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Pakistan's Electric Vehicle Market: Challenges, Opportunities, and Future Pathways †

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Abstract: The electric vehicle (EV) market in Pakistan faces a blend of challenges and opportunities as it transitions towards a more sustainable future. The transport sector, a significant consumer of carbon-intensive fuels (gasoline, diesel, CNG), contributes substantially to global GHG (greenhouse gas) emissions. In Pakistan, the shift to EVs is driven by the need to curtail the high cost of imported fossil fuels and the need to reduce carbon emissions. In this backdrop, this study conducts a market assessment of major challenges and opportunities that exist for EV uptake while also developing decarbonization pathways through scenario-based modeling using the Low Emission Analysis Platform (LEAP). Through a mixed-method approach, this study reveals that the key hurdles include the lack of charging infrastructure, the high costs of EVs, limited domestic production, and insufficient public awareness. Overcoming these challenges requires coordinated efforts in policymaking, infrastructure development, and public education. The successful adoption of EVs promises enhanced energy security, reduced environmental impacts, and economic benefits through decreased oil imports and lower operational costs.

Keywords: electric vehicles; clean energy transition; climate action; energy security

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1. Introduction

In 2021, fossil fuels accounted for almost 95% of the total energy used in the transportation industry, as shown in Figure 1 [1]. The transport sector functions as a vital component within the global economy. It facilitates the physical movement of human capital and material resources, fostering economic integration across geographic boundaries. This interconnected network enables the efficient distribution of goods and services, contributing directly to global supply chain optimization and economic activity [2]. Business-as-usual (BAU) projections indicate a steady rise in energy consumption for transport, with fossil fuels such as gasoline and diesel dominating the mix.

EVs significantly reduce lifetime emissions as compared to gasoline vehicles. This benefit grows as countries transition to cleaner electricity, making EVs a future-proof technology that becomes greener alongside the grid, offering a crucial path for slashing transportation emissions. The transportation sector is a major contributor to global energy demand, and Pakistan is no exception.

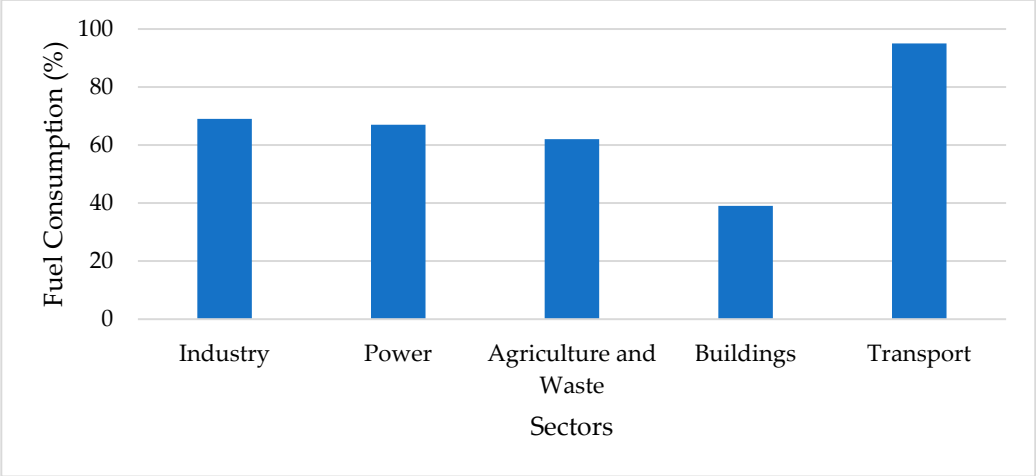

Figure 1. Total fuel consumption worldwide (2021).

1.1. Global Rise in EVs

The global transition to electric vehicles (EVs) is gaining momentum, with a staggering 14 million new EVs registered, bringing the world's total to 40 million. This represents a whopping 3.5 million increase from 2022, reflecting a robust 35% year-on-year growth and six-fold increase since 2018. Remarkably, weekly registrations in 2023 surpassed 250,000, exceeding even the total annual registrations observed in 2013. EVs also captured a significant share of the car market in 2023, accounting for around 18% of all cars sold globally. Battery electric vehicles (BEVs) dominated the electric car market, making up roughly 70% of the total EV stock in 2023.

China held a commanding position in the global EV market in 2023, capturing a massive 60% share of new registrations, which translates to 8.1 million new electric vehicles. This surging growth in EVs not only offset an 8% decline in conventional car sales but also propelled the overall Chinese car market to a 5% growth.

In the US, new EV registrations were 1.4 million, increasing by more than 40% compared to 2022. Although the relative annual growth in 2023 was slower than in the previous two years, the demand for EVs remained strong. With the revised qualifications for the Clean Vehicle Tax Credit, along with EV price cuts, some popular EV models became eligible for credit in 2023. For instance, the sales of Tesla Model Y increased by 50% compared to 2022 after it became eligible for the full USD 7500 tax credit [3].

In Europe, new EV registrations neared 3.2 million in 2023, increasing by 20% as compared to 2022 (Figure 2). Europe's strong pace of EV sales, similar to China's, indicates continued growth as markets mature. In 2023, numerous European countries achieved significant milestones.

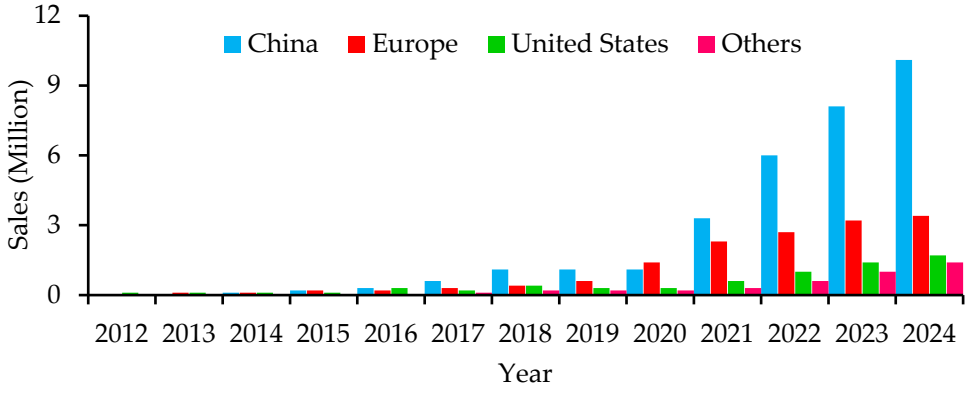

Figure 2. Global sales of EVs.

The electric vehicle (EV) market is experiencing a global boom, with Asia leading the charge. Countries like India, Thailand, and Vietnam saw explosive growth in 2023, fueled by government incentives, new EV models, and a rise in domestic production by Chinese automakers. Overall, the global EV market is on an exciting trajectory, but sustained growth will require addressing regional disparities and ongoing support for infrastructure and production [3].

1.2. Electrifying the Path to Net Zero

The Net Zero Emissions (NZE) by 2050 Scenario underscores the critical role of electric vehicles (EVs) in achieving net-zero emissions. Pakistan faces a significant challenge in achieving net-zero emissions. The country relies heavily on fossil fuels for its energy needs, leading to high air pollution levels and greenhouse gas emissions. Since transportation is a major source of greenhouse gas emissions and EVs do not produce CO_2, their widespread adoption is crucial. Achieving the Paris Agreement's ambitious net-zero emissions targets, 45% reduction by 2030 and net zero by 2050, requires an extensive makeover of the transportation industry [4]. Electrifying the transportation sector with EVs offers a game-changer for Pakistan's journey towards achieving NZE. EVs leave no harmful tailpipe emissions. This translates to cleaner air in urban areas, especially in the case of air pollutants including fine particulates such as $PM_{2.5}$ and carbon monoxide (CO). Additionally, EVs significantly reduce the overall greenhouse gas emissions that contribute to global warming and climate change. Pakistan can substantially reduce its reliance on imported fossil fuels by incorporating EVs into its own domestically produced electricity. This not only boosts energy security but also protects the country from the volatile swings in global oil prices. EVs can also contribute to a new domestic industry, creating jobs and boosting economic growth.

1.3. Pakistan's Fossil Fuel Dependency and Soaring Energy Bills

Pakistan's transportation industry accounts for a startling 30% of total energy consumption. The total energy consumption in 2022–2023 was 14.97 Mtoe (Figure 3) [5]. Pakistan relies significantly on transportation fuel imports, which cost USD 1.3 billion every month. With the rapid increase in the number of vehicles and motorcycles, the demand for fuel grows [6]. The country generates only a small amount of oil domestically, necessitating large imports of crude oil and other petroleum products. In FY2022, Pakistan's oil import bill increased by 95.9% to USD 17.03 billion from USD 8.69 billion the previous year. Higher global oil costs and the decreasing value of the Pakistani rupee also contributed to this surge. Furthermore, the value of imported petroleum products climbed by 121.15%, while the quantity increased by 24.18%. Crude oil imports also increased by 75.34% in value and 1.4% in quantity. Imports of liquefied natural gas (LNG) and liquefied petroleum gas (LPG) climbed by 82.90% and 39.86%, respectively, over the same time [7].

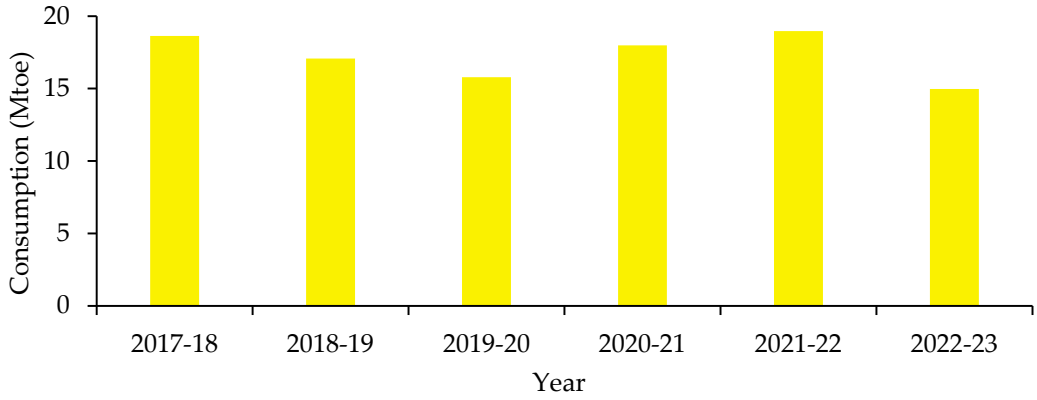

Figure 3. Total energy consumed by transport sector (2017–2023).

In the 2023 fiscal year, Pakistan imported 11.98 million tonnes of fossil fuels, valued at around USD 10.03 billion. The major imports were Motor Spirit (MS) and High-Speed Diesel (HSD), with quantities of 3.854 million tonnes and 1.646 million tonnes, respectively. The import value of these petroleum products declined by 7.23% compared to the previous year (2022). Additionally, Pakistan imported furnace oil (FO) worth USD 307.2 million during this period. However, a shift appears to be underway. During the first half of FY 2024 (July–March), Pakistan's reliance on fossil fuel imports seemed to be moderating. Compared to the same period in FY 2023, the import volume dipped by 8.2%, reaching 11.0 million tonnes in 2024. This decline was accompanied by a more substantial decrease in import value, which fell by 16.7% to USD 8.4 billion. Petroleum product consumption in 2023–2024 by the transport sector only was 79.40% [8].

Given the existing condition and rising energy consumption in the country, GHG emissions may exceed 281.8 MMT by 2035 [9]. Pakistan is heavily reliant on imported fossil fuels, which will result in climate change and global warming, and it is past time to address this critical socioeconomic issue. To address these challenges, a multifaceted approach is required, including regulatory changes, funding for environmentally friendly transportation options, and national and international collaboration to promote technology improvements [10,11]. Road transportation contributes 18% of Pakistan's total CO_2 emissions and is reliant on nonrenewable energy sources [12]. According to recent media reports, the Pakistani government plans to convert 90% of its fleet to electric vehicles by 2040 [13,14]. Switching to EVs can help lower the country's carbon footprint and improve air quality. Furthermore, decreasing reliance on imported fossil fuels will improve energy security, given the volatility of global oil prices. Economically, moving to EVs can reduce Pakistan's significant foreign exchange spending on oil imports, hence improving the trade balance and economic stability. EVs have lower operating and maintenance expenses, resulting in significant long-term savings.

1.4. Hurdles on the Road of Electrification

Under National Electric Vehicle Policy (NEVP), Pakistan has aimed to achieve an EV sale target of 30% by 2030 [15]. However, the country faces several challenges in its transition to EVs. These include a lack of charging stations, unclear government policies, limited domestic EV production, the high cost of EVs, and a lack of public awareness about EVs. Overcoming these challenges is crucial for Pakistan to achieve widespread EV adoption. The traditional automotive industry also exhibits a lack of preparedness for the EV revolution. The limited domestic production of EV models and a heavy reliance on imported technology hinder market expansion. High ownership costs are a major barrier to EV adoption in Pakistan. These challenges hinder the growth of Pakistan's EV market. To achieve widespread adoption, the country needs to develop targeted infrastructure, establish supportive policies, and encourage domestic EV production.

2. Methodology

This study employs a mixed-method approach to comprehensively assess the potential for electric vehicle (EV) adoption in Pakistan. This work utilizes the Low Emission Analysis Platform (LEAP) model for a quantitative assessment. The LEAP evaluates the social, economic, and energy demand impacts of EV penetration in Pakistan under various scenarios. These scenarios include a Reference (business-as-usual (BAU)), slow growth scenario (SGS), energy transition scenario (ETS), and an EV policy scenario (EPS). The description of each scenario is highlighted in Table 1.

Table 1. LEAP modeling scenarios.

Scenario	Description
BAU	Under the business-as-usual (BAU) scenario, the transport stock under different categories grows with historical trends. The model provides a baseline to measure the impact of EV penetrations at different growth levels.
EPS	The EPS projects the story in line with Pakistan's NEVP targets, aiming for 30% EV sales by 2030.
SGS	The slow growth scenario follows the trajectory to achieve a 10% share of EV sales by 2030.
ETS	This scenario follows the most idealistic scenario (based on expert consultations), aiming to achieve a share of EVs in line with IEA's net-zero pathway.

The modeling assumptions include the fuel economy, vehicle mileage, energy intensity, and associated costs, using data from 2020 to 2040. Qualitative analysis involves a detailed desk review of local and international transport sectors to identify challenges and priority actions. Additionally, consultative discussions, including public–private dialogues and key informant interviews with industry experts and policymakers, were conducted to gather insights on the readiness of the market and regulatory landscape for EVs in Pakistan. The two open consultative dialogues conducted for this study are as follows:

- Public–private dialogue on "Pakistan's Electric Vehicle Market: Challenges, Opportunities, and the 2030 Agenda".
- Webinar on "Market preparedness and policy support for Electric Vehicles (EVs) in Pakistan".

Under LEAP modeling, 2021 is taken as the base year, while 2040 is taken as the end year. The model development process consists of the following: (i) base year data collection, (ii) the designing of scenarios and assumption settings, (iii) model development and validation, and (iv) analyzing the results and insights. The key data inputs further attached as Supplementary Material include the following: (i) vehicle stock under different categories, (ii) vehicle mileage and the category of fuel consumption, (iii) the emission intensity of different fuel categories, (iv) the annual capital and operational expenditure of different vehicle categories, (v) the annual travel of each category, and (vi) load factors.

3. Results, Discussion, and Policy Recommendations

The results obtained in this study are grouped into two key segments: (i) the LEAP modeling results and decarbonization pathways and (ii) the results obtained from policy analysis and the market survey which highlights proposed measures that can expedite the EV uptake in Pakistan.

Energy Demand Growth under Different Scenarios

The growth of energy demand under different scenarios is highlighted in Figure 4.

Figure 4 indicates that under BAU conditions, the demand of energy from the transport sector is set to rise from around 14.9 millions of tons of oil equivalent (Mtoe) in 2020 to 19.9 Mtoe in 2030 and 26.5 Mtoe in 2040. With different penetration rates of EVs (as per scenarios), the demand by 2040 may vary from 19.8 Mtoe to 26.1 Mtoe. The EV policy scenario indicates that following the provisions mentioned under Pakistan's National Electric Vehicle Policy (NEVP), there is potential to reduce the annual energy consumption of the transport sector by 300 ktoe. Cumulatively, this leads to energy savings of over 2000 ktoe by 2030 and 5000 ktoe by 2050. The ETS indicates the highest energy saving potential by limiting the energy demand to 17.4 Mtoe until 2030 and over 19.8 Mtoe until 2040. This translates to a total energy reduction of 12.5 Mtoe by 2030 and 58.7 Mtoe by 2040. This scenario, however, goes beyond just the penetration of EVs to also betterment in the efficiency of fuel consumption, transition towards MTSs (mass transit systems), and the freight transport shift from roads to railways in Pakistan.

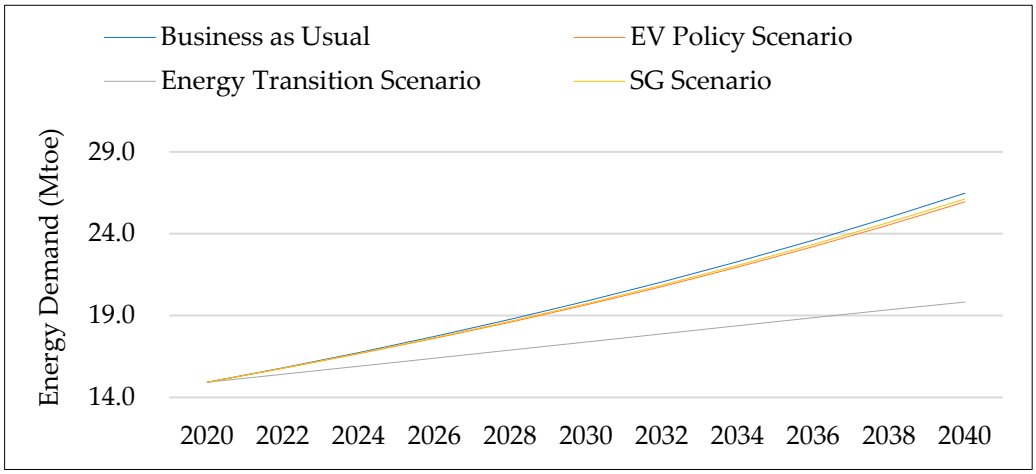

Figure 4. Energy demand growth from transport sector under different scenarios.

While the widespread adoption of EVs would likely lead to increased overall electricity consumption in Pakistan, this would be offset by a significant decrease in the consumption of petrol and diesel. While Pakistan's electricity production currently relies heavily on fossil fuels, the widespread adoption of EVs might not contribute to a significant reduction in oil imports. Therefore, a synchronized approach promoting EV penetration alongside a shift towards renewable energy sources for national electricity production can lead to a substantial decrease in Pakistan's oil import bill. The stock of EVs in the base year consumed a mere 80 GWh of electricity. Under different scenarios, the consumption could increase to a maximum of 115,000 MWh and 152,000 MWh by 2030 and 2040, respectively. The NEVP scenario represents the highest demand, driven by the high penetration of EVs. In the energy transition scenario, the demand is lower given the low travel requirement due to the shift from road to rail transport and the increased use of mass transit systems. Similarly, the consumption of diesel and petrol in the energy transition scenario would decrease to 1.10 and 1.83 Mtoe lower than in the BAU scenario, which indicates that the proposed measures could lead to a cumulative reduction in petrol consumption by 1 Mtoe and 5.7 Mtoe by 2030 and 2040, respectively, and 0.6 Mtoe and 3.1 Mtoe for diesel.

4. Cost Trends under Different Scenarios

Figure 5 describes the operating cost of Pakistan's transport sector under different scenarios.

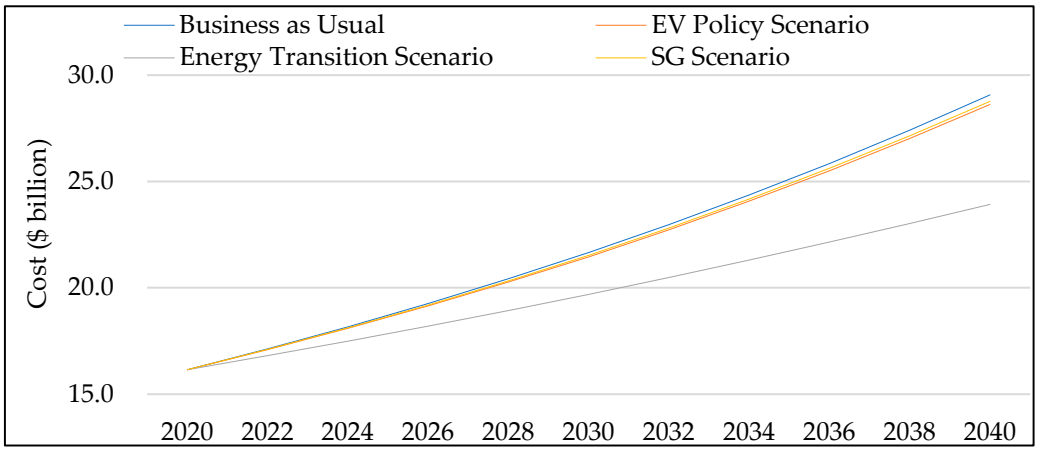

Figure 5. Operational cost of Pakistan's transport sector under different scenarios.

Based on Figure 5, the running cost of the transport sector of Pakistan is projected to increase to USD 16 billion in 2020 to around USD 29.1 billion by 2040. Under the EV policy scenario, a reduction of 200 million and 500 million can be achieved by 2030 and 2040, respectively. This indicates cumulative cost savings of USD 1.2 billion by 2030 and 4.3 billion by 2040. Since cost savings are directly linked to energy savings, the energy transition scenario shows the highest percentage savings, with costs rising to USD 19.7 billion by 2030 and USD 23.9 billion by 2040. These figures are considerably lower than the corresponding values of USD 21.7 billion and USD 29.1 billion under the BAU scenario for the same years. In this energy transition scenario, the cumulative savings are projected to reach approximately USD 10.2 billion by 2030 and USD 45.9 billion by 2040.

5. Environmental Profiles under Different Scenarios

The environmental profiles of difference scenarios are indicated in Figure 6. It is evident that the emissions from Pakistan's transport sector are expected to rise from 59300 kt in 2020 to 78,900 kt in 2030 and 105.3 Mt in 2040. Under different scenarios of EV penetration, these emissions could be limited between 75.8 Mt and 102 Mt by 2040. Under the EV policy scenario, these emissions would increase to 76.8 Mt in 2030 and 100.4 Mt in 2040. This indicates that following the provision of NEVP could lead to cumulative emission reductions of 24 Mt. The highest difference was indicated in the energy transition scenario where the emissions are limited to 67.5 and 75.8 Mt by 2030 and 2040, respectively. Collectively, this indicates an emission reduction potential of around 140 Mt.

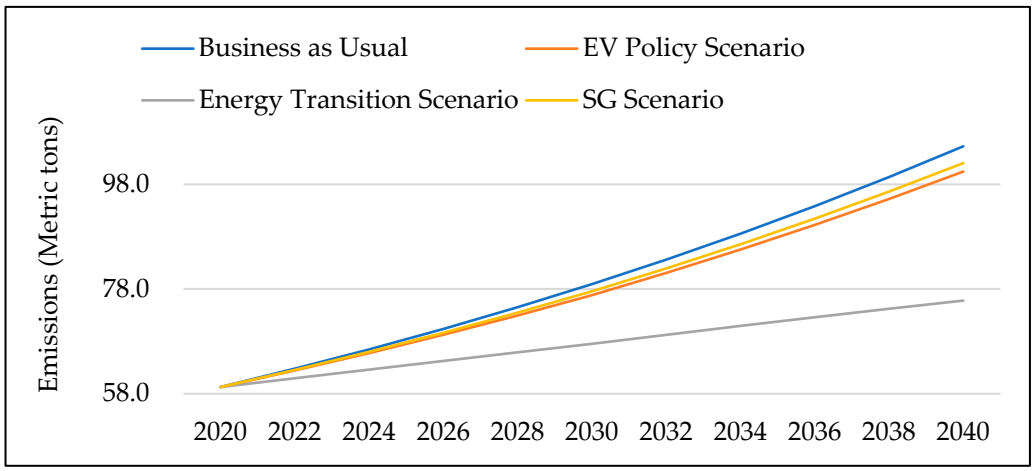

Figure 6. Environmental profile of transport sector under different scenarios.

The results and data trends highlighted above provide an indication of different trajectories of economics, emissions, and energy consumption with varying EV uptakes. However, based on the status quo, these scenarios do appear to be ambitious as limited growth has been observed around the EV market in the past 3–4 years. Addressing these ongoing challenges necessitates a coordinated response from all stakeholders in the value chain, particularly the supporting frameworks. Given this, the following key policy recommendations are proposed to accelerate the adoption of electric vehicles (EVs) in Pakistan and pave the way forward, especially in charting the 2030 agenda. These recommendations aim to address crucial aspects such as infrastructure development, incentivization schemes, regulatory frameworks, and local manufacturing.

- Pakistan should utilize its strategic position within the China–Pakistan Economic Corridor (CPEC) to establish local cell manufacturing capability, capitalizing on incentives available from China. To achieve this, it is essential for the government to facilitate a Government-to-Government (G2G) collaboration either through the CPEC or other bilateral relationships. Such a collaboration should aim to establish the necessary infrastructure for cell manufacturing. The successful example of Thailand's cell factory

underscores the feasibility and benefits of such an initiative. By developing local cell manufacturing capability, Pakistan can significantly enhance its manufacturing sector, particularly benefiting the 37–38 manufacturers licensed for 2–3 wheelers.

- Pakistan urgently needs an integrated energy plan that not only addresses energy challenges but also makes a strong economic case for the adoption of EVs. An integrated approach, starting from sourcing raw materials such as cobalt and lithium for batteries up to addressing market vulnerabilities and challenges, is paramount. Moreover, it is imperative to direct initial investments towards developing the assembly line and supply chain for EV production.
- There is a need for collaborative efforts between distribution companies, the power division and regulatory authorities like National Power Regulatory Authority (NEPRA), to facilitate the transition to EVs. Firstly, distribution companies must prioritize the establishment of charging infrastructure in cities and on highways. They should streamline processes to expedite the installation of transformers and provide priority access to connections for EV charging. Secondly, NEPRA needs to expand its role beyond tariff regulation and actively support utility companies.
- The Ministry of Climate Change and relevant stakeholders should collaborate to develop incentives and subsidies to offset the initial higher costs of EVs, particularly focusing on reducing the burden of battery imports. This may include tax breaks, rebates, or grants to encourage consumers and businesses to switch to EVs. Furthermore, strategic partnerships with battery manufacturers and technology companies should be explored to facilitate the development of local battery manufacturing capabilities, reducing dependency on imports and stimulating economic growth.
- The Ministry of Petroleum should formulate a policy to mandate the installation of charging stations at each filling station nationwide. Incentives and subsidies should be provided to encourage filling station owners to invest in charging infrastructure. This may include tax incentives, grants, or low-interest loans to offset the costs associated with installation and operation. Furthermore, public–private partnerships should be encouraged to expedite the deployment of charging stations, leveraging the expertise and resources of both government and private entities.
- The establishment of a Motor Institute and multiple manufacturing facilities for lithium batteries is imperative to reduce dependency on imported parts. The government should allocate resources to establish a Motor Institute aimed at the research, development, and production of BLDC motors, controllers, and other essential EV components. This institute will serve as a hub for innovation and technological advancement in the EV sector, enabling Pakistan to develop its own indigenous EV technology.
- It is recommended to regulate unit pricing for electricity at charging stations. Currently, many Oil Marketing Companies (OMCs) operate on a cost-plus-pricing model for electricity, which may deter potential EV owners due to high charging costs. Introducing subsidies or regulatory measures to control unit pricing for electricity at EV stations can alleviate this burden and encourage more individuals to adopt EVs. The government should consider implementing subsidies or tax incentives for OMCs or charging station operators to ensure affordable electricity rates for EV charging.
- Training programs should be established to develop a skilled workforce capable of supporting the growing EV industry in Pakistan. This includes providing technical training for the manufacturing, maintenance, and repair of EV components.
- A robust recycling system for EV batteries is crucial for environmental sustainability. The government should collaborate with industry stakeholders to develop a comprehensive plan for collecting, processing, and recycling used EV batteries.
- Standardized charging connectors and protocols are essential for interoperability and user convenience. Pakistan should adopt international standards for charging infrastructure to ensure a smooth transition to EVs.

6. Conclusions

This study highlights the critical role of electric vehicles in the decarbonization of Pakistan's transport sector while at the same time ensuring economic and energy sustainability due to the high reliance of the country on imported fossil fuels. Using a mixed-method approach, this study reveals that while Pakistan's NEVP targets are highly ambitious, providing policy and regulatory support to achieve them could lead to substantial energy and cost savings while at the same time reducing the emissions footprint of the sector. However, bringing policy consistency, addressing current challenges, and providing an enabling environment to investors are critical. Long-term planning while exploring alternate financing mechanisms that can mobilize necessary funding to support EV transition remain critical. The journey ahead requires sustained commitment and collaboration, but the potential benefits for the environment, economy, and society are profound. This study also recommends conducting a comprehensive wheel-to-wheel analysis for assessing energy consumption from different transport categories in Pakistan.

Supplementary Materials: The supporting information can be downloaded at https://sdpi.org/market-preparedness-and-socio-economic-prospects-of-electric-vehicles-in-pakistan/publication_detail (accessed on 12 March 2024), LEAP model data sets.

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References

1. Statista Research Department. Share of Fossil Fuels in Total Fuel Consumption Worldwide in 2021, by Sector. Available online: https://www.statista.com/statistics/1451665/global-fossil-fuel-share-in-total-energy-consumption-by-sector/#:~:text=The%20global%20transportation%20sector%20has,was%20derived%20from%20fossil%20energy (accessed on 5 July 2024).
2. Gnann, T.; Stephens, T.S.; Lin, Z.; Plötz, P.; Liu, C.; Brokate, J. What drives the market for plug-in electric vehicles?—A review of international PEV market diffusion models. *Renew. Sustain. Energy Rev.* **2018**, *93*, 158–164. [CrossRef]
3. International Energy Agency. Global EV Outlook. 2024. Available online: https://www.iea.org/reports/global-ev-outlook-2024/trends-in-electric-cars (accessed on 10 January 2024).
4. Internationl Energy Agency. *Net Zero Roadmap*; Internationl Energy Agency: Paris, France, 2023.
5. Ministry of Energy (Petroleum Division). *Pakistan Energy Yearbook 2022-23*; Ministry of Energy: Islamabad, Pakistan, 2024.
6. National Energy Efficiency and Conservation Authority (NEECA). The Problem: Energy Consumption and Environmental Impact. Available online: https://neeca.gov.pk/Detail/ZmZmZTkzNmItNTkzOC00MTJmLTkyOTctOWE1YjJmN2FhZTVk#:~:text=The%20transport%20sector%20in%20our,for%20fuel%20continues%20to%20grow (accessed on 26 June 2023).
7. Kiraz, G.; Bali, J.; Forness, P. (Eds.) Chapter 14. In *2 Maccabees According to the Syriac Peshitta Version with English Translation*; Gorgias Press: Piscataway, NJ, USA, 2022; pp. 20–25. [CrossRef]
8. Chapter 14. In *The Story of Apollonius, King of Tyre": A Commentary*; De Gruyter: Berlin, Germany, 2012; pp. 214–224. [CrossRef]
9. Asim, M.; Usman, M.; Abbasi, M.S.; Ahmad, S.; Mujtaba, M.A.; Soudagar ME, M.; Mohamed, A. Estimating the Long-Term Effects of National and International Sustainable Transport Policies on Energy Consumption and Emissions of Road Transport Sector of Pakistan. *Sustainability* **2022**, *14*, 5732. [CrossRef]
10. Javid, M.A.; Abdullah, M.; Ali, N.; Shah SA, H.; Joyklad, P.; Hussain, Q.; Chaiyasarn, K. Extracting Travelers' Preferences toward Electric Vehicles Using the Theory of Planned Behavior in Lahore, Pakistan. *Sustainability* **2022**, *14*, 1909. [CrossRef]

11. Kumar, R.; Kanwal, A.; Asim, M.; Pervez, M.; Mujtaba, M.A.; Fouad, Y.; Kalam, M.A. Transforming the transportation sector: Mitigating greenhouse gas emissions through electric vehicles (EVs) and exploring sustainable pathways. *AIP Adv.* **2024**, *14*, 035320. [CrossRef]
12. Rasool, Y.; Zaidi, S.A.H.; Zafar, M.W. Determinants of carbon emissions in Pakistan's transport sector. *Environ. Sci. Pollut. Res.* **2019**, *26*, 22907–22921. [CrossRef] [PubMed]
13. Malik, F.H.; Haider, Z.M.; Ali, S.; Akram, S.; Khalid, M.; Dagher, S. What is Stopping EVs? A Different Approach to Analyze the Challenges. In Proceedings of the 2023 International Conference on Emerging Power Technologies (ICEPT), Topi, Pakistan, 6–7 May 2023. Available online: https://ieeexplore.ieee.org/abstract/document/10152321 (accessed on 15 January 2024).
14. Nadeem, A.; Rossi, M.; Corradi, E.; Jin, L.; Comodi, G.; Nadeem, A.S. Energy-Environmental Planning of Electric Vehicles (EVs): A Case Study of the National Energy System of Pakistan. *Energies* **2022**, *15*, 54. [CrossRef]
15. Ministry of Climate Change, Government of Pakistan Electric Vehicle Policy of Pakistan. 2019. Available online: https://mocc.gov.pk/SiteImage/Policy/EV%20Policy%20Final.pdf (accessed on 8 July 2024).