CITY ROADMAP FOR E-MOBILITY

KATHMANDU, NEPAL

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PROJECT PARTNERS

ABOUT

To present a roadmap to upscale Electric Mobility in Kathmundu

TITLE

City Roadmap for E-mobility Kathmundu

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DISCLAIMER

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All the pictures are provided by the SOL+ partners

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Executive summary

The report focuses on preparing a roadmap for the acceleration of electric mobility (e-mobility) and scaling up the demonstration projects for e-mobility in Kathmandu, Nepal. Kathmandu city is facing significant challenges related to air pollution, traffic congestion, and a heavy reliance on imported fossil fuels to cope with the demand for increased ICE vehicles. The demonstration projects have shown that e-mobility can be a solution to these challenges but scaling them up requires a multi-tiered approach. These actions include measures related to financial, environmental, social, technological & policy aspects. The report also provides examples of successful e-mobility projects in other cities around the world and their potential applicability in Kathmandu.

The timeline for implementation is divided into short-term, medium-term, and long-term goals, with the aim of achieving a sustainable and inclusive e-mobility ecosystem in Kathmandu. The report suggests several implementations plans that can be taken to support the e-mobility transition in Kathmandu. These plans include: policy, financial, technological, social and environmental measures which includes providing incentives for the production and purchase of EVs, such as subsidies, low-interest loans, and tax exemptions, collecting and analyzing data on e-mobility deployment in the city to understand the progress and recommend future policy and plans, support establishing quality standards and guidelines for EVs and charging infrastructure, skill enhancement trainings and awareness among the people. The report also emphasizes the need for a concerted effort by all stakeholders, including the government, private sector, and civil society, to create a sustainable and inclusive e-mobility ecosystem in Kathmandu.

The report suggests that scaling up the demonstration projects in Kathmandu requires a multi-faceted approach that addresses several factors related to e-mobility. The report also emphasizes the need for a concerted effort by all stakeholders to create a vibrant e-mobility ecosystem in Kathmandu.

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List of Abbreviations

ADB	Asian Development Bank
ANSYS	Analysis of System
DoED	Department of Electricity Management
DoTM	Department of Transport Management
EV	Electric Vehicle
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GHG	Greenhouse Gas
ICE	Internal Combustion Engine Vehicle
IEC	International Electro technical Commission
INGO	International Non-Governmental Organization
KEVA	Kathmandu Electric Vehicle Alliance
MATLAB	Matrix Laboratory
MoEWRI	Ministry of Energy, Water Resources, and Irrigation
NBSM	Nepal Bureau of Standards and Metrology
NDC	Nationally Determined Contribution
NEA	Nepal Electricity Authority
NGO	Non-Governmental Organization
NPC	National Planning Commission
PM	Particulate Matter
R&D	Research & Development
SoL+	SOLUTIONSplus
SUMP	Sustainable Urban Mobility Plan
USAID	United States Agency for International Development
VAT	Value Added Tax

1 About the Roadmap

The city roadmap outlines a strategic plan for the implementation and operation of various demonstration models of electric vehicles in Kathmandu Valley, aiming to facilitate the transition towards e-mobility. It involves a step-by-step plan, outlining the key strategies and actions necessary to promote and implement sustainable transportation solutions.

1.1 Need of City Roadmap

A city roadmap is essential for e-mobility transition and scaling of SOL+ demonstration projects for the following reasons:

- **Coordination and Collaboration:** The roadmap provides a structured approach for various stakeholders, including Nepalese government authorities, transportation agencies, private companies, and community representatives, fostering effective coordination and collaboration towards the common goal of promoting e-mobility.
- **Long-Term Vision**: Outlining a comprehensive long-term vision for the Kathmandu's transportation planning system, the roadmap prioritises sustainability and livability. It sets clear objectives and targets, guiding decision-making and resource allocation, to ensure consistency and continuity in the e-mobility transition.
- **Infrastructure Planning:** The roadmap assesses the existing infrastructure and identifies gaps in charging infrastructure, public transportation, and mobility services. It then devises plans to address these gaps by strategically deploying charging stations, electric public transport, and shared mobility solutions.
- **Policy Formulation:** Financial incentives for EV adoption, scientific electricity tariff fixations, and regulations for zero-emission zones are some of the crucial policies. The roadmap provides a framework for developing and implementing these policies to support the transition.
- **Public Engagement:** The roadmap facilitates public consultations, gathering feedback, and addressing concerns, ensuring that the e-mobility transition is well-received and understood by the stakeholders.

1.2 Objectives of City Roadmap

The objectives of the city roadmap for the e-mobility demonstration projects are as follows:

- **Assess the current state of e-mobility in Kathmandu:** Conduct a comprehensive assessment of the existing e-mobility landscape in Kathmandu, including the availability and adoption of EVs, the state of charging infrastructure, and the regulatory environment.
- **Develop a comprehensive e-mobility strategy:** Based on the impact assessment conducted by SOLUTIONSplus, formulate an outline of a comprehensive e-mobility strategy for the city. This should include specific implementation actions, timelines, and performance metrics.
- **Foster partnerships and collaborations:** Foster partnerships and collaborations with relevant stakeholders, including the private sector, government agencies, and civil society organizations, to drive the adoption of e-mobility in Kathmandu and build a sustainable e-mobility ecosystem.

The expected outcomes resulting from the formulation of this city Roadmap in the Kathmandu Valley as follow:

- **Develop EV infrastructure:** Strategically plan and develop EV charging stations and other necessary EV infrastructure across the city, tailored to meet the increasing demand and accommodate the growing number of EVs.
- **Strengthen regulations and policies:** Develop and strengthen regulations and policies to support the expansion of e-mobility in Kathmandu. This includes regulations related to the installation and operation of charging infrastructure, incentives for EV manufacturers and suppliers, and policies to encourage the transition to clean energy sources.
- **Promote EV adoption:** Formulate strategies to scale-up the demonstration projects and stimulate the adoption of EVs in Kathmandu. This involves designing appropriate incentives for EV buyers, promoting EV financing options, and developing EV awareness campaigns through strategic action plans and specific targets.

1.3 Methodology for Roadmap

The methodology for developing the e-mobility roadmap in Kathmandu involved a literature review of documents and reports from governmental organization, such as the Ministry of Physical Infrastructure and Transport, Ministry of Energy, Water Resources and Irrigation, Provincial Ministry of Physical Infrastructure and Transport, local-level government and the National Planning Commission (NPC) and strategies. Strategies and documents from other countries, such as India, China, and Norway, were also consulted to understand best practices and lessons learned in the implementation of e-mobility. Data on GHG emissions, vehicle fleet, land use, modes of transport, electricity generation, and charging infrastructure had been collected from government agencies reports and publications namely the Department of Transport Management, Department of Electricity Development, and Nepal Electricity Authority. A review of national transport laws and regulations was conducted to comprehend the current policy framework for transport sector, especially for e-mobility in Nepal, and to identify government initiatives promoting EVs. Information on existing and planned charging infrastructure was extracted from the annual reports of the Nepal Electricity Authority and other relevant sources.

In addition to the literature review, the study included interviews with stakeholders involved in the e-mobility sector, including government officials (MoPIT, DOTM, NEA, NPC), private companies (Thee Go, Clean Energy International, Shree Eco Visionary), academic institutions (Tribhuwan University, Kathmandu University) and national and international non-governmental organizations (PRC, WWF, ADB). The interviews aimed to understand the current state of e-mobility in Nepal, identify challenges and opportunities, and gather perspectives on the feasibility of different e-mobility interventions. Focus group discussions were conducted with various segments of the population, including vehicle owners, public transport users, and private transport users, to understand their attitudes and perceptions towards e-mobility, and identify potential barriers to EV adoption. The study also included a stakeholder analysis, identifying major actors and local businesses in the e-mobility space to understand opportunities and barriers for growth in e-mobility in Nepal. The results of this study can be used to develop the e-mobility ecosystem, ensuring it is grounded in the realities and needs of different stakeholders in Nepal, promoting inclusivity, collaborative, and reflective.

2 Background - Where are we now?

2.1 Urban Mobility context

2.1.1 National context

Nepal, a landlocked country with challenging mountainous terrain, faces unique obstacles in developing an extensive transportation network. The primary mode of transportation in the country is road transport, connecting major cities and towns. The inception of the first public bus service in 1939 marked the beginning of buses as a common form of public transportation, catering to both urban and rural areas[1]. Various types of buses, including local and long-distance, as well as microbuses, taxis and 3-wheelers (tempos) contribute to the transportation mix. Despite this variety, ineffective public transport services have led people to rely on private vehicles, resulting in a rapid increase in the number of private vehicles compared to that of public ones. According to the Department of Transport Management, the total number of vehicles operating in Nepal reached approximately 3 million in 2018, with new vehicle registrations increasing fivefold during the last decade. As of February 2022, the total number of registered vehicles in Bagmati Province, including Kathmandu Valley, had reached 1.8 million[2].

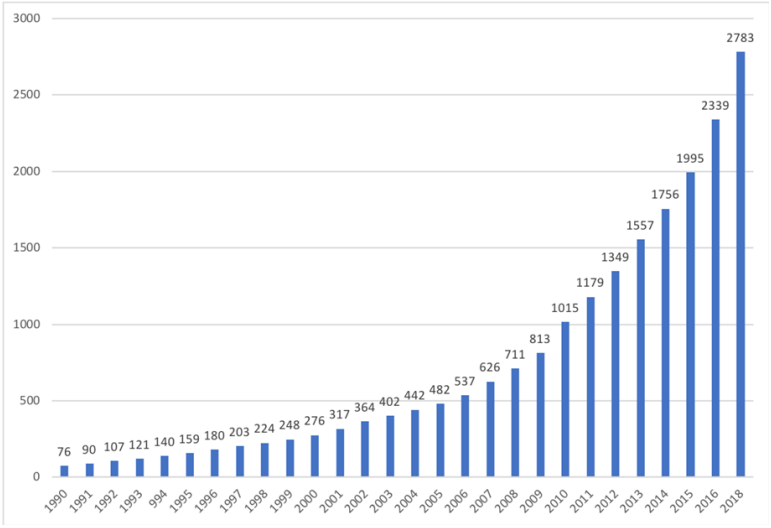

Figure 1. Total number of registered vehicle (in thousands) in Nepal (Source: DoTM, 2019)

In recent times, Nepal has made progress in improving its infrastructure and transportation systems. The government of Nepal is undertaking various projects to upgrade the existing system, focusing on improving public transport management, facilities, and operations, as well as enhancing traffic management, and supporting non-motorised transport in the city center. As part of these efforts, the Electric Mobility Program, a collaboration between the Government of Nepal and the Global Green Growth Institute (GGGI), is playing a crucial role in achieving key transport targets outlined in Nepal's Nationally Determined Contributions (NDC). This program delivers benefits across air quality, energy

[1] Nepal: Kathmandu Sustainable Urban Transport Project Report, ADB
[2] https://wecs.gov.np/source/Bagmati%20Province.pdf

security, and sustainable transport, providing technical & financial access to the e-mobility sector in Nepal.[3]

To further support these initiatives, the government of Nepal has signed a concessional financing agreement with the World Bank, securing $100 million to enhance the enabling environment in Nepal toward a green, climate-resilient, and inclusive development[4]. The SOLUTIONSplus project launched the electric 3-wheelers in Kathmandu in November 2022 and converted diesel bus to electric and converted mini truck to electric in April 2024 in the demonstration launch programs. The project's overarching goal is to establish an ecosystem for electric mobility in the city by showcasing different EV projects aimed at improving public transport. It also focuses on introducing suitable charging solutions and related services. Additionally, the project aims to provide insights into business models and financing schemes applicable for scaling up e-mobility in Nepal.

2.1.2 City level context

Kathmandu, the capital city of Nepal, has a population of approximately 1.7 million people and a gross domestic product (GDP) of around $21.1 billion according to data retrieved from a World Bank report.[4] However, the city faces significant challenges in terms of urban mobility. The transport sector, responsible for approximately 23% of the city's total greenhouse gas (GHG) emissions, contributes significantly to these challenges, primarily due to emissions from private vehicles.[5] Air pollution is also a major issue in the city, with annual average levels of PM2.5 exceeding the World Health Organization's guidelines[6].

The city has an extensive urban passenger transport network, with over 10,000 registered taxis and more than 6,000 public buses, according to data from the Department of Transport Management. On the other hand, informal transport, such as electric motorized three-wheelers rickshaws (locally known as tempos), also plays a significant role in the city's transport system. In the Kathmandu Valley, the distribution of vehicle types varies significantly, with motorcycles being the most prevalent, constituting approximately 75% of all trips in the city.[3] Private cars and taxis make up a smaller proportion, while public buses and informal transport collectively account for a significant share.

The availability of electric transport modes in Kathmandu is limited but gradually increasing. A 2021 report by the DoTM indicated around 2,000 electric vehicles in Nepal, including e-motorcycles, e-scooters, and electric cars. However, recent data from the fiscal year 2080/81 (2023/24) reveals a notable change, with the country importing 3,730 three-wheeler electric vehicles and 2,787 four wheelers, amounting Rs. 370 million & Rs. 350 million, respectively.[7]

Similarly, several transport projects are underway in the city, including the study of a metro rail system and the expansion of the city's road network and flyover. The Kathmandu Metropolitan city has also developed a sustainable urban transport planning report through Kathmandu Sustainable Urban Transport

[3] National Action Plan for Electric Mobility: GGGI
[4] World Bank GRID Project: https://www.worldbank.org/en/news/press-release/2022/08/29/nepal-and-world-bank-sign-100-million-financing-agreement-to-support-nepal-s-green-resilient-and-inclusive-development
[5] SEI. (2015). Greenhouse Gas Emissions from Urban Transport in Kathmandu. Retrieved from https://www.sei.org/wp-content/uploads/2015/10/SEI-GHG-Emissions-from-Urban-Transport-in-Kathmandu.pdf
[6] World Bank. (2019). Nepal: Environmental and Social Screening and Assessment Framework. Retrieved from https://documents1.worldbank.org/curated/en/253321580577137723/pdf/Environmental-and-Social-Management-Framework-ESMF-Nepal-Strategic-Road-Connectivity-and-Trade-Improvement-Project-P170409.pdf
[7]https://risingnepaldaily.com/news/35380#:~:text=The%20country%20has%20imported%203%2C730,vehicles%20during%20the%20review%20period.

Project (KSUTP) financed by Asian Development Bank (ADB) that aims to improve urban transport and reduce GHG emissions. The report includes measures such as the promotion of public transport and sustainable means of transport, the improvement of public transport services, and the introduction of electric vehicles.[8] On the other side, the neighboring Lalitpur Metropolitan City has endorsed policy of purchasing EVs and introduced an innovative scheme that waives house rent tax for residents owning EVs in the city.[9]

2.2 Current policy framework and market readiness

Currently, Nepal has made some efforts to promote sustainable transport and electric vehicles through various policies and plans however, it is still lacking in terms of operation and implementation. The National Transport Policy aims to develop a reliable, cost-effective, safe, facility-oriented, and sustainable transport system that include electric as well as other clean source vehicles.

The Environment Friendly Vehicle and Transport Policy aims to reduce emissions from the transport sector, increase the share of electric vehicles, and provide a subsidy scheme for the promotion of electric vehicles and non-motorized transport modes.

The National Sustainable Transport Strategy for Nepal aims to develop an efficient, affordable, reliable, safe, inclusive, environmentally friendly, and climate and disaster-resilient transport system. This strategy emphasises increasing the mode share of public transport and the percentage of electric vehicles in the total fleet. The National Energy Efficiency Strategy of Nepal aims to enhance the energy efficiency of the transport system by promoting the use of energy-efficient equipment, including electric vehicles and public transport.

The Kathmandu Valley Transport Management Authority is prioritising emission mitigation from vehicles and the promotion of an environmentally sustainable transportation system. The plan foresees the establishment of charging infrastructures for electric vehicles and the introduction of legal provisions for converting old vehicles into electric vehicles.

The Second Nationally Determined Contribution prioritizes the transport sector, setting targets for electric vehicles sales and reducing dependency on imported petroleum products. The National Climate Change Policy of Nepal adopts sectorial policies, including for the transport sector, aiming to develop reliable, sustainable, and low-carbon technology. It identifies key causes of emissions and encourages the use of electric vehicles.

In January 2022, the board meeting of Nepal Electricity Authority revised the distribution bylaws and decided to install separate meters at public places and parking lots to charge EVs.[10] Moreover, Nepal's Sustainable Development Goals Status and Roadmap targets 50% share of electric public transport in total trips by 2030[11], promoting the transition to e-mobility. These policies and plans demonstrate Nepal's commitment of promoting sustainable transport and electric vehicles.

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[8] Kathmandu Metropolitan City. (2020). Sustainable Urban Mobility Plan for Kathmandu Metropolitan City. Retrieved from https://www.kathmandu.gov.np/en/publication/sustainable-urban-mobility-plan-for-kathmandu-metropolitan-city-2076

[9] https://techmandu.com/house-rent-tax-rebate-for-ev-buyers-in-lalitpur/

[10] https://myrepublica.nagariknetwork.com/news/residents-can-install-evs-charging-units-for-their-personal-use-nea/

[11] Nepal's Sustainable Development Goals Status and Roadmap: 2016-2030: NDC

The Vehicle & Transport Management Act, 2049 amendment (MoPIT, 2078) has opened up the possibility of converting petrol driven vehicles to electric vehicles (EVs) in Nepal. However, uncertainty arises due to the absence of relevant directives and the delay in their formulation. The Environment Friendly Vehicle and Transport Policy (MoPIT, 2014) plans to regulate electric vehicle standards and places provisions for the conversion under the DoTM. Despite this, the drafted guidelines and standards have not been effectively implemented in the city.

The policy support for e-mobility in Kathmandu Valley is in early stages, and the government has taken positive steps to promote the adoption of EVs through the development of different National EV Master plans and policies. However, the Master Plan for public charging infrastructure, prepared by Water and Energy Commission Secretariat of the Ministry of Energy, Water Resources and Irrigation, is still in the process of being finalized, and its implementation remains unclear.[12]

Regarding standards and regulations, the Nepal Bureau of Standards and Metrology (NBSM) has developed draft standards for EVs, currently under review. Some regulatory frameworks are in place for EVs, such as the requirement for EV taxis to have a registration plate, insurance, and meet certain safety standards. However, the local manufacturing company like Yatri motorcycles has struggled to obtain the registration number for manufactured EVs due to limited laws and regulations.

Similarly, the transition towards e-mobility is a growing trend as evidenced by Sajha Yatayat as they have recently added 40 electric buses in their fleet in September 2023. The sale of EVs private cars also appears to be rising exponentially in recent times.[13] The majority of these vehicles are concentrated in the Kathmandu Valley.

The demand for e-mobility in Kathmandu is gradually increasing, with a small market size across segments with new brands introduced to the market. The limited government initiatives, limited law and enforcement, and lack of charging infrastructure are significant barriers to adoption.[14] However, there are opportunities for growth, particularly in the public transport sector, where electric buses and taxis could help reduce emissions and improve air quality.

In the e-mobility space in Kathmandu, there are a few major actors and local businesses active, including ride-hailing companies, rental companies, and electric vehicle importers. However, market adoption has been limited due to the lack of policy support for conversion, the establishment of EV infrastructure, and financing.

In terms of financing, several financial options are available for EVs in Kathmandu, Nepal. Banks and financial institutions offer auto loans for EVs with interest rates ranging from 10% to 15%.[15] The main opportunities for growth in e-mobility in Kathmandu are in the public transport sector and in the development of charging infrastructure. According to an ADB study, the development of charging infrastructure is critical for the growth of the EV market in Nepal, and government initiative is much needed.

[12] https://kathmandupost.com/money/2023/12/03/ev-infrastructure-and-state-policy-cart-before-the-horse
[13] https://kathmandupost.com/valley/2022/07/08/sajha-yatayat-flags-off-three-electric-buses-to-roll-on-valley-routes
[14]https://risingnepaldaily.com/news/35380#:~:text=The%20country%20has%20imported%203%2C730,vehicles%20during%20the%20review%20period.
[15] https://en.nepalkhabar.com/news/detail/3215/

The review and study of the transport policies, acts and guidelines in each tier of the government in Nepal are in the next section.

2.2.1 Federal Level

- **Constitution of Nepal 2015 AD**

The constitution of Nepal 2015 includes provisions related to transportation policy. Article 14 of the Constitution aims to enhance investment in the transportation sector while ensuring simple, easy, and equal access to transportation facilities for citizens. Moreover, the constitution has given the legislative powers for the Federal Parliament to draft and pass the bills and major acts related with transportation sector whereas operative power of the transport management and associated areas is given to the provincial government.

- **Motor Vehicles and Transport Management Act, 2049 (1993)**

The Motor Vehicles and Transport Management Act, 2049 (1993) is a policy passed by the Parliament of Nepal. The policy aims to provide consolidated, efficient, and effective transportation services to prevent motor vehicle accidents, provide insurance and compensation to accidents victims, and make transportation facilities easily available to the public. It classifies vehicles into five main categories based on size and capacity. The policy mandates that the owner of a motor vehicle shall not make any alteration that the owner of the motor vehicle shall not make any alteration that changes its color, number of seats, and other specifications, acting as a barrier for conversion of old vehicle. In response to this, governing bodies decided to exempt Article 39 (II), including the extra chargeable fees for 3 years in March 2022. However, the process of getting permission for vehicle conversion to electric is still tedious.

- **National Transport Policy 2001**

The National Transport Policy of Nepal was first introduced in 2001 with the aim of developing a reliable, cost-effective, safe, facility-oriented, and sustainable transport system that promotes and sustains the economic, social, cultural, and tourism development of Nepal as a whole. The policy recognizes the importance of environmentally sustainable transport, fuel conservation measures, public transport planning, integrated land-use, and transport planning, as stated in the National Climate Change Action Plan. The policy also aims to strike a balance among economic progress, social equity, a healthy and protective environment, and people-friendly infrastructural development. The policy has undergone periodic reviews and updates, with the most recent being the National Sustainable Transport Strategy (NSTS) for Nepal (2015-2040). The NSTS aims to develop a sustainable transport system in Nepal through the adaptation of electric vehicle in both public and private transport.

- **National Environmentally Sustainable Transport (EST) Strategy for Nepal**

The National Environmentally Sustainable Transport (EST) Strategy for Nepal is a formal policy designed to create a more sustainable transportation system in Nepal. This policy acknowledges the negative effects of current trends in motorization, such as traffic congestion, air and noise pollution, and traffic accidents. The primary goal of this policy is to find a balance between promoting economic growth, ensuring fairness in society, protecting the environment, and developing infrastructure that benefits people. The strategy includes promoting a common understanding of EST principles in Asia, recognizing the importance of efficient transportation for people and goods. It also aims to ensure that transportation is both environmentally friendly and affordable. The goal is to improve fairness in society, public health, and the resilience of cities, rural areas, as well as landlocked and transit developing countries.

- **Environment-friendly Vehicle and Transport Policy (2014)**

Nepal's Environment-friendly Vehicle and Transport 2014 Policy is a guiding policy designed to encourage the use of eco-friendly vehicles in the country. Under this policy, there is a subsidy program to promote electric vehicles. The government supports the conversion of fossil fuel-powered vehicles into electric ones and provides financial incentives for industries involved in electric vehicle production, research, and development and policies to encourage conversion of fossil fuel vehicles to electric ones, Additionally, the policy promotes the adoption of alternative energy sources in the transportation sector. This initiative acknowledges the negative consequences of current motorization trends, including issues like traffic congestion, air and noise pollution, and traffic accidents and injuries. The overarching aim is to strike a balance between fostering economic growth, ensuring fairness in society, protecting the environment, and creating infrastructure that benefits people. It includes targets to increase the electric vehicles share to 20% by 2020 but this wasn't achieved as less than 1% vehicles are electric in Nepal

- **Kathmandu Valley Public Transport Infrastructure Authority Bill**

The Kathmandu Valley Public Transport Infrastructure Authority bill is a government bill that aims to establish an authority responsible for planning, managing, and operating the public transportation system in the Kathmandu Valley. The authority is responsible for making the public transportation in the valley accessible, easy, reliable, and safe. According to the bill, the authority will fix the routes for public transportation and set standards for vehicles. For implementation, the government has formulated a 10-member board under the chairmanship of the Minister of Urban Development to manage the public transport system of the Valley in an integrated manner. The board will introduce a cashless fare system in public transport and develop e-ticketing. The main objectives of the authority include developing an integrated infrastructure for public transport, issuing an e-ticketing facility, and determining the routes and fare rates for public transport within the Valley. This bill is essential for the systematic deployment of SOLUTIONSplus demonstration projects and the authority is responsible for the management of public vehicle in Kathmandu Valley.

- **Nationally Determined Contribution (NDC) Nepal**

National Determined Contribution is the legal commitment signed during UN Climate Convention 2015. Nepal's NDC conditional mitigation targets are estimated to be USD 25 billion and the cost of achieving unconditional targets outlined in the NDC is estimated to be USD 3.4 billion Under NDC, Nepal has set different targets and plans on various sectors for contributing in reduction of the greenhouse gas (GHG) emissions. Similarly, Nepal has set different targets in transport sector. The targets are listed below:

Targets for 2025 in Transport Sectors

- Sales of EVs in 2025 will be 25 % in private passenger vehicle industry including both four and two-wheelers.
- In 2025 an increase in EV mobility leads BAU situation demands of fossil fuels decreases from 40 million GJ to 36 million GJ.
- Similarly, in 2025, targets to reduce emission from 2988 Gg $C0_2$ equivalence to 2734 Gg $C0_2$ equivalence which accounts for 8 % decrease in emissions.
- 20 % coverage in public transport by electric bus sales in 2025

Targets for 2030 in Transport Sectors

- Sales of EVs in 2030 will be 90 % in private passenger vehicle industry including both four and two-wheelers.
- In 2030 increase in EV mobility leads BAU situation demands of fossil fuels decreases from 48 million GJ to 34.5 million GJ.
- Similarly, in 2030, targets to reduce emission from 3640 Gg $C0_2$ equivalence to 2619 Gg $C0_2$ equivalence which accounts for 28 % decrease in emissions.
- 60 % coverage in public transport by electric bus sales in 2030.

- **Nepal's National Adaptation Plan (NAP) 2021-2050**

The National Adaptation Plan is a comprehensive strategy which aims to strengthen nation's resilience against climate change. The NAP outlines 64 specific adaptation interventions across eight key economic sectors which include Agriculture and Food Security (AFS), Forests, Biodiversity and Watershed Conservation (FBWC), Water Resources and Energy (WRE), Rural and Urban Settlements (RUS), Industry, Transport and Physical Infrastructure (ITPI), Tourism, Natural and Cultural Heritage (TNCH), Health, Drinking Water and Sanitation (HDWS),Disaster Risk Reduction and Management (DRRM) and Gender Equality and Social Inclusion (GESI), Livelihood and Governance (GESILG) and total budget of USD 47 billion over the project period. Under which 500 million USD has been allocated for developing and promoting clean energy-based transport system through infrastructural development, policy reform and financing.

2.2.2 Provincial Level

- **Provincial Vehicle & Transport Management Act 2075**

The Provincial Vehicle & Transport Management Act 2075 is a law related to transportation and traffic management in Nepal. The law, passed in 2018, grants authority to provincial government to regulate and manage transportation in the state. It establishes provisions for the registration and operation of vehicles, the issuance of driving licenses, and the regulation of traffic. Additionally, the law also provides for the establishment of a transportation authority to oversee and carryout the activities related with vehicle and transport management.

- **Standards for operation, and management of public electric taxi**

The Ministry of Labor, Employment, and Transportation, Bagmati Province has set standards for the quality, operation, and management of public electric taxi service. The document focuses on assessing the quality and efficiency of these services. It aims to evaluate the performance of electric taxi services against predetermined criteria and benchmarks where the taxis are classified as Normal (30 kwh or above motor capacity) and Special Taxi (50 kwh or above motor capacity).

2.2.3 Local Level

- **Kathmandu Metropolitan City's Vehicle and Traffic Management Act 2075**

The Kathmandu Metropolitan City's Vehicle and Traffic Management Act of 2075 is a significant legislative framework governing transportation and traffic management within the city. This act encompasses a wide range of regulations and provisions aimed at enhancing the organization and efficiency of transportation systems in Kathmandu which addresses various aspects of vehicle and traffic management, including traffic rules, parking regulations, and measures.

- **Motor Vehicle Parking Management Guideline 2079**

The local government of Kathmandu Metropolitan City has enacted the Motor Vehicle Parking Management Guideline 2079. The guideline aims to ensure safe and systematic parking management at multi complexes and parking spaces. It includes provisions for a nine-member monitoring committee to carry out monitoring of parking management in Kathmandu and impose fines on rule violators. The committee includes representatives from traffic police, city police, and organizations working for the rights of consumers.

This shows the governance of the transport sector as a multi-tiered effort, involving the federal, provincial, and local governments. The roles of each sector are discussed in the next section.

2.3 Current institutional arrangements (federal, provincial and local)

Nepal's current institutional arrangements for transport management involve the federal, provincial, and local governments. In general, the federal government sets national policies and regulations related to transportation, provides funding for transportation projects, and devolves several functions to provincial and local governments. Provincial governments are responsible for the development and maintenance of transport infrastructure within their respective provinces, while local governments are responsible for the operation and management of public transportation services and parking management within their jurisdictions. The roles and activities of each level of government are as follows:

Categories	Federal Government	Provincial Government	Local Government
Policy Framework	Setting the overall policy framework for e-mobility in Nepal. This includes developing and implementing the **National Electric Mobility Action Plan,** which sets out the goals and objectives for the promotion of electric vehicles in the country.[3]	Development and implementation of e-mobility policies and programs within their respective provinces. [16]	Enforce parking regulations, tariff rate fixation[17]
Financial Incentives	Provides financial incentives and other support through tax and custom duty exemption for EV[18]	Provides subsidies for electric vehicles for vehicle registration and renewal[19]	Promote the use of electric vehicle and financing of public vehicle for their respective city[20]
Licensing and permitting	-	Provides driving license as well as provide permit and registration number for vehicle like taxi, buses, and motorbikes and so on.[16]	Provides permit & license plate number for e 3-wheelers running inside the city[21]
Infrastructure Development	Allocate funds & resources for establishment of manufacturing and assembly plant, vehicle conversion industry, charging infrastructure development and buying vehicle[18]	Develop charging infrastructure in coordination with utility companies and private sectors[19]	Day-to-day management of e-mobility infrastructure within their jurisdictions[20]
Examples	The federal government has set a target of 60% of public transportation vehicles being electric by 2030. The federal government has also provided financial incentives for the purchase of electric vehicles, including a waiver of import duty and excise duty. The federal government is also working to develop a national network of charging stations.	The provincial governments of Bagmati and Gandaki have both announced plans to procure electric buses for public transportation. The provincial governments are also working to develop charging infrastructure within their respective provinces.	The Kathmandu Metropolitan City and Lalitpur Metropolitan City are working to develop a public awareness campaign about the benefits of e-mobility. Lalitpur Metropolitan City has also endorsed policy of purchasing EVs only as well as launched innovative scheme of waiving the house rent tax for those who owns EVs in the city.

[16] Province Transport Management Act 2076
[17] https://english.onlinekhabar.com/kathmandu-parking-fees.html
[18] Nepal Budget for FY 2079/80
[19] Gandaki Province Budget for FY 2079/80
[20] Kathmandu Metropolitan City Annual Plan FY 2079/80
[21] Municipality E-ricksaw registration & management Directive 2078

2.4 Roles of Sustainable Transport implementing Organization

Name of the Organization	Objectives	Role
Ministry of Physical Infrastructure and Transport (MoPIT): Federal Government	The objective of MoPIT is to create a safe, efficient, and sustainable infrastructure & transport system that supports economic growth and improves the overall quality of life for the people of Nepal, including Kathmandu.	The Ministry of Physical Infrastructure and Transport is a government ministry that oversees and coordinates the development and maintenance of physical infrastructure, including transportation systems in Nepal.
Department of Transport Management (DoTM): Provincial Government	The objective of the DoTM is to promote sustainable transport systems in Nepal, including Kathmandu, by encouraging the adoption of eco-friendly and energy-efficient transportation modes such as electric vehicles and improving public transportation infrastructure.	The DoTM is a government organization responsible for formulating and implementing policies, plans, and programs related to the transport sector in Nepal. It plays a crucial role in regulating and overseeing transportation services, including road safety, vehicle registration, and licensing.
Kathmandu Valley Transport Management Council Local Government	The objective of the Kathmandu Valley Transport Management Council is to create a well-organized, safe, and sustainable transportation system for the residents and visitors of the Kathmandu Valley.	The Kathmandu Valley Transport Management Council oversees and manages the transportation system within the Kathmandu Valley. It would act as a centralized body responsible for formulating policies, coordinating transportation services, regulating traffic, and ensuring efficient and sustainable mobility within the region.
Nepal Electricity Authority (NEA): Electric Vehicle Charging Infrastructure Development Project	To promote and support the adoption of electric mobility in Nepal	NEA establishes an extensive network of electric vehicle (EV) charging infrastructure throughout the country, including in major cities like Kathmandu. It involves setting up public charging stations at strategic locations, such as commercial center, highways.
Asian Development Bank (ADB): Kathmandu Sustainable Urban Transport Project	To improve the transport system, establish charging stations and reduce congestion and pollution in Kathmandu	Kathmandu Sustainable Urban Transport aims to upgrade public transport management, facilities, and operations, improve traffic management, and make the city center more pedestrian-friendly by improving sidewalks and making heritage routes pedestrian-only. It also includes enhancing air quality monitoring

2.5 E-mobility Case Study around the World

2.5.1 India

India is making significant strides towards transitioning to e-mobility, with cities playing a crucial role in achieving this goal. The Indian government has set a target of 30% electric vehicle (EV) adoption by 2030, offering purchase discounts, reduced road taxes, scrapping and retrofitting to encourage this transition.[22] However, the reports named "Preparing Indian Cities for the shift to e-mobility" shows transition to EVs at the city level is facing several challenges, including coordination between departments, synchronization of action, and financial and spatial constraints.[23] To address these challenges, the Urban Mobility Lab initiative in Delhi is working collaboratively with government and industry leaders to design and implement mobility solutions.[24] Similarly, WRI India's Electric Mobility program is also offering technical assistance and capacity building while facilitating conversations between public and private stakeholders for a broader understanding of the sector.[25]

India has launched several policies and plans to promote electric mobility, from which Nepal can learn. One significant policy is the Faster Adoption and Manufacturing of Hybrid and Electric vehicles (FAME) scheme, currently in its second phase with a budget allocation of INR 12.029 billion[26]. The scheme aims to promote electric mobility and includes incentives such as subsidies for electric vehicles and the development of charging stations. Nepal can also learn from India's National Mission on Transformative Mobility and Storage, which aims to drive strategies for transformative mobility and phased manufacturing programs for electric vehicles, electric vehicle components, and batteries. Furthermore, Nepal can learn from India's state-level policies, such as the National Electric Mobility Mission Plan (NEMMP)[27], aiming to create necessary infrastructure for the adoption of electric vehicles. Additionally, Nepal can learn from India's e-AMRIT portal[28], which provides information related to the adoption of electric vehicles in India. By incorporating and developing these kinds of policies and plans, Nepal can accelerate its transition to e-mobility and support the decarbonization of the transport sector

2.5.2 China

China is leading the world in the transition to electric vehicles (EVs), with the government aiming for EVs to make up 40% of new cars sold by 2030.[29] Chinese EV companies have grown rapidly in recent years, becoming major competitors for U.S. automakers like Tesla. The Chinese government has implemented various tax exemption and reduction policies to promote the adoption of new energy vehicles (NEVs), which include EVs, plug-in hybrid electric vehicles (PHEVs), and fuel cell vehicles (FCVs).[30] China has also made significant investments and implemented supportive policies to foster the growth of its EV charger industry, with a total of 1.15 million publicly available EV charging stations as of the end of 2022.[31] Efforts at urban e-mobility transition in China are of crucial global significance. The Chinese city of Shenzhen was the first in the world to electrify all public buses in 2017, and today there

[22] https://www.theclimategroup.org/our-work/news/net-zero-2070-e-mobility-transition-pathway-india
[23] Preparing-indian-cities-shift-emobility; Observer Research Foundation.
[24] Accelerating Delhi's Mobility Transition; RMI-India, RMI, NITI-Aayog
[25] https://www.wricitiesindia.org/content/electric-mobility
[26] https://e-amrit.niti.gov.in/national-level-policy
[27] https://e-amrit.niti.gov.in/state-level-policies
[28] https://e-amrit.niti.gov.in
[29] https://energy.mit.edu/news/chinas-transition-to-electric-vehicles/
[30] https://www.china-briefing.com/news/china-extends-nev-tax-reduction-and-exemption-policy-to-2027/
[31] China Public Charging Infrastructure through 2021-feb23; International Council on Clean Transportation

are over 16,000 e-buses on its streets.[32] In terms of the EV infrastructure, China has made significant strides in the EV charging infrastructure market, with a current value of USD 3.31 billion.[33] Similarly, China has the largest number of publicly available EV charging stations in the world, with a total of 1.15 million stations, of which 41% have fast-charging capability.[34] China's EV charging infrastructure industry is segmented into buses, taxis, and electric light vehicles. On the other hand, Nepal has set an ambitious target to switch to light electric vehicles by 2031, and the government plans to shift from light vehicles that run on petroleum products to electric ones by 2031.[35] Therefore, Nepal also needs robust infrastructure to support EVs, including charging stations, and the government must address mass transit's charging infrastructure needs, and create a sustainable mobility ecosystem in order to achieve the targets and achieve commitment of net zero carbon emission by 2045.

2.5.3 Norway

Norway is a global leader in electric vehicle (EV) adoption, with over 80% of new car sales being electric in 2020.[36] The country has achieved this through a combination of strong government policies, incentives, and infrastructure development.[37] Norway has been offering incentives for EVs since the 1990s, including exemptions from registration tax and VAT for battery electric vehicles (BEVs).[38] Additionally, EVs are exempt from paying for the use of regional toll roads, and there are local incentives such as free parking and using bus lanes based on special E-Number plates for EVs. Norway has also developed a comprehensive charging infrastructure, with over 5,600 fast chargers stretching 1,700 km. The country's experience suggests that EVs bring benefits without the dire consequences predicted by some critics. Norway's success in EV adoption shows that replacing petroleum with electric vehicles is achievable, and the country is well on pace to meet its all-electric goals by 2025.

Norway has made significant progress in the transition to electric mobility. Likewise, to transition fully to EVs, Nepal too needs robust infrastructure to support these vehicles, including charging stations, and a holistic policy framework with a private-public partnership like in Norway to create a sustainable mobility ecosystem. Norway provides incentives for EV adoption, such as subsidies, cheaper parking, tolls and ferry tickets, and the right to use bus and taxi lanes. In similar cases, Nepal can establish fast-charging stations every 50km on all major highways and create large-scale, multipurpose, public e-mobility hubs in the most popular EV charger location to develop an EV eco-system in the country.

3 Factors influencing e-mobility transition in Nepal

The analysis of electric vehicle (EV) adoption across various vehicle types is crucial for informed decision-making and strategic planning in the context of transitioning to sustainable e-mobility. A SWOT analysis identifying strengths & opportunities helps policymakers, industry stakeholders, and consumers understand the potential benefits of embracing EVs. Conversely, recognizing weakness & challenges, is essential for addressing roadblocks that may impede the smooth integration of EVs into Nepal's transportation landscape. By evaluating both opportunities and challenges comprehensively, it becomes possible to develop holistic implementation plan that accelerate the adoption of electric vehicles.

[32] China: Shenzhen's shift to an electric mobility system; International Energy Agency
[33] https://www.mordorintelligence.com/industry-reports/china-electric-vehicle-charging-infrastructure
[34] https://www.thebuzzevnews.com/china-public-ev-charging-stations/
[35] NEPAL BUDGET 2078-79 (2021-22)
[36] https://time.com/6133180/norway-electric-vehicles/
[37] https://www.e-motec.net/pioneering-electric-mobility-how-norway-charged-ahead
[38] https://alternative-fuels-observatory.ec.europa.eu/transport-mode/road/norway/incentives-legislations

3.1 Opportunities and challenges in EV adoption across vehicle types

3.1.1 Opportunities for EV Adoption

The country has several opportunities for e-mobility transition. Some of the opportunities for e-mobility transition in Nepal are discussed below:

- **Surplus electricity generation**: Nepal has achieved a significant milestone in electricity production, reaching 2,689.83 MW, with expectations of surpassing 2,800 MW by the fiscal year's end. However, the country's per capita electricity consumption remains low at just 325 kWh.[39] Despite this, Nepal has surplus hydropower, generating around 500MW more than domestic demand during the wet season.[40] This surplus electricity, often referred to as the spill energy, presents an opportunity to support the electrification of public transport and decarbonization of the transport sector. Therefore, this spill electricity can be utilized to charge EVs.
- **Government initiatives:** The Nepal government has introduced various plans and policies to promote electric vehicles (EVs), including the utilization of solar power and electricity in the National Transport Policy. The government has also pledged to shift entirely to electric vehicles (EVs) by 2031.[41] To support this commitment, the government is providing five years tax waiver up to 50 percent for the establishment of electric vehicle assembly plant in Nepal as per the FY 2080/81 BS (2023/24 AD) budget.[42]
- **Financial incentives:** The government has sought to incentivize consumers to buy EVs by significantly reducing excise and customs duties, along with other charges on private EVs. As a result of these rebates, buyers of private EVs now pay around 10 times less in taxes compared to buyers of IC engine vehicles.[43]
- **Greenhouse gas emissions reduction:** EVs can help Nepal reduce greenhouse gas emissions, which are currently rapidly rising in the country.

3.1.2 Challenges for EV Adoption

The challenges in EV adoption across vehicle type and market segments for e-mobility transition in Nepal include:

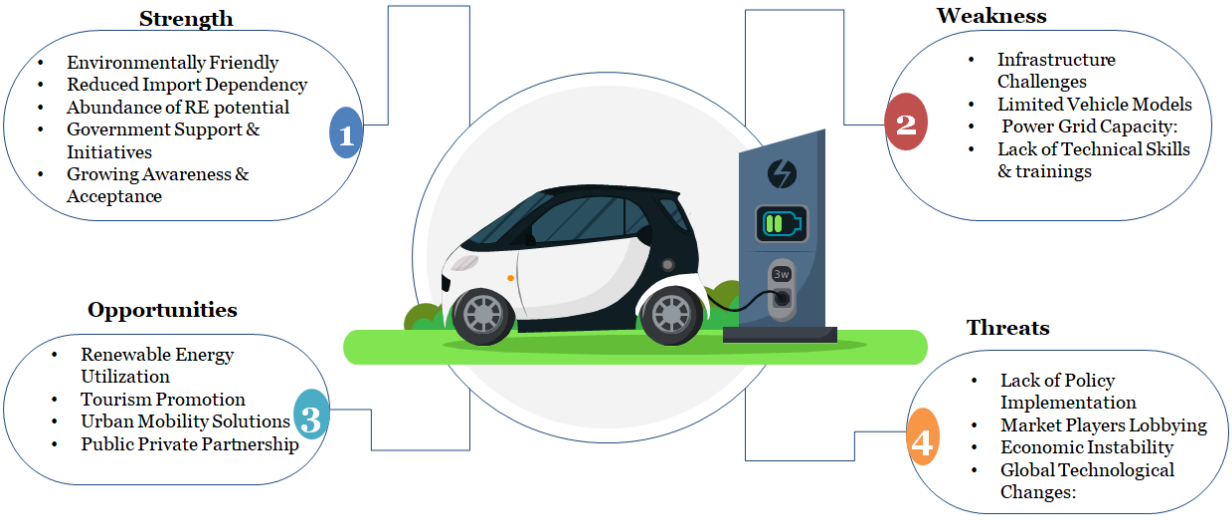
- **Inadequate regulatory framework:** The absence of comprehensive guidelines and implementation plan in accordance with the policies and proposed targets hinders the fast adoption of EVs in Nepal. Clear guidelines and supportive policies from the government are necessary to encourage investment, research, and development in the EV sector.
- **Insufficient skilled workforce:** The country lacks enough skilled professionals with expertise in electric vehicle technologies. There is a need to develop and enhance the skills of the workforce in areas such as EV design, manufacturing, maintenance, and repair to support the growth of the industry through academic and vocational training program.
- **Limited charging network and inadequate infrastructure:** The existing infrastructure in Nepal may not be adequately equipped to support the manufacturing and assembly plants of EVs, and

[39] https://myrepublica.nagariknetwork.com/news/tapping-surplus-electricity-for-prosperity/
[40] https://www.spotlightnepal.com/2022/06/07/surplus-electricity-opportunity-nepalese-industry-and-export/
[41] https://kathmandupost.com/national/2021/06/21/nepal-to-switch-to-light-electric-vehicles-by-2031-as-fossil-fuel-import-balloons
[42] https://corporatelawyernepal.com/nepal-budget-2079-80-increased-incentives-for-ev-assembly-plants-in-nepal/
[43] https://autoncell.com/detail/news/tax-rate-vehicles-fiscal-year-2076-2077-province-1-7

operation of electric vehicles. Nepal currently has a limited number of charging stations, particularly in rural areas and along highways. The availability of charging infrastructure is crucial to support the widespread adoption of electric vehicles.

- **Financing and access to capital:** Access to financing and capital is crucial for local businesses in the e-mobility sector. The limited availability of financial support, including loans, grants, and investment opportunities, can hinder the growth and expansion of the local industry. Nepal Rastra Bank (NRB) has fixed the loan-to-value ratio for electric private vehicles at 80 percent, which means that a bank can provide a loan amount up to 80 percent of the value of the vehicle.[44] Therefore, there is need of creating new green loan scheme with additional benefits for the deployment of electric vehicle.

3.2 SWOT analysis of the e-mobility in Nepal



- **<u>Strengths:</u>**
  - **Environmentally Friendly:** Electric vehicles produce zero tailpipe emissions, significantly reducing air pollution and greenhouse gas emissions. This can benefit Nepal's air quality, contribute to climate change mitigation, and act as a catalyst to achieve the net zero goal by 2045.
  - **Reduced Import Dependency:** As a landlocked country, Nepal heavily relies on fuel imports, incurring substantial costs. Embracing electric mobility can reduce this import dependency of petroleum fuel and enhance energy security through use of hydroelectricity produced in Nepal.
  - **Abundance of Renewable Energy Potential:** Nepal has substantial hydropower potential, making it feasible to generate electricity from renewable sources and power electric vehicles sustainably.

[44] https://www.newbusinessage.com/Articles/view/13158

- **Government Support and Incentives:** The government of Nepal has been providing various incentives and subsidies to promote the adoption of electric vehicles, such as tax benefits, reduced customs duties, and exemptions on EV imports.
- **Growing Awareness and Acceptance:** Awareness of environmental issues and the benefit of electric mobility is increasing among the population, creating a positive environment for the adoption of EVs.

- **Weaknesses**
  - **Infrastructure Challenges:** The lack of a robust charging infrastructure network in Nepal remains a significant challenge for widespread EV adoption. Insufficient charging stations could lead to "range anxiety" among potential EV owners.
  - **Limited Vehicle Models:** The availability of a limited variety of electric vehicle models compared to IC engine vehicle in the Nepalese market may deter consumers from switching to EVs due to limited choices and potential concerns about performance and range.
  - **Power Grid Capacity:** Integrating a large number of EVs into the power grid requires sufficient capacity and smart grid management to avoid strain on the existing infrastructure.
  - **Lack of Technical Skills and Training:** The adoption of electric mobility requires a skilled workforce to handle maintenance, repairs, and servicing of EVs. However, Nepal lacks technical resource. Adequate training and skill development initiatives might be necessary.

- **Opportunities:**
  - **Renewable Energy Utilization:** Nepal can capitalize on its abundant renewable energy resources to generate electricity for EVs, thus creating a sustainable transportation ecosystem.
  - **Tourism Promotion:** Usage of electric mobility may position Nepal as an eco-friendly and sustainable tourist destination where e-mobility can be used as sightseeing vehicle and attract more environment concern tourists.
  - **Urban Mobility Solutions:** In densely populated areas like Kathmandu, electric rickshaws and electric bikes can provide efficient and eco-friendly last-mile urban mobility solutions.
  - **Private-Public Partnerships:** Encouraging partnerships between the government, private sector, and international organizations can help accelerate the development of electric mobility infrastructure and technology.
  - **Battery Technology Advancements:** As battery technology continues to improve, the cost of electric vehicles is expected to decrease, making them more affordable and attractive to consumers.
- **Threats:**
  - **Lack of Policy Implementation**: Despite supportive policies, the effective implementation and enforcement of regulations related to electric mobility might face challenges.
  - **Market Players Lobbying:** Interests and lobbying efforts from the fossil fuel industry & IC engine vehicle dealer may hinder the growth of electric mobility in Nepal.
  - **Economic Instability:** Economic uncertainties and fluctuations can impact consumer spending and willingness to invest in relatively expensive EVs.
  - **Global Technological Changes:** Rapid advancements in autonomous vehicles or alternative clean energy technologies could divert attention and investment away from electric mobility.

4 Demonstration projects

4.1 SOLUTIONSplus Demonstration Projects

The demonstration project of SOLUTIONSplus taking place in Kathmandu has the objective of contributing to the development of an ecosystem for electric mobility in the city. This is being achieved by showcasing a variety of electric vehicles aimed at enhancing public transport, produced by local companies. The demonstration projects involved converting a diesel bus into an electric bus, developing modified e-3 wheelers for both passengers and cargo, creating redesigned e-3 wheelers suitable for passengers and cargo, developing e-shuttle vans and waste collector, and converting a mini truck into an electric vehicle.

4.1.1 Converted e-bus

The conversion of an old diesel bus to an e-bus involves primarily replacing drive system components such as the motor, transmission, and rear axle. The necessary components for this conversion are being imported and assembled locally. To aid the ongoing demo project, suitable simulation is being employed to facilitate the design, optimization, and development of a model. Furthermore, data loggers are being used to measure and establish local drive cycles for calculating the required battery capacity.

4.1.2 Remodeled e-3 wheelers (Passenger & Cargo)

The Remodeled Safa Tempo demonstration project involves the creation of the improved Safa Tempo units (passenger and cargo), which have been designed, developed, and deployed to support local entrepreneurs in enhancing the performance and sustainability of their existing Safa Tempos. The primary goal is to improve the performance and sustainability of their existing Safa Tempos, while also providing entrepreneurs with the necessary knowledge and resources for effective vehicle modification.

4.1.3 Redesigned e-3 wheelers (Passenger, Cargo)

Prototypes for redesigned e-3 wheelers (a passenger EV Safa Tempo and cargo e 3-wheelers) have a highly adaptable system that can be utilized for two purposes with just a change of rear body, while the technical specifications and primary structure remains the same. The necessary components for the prototypes are either imported or locally produced.

4.1.4 E-shuttle van

The demonstration project is developing a prototype of an e-shuttle van (4 wheels) to replace the current use of conventional cars and vans for sightseeing. The prototype vehicle will mainly be used for heritage sightseeing purposes for tourists and visitors within the inner city. For the development of e-shuttle van, the components will either be imported or locally made.

4.1.5 Converted e-mini truck

The converted tata ace mini-truck to an electric mini truck will be used as a goods carrier and has high potential to replace thousands of diesel-powered goods carriers (4-wheelers) running on different routes in the Kathmandu valley.

4.1.6 Waste collector

The demonstration project is developing a prototype of electric waste collector vehicle for the waste collection in Kathmandu Valley. The vehicle will be used to collect the waste from households to the transit hub before sending it to landfill area.

4.2 Prioritization of KPIs addressing the specific city needs based on stakeholder consultation

The survey was carried out during impact need assessment study for the demo projects with the stakeholders. Participants included stakeholders from various sectors, including academia, industry, consumers, and practitioners. According to the survey results and stakeholders' priorities regarding the project's Key Performance Indicators (KPIs), the financial aspect emerged as the top concern among stakeholders. Then, the institutional framework took the second position as stakeholders encounter regulatory challenges associated with new technologies. The wider economy and societal aspects of EV holds more priority than the environmental considerations. Stakeholders emphasized that these aspets significantly impact jobs, economic growth, and overall development, while environmental benefits, though understood, held lesser priority among KPIs.

Demonstration Projects Features Analysis

The analysis is validated with the help of KPI questionnaire survey feedback with the relevant consumers, experts, and the stakeholders from different governmental and non-governmental organizations like Department of Transport Management, Kathmandu University, Tribhuwan University, FHI 360, Theego etc. The provided rating scale divides the various demo project parameters into three distinct categories: low, medium, and high. This scale provides a framework for assessing the parameters of these projects considering specific features. A "low" rating is one that typically involves fewer than five stakeholders. The "medium" rating denotes a moderate level, typically involving 5 to 10 stakeholders. The "high" rating denotes a significant level of audience involving more than 10 stakeholders.

Demo Projects / **Parameters**	**Converted e-bus**	**Remodeled e3w (Passenger & Cargo)**	**Redesigned e3w (Passenger, Cargo)**	**E-shuttle van & Waste Collectors**	**Converted e-mini truck**
Degree of Rating: Low, Medium to High					
Provides an immediate and actual use	Commuting	Commuting, Courier,	Commuting, Courier,	Commuting & Site seeing Garbage Collector	Courier
Demonstrates local manufacturing capabilities	Medium	High	High	Low	Medium
Promotes sustainable transportation	Medium	High	High	High	High
Technical support from SoL+ partners	High	High	High	High	High
Adaptable Solution	High	Medium	Medium	High	Medium
Potential Market in other cities	High	High	High	High	High
Directly addresses a need of a specific market/ a market segment exists	Medium	High	High	Low	Medium
Scalability and reachability	High	High	Medium	Low	Medium
Dependence on imported components	High	Medium	High	High	High

Government support and policies	Low	Medium	Low	Medium	Low
Growing demand for sustainable transportation:	High	High	High	Medium	High
Funding Opportunities	Low	Medium	Low	Low	Low
Infrastructure limitations	Medium	Low	Low	Medium	Medium
Financial constraints	High	Medium	High	High	High
Competition	Medium	High	Low	Low	Medium
Banking Facility	Low	Medium	Low	Medium	Low

4.2 SWOT Analysis of the Demo Projects

The SWOT analysis of each demonstration project in the context of Kathmandu Valley:

4.2.1 Strengths

- **Converted e-bus**
  - **Reduction of emissions:** The conversion of diesel buses to e-buses will significantly reduce air pollution and greenhouse gas emissions in Kathmandu Valley, contributing to improved air quality and public health.
  - **Demonstration of technology:** The project serves as a pilot initiative to showcase the feasibility and benefits of converting existing diesel buses to electric, encouraging other cities and transportation authorities to adopt similar initiatives.
  - **Potential cost savings:** Over the long term, converted electric buses may prove to be more cost-effective than diesel buses, considering lower operating and maintenance costs and possible government incentives or subsidies.
- **Remodeled 3-wheelers (Passenger & Cargo)**
  - **Support for local entrepreneurs:** The project empowers local entrepreneurs/owners and drivers by providing them with improved e-3 wheeler options to the existing safa tempo, enhancing their business opportunities and income potential, mainly for women entrepreneurs and drivers.
  - **Customizable options:** The flexibility of remodeled e-3 wheelers allows for multiple configurations, catering to various business needs, such as passenger transport and cargo delivery.
- **Redesigned 3-wheelers (Passenger, Cargo)**
  - **Versatility:** Redesigned e-3 wheelers offer more deployment flexibility than existing 3-wheelers making them suitable for various purposes with minimal changes to their technical specifications and primary structure.
- **E-shuttle van**
  - **Eco-friendly tourism:** Introducing e-shuttle vans for heritage sightseeing aligns with sustainable tourism practices mainly in UNESCO listed heritage sites in Kathmandu valley, attracting eco-conscious tourists and promoting the valley's commitment to responsible tourism.

- **Lower operational costs:** E-Shuttle van generally have lower operating costs than conventional fuel-powered shuttle vehicles, making the e-shuttle van a cost-effective option for tour operators in the long run.

- **Converted e-minitruck.**
  - **Emission reduction:** Converting tata ace mini trucks to electric contributes to reducing emissions and improving air quality in the Kathmandu Valley, particularly in densely populated areas where goods transportation is significant.
- **Waste Collector(e4W)**
  - **Emission reduction:** Usage of electric waste collector vehicle instead of existing waste collector vehicle will significantly reduce emission and reduction in the fuel consumption.
  - **Cost effective:** EV Waste Collector will generally have lower operating and maintenance costs than existing waste collector vans making it to be more cost effective.

4.2.2 Weaknesses

- **Converted e-bus**
  - **Initial costs:** The conversion process may require a substantial upfront investment, including importing specialized components and technical expertise, which could pose financial challenges for some operators.
  - **Performance:** Since, the converted bus are quite old and had already run for some years. The performance on the real case scenario may not be as expected.
- **Remodeled 3-wheelers (Passenger & Cargo)**
  - **Limited range:** Depending on the battery capacity, Remodeled 3-wheelers (Passenger & Cargo) may have a limited range compared to other conventional 3-wheeler vehicles, which could affect their suitability for longer routes or routes with inadequate charging infrastructure.
- **Redesigned 3-wheelers (Passenger & Cargo)**
  - **Limited range:** Depending on the battery capacity, Redesigned 3-wheelers (Passenger & Cargo) may have a limited range compared to other 3-wheelers conventional vehicles, which could affect their suitability for longer routes or routes with inadequate charging infrastructure.
- **E-shuttle van**
  - **Initial Cost:** The cost of the e-shuttle van is relatively high compared to existing IC engine powered shuttle van and other 3-wheelers vehicles used in the market for the purpose. This could make it difficult for some businesses or organizations to afford the e-shuttle van.
  - **Limited range:** Depending on the battery capacity, e-shuttle vans may have limitations in terms of distance coverage, potentially affecting their feasibility for long distance travel.
- **Waste Collector(e4W)**
  - Limited Range: EV waste collector may have limited range compared to the existing fossil fuel powered waste collector vehicle which might not be enough for taking the waste to the dumping site.

- **Converted e-minitruck**
  - **Limited load capacity:** Converted mini-trucks may have lower load capacity compared to diesel-powered counterparts because of battery placement, which could limit their applicability for heavy-duty transport vehicle.
  - **Initial costs:** The conversion of e-minitruck from existing diesel powered tata ace may require a substantial upfront investment, including importing specialized components and technical expertise, which could pose financial challenges for some operators.

4.2.3 Opportunities

- **Converted e-bus**
  - **Government incentives:** Government may offer incentives, grants, or subsidies through different tax rebate scheme and external donor agencies funding to support the adoption of converted electric buses, attracting more operators to convert to electric and accelerating the deployment of e-buses. For example, The Investment Board Nepal under its project 'Electric Bus Rapid Transit in Ring Road of Kathmandu Valley' has planned to operate electric vehicles on the 27.30 km long ring road. Similarly, Ministry of Physical Infrastructure and Transportation (MOPIT) has initiated new program for Deployment of 300 inter-city EV Bus service in Kathmandu Valley
  - **Public awareness and acceptance:** The successful operation of converted e-buses can raise awareness and build public acceptance of electric buses, promoting a positive shift towards sustainable transportation.
- **Remodelled 3-wheelers (Passenger & Cargo)**
  - **Last-mile delivery:** Remodelled e-3 wheelers can play a crucial role in last-mile delivery services, addressing the growing demand for sustainable and efficient logistics solutions in the valley.
  - **Government support:** The government may provide support, financial incentives, or subsidies to local manufacturers in terms of different tax rebate scheme for purchasing the advanced equipment to produce and promote remodeled electric 3-wheelers, fostering local production which encourages for the adoption of remodeled electric 3-wheelers in other cities in Nepal.
- **Redesigned 3-wheelers (Passenger & Cargo)**
  - **Market expansion:** The success of the prototypes can open up opportunities for commercial production and deployment of these redesigned e-3 wheelers in other regions and cities beyond Kathmandu Valley.
- **E-shuttle van**
  - **Tourism promotion:** The e-shuttle van can also be integrated into broader tourism promotion efforts, highlighting the valley's cultural heritage and offering a unique and sustainable way for tourists to explore the city.
  - **Collaboration with tour operators:** Partnering with local tour operators and tourism agencies can facilitate the adoption and operation of e-shuttle vans for sightseeing tours.
- **Waste Collector(e4W)**
  - **Effective Waste Collection:** The electric waste collector (e4W) may be helpful for collecting waste where road is narrow and existing waste collector vehicle are not accessible.
- **Converted e-minitruck**

- **Carbon Emission Reduction:** Reduce the carbon footprint of the transportation industry in Kathmandu.
- **Last-mile delivery:** Converted e-mini-trucks can play a vital role in last-mile delivery services, catering to the growing e-commerce sector and facilitating efficient and sustainable logistics operations.
- **Government support:** The government may provide incentives and policy support to encourage the conversion of electric mini-trucks for goods transportation.

4.2.4 Threats

- **Converted e-bus**
  - **Infrastructure limitations:** The limited charging infrastructure in the valley could hinder the smooth operation of e-buses and may require significant investments in charging stations.
  - **Financing:** The high cost of importing and assembling components locally may make the conversion of e-buses add up the initial cost and makes it less financially viable.
- **Remodelled 3-wheelers (Passenger & Cargo)**
  - **Market competition:** The project may face competition from other electric 3-wheeler options (diesel & gas powered 3-wheelers vehicle) as well as other public & cargo vehicles that are already prevalent in the market.
- **Redesigned 3-wheelers (Passenger & Cargo)**
  - **Market adoption:** The success of these prototypes depends on market acceptance and demand for the various use cases they cater to. Limited awareness or reluctance to embrace new technologies with quality standard (compared to imported ones) may hinder their widespread adoption.
- **E-shuttle van**
  - **Infrastructure limitations:** The availability of charging infrastructure in and around heritage sites routes and tourist destinations may be limited, requiring strategic planning and investments in charging stations for quicker adaptation of e-shuttle van.
- **Waste Collector(e4W)**
  - **Infrastructure limitations:** The availability of fast charger in and around Kathmandu Valley is limited which makes the difficult for adaptation of electric waste collector vehicle for transferring the waste to the dumping site.
- **Converted e-minitruck**
  - **Market adoption:** The success of converted e-mini trucks depends on market acceptance, willingness of businesses to switch from conventional diesel trucks, and the development of supporting infrastructure such as charging stations.
  - **Financing:** The high cost of importing and assembling components locally may make the conversion of tata ace add up the initial cost if the demand for the conversion is less.

To sum up, each of the demonstration projects shows unique strengths and opportunities for advancing sustainable mobility in Kathmandu Valley. However, they also face specific challenges and threats that will require strategic planning, collaboration, and government support to realize their full potential and contribute to the city's transition towards a greener and more sustainable transportation system.

5 The City Roadmap- Where are we going?

5.1 Vision

The e-mobility city roadmap for Kathmandu, Nepal aims to provide a clear direction for the transition towards sustainable and clean transportation in the city. The roadmap will outline a vision for e-mobility in Kathmandu and set goals for the adoption and up scaling of electric vehicles demonstration projects and infrastructure. The e-mobility roadmap also aligns with areas of sustainable mobility, such as use of public transport and private transportation, to create an integrated and efficient mobility system.

5.2 Mitigating Barriers: Short, Medium, and Long-Term Strategies

List of barriers/weaknesses/threats	**Type of barrier/weakness/threats**	**Action steps and recommendations to address it**		
		Short-term	**Medium-term**	**Long-term**
Limited scale and reach	Financial, Social	<u>Awareness & Education Campaigns:</u> • **Federal:** Allocate funding for nationwide EV awareness campaigns through media, educational institutions, and public events. • **Provincial & Local:** Collaborate with local educational institutions for workshops and seminars & host community-level workshops and information sessions on EV technology and benefits.	<u>Regulatory measures & Tax Exemptions:</u> • **Federal:** Introduce duty tax exemptions and incentives for EV purchases, develop laws, acts, and policy for transition towards e-mobility • **Provincial:** Coordinate with federal policies, offer additional local incentives, and annual tax breaks for EV owners. • **Local:** Implement local tax waiver for EV owners.	<u>Partnership & Collaboration with Public & Private Sectors</u> • **Federal:** Create a platform for sharing best practices and case studies in public-private collaboration in EVs market. • **Provincial:** Institutionalize partnership by integrating private sector expertise according to the need • **Local:** Host joint forums and seminars for public-private dialogues.
Dependence on imported components	Financial & Technological	<u>Tax Exemptions</u> • **Federal:** Introduce federal tax breaks for EV components purchase to incentivize adoption • **Provincial:** Implement regional tax incentives aligned with federal	<u>R&D on EV technology, capacity development of manpower</u> • **Federal:** Invest in federal technological advancements and research, ensuring innovation in EV technology at a national level.	<u>Establishment of components manufacturing industry</u> • **Federal:** Support the establishment of a component manufacturing industry for EVs, • **Provincial:**

		policies, encouraging conversion of IC engine vehicle and usage. • **Local:** Offer local tax credits or exemptions for local industry/workshops working on Ev conversion.	• **Provincial:** Collaborate with universities and research institutions, focusing on regional technological enhancements in EV technology. • **Local:** Enhance local technology and innovation in EV infrastructure and technology maintenance within municipal boundaries.	Facilitate the setup of a state-level industry for manufacturing EV components, • **Local:** Aid in local industry establishment through local tax waiver.
Funding and Investments	Political, Institutional, Financial	<u>Policy Design & Tariff Fixation</u> • **Federal:** Set federal regulations and tariffs on EV components, ensuring uniformity across the country. • **Provincial:** Develop state-specific policies and guidelines for EV adoption, conforming to federal standards. • **Local:** Implement local regulations where applicable to support federal and state policies.	<u>Financial Incentives, Government Schemes</u> • **Federal:** Offer federal financial schemes, facilitate green scheme loans with lower interest rate, and investment incentives on EVs technology • **Provincial:** Implement state-level investment plans and financial incentives for EV infrastructure and development. • **Local:** Administer local funding programs, facilitating access to financial incentives for local EV infrastructure.	<u>Encouragement of private sector investments and FDIs</u> • **Federal:** Encourage the foreign direct investment in ev manufacturing and infrastructure industry • **Provincial:** Promote state-level initiatives to attract private investments in EV-related industries and innovations. • **Local:** Facilitates local private initiatives and collaborations, fostering innovation and growth in EV-related sectors within the municipality.
Lack of Interagency Coordination	Political, Institutional	<u>Clear assignment of roles and responsibility with organisation</u> • **Federal:** Develop a national framework for vehicle	<u>Framework for the vehicle management & operation</u> • **Federal:** Develops federal operation in guidelines for	<u>Development of one door services through single organization approach</u> • **Federal:** Establish state-level

		management, outlining operational strategies at the federal level. • **Provincial:** Establishes provincial/state frameworks for vehicle management and operation, coordinating with local authorities for implementation strategies. • **Local:** Structure local vehicle management plans and operational strategies within municipalities	smooth operation and transitions to EVs in terms of vehicle registration, tax payment, vehicle transfer. • **Provincial:** Develop state-specific plans and guidelines for operation of EVs in the respective state. • **Local:** Implement local guidelines for operational transitions within the municipality.	centralized services for efficient management and provision of transport related services. • **Local:** Manage local centralized services for residents, ensuring easy access to EV-related services and support within the municipality.

5.3 Upscaling Demo

Demo Projects	**Type of barrier/weakness/threats (e.g. could be political, institutional, technological, environmental, social, financial)**	**Action steps and recommendations to address it (it could be political, institutional, technological, environmental, social, financial)**		
		Short-term	**Medium-term**	**Long-term**
Converted E-bus	Initial costs of conversion (Financial)	Partnerships with government agencies and private investors to secure funding	Explore options for EMIs, investment	Public Private Partnership
	Limited range for e-buses (Technological) Lack of charging infrastructure (Technological)	Establish charging infrastructure in key location in coordination with utility companies	Invest in R&D to improve battery technology and increase efficiency of overall system:	Establish partnerships with research centres to continuously improve the technology and efficiency
	Market acceptance and public awareness (Social)	Extensive public awareness campaign to educate the public about the benefits of e-buses	Guidelines Development for the conversion module of vehicle	Ban on IC engine vehicle. Establish homologation facilities
Remodelled	Limited Payload capacity (technological)	Collaborate with local industry to develop 3	-	-

		wheelers with improved vehicle performance		
	Market competition from conventional 3-wheelers (Financial/Social)	Market research to identify specific business niches	marketing campaigns to promote the benefits	Partnerships with operators & e-commerce delivery services
Redesigned e-3 wheelers (passenger, cargo) and e4w waste collector)	Initial development challenges for prototypes (Technological)	Partnerships with government agencies and private investors to secure funding	Optimize the design with help of feedback	R&D for better design and operation
	Market adoption (social)	pilot projects in collaboration with local manufacturers	Develop marketing strategies to showcase the versatility and adaptability	Collaborate with government and non-governmental organizations for larger production and deployment
E-shuttle van	Limited range (Technological)	Collaborate with local industry to develop 3 wheelers with improved vehicle performance	Develop partnerships with hotels and tourism businesses to integrate e-shuttle van services	Develop & Implement city-wide sustainable transportation plans
	Market adoption (social)	Encourage pilot projects with improved designs in collaboration with local manufacturers	Develop marketing strategies to showcase the long term economic and social benefits	Collaborate with government and non-governmental organizations for larger production and deployment
Converted E-Mini Truck	Limited Payload capacity (technological)	Collaborate with local industry to develop-mini truck with improved vehicle performance	Develop partnerships with hotels and tourism businesses to integrate e-shuttle van services	Develop & Implement city-wide sustainable transportation plans
	Market adoption (social)	Encourage pilot projects with improved designs in collaboration with local manufacturers	Develop marketing strategies to showcase the long term economic benefits	Collaborate with government and non-governmental organizations for larger production and deployment

5.4 Timeline

Phase	***Demonstration***	***Scale-Up***	***Mainstream***
Timeline	2022-2023	2024-2029	2030 onwards
Target/ Focus area	Feasibility study and demonstration project development for different EV models: 8 demo projects	Incentives and regulatory framework in place to increase demand in the city and create a platform for EV usage.	EVs will be the default choice due to better performance and lower costs: Deploy EV in exchange of conventional vehicle through bank loans, incentives and tax exemptions.
Finance	Grants	Green loans, subsidiary	Commercial banks, Investment companies
Responsible Agencies	Government, private sector, academia	Government, private sector, academia, consumers	Government, private sector, academia, consumers
Action Plans to meet the goals	- Route mapping for Evs - Development of piloting model of different ev types - Testing of prototype in the assigned route - Workshops and dialogue program for capacity development - Design and Develop business models for deployment of electric vehicle. - Develop scale-up concepts for different cities.	- Initiate plan to electrify public transport government vehicles & private vehicles. - Development of charging station network and upgrade the electricity infrastructure across the country. - Promote the deployment of electrified public transport. - Public awareness program - Develop technical & emission standards. - Study on developing a master plan for charging network	- Enforce laws & standards. - Establish battery recycling plant. - Build local manufacturing plant for ev production. - Implement plan to to electrify public transport government vehicles & private vehicles. - Introduce policy to exchange ICE vehicles with evs which has been used for more than 15 years with subsidy or in EMIs basis

6 Implementation plan- How do we get there?

To achieve a sustainable e-mobility transition timeline and execute city roadmap successfully in Kathmandu, a comprehensive implementation plan is needed. This proposed plan has incorporated in five different sections: policy, financial, technological, social, and environmental. The tripartite approach involving local, provincial, and federal governments as well as academia, industries and development organizations is crucial for implementing these e-mobility initiatives. Some targets, roles and proposed activities for each section in accordance to the findings and government missions are as follow:

6.1 Implementation Plans

Section	Proposed Activities	Supporting Agencies
Policy Measures	Develop a comprehensive regulatory framework with well defined targets, and promote the use of EVs by providing incentives such as tax waivers, rebates, and reduced excise and customs duties. Consider implementing feebate programs that impose taxes on inefficient ICE vehicles to finance subsidies for low-emission or EV purchases	• 3-Tier Governments • National Planning Commission
Financial Measures	Establish green loans with added benefits to facilitate the deployment of electric vehicles. Provide financial support, such as loans, grants, and investment opportunities to bloster the growth and expansion of the local industry. Encourage private sector investment by providing tax waivers and other financial incentives on establishment of assembly plant and research institution	• Banking & Financial Institutions • Government Aids • Investment Companies • FDIs
Technological Measures	Develop and enhance the skills of the workforce in areas such as EV design, manufacturing, maintenance, and repair through academic and vocational training programs. Collaborate with private sector partners to expand the charging infrastructure in Kathmandu and other parts of the country.	• Research Centres, • Universities • Training Centre • Automobile Dealers • Utility Companies
Social Measures	Involve local communities in decision-making processes, including them in the planning and implementation of charging infrastructure. Raise public awareness about the benefits of EVs and the importance of a sustainable e-mobility transition through public campaigns, and education	• Local Club, NGOs, INGOs • 3-Tier Government
Environmental Measures	Set targets for reducing emissions from the transport sector and promote the use of EVs as a key strategy to achieve these targets. Improve air quality by reducing emissions from vehicles	• Local Club, NGOs, INGOs • 3-Tier Government

6.2 Focus Area 1: Policy Measures

The transition to electric vehicles (EVs) in Kathmandu requires a comprehensive and detailed policy framework to support and promote EV adoption. The government of Nepal has commitment to achieving net-zero carbon emissions by 2045 and has set ambitious targets for EV adoption, aiming for EVs to comprise 25% of all private passenger vehicle sales by 2025 and 90% by 2030. Similarly, it aims for 20% adoption in four-wheeler public passenger vehicles by 2025 and 60% by 2030.[45] To achieve these targets, a well-coordinated and sustained effort is required to overcome current challenges such as policy instability, lack of interagency coordination. Therefore, policy framework should include the development of standards for EVs, charging infrastructure, and tariff rate fixations. Additionally, the government should consider implementing tax incentives such as waivers, rebates, and reduced excise and customs duties, to enhance EV's affordability. These policy measures, along with infrastructure development and incentives, are crucial for the successful transition to electric vehicles in the region. The policy framework should also consider the environmental benefits of EVs, as they can contribute to reducing air pollution and greenhouse gas emissions. Moreover, the transition to EVs can help reduce dependence on fossil fuels and contribute to energy security. To ensure success, the government should collaborate with stakeholders, including the private sector, international partners, and local communities. This collaborative approach is vital for the successful transition to electric vehicles in Kathmandu Valley and Nepal as a whole.

6.3 Focus Area 2: Financial Measures

The transition to electric vehicles (EVs) in Kathmandu demands a comprehensive approach that goes beyond effective policy measures to include substantial financial support to promote widespread EV adoption. One impactful financial measures is the introduction of green loans with added benefits to boost widespread EV adoption. These loans could offer lower interest rates and extended repayment periods, incentivizing consumers to purchase EVs. Likewise, infrastructure development is also crucial for the successful transition to electric vehicles in Kathmandu Valley. To facilitate this, the government could provide loans, grants, and investment opportunities to support the growth and expansion of the local EV industry. The authorities should allocate resources for the development and expansion of EV infrastructure, ensuring that these facilities are accessible and affordable for EV owners. Encouraging private sector investment is equally important, and financial incentives for entities establishing EV assembly plants, charging stations and research institutions can significantly contribute to the development of the EV industry in Nepal.

6.4 Focus Area 3: Technological Measures

The shift to electric vehicles in Kathmandu requires for technological advancements to boost and encourage EV adoption. One crucial measure involves elevating the expertise of the workforce in areas like EV design, manufacturing, maintenance. This can be achieved through academic and vocational training programs, ensuring the development of a skilled labor force capable of supporting the local EV industry's growth and development. In addition to workforce development, fostering a robust research and development (R&D) ecosystem is vital for the successful transition to electric vehicles in Kathmandu Valley. Collaborative efforts with various universities and research institutions are essential components of this ecosystem. Investment in R&D can lead to innovations that improve EV technology, reduce costs, and address specific challenges associated with EV adoption in context of Kathmandu Valley.

[45] Nepal's Sustainable Development Goals Status and Roadmap: 2016-2030: NDC

6.5 Focus Area 4: Social Measures

The transition to electric vehicles (EVs) in Kathmandu requires not only policy, financial, and technological measures but also social measures to support and promote EV adoption. One of the social measures that could be considered is involving local communities in decision-making processes, actively participating them in the planning and implementation of electric vehicle related projects. Additionally, raising public awareness about the benefits of EVs and the importance of a sustainable e-mobility transition through public campaigns and education can help promote EV adoption and create a culture of sustainability. The NGOs, local clubs along with governmental entities can collaborate for promoting EV adoption and raise awareness about the benefits of EVs.

6.6 Focus Area 5: Environmental Issues

Environmental measures must be taken in action to ensure a successful transition to electric vehicles (EVs) in Kathmandu. Nepal has set ambitious targets to reduce its greenhouse gas (GHG) emissions and transition to a more sustainable future. The country announced a 2045 net zero carbon emissions target at COP26 and released its Long-term Strategy in 2021, aiming to achieve carbon neutrality by 2045 or sooner and negative carbon emissions by 2050. Therefore, the key environmental measure is setting realistic and achievable targets for EV adoption for reducing emissions from the transport sector. This can be a key strategy to achieve the above targets. This can help reduce air pollution and greenhouse gas emissions, which are major environmental concerns in the region. Additionally, improving air quality by reducing emissions from vehicles can have significant health benefits for the local population.

7 Conclusion and next steps- What do we need?

The e-mobility city roadmap for Kathmandu, Nepal represents clear and concise blueprint that envisions a future where sustainable and clean transportation takes into the limelight of the city's urban landscape. Through an in-depth exploration of various aspects, ranging from policy review, current institutional structure, and demonstration projects to barriers and opportunities, this roadmap outlines an implementation plan that encompasses policy, financial, technological, social, and environmental dimensions. This holistic approach helps to steer the successful execution of the roadmap, ultimately leading to a more sustainable and eco-friendly transportation ecosystem in Kathmandu.

The roadmap's strength lies in its systematic analysis of demonstration projects, each tailored to specific needs and segments of the population. By spotlighting key strengths such as emissions reduction and entrepreneurial empowerment, while acknowledging challenges, such as initial costs and limited range, the roadmap recognizes the nature of the transition to electric mobility. This comprehensive understanding sets the stage for a balanced and well-informed approach to implementation. This roadmap is prepared with reference to the prioritization of key performance indicators (KPIs) based on stakeholder analysis which ensures that the roadmap resonates with the needs and expectations of various stakeholders, ranging from government bodies to local communities.

In addition, the emphasis on financial considerations, institutional framework, and public awareness underscores the roadmap's comprehensive nature, revealing a strategic path that aims to address diverse aspects of electric mobility implementation. Therefore, the phased timeline of the roadmap is indicative of a well-thought-out strategy that spans short-term feasibility studies and demonstration projects to the long-term goal of mainstream electric vehicle adoption. The roadmap's focus on areas such as policy formulation, financial incentives, workforce development, public engagement, and emissions reduction showcases its intention to create a comprehensive and sustainable transition plan.

Furthermore, the roadmap highlights the roles and responsibilities of various sustainable transport implementing organizations. Government bodies, international partners, and local authorities are assigned specific responsibilities, fostering a collaborative approach that is essential for a successful transition. This collaborative spirit ensures that a range of expertise and resources are harnessed to navigate challenges, catalyze change, and drive the vision of sustainable mobility forward.

In summary, the e-mobility city roadmap for Kathmandu reflects a well-researched, comprehensive, and strategic plan for transitioning the city's transportation landscape towards sustainability. By adopting this roadmap, Kathmandu has the potential to position itself as a pioneer in embracing electric mobility, ultimately leading to improved air quality, reduced emissions, enhanced economic growth, and a higher quality of life for the people.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