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## **SERVICE ISSUES: overview of electric vehicles use in Vietnam**

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### **Abstract:**

Due to the problems caused by the gasoline engine on the environment and people, the automotive industry has turned to the electrically powered vehicle. Electric Vehicles (EVs) such as electric two-wheelers and electric cars provide convenient local transportation and are becoming popular means of transport in Vietnam in recent years. Electric bicycles, electric motorbikes and electric cars appeared in Vietnam since the early 2000s and are growing very quickly. As of September 2015, Vietnam's EV market has grown to an estimated 2.5 million e-bike units and over 1000 electric cars. However, electric vehicles, as a competitive solution for *green transportation*, are yet to be bettered off. Lead poisoning, traffic accidents, lack of charging facilities, lack of policies and regulations to ensure safe and effective usage for a better environment and sustainability, in general are the elements that affect and restrain the further development of the Vietnamese market. In this paper, we present an overview of EV use in Vietnam, as well as the benefits and limitations of EV use, especially the many existing issues, and some recommendations to manage the development of these new modes of transport.

*Keywords:* electric vehicle, electric cars, electric two-wheelers (electric bicycle, electric scooter, electric motorcycle), environment pollution, sustainability, issue

### **I. INTRODUCTION**

Today the use of personal vehicles causes a big pressure on transport infrastructure and urban environment in Vietnam. Recent years in big cities of Vietnam, the rapid population increase and urbanization are paralleled by a blowing-up of traditional transport vehicles and the appearance of electric vehicles (electric two-wheelers – electric bicycles and electric motor bicycles, three and four-wheelers – electric cars). According to the report of the Vietnam National Traffic Safety Committee (VNTSC), by the end of December 2014, approximately 43 million motorcycles, 2.2 million cars are registered. The number of vehicles has exceeded the planning of the Vietnamese government by the year of 2020 [1]. The outbreak of motorcycles in circulation since 1990 has increased traffic congestion and air pollution in large cities such as Hanoi and Ho Chi Minh City. By 2015, Vietnam's electric bicycles in use has grown to an estimated 2.5 million units. Since the introducing electric three and four-wheelers in big cities in 2000, by November 2015 there has been over 1000 electric cars and the number of users has been increasing substantially. The introduction of electric vehicles has already begun and is now underway. The growing popularity of electric vehicle recently raised some questions to the authorities and policy makers: whether or not EVs are good alternatives to motorcycles and automobiles as means of personal transport due to its help of saving fuel and reducing environmental pollution (noise and CO<sub>2</sub> emission); and should EV be encouraged in order to reduce personal motorcycles for a more sustainable urban transport in Vietnam? It is necessary

to make a preliminary research on the current usage of EVs, as well as the benefits and service issues that they bring about. In the same time, it is necessary study the impact of electric vehicles (as a new kind of load) on the electric distribution grid in Vietnam.

The objective of this paper firstly is to review the current situation of e-bicycles, e-motorcycles and electric cars use in Vietnam and to give some recommendations on regulating them effectively and safely. The preliminary analysis relies on literature bibliographies and make collective data from the field of Vietnam's electric vehicle market; relevant data from magazines and reports of Ministry of Transport, Department of Transport, and National Traffic Safety Committee, etc. Collected data is used to provide an overview and current situation of the electric vehicle use in Vietnam.

## **II. ELECTRIC TWO-WHEELERS USE IN VIETNAM**

### **1. Background and current situation**

Electric two-wheelers are electricity-powered two-wheelers. A battery pack and a motor are equipped to store and transform the electricity. A user control is usually attached to the handle bar to brake and adjust the speed. By this abstract definition, a variety of types and styles are available to consumers in the market and still developing. In this paper, we follow the mainstream definition and mainly focuses on the Vietnamese market (electric bicycle and electric motorcycle).



*Electric bicycle and electric motorcycle use in Vietnam's market*

Electric bicycles (e-bikes) come in a range of styles and performance specifications, but the primary technology is the same. The vast majority of them utilize lead acid batteries to provide energy to a hub motor that is usually on the rear wheel. Most electric bikes have two apparent shapes: *scooter style electric bikes* or *bicycle style electric bikes*. The first style appears much like gas scooters complete with headlights, turn signals and horns; with large battery packs under the footboard. There type typically has larger 48 V batteries and higher powered motors 350-500 W. The second style resemble bicycles, with functioning pedals and usually have smaller batteries and a lower power motor. It typically has 36 V batteries and 180-250 W motors. Electric bikes are capable of speeds exceeding 20-30 km/hour and weight between 40 and 60 kilograms [2, 3]. Electric bikes have a range of 40-50 km on a single charge.

According to the National technical standardized regulations for electric bicycles by the Vietnamese Government (Decree No.171/2013/NĐ-CP of the Government dated 13 November 2013) and by the Ministry of Transport (Circular No. 66/2015/TT-BGTVT dated 06 November 2015) [4, 5], electric bicycle and electric motorcycle are distinguished by speed, weight and motor power. The electric bicycle is two-wheeler bicycle which is operated by pedal structure with the assistance from a direct current motor, having the largest motor power of no greater than 250 W and maximum designed speed of no more than 25 km/h. The weight itself

(including the battery) is no greater than 40 kg. The electric bikes are allowed to operate in the bicycle lane and are considered a bicycle from a regulatory perspective (i.e. crash-helmets and driver's licenses are not required). The electric motorcycles are equipped with an electric motor which required to have maximum speed of no greater than 50 km/h, maximum engine capacity of no greater than 4 kW, and vehicle weight of up to 118kg.

In Vietnam, the major cities currently have to face with frequent traffic congestion, air pollution (i.e., noise and CO<sub>2</sub> emission) and accidents. To avoid the problems, a number of residents are switching from automobiles and motorcycles to alternative means of transport such as e-bikes and e-motorbikes for short distances. Most people who use them in their daily lives are pupils, students, and middle-aged people because of its convenience, low travel cost, quiet operation, parking space efficiency and its contribution to reduce quantity of CO<sub>2</sub> emission. This transport mode is suitable for students at school because it does not require a driving license. Around 70% of e-bikes and e-motorbikes are owned by teenagers and students aged 14 and above. E-bikes and e-motorbikes are widely used in several crowded cities of Vietnam, such as Hanoi, Ho Chi Minh City, Hai Phong, Da Nang, Thanh Hoa, Ha Long, etc. During rush hours, the streets of the capital city of Vietnam are seen filled with electric bikes nowadays, a new alternative means of transport to bikes and motorcycles. There are actually hundreds of models of e-bikes and e-motorcycles presented in Vietnamese market. The number of e-bikes consumed in Vietnam's market is increasing every year, gaining its place as a youth's favorite personal transport. In the first 9 months of 2013, the quantity of Chinese bicycles and e-bikes exported to Vietnam reached 117,000 units, increasing by nearly 49% compared to the same period in 2012. The total number of e-bikes in 2013 was 53,000 units, which is equivalent to an increase of 94% as compared to the same period in 2012. The number of e-bikes and e-motorbikes in use in Vietnam reaches about 370,000 (about 150,000 e-bikes were sold), equivalent for 14 % by buying conventional gasoline motorcycles. In 2014, sales increased to 500,000 units, i.e. growth of 35%. As of September 2015, Vietnam's e-bike market has grown to an estimated 2.5 million units [6].

Electric bicycle and electric motorcycle can be categorized according to source: imported e-bike and e-motorbike represent about 95 percent of market share, and domestic e-bikes, e-motorbikes account for only 5% (HKBIke...) of market share. Imported e-bikes and e-motorbikes are mainly from China (TenBike, Yadea, Aima...) and Taiwan (Giant...), accounting for 80% of market share, and from Japan (Asama, Yamaha, Honda, Bridgestone) accounting for 15 %. According to the report of the VNTSC, nearly 70% of imported electric two-wheeler vehicles are e-motorbikes and 30% of those are e-bikes. Popular brands of electric bikes in Vietnamese market include Honda, Yamaha or Bridgestone and Giant, among others. On average, one electric bike rider who commute urban distance is estimated to pay only 50,000 Vietnamese dong (nearly 2.4 U.S. dollars) more in their monthly electricity bill. Meanwhile, a scooter or motorcycle will cost around 500,000 Vietnamese dong (24 U.S. dollars). In addition, modern types of electric bikes are integrated with advanced battery technology, which can run a longer distance for each charging time.

**E-Bike project (5 years 2013 – 2018): green energy, clean transportation [7].** Caritas Switzerland in Vietnam and BK-Holdings have decided to implement a project namely: "*Promotion of electric two-wheelers and solar energy in Vietnamese Cities, an explorative project Initiated and Tested in Hanoi*". The goals of this project are: (i) to provide an electric bike service center for students with green energy, clean traffic (electric bike is charged by solar energy), (ii) to promote the use of renewable energy, reduce CO<sub>2</sub> reduction, and improve knowledge of renewable energy, solution of clean transport; and to protect environment, (iii) to build sustainable society business model. By the end of 2013, Hanoi University of Science and Technology was selected to implement the project, which first came into operation in 2014 and

started bike rental services in 2015. With the advantages of Bach Khoa Center of electric bikes located adjacent to area of students of Universities, there is a high demand for this product. In the upcoming time, BK-Ebike will expand its service for tourism, offices and visitors.

However, since this type of vehicle does not have to be registered, no one can be sure if the products sold on the local market are of good quality and if they are roadworthy. There are also no figures as to how exactly many electric bikes are now running in Vietnamese streets. The increasing use of e-bikes and e-motorbikes recently has raised some questions to the authorities and policy makers: whether or not e-bikes and e-motorbikes are an effective alternative of personal transport mode for motorcycles due to its help of saving fuel and reducing environmental pollution; and should this vehicle be encouraged to use in order to reduce more personal motorcycles in Vietnam's urban in the near future? Therefore, it is needed to make a research on the practical use of e-bikes and e-motorbikes, as well as their benefits and their limitations.

## **2. Advantages of electric two-wheelers use in Vietnam**

Electric vehicles are considered to be the future of vehicle industry as well as a worldwide advancement of transport thanks to the numerous advantages that this type of vehicle, praised as “*green vehicle*”, has to offer. Among them are resource and fuel economy, environmental friendly, low air and noise pollution, and especially high safety for users with very few accidents caused by e-vehicles recorded as well as lower fire and explosion hazard compared to gasoline-consuming vehicles of today. The market for e-bikes and e-motorbikes is one of the most promising since this is a continuing trend worldwide. Teenagers, students, and middle-aged people in Vietnamese urban areas are having more needs to use e-bikes and e-motorbikes. They generally offer the following some benefits:

**Lightweight, small and compact size:** in comparison with motorcycles, average weight of e-bikes and e-motorbikes from 20 to 50 kg is smaller than that of motorcycles. With the traditional shapes, the load of e-bikes can reach 150 to 180 kg for imported vehicles from popular and high-quality brands such as HKBike.

**High flexibility and mobility:** thanks to the compact size, e-bikes and e-motorbikes require less space for parking space and traffic than motorcycles. They can move quickly and conveniently for a short distance of less than 15 km and through narrow streets typical of populated cities in Vietnam. In particular, they are highly effective in the face of traffic congestions and noise pollution during active hours in Vietnam (from 6.00 am to 9.00 pm).

**Less physical effort:** e-bikes are able to overcome common barriers of traditional bicycle like climbing steeps, going against strong wind or travelling longer distances. E-bikes can be an optimal solution for the elderly because they move more smoothly.

**Diversified style and design, fashionable with youths:** currently in Vietnam's market, there are hundred different models of e-bikes and e-motorbikes from many manufacturers. Consequently, this gives consumers a wide variety of choices. The size and shape of e-bikes and e-motorbikes are able to fit to the body condition, age, gender as well as the various interests of Vietnamese consumers, especially the youth.

**No need for a driver's license:** e-bike is the perfect vehicle for pupils and students to travel (Vietnamese people have to wait until 18 years old to be licensed for driving motorcycle). For those who are less than 18 years old, they will not be fined if they did not wear a helmet. E-bikes participate in the same lanes with other motor vehicles.

**Environmentally friendly:** since e-bikes use electricity stored in batteries, they emit almost nothing into the atmosphere. In contrast, motorcycle operation generates harmful emissions to

the environment and public health, such as VOCs, CO, NO<sub>x</sub>, PM, SO<sub>2</sub>, SO<sub>3</sub>, PbCl<sub>2</sub>. Hydrocarbons from motorcycle emissions can cause genetic mutations, cancer and reproductive health problems for human. The potential use of e-bikes and e-motorbikes can be considered as a clean alternative for motorcycles or conventional cars as urban planning is currently aiming to be sustainable and eco-friendly. However, e-bikes with lead-acid batteries cause environmental pollution to a certain extent. Therefore, manufacturers and consumers should switch to lithium-ion technology to reduce the negative impacts of lead-acid batteries, and help make the nation more energy-efficient.

**Safety in traffic:** because the prescribed maximum speed of e-bikes is 25 km/hour, their risk of accidents will be less than motorcycles. The involvement of motorcycle in accidents accounts for 80% in the cities of Vietnam. E-bike and e-motorbike are not involved into the accident caused by explosion and fire, which is common in the motor vehicle gasoline.

**Quiet operation:** E-bikes and e-motorbikes do not make noise like motorcycle. This really is advantages over motorcycles. Stress by engine noise putty motorcycle in major cities in Vietnam are common.

### **3. Issues and and recommendations to encourage electric two-wheelers use in Vietnam**

The development of electric bicycles and electric motorcycles market largely depends on the policy of the government. Without government's support for the e-bike and e-motorbike industry and business such as battery manufacturing technology, supporting facilities, financial incentives..., a growth in the near future will be unlikely.

#### **Infrastructure needs to be developed faster**

The biggest obstacle to overcome for the adoption of electric vehicles at the moment is still the battery and charging infrastructure issue. There is a notable that there is none charging infrastructure in Vietnam for e-bike and e-motorbike. Most electric two-wheelers are charged at home or at the workplace. Meanwhile, the current electric power infrastructure is sufficient and it is not hard to set up a charging stations for electric vehicles.

Since the end of 2014, many companies in Vietnam have actually considered providing charging stations for e-bikes and e-motorbikes and expected to establish 10-minute quick charge stations at e-bike stores or on the road. However, all of these remained as projects on paper yet to be realized. The reasons can be that the companies are not big enough to carry out this job. The chances of making profit is very low once they invested their money, as there is no way to charge users more effectively and quickly each time they use the service. In addition, the business is not completely safe because the stores to install a charging system are usually not committed: they can change their business at any time. An experience from Japanese government is to set up charging stations all over the country to encourage its citizens to use e-bike. For the USA, the policy is to provide technological companies like Tesla with concessional loans for the research and manufacture of e-bikes which are competitively priced with respect to traditional fuel vehicles [7].

Besides, it is necessary to have dedicated lanes for e-bike and e-motorbike to avoid conflict with other vehicles. This issue should be considered in the long term due to crowded and narrow lanes, weak infrastructure and many intersections in Vietnam. Experience from other countries has shown that, some countries have already separated lane for e-bike e-motorbike, bicycle and motorbike. In Japan, electric bikes and bike are ridden on sidewalks. However, in Toronto, they have considered banning electric bikes ride in bicycle lanes. Also in New York City in USA and some countries in Europe, the use of same lanes between e-bike and conventional bike has created conflicts for users. In the large cities in Vietnam, in order to have an appropriate lane

for e-bike and e-motorbike, it is needed to take into account the high density of two-wheelers in circulation, especially motorcycles.

### **Electric two-wheeler manufacturing industry**

More determined actions can be taken to encourage electric vehicle adoption: the governments of Singapore, Thailand and Malaysia have offered reduced taxes for both buyers and auto manufacturers to participate the market. Thailand had a favorable tax for imported hybrid vehicles and a 10% tax reduction for low-emission vehicles in general.

Regarding Vietnam, as of 2012, the government showed its interest in promoting electric vehicles in its national policy. More of the government's concern is about public transportation rather than private vehicles, for which it issued only technical barriers [8]. Based on the current demand and trends of the market, the government should orient the electric bicycle industry to be a part of the green economy, and manage the market so as to limit spontaneous developments. There is no policy to support the research and development of various types of electric vehicle up today. Instead, there are regulations being finalized to tighten control over safety, quality and technical standards.

The government should also have a consistent with tax preference policies for *green industries* to encourage the development of domestic manufacturers. Projects related to the production of bicycles, electric bicycles, electric motorcycles, especially lithium high technology industries should be priority investment.

### **Electric two-wheeler safety and regulation**

In order to manage traffic safety plus e-bike and e-motorbike market, and to protect consumers, the Vietnamese government has issued number of decrees and circulars on e-bike, e-motorbike technical standards; technical quality control; helmet wear regulation, inspection fee for safety and environment protection, keeping fee, etc. However, it is necessary to have more a regulation that lets people use e-bike and e-motorbike more safely. Researching possibilities to register and issue driving license for e-motorbikes to manage systematically and clearly defining management authorities who issue registration and driving license are the important terms which should be effected by the governmental authorities such as Department of Transport, Ministry of Transport and National Traffic Safety Committee, etc. The registration and use of license drivers for e-motorbikes could be a secure solution to protect consumers from smuggled vehicles, unqualified vehicles and fakes. And if yes, what type of driving license is required for e-motorbike?

## **III. ELECTRIC CARS USE IN VIETNAM**

Electric cars (electric three and four-wheelers) appeared in the market of some major cities like Hanoi, Ho Chi Minh City and Da Nang in recent years. Their number in the four regions in northern (Hanoi, Ha Long) and central (Da Nang, Hue) Vietnam is 621 electric cars, 50 of which are in Hanoi, from statistics released by the Ministry of Transport in November 2014. By the end of November 2015, there has been over 1086 electric cars serving personal use and tourism. These vehicles are not officially regulated in the Law of Road Traffic, therefore administrative tasks such as driving license registration, safety control, traffic monitoring system, road tax policy, import and export taxes, etc., represent difficulties to businesses, as well as consumers and the authorities. Facing this number of electric cars running in the street of big cities that tends to increase, it is time to discuss the management challenging issues. On April 14<sup>th</sup>, 2015, the Ministry of Transport addressed an official dispatch No.4638/BGTVT-VT to the Prime Minister to report and propose the regulation of automobiles (with electric or fuel engine) [9, 10]. The Transport Ministry has proposed that the Public Security Ministry

oversee the registration of all electric cars, raising the fact that they currently do not come under any control.



### *Nissan Leaf electric car and electric car tour use in Vietnam's market*

In fact, personal electric cars are proving popular in Ho Chi Minh City since 2010 even though the authorities have yet to allow them to be registered for use due to concerns about safety and suitability to traffic conditions and drivers have been told to get off the road. The cars are imported from China. Be assured, their maximum speed is only 30 km per hour. The three-wheeled vehicles cost VND 45 million (USD 2,100) to VND 55 million each. The most expensive are capable of running for 100 km on a single charge, while the cheapest model has a range of 40 km. Recently there were two new electric car models imported from Europe. The Nissan Leaf electric car, capable of running 160 km after each full charge, is fit for everyday transport needs. Field test in Vietnam, with 220 V Leaf power source and 6.6 kW charging pack equipped, showed that users have to wait for 3 hours 15 minutes to charge the batteries completely before departing. Another model, the high-end sedan Tesla model runs entirely on electricity, with mileage rating of over 400 km per charge on optimal road conditions.

Hanoi, which was the country's first city to pilot electric cars in its Old Quarter in Hoan Kiem District and around West Lake, has seen the service enthusiastically embraced among locals and tourists since its launch on July 2010, in celebration of Hanoi's 1000<sup>th</sup> birthday. It was an effort by city's officials to recall nostalgia in Hanoi, as it may be surprising for some that there was time when Hanoi only had electric trains and bicycles. While enjoying the city tour, tourists will also have a chance to listen to many beautiful old songs about Hanoi played on the car's speaker. There too will be explanation as for the history of each street the car is going through, but unfortunately, it is in Vietnamese. An electric car service was expected to launch in Ha Long City, home to the UNESCO-recognized Ha Long Bay to diversify its tourism products in June 2015. These environmentally-friendly, Japanese-made cars are capable of transporting from 09 to 12 passengers each, with their technical and environmental conditions having been fully inspected by competent agencies. In July 2015, Ho Chi Minh City People's Committee set out the pilot scheme on using electric cars to serve tourists in the vicinity of the city center (930 hectares), the local Department of Transport announced in early January. The cars will carry visitors to the city's noted tourist attractions in the downtown area, including Ben Thanh Market, the Municipal Theater, the People's Court Mansion, Saigon Notre-Dame Cathedral, Saigon Central Post Office, Reunification Palace, and the Saigon Zoo and Botanical Gardens. An electric car tourism service will be launched on a pilot basis in the northern city of Hai Phong during the upcoming Tet. Tet begins on February 19 this year, with festivities lingering for around one week after that. The service is expected to inaugurate on February 16, 2015. There were 30 four-wheelers electric cars deployed for the service in its initial stage. The cars carry visitors to the city's major tourist attractions, including the downtown area, Do Son and Cat Ba tourism complexes, beaches, pagodas, and temples. the environmentally-friendly cars



are capable of transporting from eight to 14 passengers each time and their speed is expected to be around 25-30km per hour [11]. The model of electric cars tourism service has been adopted in other places in Vietnam, namely Sam Son Town in northern Thanh Hoa Province, Dong Hoi in central Quang Binh Province, in central Hue city, and Cua Lo Town in central Nghe An Province.

### **Current situation of Vietnam in the electric car industry**

NAMAs, Nationally Appropriate Mitigation Actions are policies, programmers and projects that developing countries undertake to contribute to the global effort to reduce greenhouse gas emissions. In order to reduce GHG emissions from transport sector, through the project namely “*production and application of hybrid and electric cars in Vietnam*”, towards the target of the Vietnam Government that 6 million environmentally-friendly vehicles will be in operation by 2020. the project will be done by two different phases [12].

- Phase 1 (2013-2016): Application of hybrid cars, this phase dedicates a pilot application for 15,000-20,000 Mai Linh taxi cars
- Phase 2: Application of electric cars, while 10,000 electric cars with the aim of producing and commissioning year 2016, 2017 for 20,000 electric cars, 2018 for 20,000 electric cars, 2019 for 20,000 electric cars and by the end of year 2020 is for 30,000 electric cars.

As Vietnamese traffic and environment are being heavily affected by millions of motorbikes and cars, electric transportation is planned in large cities and/or tourism cities, thus raising the demand for charging infrastructure. However, the electric transportation is currently under direct control of the Ministry of Transportation. The development of electric cars market largely depends on the policy of the government.

## **IV. CONCLUSION**

A few recent years, electric bikes and electric motorbikes have become popular in Vietnam and are praised by businesses and consumers thanks to their benefits, proceeding to replace effectively the conventional motorcycles. However, there are still many obstacles, such as tax policies and technical knowledge that are slowing down the adoption of these means, despite the facts that they offer numerous advantages and that they have appeared in the Vietnamese market for a few years and have gained the interest of consumers. In addition, after a short time of entering circulation, electric vehicles have raised some issues on traffic safety, quality control and infrastructure. The growth of electric vehicle market is remarkable as sales of e-bikes, e-motorbikes, e-cars in cities and provinces are increasing progressively, without mentioning the number of illegally imported EVs which is difficult to monitor. Besides, technically the future of EV relies on its battery technology and charging infrastructure. Minimizing the use of lead-acid battery, encouraging the use of lithium-ion battery, building public infrastructures for EV's services in association with effective measures to manage effectively the quality of EV should be implemented. The supportive policies for EVs industry and for innovative research are also a very important role to promote the development of EV in Vietnam.

Data relevant to electric vehicle use, its consumers and producers in Vietnam is still very limited. Another comprehensive research should be implemented in Vietnam market for further study in this field in order to fully understand the impact of EVs use on environment as well as the important characteristics of EV consumer and producer and factors influencing on EV user's choice. The experience on EV management and relevant policies from other countries should be used and adopted for the successful application in Vietnam in the future. In the same time, it is necessary to evaluate the impact of electric vehicles (as a new kind of load) on electric distribution grid in Vietnam.

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