

Case Study: Study on the Business Model of Electric Vehicles in Chinese Taipei

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I. Abstract

In response to the international trend of carbon reduction, Chinese Taipei has been promoting the electrification of transport vehicles for a long time, and electric vehicles are also moving towards the trend of intelligence with the rapid advancement of technology. With the increasing choice of electric vehicles available in the market, differentiation will be one of the ways to increase market share as major manufacturers from all over the world are investing in the production of electric vehicles. This paper examines the business models of different types of electric vehicles in Chinese Taipei and explores the ways in which operators have succeeded in the Chinese Taipei market and their vision for future development.

Keywords: Electric Vehicle, Low-carbon Transportation, Business Model

II. Introduction

In light of the international trend towards a sustainable environment, the Greenhouse Gas Reduction and Management Act (hereinafter the GHG Act) was promulgated on July 1, 2015 in Chinese Taipei, stipulating that greenhouse gas (GHG) emissions should be brought down to less than 50% of 2005 levels by 2050. To achieve this goal, the Environmental Protection Administration (EPA) of the Executive Yuan has planned to reach a 2%, 10%, and 20% reduction in emissions by 2020, 2025, and 2030, respectively, compared to 2005. In this regard, the transportation sector accounts for about 12.7% of the total GHG emissions, so it will align itself with the departmental emission control targets, promotion strategies and measures set out in the Phase 2 (2021-2025) "Transportation Sector Greenhouse Gas Emission Control Action Plan" to implement the corresponding GHG reduction management issues. Accordingly, the Ministry of Transportation and Communications (MOTC) continues to revise and compile the White Paper on Transportation Policy, and has released the latest version in 2020. In the Green Transportation section, the MOTC has formulated a vision, goals, policies, strategies and action plans for green transportation development on the aforementioned issues, and will make every effort to promote them.

Green transport development policies can be divided into three main policies: "developing public transport systems and strengthening demand management," "building a low-carbon and low-pollution transport environment," and "boosting energy efficiency of transport systems and vehicles," further planning for nine strategies—"enhancing public transport capacity through multiple incentives," "stepping up transport demand management,"

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"upgrading cycle lanes and integration of multiple routes around Chinese Taipei," "promoting the electrification of transport vehicles," "promoting greenhouse gas reduction in the transport sector," "strengthening energy saving, carbon reduction and pollution reduction measures in transport areas," "replacing highly polluting and energy-intensive transport vehicles," "developing intelligent transport systems and raising vehicle efficiency standards," and "constructing a green transport network with high energy efficiency". The two strategies of "stepping up transport demand management" and "promoting the electrification of transport vehicles" are currently the main business models implemented by the electric vehicle operators in Chinese Taipei, driving the development of the electric vehicle sharing and sales markets respectively.

III. Study on the Business Model of Electric Buses in Chinese Taipei

The main demand for buses in Chinese Taipei comes from operators of urban buses, national freeway buses and general highway buses. At the end of 2017, the Executive Yuan announced the policy goal of "full electrification of passenger transport (buses) by 2030," which was officially launched in 2020, and is expected to attain the target of full electrification of 10,600 urban buses by 2030. Like the MRT, urban buses are subject to local self-governance and are under the jurisdiction of the governments of the municipalities, cities, counties. By July 2020, there were 494 electric buses registered and running on the road in the nation. Urban buses are characterized by fixed routes, short distances, low speeds and stop-and-go services, and the shared nature of urban buses can reduce the use of private vehicles, effectively cutting down on GHG emissions, and if coupled with the implementation of electrification, there is a chance of achieving the goal of zero-carbon transport. As a result, the electrification of urban buses has become a strategic priority in the country.

1. Overview of the development of electric bus manufacturing technology in Chinese Taipei

After years of research and development, Chinese Taipei manufacturers have cultivated their own technology to develop key components for electric buses, such as motors, chassis, bodywork, and vehicle control system-related components, while batteries are still mostly sourced from international companies, but battery management systems and charging equipment can be home-made.

2. Government subsidy policy for electric buses

In 2019, the MOTC approved the "Subsidies Guidelines for Electric Buses on Public Transport," with a maximum subsidy of NT\$3.338 million per vehicle for Category A and NT\$2.6 million for Category B. If the electric vehicles show good performance, there will be a performance bonus of up to NT\$2 million. In 2020, an inter-ministerial collaboration between the Ministry of Economic Affairs (MOEA) and the EPA of the Executive Yuan was conducted to approve the "Electric Bus Demonstration Program Subsidy Guidelines," under which purchasers will be able to obtain grants of up to NT\$10 million per electric bus (including a 12-year maintenance grant) for Category A and NT\$6.1 million per electric bus (including a 12-year maintenance grant) for Category B, provided that proof of the degree of localization is obtained and the operating performance is maintained over a certain period

of time, in the hope that with the incentive of the relevant subsidy scheme, the price competitiveness of electric buses will be enhanced and domestic operators will be more willing to purchase them.

3. Business model features in the electric bus market

I. Diversification and differentiation of products in domestic and international markets

Due to the relatively small market for electric buses in Chinese Taipei, almost all domestic electric bus manufacturers are focusing on overseas markets, offering not only products for different vehicle types, but also major key components or management systems. After gaining a solid track record of sales in the country, they can then design their products for overseas target markets, such as the needs of buyers for complete vehicles or components, customized vehicle performance design to suit the characteristics of the operating route, or price-oriented system design, which are all potential solutions for domestic electric bus manufacturers, and they will choose markets that match their technical characteristics as their primary targets. At this stage, the main overseas target markets for domestic manufacturers are Southeast Asian countries, hoping to enter the local markets with the advantage that the domestic products have a higher cost/performance ratio than those produced by European and American companies, and by availing themselves of the green transportation plan in Southeast Asian countries.

II. Customized charging facilities for electric buses

Electric buses have a larger battery capacity and therefore take longer to charge. However, as the technology for batteries and charging equipment matures, domestic manufacturers will be able to configure battery capacity and charging solutions to suit the operators' needs. For example, some operators use a fast-charging solution, which allows the battery to be fully charged with a shorter charging time. Therefore, higher battery reserve capacity is not needed, which not only lowers the battery cost, but also lessens the weight of the vehicle and boosts the operating efficiency of the operator. Domestic manufacturers can also allocate the right number of charging piles according to the existing vehicle management model of the operators, and the number of piles can be shared by multiple vehicles, thus reducing the number of periods when the charging equipment is left idle or used intensively, and driving down the cost of purchasing or maintaining charging equipment for the operators.

III. Charging stations combining renewables and energy storage applications

The charging facilities for electric buses are mainly installed in car parks purchased or leased by bus operators, where there is a large area and few buildings. As the cost of fuel for electric buses is the cost of electricity procurement, the cost of electricity procurement can be further brought down by building up renewable energy in combination with energy storage systems, such as utilizing renewables directly to generate electricity to reduce electricity costs or employing energy storage systems to avoid contractual capacity overruns and fines.

IV. Repurposing batteries for emerging commercial applications

As electric buses are driven by power, they require higher battery charge status, so if the battery declines to a certain level (mostly set at 60% to 70%), it may affect operational safety and needs to be replaced. Repurposing batteries, however, still have a certain amount of charging capacity, so domestic makers are developing technologies related to repurposing batteries for buses, hoping to use the batteries to tap into the energy storage market in the future, creating a commercial value of secondary use of batteries.

4. Targets for the development of the electric bus industry

The government is continuing to implement policy support programs to accelerate the localization of electric buses through the integration of key technologies from Chinese Taipei manufacturers in different fields, in order to achieve the goal of electrification of buses in the country. In addition to helping to improve key technologies, it has also expanded its target markets from home to abroad, exporting complete vehicle products. Besides bus manufacturing, Chinese Taipei is also moving towards the development of intelligent and unmanned buses, using Internet of Things (IoT) technology and big data analysis to bring real-time information on vehicle movements to the public and to help operators boost operational efficiency. At the same time, with the advent of the Internet of Vehicles (IoV), automatic driving and 5G communication technology, we are heading towards unmanned electric buses, which not only reduce the demand for driving staff at night, but also meet the demand for transportation during off-peak hour.

IV. Analysis of the Business Models for Domestic Electric Scooters

1. Trends in the development of the electric scooter industry

To reach the GHG emission reduction target at an earlier time, governments are attempting to cut CO₂ emissions through policies such as banning the sale of fossil-fuel vehicles. Many countries have introduced incentives such as purchase subsidies or tax breaks to encourage people to choose electric motorcycles, including Norway, which is expected to ban the sale of cars that run on gasoline by 2025, the UK and France, which are expected to prohibit the sale of diesel and petrol vehicles by 2040, and India, which has set a target of 100% electrification of three-wheelers by 2023 and electrification of all gasoline-powered motorcycles over 150 c.c. by 2025.

The development of the global electric vehicle industry has been further boosted by the imposition of a timetable for the restriction of the sale of fuel-powered vehicles, as well as incentives such as car purchase subsidies and tax incentives, combined with the promotion of green energy and smart cities. Global sales of electric motorbikes have reached a total of 600,000 units in 2019, with cumulative total sales from 2015 to 2019 accounting for 76%

in Asia, 8.8% in Europe, 7.5% in North America and 7.8% in other regions. With the rise of environmental awareness, the world continues to see a boom in the growth of electric vehicles. According to a new research report published by Grand View Research, a U.S. market research firm, the global electric motorcycle market was valued at US\$17.4297 billion in 2018 and is expected to reach US\$41,976 billion by 2030.

2. Overview of Chinese Taipei's electric motorcycle industry

The main export regions are the EU (Spain, Germany), followed by the US. Emerging markets such as the ASEAN countries have the highest growth potential for electric motorcycles due to their rapid population increase, rising economic strength, increasing per capita income and high air pollution index. In view of the fact that smart electric scooters are a global trend for future development, the Chinese Taipei government has planned to invest nearly NT\$17 billion to implement various guidance programs and subsidies until 2030 to push the growth of the smart electric motorcycle industry, which is estimated to add at least NT\$50 billion in production value and 20,000 jobs in five years.

In the early days, as the electric vehicle industry did not have a market scale, manufacturers in the related industry chain were not willing to invest in it, making it difficult to exploit the shared economy. Therefore, the Chinese Taipei government committed resources in three phases from 2014 to 2017 to establish a key component supply chain for domestic electric motorbikes, driving the self-production capability of battery packs, battery cells and materials, motor assembly, stators and rotors, controllers, etc. Chinese Taipei's electric motorbike industry chain is now well-developed, with the exception of power battery cells, which are still made by international battery manufacturers due to the lack of economies of scale and price considerations, and other related components are mostly home-made, with a self-production capacity of nearly 80% of the entire vehicle.

3. Innovative business models and cases of electric motorcycles

At this critical turning point in the rapid growth of global demand for electric motorcycles, Chinese Taipei's electric motorcycle industry occupies an important position. As ordinary heavy-duty motorbikes are the most popular type purchased by consumers worldwide, the world's leading manufacturers of ordinary heavy-duty electric ones are all located in Chinese Taipei, including KYMCO, eMOVING, Aeon Future Mobility Co and Gogoro, all of which are leaders in production technology in the world. In recent years, operators have launched more affordable and lightweight motorbike models (e.g. Gogoro VIVA) to tap into the green market and attract different customer segments to drive sales growth.

I. Development of an open smart battery exchange platform and establishment of an independent business entity

Gogoro, Chinese Taipei's leading electric motorbike maker, has launched the Gogoro Network smart battery exchange platform to provide consumers with a fast, convenient and smarter way to swap batteries. The battery exchange stations are designed for "6-second swapping," and more than 2,000 battery exchange stations have been built

throughout Chinese Taipei, ranging from supermarkets and car parks to convenience stores. This open energy exchange system is not only available for Gogoro's own scooters, but is also accessible to other companies to develop their own models using its electronic control systems, smart batteries, battery exchange platforms, etc.

In 2019, Gogoro has announced the development of the Gogoro Network as a new independent business entity in order to focus more on providing an open smart battery swapping platform and smart mobility services. In addition to continuing to focus on the upgrading of smart battery technology and optimizing the battery swapping service and GoStation battery exchange stations deployment through AI, the company will also extend its support to more partner companies in developing Powered by Gogoro Network smart electric vehicles, as well as provide more innovative service models based on this open platform and battery technology. Currently, the Powered by Gogoro Network (PBGN) battery exchange platform is driving the rapid development of Chinese Taipei's smart e-scooter market. Six major e-scooter brands, including 2 Plus, AEON Mobility, SUZUKI eReady, PGO e-scooters, Yamaha Motor Chinese Taipei, and eMoving are taking turns to launch new e-scooters on the PBGN platform, while driving hundreds of traditional motorcycle shops to join the ranks of new energy and smart transportation of e-scooters, becoming the mainstream of the e-scooter market.

II. Launch of an electric motorbike sharing service to link up the city's public transport network

The Industrial Development Bureau of Chinese Taipei's MOEA has approved grant applications for shared electric motorbikes in 2019 as a new mobility option for metropolitan areas. Since shared motorcycles can be ridden flexibly in the alleys and streets of the downtown and combined with public transportation, they can meet the needs of consumers for commuting, pick-up and drop-off, carrying goods, temporary rides, and trips, etc. After considering the cost, performance, speed limit, range, rental rate, management, and the main purpose of consumers' renting, many operators have primarily adopted low and medium power electric motorcycles with green license plates (80-100 c.c. class) as the mainstream.

Among the three major electric motorbike sharing service providers, WeMo, the earliest one, has 6,014 units on the market and operates in Taipei, New Taipei City and Kaohsiung, using KYMCO Candy 3.0 electric motorbikes because its batteries and systems provide stable and reliable services and have low warranty and maintenance costs. The number of electric motorcycles purchased by iRent has reached 4,000, and its scope of operation is the widest among the three major players, spanning the six special municipalities, with the KYMCO Many110 EV being the main model used. GoShare, despite being a latecomer to the game, has been supported by Gogoro, and expanded its business from Taoyuan to Taipei City, with 3,740 electric scooters purchased, and currently serves Taoyuan, Taipei, New Taipei City, and Tainan.

In order to integrate urban transport services, scooter sharing services are also combined

with other public transport to provide convenient transfer services and special offers. WeMo offers free transfers and hours for electric scooter sharing services for commuters who purchase an EasyCard monthly pass for NT\$1,280. New GoShare members can enjoy the first 30 minutes of their first ride for free and a NT\$100 ride bonus upon completion of 11 rides on Taipei Metro with their EasyCard under certain conditions. iRent is offering a free 30-minute motorbike ride with its own vehicle/motorbike transfer, and the Kaohsiung City Government is combining shared electric motorbikes with MenGo monthly passes to seamlessly transfer to MRT stations, buses, ferries, light rail stations, shared electric motorbikes and public bicycles to meet the diverse mobility needs of the metropolitan area.

4. Future prospects for the electric motorbike industry

Since the Chinese Taipei government established a policy to ban the sale of fuel-powered motorbikes in the country by 2035 at the end of 2017, the country has seen a boom in the development of electric motorbike models and vehicle charging network systems, and has built up a variety of operating service models. At this stage, the domestic electric motorcycle production and sales market has shown growth momentum, and some manufacturers have received international recognition for their products and services. In the future, apart from focusing on the development and advancement of vehicle and charging technology, it will promote electric scooters combined with roadside facilities to increase the implementation of intelligent technology and safety equipment, such as IoV to boost driving safety and efficiency, and continue to encourage the development of innovative motorbike sharing applications to ease the ownership and use of private vehicles in metropolitan areas. The integration of supplementary energy services with the power companies' electricity needs, the optimization of charging schedules and the use of switching stations as energy storage systems to maintain a balanced grid will be the three main directions for the future development of the electric motorbike industry.

V. Conclusion and Outlook

Chinese Taipei continues to promote the electrification of transport vehicles. The government's policy is to enhance the technological development capacity of domestic electric vehicle manufacturers and to drive market demand for electric vehicles through a procurement subsidy program. The industry is continuing to add value to its services and operations through smart and emerging technologies, with passenger experience and operational efficiency as the main objectives, leading to a greater willingness to adopt electric vehicle solutions and move towards national low-carbon goals.