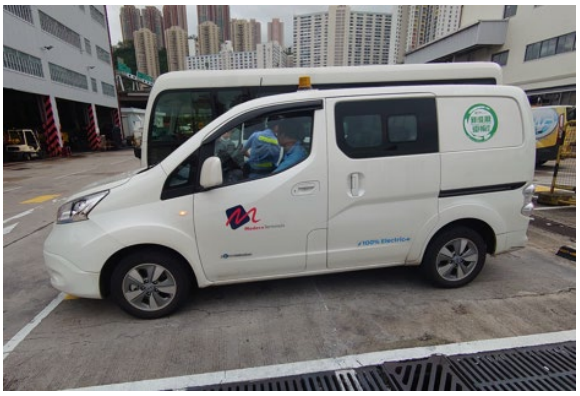
Registration mark:	**CY66 (DV-2)**
Make:	Hyundai
Model:	H-1 A/T Euro 6
Class:	Light goods vehicle
Gross vehicle weight:	3,200 kg
Payload:	1,060 kg
Seating capacity:	Driver + 5 passengers
Cylinder capacity:	2,497 c.c.
Year of manufacture:	2018

Appendix 2: Photos of Vehicles and Charging Facility

1. Trial EVs and Charging Facility

(a) Trial EVs

EV-1 (CY68)

	
Front view	Rear view
	
Left side view	Right side view

EV-2 (CY69)

	
Front view	Rear view
	
Left side view	Right side view

(b) Charging Facility

	
Charging facility – 50 kW DC quick charger in Container Terminal 2	Charging facility – 50 kW DC quick charger in Container Terminal 9 (South)

2. DVs Used for Comparison

DV-1 (CY67)

	
Front view	Rear view
	
Left side view	Right side view

DV-2 (CY66)

	
Front view	Rear view
	
Left side view	Right side view