

The market and policy development of EV industry on a global level and in Uzbekistan - Review

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Abstract: This paper reviews the historical and recent growth of the global EV industry and examines the importance of green vehicles in sustainable development. Notably, the study describes the situation in the leading EV markets in terms of the market situation, legislative aspects, and infrastructural development. The paper finally examines the EV market in Uzbekistan and the local government's official position on adopting electric vehicles.

The study found that the EV industry in Uzbekistan is at the infant stage, and a great deal remains to be done in legal and infrastructural improvements to reach the market level of other leading countries. The paper also showed the implication of EVs' adoption in parallel with other favorable reforms in Uzbekistan.

Further research into the EV industry of Uzbekistan is recommended to accurately assess the needed level of monetary incentives through the analysis of the current and future market capacity and administrative budget.

Key words: BEV (Battery Electric Vehicles); PHEV (Plug-in Hybrid Electric Vehicle); EV (Electric Vehicle); NEV (New Energy Vehicle); ICE (Internal Combustion Engine);

1. Introduction

The contraction of global greenhouse emissions and ecological improvement are significantly important in the sustainable development of the world and the prosperity of its population. In this context, electric vehicles have long been recognized as an essential part of the comprehensive program to curb greenhouse gases and maintain ecologic protection. The substantial resource capacity of developed countries helped them penetrate this emerging market considerably in the last decade and form the benchmarked practices for other nations. However, every country should be accountable for environmental protection, and Uzbekistan has an indispensable role in the global ecosystem. Therefore, understanding best practices and market tendencies in the EV industry may help developing economies like Uzbekistan predict the optimal approach for adopting alternative-energy vehicles.

After repeated attempts to produce green vehicles at the turn of the 20th century, the second decade of the 20th century was the dawn of EVs because of a combination of factors. In particular, the success of Ford's "Model T" with a gasoline engine, petroleum price reduction, discoveries of new oil reserves, and the global problem with the electricity supplies have delayed the development of EVs until the start of the 21st century (U.S. Department of Energy, 2014).

Many positive transformations increased the sales volume of EVs from nearly 130'000 units in 2010 to 6.6 million in 2021 (GreenCarReports, 2021). Within a short period of time, the price of the electric vehicles' major components like the battery pack has also decreased extensively and stimulated EV sales. Economies of scale¹, growing production capacity, and technological innovation contributed to a steady decrease in battery prices. Particularly, in 2010, the price of the average battery pack was \$1191 per kWh, which decreased by 89% to reach \$137 per kWh in 2020 (*see* Figure 1). The future of the battery packs is also quite optimistic,

¹ "Economies of scale" refers to the cost advantages that are reached by increasing the level of output and production efficiency.

with the forecasted average price of \$45/kWh by 2035 (Bloomberg NEF, 2021). All these factors open new opportunities in the global automobile business and facilitate EVs to be an indivisible part of future life.

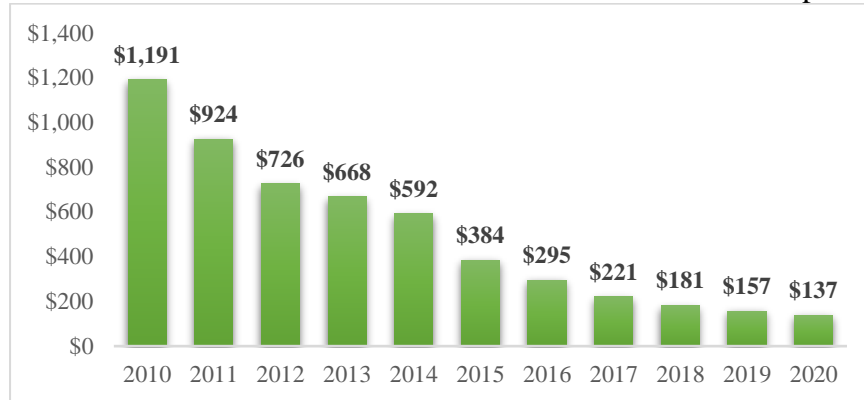


Figure 1: The reduction in battery price between 2010 and 2020
Source: BloombergNEF, 2021

Moreover, the situation related to global warming emphasizes the significance of electric vehicles' adaptation. In particular, since the pre-industrial period, the average global temperature has increased by roughly 1.0°C, while human-induced global warming is lifting the temperature by 0.2°C per decade (C2ES, 2022). Therefore, there are two potential outcomes of global environmental development for this century. The first and most favorable scenario is reaching Earth's temperature of 1.4°C, and the second is the global warming of 4.4°C by 2100 (World Resources Institute, 2021). The latter is the perilous high carbon pathway that can damage the ecosystem and the future of all nations worldwide, whereas the first scenario is optimistic environmental development requiring a 45% cut of CO₂ emissions by 2030 and achieving net-zero emissions by 2050 through using all possible measures, including electric mobility (UNDP, 2015).

Different international policies and acts have been adopted to follow the promising scenario of environmental stability, including sustainable development goals (SDGs) formulated by the United Nations in 2015. The use of EVs is primarily aligned with the 7th global goal of "Affordable Clean Energy" and the 13th global goal of "Climate Action" because road transportation produces a substantial 12,5% of the global greenhouse emissions worldwide (ClimateWatch, 2018). In addition, many countries have recognized the importance of zero-emission achievement for a better tomorrow and accepted various essential legislations, targets, ambitions and proposals to deploy EVs. (IEA,2021).

The automotive industry is strongly responsive to governmental measures (Kearney.com, 2020), thus regulatory advancement and governmental forward-thinking are crucial aspects of the overall growth of the emerging industry of EVs. Government incentives address the financial concerns of the EV buyers and reduce the practical and psychological barriers to adopting EVs and show that the authority is helping them overcome those difficulties (Kearney.com, 2020). Therefore, the significant development of the EV industry in the last decade is mainly attributed to the generous governmental support in the leading economies. Between 2013 and 2020, thirteen developed countries invested \$43 billion in consumer incentives to support the EV market and contributed to a 40% increase in this industry during the given period (Worldbank, 2021). As such, it is important to understand the governmental approach of those leading countries in terms of EV deployment and analyze the steps that the Uzbek government is taking towards the popularization of electric automobiles.

Today, Uzbekistan has the 37th position in the global CO₂ emitters ranking (Global Carbon Atlas, 2022), and in 2021, the country was ranked disappointingly low (12th out of 118 countries) in the list of places with the worst air quality in the world. Such a situation can be partly attributed to the overutilization of low emission standard vehicles in the country. The footprint calculation of gasoline vehicles based on approximately 17'000 km annually reveals that the favored vehicle of the Uzbek market Chevrolet "Lacetti" produces 6,8 tons of carbon dioxide per year. Meanwhile, the main electric alternative in this segment, Volkswagen "e-Bora" can reduce this carbon emission to over three times and produce only 1,9 tons per year². This calculation was applied only for one model in the Uzbek market, yet the significant annual sales of

² Myclimate.org

conventional vehicles in the local market (nearly 200'000 units) underscore the importance of EVs' adoption in Uzbekistan.

2. Global EV market

The landscape of the global EV market has transformed dramatically over the last three years. In particular, the proportion of electric cars in the global vehicle market has increased from 2.5% in 2019 to 8.6% in 2021 (see Table 1) (IEA, 2022). The number of newly registered electric vehicles tripled from 2.2 million to 6.7 million in 2019 and 2021, respectively (IEA, 2022).

Period	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
% of EVs	0,01 %	0,07 %	0,17 %	0,27 %	0,41 %	0,67 %	0,89 %	1,36 %	2,30 %	2,49 %	4,11 %	8,57 %

Table 1. The global proportion of EVs in the automobile market (2010-2021)

Source: International Energy Agency, 2022

Ever-increasing mass interest in EVs made their sales resilient to different macroeconomic factors and COVID-19 related problems and helped them reach accumulated sales of 16 million electric cars (IEA, 2021). The major regions that attained the largest EV sales were China, European countries, and the USA. In 2021, China was an incredibly dominant market with sales of 3.4 million units of EVs, followed by Europe, which hit 2.3 million units, and the United States with 0,7 million units. Other countries in total accounted for only 300 thousand new electric cars in that period (IEA, 2022).

Considering that the battery pack of EVs is continuously driving the prices of vehicles down, it is projected that by 2030, regions like the USA, China, Europe, and developed Asian countries will reach the price parity of EVs with ICE vehicles in most automobile segments (BloombergNEF, 2021).

In 2021, Tesla, VW Group, BYD, and General Motors were the four most prominent companies in the global EV market with the largest sales proportion (see Table 2) (IEA, 2022).

Manufacturers	World	Europe	China	USA	Others
Tesla	936	170	321	352	93
VW Group	763	549	154	44	15
BYD	598	1	595	0	2
GM	517	0	486	25	6

Table 2. The sales of global leading manufacturers of EVs (in thousand units)

Source: International Energy Agency, 2021

In 2021, *Model 3* and *Model Y* were the two popular models in Tesla's product line, and Volkswagen buyers ordered more *ID.3* and *ID.4* models, while models like *BYD Qin Plus DM (PHEV)* and *BYD Han EV* were the most sought-after in BYD's case (InsideEvs.com,2022). Given models helped these companies to become the world's top three brands in the e-vehicles market in 2021.

At the same time, other brands are striving to achieve some portion of the global EV market. Stellantis with its compact EV (Stellantis.com,2021) or Ford with the newly introduced Mustang "MachE" or electric pickup "F-150" (Ford.com, 2021).

Nowadays, automobile manufacturers consider EV production as part of their long-term strategy rather than simple compliance with environmental regulations. The automobile giants' increased R&D and capital expenditures on EVs and digital technologies can prove this motive (see Figure 2).

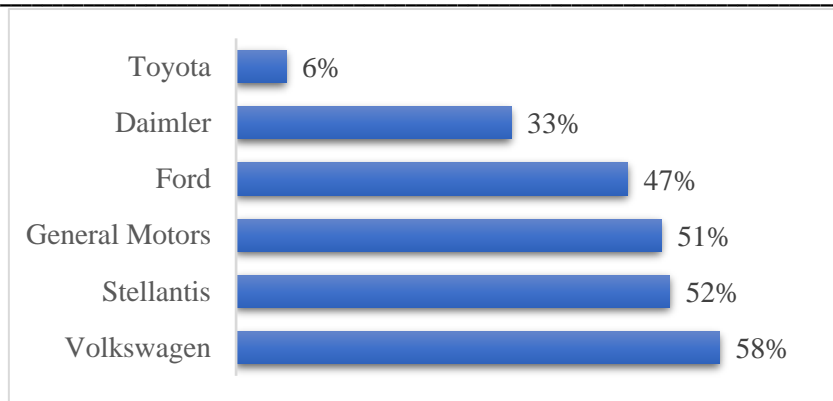


Figure 2: The allocation of R&D and capital expenditure to EVs of automobile producers
Source: BloombergNEF, 2021

With such an approach and corporate vision, it is projected that the sales of EVs will make up a significant two-thirds of the global automobile market by 2040 (BloombergNEF, 2021).

3. Green policies in leading EV markets

In the 2000s, China started its early policy attempt to popularize EVs. Nevertheless, the administrative road map between 2004 and 2008 was the theoretic framework describing energy-science-technology planning of EVs rather than a practical instrument (Zhang et al., 2016). Mainly this period was memorized for the active procurement of New Energy Vehicles (NEVs)³ by the government during the period of the Olympic Games when 500 units of homemade EVs were presented (ICCT, 2021).

In 2009, the Chinese government started landmark reform of the so-called "Ten Cities, Thousand Vehicles" program to speed up the adaptation and commercialization of (NEVs). Initially, the program was focused on reaching at least 1000 units of EVs in each of the ten cities in China that was further extended to include 25 cities (Ch. Marquis, et al. 2013). The subsidies were also introduced during this period when the Chinese government supported the EV producers, depending on their petrol reduction level. These subsidies were substantial for 100% electric automobiles, up to \$8 700 for BEVs, and \$7 250 for PHEVs, covering 40-60% of the vehicle's price (NBR, 2017). Although the government provided substantial subsidies to the participating cities, it was a decentralized exploring program when each city, like Shenzhen, Hefei, Beijing, Hangzhou, and more, used its tailored strategy and improvement models to reach the goal of 1000 units and achieve state subsidy targets. For example, Beijing heavily relied on preferential methods to create EV production infrastructure, Hangzhou used renting techniques to boost the sales of NEVs, and Shenzhen promoted cooperation between producers and financial institutions, e.g., the partnership between battery producers, vehicle manufacturers, and leasing organizations (Ch. Marquis, et al. 2013).

In 2011, the "Airpocalypse"⁴ in China stressed the importance of green transportation. Beijing started quoting the registration of new conventional cars to decrease the gridlock and increasingly allowed to register more NEVs (Independent.com, 2011.). In 2017, the regulation legally required 40% of new automobile owners in Beijing to have green alternatives, and this practice is globally recognized as an effective instrument to popularize EVs (ICCT, 2021). Restriction to drive ICE vehicles in the central parts of the city, driving conventional cars on particular days, favorable handling of green license plates increased the number of EV drivers by 2017, when 60% of 60'000 vehicles belonged to private households (ICCT, 2021). In 2014, Beijing provided local subsidies besides the central one and enabled to reduce the price of the NEVs by up to 60%.

Other local governments were actively using such incentives as free parking and fee waivers for license plates, the auction price of which even could reach \$14 500 (NBR, 2017). The central government was also active in the procurement process. At the state level, the minimum required proportion of governmental EV purchases increased from 30% in 2014 to 50% in 2016 (NBR, 2017). The governmental support also accelerated the creation of charging infrastructure in China. For example, the country has over 1,1 million

³ NEVs – is the term used by the Chinese government to designate PHEVs, EVs, and Hybrid vehicles.

⁴ The period when people living in China, especially in Beijing, were exposed to the harmful smog that occasionally exceeded recommended levels by WHO.

public charging stations (InsideEvs.com,2011), and the total Chinese share in the global EV charging network surpassed 50% (ICCT,2021).

China has progressed through five phase-out stages, and since 2020, the country has reached its sixth phase. At this stage, the Chinese government has narrowed the threshold of the electric range from 250 km to 300 km and set a qualifying maximum pre-subsidy price at \$43 000 (ICCT,2020). In 2021, the base subsidy for the BEVs was between \$1 999 and \$2 768, depending on the range that notably decreased from the previous level of subsidies (LMC,2022) (see Table 3). The Chinese government announced the plan to eliminate the subsidization system by the end of 2022 by gradually cutting financial support by 10%, 20%, and 30% from 2020 to 2022, respectively (Reuters,2022).

Year	BEV electric range (ER, km)	
	300 km ≤ R < 400 km	R ≥ 400 km
2019	\$2 610	\$3 620
2020	\$2 350	\$3 260
2021	\$1 999	\$2 768
2022	\$1 399	\$1 937

Table 3: The amount of subsidy for BEVs in China (2019-2020)
 Source: ICCT,2021 and LMC Automotive,2022

Even though the country has the largest network of public charging stations of over 1 million points (Bloomberg,2021), the infrastructure still needs development because 70% of them are located in affluent cities like Shanghai and Guangdong, and many drivers have limited access to the public charging network (State Council of the PRC,2022). Therefore, the Chinese government is working on this issue and plans to develop additional charging stations to cover the needs of 20 million EVs by 2025 (Protocol.com,2022).

In 2020, for the first in the history of EVs, Europe had outpaced China in registering new vehicles with 1,4 million units against 1,2 million units in China (IEA, 2021). Even though the numbers nowadays look significant, in 2010, EV sales were marginal in the EU market, with 700 annual units (European Environmental Agency,2021). In the last decade, there was a severe shift toward the adaptation of EVs on the European continent, backed by governmental incentives and centralized policies of the European Union.

Europe aims to become the first region globally that reaches net-zero emissions by 2050 (Financialtimes,2021). This was set in one prominent environmental road map presented in 2019, the so-called "European Green Deal" (M.Kaup et al.,2021). The fundamental problem in electric mobility between different parts of Europe remains the charging infrastructure. Therefore, the "European Green Deal" proposed an ambitious plan to develop 1 million charging stations by 2025 over the European continent (M.Kaup et al.,2021). For comparison, the EU's current number of public charging stations is composed of 285'500 places (ICCT,2021).

Europe has increased its global battery production by three times in the last three years but still lags behind the Chinese lithium-ion cell manufacturing capacity (BloombergNEF,2021). To tackle Chinese dominance in battery production, Europe has also launched its factory in Sweden with the "Northvolt" battery group that can provide 60 gigawatt-hours of power annually (GWh) (Euronews,2022). Apart from private investments from companies like Volkswagen or BMW, European Investment Bank allocated \$400 million in loans (European Commission, 2020).

It should be noted that some European countries lead the ranking of electric mobility with the highest sales proportion of EVs in the world. Particularly, Nordic countries like Norway, Iceland, and Sweden have a leading position globally with EVs' sales allocation in their automobile market, accounting for 74,8%, 45%, and 32,2%, respectively (World Economic Forum,2020).

Apart from the central support and incentives from the European Union, each country in Europe is working on a local strategy to popularize EV sales in its region. Special mention deserves the government incentives of Norway. As one of the developed countries in the world, Norway has put hefty taxes on the purchase of conventional vehicles while significantly exempting them for EVs owners. For example, governmental incentives include the exemption of 25% VAT for purchasing and leasing EVs, access to bus lanes with at least one passenger, no purchasing and importing taxes, and more (Norsk-Elbilforening,2022). One of the well-known supportive instruments of the country, "the 50% rule" was introduced in 2011. This

rule prohibits local authorities from charging EV drivers over 50% of the fees paid by drivers of ICE vehicles for public parking, road tolls, and ferry rates (TheGuardian,2020). The Norwegian Parliament aims to have all new vehicles zero-emission by 2025 with all these instruments and additional government support (Reuters,2018).

In 2020, Germany, France, and the UK were the leaders in the EU market in registering new EVs with 395'000, 185'000, and 176'000 units, respectively (IEA, 2021). There were several reasons for the record-breaking year of 2020, including upgraded facilities and expertise of the producers, the drivers' green enthusiasm, the reduction in battery prices, and governmental support.

The so-called "diesel crisis" in Germany vastly stimulated the adoption of EVs in the region. In 2017, Germany launched the €1 billion program-"Immediate Action Plan Clean Air 2017-2020" to cover up to 75-90% of expenses for the government procurement of EVs and refund the purchases of up to 60% of EVs for commercial purposes (CMS,2018). Germany additionally offered a vehicle tax exemption for up to ten years for EV owners (Volkswagen.com, 2019). After the COVID-19 outbreak, Germany revised most of its support policies. For example, the country has increased its purchase subsidy for EVs to €9 000 (for BEVs) and €6 750 (PHEV) from the previous €6 000 (BEV) and €4 500 (PHEV), respectively for vehicles costing less than €40 000. This enhanced subsidy was valid until the end of 2021, with a steady phase-out until 2025.

France uses an environmental bonus-malus system that was introduced in 2008 and repeatedly changed over time (RenaultGroup,2021). Currently, private EV drivers can apply for a €6 000 bonus (€5 000 for corporate purchases) with a price tag up to €45 000, while corporate and private drivers can opt for €2 000 for the EVs with a price between €45 000 to €60 000. The French government also offers a scrapping premium where the buyers can receive up to €5 000 when buying EVs by scrapping old diesel or petrol cars (Electrive.com,2021).

The UK offers the maximum grant of £2 500 in 2021 (with a minimum price cap of £35 000), which was initially £5 000 in 2011(TheGuardian, 2021). In 2021, the UK also enacted innovative laws requiring new construction of homes and buildings or those going through renovation to have EV charging points. The government expects that this move will help develop an additional 145 000 private charging points annually (BBC,2021). These and other policies are directed to ban diesel and petrol vehicles in the UK by 2030 as part of the country's "Road to Zero Strategy" (WEFORUM,2021).

The USA is one of the significant regions actively restoring the automobile volumes to the previous considerable size after the economic crisis of COVID-19 (Forbes, 2021). For example, the sales of EVs in the USA nearly doubled in 2021, reaching over 600'000 units compared to 295'000 units in 2020 (IEA,2021).

Even though the current share of the USA in the EV market is only one-third of the Chinese one, America has a unique role in the electrification process of the global auto industry. Nowadays, America's EVs sales account for only 4% of the total market, which is 11% lower than the Chinese figures (Protocol.com,2022). Nevertheless, US companies outpace Chinese manufacturers of only EVs by market value. For example, the top-3 companies by market capitalization in the EV industry, such as Tesla (1 trillion), Lucid Motors (36.45 billion), and Rivian (35,8 billion), are all American-based EV producers. Altogether, six US companies are among the top-10 most expensive EV producers globally, while Chinese companies represent only three EV manufacturers on this list (Companiesmarketcap.com, 2022).

To support the EV market, the US government mainly relied on federal tax credits started during the period of President Obama (Obamawhitehouse,2008). Fiscal incentives included up to \$7 500 tax rebates to the EV manufacturer for each unit sold until the individual production volume hits 200'000 units (InsideEvs.com, 2020). However, large manufacturers in the local market, represented by Tesla and Chevrolet, have already reached that limit and could not rely on this particular government support. Optimistically, the new US administration again started to support green initiatives in the automobile market and aims to catch up with other leading countries in the EV market.

The current US government announced the so-called "Steps to drive American Leadership Forward on Clean Cars and Trucks" and the "Biden-Harris Electric Vehicle Charging Action Plan". Biden's administration is an active driver of the auto industry's green developments. With these programs, the US administration aims to have 50% of US car sales share electrified and reduce greenhouse gases by over 60% in 2030 (Whitehouse,2021). To achieve these goals, the government is addressing the following points:

-Establishing an initial nationwide network of EV charging stations by establishing 500'000 public charging stations and allocating \$5 billion in government funding to develop the charging infrastructure available and convenient for every American. It is crucial because current charging stations of only 47 000 chargers lack uniformity with different payment and charging systems and are insufficient for increased regional demand (AFDC,2022).

-Supporting the modernization and expansion of the national manufacturing ecosystem. It primarily addresses the subject of local battery production by creating a national production capacity and mining system of crucial battery components, such as lithium or cobalt. China is dominant in this market, with 70% of the global EV battery production (IEA,2021). To catch up with the leader, the US government announced a \$17 billion loan program to support domestic battery production and \$7 billion to stimulate battery materials production and recycling mechanism (Whitehouse, 2021). At the same time, the US Transport and Energy Departments are helping the administration of each state plan and construct EV chargers along the highways (PWC, 2022).

-Innovating green technologies to maintain the competitive edge by distributing \$2,5 billion of governmental grants.

-Launching consumer incentives to drive domestic production and job creation in the domestic EV market.

While the administrative progress toward electrification of the auto market had recently intensified, some local authorities had already outpaced the country-level shifts. During Trump's presidency in 2020, California was brave enough to enact the regulation that all new vehicles in its state should have zero-emission by 2035. Local administration even agreed on this concept with five large auto manufacturers: Volvo, Honda, BMW, Volkswagen, and Ford (Forbes,2020).

The current government and Congress members are also working to increase tax rebates up to \$12 500 and remove the existing market cap. If the bill wins sufficient votes, the tax incentive will rise by \$5 000, and the proposed regulation will remove the market ceiling of 200'000 units for EV producers (PWC, 2022).

4. EV market and green policies in Uzbekistan

The number of EV imports in Uzbekistan is constantly rising from a tiny 18 units in 2018 to 809 units in 2021 (see Figure 3) (Stat.uz,2022). The sales of EVs is steadily rising every year in Uzbekistan, for example in the first quarter of 2022, the accumulated EV imports accounted for 455 units (Stat.uz,2022), and annual EV sales in 2022 are projected to surpass the milestone of 1'000 and reach nearly 2'000 units, and additional stimulation can exponentially increase this number to the new level.

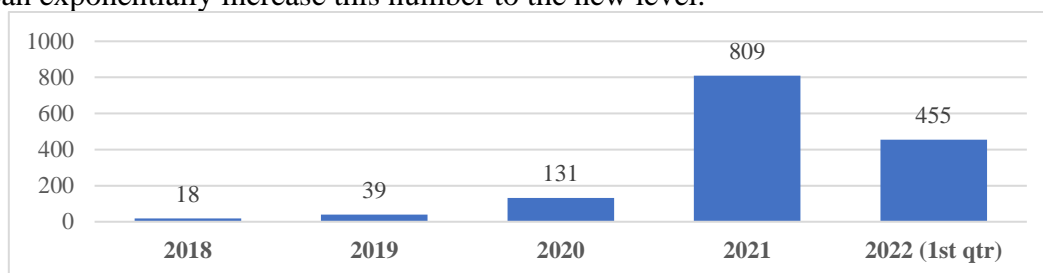


Figure 3: The import of EVs in Uzbekistan (2018-2022 1st qtr)

Source: Stat.uz, 2022

Uzbekistan has strategically started the electrification process in the auto industry in 2019. In June 2019, the Uzbek government enacted the presidential decree - regarding the exemption of excise tax and customs duty for EVs that could cost up to half the price of conventional cars (Lex.uz,2019). By 2021, EVs were also exempted from the car registration tax of 3%, which is included in the retail price of traditional vehicles (Spot.uz,2020).

In 2019, the government adopted another presidential decree - on the strategic transition to the “green economy” between 2019 and 2030 (Lex.uz,2019). According to this decree, any transporting means below the Euro-4 standard are prohibited from being sold in Uzbekistan since 2022 (Mintrans,2020).

It is also important to mention about governmental policy that was recently developed and brought to the open discussion until the first decade of April-2022 (Regulation.gov.uz,2022). Although this regulation is

not finally adopted, it has essential items for developing EVs and their infrastructure. In particular, as one of the priority directions, the government aims to electrify the automobile segment of Uzbekistan by 15% in 2030 by developing the whole ecosystem that starts from the production plant and ends with the after-sales system. The official adoption of this complex decree can lead to significant changes in the EV industry of Uzbekistan.

The preliminary decree proposes excluding the scrapping fee for the local EV producers and the imported EVs between 2024 and 2027. With the latest amount of “*Base Rate*”⁵ the utilization fees for the light passenger EVs (up to 3 years old) accounts for \$720 (Norma.uz,2020). Other examples of the practical proposals in this decree include the following:

- An exemption from the land tax for any owners of the building with at least two charging stations and parking space;
- Customs duty exemption for the technical equipment of charging stations and for the spare parts of locally produced EVs;
- The coverage of the total cost of electric supply by the government subsidies for the enterprises providing charging services;
- The governmental subsidy of \$10 000 to help a local entrepreneur purchase and install the Mode-4 charging stations with an electric supply of at least 60 kW/hour;
- Obligating developers to build new residential complexes with EV chargers and the owners of fuel stations in Tashkent to create at least two fast chargers in each location;
- Obligating each governmental institution to have at least 10% of EVs from the overall motor pool by 2025 and 100% by 2030. At the same time, it is required that 20% of new vehicle purchases should be electric from 2022;
- Obligating “Uzavtosanoat” SC⁶ to create a joint venture with the foreign producers of EVs and set up domestic production from 2027.

The governmental budget for these measures is planned to be formed by directing different fees to the “Green Economic Development” foundation. Such fees include the portion of registration fees for conventional automobiles, i.e., 0,2% for new vehicles and 0,5% for old ones, fuel duties, or fees for entering special ecological zones with ICE vehicles (Regulation.gov.uz,2022).

In 2021, the Uzbek government activated its actions toward sustainable development and EV popularization. For instance, in November 2021, the government announced a non-monetary policy of using green plates for private and governmental electric vehicles with a minimum speed requirement of 40km/hour (Lex.uz, 2021). It could lead to the next logical step of adopting the package of non-fiscal incentives, like free parking zones or road tax exemption. According to the World Bank Group research, the “green plate” system increased EV sales in China by nearly 18% (Sh. Li et al., 2020). The research suggests that the psychological effect of the environmentally friendly color and multiple benefits associated with this plate can substantially contribute to the EVs’ popularization. Therefore, with further additional incentives, Uzbek consumers might be more inclined to purchase EVs.

The procurement of EVs on the governmental scale is also intensifying. For example, in 2022, the Ecological committee of Uzbekistan announced the renewal of its motor pool with ten EVs (Gazeta.uz,2022), and the Ministry of Energy of Uzbekistan also has purchased twenty EVs for the needs of their new project solar energy (Spot.uz, 2022).

Recently, the authority of Uzbekistan enacted the so-called strategy of “New Uzbekistan” for the period of 2022-2024 (Strategy.uz, 2022). This strategy includes 100 objectives to develop Uzbekistan’s social and economic landscape. The 24th objective of this strategy is concerned with the green advancement of the country regarding renewable sources of energy like solar panels, the reduction of greenhouse gases by 10%, and the production of EVs with the local capacity (Strategy.uz, 2022). Regarding the last one, in February 2022, the governing company in the automobile industry of Uzbekistan– “Uzavtosanoat” SC has signed a memorandum of agreement with one of the largest producers of EVs in the world, Chinese automobile producer “BYD” (Uzavtosanoat.uz, 2022).

⁵ Base rate - is an indicator that is used in determining the amount of taxes, fees, duties, fines, and payments for public services in Uzbekistan.

⁶ “Uzavtosanoat” SC - Organization regulating the auto industry of Uzbekistan.

The government is also working on revising the local transportation system, especially in such big cities like Tashkent. For example, according to the adopted presidential decree №111 dd. 02.02.2022 and its road map, the Ministry of Transport needs to develop a system of motivating private taxi enterprises to purchase EVs in 2022 (Lex.uz,2022). This particular decree also requires the government to develop the charging infrastructure for the public buses by the mid of 2023.

Moreover, according to this decree, the Ministry of Transport was given the right to purchase 20 units of “Yutong” electric buses for the needs of Tashkent city, equivalent to the amount of approximately \$5.7 mln US dollars. The purchase is wholly exempted from 15% VAT (Lex.uz,2022). Within this decree, the Ministry of Transport, in cooperation with the Tashkent city council and other governmental institutions, must purchase electric buses between 2022 and 2025. For example, the annual planned purchase of electric buses for 2025 accounts for 200 units, while the accumulated governmental procurement of E-buses will make up 673 units by the end of 2025. At the same time, the government is attempting to stop the purchases of buses with natural gas and diesel engines from 2023 and increase the share of electric buses in the public transport segment up to 49% in 2025 (Lex.uz,2022). The same decree obliges “Uzavtosanoat” SC to develop the action plan until mid-2022 concerning the local production of electric buses in Uzbekistan.

While the government is developing the action plans for the public charging system, private enterprises like “TOKBOR” are already implementing the first charging station network in Uzbekistan. “TOKBOR” offers a turnkey project to provide all equipment and installation service, guarantee package, technical support, call-center support, integration to the local payment system, and marketing promotion to the investor (Tokbor.uz,2022). The investor must only invest in charging infrastructure and electricity supply. Today, the company has fruitful cooperation with a supermarket chain, “Makro” which has already created charging stations in its 14 locations (Themag.uz,2021). Large real-estate company - “NRG”, premium sports complex - “BeFit”, national petrol station chain - “UNG Petro” and several hotels have already started their cooperation in creating charging stations with “TOKBOR”. The company is simultaneously partnering with private EV dealers to provide discount charging services for potential EV buyers (Tokbor.uz,2022). Overall, “TOKBOR” has already developed 23 charging points and is continuously working on expanding its chain.

In parallel, one of the significant private sellers of electric vehicles – “Megawatt Motors” within the program of public-private partnership, started the cooperation with the Ecological Committee of Uzbekistan and committed to building 68 fast-charging stations in Uzbekistan between the period of 2022-2023 (Kapital.uz, 2022).

The Ministry of Energy in Uzbekistan is also developing a unique network of charging stations based on solar energy. Each charging station of this type can annually economize 19.8 tons of air pollutants and charge up to 950 vehicles per year (Minenergy.uz,2022). It should be noted that only 45 public charging stations are available in Uzbekistan at the moment⁷.

The positive environmental outcome of electric vehicles also depends on the country's energy mix⁸. The value of electric vehicles can be twice efficient in curtailing greenhouse emissions if the power supply for the vehicles can be sourced from renewable energy. Therefore, it is essential to develop a policy for green energy generation for the effective implementation of SDGs. Particularly, Uzbekistan generates 85% of power-burning natural gas, and only 10.2% of the country's energy distribution belongs to renewable sources, mainly gained by hydropower, while other renewable energies like solar or wind are negligible (IEA,2020). Nevertheless, in recent years, Uzbekistan has been attempting to reduce its greenhouse emissions by decreasing its reliance on fossil fuels and adopting appropriate government policies concerning green technologies, mobility, and infrastructure. For example, in 2021, the Ministry of Energy of Uzbekistan and "Masdar Clean Energy" (UAE) jointly launched the first significant solar energy plant with a 100 megawatts capacity. This project plans to eliminate the production of 80 million cubic meters of natural gas per year and prevent 160,000 tons of greenhouse gases. Uzbekistan has other joint projects in the renewable energy sector with a total electric capacity of 1,497 megawatts, waiving 2.4 mln tons of greenhouse emissions in the atmosphere (Ministry of Energy Uzbekistan, 2022). In 2018, the president also signed a decree regarding

⁷ Plugshare.com

⁸ Energy mix - the range of primary energy sources used to satisfy the needs of a given geographical region.

measures to develop nuclear energy in Uzbekistan. This decree establishes the state program for developing nuclear energy between 2019 and 2029 (Lex.uz⁹, 2018).

5. Discussion and Recommendation

According to the Center for Sustainable Energy (CSE), a primary problem with the widespread adoption of EVs is the deficiency of charging stations in the region (CSE, 2021). CSE proposes five-stage methods to develop an EV charging infrastructure, and the first vital stage is understanding the market gap and needs.

At the moment, there is a big infrastructural gap in the adoption of EVs in Uzbekistan. Since 2018, the cumulative import of EVs has accounted for 1452 units (Stat.uz), and the number is rising exponentially every year. European Union proposes the ratio of 1 charging station per 10 vehicles (IEA,2021) for the comfortable use of EVs, and Uzbekistan is far from reaching this indicative benchmark with the available chain of public charging stations. Except for top locations with the most registered passenger vehicles like Tashkent city and Ferghana region, the remaining administrative areas significantly need to build up charging points to adopt EVs in Uzbekistan (*see* Table 4).

No	Locations	EV charging stations ¹⁰	Cumulative number of passenger vehicles ¹¹
1	Tashkent city	24	467 176
2	Samarkand region	2	323 586
3	Ferghana region	9	276 558
4	Tashkent region	3	262 741
5	Kashkadarya region	1	223 733
6	Andijan region	1	192 944
7	Khorezm region	n/a	187 457
8	Bukhara region	n/a	180 478
9	Namangan region	4	180 367
10	Surkhandarya region	n/a	150 574
11	Republic of Karakalpakstan	n/a	113 140
12	Navoi region	1	75 039
13	Jizzakh region	n/a	72 530
14	Sirdarya region	n/a	60 803
	Total	45	2 767 126

Table 4: The number of public charging stations in Uzbekistan in administrative locations
Source: Plugshare.com, 2022 / Gazeta.uz, 2021

The paper shows that the government of Uzbekistan has no working program for EV charging network expansion, and the market primarily relies on private entities in the expansion process. However, the research of the World Bank suggests that the government's spending on the charging infrastructure is more effective than the subsidy on consumer purchases in EV popularization (Shanjun Li, 2021). In particular, to achieve one additional sale of EV, the government can either spend \$10,872 through consumer subsidies per car or only ration \$1,587 per car for installing a new public charger (Shanjun Li, 2021). Considering the present infrastructural situation and the viability of subsidizing the charging network, Uzbekistan should concentrate its efforts on this topic as the main starting point.

Kick-starting the market of EVs incorporates different subsidies, incentives, and government funding that are considered effective but expensive (BloombergNEF,2021). However, recent macroeconomic factors and the unstable situation in the world have forced the government of Uzbekistan to decrease the anticipated expenditures on different governmental projects by nearly \$880 million in 2022 (Gazeta.uz). In a tight budget condition, the government should be more flexible in organizing investment funding, and the foreign

⁹ National Legislation Base

¹⁰ Plugshare.com

¹¹ <https://www.gazeta.uz/ru/2021/03/17/cars-summary/>

experience can be helpful. For example, the local authority has not yet employed the so-called “cap and trade” auction system that is popular in developed countries like the USA or China. This instrument forces industrial enterprises to reduce their emission by a certain level and allows the government to trade allowances through auctions (EDF,2022). Additionally, the public-private partnership is also a great tool for diversifying the budget allocation (CSE,2021) and the preliminary project of offering \$10’000 for the local entrepreneurs to share the cost of charging network development is a wise approach.

The involvement of local oil and gas companies in EVs’ infrastructural development can also lead to practical results in electric mobility. Nowadays, once reluctant companies in oil industries such as BP, Shell, Enel, and EDF are actively developing a global public charging network (BloomberNEF,2021). For example, BP has recently changed its trajectory and expects selling electricity to be more profitable in the future (Reuters,2021), and plans to create 500’000 chargers globally by 2025 (BloomberNEF,2021). Therefore, EV infrastructural expansion is not only ecologically relevant but also potentially profitable for every oil and gas company like JSC "Uzbekneftgaz". The company is recommended to be involved in the development process of EV charging stations through its network of over hundreds of "UNG Petro" branded petrol and gas fuel stations (Ungpetro.uz, 2022) and through other greenfield projects.

Manufacturers' and consumers' incentivization system is also very effective tool for popularizing alternative-energy vehicles. However, Uzbekistan needs to have a regulatory body to track the subsidy allocation and avoid subsidy misuse. China was generous in subsidizing EVs in different segments, yet the country also suffered significantly because of fraudulent actions from the manufacturers. For example, in 2016, the Chinese government fined five electric bus producers for the subsidy falsification and accused them of defrauding \$150 million of the government funds (WSJ,2016). The fraudulent schemes took many forms, including falsified client registration, using bribery to receive the licenses, or falsified battery sizes to increase the amount of subsidy (ICCT,2017). Therefore, it is essential to create an independent regulatory body in Uzbekistan. Currently, the local auto industry is mainly represented by "Uzavtosanoat" SC, yet this institution mainly acts as the founder of almost all government vehicle producers directly or through affiliated companies (Uzavtosanoat.uz,2022). Creating a third regulatory body that will provide, track, and validate all subsidies in the EV industry is crucial to producing transparency and equal opportunity for private and public manufacturers and avoiding conflict of interest. The regulatory bodies and policies can eliminate consumer concerns and motivate vehicle or battery producers to improve constantly their technological process and the industry itself (X.F. Liu and L.Wang, 2021). As such, tightened technical requirement, random checks, severe punishment for illegal practices and anti-fraud measures of verified proof of sales should be an essential part of regulatory policy in the country (ICCT,2017).

Finally, it is also essential to enrich the non-financial rewards in Uzbekistan by using the practices of developed countries. Uzbekistan can use parking incentives with its planned reforms in the city infrastructure. In March 2022, it was announced that the parking in the capital city of Tashkent is planned to be chargeable per hour (Gazeta.uz,2022). Therefore, the government can simultaneously adopt a free parking mechanism for EV owners to stimulate the purchase of these vehicles. The administration can also propose a discount for the license plates sold at auctions, where prices can even reach \$44’500 during the bidding process (Uznews.uz,2021). EV buyers can be discounted while purchasing those auctioned license plates. In 2022, the authority also announced transportation reforms that included creating separate bus lanes for the quick movement of the buses in the city (Podrobno.uz,2022). The logical incentive of the bus lane access for the EV drivers could be an additional demand booster for alternative-energy vehicles

6. Conclusion

The development of the EV market is imperative to maintain the global ecological balance. Since its early beginning, the landscape of the EV industry has changed optimistically and delivered extensive experience and practices in forming this market. There has been a visible shift in the world of EVs since 2020, and the volume increased in parallel with new consumers' willingness to purchase those vehicles. The government's optimism is also rising exponentially to use new energy vehicles as part of the comprehensive strategy to tackle global warming.

Today, activism in the matter of green projects is actively done and prompted by developed countries, and Uzbekistan can hugely learn from their experience. Particularly, innovative practice and the benchmark

of those developed nations will be advantageous for developing countries like Uzbekistan, and this concept matches with the main idea of UN Global Goals that advocate that experience, technology, and creativity are necessary to be shared among different nations to achieve all sustainable targets, as well as that the sub-target of 7th Global Goals regarding the development of sustainable infrastructure by especially helping the least developed countries which are geographically land-locked¹² (UNDP, 2015).

Governmental support is essential to have a flying start in the early markets, and thus, accurate administrative backing is required in the case of Uzbekistan. Conspicuous enthusiasm and preliminary legal projects illustrate that the Uzbek EV market is on the right pathway, yet much remains to be done and adapting the best practices of the leaders in the EV industry is important.

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¹² Uzbekistan is one of the few landlocked countries in the world.

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