

Current State and Energy Policy Roadmap for Sustainable Adoption of Electric Vehicles in Nepal

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Received: 22 December 2024

Accepted: 23 May 2025

DOI: <https://doi.org/10.32479/ijeep.18634>

ABSTRACT

The transportation sector in Nepal predominantly relies on internal combustion engine vehicles, is a major contributor to greenhouse gas emissions. Despite this, electric vehicle (EV) adoption has shown significant growth, with increasing registrations of two/three-wheelers, cars, and buses. This study provides a comprehensive analysis of the current state of EV in Nepal, identifying barriers to adoption and evaluating gaps in existing policies. The methodology encompasses a policy overview, data collection through surveys and workshops, stakeholder mapping, and focal group discussions to analyze barriers and propose actionable solutions. The total registered vehicles reached 5,526,192 by mid-March 2024, with a 10% compounded annual growth rate (CAGR) from 2020, where motorcycles dominate with an 81% share. Electric vehicle imports increased by more than 75,000 units since 2020, demonstrating a 70% CAGR, with forecasts projecting 205,562 EV by 2045 at a 14% CAGR. Charging infrastructure expanded to over 600 stations by mid-March 2025, growing at 20% annually. Government policies show inconsistencies, with recent changes including a 5% increase in excise duty for vehicles up to 50 kW capacity and reduced financing limits from 80% to 60%, while simultaneously increasing financing limits for conventional vehicles from 50% to 60% in 2025. However, inconsistent fiscal policies, such as fluctuating custom, excise duties and reduced financing limits for EV, alongside persistent technical, infrastructural, and financial barriers, hinder progress. This study recommends an effective action plan to harmonize fiscal policies, expand infrastructure, and enhance financial accessibility for EV, providing a roadmap for policymakers to foster widespread adoption and achieve long-term sustainability goals in Nepal's transportation sector.

Keywords: Electric Vehicle, Charging Station, Barriers, Vehicle Tax

JEL Classifications: L94, L98, O18, P28, P48

1. INTRODUCTION

The transportation sector in Nepal predominantly relies on internal combustion engine vehicles, including motorcycles, cars, buses, and trucks, which constitute the primary mobility modes nationwide. The transportation sector is major contributors to greenhouse gas (GHG) emissions in Nepal. Electric vehicle (EV) penetration in Nepal has demonstrated a significant upward trajectory, with registration of variety of EV including two/three-wheelers, cars/jeep/van, and buses. Nepal has implemented a series of progressive policies to promote the sustainable adoption of EV, including the National Action Plan for Electric

Mobility-2018 (GGGI, 2018), Environmentally Friendly Transport Policy (2014) (MoPIT, 2014), Nepal's Long-term Strategy for Net Zero Emission, 2045 (Government of Nepal, 2021), and Second Nationally Determined Contribution -2020 (Government of Nepal, 2020). These policies support Nepal's commitment to reducing fossil fuel dependency and fostering a transition to low-carbon transportation. Nepal's abundant hydropower resources and accelerating urbanization create a strategic opportunity for transitioning to a sustainable transportation system. However, this shift demands comprehensive energy policies addressing existing regulatory gaps, implementation barriers, and strategic frameworks to facilitate widespread EV adoption.

The transport sector in Nepal is dominated by road transport, which accounts for about 90% of all trips (Acharya et al., 2015). Nepal's vehicle registration reached 5,526,192 as of the fiscal year 2023/24 (mid-March), demonstrating a compound annual growth rate (CAGR) of 11% over the past five years (Ministry of Finance, 2024b). The majority of registered vehicles are two-wheelers, comprising approximately 81% of the total fleet, while four-wheelers car/jeep/van 6%. To meet the rising demand for transportation, Nepal has relied heavily on imported fossil fuels, which are subsidized, exerting considerable financial pressure on the national economy. In FY 2021/22, expenditure on imported petroleum products surged to NPR 292.77 billion, marking an 88.7% increase compared to the previous year. This dependence on fossil fuels has exacerbated the fiscal deficit, leading the government to promote EV adoption through various incentives and subsidies. Additionally, the emission from the transportation sector has also increase. In 2019, Nepal's energy sector emitted 17.18 million metric tons of CO₂ equivalent (MtCO₂eq), of which the transportation sector contributed 29.97%. The federal and provincial governments of Nepal have integrated EV-related policies into sectoral frameworks covering transportation, energy, and environment, emphasizing emission reduction through private sector engagement and phasing out high-polluting vehicles (Gentle and Mainaly, 2024). Nepal aims to reduce pollution by 2025 by monitoring emissions from waste, aging vehicles, and industrial sources (Singh et al., 2024). Key objectives include ensuring reliable clean energy supply, improving renewable energy accessibility, and enhancing EV infrastructure (Laudari et al., 2021). Stable fiscal policies aligned with Sustainable Development and Net Zero Emission targets are crucial for phasing out ICE vehicles (Rajbhandari et al., 2024). A multifaceted approach involving EV subsidies, vehicle conversion, reduced travel demand, and improved alternative transportation systems has been proposed (Shrestha and Rajbhandari, 2010). Nepal's Long-Term Strategy targets net-zero emissions by 2045 through clean energy trade, bold policymaking, and technological innovation (Lohani et al., 2023). However, current efforts toward low-emission development remain modest, requiring strengthened capacity and better preparation for effective policy implementation (Uprety and Chhetri, 2024).

Nepal, as a signatory to the Paris Agreement, has pledged to contribute to global efforts to limit temperature rise to 1.5°C by the end of the century. The government has submitted its second Nationally Determined Contribution (NDC), aiming to reduce greenhouse gas (GHG) emissions by 28% by 2030 through the promotion of EV. Additionally, the Long-Term Strategy for Net Zero Emissions (LT-LEDS) targets carbon neutrality by 2045, with a vision of achieving a 97% reduction in transport-related emissions by that year through widespread EV adoption. The Environmentally Friendly Transport Policy, 2014 establishes clear goals for EV adoption. By 2020, it aims to raise the proportion of ecologically friendly automobiles to at least 20% (MoPIT, 2014). EV are encouraged under the National Climate Policy, 2019 (MoFE, 2019a) and the National Environment Policy, 2019 (MoFE, 2019b). The first periodic plan for Bagmati Province encourages towns to build charging stations and promote EV. By 2028, it also aims to replace all petroleum-powered cars with EV in metropolitan areas, namely in the Kathmandu Valley, Chitwan, Hetauda and Dhulikhel,

Banepa, and Panauti (Province Government, Bagmati Province, 2019). To support this transition, Nepal has set an ambitious goal of increasing power generation capacity to 28,000 MW by 2035 (MoEWRI, 2025), as outlined in its Energy Development Roadmap 2025. The total domestic consumption in FY 2023/24 was 10,243 GWh, an increase by 9.46 % over the corresponding figure of 9,358 GWh in FY 2022/23 (Nepal Electricity Authority, 2024). Sectoral roadmaps are under development to enhance electricity consumption in the transportation sector, thereby reducing reliance on fossil fuels. This has directly led to increase in the number of EV in Nepal is continuously increasing with more than 75,000 EV imported in the country since 2020 (Department of Customs, 2024b). In the last fiscal year more than 45% of these vehicles were imported.

Despite increase in EV imports in Nepal faces a critical shortage of charging infrastructure, particularly along major highways, severely limiting long-distance travel capabilities for EV owners. The current concentration of charging stations in urban areas creates range anxiety for potential adopters, delaying widespread EV adoption across the country. Government incentives and tax exemptions for EV remain insufficient compared to other countries with successful EV markets, directly impacting consumer purchasing decisions and market growth. Implementation gaps in existing government policies and objectives have created barriers to EV adoption that require comprehensive analysis to develop an effective action plan for sustainable EV integration in Nepal.

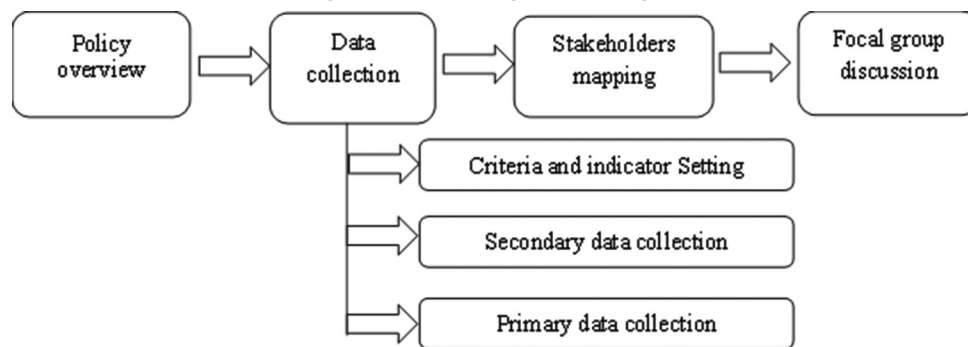
This study aims to provide a comprehensive analysis of the current status of EV in Nepal, identify key barriers hindering their adoption, and evaluate gaps in existing policies and government targets that have impeded effective implementation. By analyzing vehicle growth trends, including both electric and internal combustion engine vehicles, and examining EV import trends, this research aims to forecast the trajectory of EV adoption in Nepal up to 2045. Additionally, the study seeks to critically assess the government's tax structures and financial support policies for vehicle purchases, comparing the incentives for EV and conventional vehicles. Building on these analyses, the research intends to propose a robust and effective action plan to address existing gaps. Ultimately, this study aims to contribute to the formulation of evidence-based strategies that can accelerate the transition to a sustainable transportation ecosystem in the country.

2. METHODOLOGY AND DATA

This section outlines the methodological framework employed in this study to investigate vehicle growth, barriers, and gaps to EV promotion in Nepal, as well as to develop an action plan for promoting EV. The methodology is structured into four key components: policy overview, data collection, stakeholder mapping, and which is shown in Figure 1. Each component systematically addresses the research objectives and provides a comprehensive understanding of the challenges and opportunities associated with EV adoption in Nepal.

2.1. Policy Overview

The policy overview process forms the foundation of this study, providing a critical analysis of existing policies, strategies, and

Figure 1: Methodological flow diagram

trends related to EV adoption. The review encompasses two primary dimensions: international and national perspectives.

At the international level, the study examines key policies and strategies from developed countries and nations with high EV use, sales, and growth. This includes an analysis of fiscal incentives, regulatory frameworks, and infrastructure development initiatives that have successfully accelerated EV adoption. The insights from these countries serve as benchmarks for identifying best practices and potential strategies applicable to Nepal.

At the national level, the review focuses on Nepal's policy landscape, including the Second Nationally Determined Contribution (NDC), the National Action Plan for Electric Mobility, and Nepal's Long-Term Strategy for Net Zero Emissions. Additionally, the study analyzes vehicle growth scenarios, tax policies, and government financial incentives aimed at promoting EV. This dual focus ensures a comprehensive understanding of both global trends and local contexts, enabling the identification of gaps and opportunities in Nepal's EV promotion efforts.

2.2. Data Collection

The data collection process was designed to gather both primary and secondary data to address the research objectives. Prior to data collection, a structured approach was adopted to establish criteria and indicators through focal group discussions. These criteria and indicators were essential for guiding the data collection process and ensuring alignment with the study's objectives.

2.2.1. Criteria and indicator setting

To establish the criteria and indicators for data collection, focal group discussions were conducted in two distinct geographical locations: Malangawa and Jaleswor in Madhesh Province, and Bhairahawa in Lumbini Province, Nepal. These locations were selected to capture regional variations in EV adoption barriers and opportunities. The focal group discussion involved diverse participants, including EV users, policymakers, and representatives from the private sector. The discussions were facilitated to identify key barriers to EV adoption, such as infrastructure limitations, financial constraints, and policy gaps, as well as to define actionable indicators for promoting EV. The outcomes of these discussions informed the design of subsequent data collection tools and methodologies.

2.2.2. Secondary data collection

Secondary data were collected through surveys and questionnaires distributed to a broader audience, including EV users, dealers, and government officials. The survey instruments were designed based on the criteria and indicators established during the focal group discussion. The questionnaires focused on gathering quantitative data on EV adoption rates, user satisfaction, and perceived barriers. Secondary data sources also included government reports, academic publications, and industry analyses, which provided contextual information and validated the primary data findings.

2.2.3. Primary data collection

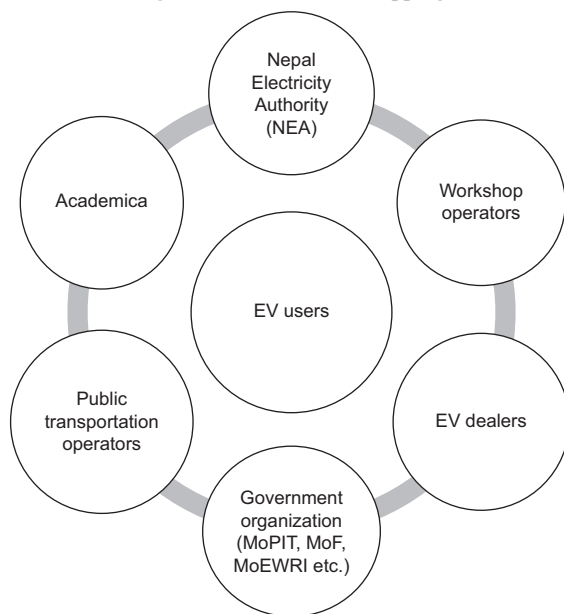
Primary data were collected through focal group discussions and workshops. The focal group discussion, as described above, were instrumental in identifying barriers and setting criteria. The focal group discussion engages diverse participants, including EV users, dealers, policymakers, and representatives from the Nepal Electricity Authority, with discussions structured around predefined criteria and indicators developed through an initial consultative process. While the primary objective of the focal group discussion is to identify barriers to EV adoption and gather insights for developing a national action plan, workshops are subsequently conducted to validate findings and engage stakeholders in refining the proposed action plan, providing a platform for collaborative problem-solving and ensuring recommendations are grounded in practical realities.

2.3. Stakeholder Mapping

Stakeholder mapping was conducted to identify key actors involved in the EV ecosystem and to define their roles and responsibilities. The objective of this mapping was to foster a collaborative approach to addressing EV adoption barriers and to ensure that the proposed action plan reflects the interests and capacities of all relevant stakeholders. The mapping exercise also facilitated the identification of potential partnerships and synergies, enabling a more coordinated and effective implementation of EV promotion strategies. The process involved engaging with a wide range of stakeholders, shown in Figure 2.

2.3.1. Focal group discussion

Focal group discussions were strategically conducted across locations, including Biratnagar, Janakpur, Jaleswor, Chandranigahapur, Birjung, Butwal, Dhangadi, and Baitadi. These locations were selected to ensure geographical representation across Nepal's diverse regions. The focal group discussion

Figure 2: Stakeholders mapping

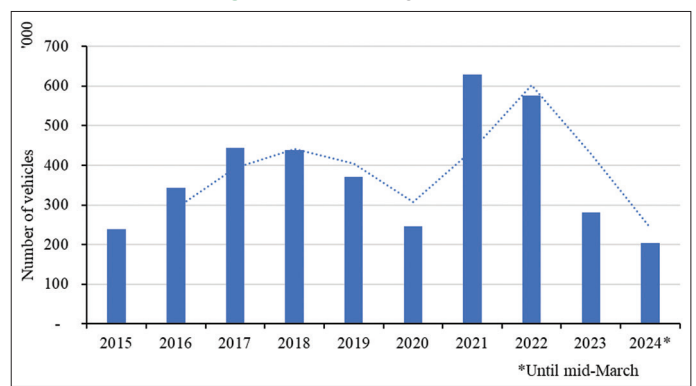
engaged participants from all previously mapped stakeholder groups, facilitating dialogue on region-specific challenges, policy implementation barriers, and potential solutions. The discussions were structured around three key themes: identifying adoption barriers, evaluating policy gaps, and formulating action plans. Data from these discussions were systematically coded and analyzed to identify recurring themes and regional variations in EV adoption challenges. These discussions provided critical insights into the challenges and opportunities within Nepal's EV ecosystem, enabling a comprehensive understanding of policy shortcomings and stakeholder perspectives. The findings from the focal group discussion were instrumental in formulating actionable recommendations to address barriers and enhance the adoption of EV in the country.

3. RESULTS AND DISCUSSION

3.1. Synopsis of Vehicle Growth

Vehicle registration in Nepal from 2015 to 2024 has exhibited significant fluctuations, reflecting varying economic, policy, and environmental factors, which are presented in Figure 3.

The registrations experienced significant spikes during 2015 and 2017., followed by a decline from 2018 to 2020, with sharp decreases occurring in 2020 (−34%), likely influenced by economic constraints and the COVID-19 pandemic. The total number of vehicles registered at the end of 2020 reached 3,836,502, demonstrating a compounded annual growth rate (CAGR) of 14% from 2015. Vehicle registrations peaked in 2021 at 629,339, marking a 157% surge, likely driven by post-pandemic recovery and eased import policies. The vehicle registration trend after 2021 is declining, and 2023 (−51%), attributed to economic constraints, pandemic, fuel price increases, and stricter import regulations. The registered vehicles at mid-March 2024 reached 5,526,192 (MoF, 2024b), demonstrating a compounded growth rate (CAGR) of 10% from 2020.

Figure 3: Vehicle registration

3.1.1. Share of registered vehicle

The data reveals a significant dominance of motorcycles, constituting 81% of total registered vehicles, reflecting their widespread use as a primary mode of transportation. Cars/Jeeps/Vans and Tractors/Power Tillers follow distantly at 6% and 3%, respectively, indicating moderate occurrence. Other categories, such as buses, minibuses/minitrucks, and e-rickshaws, each account for 1-2%, underscoring their special function. The minimal shares of microbuses and others vehicle (1%) highlight their limited presence in the vehicle fleet. The detailed share of different type of vehicle is shown in Figure 4.

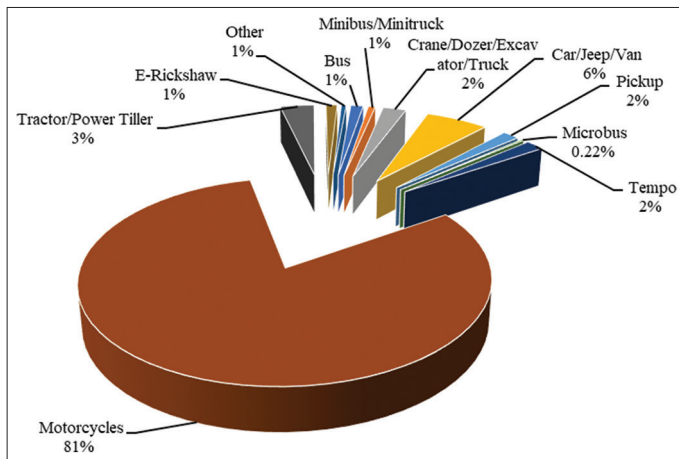
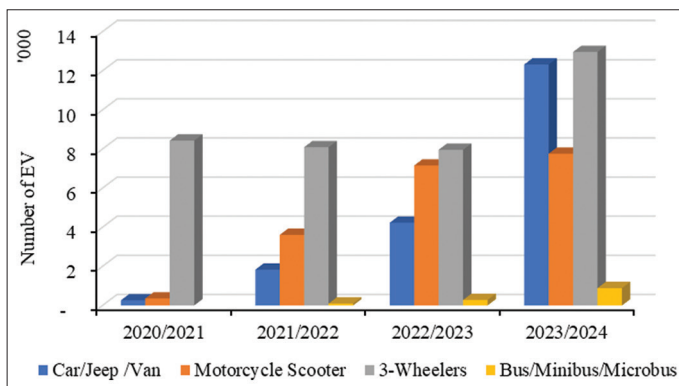
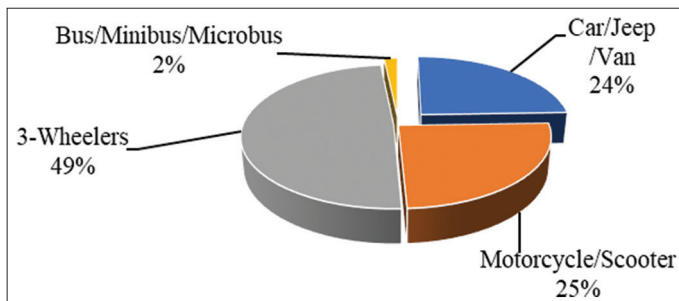
3.1.2. Electric vehicle import trend

Electric vehicle imports in Nepal have seen a significant upward trend in recent years. The details of the imported EV are shown in Figure 5. The import trend of EV in Nepal demonstrates a remarkable upward trajectory, with consistent and accelerating growth rates from 2021 to 2024. Starting at 9,052 units in 2021, EV imports surged by 51% in 2022, reaching 13,629 units, followed by a 44% increase in 2023, totaling 19,629 units (Department of Customs, 2024a). The most significant growth occurred in 2024, with a 73% rise to 33,928 units, reflecting a rapid adoption of EV driven by policy incentives, environmental awareness, and improving infrastructure. This trend underscores Nepal's shifting focus toward sustainable transportation solutions.

Based on analysis of four years import trend from 2020 to 2024, the EV imports in Nepal reveals a distinct distribution across vehicle types, which is shown in Figure 6. Three-wheelers dominating at 49% of the total share, reflecting their widespread use for short-distance transport and commercial purposes. Motorcycles and scooters follow closely at 25%, indicating their growing popularity as affordable and efficient personal mobility solutions. Cars/Jeeps/Vans account for 24%, highlighting increasing adoption among private vehicle users, while buses/minibuses/microbuses represent a minimal 2%, suggesting limited integration of electric technology in public transport. This distribution underscores the varying degrees of EV adoption across different segments of Nepal's transportation sector.

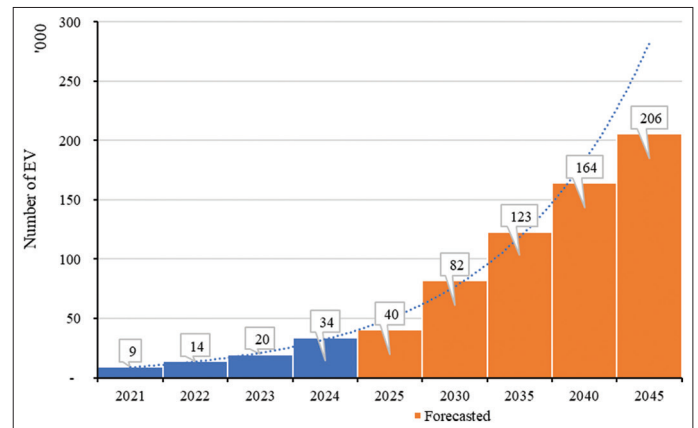
3.1.3. Projecting electric vehicle import trend in Nepal

The year-on-year growth in EV imports, from 9,052 units in 2020/2021 to 33,928 units in 2023/2024, reflects a broader trend towards sustainable transportation. As the infrastructure for EV,

Figure 4: Share of registered vehicle**Figure 5:** Electric vehicle import**Figure 6:** Electric vehicle share

such as charging stations, improves and the variety of available models increases, it is expected that this upward trend will continue, contributing to a greener and more sustainable future for Nepal. The number EV import growth up to 2045 is forecasted in excel using FORECASTED.ETS function which is shown in Figure 7.

The electric vehicle import trend in Nepal demonstrates a robust and accelerating growth trajectory from 2021 to 2024. Starting at 33,928 units in 2024 with a remarkable annual growth rate of 73%, the number of EV is projected to rise sharply to 40,471 by 2025, reflecting a 19% increase. This upward trend continues exponentially, with EV imports expected to reach 81,744 by 2030, marking a 102% growth over five years. By 2045, the figure is anticipated to surpass 205,562 units, albeit with a

Figure 7: Electric vehicles import growth up to 2045

gradually declining growth rate, stabilizing at 25%. This trend underscores Nepal's increasing adoption of EV, likely driven by policy incentives, environmental awareness, and advancements in EV infrastructure.

3.1.4. Charging station in Nepal

In Nepal, EV charging infrastructure development represents a coordinated public-private partnership approach. The Nepal Electricity Authority (NEA) and Sajha Yatayat have established strategic charging networks in urban centers and highway corridors, while automotive companies including TATA, BYD, MG, Hyundai, and KIA have deployed charging facilities to support their EV product lines. With the increase in EV imports, the NEA is planning to build 500 more charging stations, significantly expanding the national network. This collaborative effort between public and private stakeholders is crucial for building a robust EV ecosystem in Nepal. The details of the charging station installed by both government and private sector is shown in Figure 8.

The charging station infrastructure in Nepal has seen substantial contributions from both the government and private sectors, with more than 600 stations (Charging Station Nepal, 2024; Nepal Electricity Authority, 2024; TATA Motors, 2025) established nationwide. TATA Motors leads as the top installer, representing 27.14% of the total stations. CG follows closely with a 21.71% share, while the Nepal Electricity Authority (NEA) accounts for 10.20%. Private players such as BYD Motors, Hyundai, and KIA Motors also play significant roles, contributing 7.57%, 7.40%, and 4.93% of the charging stations, respectively. This collaborative effort highlights the growing emphasis on electric mobility in Nepal. The expansion pattern, as illustrated in the Figure 9, demonstrates a consistent yearly increase in the number of charging stations across Nepal.

The annual installation of charging stations in Nepal exhibits a steady upward trajectory, underscoring the nation's commitment to advancing electric mobility and sustainable transportation systems. Between 2022 and 2023, the growth rate surged by 31%, marking a substantial acceleration in infrastructure deployment. While the growth rate tapered to 20% in 2024, the persistent expansion reflects the concerted efforts of both public and private entities to facilitate EV adoption. This trend aligns

with Nepal's broader objectives of reducing carbon emissions and fostering energy transition, highlighting the critical role of charging infrastructure in enabling a sustainable transport ecosystem.

3.1.5. Vehicles tax scenario in Nepal

Nepal has progressively adjusted its tax policies on EV to promote sustainable transportation and reduce fossil fuel dependence. From fiscal years 2020/21 through 2024/25, the government has established variable custom and excise duty rates on imported electric cars, jeeps, and vans, classifying them according to motor capacity. The 2021/22 fiscal year marked a significant policy shift with the elimination of excise duties across all EV categories to stimulate adoption. However, subsequent fiscal periods, particularly 2023/24 and 2024/25, have witnessed substantial modifications to the tax framework, indicating evolving policy priorities in the EV sector. The details of taxes are illustrated in Figure 10.

Nepal's electric vehicle imports taxation reveals a nuanced policy evolution from 2020/21 to 2024/25, characterized by strategic duty modulation across vehicle capacity segments. Initial zero-excise incentives in 2021/22 transitioned to a differentiated tax structure, with custom duties ranging 10-80% and excise duties 0-60% based on vehicle kilowatt capacity (Department of Customs, 2021). In fiscal year 2023/24, Nepal implemented a progressed taxation structure for EV based on motor capacity. EV with 50 kW capacity maintained a 10% custom duty with 0% excise duty, while higher-capacity vehicles

faced progressive rate increases. Specifically, 50-100 kW EV incurred 15% custom and 10% excise duties; 101-200 kW models were subject to 20% custom and 20% excise duties; and vehicles exceeding 300 kW capacity attracted the highest rates at 60% for both custom and excise duties (Department of Customs, 2023). The 2024/25 fiscal year introduced further tax intensification across all categories, with 50 kW EV now subject to 15% custom and 5% excise duties, while vehicles exceeding 300 kW capacity face substantial 80% custom and 50% excise duties (Department of Customs, 2024a). This escalating taxation framework, particularly pronounced for high-capacity EV, indicates a strategic policy recalibration that aims to balance revenue generation with environmental objectives while potentially deterring importation of premium, high-powered EV. The tax structure for internal combustion engine (ICE) car/jeep/van is presented in Figure 11.

Nepal has maintained a progressive taxation framework for imported internal combustion engine (ICE) vehicles throughout fiscal years 2020/21 to 2024/25. For the most recent fiscal periods (2020/21 to 2024/25), the government has implemented a uniform 80% custom duty across all engine capacities, while employing a graduated excise duty structure correlated with engine size. Specifically, excise rates increase incrementally from 65% for smaller engines (1000-1500cc) to 105% for larger engines exceeding 3000cc, with intermediate rates of 75%, 85%, and 95% for the respective capacity categories. This taxation approach demonstrates a deliberate policy orientation toward discouraging higher-emission vehicles. The contrast becomes particularly evident

Figure 8: Charging station

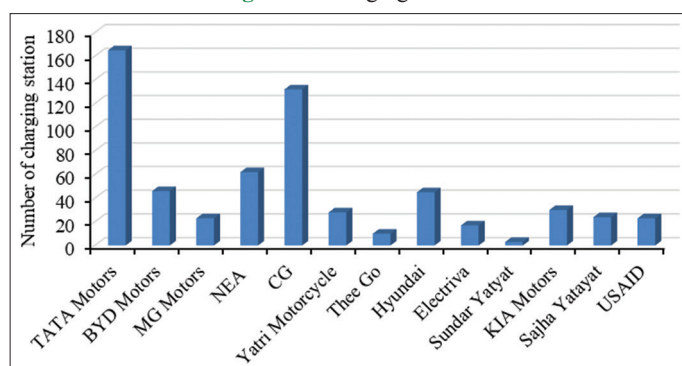


Figure 9: Yearly growth of charging station

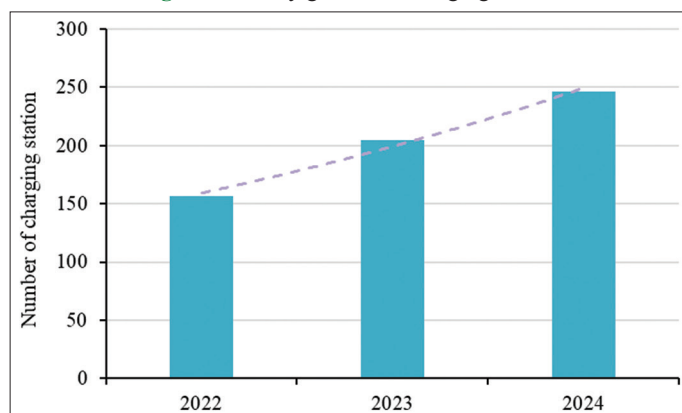


Figure 10: Electric vehicle tax structure

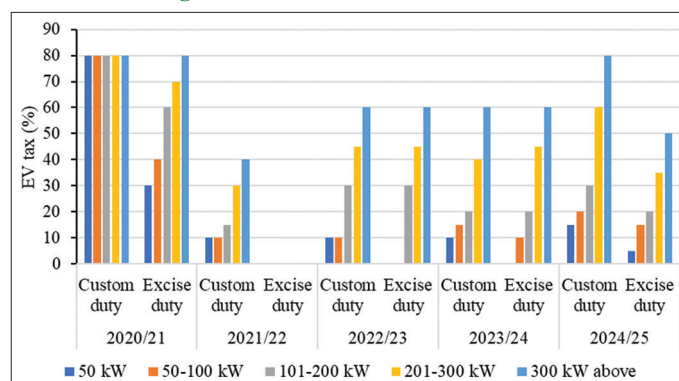
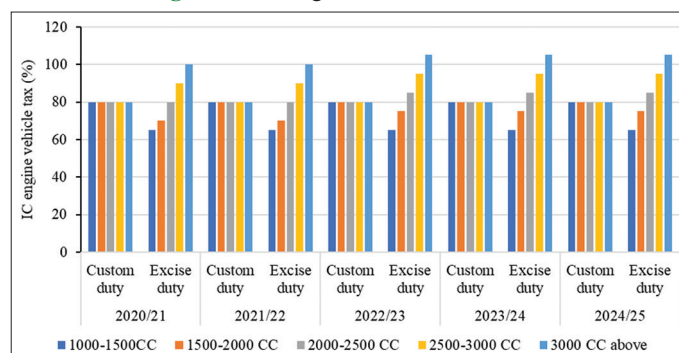


Figure 11: IC engine vehicle tax structure



when compared to the temporary elimination of excise duties for EV in fiscal year 2021/22, highlighting Nepal's strategic fiscal interventions aimed at promoting cleaner transportation alternatives while maintaining significant tax burdens on conventional fossil-fuel vehicles.

3.1.6. Analysis of government financing policy

The recent adjustment in Nepal Rastra Bank's (NRB) financing policy for vehicle purchases reflects a significant shift in the government's approach to promoting different types of vehicles. By reducing the loan-to-value (LTV) ratio for EV

from 80% to 60% while simultaneously increasing the LTV ratio for petrol and diesel vehicles from 50% to 60%, the policy appears to be moving away from incentivizing EV adoption. This change could have far-reaching implications for the automotive market and environmental goals. The reduced financial support for EV may discourage potential buyers due to higher upfront costs, potentially slowing the transition to cleaner transportation. Conversely, the increased financing limit for petrol and diesel vehicles could make them more accessible, potentially leading to a rise in sales of traditional vehicles and, consequently, higher carbon

Table 1: Government financing policy

Year	Policy's Objective/Programme	Financing Term	
		Electric Vehicle	Petrol/Diesel vehicle
2018/19	<ul style="list-style-type: none"> For private vehicles, the maximum financing limit has increased from 50% to 65% of the vehicle's valuation For personal electric vehicles, the financing limit is now 80% The financing limits are exempt for public transport vehicles (40 + seats) and those used for construction, education, health, or other service purposes (Nepal Rastra Bank, 2017) 	Up to 80% of quotation price	<ul style="list-style-type: none"> Up to 50% of quotation price (for personnel use) Up to 65% of quotation price (for business use)
2022/23	<ul style="list-style-type: none"> The LTV ratio for EV purchases remains unchanged. Refinancing facilities will be made available for loans designated for the establishment of EV charging stations (Nepal Rastra Bank, 2022) 	Up to 80% of quotation price	<ul style="list-style-type: none"> Up to 50% of quotation price (for personnel use) Up to 65% of quotation price (for business use)
2024/25	<ul style="list-style-type: none"> The LTV ratio limit has been established at 60% for personal vehicles This same 60% LTV ratio limit applies to all categories of EV (NRB, 2025) 	Up to 60% of quotation price	<ul style="list-style-type: none"> Up to 60% of quotation price

Table 2: SWOT analysis

Policies	Strength	Weakness	Opportunities	Threats
Second Nationally Determined Contribution (2020)	<ul style="list-style-type: none"> Clear targets for EV adoption (25% private and 20% public EV by 2025, 90% private and 60% public EV by 2030). Focus on clean energy expansion (15,000 MW by 2030). Includes electric rail network development (200 km by 2030) (Government of Nepal, 2020) 	<ul style="list-style-type: none"> Ambitious targets may be challenging to achieve due to infrastructure and financial constraints. Lack of detailed implementation plans for EV adoption Limited focus on rural areas and affordability of EV 	<ul style="list-style-type: none"> Growing global EV market can reduce costs and improve technology Potential for international funding and partnerships. Rising public awareness of climate change and clean energy benefits 	<ul style="list-style-type: none"> Dependence on imported EV and batteries may increase costs. Inconsistent policy implementation and bureaucratic delays Competing priorities in national budgets may limit funding for EV promotion
National Action Plan for Electric Mobility (2018)	<ul style="list-style-type: none"> Aims to cut fossil fuel use by half by 2050 Proposes establishment of dedicated institutions (taskforce, financing vehicle) for e-mobility Focus on legislative support and public awareness (Global Green Growth Institute, 2018) 	<ul style="list-style-type: none"> Lack of clear timelines and measurable targets Limited progress in establishing dedicated institutions Insufficient focus on charging infrastructure development 	<ul style="list-style-type: none"> Collaboration with private sector can drive innovation and investment. Potential for job creation in EV manufacturing and maintenance. Growing interest in green financing and sustainable development 	<ul style="list-style-type: none"> Limited private sector participation due to high initial cost Policy stagnation due to political instability Lack of skilled workforce for EV maintenance and infrastructure development
Nepal's Long-Term Strategy for Net-Zero Emission	<ul style="list-style-type: none"> Ambitious target of net-zero emissions by 2045 Focus on clean energy transition across all sectors Emphasis on decarbonizing transportation and promoting clean fuels (Government of Nepal, 2021) 	<ul style="list-style-type: none"> Long-term targets may lack short-term actionable steps. Limited focus on EV affordability and accessibility for low-income groups. Insufficient details on financing mechanisms for clean energy 	<ul style="list-style-type: none"> Global climate funding and carbon credit mechanisms can support implementation. Technological advancements can reduce costs of clean energy and EV Potential for regional cooperation in clean energy 	<ul style="list-style-type: none"> Economic challenges and competing priorities may divert resources from long-term climate goals Reliance on international funding may lead to delays Resistance from fossil fuel-dependent industries and stakeholders

Table 3: Barrier's analysis

Category	Barriers	Description
Technical Barriers	Limited Range	EV have restricted travel distance per charge, limiting long-distance usability
	Lack of evidence on reliability and performance	There is a lack of empirical evidence on the reliability and performance of EV under local conditions, which diminishes consumer confidence
	Limited battery life	Batteries degrade over time, reducing vehicle performance and increasing long-term costs
Economic Barriers	Skilled technician shortage	The scarcity of trained technicians for EV maintenance and repair
	High purchase cost	EV are more expensive upfront compared to internal combustion engine vehicles
	Battery replacement cost	High costs associated with replacing EV batteries after their lifespan ends
Infrastructure Barriers	Absence of tax exemption	Lack of annual tax exemptions for EV, lower incentives to switch to EV
	Lack of charging station	Insufficient charging infrastructure to support widespread EV adoption
	Lack of repair and maintenance workshops	Few facilities equipped to handle EV-specific repairs and maintenance
	Lack of domestic industry	No local manufacturing or assembly of EV, increasing dependency on imports
Financing and Investment Barriers	Limited investment in EV infrastructure	Investors are hesitant due to perceived risks and uncertain returns
	Absence of government incentives	No large-scale subsidies or incentives to encourage EV purchases
	Inadequate financing mechanisms	Absence of innovative financing options, such as green loans or leasing models, further restricts EV accessibility for consumers
Policy Barriers	Gaps in policy implementation	Some policies are comprehensive but not effectively operationalized
	Absence of long-term EV planning and goals	No clear roadmap or vision for EV integration into the transportation system
	Lack of regulation and standards for EV	Absence of standardized guidelines for EV manufacturing, safety, and performance
	Lack of coordination among key stakeholders	No framework to facilitate the transition from traditional vehicles to EV
	Lack of policy to support conversion of IC engine to EV	Absence of standardized guidelines for EV manufacturing, safety, and performance

emissions. This policy shift has sparked debate among stakeholders, with environmentalists likely concerned about its impact on sustainability goals, while traditional automakers may welcome the eased financing for fossil-fuel vehicles. The details of the policy and financing term is presented in Table 3.

3.1.7. SWOT analysis of different policies

Nepal has implemented strategic policies to advance sustainable transportation, primarily through EV adoption, as part of its commitment to greenhouse gas reduction and net-zero emission targets. These initiatives include the Second Nationally Determined Contribution (NDC), National Electric Mobility Action Plan 2018, and Nepal's Long-Term Strategy for Net-Zero Emission. The SWOT analysis, presented in the table below, will provide a comprehensive understanding of their effectiveness, challenges, and potential contributions to Nepal's sustainable development objectives. Table 2 illustrate the SWOT analysis of Nepal's key policies promoting EV.

3.1.8. Analyzing barriers to electric vehicle integration in Nepal

The adoption of electric vehicles (EV) in Nepal faces several barriers across technical, economic, infrastructure, financing, and policy domains. These barriers collectively hinder the widespread integration of EV into the transportation sector. Table 3 shows detailed analysis of these challenges:

3.1.9. Action plan for promotion of electric vehicles

A comprehensive action plan for Nepal's electric vehicle (EV) transition integrates infrastructure development, fiscal incentives, and public education initiatives. Key interventions include establishing charging station standards, providing financial subsidies, retrofitting conventional vehicles, implementing governmental EV mandates, developing maintenance facilities, and instituting regulatory frameworks for battery recycling and climate finance mechanisms. The details of the action plan is shown in Table 4.

Table 6. Action plan

Category	Actions	Targets	Responsible Organization
Infrastructure Development	Benchmarking standards of charging stations	Guidelines for estimating the number of charging stations should be developed, along with a review of international standards for different vehicle types, and the establishment of standard testing units at various locations to ensure consistency and reliability	Nepal Electricity Authority/Nepal Bureau of Standards and Metrology/ Water and Energy Commission Secretariat/Alternative Energy Promotion Centre/Universities
	Establishment of repair and maintenance center for EV	Establishment in areas with high EV density, along with training for skilled mechanics and technicians and providing necessary tools and technology for repairing	Ministry of Physical Infrastructure and Transport, Private sector
Fiscal and Financial Incentives	Provides initiatives to shift to EV	Subsidizing EV, providing tax incentives, and reducing electricity costs for EV users are essential measures to encourage adoption and make EV more financially accessible	Ministry of Finance
	Develop emission factors and identify potential for carbon and climate financing	Establishing standards for local emission factors, facilitating the transition from fuel-powered vehicles to EV to ensure access to climate/carbon finance, while maintaining environmental responsibility and ensuring economic viability.	World Bank, Asian Development Bank, United Nation Development Programme, Global Environment Facility (GEF), Green Climate Fund (GCF), Global Green Growth Institute (GGGI) and Universities
Regulatory and Policy Framework	100% shifting to EV in government organizations	Establish policies to support the transformation of government institutions to 100% EV, while maintaining records of purchased EV and constructed charging infrastructures, and monitoring, effectively implementing, and evaluating the progress of these policies	Ministry of Physical Infrastructure and Transport, All government ministries
	Develop EV battery recycling and management guidelines	Establish a comprehensive regulatory framework for EV battery lifecycle management, create institutional infrastructure	Ministry of Physical Infrastructure and Transport, Private sector and Academic institutions
Technology and Innovation	Optimizing current IC engine vehicle to operate on electricity	Developing comprehensive plans for transitioning medium-duty, heavy-duty, transit vehicles and three wheelers IC engine (tempo, rickshaw) that are over 20 years old internal combustion engine to zero emission alternatives	Ministry of Physical Infrastructure and Transport/Nepal bureau of Standards and Metrology/Ministry of Energy, Water Resources and Irrigation/Private sectors, Universities
	Development of charging stations in public private modality	Development of nationwide public charging infrastructure, modeled after existing fuel station networks, coupled with strategic establishment of institutional charging facilities through public-private partnerships	Nepal Oil Corporation, Nepal Electricity Authority and respective institutions, Private sectors
Public Awareness and Education	Mass awareness campaign to promote e mobility	Trainings to understand latest in new technologies, EV models, their performance and charging infrastructure	Nepal Electricity Authority/Water and Energy Commission Secretariat/ Alternative Energy Promotion Centre/ Universities, Nepal Television, Radio Nepal etc.

4. CONCLUSION

The vehicles registrations growth significantly, with motorcycles accounting for 81% of the total, underscoring their dominance in private transportation. Concurrently, the EV sector has demonstrated rapid expansion, with imports increasing by over 75,000 units since 2020, achieving a 70% CAGR, and projected to reach 205,562 by 2045 at a 14% CAGR. However, EV infrastructure development remains slow, with over 600 charging stations installed by mid-March 2025 and an annual growth rate of 20% in 2024. Government policies exhibit inconsistencies, such as

excise duty exemptions for EV up to 50 kW in 2023/24, followed by a 5% increase in 2024, and a 10% reduction for EV above 300 kW. Additionally, EV financing limits were reduced from 80% to 60% in 2025, while financing for conventional vehicles increased from 50% to 60%, creating financial disincentives for EV adoption. These policy gaps, alongside persistent technical, infrastructural, and financial barriers, highlight the need for cohesive strategies. The action plan is supportive to harmonizing fiscal policies, expanding EV infrastructure, and enhancing financial accessibility, thereby accelerating Nepal's transition to a sustainable transportation ecosystem and achieving long-term environmental goals.

5. ACKNOWLEDGEMENT

We would like to express our sincere gratitude to the Research Coordination and Development Council (RCDC), Tribhuvan University, for their generous support and funding of our research project titled “Projection of Energy Demand and Emission Reduction for the Sustainable Use of Electric Vehicles in Nepal: TU-NPAR-079/80-ERG-05”. We also extend our heartfelt thanks to the Centre of Pollution Studies (CPS), Institute of Engineering, Tribhuvan University

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