BRIEFING

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Electric two-wheeler market growth in Vietnam: An overview

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INTRODUCTION AND BACKGROUND

Vietnam aims to reduce its GHG emissions and air pollution. In September 2020, the country submitted its updated NDC (Nationally Determined Contribution) policy to the United Nations Framework Convention on Climate Change (UNFCCC) with a goal of reducing GHG emissions by 9% (using domestic resources only) and 27% (with international support) by 2030, compared to 2014.[1] During COP26, Vietnam also committed to reaching the net-zero emission target by 2050. To achieve these goals, actions from the transport sector are urgently needed. The government has set as a goal, by 2040, to end the production, assembly, and import of cars, motorcycles, and mopeds powered by fossil fuels and intended for domestic use. Furthermore, by 2050 all motorized road vehicles are to be powered by electric and green energy.[2]

In Vietnam, two-wheelers (motorcycles and mopeds)[3] are the most common transport mode. In 2020, according to Vietnam Register (VR) there were 65.2 million two-wheelers (2Ws) on the road in the country, for a 2W ownership rate of 670 vehicles per 1,000 population. In term of new sales, Vietnam's two-wheeler market ranks second in the Asian region (after Indonesia) and fourth in the world behind India, China, and

1 The previous NDC target would have reduced GHG emissions by 8% (domestic resources only), and by 25% (with international support) by 2030 compared to 2010.

2 The Prime Minister, Decision No. 876/QD-TTg date July 22, 2022: Decision on approving the action program for transition to green energy and mitigation of carbon emissions and methane emission from transportation, https://vanban.chinhphu.vn/?pageid=27160&docid=206188

3 Motorcycles are vehicles with two wheels, engine displacement of 50 cm3 or greater, and a maximum speed of more than 50 km/h. Mopeds are vehicles with two wheels whose maximum speed does not exceed 50 km/h and whose engine displacement is not more than 50 cm3 for the internal combustion engine (ICE) and whose motor power, in the case of electric models, is not more than 4 kW.

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Indonesia.[4] Due to the COVID pandemic, in 2020, total sales of two-wheelers fell to 2.93 million units, the first time sales have dipped below 3 million in the last decade. In 2021, the Vietnam two-wheeler (2W) market continued to drop, to 2.8 million units, the lowest level in 15 years.[5]

Although the 2W market contracted sharply, sales of electric two-wheelers (E2W) increased significantly, rising from 5.4% of the 2W market in 2019[6] to 8.5% in 2020, and reaching 10% in 2021.[7] Vietnam leads the ASEAN region in electrification of 2Ws, and is second in the world, behind China.[8] Honda and Yamaha dominate the 2W market in the country, offering only internal combustion engine (ICE) two-wheelers. In 2020, Honda's share of the 2W market was 71.8%, followed by Yamaha's 15.8%. Other manufacturers share the remaining 12.4% of the 2W market. The E2W market is led by local companies VinFast and Pega, with market shares of 43.4% and 15.7%, respectively, in 2020.

Because 2Ws are the main transport mode in Vietnam, electrifying the 2W fleet is a promising approach to reducing GHG emissions and air pollution in the country. In this paper, we take a close look at the readiness of and potential for mass E2W deployment in the country. The analysis is from the perspective of manufacturers, who are the chief drivers of incentive policies for E2W manufacturing in the country. This briefing aims first to provide an overview of 2W market sales in Vietnam. We then analyze major ICE 2W and E2W manufacturers in the country to identify their manufacturing capacities and plans, especially for producing electric models. The status of charging infrastructure, the E2W industry and its supply chains, and the policy context related to E2W development are also reviewed. Finally, recommendations to promote the development of E2Ws are provided.

OVERVIEW OF TWO-WHEELER MARKET SALES

OVERVIEW

Annual sales of two-wheelers from 2016 to 2021 are shown in Figure 1. The data relating to 2W market sales in this paper were collected from different sources, but mainly from: MotorcycleData (https://www.motorcyclesdata.com/); Vietnam Register (http://www.vr.org.vn/), and manufacturers' websites (e.g., www.honda.com.vn/).

Sales of two-wheelers increased continuously from 2016 to 2017, reached a peak in 2018 at nearly 3.6 million vehicles, and began to fall in 2019. Due to the COVID-19 pandemic, 2W sales in the country decreased significantly in 2020 and 2021. In 2021, 2.8 million 2Ws were sold, the lowest volume in 15 years. Before the pandemic, 2W sales in the country had already experienced a reduction (falling by 4% between 2018 and 2019). By contrast, sales of passenger cars[9] trended in the opposite direction, increasing by 20% between 2018 and 2019), having been less affected by the pandemic than the 2W market. In addition, Vietnam has one of the highest motorcycle ownership rates in the world. In 2020, there were more than 65.2 million registered motorcycles and mopeds in the country. The ownership rate for 2Ws was approximately 670

4 Dat Nguyen, "Vietnam's motorbike sales second highest in ASEAN", VNexpress, February 26,2020, https://e.vnexpress.net/news/business/data-speaks/vietnam-s-motorbike-sales-second-highest-in-asean-4059655.html.

5 MCD Team, "Vietnam 2022. Motorcycles market recovers (+5.0%) in first half", motorcyclesdata, July 20,2022, https://www.motorcyclesdata.com/2022/01/25/vietnam-motorcycles/.

6 Huong Le, Zifei Yang, *Market analysis of two- and three-wheeler vehicles in key ASEAN member states* (ICCT: Washington, DC, 2022), https://www.motorcyclesdata.com/2022/01/25/vietnam-motorcycles/ .

7 MCD Team, "Vietnam 2022. Motorcycles market recovers (+5.0%) in first half", motorcyclesdata, July 20,2022, https://www.motorcyclesdata.com/2022/01/25/vietnam-motorcycles/.

8 Huong Le, Zifei Yang, *Market analysis of two- and three-wheeler vehicles in key ASEAN member states* (ICCT: Washington, DC, 2022), https://www.motorcyclesdata.com/2022/01/25/vietnam-motorcycles/.

9 The sales data of passenger cars were collected from annual sale reports of the Vietnam Automobile Manufacturer's Association (VAMA). Major car manufacturers in Vietnam are VAMA members (including Ford, Toyota, Honda, Nissan, Thaco, and VinFast), www.vama.org.vn.

vehicles per 1,000 inhabitants[10] (meaning that on average, for every three persons in Vietnam, two owned two-wheelers). This ratio suggests that the 2W market in Vietnam is approaching the point of saturation.

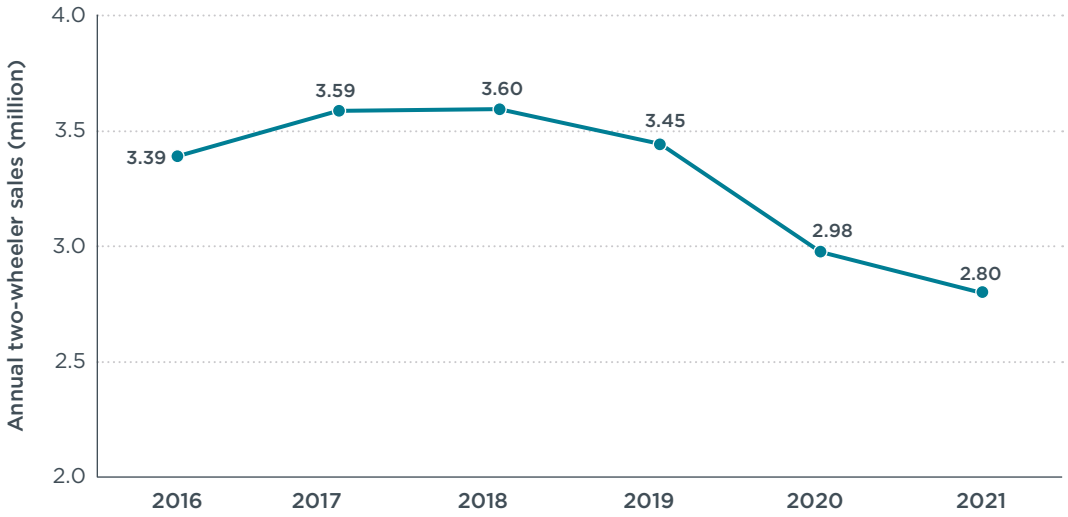

Figure 1. Annual sales of two-wheelers in Vietnam, 2016-2021

In 2020, over 250 2W models from more than 30 brands were offered for sale in Vietnam. The 2W market share of the top 10 manufacturers that accounted for 98.6% of the 2020 2W fleet is presented in Figure 2. Japanese manufacturers, especially Honda and Yamaha, have dominated the 2W market in the country. A full 87.6% of 2Ws sold in the country in 2020 were from these two brands. Among the top 10 manufacturers, four offered only internal combustion (ICE) 2Ws, including Honda, Yamaha, Suzuki, and Piaggio. SYM offered both ICE 2Ws and E2Ws, but focused mainly on ICE 2Ws. All these manufacturers have production facilities in the country. The other four manufacturers, including VinFast, Pega, Yadea, and Anbico offered E2Ws exclusively. Dibao offers both E2Ws and ICE 2Ws, but mainly focuses on e-mopeds and ICE mopeds.

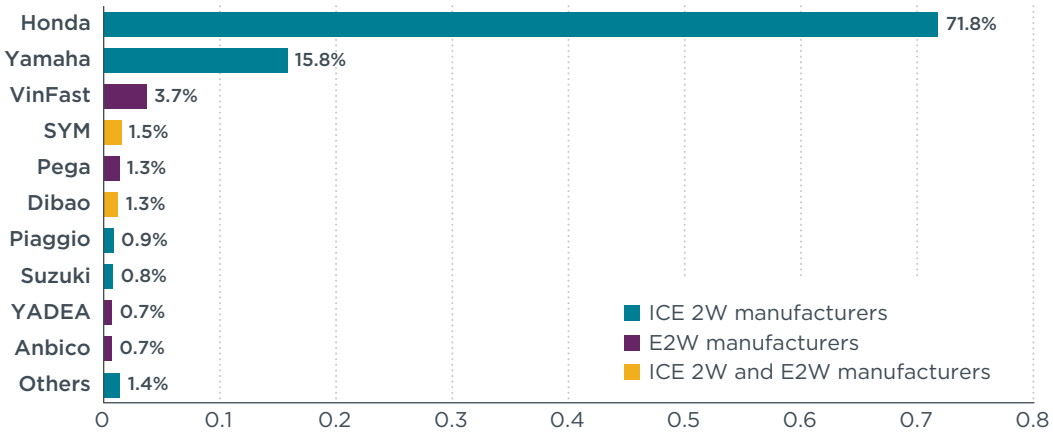

Figure 2. Market share of 2W fleet by manufacturer, 2020

VIETNAM'S E2W MARKET

E2W sales have increased significantly in recent years, from 163,428 vehicles in 2019 to nearly 237,000 vehicles in 2020 (an increase of 45%). Vietnam's 2020 E2W market was

10 Vietnam Register, http://www.vr.org.vn/.

dominated by local brands. Figure 3 depicts E2W market share by manufacturers in 2020. Ten manufacturers sold E2Ws in Vietnam, of which five were Vietnamese firms, including VinFast, Pega, Anbico, DK Bike, and Detech. These accounted for 69.6% of E2Ws sold in the country in 2020. VinFast, a local manufacturer established in 2017, had the largest E2W market share, at 43.4%, followed by Pega, with a share of 15.7%.

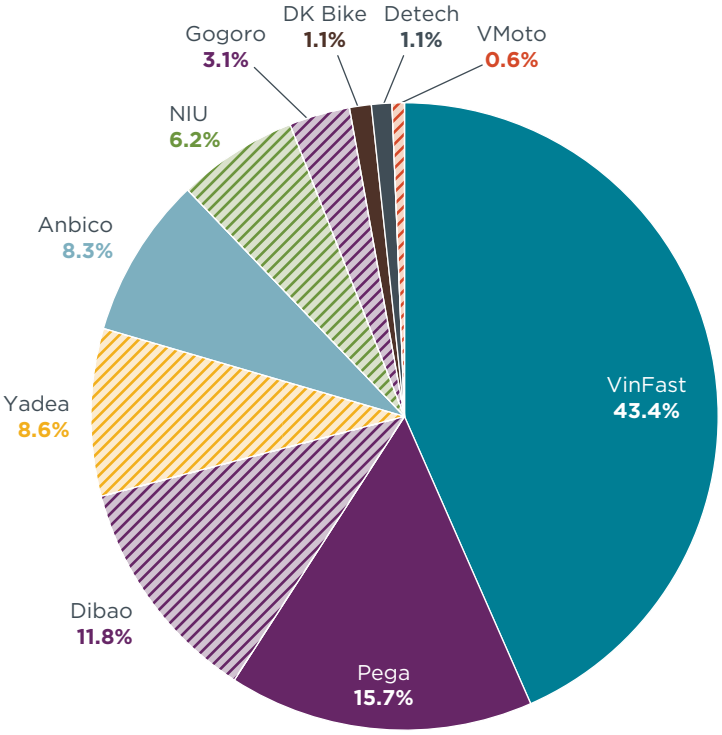

Figure 3. E2W market share by manufacturers in 2020

Note: The solid fill represents local manufacturers; the patterned fill represents foreign manufacturers.

In general, the 2W market in Vietnam is still dominated by ICE 2Ws from Honda and Yamaha. However, the market share of these big players has declined steadily. In 2021, sales of 2Ws by Honda and Yamaha fell by 6.8% and 9.7% compared to 2020, while E2W manufacturers as a whole gained market share in the last two years.[11] The market share of E2Ws in the country has increased rapidly, accounting for 10% of the country's 2W market in 2021 compared to 8.5% in 2019 and 2.9% in 2018; this trend may represent a threat to ICE 2W manufacturers who do not diversify or transition to E2Ws.

As electrification of the transport sector proceeds, ICE 2W manufacturers need to invest in manufacturing and to offer E2Ws for sale in Vietnam to maintain their market presence. Detailed analysis of Vietnam's 2W fleet (including E2Ws) segmented by vehicle type and key manufacturer can be found in the paper "Two-wheelers in Vietnam: A baseline analysis of fleet characteristics and fuel consumption in 2019 and 2020."[12]

POSITION OF VIETNAM'S 2W MARKET IN THE ASEAN REGION

In the ASEAN region, Vietnam's 2W market ranks second, after Indonesia. In 2021, total 2W sales were 5.17 million in Indonesia,[13] compared to 2.8 million in Vietnam.

11 MCD Team, "Vietnam 2022. Motorcycles market recovers (+5.0%) in first half", motorcyclesdata, July 20,2022, https://www.motorcyclesdata.com/2022/01/25/vietnam-motorcycles/.

12 Dinh-Son Tran, Huong Le, Zifei Yang, *Two-wheelers in Vietnam: A baseline analysis of fleet characteristics and fuel consumption in 2019 and 2020* (ICCT: Washington, DC, 2022), https://theicct.org/publication/2w-lvs-vietnam-asia-baseline-feb22/.

13 MCD team, "Indonesia 2022. Two-Wheeler Market Struggles in First Quarter (-1.8%)," motorcycledata, Apr. 18, 2022, https://www.motorcyclesdata.com/2022/04/18/indonesia-motorcycles/.

As in Vietnam, the 2W market in other ASEAN countries is also dominated by ICE two-wheelers manufactured by Japanese brands, the leading players being Honda and Yamaha. Indonesia, Vietnam, Thailand, and the Philippines are the four largest 2W markets in the region, accounting for more than 90% of the ASEAN 2W market. In 2020, 85.6% of 2Ws sold in these four countries belonged to Honda and Yamaha. The 2W market in these countries, excluding Vietnam, recovered in 2021.[14]

Vietnam is the largest E2W market in the ASEAN region and the second largest E2W market worldwide, after China.[15] The E2W share of the 2W market has increased significantly in recent years in the region. However, the absolute increase in sales in the Vietnamese market towers over the increase in other countries where this technology is still very marginal. Figure 4 shows the increase in E2W market share between 2019 and 2020 of four major markets in the region. The market share of E2Ws in Indonesia, Thailand, and the Philippines is relatively small, with less than 1.5% of all 2Ws sold in these countries. Vietnam has the largest share of E2Ws among these countries, and it grew substantially, from 5.14% in 2019 to 8.54% in 2020 and 10% in 2021.

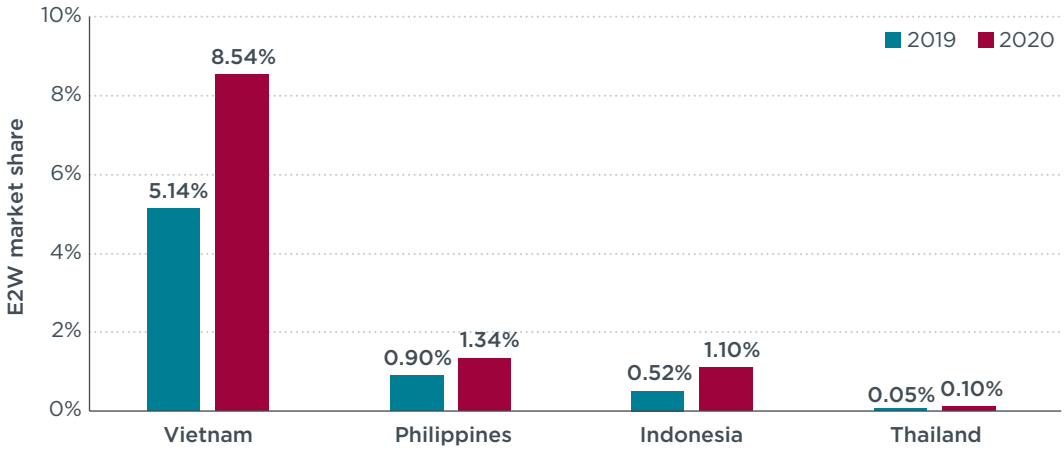

Figure 4. E2W market share in key ASEAN countries, 2019 and 2020[16]

To address climate change and air pollution, several ASEAN countries are taking action to promote electromobility, including advancing the use of E2Ws. Thus, the demand for E2Ws in the region is predicted to increase significantly in the coming years. Meanwhile, Vietnam's local E2W production capacity has already exceeded 1 million units per year. With strong support from the government, Vietnam has the potential to become the E2W market leader (both in demand and supply) in the ASEAN region, as well as worldwide. The next section explores the existing and potential production capacity of 2Ws with particular focus on E2Ws in the country.

MAJOR TWO-WHEELER MANUFACTURERS

MAJOR ICE TWO-WHEELER MANUFACTURERS

Vietnam's five largest ICE two-wheeler manufacturers are Honda, Yamaha Motor, SYM, Suzuki, and Piaggio. They are members of the Vietnam Association of Motorcycle Manufacturers (VAMM)[17] and all have manufacturing factories in Vietnam.

14 MCD team, "ASEAN 2021. Two-wheeler industry recovery is slow and still 2.5 million below pre-covid level," motorcyclesdata, Feb. 19, 2022, https://www.motorcyclesdata.com/2022/02/19/asean-motorcycles-industry/.

15 https://www.motorcyclesdata.com/2022/04/13/vietnam-motorcycles/.

16 Huong Le, Zifei Yang, *Market analysis of two- and three-wheeler vehicles in key ASEAN member states* (ICCT: Washington, DC, 2022), https://www.motorcyclesdata.com/2022/01/25/vietnam-motorcycles/.

17 VAMM was established in 2013 with five members—Honda, Yamaha, SYM, Suzuki, and Piaggio—under Decision No. 996/QĐ-BNV, signed by the Minister of Home Affairs on August 20th, 2013.

In 2020, 90.8% of the two-wheelers sold in the country were made by these manufacturers. VAMM aims to connect motorcycle manufacturers and the national government to contribute policy-making ideas relevant to the motorcycle industry and supporting industries.[18] Other brands that have manufacturing plants in the country but are not VAMM members are Kymco (a Japanese brand) and Sufat (a Vietnamese brand). Several brands that distribute only imported 2W models are BMW, Triumph, Brixton, Ducati, and Kawasaki. The market share of non-VAMM brands and importers is very limited (<1% each). Therefore, in this paper, we focus only on five major brands covering more than 90% of the Vietnamese 2W market, which happen to be VAMM's members.

Five of the seven 2W manufacturing factories belonging to the five major ICE 2W manufacturers in Vietnam are clustered in the North: three in Hanoi, two in Vinh Phuc province, and one in Ha Nam province. Two factories are in Dong Nai province, in the southern part of the country. Thus, the strong supply chain network for 2Ws in the north of Vietnam could be beneficial for establishing new 2W factories in the region.

Table 1 gives an overview of the production capacity of these five major ICE 2W manufacturers. Their total production capacity is nearly 5 million vehicles annually. Honda has the largest capacity, with three factories and an annual production capacity of 2.5 million vehicles. Next is Yamaha, with 1.5 million vehicles per year.

Table 1. Production capacity of key ICE two-wheeler manufacturers

Manufacturers (OEMs)	Market share in 2020	Year established	Local production capacity (vehicles/year)	Country of origin	Number of factories
Honda[19]	71.8%	1996	2,500,000	Japan	3
Yamaha Motor[20]	15.8%	1998	1,500,000	Japan	2
SYM[21]	1.5%	1992	540,000	Taiwan	2
Suzuki[22]	0.8%	1995	100,000	Japan	1
Piaggio[23]	0.9%	2007	300,000	Italy	1
Total	**90.8%**		**4,940,000**		

(OEM - Original Equipment Manufacturer)

Table 2 presents the production volume and domestic sales of these five major ICE two-wheeler manufacturers from 2018 to 2021. In general, these manufacturers' collective total annual production volume (3.0-3.4 million/year) is significantly lower than their collective production capacity (approximately 5 million/year). In 2021, the production volume of these manufacturers was 2.98 million vehicles, 40% lower than its production capacity. The domestic sales of 2Ws by these manufacturers in 2021 was approximately 2.5 million vehicles (8.1% lower than in 2020).[24]

18 "Thư ngỏ", VAMM, accessed July 20, 2022, https://vamm.vn/thu-ngo/ (In Vietnamese).

19 "Giới thiệu Honda Vietnam," Honda Vietnam, accessed July 20, 2022, https://www.honda.com.vn/gioi-thieu/gioi-thieu-honda-viet-nam (in Vietnamese).

20 "Doanh nghiệp xe máy FDI chạy đua tăng quy mô," Người lao động, August 31, 2008, https://nld.com.vn/kinh-te/doanh-nghiep-xe-may-fdi-chay-dua-tang-qui-mo-237536.htm (In Vietnamese).

21 "SYM Việt Nam: Thương hiệu xe máy thành công," Tạp chí tài chính, May 9, 2013, https://tapchitaichinh.vn/thuong-hieu-viet/sym-viet-nam-thuong-hieu-xe-may-thanh-cong-55910.html (In Vietnamese).

22 "Suzuki xây nhà máy mới tại KCN Long Bình," Tuổi trẻ, July 21, 2004, https://tuoitre.vn/suzuki-xay-nha-may-moi-tai-kcn-long-binh-42345.htm (in Vietnamese).

23 "Piaggio tăng gấp đôi công suất tại Việt Nam," VnEconomy, April 7, 2011, https://vneconomy.vn/piaggio-tang-gap-doi-cong-suat-tai-viet-nam.htm (In Vietnamese).

24 "Báo cáo bán hàng," VAMM, accessed July 25, 2022, https://vamm.vn/bao-cao-ban-hang (in Vietnamese).

Table 2. Production volume and domestic sales of VAMM members, 2018 to 2021

	2018	2019	2020	2021
Production	3,077,936	3,431,270	2,869,791	2,981,332
Domestic sales	3,386,098	3,254,964	2,712,615	2,492,372

Note: Production and domestic sales were collected from FAMI.[25]

As the domestic market for 2Ws shrinks, manufacturers are turning toward export markets. Since 2019, the production volume was higher than domestic sales, and 2021 experienced the largest difference, with 2W production 16.4% higher than domestic sales, reflecting the slowdown in local market growth in the country. To address this issue, several manufacturers have been focusing on exporting their 2Ws, stamped "made in Vietnam," to other countries. The advantages of a strong and well-established network of local suppliers, low labor costs, and political stability lead these manufacturers to continue investing in manufacturing 2Ws in the country, with an eye on exporting. The important export markets for the 2W industry in Vietnam are other ASEAN nations (Laos, Thailand, Cambodia, Malaysia, Philippines), Japan, and several European countries.

HONDA

Honda Vietnam is a joint venture among 3 partners—Japan Honda Motor Company (42%), Thailand Asian Honda Motor Company (28%) (Thailand), and Vietnam Engine and Agricultural Machinery Corporation (30%)—to manufacture 2Ws and automobiles. After more than 25 years in Vietnam, Honda is now the country's largest maker of 2Ws, and by October 2020 had produced 30 million units cumulatively over its tenure in the country.[26] In 2020, Honda offered more than 30 2W models, and 8 were among the top 10 best-selling models.

Table 3. Honda's 2W factories in Vietnam

Factory	Year opened	Capacity (vehicles/year)	Investment (million USD) (*)	Location
First factory	1998	500,000	> 290	Phuc Thang, Phuc Yen, Vinh Phuc
Second factory	2008	1,000,000	374	Phuc Thang, Phuc Yen, Vinh Phuc
Third factory	2014	1,000,000	120	Dong Van, Duy Tien, Ha Nam

(*) This was a single investment for each factory, spent at the time of establishing the factory.

In addition to developing a supplier network for 2W manufacturing in Vietnam, Honda also tries to increase the localization rate for its products by establishing various workshops producing 2W parts and components, which has created a firm foundation for local manufacturing and export expansion of the company.[27]

Table 4 presents Honda's annual 2W domestic sales, export volume, and total sales for the period 2018-2021. Similar to the 2W market in Vietnam, due to COVID pandemic impacts, the domestic sales of Honda 2Ws fell significantly in 2020 and 2021 compared to previous years. However, the number of exported 2Ws increased rapidly in 2021 to 213,492 vehicles, an increase of 31.9% compared to 2020. The domestic market still dominated Honda's 2W sales, accounting for more than 90% of Honda's annual 2W sales. However, Honda's domestic market share has decreased in recent years, while the small export market share has increased.

25 "Database," Fami, accessed August 1, 2022, https://fami-motorcycle.org/databases/.

26 "Honda reaches 30 million-unit cumulative motorcycle production milestone in Vietnam, "Global Honda, October 29,2020, https://global.honda/newsroom/news/2020/c201029aeng.html?from=r.

27 "Honda Vietnam to open piston workshop and welcome the 15 millionth motorcycle unit manufactured," Global Honda, March 21, 2014, https://global.honda/newsroom/news/2014/c140321beng.html.

Table 4. Honda's domestic sales and exports, total and as a share of the firm's production in Vietnam, 2018-2021

Year (1st January - 31st December)	Domestic sales (vehicles)	Export (vehicles)	Total sales (vehicles)
2018	2,568,668 (94.7%)	144,055 (5.3%)	2,712,723 (100%)
2019	2,573,373 (94%)	164,173 (6.0%)	2,737,546 (100%)
2020	2,142,564 (92.8%)	165,096 (7.2%)	2,307,660 (100%)
2021	1,992,365 (90.3%)	213,492 (9.7%)	2,205,857 (100%)

Source: Annual sales reports, Honda

HONDA E2W DEVELOPMENT IN VIETNAM

Globally, Honda has set out to become carbon neutral by 2050, measured across all products and corporate activities, and it is working to reach this goal.[28] Electrification of motorcycles is one of Honda's strategies for achieving this goal. The first Honda E2W model was put on the market in 1994, and in 2018, Honda introduced its PCX electric motorcycle in Japan and several ASEAN countries (e.g., Indonesia: 1,353 vehicles in 2020; Philippines: 228 vehicles in 2020; and Thailand: 19 vehicles in 2020), but not in Vietnam. Details on the classification of two-wheelers in Vietnam can be found in the report "Using policy and regulation to pave the way for two-wheeler electrification in Vietnam."[29] In 2020, Honda introduced three electric models for business use (for goods delivery), including the BENLY e, an E2W; GYRO e, an E3W; and GYRO CANOPY e, an E3W.[30] Although Honda has not offered its E2Ws in Vietnam, it has taken several actions to investigate the potential deployment of E2Ws in Vietnam, including:

- Cooperating with the National Traffic Safety Committees and the University of Transport Technology to conduct a research project, "Mainstreaming Electric Mobility in Vietnam." Honda has provided 180 PCX electric two-wheelers for this research in the form of lending to evaluate the performance of E2Ws in Vietnamese traffic conditions. The project was implemented in three years, from 2019 to 2022.[31]
- Cooperating with the Vietnam Post Corporation to implement the pilot project on deploying the use of electric vehicles for delivery services using the battery swapping model. For this project, from January 2022, Vietnam Post has rented a total of 70 BENLY e: models to deliver mail and goods in Hanoi; the drivers can actively change the batteries to ensure continuous travel.[32]
- Implementing the PCX E2W rental service at several Honda exclusive authorized dealers and stores (HEAD) in different cities across the country to collect customer feedback on using E2Ws.[33]

28 "Efforts to promote the use of electric motorcycles," Global Honda, accessed August 12, 2022, https://global.honda/innovation/technology/motorcycle/ecology/MPP.html.

29 Huong Le, Zifei Yang, *Using policy and regulation to pave the way for two-wheeler electrification in Vietnam* (ICCT: Washington, DC, 2022), https://theicct.org/publication/vietnam-asia-e2ws-lvs-mar22/.

30 "Efforts to promote the use of electric motorcycles," Global Honda, accessed August 12, 2022, https://global.honda/innovation/technology/motorcycle/ecology/MPP.html.

31 "Honda Việt Nam tài trợ 180 xe máy điện PCX electric phục vụ nghiên cứu," VOV, March 28,2019, https://vov.vn/oto-xe-may/xe-may/honda-viet-nam-tai-tro-180-xe-may-dien-pcx-electric-phuc-vu-nghien-cuu-891584.vov (in Vietnamese).

32 "Honda Việt Nam phối hợp với bưu điện Việt Nam triển khai thí điểm dự án sử dụng xe điện giao hàng," Honda, December 29, 2021, https://www.honda.com.vn/tin-tuc/xe-may/honda-viet-nam-phoi-hop-voi-buu-dien-viet-nam-trien-khai-thi-diem-du-an-su-dung-xe-dien-giao-hang (in Vietnamese).

33 "Honda Việt Nam phối hợp với bưu điện Việt Nam triển khai thí điểm dự án sử dụng xe điện giao hàng," Honda, December 29, 2021, https://www.honda.com.vn/tin-tuc/xe-may/honda-viet-nam-phoi-hop-voi-buu-dien-viet-nam-trien-khai-thi-diem-du-an-su-dung-xe-dien-giao-hang (in Vietnamese).

YAMAHA MOTOR

Yamaha (Yamaha Motor) Vietnam established its first factory in 1998 and a second one in 2008; both are located in Hanoi. The total production capacity of these two factories is 1.5 million vehicles per year. Yamaha is offering more than 20 2W models in Vietnam; two of these were among the top 10 best-selling models in 2020 (Sirius (R/RC/RL, and Exciter).

Globally, Yamaha Motor aims to achieve carbon neutrality by 2050 based on its environmental plan 2050.[34] Electrification of its motorcycle fleet is one of its approaches to achieve this goal. By 2030, 2.6% of Yamaha's 2Ws are expected to be E2Ws, increasing to 20% by 2035, and to 90% by 2050. In 2019, Yamaha Motor introduced two E2W concepts (the E01 and E02 scooters), but these are not yet in production. Regarding E2W development, Yamaha Motor first focuses on Europe, whose share of renewable energy in the generation of electricity is high. It will move into the ASEAN region between 2030 and 2035. Therefore, in Vietnam, Yamaha is still focusing only on ICE two-wheelers and has no implementation plan for E2W sales.

Although Yamaha has not focused on selling its E2Ws in Vietnam, the company is using Vietnam as a production base to produce E2Ws for the European and other markets. In March 2022, Yamaha officially inaugurated the assembly and production line of NEO's electric scooter model at the Yamaha Vietnam factory in Noi Bai, Ha Noi, Vietnam. Yamaha Vietnam is the first company in the ASEAN region to produce E2Ws for the European market. In the first phase, the factory used only one line, with a capacity of 50 vehicles per day, but the line may expand in the future, depending on market demand.[35]

Table 5. Yamaha's 2W production factories[36]

Factory	Year opened	Production capacity (vehicles/year)	Investment (million USD)	Location
First factory	1998	700,000	n/a	Trung Gia, Soc Son, Ha Noi
Second factory	2008	800,000	43	Noi Bai Industrial Zone, Ha Noi

SYM, SUZUKI, AND PIAGGIO

SYM, Suzuki, and Piaggio are among the top five ICE-two-wheeler brands in Vietnam, but their market share is relatively small—only 3.2% of 2Ws sold in the country in 2020. SYM is the third largest ICE two-wheeler brand in Vietnam; it has two factories with a production capacity of 540,000 vehicles per year. SYM is the only brand that sells both ICE two-wheelers and E2Ws in the country. Z1 is an e-moped model offered by SYM with an engine power of 800 W.

Suzuki was established in 1995; the annual production capacity of its plant is 100,000 vehicles per year and the production volume has been approximately 60,000 vehicles per year. Suzuki was also listed among the top 5 2W manufacturers in the Philippines, accounting for 8% of the Philippines' 2W market in 2020. Until now, Suzuki has focused mainly on producing and selling ICE 2Ws in Vietnam, and plans for deploying E2Ws are not available.

Compared to other brands, Piaggio entered the 2W market in Vietnam later. It has a production capacity of 300,000 vehicles annually. Although Piaggio is among the

34 "Overview of 'Yamaha Motor group environmental plan 2050'," Global Yamaha, accessed August 1, 2022, https://global.yamaha-motor.com/about/csr/the_environment/plan-2050/.

35 "Bị Honda bỏ xa, Yamaha Việt Nam xoay hướng sang xe điện, cạnh tranh VinFast," Tuổi Trẻ, March 19, 2022, https://tuoitre.vn/bi-honda-bo-xa-yamaha-viet-nam-xoay-huong-sang-xe-dien-canh-tranh-vinfast-20220318112908629.htm (in Vietnamese).

36 "Doanh nghiệp xe máy FDI chạy đua tăng quy mô," Người Lao Động, August 31, 2008, https://nld.com.vn/kinh-te/doanh-nghiep-xe-may-fdi-chay-dua-tang-qui-mo-237536.htm.

top 5 ICE 2W manufacturers in the country, its market share is small, only 0.9% in 2020. Piaggio ranked 3rd among 2W manufacturers in Thailand in 2020, with 1.9% of Thailand's 2W market. In 2018, Piaggio launched the Vespa Elettrica, an electric scooter, and in 2021, the group presented an innovative electric scooter, Piaggio 1, with removable batteries.[37] However, these Piaggio E2W models are not yet produced and offered in Vietnam.

Overall, even though Honda, Yamaha, SYM, Suzuki, and Piaggio own more than 90% of the 2W market in Vietnam, their investment in manufacturing and selling E2Ws is still limited.

3.2. MAJOR E2W MANUFACTURERS

Unlike the ICE 2W market, which is dominated by foreign brands, the E2W market in Vietnam is dominated by local manufacturers, whose share was approximately 70% in 2020. The major players in the E2W market are VinFast, Pega, Dibao, Anbico, Yadea, and NIU. Despite the COVID pandemic, the market share of these manufacturers increased in 2020 and 2021. This section focuses on the manufacturers that have manufacturing plants in Vietnam only: VinFast, Pega, Anbico, Yadea, Detech, DK bike, and Datbike (which together accounted for around 80% of the E2W market in 2020). Other manufacturers also offered E2Ws in the country, such as NIU and Gogoro (with less than 20% of the E2W market share in 2020). However, these brands do not have manufacturing plants in Vietnam, and therefore are not included in this section. Table 6 gives an overview of seven E2W manufacturers in Vietnam, six of which are Vietnamese brands. Yadea is the only foreign brand that has established manufacturing in the country.

Table 6. E2W manufacturers in Vietnam

Manufacturers (OEMs)	E2W market share in 2020	Year established	Production capacity (1,000 vehicles/year)	Country of origin	Factory location
VinFast	43.4%	2017	250 (*)	Vietnam	Dinh Vu, Hai Phong
Pega	15.7%	2012	480 (**)	Vietnam	Yen Dung, Bac Giang
Anbico	8.3%	2015	480 (**)	Vietnam	Vinh Yen, Vinh Phuc
Yadea	8.6%	2019	200	Hong Kong	Viet Yen, Bac Giang
DETECH	1.1%	1999	100 (***)	Vietnam	My Hao, Hung Yen
DK bike	1.1%	2009	450 (***)	Vietnam	Hoang Dong, Lang Son
Datbike	n/a	2019	n/a	Vietnam	Binh Duong
Total	**78.2%**		**>1,000,000**		

Note: (*) means expected to expand to 500,000 vehicles in the second phase, with capacity to produce a maximum of 1,000,000 vehicles; (**) includes electric bicycles; (***) includes electric bicycles and ICE two-wheelers

In total, the annual E2W production capacity of these brands could exceed 1 million units per year, which is significantly higher than the E2W domestic sales volume (around 280,000 E2Ws were sold in 2021). This opens opportunities for these E2W manufacturers to export their vehicles to other ASEAN countries and beyond. VinFast is the largest E2W manufacturer in the country, with a manufacturing capacity of 250,000 E2Ws annually and with the potential to expand to 1,000,000 vehicles annually.[38] Among these brands, VinFast, Yadea, and Datbike are producing E2Ws only (e-mopeds and e-motorcycles), Pega and Anbico produce both electric bicycles

37 "Profile," Piaggio group, accessed August 15, 2022, https://www.piaggiogroup.com/en/group/profile.

38 "Bên trong nhà máy sản xuất xe máy VinFast," Vnexpress, November 6, 2018, https://vnexpress.net/ben-trong-nha-may-san-xuat-xe-may-VinFast-3834786.html (in Vietnamese).

(e-bicycles) and E2Ws, and Detech and DK bike focus on e-bicycles, E2Ws, and ICE two-wheelers.

Six of these seven E2W manufacturing plants in Vietnam are clustered in the northern part of the country. This may benefit these E2W manufacturers since they can utilize the existing supply chains of ICE two-wheelers.

E2W MODELS BY MANUFACTURER

In total, 68 E2W models are offered by seven manufacturers, and the key features of these models are presented in Table 7. Anbico and Yadea has the highest number of E2W models with 17 each, followed by VinFast with 12 models. Other manufacturers have a smaller number of E2W modes. The majority of E2W models are e-mopeds (54 models); only 14 are e-motorcycles (8 models are from VinFast).

Regarding battery type, only 12 of the 68 models are equipped with the lithium-ion battery, of which 9 models are from VinFast, 2 are from Datbike, and 1 is from Yadea. Several of VinFast's E2W models are powered by LFP (lithium ferrous phosphate) batteries that is developed by VinFast (in collaboration with Gotion High Tech from China). Compared to traditional lithium-ion batteries, LFP batteries have greater battery capacity and durability; they can be charged/discharged more than 2,000 times (compared to 300-400 times for lead-acid and 1,000 times for lithium-ion battery) and still have up to 70% of battery capacity.[39] Fifteen models from Yadea are equipped with the graphene or graphene TTFAR battery, which is battery technology developed by Yadea. The graphene battery improves battery capacity and durability. The graphene TTFAR battery is an upgraded version of graphene battery from Yadea that offers longer cruising range and has an energy recycling system; E2Ws equipped with Graphene TTFAR can automatically recycle kinetic energy into electricity while kicking-starting, braking, and riding downhill.[40] The rest use unremovable lead-acid batteries. Prices of E2Ws equipped with lithium-ion batteries are much higher than those equipped with lead-acid batteries.[41] However, E2Ws powered by lithium-ion batteries have a longer lifespan, and are lighter, than E2Ws powered by lead-acid batteries, and their batteries are replaced less frequently.[42]

Most of the E2W models in Vietnam are lighter than 100 kg. Pega S (from Pega) is the heaviest, at 155 kg, while Espero 133I (from Detech) is the lightest, at 65 kg. E-mopeds tend to be lighter than ICE mopeds, but e-motorcycles are heavier than ICE motorcycles.[43] The maximum speed of most electric vehicle models ranges from 40 km/h to 50 km/h, with the fastest electric motorcycle (Theon S 200 from VinFast) registering a maximum speed of 99 km/h.

Regarding vehicle prices, the cheapest model, the Espero 133I from Detech, is 13.6 million VND (around 580 USD). The most expensive model, Theon S from VinFast, is 89.8 million VND (around 3,820 USD). Vehicle prices were collected from showrooms and manufacturer websites and usually include value-added tax. There are currently no subsidies or incentives to support E2W uptake in the country. Most manufacturers include batteries in their vehicle prices, except for VinFast. VinFast allows customers to

39 "Pin LFP là gì? Ưu điểm và ứng dụng của pin LFP trên xe điện mới nhất," VinFasauto, May 17, 2022, https://vinfastauto.com/vn_vi/pin-lfp-uu-diem-va-ung-dung (in Vietnamese).

40 "TTFAR", Yadea, accessed August 12, 2022, https://www.yadea.com/technology.

41 Dinh-Son Tran, Francisco Posada, *Total cost of ownership comparison: lead-acid battery, lithium-ion battery, and internal combustion engine two-wheelers in Vietnam*. (forthcoming)

42 Andrew Trevitt, "Motorcycle batteries: the difference between lead-acid and lithium-based batteries," Cycle World, November 2, 2016, https://www.cycleworld.com/sport-rider/motorcycle-battery-basics-lead-acid-or-lithium/.

43 Dinh-Son Tran, Huong Le, Zifei Yang, *Two-wheelers in Vietnam: A baseline analysis of fleet characteristics and fuel consumption in 2019 and 2020* (ICCT: Washington, DC, 2022), https://theicct.org/wp-content/uploads/2022/02/2w-vietnam-baseline-analysis-2019-and-2020.pdf.

choose to buy batteries or rent them with monthly subscriptions. The rental fees vary depending on the customer's choice of distance desired. Table 7 shows E2W models and the key features being offered in Vietnam.

Table 7. E2W models and their key features in Vietnam in 2022

OEM	Model name	Vehicle type	Battery type	Vehicle weight (incl. batteries) (kg)	Range (Km)	Maximum speed (km/h)	Price (million VND) (incl. battery, charging cable)
VinFast	LUDO	E-moped	Lithium-ion	68	75	35	21.50
	IMPES	E-moped	Lithium-ion	75	70	49	23.50
	Tempest	E-moped	Lead acid	103	80	49	19.25
	Feliz	E-motorcycle	Lead acid	126	90	60	24.90
	Feliz S	E-motorcycle	Lithium-ion (LFP)	110	198	78	49.80
	Klara A2	E-motorcycle	Lead acid	127	90	60	26.90
	KLARA S	E-moped	Lithium-ion	108	120	48	49.60
	KLARA S (2022)	E-motorcycle	Lithium-ion (LFP)	112	194	78	56.80
	Vento	E-motorcycle	Lithium-ion	117	110	80	> 56.35
	Vento S	E-motorcycle	Lithium-ion (LFP)	122	160	89	75.90
	Theon	E-motorcycle	Lithium-ion	146	101	90	81.10
	Theon S	E-motorcycle	Lithium-ion (LFP)	145	150	99	89.80
Pega	AuraS	E-moped	Lead acid	90	100	50	17.40
	Pega New Tech	E-motorcycle	Lead acid	123	140	60	21.70
	Pega S	E-motorcycle	Lead acid	155	120	65	35.00
	Pega Xmen	E-moped	Lead acid	90	100	50	17.80
Anbico	Valerio	E-moped	Lead acid	90	80	50	16.50
	Valeriox	E-moped	Lead acid	90	90	50	18.06
	Valerios	E-moped	Lead acid	93	90	50	18.24
	valerio SP	E-moped	Lead acid	93	100	50	15.90
	Valerio GS	E-moped	Lead acid	90	100	50	16.90
	Gogo SS	E-moped	Lead acid	90	100	50	n/a
	Gogo one	E-moped	Lead acid	90	100	50	15.59
	F88	E-moped	Lead acid	95	90	50	18.00
	Xmen boss	E-moped	Lead acid	95	85	50	14.90
	Xmen Tiger 2022	E-moped	Lead acid	95	85	50	n/a
	Xmenx	E-moped	Lead acid	95	80	45	16.30
	Xmans	E-moped	Lead acid	95	80	50	17.50
	Jeek	E-moped	Lead acid	100	80	50	18.50
	Jeek 2019	E-moped	Lead acid	100	85	50	17.99
	V5	E-moped	Lead acid	100	90	50	18.60
	Zoomerx	E-moped	Lead acid	95	80	50	14.50
	Zoe	E-moped	Lead acid	95	80	50	14.10

OEM	Model name	Vehicle type	Battery type	Vehicle weight (incl. batteries) (kg)	Range (Km)	Maximum speed (km/h)	Price (million VND) (incl. battery, charging cable)
Yadea	**Xmen Neo**	E-moped	Graphene	101	80	43	17.59
	Xmen	E-moped	Graphene	97	70	43	16.90
	Odora S1	E-moped	Lead acid	94	82	45	18.90
	Odora S1 TTFAR	E-moped	Graphene TTFAR	94	82	45	20.50
	Odora TTFAR	E-moped	Graphene TTFAR	96	101	43	18.99
	M61 TTFAR	E-moped	Graphene TTFAR	94	101	43	17.99
	S3	E-moped	Graphene	118	90	50	22.49
	Ulike	E-moped	Graphene	104	109	47	18.99
	Ulike A1	E-moped	Graphene TTFAR	96	95	42	17.90
	Ulike 2.0	E-moped	Graphene	111	90	50	20.99
	G5 Lite	E-moped	Graphene TTFAR	103	80	50	18.90
	G5	E-motorcycle	Lithium-ion	84	65	55	39.99
	Buye	E-moped	Graphene	113	90	50	21.99
	X5 Lite	E-moped	Graphene TTFAR	103	80	50	18.90
	X5	E-moped	Graphene	115	90	50	21.99
	E3	E-moped	Graphene	94	82	37	16.49
	X-Joy	E-moped	Graphene	78	90	40	14.49
Detech	**Xmen CPI**	E-moped	Lead acid	98	80	50	17.00
	Espero Ecrea	E-moped	Lead acid	94	80	50	n/a
	Espero Monster	E-moped	Lead acid	95	100	50	15.50
	Espero Monster II	E-moped	Lead acid	95	n/a	50	n/a
	Espero eVS	E-moped	Lead acid	96	95	50	n/a
	Espero EVS classic	E-motorcycle	Lead acid	96	95	55	n/a
	Espero Gogo	E-moped	Lead acid	95	90	50	16.40
	Espero 133I	E-moped	Lead acid	65	65	45	13.60
DK bike	**Roma Si**	E-moped	Lead acid	100	65	50	24.00
	Roma Lite	E-moped	Lead acid	91	65	43	n/a
	Roma SX	E-moped	Lead acid	97	65	50	17.99
	Gogo new 2022	E-moped	Lead acid	90	60	50	20.00
	GogoS	E-moped	Lead acid	90	60	50	18.00
	Xman X2	E-moped	Lead acid	100	60	50	17.99
	Xman One	E-moped	Lead acid	95	65	50	16.00
	Aima Jeek	E-moped	Lead acid	114	75	50	22.50
Datbike	**Weaver**	E-motorcycle	Lithium-ion	85	100	80	39.90
	Weaver 200	E-motorcycle	Lithium-ion	120	200	90	54.90

Note: (Data collected in September 2022)

E2W CHARGING INFRASTRUCTURE AND BATTERY SWAPPING SYSTEMS

One of the major factors discouraging Vietnamese consumers from buying E2Ws is concern over the range made possible by the batteries.[44] The E2W charging network and E2W battery swapping system are still limited in Vietnam and E2W users mainly charge their vehicles at home. Thus, to accelerate the E2W development in Vietnam, charging infrastructure and battery swapping system expansion play an essential role.

Among the seven E2W manufacturers presented in Table 6, VinFast is the leader in providing charging infrastructure and battery swapping services. In 2021, VinFast planned to implement 2,000 charging stations with more than 40,000 charging ports for both E2W and electric cars across the country. This is the largest project providing charging infrastructure for EVs in Vietnam.[45] The company plans to install 150,000 charging ports across the country in the coming years. These charging stations can be at commercial centers, gas stations, supermarkets, bus stations, public parking spaces, apartment buildings, offices, universities, etc. VinFast invites partners who provide the locations for charging stations to collaborate on the installation and operation of the stations. In such a collaboration, VinFast would be responsible for installing, maintaining, and repairing the charging infrastructure, and for taking care of customer services. Partners will be responsible for providing spaces and operating charging stations. In 2018, VinFast also collaborated with the state-run company PV Oil (the leading petroleum retailer in Vietnam) to install charging stations at PV Oil gas stations.[46] VinFast is also offering battery swapping services for E2W in different cities. Around 400 swapping points are located across the country.[47] Charging stations and swapping services are available only to VinFast E2Ws. Regarding other E2W manufacturers, they do not yet have any actions to implement charging infrastructure and battery swapping systems in Vietnam. The actions from the private sector on developing E2W charging infrastructure and battery swapping services are also very limited in the country.

At the global level, major ICE 2W manufacturers, including Honda, Yamaha, Piaggio, and KTM created the Swappable Batteries Motorcycle Consortium (SBMC) in September 2021.[48] This Consortium aims to develop the common technical specifications of swappable battery systems and expand the use of the consortium's specifications to the global level. In Vietnam, technical regulations and standards related to E2W charging infrastructures and battery swapping systems are still unavailable, which is one of the major factors hindering the development of charging infrastructure and battery swapping services and leading to low E2W uptake in the country.[49]

44 Le Tuan Anh, "Study on the criteria development of pilot city selection for e-mobility adoption in Vietnam," presented at NDC-TIA kick-off meeting 15 March 2021, Hanoi, Vietnam https://www.changing-transport.org/wp-content/uploads/3.-210312-NDC-TIA-kick-off-Vietnam_Le-Anh-Tuan_Consultant-team-leader.pdf.

45 "Quy hoạch trạm sạc VinFast," VinFast, accessed August 20, 2022, https://VinFastauto.com/vn_vi/tram-sac

46 Thu Trang," VinFast cùng PV Oil hợp tác triển khai trạm sạc điện và thuê pin," VinFast, October 25, 2018, https://VinFastauto.com/vn_vi/VinFast-va-pv-oil-trien-khai-tram-sac-dien-va-thue-pin (in Vietnamese).

47 "Quy hoạch trạm sạc", VinFast, accessed August 3, 2022, https://VinFastauto.com/vn_vi/he-thong-tram-sac-doi-pin (In Vietnamese)

48 "Swappable batteries motorcycle consortium agreement signed between Piaggio group, Honda Motor, KTM, and Yamaha Motor for motorcycles and light electric vehicles," Piaggio group , September 6, 2021, https://www.piaggiogroup.com/en/archive/press/swappable-batteries-motorcycle-consortium-agreement-signed-between-piaggio-group-honda.

49 Huong Le, Zifei Yang, *Using policy and regulation to pave the way for two-wheeler electrification in Vietnam* (ICCT: Washington, DC, 2022), https://theicct.org/publication/vietnam-asia-e2ws-lvs-mar22/.

E2W REGULATORY AND INDUSTRIAL LANDSCAPE

This section provides an overview of key regulations that govern domestic manufacturing, assembling, and importation of 2Ws in Vietnam. Major opportunities and challenges for developing the E2W industry in the country are highlighted.

KEY REGULATIONS FOR MANUFACTURING, ASSEMBLING, AND IMPORTING 2WS IN VIETNAM

As in most countries, manufacturing and assembling 2Ws in Vietnam requires type-approval steps. 2Ws manufacturing and assembling in Vietnam must receive the certificates of type approval before entering the market. The inspection of domestic manufactured and assembled 2Ws is regulated by Circular 45/2012/TT-BGTVT.[50] Before being released to the market, imported two-wheelers must be granted certificates of conformity from inspection of technical safety and environmental protection issued by the Vietnam Register (VR).

Imported vehicles have to pay import tax and customs fees. The import taxes vary greatly depending on the vehicle characteristics (e.g., engine displacement) and country of origin. Three import tax rates that may apply to imported two-wheelers are normal tax (usually more than 100%), preferential import tax (ranging from 40% to 75%), and special preferential import tax (0%). The preferential import tax applies to products originating from countries that have trade relations with Vietnam under the most-favored nation treatment policy. Special preferential import tax applies to products imported from countries that have trade relations in bilateral or multilateral agreements with Vietnam. For example, based on the Asian Trade in Goods Agreement (ATIGA), the import tax on two-wheelers produced from Asian countries has been 0% since 2018. However, preferential treatment for imported E2Ws and parts is unavailable. As a result, the price of imported E2Ws to Vietnam could be significantly higher than E2Ws that are domestically manufactured or assembled. This protects the growth of the local E2W industry, but also temporarily increases the cost of strategic components, such as advanced chemistry batteries, that are not locally manufactured.

DEVELOPMENT OF THE E2W INDUSTRY IN VIETNAM

The moped and motorcycle industry in Vietnam has produced ICEs for decades, with a high localization rate (based on vehicle value). Therefore, the country can effectively use its existing ICE two-wheeler supply chains together with the enterprises that can produce electric batteries and other parts for manufacturing and assembling E2Ws to support the development of the E2W supply chain. The most common components that still need to be imported for manufacturing E2Ws in Vietnam are batteries, controllers, and electric motors.[51] However, in recent years, several domestic companies have shown the capacity to produce these parts locally.

Regarding electric batteries for E2Ws, several companies have the potential to become major players in providing electric batteries for E2Ws, such as Dry Cell and Storage Battery Joint Stock company (Pinaco, in which the government holds 51% of the company capital) and 365 Creative Technology Joint Stock company (private funding). They are local enterprises and are currently focused on producing lead batteries. These companies have established their supply chains in battery production for many years. The growing E2W market together with appropriate support from the government could encourage these companies to invest in manufacturing batteries for E2Ws. Two

50 Circular No. 45/2012/TT-BGTVT: Circular on the inspection of the technical safety and environmental protection in manufacturing and assembling motorcycles and mopeds, https://thuvienphapluat.vn/van-ban/Thuong-mai/Circular-No-45-2012-TT-BGTVT-on-the-inspection-of-the-technical-quality-safety-152304.aspx.

51 Khiem V et al., "Mainstreaming Electric Mobility in Vietnam-Focusing on 2-wheelers," Public House of Transport, December 2020, ISBN: 978-604-76-2323-5.

other large foreign brands that also established battery production plants in Vietnam are GS battery Vietnam Co., Ltd (a Japanese brand) and Samsung SDI Co., Ltd. (a Korean brand). In addition, Vingroup started to build the VinES battery factory in Ha Tinh in December 2021. The factory is 8 hectares large in the first phase with a total investment of 4,000 billion VND. It aims to provide the lithium-ion batteries for electric vehicles (including passenger vehicles) of VinFast.[52]

Local production capacity is still very limited for other components (controllers, electric motors). In manufacturing and assembling E2Ws, electric motors and controllers are usually provided by the same vendors. Pega and VinFast rely on imported motors from Bosch, and other manufacturers rely on motors imported from China and Taiwan.[53]

Major ICE 2W manufacturers such as Honda and Yamaha could utilize their robust supply chains to produce E2Ws if they determine to make the transition. However, their actions in the deployment of E2Ws in Vietnam are still limited. High profits in the ICE 2W market and the lack of government support and regulations for promoting E2Ws could be two key reasons preventing these major ICE 2W manufacturers from investing in producing E2Ws. Despite falling sales in the ICE 2W market, major ICE 2W manufacturers control more than 90% of the market and still generate huge profits. In addition, government policies to restrict ICE 2Ws and promote E2Ws are not available, resulting in manufacturers not being keen to shift to E2W production. In general, the development direction of the 2W industry in Vietnam is largely driven by the market and there is no preferential treatment given to support the development of the E2W industry.

POLICY ENVIRONMENT TO PROMOTE THE ADOPTION OF E2WS IN VIETNAM

Policies that support E2W consumers and manufacturers are essential to accelerate E2W adoption and to stimulate the expansion of domestic E2W production in Vietnam. The national government shows signs of its intention to adopt cleaner transport modes, including electric vehicles. Several policies have been implemented to support EV development, such as reducing the special consumption tax and elimination of registration fees, but these apply only to electric cars. Policies supporting E2W uptake and production, and the development of charging infrastructure and battery swapping systems, do not exist.

POLICIES SUPPORTING E2W DEMAND

From the demand side, using and operating E2Ws is still subject to the same taxes and fees as ICE two-wheelers. High vehicle prices is a leading factor Vietnamese consumers cite for not buying E2Ws.[54] People believe that cheap E2Ws have a shorter lifespan than equivalent ICE 2Ws, and high-quality E2Ws require higher upfront costs. Therefore, policies that provide financial incentives for owning and operating E2Ws, such as vehicle purchase subsidies, tax exemptions, or tax reduction, could potentially increase purchases of E2Ws. Non-fiscal incentives such as prioritized parking places or implementing low-emission zones could also increase the attractiveness of E2Ws over ICE 2Ws. In addition, public campaigns to raise awareness and gain people's

52 Nguyễn Hải, "Vingroup starts construction on EV Battery Manufacturing Factory in the Vung Ang Economic Zone (Ha Tinh) ," Vinfast, December 12, 2021, https://VinFastauto.com/vn_en/vingroup-starts-construction-on-ev-battery-manufacturing-factory-in-the-vung-ang-economic-zone-ha-tinh.

53 Khiem V et al., "Mainstreaming Electric Mobility in Vietnam-Focusing on 2-wheelers," Public House of Transport, December 2020, ISBN: 978-604-76-2323-5.

54 Khiem V et al., "Mainstreaming Electric Mobility in Vietnam-Focusing on 2-wheelers," Public House of Transport, December 2020, ISBN: 978-604-76-2323-5.

trust on E2W technology are also essential to increase E2W uptake. Safety concerns, travel distance, and vehicle price are the top 3 reasons for not buying electric vehicles in Vietnam.[55] Implementing electric vehicle educational programs and awareness campaigns through test drive events or exhibitions can help address consumers' concerns and inform them of the design of new technologies and policies (if any), increasing the uptake of electric vehicles.

POLICIES SUPPORTING E2W PRODUCTION AND E2W SUPPLY CHAIN DEVELOPMENT

From the industry side, there are also no policies to support E2W manufacturers and their supply chains in Vietnam. This could be a major factor delaying the transition to manufacturing E2Ws among major 2W manufacturers in Vietnam, including Honda and Yamaha. High production costs (especially for vehicles powered by lithium-ion batteries) and low demand for E2Ws could prevent the manufacturers from shifting to producing E2W. Currently, E2Ws powered by lead-acid batteries and battery capacity smaller than 4 kW dominate the E2W market in Vietnam (accounting for 75% of E2Ws sold in 2020), and students and the elderly are two major customers of this vehicle type since using this vehicle does not require a driving license and the vehicle price is significantly cheaper than for vehicles that run on lithium batteries. By contrast, in other ASEAN countries including Thailand and Indonesia, E2Ws with lithium-ion batteries dominate the E2W market.[56] For other consumer groups, E2Ws powered by the lithium-ion battery may be more attractive; however, the vehicle price is relatively high, and the number of models is still limited. Thus, the majority of customers still prefer to own ICE 2Ws.

The EV industry cannot rely on customer demand only at this early stage, and therefore, to encourage EV development in Vietnam, strong government support in promoting and supporting the E2W industry is crucial. The incentives should be designed to support the local E2W manufacturing industry and to attract foreign investment in the E2W industry. Many countries are providing supply-based incentives, including in the ASEAN region, such as Thailand and Indonesia. Examples of these incentives include waived or reduced corporate income tax and tax holidays for manufacturers over a specified timeframe; investment tax allowances; waived or reduced duties and VAT for imported production-related raw materials and EV/battery components; allowance for greenfield investments involving foreign direct investment (FDI) by international companies for EV manufacturing; reduced-rate financing for EV manufacturers; and government land grants for developing assembly plants. These incentives may be helpful in the very early stage of market development, but they may need to be gradually replaced by supply-side regulations.[57]

In addition, policies that incentivize ICE 2W manufacturers to sell electric models are also required. Examples of such policies include regulating the fuel consumption (or CO_2 emissions, or fuel economy) standards, tightening vehicle emission standards, and mandating E2W production. There is a positive correlation between fuel consumption (or CO_2 emission) standards and EV uptake. An example shows that setting fuel consumption or CO_2 emission standards based on incremental efficiency could drive up to 20% of electric share in China, 11% in Europe, and 5% in the United States by

55 Le Tuan Anh, "Study on the criteria development of pilot city selection for e-mobility adoption in Vietnam," presented at NDC-TIA kick-off meeting 15 March 2021, Hanoi, Vietnam, https://www.changing-transport.org/wp-content/uploads/3.-210312-NDC-TIA-kick-off-Vietnam_Le-Anh-Tuan_Consultant-team-leader.pdf.

56 Huong Le, Zifei Yang, *Market analysis of two- and three-wheeler vehicles in key ASEAN member states* (ICCT: Washington, DC, 2022), https://www.motorcyclesdata.com/2022/01/25/vietnam-motorcycles/.

57 Tanzila Khan, Zifei Yang, Sumati Kohli, Josh Miller, *A critical review of ZEV deployment in emerging markets,* (ICCT: Washington, DC, 2022), https://theicct.org/publication/zev-market-review-global-feb22/.

2025.[58] In addition, mandating E2W production also pushes ICE 2W manufacturers in the country to shift investment and production to E2Ws. The mandated program would require manufacturers to meet increased annual levels of E2W sales over time until 100% of new vehicles sales are electric-powered. In the ASEAN region, Thailand and Indonesia have set targets for EVs; for example, Indonesia aims to achieve a stock of 2 million electric passenger vehicles and 13 million E2Ws by 2030.[59] Vietnam should set mandatory targets for E2V production or sales. These targets will serve as a guideline for manufacturers to plan their scaling up of E2W production, building infrastructure, and gradually phasing out ICE 2W sales. In addition, to avoid and mitigate the potential negative effects of increased E2Ws in the future, policies related to E2W vehicle disposal and recycling of expired batteries are necessary.

These policies will provide clear signals to the industry to accelerate its investment in manufacturing of E2Ws and their components. With the proper policy design, Vietnam could potentially become a production hub not only for the domestic market but also for exporting to other markets.

POLICIES SUPPORTING THE DEVELOPMENT OF CHARGING INFRASTRUCTURE AND BATTERY SWAPPING SYSTEMS

Regarding charging infrastructure and battery swapping networks for E2Ws, there is a lack of government investment and support in researching, providing, and operating charging infrastructure and battery swapping services. Addressing this issue is needed to promote E2W development in the country. Fiscal incentives such as reducing the land use tax, and direct grants to support early development could potentially encourage investment in charging infrastructure and in providing battery swapping services in the country. The government should also require the provision of charging infrastructure and battery swapping stations at new residential areas, shopping malls, parking places, and other locations. In addition, encouraging collaboration among manufacturers and providers is necessary to standardize technologies to reduce investment costs for the charging infrastructure network and battery swapping system, and to increase convenience for E2W users by allowing them to access these infrastructures regardless of their vehicle brands.

In addition, adopting policies that incentivize innovative business models for the sale of electricity for EV applications should also be considered and encouraged. For example, in Indonesia this is led by the Ministry of Energy and the national electric utility company (Perusahaan Listrik Negara PLN), which has created a regulatory framework that allows third parties to buy electricity and sell it to EV customers. The business models cover the sale of electricity via both battery swapping and charging points.

CONCLUSION AND RECOMMENDATIONS

This paper provides an overview of 2W sales in Vietnam. Vietnam's 2W market has contracted since 2018, from 3.6 million vehicles in 2018 to 2.8 million in 2021, the lowest level in 15 years. Although the 2W market declined, the market share of E2Ws increased significantly and reached 10% in 2021. The paper also reviewed the major 2W manufacturers in Vietnam, their production capacities and E2W development plans. We also review the development of charging infrastructure, E2W industry and its supply chains, and the policy context of promoting E2Ws in the country.

58 Nic Lutsey, *Modernizing vehicle regulations for electrification* (ICCT: Washington, DC, 2018) https://theicct.org/publication/modernizing-vehicle-regulations-for-electrification/.

59 Aditya Mahalana, Zifei Yang, Francisco Posada, *Indonesia transport electrification strategy* (ICCT: Washington, DC, 2021), https://theicct.org/publication/indonesia-transport-electrification-strategy%E2%80%AF/.

The key messages from this paper are summarized as below:

- **The two-wheeler market in Vietnam is facing market saturation.** Sales of 2Ws have fallen continuously since 2019, reaching 2.8 million units in 2021, the lowest record in 15 years, in part because of the COVID-19 pandemic. However, 2W markets in other countries in the ASEAN region have recovered, while Vietnam's 2W market continues to decline.
- **Vietnam's electric 2W market is the second largest in the world and the largest and fastest growing in the ASEAN region.** Although the 2W market is declining, the demand for E2Ws is increasing. The market share of E2Ws is growing significantly, rising from 5.4% in 2019 to 10% in 2021 without policy support from the government, which demonstrates the high potential demand for E2Ws in the coming years. Vietnam is the E2W market leader in the ASEAN region.
- **Several brands dominate the two-wheeler market.** Honda and Yamaha are the two largest players, 87.6% of 2Ws sold in 2020 were from these two brands; however, neither has signaled that it intends to develop electric vehicles in Vietnam**.** Although the transition to electric vehicles is underway, ICE 2W manufacturers are delaying investment in electrification; their actions to deploy E2Ws in Vietnam are very limited. Key reasons for this could include (1) their ICE 2W market is still very profitable and (2) supporting policies and regulations for E2W development are lacking.
- **Vietnam's existing production capacity of ICE 2Ws and E2Ws can support Vietnam becoming a substantial exporter of ICE 2Ws and E2Ws.** Currently, the production capacity of ICE 2Ws and E2Ws is 5 million and 1 million per year, respectively.
- **The E2W market is dominated by local brands**. Seven E2W manufacturers have established their production plants in Vietnam, and six are Vietnamese brands. VinFast, a local company, has the largest E2W market share (47% of the E2W market in 2020), and plays a leading role in developing E2W charging infrastructure and E2W battery swapping systems.
- **Vietnam could become a leader in manufacturing E2Ws and E2W parts in the ASEAN region with proper support from the government.** The E2W production capacity is already over 1 million vehicles annually. As the global transition to electric vehicles advances, the country can become the hub for E2W production and its supply chains in the region.
- **Vietnam's E2W market penetration is high, but most E2Ws use lead-acid batteries.** Compared to E2Ws powered by lithium-ion batteries, E2Ws powered by lead-acid batteries are less durable and require frequent battery replacement, generating negative effects on the environment.
- **On the demand side, policies to support E2W ownership and usage as well as the E2W industry are not yet available.** The adoption of E2Ws could be accelerated if there is strong support from the government at the national and local levels.

RECOMMENDATIONS

Some key recommendations to accelerate the development of E2Ws in Vietnam are as follows:

- **Develop policies to increase E2W demand, especially for vehicles with advanced chemistry batteries**. The policies should aim to make the cost of owning and operating E2Ws comparable to that of ICE 2Ws. Public campaigns to raise the population's awareness regarding the benefits of E2Ws are also necessary.
- **Develop policies to support the E2W industry and its supply chains.** Incentives should be provided for E2W manufacturing and assembling industries and to

promote the localization of E2W supply chains. Policies to support domestic E2W manufacturers in ramping up E2W sales, such as providing preferential loans and reducing company income taxes, are also essential to increase their competitiveness with foreign manufacturers.

- **Develop EV roadmaps and regulations to push and motivate ICE 2W manufacturers to produce E2Ws.** Potential regulations include fuel economy standards or CO_2 emission standards on 2W- and E2W-mandated production programs. These regulations will send a clear signal to major 2W manufacturers to invest in manufacturing E2Ws and their components.
- **Design policies to promote the development of E2Ws powered by lithium-ion batteries over lead-acid battery vehicles.** Policies should focus on reducing the up-front cost of E2Ws with lithium-ion batteries, and on raising public awareness of the advantages of these E2Ws over lead-acid ones. This could also help Vietnam to be more competitive as an exporter of E2Ws because E2Ws with lithium-ion batteries are more common in other countries and have fewer impacts on the environment than E2Ws with lead-acid batteries.
- **Craft policies to support the development of charging infrastructure and battery swapping services for E2Ws.** Establishing a network of charging stations and battery swapping services is critical to increasing E2W uptake in the country. The charging stations and battery swapping should have uniform standards to allow users to access these infrastructures regardless of vehicle brand. Mandates to install charging stations at all new residential areas, new shopping malls, parking places, and other sites are also necessary.
- **Write technical regulations and standards related to E2W vehicle disposal and recycling of expired batteries**. As Vietnam's E2W market expands, improper management of electric batteries could negatively affect the environment. Strong waste management regulations applied to E2Ws are necessary to mitigate or avoid potential negative impacts of these vehicles in the future.

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