



ELECTRIC VEHICLES AND CHARGING STATIONS: DEVELOPMENT TRENDS IN THE WORLD AND UZBEKISTAN

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Abstract. This article examines the current state of electric vehicle (EV) development and charging infrastructure, focusing on global trends and the situation in Uzbekistan. It explores key factors that influence the expansion of the EV market, including government policies, charging station technology, battery cost reduction, and infrastructure availability.

The analysis is based on data from international sources, statistical reports, and academic research, and it indicates significant progress in global adoption of EVs. China, Europe, and the United States lead the market, while Uzbekistan is taking steps to accelerate the deployment of charging stations and promote sustainable transportation.

While challenges such as limited infrastructure and economic feasibility remain, the paper emphasizes the importance of technological innovation and strategic planning for future development.

Keywords: Electric vehicles, charging infrastructure, government policies, sustainable mobility, battery technology, Uzbekistan, global market trends

1. Introduction

In recent years, there has been a significant increase in the adoption of electric vehicle (EV) transport, driven by technological advancements, stricter environmental regulations, and government incentives. According to data from the International Energy Agency (IEA), the share of EVs in the global vehicle fleet is projected to reach approximately 18% by 2024, up from 4% in 2020 [30].

According to data from Bloomberg New Energy Finance (BloombergNEF), global sales of electric vehicles (EVs) in 2023 exceeded 14 million units, an increase of 35% compared to the previous year. The main markets for EVs are China, Europe, and the United States [14].

The article examines the factors that contribute to the development of electric vehicle (EV) and charging infrastructure, and analyzes current trends in both the global and Uzbekistan markets.

2. Methods

IS To analyze the current market situation for electric vehicles and charging infrastructure globally and specifically in Uzbekistan, we have utilized data from international and domestic reports, statistical sources, and research findings published in academic journals.

The primary aim of the report is to compare and analyse key factors that impact the development of electric vehicle infrastructure and market. These factors include government initiatives, charging station technologies, the cost of lithium-ion batteries, and the availability of infrastructure for electric vehicle users.

The comparison includes data from key countries (China, the USA, Europe), as well as an analysis of trends in Uzbekistan.

3. Results

3.1 Global Electric Mobility Transition

- In 2024, approximately 18% of the global vehicle fleet will be electric [30].
- Sales of electric vehicles globally exceeded 14 million units in 2023 [14].
- China leads the market, accounting for approximately 60% of all global electric vehicle sales, with BYD having surpassed Tesla.
- Europe is actively supporting electric vehicle growth through subsidies and tax incentives.

3.2 Development of Charging Infrastructure:

- In 2024, China installed over 11.4 million charging points, Europe - 1 million and the United States - 61,000 [15,32,32].
- In the United States, a program is underway to create 500,000 additional charging stations by 2030, with incentives in place to facilitate this goal [11,5,3232].

3.3 Uzbekistan

- In 2024, approximately 200 electric vehicle charging stations are currently in operation, and based on new government initiatives, it is projected that by the end of 2025, 32,400 additional charging stations will be installed [11-8].
- Requirements have been introduced to ensure the mandatory installation of charging stations in parking lots of new state and commercial buildings [10].
- Differentiated electricity tariffs are being developed for charging, taking into account the time of day, with the aim of promoting sustainable transportation and reducing emissions [42].

4. Discussion

The global and Uzbek development of electric vehicles is linked to a number of key factors, including lower battery costs, government incentives and support programs, as well as improved charging infrastructure. However, significant challenges exist, such as the scarcity of certain rare earth metals, the limited infrastructure in developing countries, and the higher cost of electric vehicles relative to traditional internal combustion engine cars.

Global experience demonstrates that the successful development of charging infrastructure necessitates a comprehensive approach encompassing government regulation, private investment, and innovation in charging technologies. For instance, China is actively implementing ultrapowerful charging stations and has established government programs aimed at establishing a network of such stations. Similarly, in Europe and the United States, extensive measures have been undertaken to expand charging infrastructure and boost demand for electric vehicles.

Uzbekistan, in turn, is actively pursuing the development of the market for electric vehicles and charging infrastructure, which demonstrates its dedication to sustainable and eco-friendly transportation. Despite these positive developments, Uzbekistan faces several challenges, including the need to modernize its energy infrastructure, make electric vehicles more economically viable, and raise public awareness about the benefits of using electric transportation.

5. Conclusion

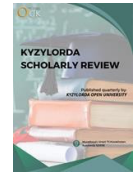
In conclusion, the development of electric transportation requires a coordinated effort from the government, private companies, and the general public. To ensure sustainable market growth, it is essential to address existing challenges related to infrastructure, energy supply, and economic viability of electric vehicles.

Introducing new technologies and optimizing charging infrastructure will be key factors in the successful transition to electric mobility.

For Uzbekistan, implementing strategies and programs to expand the network of charging stations can contribute to creating an efficient infrastructure for electric vehicles, which will help the country meet its goals of reducing CO₂ emissions and promoting sustainable development.

References

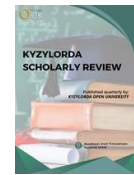
- [1] Abdurashidov I.Zh., Alimardanov R.A. (2025). "Comparative Analysis of WLTP and CLTC Test Cycles for Passenger Electric Vehicles: Features of Measurements and Unification of Indicators." *Research Focus International Scientific Journal*, vol. 3(12), pp. 41-48. Available at: <https://refocus.uz/index.php/1/article/view/1207>
- [2] Abdurashidov I.Zh., Mirzaliev S.M. (2024). Review analysis and comparison of operational characteristics of different models of electric vehicles: A case study of the Russian and Uzbek markets. *Journal of Transport Science and Technology*, Vol. 1(4), pp. 14–20.
- [3] Mirzaliev S.M., Abdurashidov I.Zh., "The Impact of Electric Vehicles on Transport Infrastructure," presented at the X International Scientific and Practical Conference "Scientific and Technical Aspects of the Development of the Motor Transport Complex" (correspondence and distance), held in conjunction with the 10th International Scientific Forum of the Donetsk People's Republic, May 31st, 2024, in Gorlovka.
- [4]
- [5] Abdurashidov I.Zh., Alimardanov R. A. (2021). Investigation of the effectiveness of automotive brake testing. *Scientific Journal*, 12(93)
- [6] Abdurashidov I.Zh., Ibrahimov K.I. (2021). Influence of dump truck operation conditions on their service life. In *International scientific and practical conference "Digital technologies, innovative ideas, and prospects for their application in production"* (Vol. 2, pp. 32–36).
- [7] Abdurashidov I.Zh., Kulmukhamedov D., Mirzarakhimov Sh. (2022). Additional device ANDAR for motor vehicle signaling. In *Republican*



- scientific and practical conference "Formation of skills for scientific and practical creativity among technical school graduates preparing for higher education" (pp. 72–74).
- [8] Abdurashidov I.Zh., Sharifbaeva K.Y. (2024). Research on the Efficiency of Different Energy Sources for Electric Vehicle Charging. International Conference on Thermal Engineering, 1(1)
- [9] Abdurazzakova D.A., Abdurashidov I.Zh., Alimardanov R.A. (2023). Digital Applications in Teaching Technical Disciplines. Internauka, 2, 225.
- [10] Highway. The number of electric vehicle chargers will increase sharply in Uzbekistan // Highway. – URL: https://www.autostrada.uz/pora-pokupat-elektromobil/?utm_source (date of access: 22.01.2025).
- [11] U.S. Environmental Protection Agency. Biden-Harris Administration Finalizes Strongest Ever Pollution Standards for Cars to Empower American Companies and Workers to Lead the Clean Transportation Future, Protect Public Health, Address the Climate Crisis, Save Drivers Money // U.S. Environmental Protection Agency. – 03.20.2024. – URL: <https://www.epa.gov/newsreleases/biden-harris-administration-finalizes-strongest-ever-pollution-standards-cars-position>
- [12] Alimardanov Ravshanjon, et al. (2023). "A Theoretical Study of Adaptation of the Engine Control System in Autotractor Machines Converted from Diesel to Compressed Natural Gas." Universum: Technical Sciences, no. 2-5 (107).
- [13] BloombergNEF. Battery pack prices slumped below \$100/kWh for the first time in 2020 while market average sits at \$137/kWh // BloombergNEF. – 2020. – URL: <https://about.bnef.com/blog/battery-pack-prices-cited-below-100-kwh-for-the-first-time-in-2020-while-market-average-sits-at-137-kwh/>
- [14] G.V. Babayan analyzed the impact of electric vehicle charging infrastructure on mass adoption of electric vehicles in major cities in the United States and Europe. His study was published in the Universum Scientific Journal in 2024 (Vol. 10, No. 127). (Babayan, 2024).
- [15] Bizek, D.K.U. Bizek_DKU_15_April.pdf // Wecoop. – April 15, 2021.
- [16] Business Insider. How Joe Biden Can Build 500,000 Electric Vehicle Charging Plugs by 2030 // Business Insider. – 2021.
- [17] Gazeta.uz. More than 32 thousand charging stations for electric vehicles will be installed in Uzbekistan by the end of 2025 // Gazeta.uz. – November 6, 2024.

- [18] Gazeta.uz. Separate accounts are planned for electric vehicle charging stations — RES // Gazeta.uz. – July 15, 2024. – URL: https://www.gazeta.uz/ru/2024/07/15/e-cars/?utm_source.
- [19] S.G. Ekubzanov., K.I. Ibrahimov., I.Zh. Abdurashidov., and M.M. Mirzaev, "Testing of the MAZ dump truck under hot climate conditions," Proceedings of the Republican Scientific and Practical Conference "Problems of Improving the Professional Skills of Workers to Ensure the Safety of Society," vol. 1, no. 1, pp. 211–216, 2021.
- [20] Zh.N. Yedgorov., R.A. Alimardanov., I.Zh. Abdurashidov., M.F. Kodirov, "Analysis of breakdowns and malfunctions of ISUZU buses operating in Tashkent," Universum: Technical Sciences: Electronic Scientific Journal, vol. 9(102), pp. 14–17, 2022.
- [21] European Parliament. Fit for 55: net zero CO₂ emissions for new cars and vans in 2035 // News of the European Parliament. – 14.02.2023.
- [22] Echarge Group (2024). The number of charging stations in China is close to 12 million. – Accessed: 22 January 2025. URL: <https://dzen.ru/a/Z0nVxYZiRwKj-JX5>
- [23] Ismatov A.A., Abdurashidov I.Zh., Yekubzhonov S.G. (2021). Analysis of ISUZU Bus Braking System Malfunctions During Operation. Scientific and Methodological Journal "Problems of Science", No. 5 (64), pp. 18–20.
- [24] Kulmukhamedov D.R., Abdurashidov I.Zh. (2023). Scientific Bases for Improving the Efficiency of Motor Vehicles in Hot Climate. 113th International Scientific and Technical Conference "Technical Regulation in the Field of Motor Vehicles", Moscow Region, Russia.
- [25] D.R. Kulmukhamedov., Sh.I. Erbekov., I.Zh. Abdurashidov., A.R. Saidumarov., S.K. Utaganov. "Research of Features and Typification in the Conditions of Operation of Motor Vehicles in the Hot-Dry Climate Region". MiTR 2022: International Scientific and Practical Conference, Nizhny Novgorod, 2022.
- [26] Zh.R. Kulmukhamedov., R.S. Khikmatov., A.R. Saidumarov., I.Zh. Abdurashidov. "Effective Power and Engine Torque as a Function of Ambient Temperature" // Scientific Journal of Vehicles and Roads. 2023, No. 2, pp. 43-50.
- [27] The number of electric vehicle charging stations in the Republic of Uzbekistan // Kursiv, April 22, 2024. URL: https://uz.kursiv.media/2024-04-22/skolko-v-uzbekistane-zaryadok-dlya-elektromobilej/?utm_source. International Energy Agency. URL: <https://www.iea.org/>

- [28] S.M. Mirzaliev and K.A. Sharipov. Modeling and Simulation of Hydraulic Load Sensing Proportional Valve PVG32 // Proceedings of the 104th International Scientific and Technical Conference on the Topic "Experience in Creating and Operating Automobile Transport in a Hot Climate". Tashkent, Uzbekistan, 2018. pp. 121-129.
- [29] S. M. Mirzaliyev., K. A. Sharipov., and Zh.Sh. Inoyatkhodjayev. Prospects for the Development of Cars Based on Renewable Energy Sources // International Conference on "Modern Technologies of Electric Vehicles Using New Energy Sources". Tashkent, Uzbekistan. 2019. pp. 26-29.
- [30] 28. "RenEn". The Number of Electric Vehicle Charging Points in China Exceeded 11.4 million in September. RenEn, 22 January 2023. URL: https://renewableenergy.com/ru/kolichestvo-tochek-zaryadki-elektromobilej-v-kr-prevysilo-11-4-milliona-po-itogam-sentyabrya/?utm_source.
- [31] Abdunabi Tajibaev., Ravshanjon Alimardanov., Iskandarbek Abdurashidov. Study of Failures of Isuzu Buses Operated in the City of Tashkent. Tashkent, Universum: Technical Sciences, 2023, No. 3-4 (108).
- [32] Kh. Ya. Sharifbaeva., I.Zh Abdurashidov. Prospects for Using Mobile Technologies in the Educational Process. 2021, No. 17-2 (120), pp. 85–87.
- [33] Kh. Y. Sharifbayeva., I.Zh. Abdurashidov. Experience of Training Teachers of Technical Disciplines in Leading Universities of the World. 2021 No. 7(110) pp. 27–29.
- [34] Kh.Ya.Sharifbaeva., I.Zh.Abdurashidov., R.A.Alimardanov. Opportunities and Prospects for the Development of Mobile Technologies in Higher Technical Education. Universum. Scientific Journal, 2022, 1(94).
- [35] Sharifbaeva K., et al. (2022). Formation of methodological competence among teachers of specialized subjects in technical universities. AIP Conference Proceedings, 2432(1).
- [36] Sharifbaeva K. Y. & Abdurashidov I.Zh., Alimardanov R.A. (2022). Training of road construction engineers. Universum: Technical Sciences, 94(1).
- [37] Sharifbaeva Kh.Ya., Abdurashidov I.Zh. General methodological training of teachers in specialized disciplines at technical universities. No. 23-3(101), pp. 49-51. (2020).
- [38] Sharifbaeva Kh. Ya & Abdurashidova, M. Zh (2024). Integrating strategies for developing STEM competencies in education: A



comprehensive analysis from primary to high school. *Economy and Society*, 116(1), 1673-1683.

- [39] Sharifbaeva Kh. Y. and Abdurashidova, M. J. (2024) Applying AI to Personalize the Training of University Students. *Universum: Technical Sciences*, 128(11).
- [40] Electric Vehicles and Peak Hours: How Will Charging Rates Change? // UZ24 - January 25, 2024 – URL: https://uz24.uz/ru/articles/charging-25-01-03?utm_source.
- [41] Yuz.Uz. Network of Charging Stations for Electric Vehicles Expands in Uzbekistan // Yuz.Uz – URL: https://yuz.uz/ru/news/v-uzbekistane-rasshryaetsya-set-zaryadnx-stantsiy-dlya-elektromobiley?utm_source