Global Green Growth Institute

Accelerating Implementation of
Nepal's *Nationally Determined Contribution*

National Action Plan for Electric Mobility

April 2018

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Recommended citation:
GGGI (2018). *National Action Plan for Electric Mobility: Accelerating Implementation of Nepal's Nationally Determined Contribution*. Seoul: Global Green Growth Institute.

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Preface

In our country, outdoor air pollution has become an urgent issue. Every year, is contributes to an estimated 9,000 premature deaths in Kathmandu Valley alone. In our fight against air pollution and greenhouse gas emissions, the electrification of the transport sector is an important goal because widespread electrification would greatly improve the quality of the air we breathe. And in fact, switching to electric vehicles has been a core target of the Ministry of Forests and Environment since 2015, when Nepal's *Nationally Determined Contribution* was established.

But switching to electric is challenging and much needs to change. This *National Action Plan for Electric Mobility* charts a path ahead for the achievement of the ambitious electric mobility targets we adopted under the *Nationally Determined Contribution*, supported by policy from the Ministry of Physical Infrastructure and Transport. The plan identifies both the major barriers that constrain us and proposes ideas and strategies for solutions and opportunities that can lead us forward. Success with the plan's many recommendations will require proactivity and optimism from a range of government, private sector and civil society partners.

I would like to thank the team that assembled this plan, including experts from the Ministry of Forests and Environment, the Ministry of Physical Infrastructure and Transport, and the Global Green Growth Institute, as well as private sector and civil society partners. As Nepal moves toward greater and greater sustainability, this plan acts as an important guide for cleaning our air and greening our transport sector.

Bishwa Nath Oli, Ph.D
Secretary
Ministry of Forests and Environment

Foreword

We are a landlocked country and to meet our demand for fossil fuel, we must import all our oil needs, costing an estimated NPR 108 billion (USD 1.3 billion) during the last fiscal year (2073/74). But the other side of the coin looks better - we have immense hydropower potential. There is an estimated 83,000 MW of energy in our rivers, and we are currently capturing only a fraction of that. This makes electric vehicles well positioned to assume a much greater role within our transport systems. In addition, electric vehicles are cheaper to run than conventional vehicles.

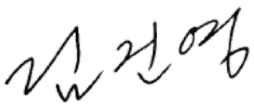
The Ministry of Physical Infrastructure and Transport believes that the electrification of the transport sector is the way forward. For over a decade, we have been setting out ambitious, sustainable and low-carbon transport policy and targets. We need to ensure that all the supporting and enabling conditions are in place to stimulate growth in electric vehicles, and this plan is a valuable contribution to this. The many actions in the plan collectively chart a path forward, supporting the transport sector into a bold new electric future.

Madhusuda Adhikari
Secretary
Ministry of Physical Infrastructure and Transport

Foreword

I would like to thank the leaders of the Ministry of Forests and Environment and the Ministry of Physical Infrastructure and Transport for giving the Global Green Growth Institute the opportunity to support the Government of Nepal by developing this *National Action Plan for Electric Mobility*. The Institute's Nepal office is hosted by the Ministry of Forests and Environment, and we are particularly grateful to Dr. Oli for his ongoing guidance. In many of Nepal's sectors, ambitious policy and targets are in place for a greener, more sustainable and inclusive future, and the Global Green Growth Institute is actively working alongside the Government of Nepal to help realize these.

We believe the actions presented in this plan, if realized by government and partners, can make a significant difference to the sustainability of Nepal's transport sector, and as a result, the prosperity, health and well-being of Nepal's people and environment. We are confident that these actions are well designed to generate strategic and operational advantages for Nepal, and we stand ready to support federal, provincial and local governments with any further services to advance implementation.



Jin Young Kim
Head of Program
Asia and Pacific Region
Global Green Growth Institute

Abbreviations

AAGR	annual average growth rate
ADB	Asian Development Bank
BAU	business as usual
CAGR	compound annual growth rate
CDKN	Climate and Development Knowledge Network
CO	carbon monoxide
CO_2	carbon dioxide
CO_{2e}	carbon dioxide equivalent
COP21	21st Conference of the Parties
DOTM	Department of Transport Management
EU	European Union
FDG	focus group discussion
GCF	Green Climate Fund
GDP	gross domestic product
GGGI	Global Green Growth Institute
GHG	greenhouse gas
GON	Government of Nepal
ICIMOD	International Centre for Integrated Mountain Development
KII	key informant interview
KMC	Kathmandu Metropolitan City
LMC	Lalitpur Metropolitan City
LULUCF	land use, land-use change, and forestry
MOF	Ministry of Finance
MOFE	Ministry of Forests and Environment
MOPIT	Ministry of Physical Infrastructure and Transport
NDC	Nationally Determined Contribution
NMVOC	non-methane volatile organic compound
NO_x	nitrogen oxide
NPR	Nepali rupee
PM	particulate matter
SO_2	sulfur dioxide
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar

Contents

Executive Summary

Working under the overall direction of the Ministry of Forests and Environment and in partnership with the Ministry of Physical Infrastructure and Transport, the Global Green Growth Institute (GGGI) launched the *Electric Mobility Program* in 2017, to support a transition towards clean and sustainable transportation in Nepal. Under the program, which supports implementation of Nepal's *Nationally Determined Contribution* (NDC) by boosting the adoption of electric vehicles in Nepal, this *National Action Plan for Electric Mobility* was developed.

This *National Action Plan* supports implementation of Nepal's NDC targets for the transport sector. It does this by reviewing Nepal's NDC and related policy (Part 1); exploring the transport sector and most effective policy options for increased adoption of electric vehicles (Part 2); identifying a wide range of barriers and issues that are currently restricting adoption of electric vehicles (Part 3); and outlining key proposed actions and initiatives for overcoming these barriers (Part 4). As well as quantitative analyses, the development of the *National Action Plan* pursued an intensely participatory process, drawing on numerous interviews and focus group discussions with government bodies, non-government organizations, consumers and the business and research communities.

Transport and Nepal's Nationally Determined Contribution

Leveraging a history of pioneering electric mobility initiatives, Nepal's* Nationally Determined Contribution *includes ambitious targets for low-carbon sustainable transport - The Paris Agreement (2015) established the NDC as the primary policy mechanism through which global action for climate change is expected to take place. Nepal's NDC outlines a series of 14 targets. Of these, four targets are focused on the transport sector:

- By 2020, Nepal aims to increase the share of electric vehicles up to 20% from 2010 level.
- By 2050, Nepal will decrease its dependency on fossil fuel in the transport sector by 50% through mass public transport, while promoting energy efficient and electric vehicles.
- Nepal will develop its electrical (hydro-powered) rail network by 2040 to support mass transportation of goods and public commuting.
- By 2025, Nepal will strive to decrease the rate of air pollution through proper monitoring of sources of air pollutants like wastes, old and unmaintained vehicles, and industries.

These transport sector targets are backed by robust policy and necessary fiscal and banking incentives - The government has put in place a robust policy framework to support sustainable and electric transport. In particular, this includes the *National Transport Policy* (2001) and the *Environment Friendly Transport Policy* (2015). This latter policy sets specific targets for electric vehicle adoption. More broadly, Nepal's adoption of the Sustainable Development Goals further cements an overall policy shift towards electric mobility. A supportive fiscal environment is also now in place, with a significantly reduced customs tax on electric vehicles, and value added tax (VAT) exemption. Similarly, the Nepal Central Bank and the Ministry of Finance are consistently improving the lending regulations to support electric vehicle consumption, for example through increased loan-to-value ratios (loan limits).

Transport Sector Growth, Associated Emissions and Electrification Scenarios

The transport sector is growing rapidly due to urbanization, rising incomes and increased road access in rural areas - Road transport accounts for over 90% of the domestic movement of passengers and freight in Nepal. As a landlocked country, Nepal does not have direct access to any sea ports, and as such the country imports 100% of its fossil fuel, and more than 75% of its goods from immediate neighbours. Expansion of national and local road networks go hand-in hand with economic development and urbanization. The total number of registered vehicles grew by 14% per annum during 1990-2015. In this, the share of registered two-wheelers increased substantially from 55% in 1991 to more than 80% in 2014. As a result, the share of public buses in the total vehicle fleet declined from 11% in 1990 to only 3% in 2015.

As a result of rapid transport sector growth and rising fossil fuel consumption, greenhouse gas and local pollutant emissions are climbing - Greenhouse gas emissions grew by 22% per year during 2007-2013, mostly due to the rise in number of passenger vehicles on the roads. In addition, non-methane volatile organic compounds and carbon monoxide (CO) emissions increased by 5.4% and 5.2% respectively per year during 1994-2008. According to the World Health Organization, poor air quality contributes to an estimated 9,000 deaths per year in Nepal, and a loss of welfare of USD 2.8 billion.

Increased adoption of electric vehicles across the transport sector will reduce final energy consumption, greenhouse gas and local pollutant emission, and enhance energy security – To address these transport-related challenges, sector electrification is needed. For this, a range of scenarios are feasible. These scenarios, when modelled, lead to differing degrees of benefit when compared against a baseline case (business as usual). In particular, scenarios show that a combination of increased electric mass transport and increased adoption of electric passenger vehicles will lead to robust benefits through to 2050. Under these scenarios, final energy consumption will decrease by 14-19% compared to business as usual with moderate rises in electric mass transport capacity, and moderate increases in electric passenger vehicles. Similarly, greenhouse gas emissions will decrease by 9-25%, and local pollutant emissions by 5-10%.

Barriers to Electric Mobility

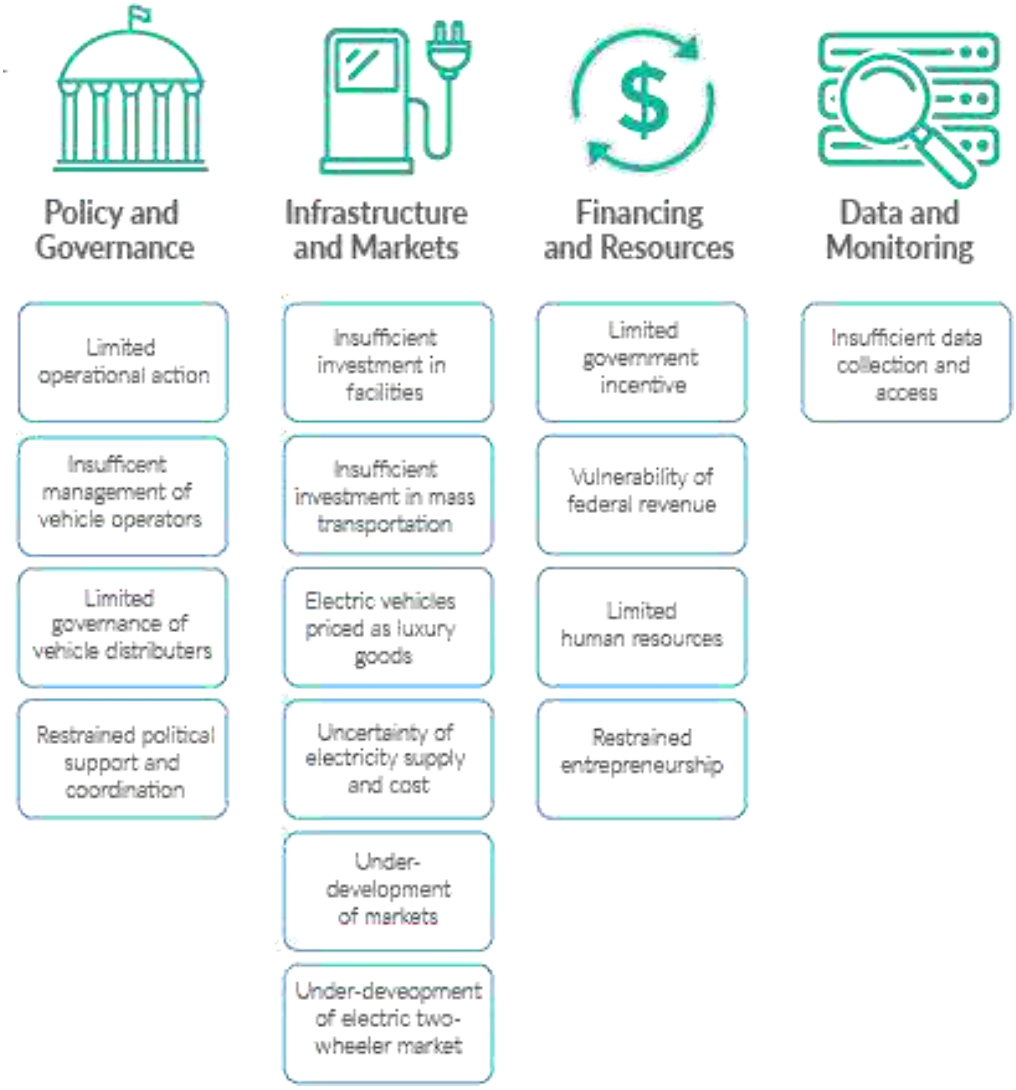
Although robust policy and fiscal incentives are in place, a range of barriers currently restrict greater adoption of electric mobility – These barriers can be identified across four major areas, namely a) policy and governance; b) infrastructure and markets; c) financing and resources; and d) data and monitoring (see Figure 1 below).

Gaps in the policy and governance system for electric vehicles undermine operational action and progress on the ground – High-level policy needs to be transformed into concrete directives, plans and regulation to support a switch to electric vehicles. In addition, management of public vehicle operators and businesses, and management of vehicle distributors need to be strengthened. Furthermore, greater political support and leadership for electric mobility would help to foster buy-in, investment and enthusiasm from consumers and the private sector

Insufficient infrastructure and underdeveloped electric vehicle markets discourage consumers and inhibit private sector investment and entrepreneurship – Insufficient investment in charging stations acts as a major barrier to increased adoption of electric vehicles by significantly reducing the convenience of electric vehicle ownership. There has also been very limited investment in electric mass transport infrastructure such as electric rail and electric bus systems. In addition, the electric vehicle market is underdeveloped: consumers are unaware of the benefits of electric vehicles; some vehicle types are difficult to purchase; vehicle prices overall remain prohibitively high; spare parts are expensive; and electricity supply is uncertain.

Insufficient financing, limited technical and human resources, and limited data availability restrict investment and business activity for electric mobility and undermines decision-making - Although government has provided tax relief measures and increased the loan-to-value ratio for electric vehicles, a lack of subsidy and other government incentives reduces consumption of electric vehicles. In addition, there is limited financial support for electric vehicle start-ups, which weakens entrepreneurship. Human and technical resources for vehicle servicing and testing could also be improved. Data on electric vehicles, on the current vehicle stock and on air quality and emissions levels is under-developed which leads to issues of decision-making for policy and regulation. In addition, the lack of access to data hampers analysis to assess electric mobility options in the country.

Figure A.1. Summary of barriers by category



Priority Actions for Electric Mobility

To overcome the barriers outlined above, three strategic actions should be prioritized at the national level – These priority actions include setting up a national taskforce for electric mobility, designing and implementing a national program for electric mobility and establishing a national financing vehicle for electric mobility (see Figure 2 below). Each of these priority actions will deliver progress across numerous of the 15 identified barriers. As such, they are high-level umbrella actions with multiple operational and strategic benefits.

A* Unit for Electric Mobility *will act as a centralized regulatory and promotional entity providing oversight to financial and programme initiatives - The proposed unit could be established either as a unit within an existing government entity, or as a quasi-independent government entity (taskforce or center, for example) answerable to a board comprised of government, business and citizen representatives. The fundamental mandate of the unit would be the promotion of electric mobility across relevant transport systems in Nepal, in line with national policy, and well as to provide oversight on the proposed program and financing vehicle for electric mobility.

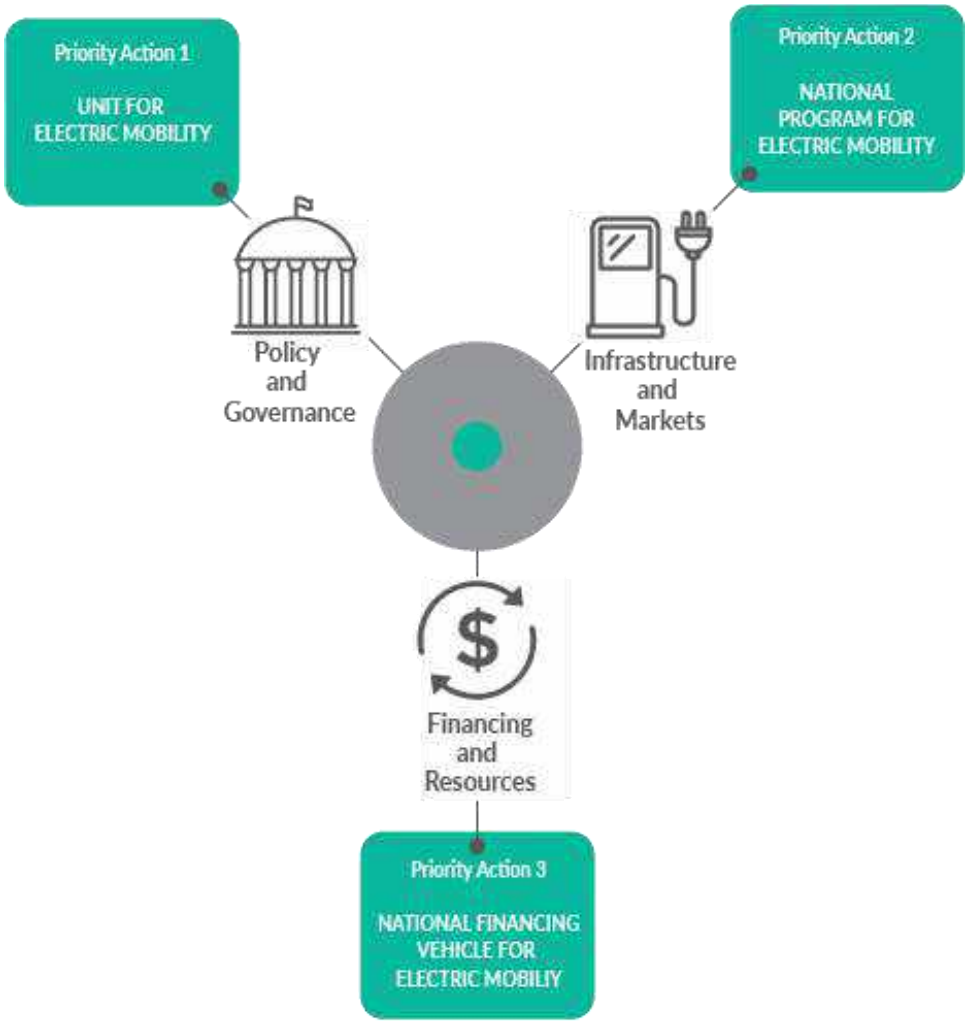
A* National Program for Electric Mobility *will facilitate public and private acquisition of electric vehicles, invest in infrastructure, push for operational progress and refine legislation – The proposed program would comprise a suite of regulatory, institutional, financing and legislative measures designed to collectively provide focused support

to boost electric vehicle adoption in Nepal. The program would proactively and comprehensively address the barriers identified above, with a focus on progressing within the infrastructure and markets space. The program would include measures to support consumer and government acquisition of electric vehicles, measures to support investment in construction of charging stations and measures for the legislative changes required for greater electric vehicle adoption, and build market awareness.

***A* National Financing Vehicle *will manage and disburse financial support to promote infrastructure, innovation and entrepreneurship for electric mobility* -** The proposed financing vehicle will boost business and industry activity and investment in electric mobility and electric vehicles. Part of the role of the financing vehicle will be to signal strong and consistent commitment from government to the market, reassuring entrepreneurs and investors. Through its funding and co-funding decisions the financing vehicle will also help to put in place the necessary facilities and infrastructure for widespread electric vehicle adoption.

Lastly, in addition to the three priority actions outlined above, a range of contributing initiatives to support greater electric mobility in Nepal should be implemented – These range across a) policy and governance; b) infrastructure and markets; c) financing and resources; and d) data and monitoring and are designed to act as targeted, specific interventions that directly respond to barriers identified in Part 3. In this way, such initiatives support the three priority actions, and/or can be implemented separately, depending on the appetite for action.

Figure A.2. Overview of priority actions



Introduction to the Action Plan

Background

The Ministry of Forests and Environment produced Nepal's *Nationally Determined Contributions* (NDC) in 2015. The NDC effectively gathered targets, strategies and policy goals from numerous national policies across a range of sectors. As such, the NDC constituted an effort to consolidate existing climate change and low-carbon related ambitions from across the federal government. An overview of the relevant policies upon which the NDC drew are outlined in Chapter 2.

However, since the production of the NDC, and its submission and adoption at the international level via the UNFCCC COP21 platform, implementation has been limited. While many of the policy origins of the NDC have progressed, as policy efforts in their own right, systematic NDC-focused progress has yet to fully emerge. As such, this action plan has been formulated by the Global Green Growth Institute (GGGI), through extensive consultations and in partnership with a range of government bodies, in an effort to direct, facilitate and align efforts for investment and implementation of the ambitious electric mobility-related targets set out under the NDC.

The request to develop this Action Plan, and more generally to provide technical assistance to the Government of Nepal in implementing the NDC and achieving green growth within the transport sector, came from the Ministry of Forests and Environment (MOFE). In responding to this request, GGGI and MOFE jointly developed the *Electric Mobility Program*, with significant guidance from the Ministry of Physical Infrastructure and Transport (MOPIT). The *Electric Mobility Program*, expected to run through to 2021, is designed to boost action and investment for electric transportation in Nepal, thereby significantly reducing greenhouse gas (GHG) emissions from the transport sector. The first phase of the program (2017-18) involves the development of this National Action Plan, to guide systematic efforts for electric mobility nationally; as well as the development of an investment plan for viable electric vehicle projects, and the facilitating of financing for these projects; and the initiation of an electric bus pilot project in Kathmandu.

Goal and objectives

Within this context, the overall goal of this National Action Plan is to facilitate action for the achievement of transport provisions laid out under the NDC.

Such a goal includes the following objectives:

- Undertake a comprehensive review of current gaps, barriers and challenges to the implementation and/or advancement of the NDC's transport provisions;
- Identify and conceptualize clear and concrete action to support implementation of the transport provisions of the NDC;
- Engage a comprehensive range of stakeholders, including public and private sectors and consumers, in participatory dialogue, prioritization and action planning for electric mobility; and
- Build the capacity of government partners, civil society and transport operators to support and advance the transport provisions of the NDC.

Box B.1 The NDC and its transport related targets

Nepal's *Nationally Determined Contribution* includes 14 targets to support climate change mitigation and adaptation in Nepal. Of these targets, four focus on climate change adaptation; three focus on energy sources and supply; two address the forestry sector; one addresses multi-sectoral mitigation; and four address the transport sector.

The NDC targets that address the transport sector include:

- **NDC Target 9**: By 2020, Nepal aims to increase the share of electric vehicle up to 20% from 2010 level.
- **NDC Target 10**: By 2050, Nepal will decrease its dependency on fossils in the transport sector by 50% through effective mass public transport means while promoting energy efficient and electrical vehicles.
- **NDC Target 11**: Nepal will develop its electrical (hydro-powered) rail network by 2040 to support mass transportation of goods and public commuting.
- **NDC Target 14**: By 2025, Nepal will strive to decrease the rate of air pollution through proper monitoring of sources of air pollutants like wastes, old and unmaintained vehicles, and industries.

This National Action Plan explores barriers to achieving these four targets and lays out actions and initiatives for overcoming them. Above all, given the primacy of road transport in Nepal, it supports activities for Target 9, 10 and 14.

Source: Adapted from MOPE 2016 – the NDC.

Structure of the report

This action plan is divided into four parts, as outlined below:

- **Part 1. Electric Mobility in the Nationally Determined Contribution and Associated Policy** – The action plan opens with a review of Nepal's NDC. The specific transport-related targets and provisions of the NDC are presented. Given the role of the NDC as a consolidating mechanism, a review of wider policy efforts is also undertaken.
- **Part 2. Transport Sector Growth, Emissions and Electrification Scenarios** – This second part begins with an overview of the transport sector, including key growth trends. Based on this, energy consumption patterns and greenhouse gas emissions are presented, with an initial focus on emissions over the past two decades. Issues around local pollutant emissions are also presented. Projecting through to 2030 and 2050, likely emissions and consumption patterns for the transport sector are explored, and three key transport electrification scenarios are introduced and extrapolated for their impact on their sector.
- **Part 3. Barriers to Electric Mobility** – Barriers, gaps and challenges to widespread and systematic adoption of electric mobility, including the achievement of the NDC transport provisions, are presented in Part 3. These barriers range across four key thematic areas, namely policy and governance, infrastructure and markets, finances and resources, and data and monitoring. Each of the fifteen barriers identified is comprised of a series of issues. Barriers and issues were identified using the highly consultative process outlined in the sections below.
- **Part 4. Actions for Electric Mobility** – The fourth part of the Action Plan lays out three priority actions and a suite of contributing initiatives to speed up implementation of the NDC's transport provisions. As for Part 3, actions are categorized across four thematic areas, namely policy and governance, infrastructure and markets, finances and resources, and data and monitoring. These actions are the result of both qualitative and quantitative assessments and respond specifically to barriers and issues identified in Part 3, as well as medium- and long-term opportunities that can be capitalized.

Methods and engagement process

The overall framework for the preparation of this Action Plan was set by a combination of GGGI knowledge and experience developing NDC implementation tools; globally emerging best practices advocated by Ricardo Energy and Environment and CDKN (Climate and Development Knowledge Network); and the United Nations Development Program (UNDP). The GGGI team gratefully acknowledges the work of both these agencies in this field and recognizes the precedent and best practices they have established. In particular, the work and methods of Ricardo Energy and Environment were built up in the methodological development of this Action Plan, under consultation with

experts within the government and development community in Nepal.

Overall, a highly participatory approach was taken, blending qualitative and quantitative data, and using data gathering methods including key informant interviews with over twenty priority stakeholders, focus group discussions with transport operators and investors, and a small survey with current and prospective electric vehicle consumers.

The preparation of this National Action Plan followed the process outlined below, and presented in Figure 1:

- **Review of NDC Technical Literature –** A range of NDC technical documents and literature were reviewed, including UNFCCC, CDKN and UNDP documentation, and national action plans and strategies for NDC implementation globally.
- **Consultation Round 1:**
    - **Key Information Interviews –** Priority stakeholders were identified, and first round consultations were implemented using key informant interviews
    - **Focus Group Discussion -** focus group discussion methods to constitute a gap analysis.
    - **Consumer Interviews –** Current and prospective consumers of both electric car and electric motorbike were interviewed using a structured questionnaire.
- **Scenario Discussion –** Scenarios from a range of sources was discussed and analyzed.
- **Consultation Round 2**
    - **Stakeholder Workshop –** A second round of stakeholder consultations presented draft actions for NDC transport provision implementation to stakeholders for discussion and feedback. Actions were then revised based on stakeholder inputs, and prioritization.
- **Preparation of Draft Action Plan –** The draft Action Plan was prepared, and reviewed by both technical, private sector and government stakeholders.
- **Validation of Final Action Plan –** The finalized action plan was validated by lead government partners, including MOFE and MOPIT, through focused consultations.

Stakeholders and consultations

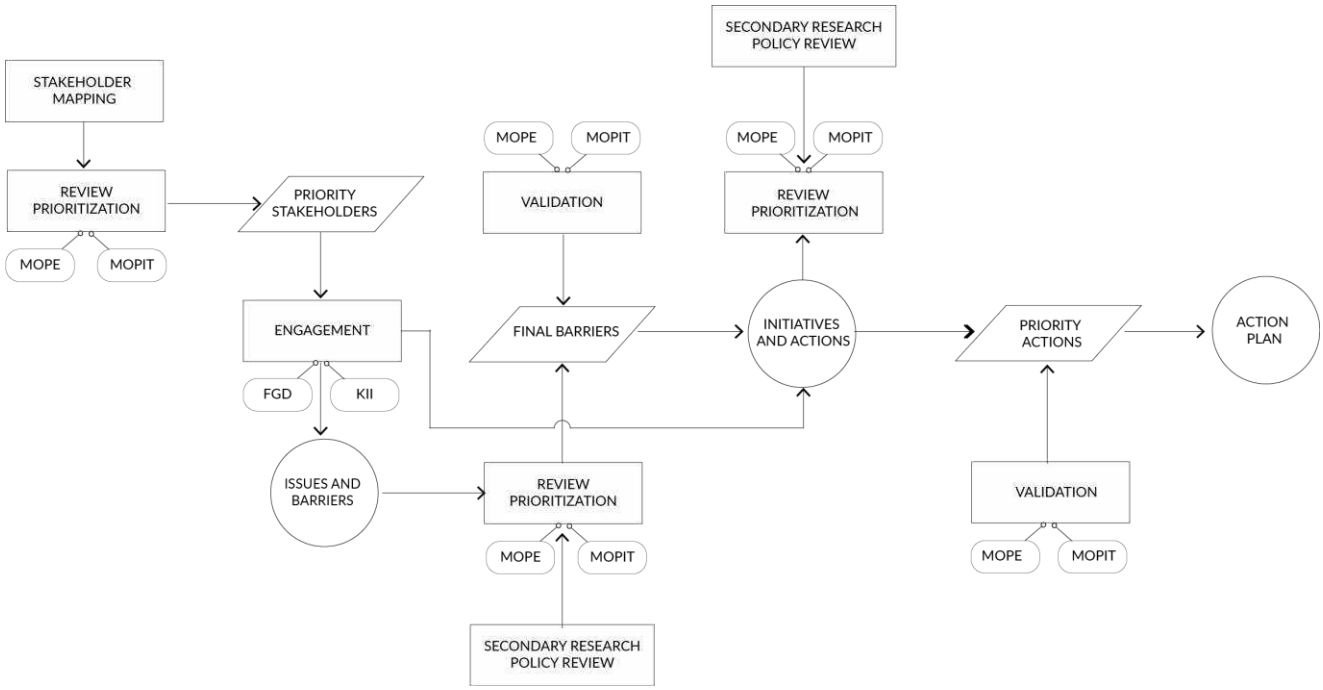
A comprehensive stakeholder mapping exercise was undertaken internally, with guidance and feedback from MOFE and MOPIT. In this way, MOFE and MOPIT, with GGGI, constituted an effective program management unit for the development of this work, under the formal oversight of a technical working group comprised of MOPIT, MOFE, Ministry of Finance, Ministry of Energy and GGGI.

In addition to their roles on the technical working group, both MOFE and MOPIT were active stakeholders during consultations, as reflected in Table 2 below. As a result of stakeholder mapping, priority stakeholders were identified for consultation and engagement, as outlined in Tables 1 and 2, below. Engagement and consultation then took place over the course of June – September 2017.

Table B.1. Total stakeholders consulted by type

Type of stakeholder	Number consulted
Government bodies	8
Development partner organizations	2
Scientific and monitoring organizations	4
Consumers (individuals)	8
Private sector businesses and business groups	11
Total	**33**

Figure B.1. Stakeholder engagement process



Source: GGGI

Table B.2. List of stakeholders and engagement modality

Stakeholder Name	Consultation 1		Consultation 2
	KII	FDG	
GOVERNMENT BODIES			
Kathmandu Metropolitan City	X		
Lalitpur Metropolitan City	X		
Ministry of Physical Infrastructure and Transport	X	X	X
Ministry of Environment	X	X	X
Department of Transport Management	X		X
Department of Customs	X		X
Nepal Electricity Authority	X		X
Department of Electricity Development	X		X
DEVELOPMENT PARTNERS			
KOICA	X		X
Asian Development Bank (ADB) Nepal	X		X
SCIENTIFIC AND MONITORING ORGANIZATIONS			
Environment Unit, KMC	X		
Environment Unit, LMC	X		
Department of Environment, MOFE	X		
ICIMOD	X		
CONSUMERS			
Individuals consulted	X		
BUSINESSES AND BUSINESS GROUPS			

Sajha Yatayat	X		X
Electric Vehicle Association of Nepal	X	X	X
National Fed. Eco-Friendly Transport Entrepreneurs		X	X
Clean Locomotive Entrepreneurs Association		X	X
Nepal Electric Vehicle Charging Station (Association)		X	X
Tata	X		
KPIT (India)	X		
Ashok Leyland (India)	X		
BYD (Nepal Representative)	X		X
Mahindra (Nepal Representative)	X		X
Kia Motors (Nepal Representative)	X		X

Part 1

Electric Mobility in the Nationally Determined Contribution and Associated Policy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Chapter 1
Transport and Nepal's Nationally Determined Contribution

1.1 Introduction

Given the growth of the transport sector, its reliance on fossil fuels and its contribution to national greenhouse gas emissions, any dedicated mechanism to address climate change in Nepal needs to proactively address the sector. Nepal's NDC, which is such a mechanism, provides a range of critical targets for transport. These targets, as well as the process and role of the NDC at national and global levels, are presented below.

1.2 A Global Mechanism for Managing Climate Change

The NDC is a mechanism by which countries agree to manage climate change. It is the principal mechanism of the Paris Agreement, adopted by 196 parties of the UNFCCC, during the 21st Conference of the Parties, in December 2015. As such, NDCs constitute the primary mechanism through which global action to combat climate change is taking place. The Paris Agreement entered into effect in November 2016.

The Paris Agreement deals with greenhouse gas mitigation, and climate change adaptation and financing. The overall goal of the Paris Agreement, itself the subject of much negotiation and contention, is to keep global temperature rise, measured against pre-industrial levels, as 'well below' 2 degrees centigrade, and ideally only 1.5 degrees centigrade. The Paris Agreement starts in 2020

Under the Paris Agreement, the NDC mechanism allows countries the freedom to determine the extent of their contribution to global action for climate change. Countries are expected to report on this contribution regularly. However, there is no mechanism to enforce compliance with targets and goals set by countries under their NDCs.

1.3 Nepal's Nationally Determined Contribution

Nepal's NDC was developed by the MOFE, and was submitted to the UNFCC in October, 2016[1]. It covers both climate change mitigation and adaptation. The NDC begins by outlining Nepal's vulnerability to climate change. It highlights the country's mountainous terrain and poverty as key vulnerability factors. It also outlines current changes in climatic conditions which are already observable in Nepal, including changes in precipitation and temperature. Drawing off Nepal's *Initial National Communication* (2004) and *Second National Communication* (2014), the NDC also outlines emissions across key sectors.[2,3]

The NDC follows this with an extensive review of climate-related institutions, policies, frameworks and activities being pursued by the federal government. These include institutions in the forestry sector, and policies for climate

[1] Ministry of Population and Environment. 2016. Nationally Determined Contributions. Government of Nepal. Accessed at http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx x

[2] Ministry of Population and Environment. 2004. Initial National Communication to the Conference of the Parties of the United Nations Framework Convention on Climate Change. Government of Nepal. Accessed at http://unfccc.int/resource/docs/natc/nepnc1.pdf.

[3] Ministry of Science Technology and Environment. 2014. Second National communication to UNFCCC. Government of Nepal. Accessed at http://unfccc.int/resource/docs/natc/nplnc2.pdf.

change, forestry, energy, transportation, local governance, low-carbon development and adaption. In particular, it explores quite extensive adaptation initiatives at national and local level. In addition, it outlines mitigation options for Nepal, and offers a range of development pathways in multiple sectors that will contribute to reduced greenhouse gas emissions nationally.

The final section sets out Nepal's specific contributions. These are a series of fourteen targets and broader goals, some quantified and others not. Of these fourteen targets, four focus on climate change adaptation; three focus on energy sources and supply; two address the forestry sector; one addresses multi-sectoral mitigation; and four address the transportation sector, as below:

- NDC Target 9: By 2020, Nepal aims to increase the share of electric vehicles up to 20% from 2010 level.
- NDC Target 10: By 2050, Nepal will decrease its dependency on fossils in the transport sector by 50% through effective mass public transport means while promoting energy efficient and electrical vehicles.
- NDC Target 11: Nepal will develop its electrical (hydro-powered) rail network by 2040 to support mass transportation of goods and public commuting.
- NDC Target 14: By 2025, Nepal will strive to decrease the rate of air pollution through proper monitoring of sources of air pollutants like wastes, old and unmaintained vehicles, and industries.

Lastly, the NDC concludes with a summary of financing options in order to realize these targets. It clearly calls upon international financing support.

1.4 Compliance and Implementation

Without any formal way to ensure compliance from participating governments, implementation is expected to come through a mix of genuine political ambition and accountability to the international community and local electorates. For this, NDCs require robust political backing, as well as whole-of-government participation during developmental stages.

Because NDCs are multi-sectoral and wide-ranging, tackling issues across the entirety of the development spectrum, implementation can be strengthened through integration with wider development planning and policy.[4] In particular, such as approach expects national government to integrate NDC spending requirements into national budget setting, to provide monitoring and oversight through national bodies, to provide strong political backing and to ensure cohesion and consistency between NDC targets and other development goals.

In the case of Nepal's NDC, much can be done to improve scope and capacity for implementation. This includes specifically within the transport sector, which is the subject of this National Action Plan, as well as more broadly within other sectors, and more strategically across government as a whole, particularly through engagement with planning and policy making bodies and budget setters.

[4] Bird, N., Monkhouse, C., Booth, K. 2017. 10 Propositions for Success: Integrating international climate change commitments into national development planning. Accessed at https://cdkn.org/wp-content/uploads/2017/07/10-propositions-for-success-integrating-international-climate-change-commitments-into-national-development-planning.pdf

Chapter 2
Associated Policy and Regulation

2.1 Introduction

As noted in the preceding chapter, Nepal's NDC draws heavily on existing policy and regulation from a range of sectors. In this chapter, these policy and regulation are presented. This includes a range of specific transport policy issued by the federal government over the period 2001-2014, and associated policy from sectors including:

- Energy policy
- Urban development and local governance policy
- Climate change policy and air quality regulation
- Fiscal and monetary policy

This enables a deeper understanding of the policy roots and origins of Nepal's NDC, as well as indicates the broader orientation of the federal government on these topics, issues and sectors. For all policy reviewed below, special attention is paid to policy provision for electric transport, and clean, sustainable transport technologies.

It should be mentioned that in preparation of this chapter, a range of policies were reviewed which were not in turn presented below. This includes, for example, the National Urban Development Strategy or the Environmentally Friendly Local Governance Framework and others. Both policy initiatives are extremely useful, and both touch upon the theme of transportation. However, as the NDC does not draw upon them directly, and as they do not contain specific provisions for electric mobility, there are not presented below.

2.2 Transport Policy and Regulation

The transport sector in Nepal is guided by three main policies. These set the overall direction for development of the sector, specify goals and targets, outline initiatives and principles and demonstrate vision and forward-thinking from the government. Each of the three policies are explored below.

Name	**National Transport Policy**
Date published	2001
Ministry or body	Department of Roads
Core policy goal	To develop a reliable, cost-effective, safe facility-oriented and sustainable transport system that promotes and sustains economic, social, cultural and tourism development in Nepal.
Summary	The *National Transport Policy* is an overarching policy aimed at developing the transport system and improving clean transport services (powered by gas, electricity and solar). The policy addresses the development of sustainable transport infrastructure, including infrastructure to connect the Strategic Road Network to Local Road Networks at the district level. The aim is to develop an efficient and effective

	transport system, thereby supporting Nepal's trajectory towards a prosperous and dynamic country. Urbanization is recognized a key component of this effort, driving demand. In addition, the policy emphasizes development of the East-West Midhills Highway in a progressive, planned and systematic manner; the construction of roads from hilly districts to the northern border to support market expansion; and maintenance of existing transport infrastructure based on traffic density and a range of economic considerations. Public transport service provision is also key, and the policy focuses on transport sustainability through gas and electric mobility solutions. It seems to ensure that gas and electric public transport services are sustainable, safe, reliable, comfortable and affordable through the introduction of different standards. A key issue here is the reduction of vehicular greenhouse gas emissions. The policy seeks to motivate private sector investment in transport, especially in the operation of vehicles, and the construction and maintenance of transport infrastructure.	**Core policy goal**	To promote environment-friendly vehicles
		Summary	Whereas the *National Transport Policy* underlines the need for clean transport, and sets out broad provisions, the *Environment-Friendly Transport Policy* sets out more detailed targets and directions. The policy discusses overall share of electric vehicles in the national fleet, transport-related greenhouse gas emissions, and explores financing options. The policy adopts the 'Avoid, Shift and Improve Approach' (ASI Approach), encouraging that unnecessary travel is avoided, and that trip distance is reduced. It promotes a wider shift towards more sustainable transport modes, especially within the public transport system, and also calls for the improvement of transport practices and technologies to support this. In this regard, the policy seeks to diversify vehicle technology towards electric, gas-powered and hybrid vehicles. It also seeks stricter regulation of vehicle and promotes affordable and progressive standards for fuel quality.
Provisions for electric mobility	The following are specific provisions for electric mobility included in the policy: • Expanding the use of electric vehicles, using electricity from renewable energy sources. • Operating electric bus, tram and other public transport vehicles, especially in cities. • Planning for an electric rail service, utilizing hydropower.		Within these areas, the policy sets out targets (outlined below). These targets provide substantial support to programs that aim at strengthening clean transport services, specifically electric vehicles.[5] In addition to unlocking opportunities for electric vehicle sales and retrofitting existing vehicles to become hybrid vehicles, this policy and its targets also recognize the need to kick-start the electric vehicle manufacturing industry to increase local job opportunities, decrease production costs and encourage local resource use.
Name	**Environment Friendly Transport Policy**		
Date published	2014		
Ministry or body	Ministry of Physical Infrastructure and Transport		

[5] Ministry of Physical Infrastructure and Transport. 2015. Environmentally Friendly Transport Policy 2015. Government of Nepal. Accessed at http://www.mopit.gov.np/uploads/files/policies&directives/Watawaranmaitri%20Sawari%20tatha%20Yatayat%20Niti%202071.pdf.

Provisions for electric mobility	The following are specific provisions and targets for electric mobility included in the policy: • Increasing the share of what the policy terms "environment friendly vehicles" to a minimum of 20% of the total vehicle fleet by 2020. • Encouraging manufacturing of environment friendly vehicles, which include electric vehicles. • Encouraging private sector to invest in construction and management of electric vehicle parking stations and service centers. • Facilitating land for the construction of ten charging stations in Kathmandu, under a pilot initiative. • Installing charging stations in retail outlets such as shopping malls, hotels and large parking areas. • Improving the possibility of local assembly by improving access to required vehicle parts, including batteries.

Name	**National Sustainable Transport Strategy [Draft]**
Date published	Prepared in 2015. The strategy awaits final approval.
Ministry or body	Ministry of Physical Infrastructure and Transport
Core policy goal	To develop a transport system that is efficient, accessible, people-centric, affordable, reliable, safe, inclusive, environmentally-friendly, and resilient.
Summary	The *National Sustainable Transport Strategy* sets out a long-term strategic vision for the transport sector, and provides for a range of sustainable transport solutions. The strategy seeks to strengthen the economic, social and environmental indicators used to guide, manage and monitor transport development. In particular, the strategy lays out ways to integrate cross-cutting issues, such as resilience, sustainability and social inclusiveness, into relevant processes of transport policy formulation, plan preparation, infrastructure building and transport service operation. Such integration seeks, ultimately, to lead to the development of an improved transport system. The strategy lays out 19 objectives, ranging over the three dimensions of sustainability, and provides indicators by which to monitor and measure transport development. These objectives support improved transport performance in terms of service operation, maintenance of infrastructure and facilities, minimization of pollution, ensuring sustainable use of natural resources and conservation of nature, and ensuring social inclusion. In addition, the *National Sustainable Transport Strategy* streamlines existing strategies and guidelines on transport to make the sector and its regulatory framework more robust. The strategy also specifies action necessary for a sustainable transport system, and some of these strategic actions pertain specifically to electric vehicles, as outlined below.
Provisions for electric mobility	The following are specific provisions for electric mobility included in the policy: • Promoting electric vehicles across all systems. • Undertaking feasibility studies for alternative, electric transport initiatives. • Encouraging the development of a high-priority, national electric rail system. • Developing required institutional structures and support for electric mobility. • Introducing electric bus public transportation in urban areas

	• Providing electric vehicle options in priority tourist destinations. • Aligning and integrating the development of hydropower with the development of electric mobility (vehicles). • Introducing electric rickshaws in small and medium-sized cities.

2.3 Associated Policy, Plans and Regulation

In addition to drawing directly on the transport sector policy outlined above, Nepal's NDC also references and indirectly draws support from a range of other policy and regulation. These are outlined below, with particular attention to the electric mobility provisions of these policy and regulation.

Name	**Fourteenth Three-Year Plan 2016/2017-2018/2019**
Date published	2016
Ministry or body	National Planning Commission
Summary	The *Fourteenth Three-Year Plan* seeks to guide economic growth and social development across Nepal. It projects an average economic growth rate of 7.2%, supporting an increase in per capita income. The plan also sets out capital investment amounts required from government, private sector and through development partners for the time period. Overall, domestic production is expected to increase, with an expansion of the number and activity of small and medium enterprises. The tourism and agriculture sectors are key. In addition, infrastructure investment is a priority, particularly by road and air, as well as investment in energy systems. Social development, through social protection, social security systems and human rights, is also promoted. Good governance, social inclusion, gender equality, environmental protection and the capacity development of different institutions are also given special focus in the plan.
Provisions for electric mobility	The plan includes the following provisions related to electric mobility: • Support for the creation of an environmentally-friendly transport sector. • Encouragement of vehicles powered by alternative and renewable energy sources. • Recognition of the need to strengthen electric rail and sustainable mass transport services. • Recognition of the need to undertake feasibility studies for the establishment of a metro or monorail service in the capital.

Name	**National Urban Development Strategy**
Date published	2017
Ministry or body	Ministry of Urban Development
Summary	The *National Urban Development Strategy* sets a strategic direction for the development of the urban economy and management of the urban environment, and lays out needs for urban infrastructure development, including investment, finance, and governance. The strategy is formulated over a time period of 15 years. It outlines critical themes for sustainable urban development, and sets conditions, targets and indicators for growth within these themes. Transport and mobility is one theme. The strategy focuses on improving connectivity between urban areas, and strengthening urban-rural linkages, upgrading provincial road connections, improving overall connectivity infrastructure and standards. The strategy recognizes the need for improved air quality in cities, and the role of sustainable urban public transport in achieving that. In order to

	improve public transport in urban areas, the strategy outlines a series of provisions, as below.
Provisions for electric mobility	The plan includes the following provisions related to sustainable transport: • Promoting the development of sustainable urban public transport services in all urban areas with over 100,000 residents. • Calling for balanced road network development. • Promoting integrated land-use and transport planning, through institutional and capacity development. • Preparing comprehensive transport management standards and plans.

Name	**National Energy Strategy**
Date published	2013
Ministry or body	Water and Energy Commission Secretariat
Summary	The long-term *National Energy Strategy* integrated energy, environmental and economic considerations, and is designed to increase energy supply and ensure that energy is clean and efficient. The strategy aims for sustainable economic development through efficient and effective utilization of energy resources. For this, the strategy sets out the following goals: promoting renewable energy technologies and energy efficiency and supplying adequate energy at an affordable and reasonable price; developing hydropower resources as the lead energy resource; reduce dependency on fossil fuel imports; and ensure sustainability in the consumption of biomass energy resources.
Provisions for electric mobility	The strategy includes the following selected provisions related to sustainable transport: • Emphasizing the role of electric vehicles in accomplishing the strategy's goals. • Undertaking research and analysis into the viability of establishing electric ail and ropeways. • Prioritizing the development of electric rail systems. • Facilitating and increasing the import of hybrid and electric vehicles. • Ensuring continuous supply of power to electric vehicle charging stations.

Name	**Climate Change Policy**
Date published	2011
Ministry or body	Ministry of Environment
Summary	The Climate Change Policy[6] is the principal document outlining the government's objectives and targets specific to climate change mitigation and adaptation in the country. It advocates and calls for a range of initiatives, including national adaptation planning and improved financing, capacity building, local participation and empowerment. As part of a suite of measures designed to expedite low carbon development, reduce greenhouse gas emissions and build climate resilience, the policy highlights the importance of promoting electric transport industries such as electric train, ropeway and cable car.
Provisions for electric mobility	The plan includes the following provisions related to sustainable transport: • Highlighting the importance of promoting clean energy such as

[6] Ministry of Environment. 2011. *Climate Change Policy 2011* Government of Nepal

	hydropower, renewable and alternative energy sources. • Encouraging the use of green technology and increasing energy efficiency. • Promoting transport industries that use electricity.
Name	**Budget Speech 2016/2017**
Date published	2016
Ministry or body	Ministry of Finance
Summary	Nepal Government's NRP 1048.92 billion budget for fiscal year B.S. 2073/74 has been allocated at the proportion of 58.9%, 29.7% and 11.4% for current expenditure, capital expenditure and financial management respectively. The fiscal year budget's priority sectors were reconstruction, rehabilitation and new construction, hydro-electricity production, road, airport and irrigation, agriculture, industry, tourism and forest, city and local infrastructure, education, health, drinking water and sanitation, social security and service mobilization.
Provisions for electric mobility	For electric vehicles for public transport: • A customs (import) duty of 1% is in place (compared to a customs duty of 5% for fossil fuel vehicles with more than 40 seats for public transport mentioned in the Budget Speech for FY 2015/16). • Exemption of value added tax (compared to a VAT of 13 % leveed on fossil fuel vehicles for public transport). For electric vehicles for private transport: • A customs (import) duty of 10 % is in place (compared to a customs duty of 80 % for fossil fuel vehicles for private usage). • Exemption of value added tax (compared to a VAT of 13 % leveed on fossil fuel vehicles for private usage). For battery recycling equipment: • A customs duty of 1 % is in place on machinery and equipment used for the recycling of batteries. For electric rickshaw parts: • Exemption of value added tax (compared to a VAT of 13 % leveed on fossil fuel vehicle parts).

Name	**Bank Monetary Policy**
Date published	2017
Ministry or body	Nepal Rastra Bank (Central Reserve Bank)
Summary	The *Monetary Policy* aims to promote financial stability by managing and optimizing national interest rates and resource allocation. It encourages banks and commercial institutions to channel credit towards projects of national interest, including in the energy, agriculture, tourism sectors, and especially towards small and medium enterprises. Within this, Nepal Rastra Bank set the loan-to-value ratio (loan limit) for private retails loans used to purchase electric vehicles to 80% of vehicle value. In contrast, the loan-to-value ratio for fossil fuel vehicles is set at 65%. This policy came into effect in July 2017. Interest rates on these loans are high, ranging from 10-15%.
Provisions for electric mobility	The policy includes the following provision related to electric mobility: • The maximum loan-to-value ratio for personal electric vehicles loan has been increased to 80 percent.

Name	**National Ambient Air Quality Standards**
Date published	2012
Ministry or body	Department of Environment
Summary	In order to address the rising challenge of air pollution in Nepali cities, the *National Ambient Air Quality Standards* of Nepal were revised in 2012. This revision introduced new standards for PM2.5 emissions. Under the new standards, PM2.5 concentration can only exceed 40 µg/m3 for 18 days per year. However, in many larger cities, PM2.5 concentrations regularly exceed this level. In Kathmandu, for example, PM2.5 exceeds this level on an estimated 90% of days.
Provisions for electric mobility	While the standards do not specifically address vehicular emissions per se, they do in effect support the validity of electric vehicles, which enjoy zero tailpipe emissions.


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Part 2
Transport Sector Growth, Emissions and Electrification Scenarios


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Chapter 3
Overview of the Transport Sector

3.1 Introduction

The importance of the transport sector in the NDC is due to a number of factors, including the dominance of road transport, the quality of the transport stock, the terrain of the country, the structure of urbanization in Nepal, the capacity for public transport provision and the structure of fuel and energy sources. These various factors are explored below.

This chapter is intended to provide critical background and contextual information, and to set the scene for a closer examination of the NDC and its transport targets (Chapter 1). It also allows for the contextualization of the policy and regulation upon which the NDC was built (Chapter 2).

3.2 Vehicles and the Motorization of Nepal

Road transport is the dominant mode of transport in Nepal, accounting for over 90% of the domestic movement of passengers and goods.[7] In addition, there is one international airport currently, in Kathmandu, with two further under construction, namely in Pokhara and Lumbini. There are also some 30 airports capable of domestic commercial air traffic. The share of movement by air is increasing. As a landlocked country, there are no ports and while some transport of goods takes place via the country's many waterways, it is extremely limited. As a result, this National Action Plan focuses on road transport and the term 'transport' is used in this report to mean transport by road, unless explicitly stated otherwise.

Nepal's road network is categorized as a) highways and feeder roads, constituting the Strategic Road Network; and b) local, agricultural and minor roads, constituting the Local Road Network. In 2016/17 the total road network comprised of 29,157 km that included both road networks. Out of this 12,305 km has been paved, 6865 is graveled and 9987 km is in earthen condition.[8] Due to a largely hilly and mountainous terrain, especially in the north, road projects tend to be expensive, and require frequent maintenance. The southern lowland *terai* area is flatter, and as result holds over 60% of the country's road network.[9] The Department of Roads is responsible for the Strategic Road Network, and the Department of Local Infrastructure and Agriculture Roads is responsible for the local network. Investment by the government in roads is significant and ongoing, though work remains. The last remaining district headquarters not connected to the Strategic Road Network, are expected to be integrated into the network in late 2017, and mid-2018 respectively. At this point, the long-held policy goal of the Department of Roads (per National Transport Policy), that all citizens be at maximum a four hour walk from a strategic road, will have been achieved.

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[7] ADB. 2013. Country Partnership Strategy 2013-2017: Sector Assessment (Summary) – Transport and Information and Communication Technology. Accessed at https://www.adb.org/sites/default/files/linked-documents/cps-nep-2013-2017-ssa-02.pdf

[8] MoF. 2017. Economic Survey 2016/2017. Ministry of Finance. Government of Nepal.

[9] ADB. *Ibid.*

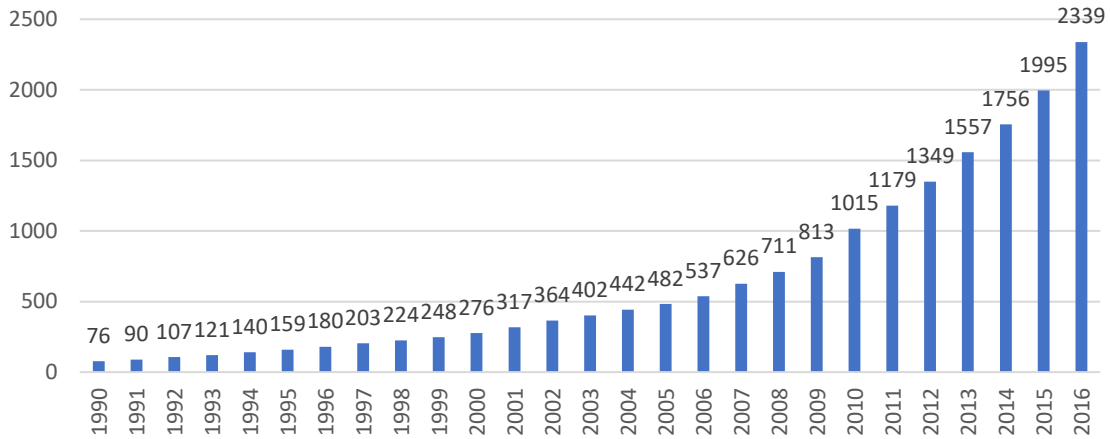

Figure 3.1. Total registered vehicles in Nepal (thousand)
Source: United Nations Centre for Regional Development, 2015

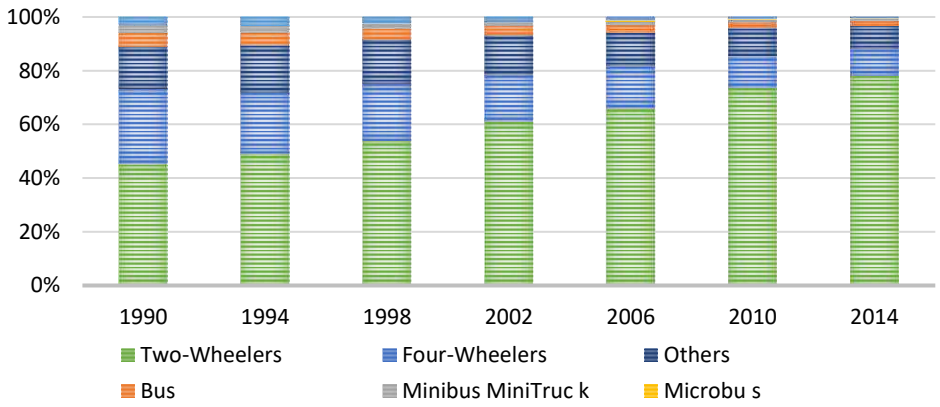

Figure 3.2. Shares of passenger transport during 1990-2014.
Source: United Nations Centre for Regional Development, 2015

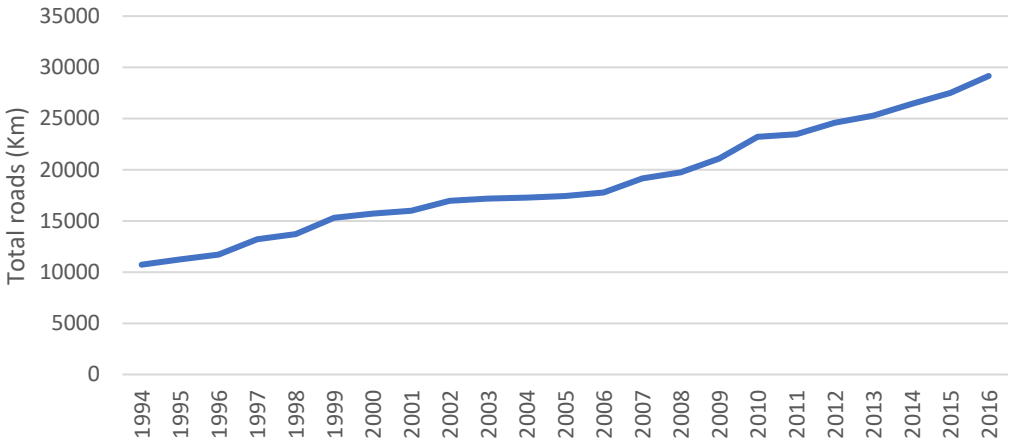

Figure 3.3. Increase in total road network in Nepal during 1990-2016

Source: Ministry of Finance. 1994-2016

As Nepal develops, demand for vehicles is growing, fueled by urbanization and higher incomes. During 1990-2015, the number of total vehicles registered annually grew by 14% per year (see Figure 3.1). Within this, during 1990-2014, the number of registered personal cars grew at 11%; the number of two wheelers grew at 12%.[10] By 2016, there were a total of 2,339,169 vehicles registered in Nepal. A major share of these vehicles is concentrated in and around Kathmandu. The wider Bagmati Zone, which contains the linked cities of Kathmandu, Lalitpur, Bhaktapur, accounts for 43% of total vehicles registered in Nepal

Overall growth in motorization masks shifts in modal share. An overwhelming majority of registered vehicles are two wheelers. Modal share for two wheelers has risen from 55% in 1991, to over 80% in 2014. Affordability and the capacity of two wheelers to cut through congested city streets are two primary factors driving this dominance. The number of buses rose from 4000 units in 1990, to more than 35,000 units in 2015. This category includes full size buses, minibuses, microbuses and three-wheeler microbuses, called tempos. However, as a share of the total vehicle fleet, buses have declined from 11% of the total in 1990, to only 3% in 2015.[11]

With such highly concentrated motorization, insufficient investment in road and highway networks, and weak public transport systems, congestion is common in Nepal's larger cities. Additional challenges linked to poorly managed road transport including low urban air quality and associated public health costs.

Increasing road networks has been known to positively correlate with the increase in transport services in the country. A steady growth in road connectivity has been observed, by about 5% AAGR during 1990-2016. This growth has supported increase in vehicles accessing areas that were previously thought to be unimaginable due to the difficult terrain. Currently, the road network reaches 73 out of the 75 districts of Nepal. This increase in the road network and consequently, vehicles covering larger distances has also been known to increase transport sector emissions in the country.

[10] Department of Transport Management. 2014. Vehicle Registration Number. Ministry of Physical Infrastructure and Transport

[11] UNCRD. 2015. National Sustainable Transport Strategy (NSTS) for Nepal (2015-2040)Ninth Regional Environmentally Sustainable Transport (EST) Forum in Asia. Ministry of Physical Infrastructure and Transport, Nepal. Ministry of Environment, Japan. United Nations Economic and Social Commission for Asia and the Pacific.


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Chapter 4
Greenhouse Gas Emissions 1995-2015

4.1 Introduction

As explored in Part 1, a number of policies and initiatives for sustainable transport are now in place at the national level. Fundamentally, these policies respond to a) sustained deterioration of air quality in cities; b) suboptimal transport systems and congestion; c) economic risk and vulnerability due to energy insecurity; and d) concern over greenhouse gas emissions. When viewed relative to other emitters, Nepal's greenhouse gas emission is minor, constituting some 0.027% of global emissions[12]. Concern over air quality is more acute. Ambient air pollution in Kathmandu, for example, far exceeds the level stipulated by the World Health Organization. Indeed, in 2017, the city had some of most polluted urban air in Asia.[13]

In Part 2 of this report, an analysis of recent, current and projected future greenhouse gas emissions is undertaken. An initial baseline study of greenhouse gas emissions in any country is important in determining the country's emissions pathway, prioritizing sectors where interventions are required and designing, as well as implementing, mitigation activities to address critical emissions areas. This is the aim of Chapter 4. Much of the analysis will draw off Nepal's *Initial National Communication* and *Second National Communication*, as well as more recent academic work and climate modelling. These two communications were submitted by the Government of Nepal to the United Nations Framework Convention on Climate Change (UNFCCC) in 2004 and 2014 respectively. These are the only national records of national greenhouse gas inventories. Additional data from the World Resources Institute and the World Bank will also be utilized in this chapter. Attention will also be paid to particulate matter and local air pollutants.

This chapter focuses on the time period 1995-2015. As such, it looks backward at emissions across multiple sectors, with special focus on the transport sector. In Chapter 5, future projected emissions for the transport sector are presented using a base year of 2005, and projecting forward to 2030, and 2050 under different scenarios.

4.2 Energy Sources and Consumption

Energy is derived from a range of sources in Nepal, including traditional, commercial and alternative sources. A review and summary of energy supply and consumption follows:

Overall energy demand is rising, across all sectors. The energy demand of the country has been estimated to grow at an annual average growth rate of 3% during 1995-2015. Over this period, the highest annual growth in energy consumption was observed in the agriculture sector (21%) followed by the industrial sector (9%), transport sector (7%), commercial sector (6%) and residential sector (2%).[14]

[12] Ministry of Population and Environment. 2016. Nationally Determined Contributions of Nepal. UNFCCC

[13] Numbeo. 2017. Pollution Index by City Accessed at https://www.numbeo.com/pollution/rankings.jsp

[14] WECS. 2010. Energy Synopsis Report. Water and Energy Commission Secretariat, Government of Nepal.; IEA. 2017. Energy Balances. Accessed at https://www.iea.org/statistics/statisticssearch/report/?country=NEPAL&product=balances&year=2015

Biomass makes up a significant proportion of overall energy supply. Biomass is a traditional source of energy that meets the significant energy demands of the residential sector within the country. Around 77% of the energy consumed in the residential sector of Nepal is being supplied by biomass.[15] Biomass in Nepal includes fuel wood, agriculture residue and animal dung.

Dependence on imported fossil fuel is rising. Nepal's reliance on fossil fuel imports has been growing at an average annual growth rate (AAGR) of 8% since 1993.[16] The price of petroleum imports increased by 38.3% between 2071/72 (2014/15) and 2072/73 (2015/16), and the revenue collected from total sales rose by 30% in the same time. This reliance is expected to decrease as the country realizes its tremendous hydropower potential, currently estimated at 43,000 MW, due to which demand-side fuel diversification will be possible.

Totality of fossil fuel consumed in Nepal is imported. Because the country lacks viable fossil fuel reserves, Nepal imports the totality of its fossil fuel resources.[17]

Non-renewable energy demand from the transport sector is highest of all sectors. The residential sector consumes the highest share of energy, followed by the transport and Industrial sectors. However, because the residential sector consumes primarily biomass, a renewable energy source, in terms of fossil fuel consumption the transport sector leads. The share of cumulative transport sector energy demand of the total energy demand, excluding residential sector demand, is 43% during 1995-2015. This is outlined in Figure 4.1 below.

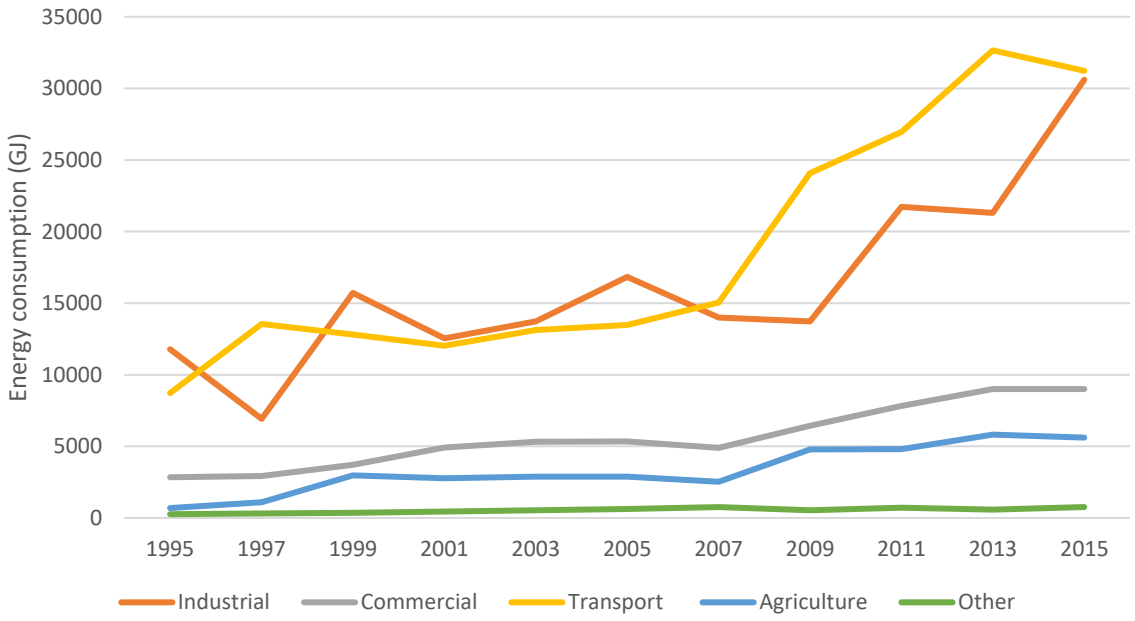

Figure 4.1: Energy consumption in different energy using sectors of Nepal during 1995-2015.
Source: IEA, 2017; WECS, 2010

Note: Residential sector energy consumption is not included in this figure as it relies predominantly on biomass energy for cooking and space heating.

[15] International Energy Agency. 2017. Nepal: Balances for 2015. Accessed at https://www.iea.org/statistics/statisticssearch/report/?country=NEPAL&product=balances&year=2015

[16] Nepal Oil Corporation. 2016. Annual Pratibedan FY 2072/73. Accessed at http://nepaloil.com.np/np-new/content/annual-report/72-73/annual_report_2072-73.pdf

[17] ICIMOD. n.d. Nepal's energy resource base and its use. Accessed at http://lib.icimod.org/record/25370/files/c_attachment_425_4981.pdf

4.3 Emissions Monitoring in Nepal

Within this context, it is clear that energy consumption in Nepal has risen substantially as economic activities have increased. This is leading to a corresponding rise in greenhouse gas and local pollutant emissions. However, monitoring of both emissions types (greenhouse gas and local pollutants) remains limited.

In an attempt to address this, in terms of local pollutants, the Department of Environment, with support from the International Centre for Integrated Mountain Development (ICIMOD), have recently installed air pollution monitoring stations in 12 sites across Nepal. There are further plans to expand the number of sites to 50. In addition, the US government has installed two monitoring stations in Kathmandu Valley.

In-terms of greenhouse gas emissions, the *Initial National Communication* and the *Second National Communication* are the only inventories available. Nepal's first efforts at assembling a greenhouse gas inventory was published in 1997, using data from the 1990/91. This was a preliminary attempt at assessing GHG emissions from a very limited set of sectors namely, fuel combustion, agriculture and biomass burning. This was taken as one of the references for estimating the country's greenhouse gas inventory, with base year 1994/95, in the *Initial National Communication*, which was submitted to the UNFCCC in 2000. In 2014, Nepal completed its *Second National Communication*, using 2000-2001 as the base year. This communication was submitted and accepted by the UNFCCC, in compliance with Nepal's international commitments in 2015. In 2017, Nepal began the process of assembling its *Third National Communication*, though findings and data from this process have not been released (as at December 2017). As such, the greenhouse gas inventory set out in the *Second National Communication* constitutes the most up-to-date national inventory available.

In the *Initial National Communication*, the *Revised 1996 Guidelines for National Greenhouse Gas Inventories* from the International Panel on Climate Change (PICC) and default emission factors recommended by the IPCC were utilized. The Long-Range Energy Alternatives Planning (LEAP) model was utilized to analyze projections of energy demands, greenhouse gas emissions and other components in the residential and transport sectors. Since the commercial sector's emissions were negligible, this sector has not been included in the *Initial National Communication*'s GHG inventory. In addition, the industrial sector has not been included in the analysis due to lack of accurate data, such as the energy efficiency of different technologies, for optimal use of the LEAP model. Instead, a simpler model has been used to estimate emissions from the industrial sector.[18] Similarly, the *Second National Communication* also used the Revised 1996, including the IPCC's *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and *Good Practice Guidance for Land-Use, Land-Use Change and Forestry* (LULUCF) to estimate the emissions for the base year 2000.[19]

It should be noted that there are discrepancies between agriculture sector and LULUCF emissions inventory presented in the *Initial* and *Second National Communications* mainly due to differences in methodologies and associated emissions factors used. There is a large disparity between emissions from the LULUCF sector in 1994 and 2000, particularly because of the higher default growth rate used for the forestry sector along with the lower grassland conversion rate used in the SNC estimates, compared to the INC estimates. The 2000 and 2008 inventory values are in line as the same emissions factors were used to estimate emissions in both years.

The *Second National Communication* includes estimates emissions for CO_2, methane (CH_4), NO_x, CO, non-methane volatile organic compounds (NMVOC) and sulfur oxide (SO) from fossil fuel combustion in the transport, industrial, commercial, residential and agriculture sectors. Biomass is classified as a renewable energy due to which CO_2 emissions from biomass are not included in the inventory. However, due to local pollutant emission from biomass burning, it has been observed to have substantial negative effect on the human health, ecosystems and the environment. In addition, in both the national communications, emissions from combustion of both stationary and mobile fossil fuel sources are included in the energy emissions. The stationary sources are energy industries, residential, commercial and agriculture sources, whereas mobile sources include road transport, civil aviation and railways.

[18] Ministry of Population and Environment. 2004. Initial National Communication to the Conference of the Parties of the United Nations Framework Convention on Climate Change. Government of Nepal.

[19] Ministry of Science, Technology and Environment. 2014. Second National Communication to United Nations Framework Convention on Climate Change. Government of Nepal.

4.4 Emissions from All Sectors 1995-2013

Following a review of both national communications, as well as additional international data, four key findings emerge as outlined below:

National greenhouse gas emissions are rising, driven mainly by fossil fuel consumption in the energy-using sectors. Nepal emitted 21,810 Gg of CO_2 equivalent (excluding LULUCF) and 9035 Gg CO_2e (including LULUCF) in 2000.[20] The residential sector's emissions in 2000/01 were highest, comprising 76% of total emissions, when compared to emissions from the other sectors. As noted earlier, this is due to the fact that LULUCF emissions are driven by biomass consumption.[21] As can be seen in Figure 4.2, emissions from waste and industrial processes were significantly lower than the energy and agriculture related emissions during the period of 1994-2008.

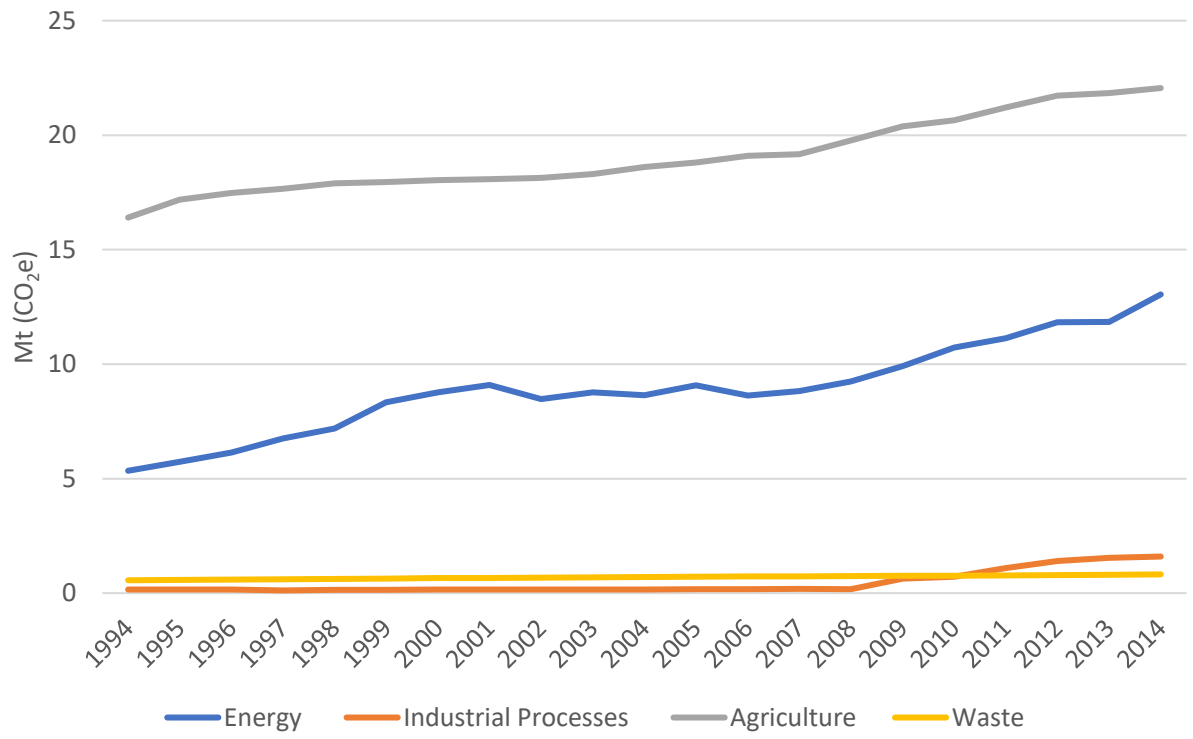

Figure 4.2. Trend of GHG emission in Nepal during 1994-2008

Source: MoSTE, 2014[22]

Note: *Excludes LULUCF emissions

** "Energy" emissions include emissions from the energy-using sectors- Transport, Residential, Commercial, Industrial and Agriculture.

[20] The total emissions from Nepal has been obtained from table 2-4 of the Second National Communication of Nepal.

[21] It should be noted that energy sector emissions include emissions from the transport, industrial, agriculture, residential and commercial sectors.

[22] Ministry of Science Technology and Environment. 2014. Second National Communication to the UNFCCC. Government of Nepal

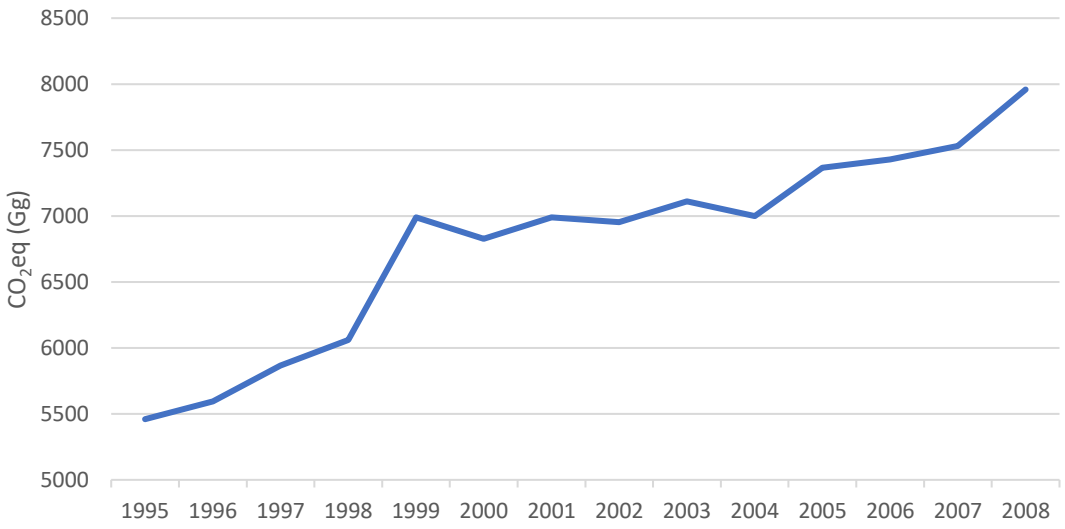

Figure 4.3. Trend of Emissions from the energy-using sectors during 1995-2008

Source: MoSTE, 2014

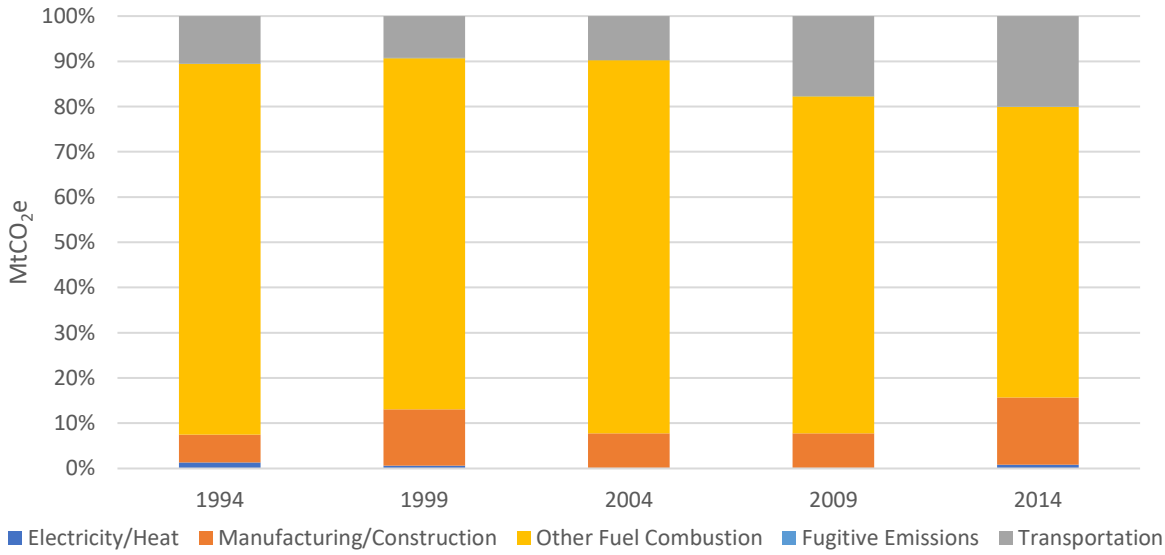

Figure 4.4. Emissions from energy* sub-sectors during 1994-2014

Source: WRI, 2017.

Note: *Energy refers exclusively to the combustion of fossil fuel and biomass.

** Energy emissions from the Residential Sector is included in "Other Fuel Combustion"- this includes CO_2 emission from the combustion of fossil fuel and CH_4 [23] as well as N_2O[24] emissions from combustion of biomass. Emissions from biomass has also been included in this figure.

23 CO2eq = 21 (GWP of CH4) * CH4

24 CO2eq = 310 (GWP of N2O) * N2O

Overall, GHG emissions from the energy sector increased by a CAGR of approximately 5% during 1994-2014. This increase was primarily due to an increase in economic activities that led to increasing energy consumption in the residential, transport and energy-intensive industrial sectors. The *Second National Communication* also presents the 2008 GHG emissions inventory, which shows an increase of 2% in the GHG emissions, when compared to those of 2000. Although the industrial processes emission was 2% of the total emissions in 2008, highest growth in emissions, at a CAGR of 19%, was estimated from this sector during 1994-2014. Growth across all sectors can be seen in Figure 4.2

Economic activity has a major influence on change in energy emissions of the country. Figure 4.3 shows the trend in increase in emissions from the energy using sectors of Nepal. Steady growth at AAGR 3% has been observed for the period 1995-2008.

A spike in emissions in 1999 may have been a result of six-fold increase in the quantity of diesel consumed in the agriculture sector[25]. Economic activity in 1999 was also observed to have increased, when compared to 1998: a 6.4% increase in GDP, with growth in the agriculture sector by 5% and non-agriculture sector by 7.4%. As a result, the growth in energy demand increased by 5% in 1999, compared to only 3% in 1998, with the most noticeable increase by 109% and 318% observed in the industrial sector and agriculture sector energy consumption, respectively.

The dip in GHG emissions subsequently (i.e., in 2000) may have been the result of the decrease in economic activity that yea. The GDP growth rate was 5.8% with the agriculture output growth of only 4% and non-agricultural output growth by 6.9%, lower than the productivity in the previous year.[26] Decline in the overall GHG emissions in 2004 may have also been a result of the decrease in energy consumption in the industrial sector in the same year.

A summary of the energy emissions inventory referenced from the World Resources Institute[27] is presented in Figure 4.4. The share of emission from "other fuel combustion" shown in Figure 4.4, is mainly from biomass in the residential sector. When fuel combustion from the residential sector is excluded, the share of cumulative transport sector emission is highest, at 57%, followed by industrial sector (42%) emissions during 1994-2014. The transport sector emissions have been observed to grow at an AAGR of 9% during 1994-2014.

In addition to carbon dioxide emissions, the GHG inventories quantify emissions of methane and nitrous oxide. However, the transport sector has no role in emission of methane and nitrous oxide. Figure 4.4 shows that the transport component is the leading contributor of carbon dioxide emissions within the energy sector, contributing some 7% of total carbon dioxide emissions, excluding LULUCF, across all sectors in 2014.

Urban air is increasingly polluted. Air quality in especially larger cities in Nepal has fallen sharply, as concentrations of pollutants rise. In Kathmandu, exposure to fine particulate matter (PM2.5) as per the Environmental Performance Index was 30.40 μg/m^3 in 2014, three times higher than the World Health Organization standard of 10 μg/m^3.[28] This level of exposure is more than four times higher than the average level across low-income countries (7.17 μg/m^3) and 3.5 times higher than that of lower middle-income countries (8.54 μg/m^3). In 2016, only the rapidly developing and industrialising economies of China, India and Bangladesh performed worse than Nepal in this indicator. In 2016, the annual average exposure of PM 2.5 in Kathmandu Valley was nearly five times higher than the WHO standard[29] , and more than four times higher than in the entire country.[30] The concentration has almost doubled within the past three decades. Satellite images taken between 2012 and 2014 show that Nepal is among the countries with the highest PM 2.5 concentrations in Asia.

[25] Nepal Oil Corporation. 2017. Import and Sales. Accessed at http://www.nepaloil.com.np/import-and-sales-22.html
[26] Ministry of Finance. 2001. Economic Survey 2000/2001. Government of Nepal. Accessed at http://www.mof.gov.np/uploads/document/file/Economic%20Survey%202000-01_20130808025257.pdf
[27] **World Resources Institute. CAIT - Historical Emissions Data (Countries, U.S. States, UNFCCC). Accessed at http://www.wri.org/resources/data-sets/cait-historical-emissions-data-countries-us-states-unfccc**
[28] EPI. 2016. Environmental Performance Index 2016. Yale University. Accessed at http://epi.yale.edu/sites/default/files/2016EPI_Full_Report_opt.pdf.
[29] WHO. 2016. Ambient air pollution: A global assessment of exposure and burden of disease. World Health Organization. Accessed at http://apps.who.int/iris/bitstream/10665/250141/1/9789241511353-eng.pdf?ua=1
[30] World Bank. 2016. The cost of air pollution. Strengthening the economic case for action. Accessed at http://documents.worldbank.org/curated/en/781521473177013155/pdf/108141-REVISED-Cost-of-PollutionWebCORRECTEDfile.pdf

Box 4.1. Economic impacts of a warmer, dryer Nepal

Nepal has experienced changes in temperature and mean precipitation. The country, with the exception of some isolated pockets, has become warmer. Data on temperature trends from 1975 to 2005 showed 0.06^{0}C rise in temperature annually whereas mean rainfall has significantly decreased on an average of 3.7 mm (-3.2%) per month per decade. Under various climate change scenarios for Nepal, mean annual temperatures are projected to increase between 1.3-3.8°C by the 2060s and 1.8-5.8°C by the 2090s. Annual precipitation reduction is projected to be in a range of 10 to 20 % across the country.

In Nepal's Himalaya, the total estimated ice reserve between 1977 and 2010 has decreased by 29% (129 km3). The number of glacier lakes has increased by 11% and glaciers recede on an average by 38 km^2 per year. Hence, climate change has visible and pronounced impacts on snows and glaciers that are likely to increase the glacier lake outburst floods. Nepal has suffered from increased frequency of extreme weather events such as landslides, floods and droughts resulting to the loss of human lives as well as high social and economic costs.

The 2013 study titled *Economic Assessment of Climate Change in Key Sectors* (agriculture, hydropower and water-induced disasters) has estimated direct cost of current climate variability and extreme events equivalent to 1.5 to 2 percent of current GDP/year (approximately USD 270-360 million/year in 2013 prices) and much higher in extreme years. In the case of hydropower, the model projected lower dry season flows and thus lower energy availability. The additional energy generation capacity needed to meet future demand under this scenario, due to climate change, was estimated at 2800 MW by 2050 with an increase in costs of USD 2.6 billion (present value) for the period through to 2050. Overall, the economic costs of climate change in Nepal for these three sectors could be equivalent to 2-3% of current GDP/year by mid-century.

Source: MoPE, 2016.[31]

4.5 Emissions from the Transport Sector 1995-2013

The following section reviews greenhouse gas and local pollutant emissions exclusively from the transport sector. For this, the analysis draws on similar data sources to the preceding section. Key findings are as follows below.

The transport sector has the highest share in energy emissions in the country. As seen in the previous section, the share of transport sector emissions in the cumulative emissions of the energy-using sector is highest, when compared with the other sectors.[32]

There are two types of transport services mainly being used in Nepal: road transport and civil aviation. Of these two, the former dominates the sector as 90% of all passenger and freight movement within the country is carried out through road transport. According to a report prepared by the Task Force on National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change, GHG emissions (from the transport sector) due to fuel combustion include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), and pollutants such as carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs), sulfur dioxide (SO_2), particular matter (PM) and oxides of nitrate (NO_x).[33] Figure 4.5 below shows the trend in emissions from the transport sector in Nepal. The emissions from the transport sector has grown at an AAGR of 10% during 1995-2013. Growth in population, demand for vehicles and a consequent rise in demand of fossil fuels for the vehicle fleet along with change in economic activities, all play a major role in influencing transport sector emissions.

Significant growth in transport sector emissions can be observed after 2007. Transport sector emissions during 1997-2007 was relatively stable increasing by only an AAGR of 0.82% during that period. Such a low level was possibly linked to political and economic instability during the decade-long insurgency. However, after 2007, transport sector emissions increased at an AAGR of 22% during 2007-2013 (see Figure 4.5).

Transport sector emissions have been driven largely by passenger vehicles in Kathmandu. As ownership of private vehicles increase, emissions from the transport sector is rising (see Chapter 3 for a detailed discussion on vehicle

[31] Ministry of Population and Environment. 2016. Nationally Determined Contributions. Government of Nepal. Accessed at http://www4.unfccc.int/ndcregistry/PublishedDocuments/Nepal%20First/Nepal%20First%20NDC.pdf

[32] Energy emissions from the Residential sector is exempt from this analysis as consumption of biomass in this sector is very high.

[33] IPCC. 2007. Fourth Assessment Report: Climate Change 2007: Working Group II: Impacts, Adaptation and Vulnerability. Intergovernmental Panel on Climate Change. https://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch19s19-1-2.html

registration growth). Resulting growth in the GHG emissions contributes to the deteriorating environment and air quality in the country. Although the absolute number of public vehicles, particularly large buses, have increased from around 6000 in 1990 to 51,000 in 2015, its share in the total vehicle fleet has been estimated to decrease from 3% in 1990 to 1% in 2014 (see Chapter 3).

As outlined in Part 1 of this report, although consumption of petroleum products in the transport sector has increased by an AAGR of 9%, CO_2 emissions from the sector increased by an AAGR of 11% during 1994-2013 (see Figure 4.5). This is mainly because of the rise in transport vehicles, particularly private vehicles, at 14% per annum in the period 1990-2015.

Transport sector contributes significantly to local pollutant emissions in the country. There are several causes of air pollution in urban areas of Nepal, particularly in Kathmandu Valley. The list of sources includes rapid motorisation (12% annual growth over the past ten years) combined with limited public transport system (with only private operators); valley-centric industrialisation (industrial activities are mostly centred in Bara and Kathmandu Valley); Nepal`s topography (restricting wind movement and retaining the pollutants in the atmosphere), re-suspension of dust (from poor or un-surfaced roads), as well as the widespread use of diesel generators for electricity generation.[34] During periods of load shedding, diesel generators are used extensively for back-up electricity supply. Estimates suggest that air quality in larger Nepali cities can drop by as much as 40% as a result.

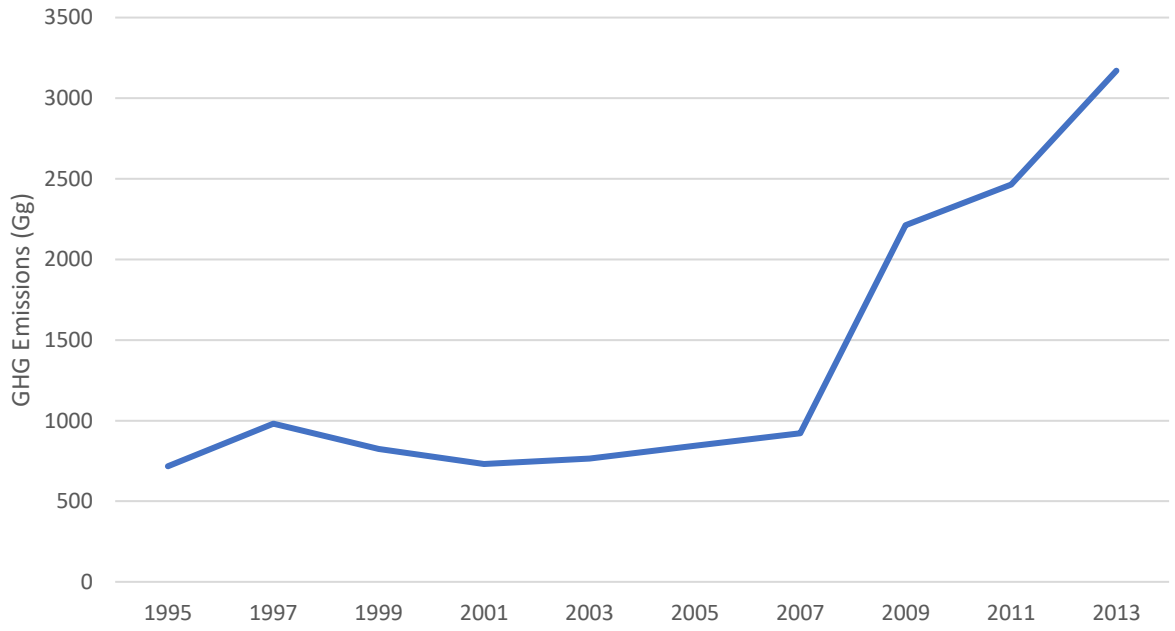

Figure 4.5. Trend in transport sector greenhouse gas emissions during 1995-2013.

Source: World Bank, 2017[35]

[34] Clean Energy Nepal, 2014. Air Quality Status and Management in Kathmandu Valley. Make the City Air Breathable. Manav-kendrit Yatayat Abhiyan (MaYA) Fact Sheet #5. Clean Air Network Nepal. UNHABITAT.

[35] World Bank. 2017. CO_2 emissions from transport sector in Nepal.

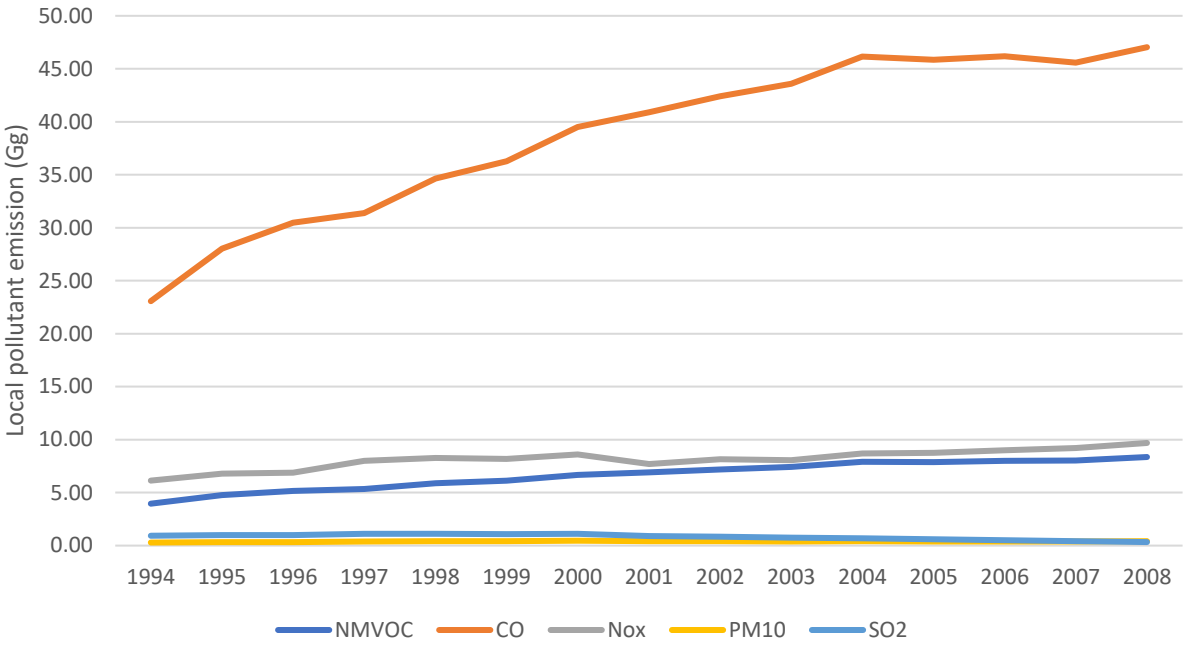

Figure 4.6. Trend in local pollutant emission from the transport sector during 1994-2008

Source: EDGAR, 2010[36]

Figure 4.6 shows that NMVOC emissions from the transport sector has increased significantly (by a CAGR of 5.4%), followed by CO emissions which increased by a CAGR of 5.2% during 1994-2008.

The rise in local pollutant concentrations negatively impact human health. Overall, almost 75% of the Nepali population is exposed to fine particulate matter .[37] Although studies on health impacts of air pollution in Nepal are limited, global research and the existing evidence in Nepal suggests that the health impacts are significant .[38, 39] High-level reports all published during 2016 by major international organisations such as the World Bank, Organization for Economic Co-operation and Development, World Health Organization, International Energy Agency, United Nations International Children's Emergency Fund show that air quality is a major concern for environmental quality and human health, with severe economic implications.

In 2013, more than 9,000 deaths in Nepal were attributed to air pollution.[40] In that same year, air pollution-induced loss of welfare was recorded at 2.8 billion USD, which is equivalent to nearly 5% of the country's GDP. This is equivalent to approximately 40% of the losses and damages caused by the 2015 earthquake, estimated at 7 billion USD.[41] It is, however, important to note that the economic losses due to air pollution occur annually. The projected increase of PM 2.5 will have a substantial effect on the economy, i.e. healthcare cost will increase, lost working days will affect labour productivity, and crop yields will decline.[42]

[36] European Commission, Joint Research Centre (JRC)/PBL Netherlands Environmental Assessment Agency. Emission Database for Global Atmospheric Research (EDGAR), release version 4.2. http://edgar.jrc.ec.europe.eu, 2010

[37] EPI. 2016. Environmental Performance Index 2016. Yale University. Retrieved from http://epi.yale.edu/sites/default/files/2016EPI_Full_Report_opt.pdf.

[38] Kurmi, O. Regmi, PR. Pant, 2016. Implication of air pollution on health effects in Nepal: Lessons from global research. Nepal Journal of Epidemiology 6 (1): 525-527.

[39] Gurung, A. Bell, ML. 2013. The state of scientific evidence on air pollution and human health in Nepal. Environmental Research 124:54-64.

[40] World Health Organization. 2016. Ambient air pollution: A global assessment of exposure and burden of disease. Retrieved from http://apps.who.int/iris/bitstream/10665/250141/1/9789241511353-eng.pdf

[41] NPC. 2015. Nepal earthquake 2015. Post Disaster Needs Assessment, Vol. A: Key Findings. National Planning Commission.

[42] OECD. 2016. The economic consequences of outdoor air pollution. Policy Highlights. Organisation for Economic Co-operation and Development.

Chapter 5
Emissions Projections and Alternative Scenarios for 2030 and 2050

5.1 Introduction

Many of the transport sector trends identified in Chapter 4, including energy consumption, energy dependency and mix, greenhouse gas emissions, and local pollutant emissions, are expected to continue for many years, if not decades. How these trends evolve, and the degrees of fluctuation they demonstrate, will be influenced by a range of factors, including economic, policy, social and infrastructural decisions. The subject of chapter 5 is to explore these trends in more detail under projections and scenarios through to 2030 and 2050.

This will draw upon a composition of academic and technical articles published on the subject using both LEAP and MARKAL models.[43] In particular, the chapter draws on analysis undertaken by Shakya and Shrestha and published in 2011.[44] This paper identifies the electrification of the transport sector as a critical strategic option in Nepal which has several co-benefits. These co-benefits range from increasing energy security to reduced greenhouse gas emissions as well as reduced local pollutant emissions. The study analyzes demand estimates from 2005 (as base year) to 2050.

This chapter starts with a discussion of projected energy consumptions and emissions through to 2030 and 2050, assuming that current energy use, industry conditions, population growth and other factors remain the same. This is known as business as usual (BAU). The chapter then explores three alternative scenarios for consumption and emissions through to 2030 and 2050 that each introduce different mixes of electric mobility into the projections. By reviewing and presenting these alternative scenarios to current business as usual, this chapter provides options in support of the targets set for the transport sector in Nepal's NDC.

5.2 National Transport Sector in the Business as Usual Scenario

The BAU scenario presented in the Shakya and Shrestha paper is summarized below to show changes in fossil fuel consumption, energy security, greenhouse gas and local pollutant emissions, along with electricity generation during 2005-2050.[45] The paper uses MARKAL to model the analysis and present projections. The model considers

[43] Bajracharya, I. Bhattarai, N. 2016. Road Transportation Energy Demand and Environmental Emission: A Case of Kathmandu Valley. Hydro Nepal. Issue 18; Shrsetha, RM. Shakya, SR. 2012. Benefits of low carbon development in a developing country: Case of Nepal. Energy Economics; 34: S503-S512.

[44] Shakya, SR. Shrestha, RM. 2011. Transport sector electrification in a hydropower resource rich developing country: Energy security, environmental and climate change co-benefits. Energy for Sustainable Development; 15: 147-159.

[45] Some of the key assumptions outlined by Shakya and Shrestha for the BAU scenario are related to GDP growth rate of 5.5% during 2010-2015, 5.8% during 2015-2020 and 6% along with a discount rate of 10% during 2020-2050. In addition, urban population is estimated to increase from 16.7 to 55.6% and household electrification is estimated to increase from 40-100% during 2005-2030. The study also assumes that the import of electricity will stay at 150 MW beyond 2020 and that the export of electricity will grow up to 2091 MW, anticipating addition of West Seti, Arun III and Upper Karnali hydropower plants onto the grid. Further to considering 70 candidate hydropower plants, the study also considers alternate power generation technologies such as diesel power plant, wood-based gasification combined cycle power plants and landfill gas-based power plant.

passenger and freight transport technologies as end-use service demand in the transport sector. Passenger transport includes ropeway and railway as mass transport options along with bus, micro-bus, car, two-wheelers (two-wheelers), three-wheelers (autorickshaws or tuk-tuks) and taxis as road transport options. The freight transport options include railway and ropeway as mass transport options and truck, tractor and pick-up as road transport options.

Primary Energy Supply Mix and Final Energy Consumption

Under the BAU scenario hydropower generation is estimated to increase by 12 times, whereas biomass use is estimated to decrease by 18% during 2005-2050. Congruent with that trend, the share of hydropower in the total electricity mix is estimated to increase from 82% in 2005 to 89% in 2050, which is a 14-fold production capacity increase. The study shows that the share of thermal power plant capacity is replaced by hydropower and other renewables (micro-hydro, solar home systems, cogeneration, and so forth).

The increase in final energy consumption, when biomass is excluded (consistent with analysis under the *Second National Communication*, presented in the preceding chapter), is highest for the transport sector, followed by the residential sector, in 2030 and 2050 (see Figure 5.1). The transport sector's final energy consumption is highest compared to the other sectors and is estimated to increase by a CAGR of 7% and 6% in 2030 and 2050 respectively, compared to the base year (i.e., 2005). The total final energy consumption is estimated to increase by a CAGR of 6% in 2030 and 5% in 2050, compared to that in 2005.

Greenhouse Gas Emissions

In the base case (which is effectively the BAU), the total greenhouse gas emissions in Nepal are estimated to have grown two- fold by 2030 and five-fold by 2050, compared to emissions in 2005. The sectoral share in greenhouse gas emissions (as seen in Figure 5.2) is estimated to increase in the transport sector from around 18% in 2005 to 49% and 39% in 2030 and 2050, respectively. As the transport sector is estimated to consume around 43% of the imported petroleum in 2050, its share of emissions in the same year is also estimated to be higher than the other sectors' emissions.

Local Pollutant Emissions

Under business as usual, the share of CO emissions has decreased from 82% in 2005, to 76% in 2050 (see Figure 5.3). The share of PM10 emissions in Nepal is estimated to increase from 2% in 2005 to 4% in 2050 mainly due to an increase in the share of fossil fuel transport services in the country (see Figure 5.1). The highest and lowest increase in emissions has been estimated for nitrous oxides (NO_x by 262%) and non-methane volatile organic compounds (NMVOC by 28%).

Energy Security

Three indicators were used to assess changes in energy security in the business as usual scenario. The Shannon-Wiener Index[46], a well-used indicator of energy security, shows that under business as usual, the level of diversification in energy resource mix will increase between 2005 and 2050. This is primarily due to the energy mix shifting from a predominantly biomass-based system to hydropower, fossil-fuel and alternative energy. However, results for the second indicator, the Net Energy Import Ratio (NEIR %), and the third indicator, simply per capita oil consumption (kgoe/capita), are both seen to increase, indicating the country is becoming more fossil-fuel intensive. With increasing dependency on neighboring countries for fossil fuel imports, it can be inferred from the study that the energy security of the country would therefore decrease in the BAU scenario.

[46] Shannon-Wiener Index – highest value is 1.7918 which shows high level of diversification, lowest value is 0 which shows that there is no diversification and only one type of fossil fuel is being used.

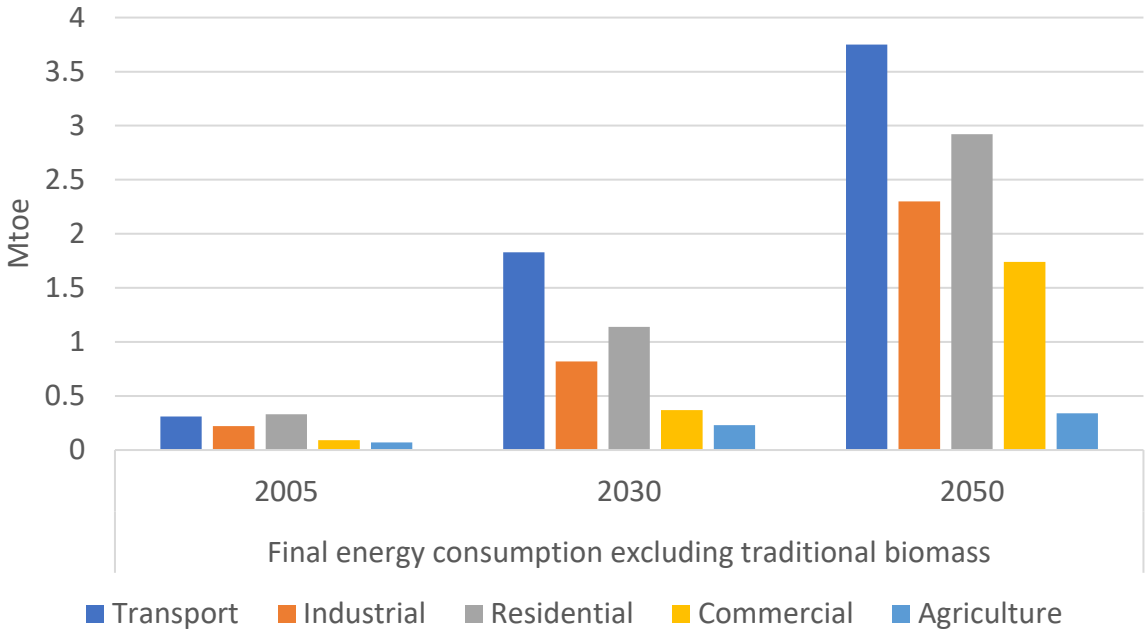

Figure 5.1. Final energy consumption during 2005-2050.[47]
Source: Adapted from Shakya and Shrestha (2011).

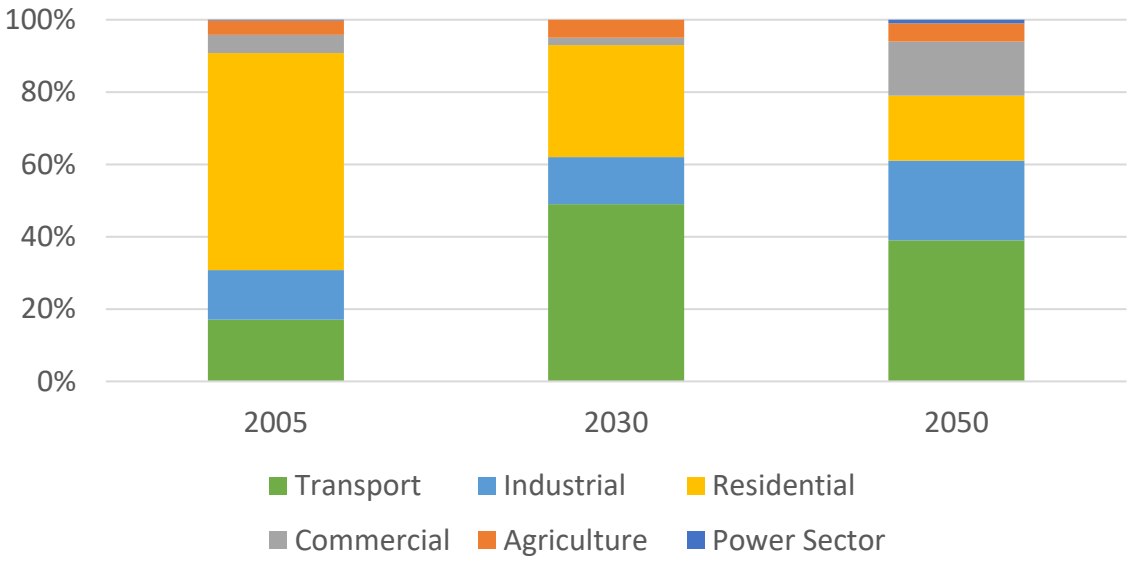

Figure 5.2. Greenhouse gas emissions (CO_2e) in different sectors during 2005 and 2050.
Source: Adapted from Shakya and Shrestha (2011).

[47] Note: traditional biomass in Nepal has not been included in this analysis.

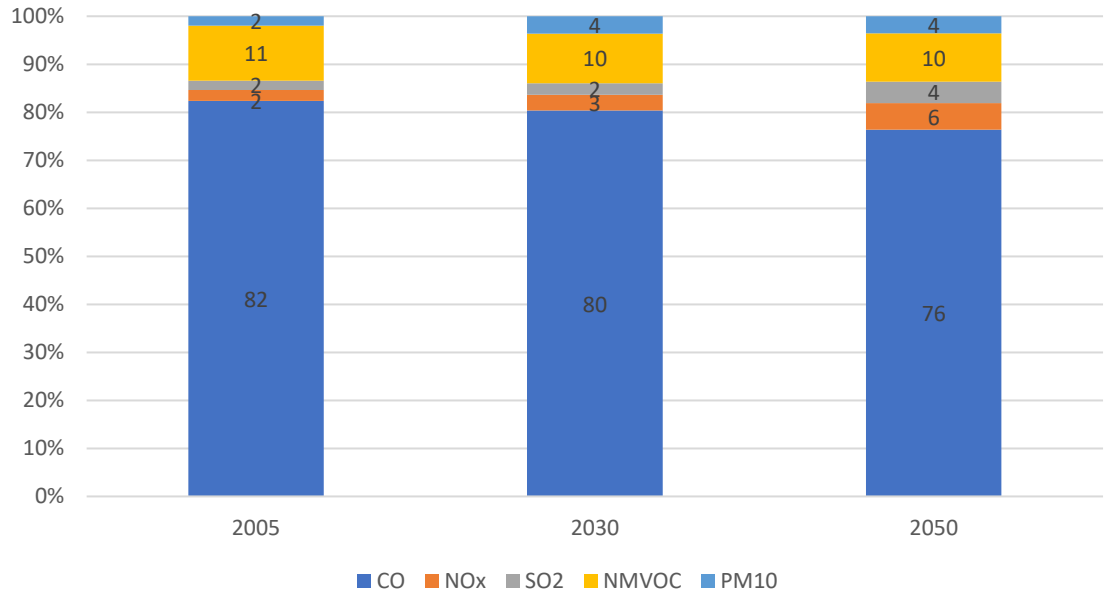

Figure 5.3. Level of local pollutant emission in the BAU scenario during 2005 and 2030.
Source: Adapted from Shakya and Shrestha (2011)

5.3 Scenarios for Electric Mobility Electrification of the National Transport Sector

Shakya and Shrestha's analysis discusses five alternate scenarios pertaining to transport electrification in Nepal. Of the five scenarios, only the three scenarios most closely aligned to the NDC targets are presented in this chapter (see also Table 5.1 below). Each scenario offers a different mix of electric transport, as follows:

- **EMT30** – Under this scenario, 10% of total transport demand would be met by electric mass transport in 2020, rising to 30% by 2050
- **EMT20 + EV10** – Under this scenario, 20% of total transport demand would be met by electric mass transport in 2015, remaining at that level through to 2050; and 10% of total transport demand would be met through electric passenger vehicles by 2015, remaining at that level through to 2050.
- **EMT30 + EV15** - Under this scenario, 20% of total transport demand would be met by electric mass transport in 2015, remaining at that level through to 2050; and 10% of total transport demand would be met through electric passenger vehicles by 2015, rising to 15% by 2050.

These three scenarios are presented in table 5.1 below.

Table 5.1. Three Scenarios for Electric Mobility

Code	Scenarios		From		To	
			%	Year	%	Year
EMT30	Shift from road transport demand to electric mas transport system		10	2020	30	2050
EMT20 + EV10	Shift of road transport demand to	electric mass transport system	20	2015	20	2050
		electric vehicles	10	2015	10	2050
EMT20 + EV15	Shift of road transport demand to	electric mass transport system	20	2015	20	2050
		electric vehicles	10	2015	15	2050

Source: Adapted from Shakya and Shrestha (2011)

This section of the report looks at implications of transport sector electrification on energy consumption, greenhouse gas and local pollutant emissions, energy security as well as power generation mix of the country.

Primary Energy Supply Mix and Final Energy Consumption

The scenarios presented above have different implications on the type and quantity of energy consumed. Since EMT30 is focused solely on mass transport systems, such as passenger and freight railway, its energy demand will be different to the EMT20+EV10 scenario in which the share of electric mass transport system is less, with an additional share of road electric vehicles. Similarly, the energy demand in EMT20+EV15 scenario will be different.

Cumulative primary energy supply has been estimated to decrease in all three scenarios. Under EMT30, it decreases by 0.92%, and under EMT20+EV15 it decreases by 2.74% compared to BAU. The share of hydropower in cumulative primary energy supply is highest in the EMT20+EV15 scenario, where it reaches 15%, followed by 14% in both EMT30 and EMT20+EV10 scenarios. Similarly, the cumulative petroleum product demand is estimated to decrease by 12% in EMT30 and by 14.7% in EMT20+EV15, compared to BAU.

Final energy consumption in the transport sector, in 2030 and 2050, is shown in Figure 5.4 below. The highest decrease in transport sector final energy consumption is estimated at 19% under EMT30, followed by a 16% decrease under EMT20+EV15 and a 14% decrease under EMT20+EV10 scenarios, when compared to BAU. It is important to note that electrification of mass transport systems (i.e., the introduction of electric train, ropeway, etc. such as in the EMT30 scenario) will produce the greatest reduction in final energy consumption.

Greenhouse Gas Emissions

The greenhouse gas emissions (see Figure 5.5) are projected to decrease against BAU accordingly. A reduction of 9% under EMT20+EV10 is estimated, with an even greater reduction of 13% under EMT20+EV15. Greenhouse gas emissions under EMT20+EV10 are 2% higher than under EMT30 and 5% higher than under EMT20+EV15. This shows that mass transportation plays a very significant role in decreasing GHG emissions in the country and is congruent with the anticipated reduction in final energy consumption which mass transport delivers (see above).

GHG emissions in the transport sector for has decreased in the range from 22% in the EMT20+EV10 to 25% in the EMT20+EV15, compared to that in the BAU in 2050. Although as discussed in the previous section, an increase in the final energy consumption in this scenario (i.e., EMT30+EV10) is estimated, the higher decrease in GHG emissions in the same scenario can be attributed to increasing electrification of the transport sector.

Local Pollutant Emissions

Cumulative local pollutant emissions, are estimated to decrease under the different scenarios when compared against BAU (see Table 5.2). The cumulative emission of CO has been estimated to decrease by 5.7% in EMT30 and 9.9% in EMT20+EV15 against the BAU. Similarly, the cumulative emission of NO_x is estimated to decrease by 8.5% under EMT30, and by 10.9% under EMT20+EV15. The other local pollutant emissions follow a similar trend. Conversely, cumulative PM10 emissions increased by 1% under EMT30 and decreased by 6.9% under EMT20+EV15, compared to the BAU. Besides PM10 emissions in the EMT30 scenario, local pollutant levels have been estimated to decrease proportional to increasing transport electrification targets.

Energy Security

Projections for annual fossil fuel imports, as a percentage of the total annual primary energy supply, as well per capita oil consumption, have been seen to decrease under all three scenarios, compared to BAU. This is outlined in Table 5.3. The Shannon-Wiener Index shows that the energy resource mix of the country will diversify to include more resources in the primary energy supply mix. Cumulative energy imports during the period 2005-2050 are estimated to decrease under all three scenarios, when compared to BAU. Of the total oil imports, the transport sector is estimated to consume the lowest share (84.4%) under the EMT20+EV15 and the highest share (91.9%) under the EMT20+EV10.

All three indicators presented show that increasing transport electrification causes a reduction in fossil fuel imports. This has a significant positive impact on increasing energy security in Nepal.

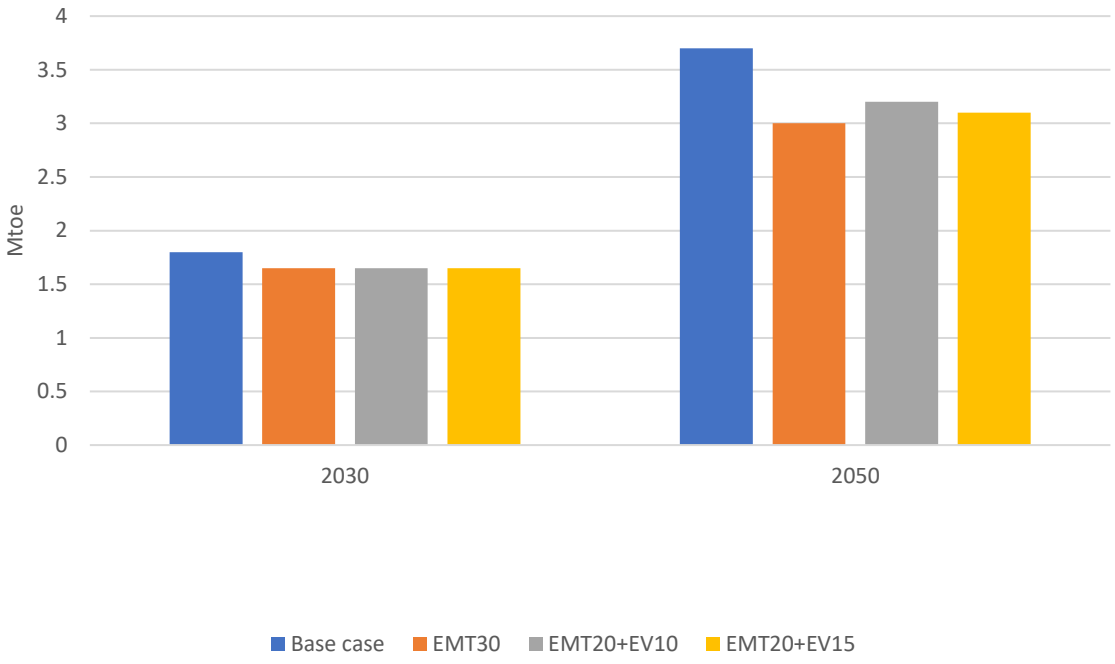

Figure 5.4. Final energy consumption in the transport sector in 2030 and 2050 (Mtoe).
Source: Adapted from Shakya and Shrestha (2011)

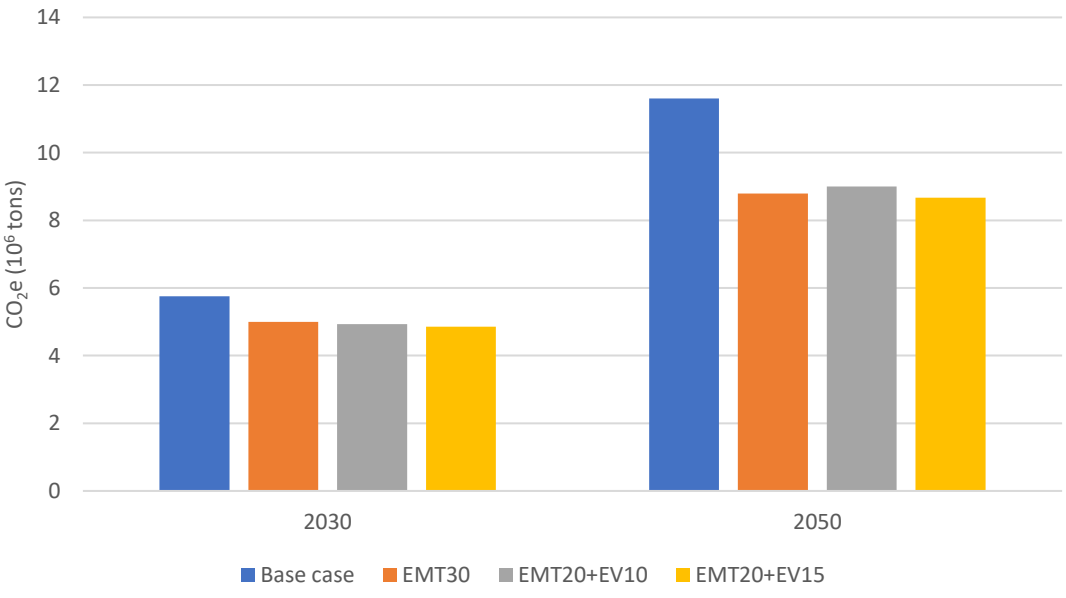

Figure 5.5. Greenhouse gas emissions in the transport sector of Nepal
Source: Shakya and Shrestha (2011)

Table 5.2. Cumulative local pollutant emissions during 2005-2050 (10^6 tons)

	CO	NO_x	SO_2	NMVOC	PM_{10}
Base case	74.68	3.41	2.68	9.59	2.89
EMT30	70.39	3.12	2.53	9.36	2.92
EMT20+EV10	69.13	3.13	2.56	9.21	2.84
EMT20+EV15	67.29	3.04	2.49	8.91	2.69

Source: Shakya and Shrestha (2011)

Table 5.3. Energy security indicators in different scenarios in 2050

Scenario	Net Energy Import Ratio (%)	Shannon-Wiener Index	Oil Consumption per Capita (kgoe/capita)
Base case (BAU)	45.36	1.48	109.75
EMT30	43.37	1.52	91.61
EMT20 + EV10	45.40	1.54	93.01
EMT20 + EV15	44.44	1.54	89.12

Source: Shakya and Shrestha (2011).

Box 5.1. Increasing adoption of electric motorbikes in Kathmandu

A recent study on the road transport energy demand and its implication on emissions in Kathmandu Valley was carried out by Bajracharya and Bhattarai in 2016. This study uses the Long-range Energy Alternative Planning System (LEAP) model to analyze different transport policies in Nepal, and explore their impact.

More than 65% of the total vehicles registered in Nepal reside in Kathmandu Valley, and two-wheelers make up 80% of the vehicles in the city. Since the contribution of two-wheelers to greenhouse gas and local pollutant emissions is high, this study puts forward a strong case for assessing the impact of greatly increasing the share of electric two-wheelers in in Kathmandu Valley. Under this scenario, the authors of the study modelled an increase in the sale of electric two-wheelers, which rose from 1% in 2016 to 75% in 2030. The base year, in this study, is 2010.

This scenario generated a number of positive effects. In the BAU of this study, two-wheelers constituted 39% of total energy demand in Kathmandu Valley by 2030. However, a shift to electric two-wheelers would see this demand reduce by 12%. This would also deliver a saving, due to reduced fossil fuel imports, of NPR 52,576 (USD 496 million). [48] During the same period, cumulative GHG emissions would by 7% and local pollutant emissions for CO, hydro-carbon (HC), NOx and PM10, would decrease by 25%, 29%, 7% and 20% respectively.

The study indicates that policy measures to increase the share of electric two-wheelers should be adopted due to the numerous advantages outlined above.

[48] USD 1 = NPR 106

Box 5.2. Power generation capacity requirements during 2005-2050.

With increasing electrification of the transport sector comes increased electricity consumption, leading to increased demand long-term. To be effective, electric mobility initiatives must therefore be supported though increased investment in hydropower and other forms of renewable electricity generation.

Power generation requirements under the three scenarios were calculated by Shresthra and Shakya (2011). Overall power generation capacity requirements increase by a CAGR of 2% under all scenarios, except under EMT20+10 where it is estimated to increase by a CAGR of 3% during 2030-2050. In particular, in terms of hydropower specifically, in order to accommodate a rise in demand, hydropower generation would need to increase by 5% under EMT30 to as much as by 12% under EMT20+EV15 compared to BAU generation.

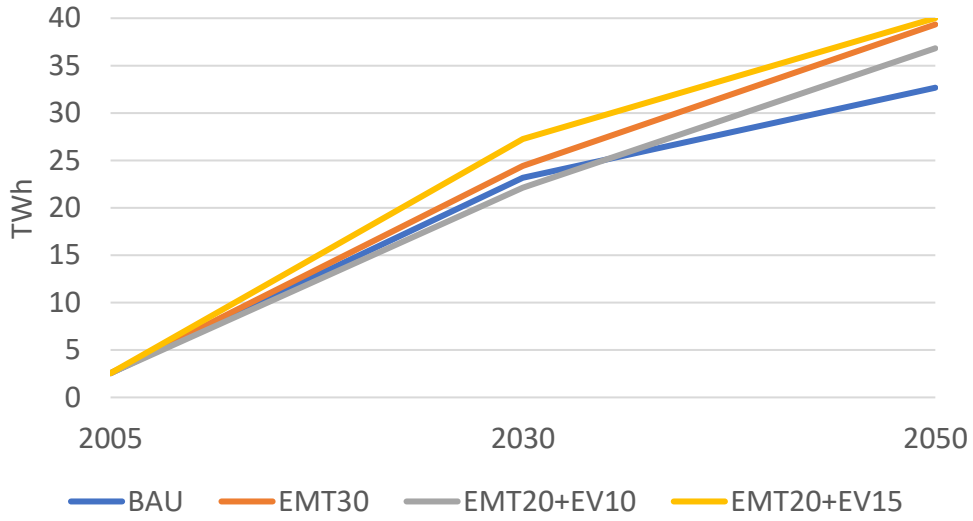

Figure 5.6. Electricity generation requirements during 2005-2050

Source: Shakya and Shrestha (2011)

5.4 Electrification Scenarios and Implications for Achieving NDCs

As a whole, the scenarios presented above demonstrate that gradual and increased uptake of electric vehicles, and wider systemic shifts towards electric mobility systems, have substantial benefits for the country, and directly support the achievement of the NDC transport sector targets. These benefits are political, financial, economic, strategic, social and environmental. Key implications from the review of scenarios are outlined below:

- **Policy interventions today deliver substantial long-term dividends in terms of meeting NDC targets** – To tackle rising emissions (greenhouse gas and local pollutant) along with rising fossil fuel consumption in the transport sector in Nepal, it is essential to recognize and implement robust policy interventions today, to reap benefits of emissions and fossil fuel reductions in the future, supporting achievement of the transport sector NDC targets.
- **Even moderate increases in share of electric vehicles and electric mobility systems deliver lasting benefits, in addition to meeting NDC**

targets – The analyses presented above shows that moderate targets are also enough to propel transition towards more efficient fuel consumption, resulting in reduced emissions. In addition to these direct benefits, there are numerous co-benefits such as increased energy security, with increasing diversification and use of local energy resources, and decreased local pollutant emissions, that can contribute towards meeting not only the four transport-related targets set in the NDC, but also the broader goals of sustainable development.

- **Increased electric mobility will reduce fossil fuel consumption in the country** - All three scenarios discussed above show that with realistic targets for transport sector electrification, significant advances in reducing dependency on fossil fuels in the transport can be made. As can be seen in Figure 5.7, the decrease in fossil fuel consumption in the three scenarios will, in themselves, deliver between 15% - 19% of the total dependence reduction target set out in the NDC (NDC target 10).
- **Increased electric mobility will significantly support strategic goals for hydropower generation** - Since 95% of electricity requirements are met through hydropower generation in Nepal, electrification of the transport sector has high implications on hydropower capacity in the country. Thus, it is essential to align transport electrification targets with hydropower generation targets.
- **Significant improvements in urban air quality can be achieved through increased electric mobility** – The scenarios explored in this chapter also achieve an overall reduction in local air pollutants. This in itself leads to improved public health, reduced fatalities and high degrees of productivity, as well as delivering wider economic benefits (for example tourism).

Figure 5.7. Reduction in the fossil fuel dependency- NDC target vs. scenario achievements

Source:

Part 3
Barriers to Electric Mobility


D-MARK COLLEGE
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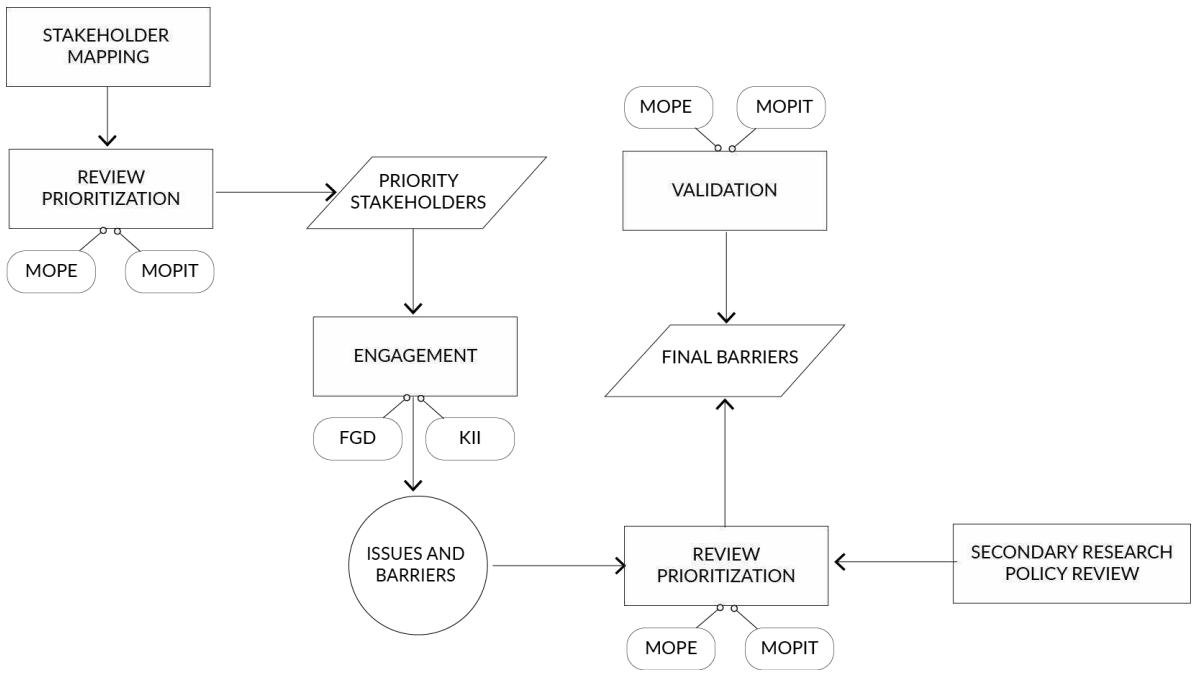
Blue Sky Tailors

Chapter 6
Overview of Barriers

6.1 Barrier Analysis Process

Part 3 reviews the current context in Nepal and identifies critical barriers that inhibit greater penetration of electric vehicles in the country. This review and subsequent identification are based on comprehensive stakeholder consultations, as laid out in Figure 6.1 below. Through these consultations, barriers were identified, graded, ordered and prioritized. In particular, the Ministries of Forests and Environment, and of Physical Infrastructure and Transport provided essential direction with prioritization.

Figure 6.1. Barrier identification and prioritization process



Source: GGGI

6.2 Overview of Stakeholders

A comprehensive stakeholder mapping exercise was undertaken internally, with guidance and feedback from MOFE and MOPIT. In this way, MOFE and MOPIT, with GGGI, constituted an effective program management unit for the development of this work, under the formal oversight of a technical working group comprised of MOPIT, MOFE, Ministry of Finance, Ministry of Energy and GGGI.

In addition to their roles on the technical working group, both MOFE and MOPIT were active stakeholders during consultations, as reflected in Table 6.2 below. As a result of stakeholder mapping, priority stakeholders were identified for consultation and engagement, as outlined in Tables 6.1 and 6.2, below. Engagement and consultation then took place over the course of June – September 2017.

Table 6.2. Total stakeholders consulted by type

Type of stakeholder	Number consulted
Government bodies	8
Development partner organizations	2
Scientific and monitoring organizations	4
Consumers (individuals)	8
Private sector businesses and business groups	11
Total	**33**

Table 6.3. List of stakeholders and engagement modality

Stakeholder Name	Engagement	
	KII	FDG
GOVERNMENT BODIES		
Kathmandu Metropolitan City	X	
Lalitpur Metropolitan City	X	
Ministry of Physical Infrastructure and Transport	X	X
Ministry of Environment	X	X
Department of Transport Management	X	
Department of Customs	X	
Nepal Electricity Authority	X	
Department of Electricity Development	X	
DEVELOPMENT PARTNERS		
KOICA	X	
Asian Development Bank (ADB) Nepal	X	
SCIENTIFIC AND MONITORING ORGANIZATIONS		
Environment Unit, KMC	X	
Environment Unit, LMC	X	
Department of Environment, MOFE	X	
ICIMOD	X	
CONSUMERS		
Individuals consulted	X	
BUSINESSES AND BUSINESS GROUPS		
Sajha Yatayat	X	
Electric Vehicle Association of Nepal	X	X
National Fed. Eco-Friendly Transport Entrepreneurs		X
Clean Locomotive Entrepreneurs Association		X
Nepal Electric Vehicle Charging Station (Association)		X
Tata	X	
KPIT (India)	X	
Ashok Leyland (India)	X	
BYD (Nepal Representative)	X	
Mahindra (Nepal Representative)	X	
Kia Motors (Nepal Representative)	X	

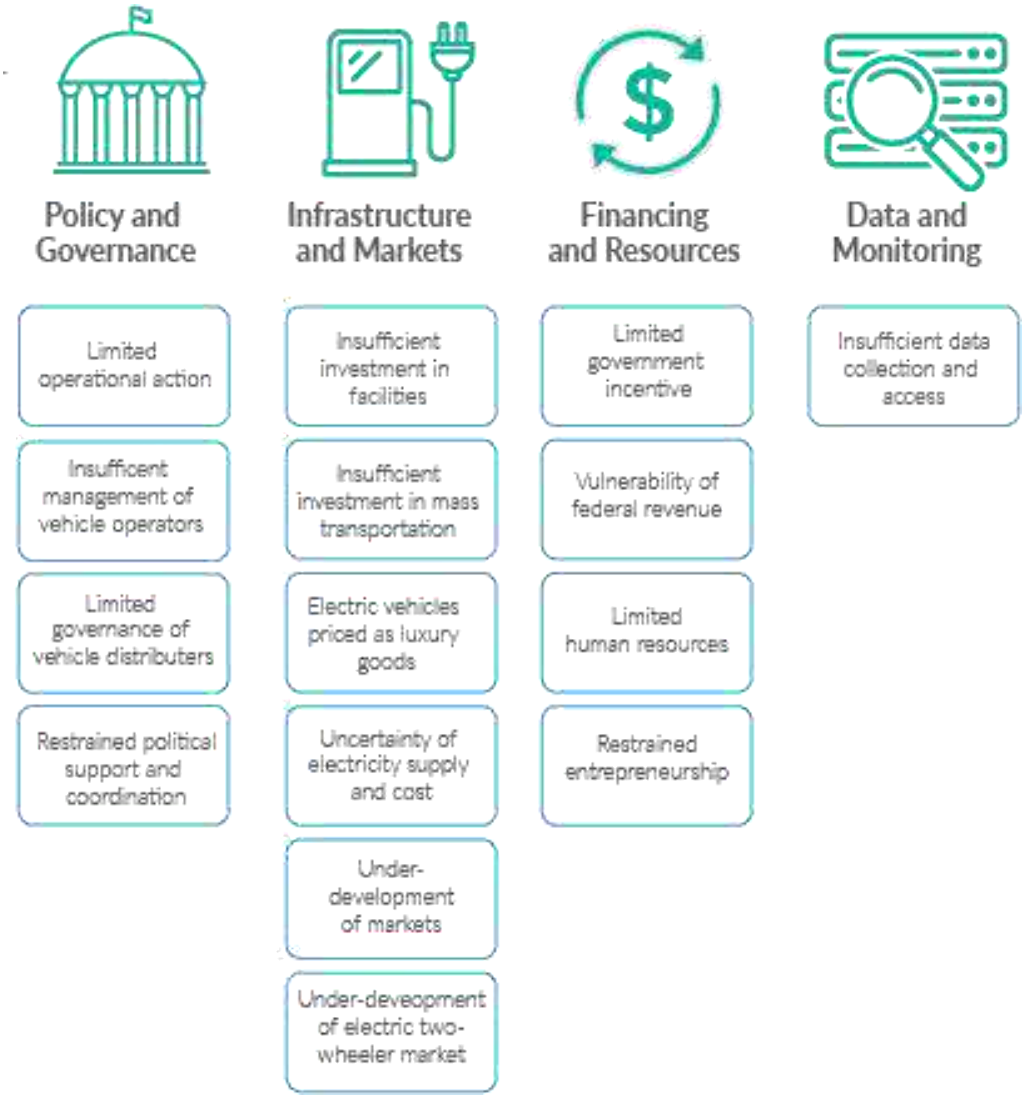
6.3 Summary of Barriers Identified and Prioritized

A wide range of barriers were identified across policy and governance, infrastructure and markets, data and monitoring, and financing and resources. Any challenge, gap or issue seen as inhibiting or restricting the uptake of electric vehicles (market penetration) was identified as a barrier. As a result of the stakeholder consultations, and given the broad sectoral and functional view taken, a great number of barriers and issues were identified.

However, not all identified barriers and issues were considered sufficiently relevant to be included in this report. Through subsequent second rounds of consultation with key stakeholders, barriers and issues were prioritized to support focused intervention, and a hierarchy was introduced. This resulted in a final set of 15 barriers, and 56 issues, as outlined in Figure 6.2 below.

Under this nomenclature, a barrier is a larger obstacle or challenge to electric mobility, comprised of a number of smaller, contributing issues. Barriers and issues were categorized into four groups, namely, a) policy and governance; b) infrastructure and markets; c) financing and resources; d) data and monitoring. This categorization drew on similar categories utilized in the foundation methodology (gap analysis) for NDC implementation promoted by Ricardo Environment and Energy[49].

Figure 6.2. Summary of barriers by category



[49] CDKN. 2016. Planning for NDC Implementation, Quick Start Guide and Reference Manual. Ricardo. Accessed at https://d1v9sz08rbysvx.cloudfront.net/ee/media/downloads/ndc-implementation-quick-start-guide-english.pdf


SAVE ENERGY
SAVE ENVIRONMENT
GO GREEN
No Petrol # No Die
Drive Electric V

Chapter 7
Policy and Governance Barriers

7.1 Introduction

Policy and governance barriers and issues are presented in Figure 7.1 below.

Figure 7.1. Overview of barriers and issues

7.2 Policy and Governance Barriers

The following are the specific policy and governance barriers to greater adoption of electric vehicles in Nepal.

Barrier 1. Limited Operational Action

While the government has published a range of high-level policy that support electric mobility, much of this policy requires operationalization. Policy reflects what a ministry hopes to achieve, but typically policy is not legally binding. Nor does policy provide specific instruction, lay out principles of operation and set standards. As such, an absence of directives, programs, standards and legislation for electric mobility currently inhibits the achievement of policy. The main exception to this general barrier is within the fiscal space, where revision to the customs and value added taxes regulation has been undertaken to favor electric vehicles.

ISSUE	**ABSENCE OF DIRECTIVES AND LEGISLATION FOR ELECTRIC MOBILITY**
Number	1.1
Category	Policy and regulation
Summary	The *Environment Friendly Transport Policy* and the *National Sustainable Transport Strategy* both set provisions and targets for electric vehicles, some of which were taken up in the *Nationally Determined Contributions.* However, there has been no subsequent action from government setting out directives, instructions or procedures for implementation of these policy. Importantly, supportive legislation has not been formulated. As such, while top-level policy is in place, reflecting high-level aspirations, the absence of operational-level work is a fundamental issue. Legislation is needed that empowers police and traffic offers to fine heavily and clearly polluting vehicles. Currently no such legislation exists (see Issue 13.4 on police capacity).
Result	Policy remains unimplemented; responsibilities and obligations for electric mobility are not set out; lack of executional clarity
Action	See Priority Action 1 overall, as well as Initiative 1, Initiative 2, and Initiative 3

ISSUE	**ABSENCE OF DEDICATED ELECTRIC MOBILITY PLAN**
Number	1.2
Category	Planning
Summary	As for Issue 1.1 above, while there is a range of policy in place, these have not been operationalized into a focused, practical electric mobility plan. Such a plan needs to lay out specific programs and initiatives, including any required subsidy or schemes, and provide clear action for implementation of policy goals and targets.
Result	Policy remains unimplemented; absence of clear road map for action
Action	See Priority Action 1

ISSUE	**ABSENCE OF PROGRAMS TO OPERATIONALIZE POLICY AND TARGETS**
Number	1.3
Category	Policy and regulation
Summary	Similar to Issue 1.1, an absence of program for electric mobility inhibit operationalization of national policy. With the exception of the 'Electric Mobility Program', a joint initiative from GGGI and Government of Nepal, there are no focused programs for electric mobility initiated at the national or local level. Such programs have the benefit of operationalization, even in the absence of directives or legislation, and permit government to pilot or trial new ideas, design specific and focused interventions and generally advance toward policy achievement without (or in parallel to) regulatory action as described in Issue 1.1. In part this absence is linked to a lack of data (see Barrier 15). While there is a 'Green Stickers Program', it is targeted at reduced central city air pollution.
Result	Policy remains unimplemented; new ideas for policy implementation are not trialed
Action	See Priority Action 1

ISSUE	**ABSENCE OF PERFORMANCE STANDARDS AND GUIDELINES FOR ELECTRIC VEHICLES AND FACILITIES**
Number	1.4
Category	Policy and regulation
Summary	There is no regulation in place describing the minimum performance requirements of

	electric (or hybrid) vehicles or setting guidelines for the operation of electric vehicles and vehicle parts. This is particularly needed in terms of charging facilities to optimize utilization.
Result	Lack of clarity on how electric vehicles should perform; facilities are unspecified
Action	See Priority Action 1

ISSUE	**ABSENCE OF REGULATION FOR VEHICLE CONVERSION AND HYBRIDIZATION**
Number	1.5
Category	Policy and regulation
Summary	There is no policy or regulation in place to support the modification, adaptation or conversion of petrol and/or diesel vehicles to electric vehicles. This discourages initiative and innovation, and restricts vehicle owners wishing to modify, adapt or convert their vehicles. It also leads to issues of safety, as some vehicle owners illegally modify, adapt or convert using unsafe methods – especially in light of the price of electric vehicles on the Nepali market.
Result	Conversion of petrol vehicles to electric vehicles cannot be undertaken legally; risk of unsafe conversion; consumers are not supported to take action
Action	See Priority Action 1, and Initiative 3

<u>Barrier 2. Insufficient Management of Vehicle Operators</u>

In Nepal's larger cities, especially Kathmandu, public transport operators tend to be small and numerous. In addition to public transport operators, other vehicle operators, such as local government solid waste management vehicle fleets, are not encouraged to go electric. Decision-making procedures, overall governance, and managerial protocols put in place by governmental bodies appear to undermine national policy and targets for electric mobility by discouraging the acquisition and operation of electric fleets.

ISSUE	**SUBOPTIMALITY OF ROUTE AND PERMIT MANAGEMENT**
Number	2.1
Category	Governance
Summary	Public transport operators require permits to operate on specific routes. The management of these permits and routes needs to be improved. Management decisions are also influenced by operator syndicates, leading to sub-optimal practices and outcomes. New operators seeking to mobilize electric public transport vehicles can face challenges in acquiring required route permits.
Result	Uptake of electric vehicles by public transport operators is discouraged; some operators are confused
Action	See Priority Action 1, Priority Action 2, and Initiative 4

ISSUE	**BAN ON REGISTRATION OF NEW THREE-WHEELERS (INCLUDING ELECTRIC)**
Number	2.2
Category	Governance
Summary	Since 2001, registration of new three-wheelers (tempos, auto-rickshaws) has been closed due to perceived saturation. This ban affects both petrol and electric three-wheelers. This undermines the ability of public transport operators to introduce new electric three-wheelers onto their routes. It also undermines the uptake of electric vehicles within a range of other sectors - for example, local government initiatives aimed at introducing electric three-wheelers for waste collection have been blocked. This ban is not backed by a vehicle specific emissions/pollution-dependent decision. Over the course of 2017, efforts were undertaken to remove electric three-wheelers from this ban (i.e. to modify the ban so that it only applies to petrol and diesel three-wheelers). However, this exemption is still to be granted.
Result	Uptake of electric three-wheelers is restricted
Action	See Priority Action 1, Priority Action 2, and Initiative 5

<u>Barrier 3. Limited Governance of Vehicle Distributers</u>

Several firms in Nepal are importing and distributing electric vehicles. This activity is essential for electric vehicle uptake as it permits consumer acquisition. However, governance of distributers is inadequate, leading to suboptimal outcomes for the consumer and a subsequent reduction in electric vehicle uptake.

ISSUE	**ELEVATED PRICES OF ELECTRIC VEHICLES**
Number	3.1
Category	Governance
Summary	Prices of electric vehicles in Nepal are high, despite significant reductions in customs tax and exemption from value added tax.[50] Models on the Nepali market retail at prices some 3-4 times higher than on the nearby Indian market. This elevated price point means that electric vehicles tend to be seen as luxury goods, often purchased as second or third cars. The elevated prices reduce consumption and undermine a broader goal of increasing electric mobility. Better governance of distributors and tighter regulation of prices would help to provide the market with more affordable vehicle models.
Result	Prices for electric vehicles remain high, reducing consumption
Action	See Priority Action 3

Barrier 4. Restrained Political Support and Coordination

To advance implementation of electric mobility goals and targets, political commitment is needed at all levels, federal, provincial and local. Currently, such commitment is not secured. While the topic has become politicized, political commitment is undermined by inconsistency, fragmentation and agenda conflicts at various levels. Many of these issues are closely linked to Barrier 5, below.

ISSUE	**LIMITED POLITICAL COMMITTMENT**
Number	4.1
Category	Governance
Summary	Transforming policy into regulation and executive action requires consistency of political and legislative effort. However, high levels of change within the government and political structures of Nepal have led to inconsistencies. Outside of governmental stability, the goal of electric mobility is also undermined by short-termism. During intense periods of air pollution and fuel supply disruptions, initiatives for electric mobility are launched, which tend to be short-lived.
Result	Long-term development of the electric vehicle market is undermined
Action	See Priority Action 2

Issue	**LIMITED PRIORITIZATION OF AIR QUALITY AT THE LOCAL LEVEL**
Number	4.2
Category	Governance
Summary	Despite the *Local Self Governance Act* (1999), which specifies that municipalities are responsible for air pollution, for many local governments, air quality is deprioritized in favor of other issues, considered to be more pressing, such as sanitation, water supply and solid waste management. Air quality tends not to be monitored by local governments.
Result	The air quality advantages of low- or zero-emissions vehicles are not fully appreciated.
Action	See Priority Action 2

ISSUE	**INTER-MINISTERIAL COORDINATION IS AD HOC**
Number	4.3
Category	Institutions
Summary	Government activities for electric mobility are not coordinated by a centralized committee, taskforce or other such mechanism. In the absence of such, degrees of coordination are maintained through discussions, workshops and entities set up on an ad-hoc basis. However, greater coordination and therefore effectiveness for concerted efforts could be achieved via the use of a coordinating committee for electric mobility. Communication between ministries on electric mobility issues is limited.
Result	Fragmentation of efforts across government continues
Action	See Priority Action 2

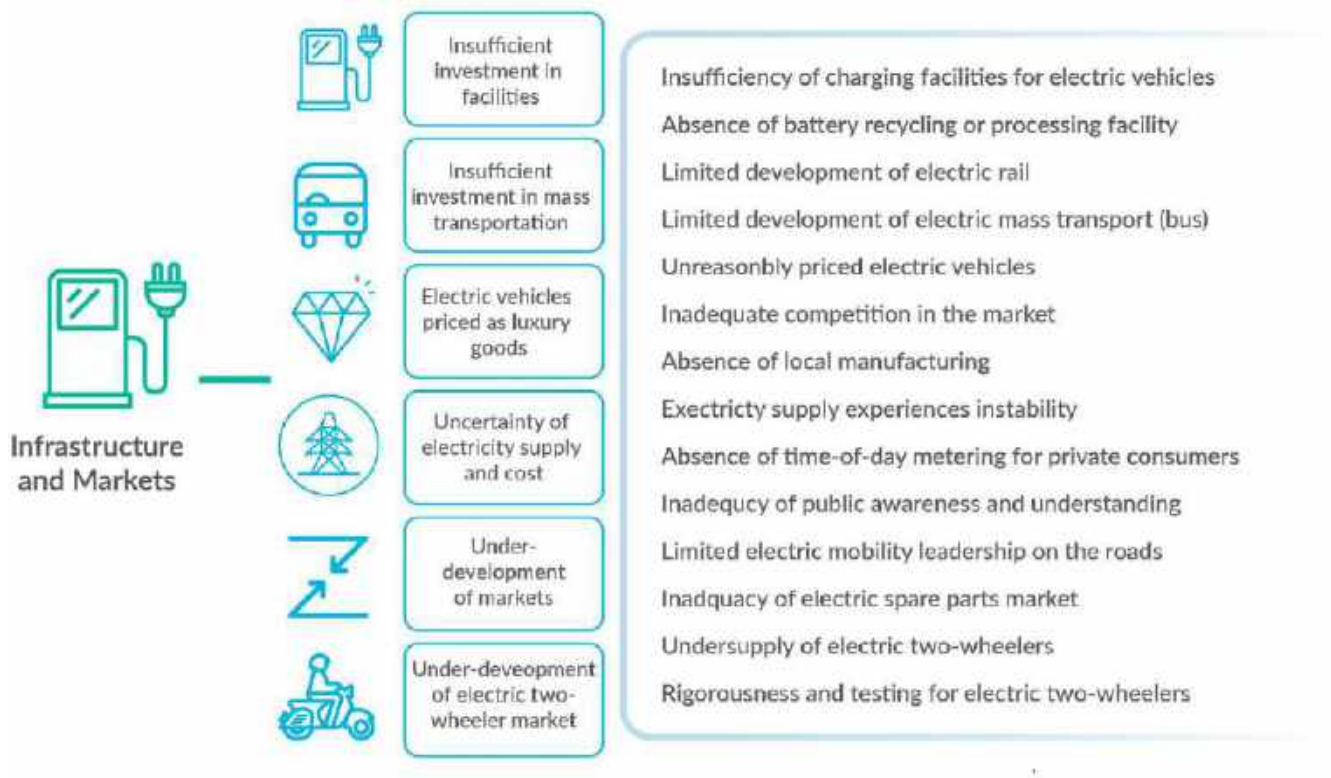
[50] For example, as at Q4 2017, the Mahindra e20 Plus retailed in Nepal at NPR 31 lakh (3,100,000) or approximately USD 30,000. The same vehicle retailed in India for INR 746,225 (USD 11,500) including a government incentive in price reduction under the FAME scheme. Without this incentive, which is INR 138,000, the market retail price is INR 884,225 (USD 13,712) some 45% of the retail price of the equivalent vehicle in Nepal. Data accessed December 8, 2017 from https://www.inheadline.com/news/mahindra-e20-plus-price-and-specifications-electric-car-in-nepal and https://www.mahindrae2oplus.com/pages/buy/price-list and http://www.firstpost.com/business/fame-india-govt-scheme-offers-up-to-rs-1-38-lakh-incentives-for-electric-hybrid-vehicles-2189845.html.

Chapter 8
Infrastructure and Market Barriers

8.1 Introduction

Infrastructure and market barriers and issues are presented in Figure 8.1 below.

Figure 8.1. Overview of barriers and issues



8.2 Infrastructure and Market Barriers

The following are the specific infrastructure and market barriers to greater adoption of electric vehicles in Nepal.

Barrier 5. Insufficient Investment in Facilities

Currently, there is very little investment in electric vehicle infrastructure and facilities in Nepal. This poses a significant barrier to greater electric vehicle adoption, as the availability of especially charging facilities is critical for widespread uptake.

ISSUE	**INSUFFICIENCY OF CHARGING FACILITIES FOR ELECTRIC VEHICLES**
Number	5.1
Category	Infrastructure
Summary	Private consumers of electric vehicles tend to charge their vehicles at home. This is the case for both electric cars and motorbikes. However, the provision of public charging stations is critical for widespread uptake, especially along intercity routes (for example, between Kathmandu and Pokhara), and at key locations in and around major cities. Greater public-private initiatives need to be taken for this to progress. For example, the public sector could provide land and the private sector install facilities, for joint investment and development of charging centers.
Result	Consumers remain concerned about the practicalities of charging once they have left their homes; consumer concern on this issue leads to reduced consumption
Action	See Priority Action 3, and Initiative 7

ISSUE	**ABSENCE OF BATERY RECYCLING OR PROCESSING FACILITY**
Number	5.2
Category	Infrastructure
Summary	Simple and relatively cheap methods exist for neutralizing battery acid, and/or processing and recycling battery components. However, there is no such facility in Nepal. As a result, batteries are either sent to India for recycling, which tends to be expensive, or they are dumped in landfill sites or 'recycled' as cleaning product which is unsafe and highly polluting.
Result	Poor end-of-life management options for batteries; pollution and higher operational costs
Action	See Priority Action 3, and Initiative 8

Barrier 6. Limited Investment in Mass Transportation

While the establishment of both rail and bus electric mass transportation systems is a goal of national policy, there has been limited action. Master-planning, analysis, and research are being undertaken so support informed decision making, and coordination, for the establishment of such systems. Targets for both electric rail and electric mass transportation (bus) are included in the National Determined Contribution.

ISSUE	**LIMITED DEVELOPMENT OF ELECTRIC RAIL**
Number	6.1
Category	Infrastructure
Summary	The development of electric rail systems requires strong political commitment, significant financial and technical resources, and sustained support from a range of stakeholders. These components have been challenging to muster in Nepal. As a result, there has been limited development of electric rail. While initial scoping studies and planning programs have been undertaken, these have yet to lead to the establishment of a functioning rail system.
Result	Road transport remains dominant; lack of modal alternatives for freight or commuters
Action	See Priority Action 2 and Initiative 9

ISSUE	**LIMITED DEVELOPMENT OF ELECTRIC MASS TRANSPORT (BUS)**
Number	6.2
Category	Infrastructure
Summary	Electric public bus transport systems remain under-invested. In part, this is linked to higher acquisition costs, as well as procurement challenges. Currently, there are no full-size electric buses operating in Nepal. With strong demand for public transport, and limited supply there is scope for improvement in this area.
Result	Limited electrification of bus systems
Action	See Priority Action 2 and Initiative 10

Barrier 7. Electric Vehicles Priced as Luxury Goods

As noted earlier, governance of electric vehicle distributors could be improved in order to overcome market results that are not favorable to adoption of electric vehicles. In particular, the price of consumer electric cars is particularly high, often beyond the reach of the average car buyer. Electric motorbikes, on the other hand, are more moderately priced.

ISSUE	**UNREASONABLY PRICED ELECTRIC VEHICLES**
Number	7.1
Category	Market
Summary	As outlined in Barrier 3 above, the market price of electric vehicles in Nepal remains high, compared to prices for similar models in neighboring markets. This price difference cannot be explained solely in terms of higher freight or transport costs into the Nepali market. The price difference is particularly noted given the low customs tax and exemption from value added tax which electric vehicles in Nepal enjoy. Increased competition in the market could help to reconcile the market price of electric vehicles.
Result	Electric vehicles are priced beyond the reach of most citizens
Action	See Priority Action 3.

ISSUE	**INADEQUATE COMPETITION IN THE MARKET**
Number	7.2
Category	Market
Summary	The federal government maintains a national trading company, designed to import and distribute goods at low prices. This helps to foster competition across the market and increase consumption. However, within the automotive sector the government had no trading activity. The market, overall, remains uncompetitive and results in low demand. Greater government activity could help to enhance the market through government-led distribution.
Result	The electric vehicle market is not competitive; low consumer demand
Action	See Priority Action 2 and Priority Action 3

ISSUE	**ABSENCE OF LOCAL MANUFACTURING**
Number	7.3
Category	Markets
Summary	While Nepal has experience assembling electric three wheelers over the 1990s-2000s, there is limited activity in the manufacturing sector currently. Only Tailg, a Chinese company, is actively manufacturing electric motorbikes in Nepal. The relative absence of local manufacturing contributes to the high prices of electric vehicles overall, underlying Issues 7.1 and 7.2 above.
Result	Electric vehicles must be imported contributing to higher retail prices
Action	See Priority Action 2, Priority Action 3, as well as Initiative 11

Barrier 8. Uncertainty of Electricity Supply and Cost

For market confidence in electric vehicles, consumers must be able to broadly assume stability of electricity supply. Unfortunately, that assumption cannot be fully made in the case of Nepal. In addition, there are no fixed charging fees tailored to electric vehicles, meaning that consumers must be willing to accommodate fluctuations in the per unit price of electricity. Both components contribute to a degree of uncertainty in terms of charging which undermines consumption.

ISSUE	**ELECTRICITY SUPPLY EXPERIENCES INSTABILITY**
Number	8.1
Category	Market
Summary	Despite progress over 2016-17, supply of electricity, especially in Nepal's larger cities, is still unstable. This restricts appetite for electric vehicles. There are periods of load shedding and during such situations, electric vehicles cannot be charged. Consumers are aware of these supply issues and make decisions accordingly. However, charging stations have been made available for electric three-wheelers (safa tempos), which ensure charge during periods of load shedding. Such charging stations need to be made more plentiful, and accessible to private vehicle owners. Overall, long-term supply needs to be proactively developed if

	broader electric vehicle penetration is to be achieved.
Result	Electricity supply disruptions dampen appetite for electric vehicles
Action	See Priority Action 1, Priority Action 2, Initiative 12 and Initiative 13

ISSUE	**ABSENCE OF TIME OF DAY METERING FOR PRIVATE CONSUMERS**
Number	8.2
Category	Market
Summary	While electricity consumed during off-peak periods is cheaper, domestic metering (i.e. at consumers' homes) does not accommodate time of day charging. As such, consumers are offered a low, overnight charge for their electric vehicles, but are not able to capitalize on it. Improvements in metering would help to consumer commitment to electric vehicles.
Result	Consumers lack certainty of operating costs, which can reduce consumption
Action	See Priority Action 1, Priority Action 2 and Initiative 12

Barrier 9. Under-Development of Markets

Overall, electric vehicle markets are underdeveloped in Nepal. This applies to sectors of the market, particularly the electric two-wheeler market, as well as associated markets such as spare parts. In addition, there is a lack of public awareness and education on the benefits of electric vehicles. These issues converge resulting in lowered demand for electric vehicles.

ISSUE	**INADEQUACY OF PUBLIC AWARENESS AND UNDERSTANDING**
Number	9.1
Category	Market
Summary	Overall, public awareness of electric vehicles, particularly their benefits, remains low. While this situation is improving, in part due to growing attention to air quality and the promotional work of civil society and private sector, there is a long way to go. Linked to Issue 9.4 below.
Result	Reduced demand for electric vehicles; reduced consumption
Action	See Priority Action 1, Priority Action 2, and Initiative 14

ISSUE	**LIMITED ELECTRIC MOBILITY LEADERSHIP ON THE ROADS**
Number	9.2
Category	Market
Summary	There are very few examples of electric mobility leadership on the roads. As a result, the public and potential consumers are not exposed to clear messaging and support for electric vehicles. Safa tempos (electric three-wheelers) are the only current example leadership, and much of the safa tempo fleet is in poor repair. Outside of this, there are no pilot electric vehicles fleets in the government system, no leadership from taxi fleets, or from transport operators – despite operational savings potential. Greater leadership on the roads would help to create a broader consumer market for electric vehicles.
Result	Public awareness of electric vehicles remains low; reduced consumption and interest
Action	See Priority Action 1, Priority Action 2, and Initiative 15

ISSUE	**INADEQUACY OF ELECTRIC VEHICLE SPARE PARTS MARKET**
Number	9.4
Category	Market
Summary	ACROSS ALL VEHICLE TYPES Electric vehicle spare parts, for example batteries, do not enjoy the same low customs tax and exemption from value added tax, as fully assembled vehicles. Rather, spare parts are subject to a customs tax of X per cent. This reduces import and reduces market availability of spare parts. As a result, buyers of electric vehicles must confront the possibility of vehicle maintenance challenges.
Result	Risk of high maintenance costs for electric vehicle owners; reduced consumption of assembled vehicles
Action	See Priority Action 3

Barrier 10. Under-development of Electric Two-Wheeler Market

In Nepal, two-wheelers comprise the largest share of any vehicle type by far, constituting some 80% of the total vehicle fleet. Given the dominance of two-wheelers, almost of all of which are petrol-powered, there is significant scope to develop the consumer market for electric vehicles broadly, by focusing on the development of the electric two-wheeler market.

ISSUE	**UNDERSUPPLY OF ELECTRIC TWO-WHEELERS**
Number	10.1
Category	Market
Summary	Demand for two-wheelers is very high. This segment is also the fastest growing. However, there is scarcely any supply of electric two-wheelers. The Indian manufacturer, Hero, closed its operations, and the Chinese manufacturer Tailg has recently started production. Some consumers complain of low-quality performance, which hampers uptake. There is great scope to supply major Nepali cities with mid-range, low-cost electric two-wheelers. Electric two-wheelers open the lower end of the market, facilitating overall shifts in market structure and demand.
Result	Motorcyclists wishing to buy electric have very limited options on the current market
Action	See Priority Action 3, and Initiative 11

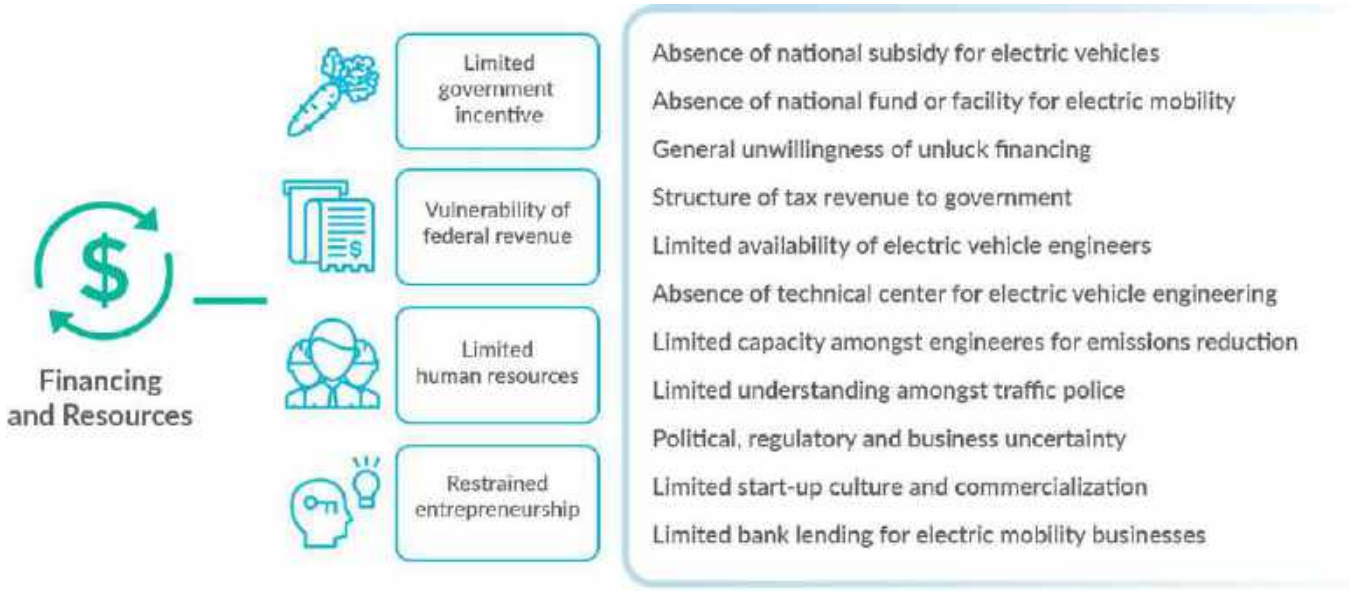
ISSUE	**RIGOROUSNESS OF TESTING FOR ELECTRIC TWO-WHEELERS**
Number	10.2
Category	Market
Summary	Current regulation for electric two-wheelers is strict. Electric two-wheelers are subject to performance standards that are difficult to meet. Such testing requirements can dampen demand and reduce consumer uptake. By easing the regulation and removing or lessening some performance requirements, consumer appetite is likely to increase.
Result	Motorcyclists wishing to buy electric have very limited options on the current market
Action	See Priority Action 1 and Priority Action 2

Chapter 9
Financing and Resource Barriers

9.1 Introduction

Financing and resource barriers and issues are presented in Figure 9.1 below.

Figure 9.1. Summary of prioritized barriers and issues



9.2 Financing and Resource Barriers

The following are the specific financing and resource barriers to greater adoption of electric vehicles in Nepal.

Barrier 11. Limited Government Incentive

There is currently no government-led financing for electric mobility. The government has minimized disincentives, through reform of the customs and value added tax regimes for electric vehicles. This is a positive development. However, government current does not provide any proactive incentive for switching to electric. Such an incentive, in the form of a subsidy, would be useful.

ISSUE	**ABSENCE OF NATIONAL SUBSIDY FOR ELECTRIC VEHICLES**
Number	11.1
Category	Financing
Summary	The provision of a focused subsidy to support switching to electric vehicles is an effective mechanism for boosting consumption of electric vehicles. Such as subsidy can apply to either or both private consumers and public transport operators seeking to procure electric vehicles into their fleets. Such a subsidy would typically reduce retail vehicle price or loan interest rate.
Result	Consumers and operators are expected to bear the entire costs of switching to electric; reduced consumption
Action	See Initiative 16.

ISSUE	**ABSENCE OF NATIONAL FUND OR FINANCING VEHICLE FOR ELECTRIC MOBILITY**
Number	11.2
Category	Financing
Summary	Beyond a focused government subsidy (Issue 11.1) to stimulate consumption and procurement of electric vehicles, the absence of any national financing vehicle or mechanism to provide government disbursement for other electric mobility initiatives more broadly is also an issue. Such a financing vehicle could support start-ups, entrepreneurs and other entities to improve electric mobility.
Result	Consumers and operators are expected to bear the entire costs of switching to electric; reduced consumption
Action	See Priority Action 3

ISSUE	**GENERAL UNWILLINGNESS TO UNLOCK FINANCING**
Number	11.3
Category	Financing
Summary	Funds are available within government that could be allocated to electric mobility. Such an action requires creative willingness to find and unlock financing and establish mechanisms of disbursement. In addition to government-held funds, international donors could be sought to provide targeting financing. Neither activities are being fully pursued, especially given the growing global interest in electric vehicles. Lastly, it should be noted that such financing could be disbursed through focused public-private partnerships.
Result	Consumers and operators are expected to bear the entire costs of switching to electric; reduced consumption
Action	See Priority Action 2, Priority Action 3 and Initiative 17.

Barrier 12. Vulnerability of Federal Revenue

Federal revenue is largely fiscal, and of that, the tax on petrol and diesel vehicles plays an important role. A wider switch towards electric vehicles, therefore, has revenue implications for the federal government which could be quite meaningful if such a switch were widespread.

ISSUE	**STRUCTURE OF TAX REVENUE TO GOVERNMENT**
Number	12.1
Category	Financing
Summary	Currently, customs tax on fossil fuel vehicles generates a significant share of total government tax revenue. As a result, the widespread adoption of electric vehicles would lead to a direct loss of government revenue, due to the extremely low customs tax on electric vehicles. While low customs tax for electric vehicles is a positive and demonstrates fiscal support for a switch towards electric mobility, the polarized

	nature of the fiscal structure may result, in fact, in reduced support from components of government for such a switch. Finding a better fiscal balance that delivered wins for both consumers and government might be more effective in the long-term.
Result	Structural vulnerability within the fiscal regime; disincentive for government to pursue electric mobility
Action	See Priority Action 2

Barrier 13. Insufficient Human Resources

There is limited availability of trained engineers and technicians for electric vehicles in Nepal. This constrains servicing, entrepreneurship and innovation. Programs in engineering colleges largely overlook electric vehicle technologies, reducing the capacity of next generation engineers.

ISSUE	**LIMITED AVAILABILITY OF ELECTRIC VEHICLE ENGINEERS**
Number	13.1
Category	Human resources
Summary	There are few engineers in Nepal skilled at servicing, designing or developing electric vehicles. This limits the scope of development and business investment within the sector. It also reduces appetite for potential investment – public transport operators, for example, are aware that acquisition of electric vehicles will necessitate additional training and skills development of their engineering staff, leading to higher costs.
Result	Insufficient expertise on the job market; inadequate technical support to electric vehicle operators and consumers
Action	See Priority Action 2 and Initiative 18.

ISSUE	**ABSENCE OF TECHNICAL CENTER FOR ELECTRIC VEHICLE ENGINEERING**
Number	13.2
Category	Human resources
Summary	Numerous well reputed engineering schools operate in Nepal, particularly Kathmandu. However, most general program curricula overlook electric vehicle engineering, and there are no specialized programs focused on electric vehicles. This reduces opportunities for engineers and technicians to develop their skillsets.
Result	Limited opportunities for engineers and students seeking to develop new skillsets; higher skills development costs for organizations and companies
Action	See Priority Action 2

ISSUE	**LIMITED CAPACITY AMONGST ENGINEERS FOR EMISSIONS REDUCTION**
Number	13.3
Category	Human resources
Summary	Practicing mechanics and technicians in workshops and garages tend to have limited capacity for emissions management through servicing. However, when diesel and petrol vehicles have been brought in for servicing can be a particularly effective opportunity to clean exhaust systems and ensure minimized pollution.
Result	Limited servicing for particulate matter emissions and air quality
Action	See Priority Action 2 and Initiative 18

ISSUE	**LIMITED UNDERSTANDING AMONGST TRAFFIC POLICE**
Number	13.4
Category	Human resources
Summary	Traffic police are tolerant of clearly polluting vehicles, having limited understanding of the issue and their responsibility to improve it. Such capacity can only be built following the passage of legislation enabling police to fine heavily or clearly polluting vehicles (see Issue 1.1). Currently, such legislation is absent; in effect, air pollution is legal.
Result	Polluting vehicles are not managed on the road
Action	See Priority Action 1 and Priority Action 2

Barrier 14. Insufficient Entrepreneurship

Entrepreneurship in the electric mobility sector is relatively quiet in Nepal. There is scope for greater investment, as opportunities are numerous. Entrepreneurs and investors currently hesitate to assemble and implement viable business projects.

ISSUE	**POLITICAL, REGULATORY AND BUSINESS UNCERTAINTY**
Number	14.1
Category	Investment
Summary	Changes at multiple levels of government, regulatory and policy fluidity and a lack of transparency in certain areas of the transport sector constitute risk for investors and entrepreneurs. Greater stability and transparency would help to create an enabling environment for investment.
Result	Higher degrees of perceived uncertainty and risk; limited entrepreneurship
Action	See Priority Action 1

ISSUE	**LIMITED START-UP CULTURE AND COMMERCIALIZATION**
Number	14.2
Category	Investment
Summary	Business, investment and innovation within the electric mobility sector is not encouraged by government. There is an absence of commercialization campaigns, schemes, and programs, and more generally the start-up culture in Nepal is under-developed. Nonetheless, numerous opportunities for business investment exist – in part due to higher and growing demand for mobility services.
Result	Limited entrepreneurship despite clear opportunities and high demand
Action	See Priority Action 1, Priority Action 2 and Priority Action 3

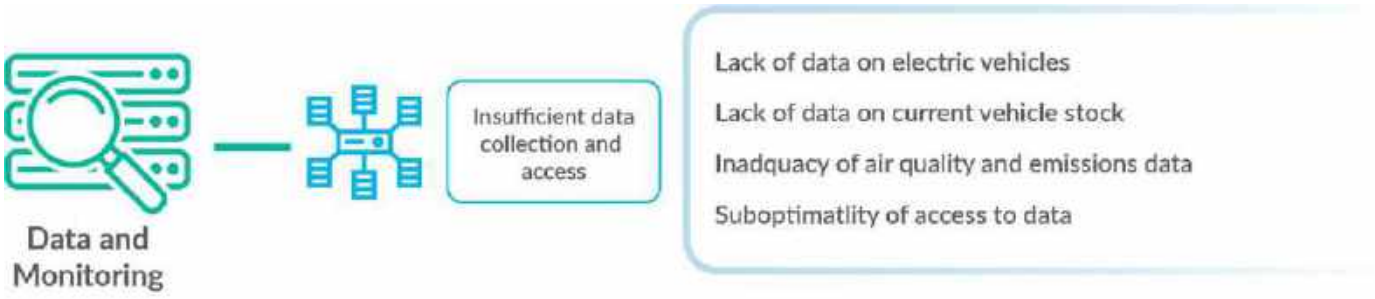
ISSUE	**LIMITED BANKING FOR ELECTRIC MOBILITY BUSINESSES**
Number	14.3
Category	Investment
Summary	Interest rates on business loans are high (typically around 10-15%), forcing entrepreneurs into unfavorable terms. There are no priority loans provided for business projects within the electric mobility sector. Due to the high upfront costs of most electric mobility initiatives, and longer pay-back periods, low interest loans are essential.
Result	Reduced entrepreneurial activity
Action	See Priority Action 2, and Initiative 17

Chapter 10
Data and Monitoring Barriers

10.1 Introduction

Data and monitoring barriers and issues are presented in Figure 10.1 below.

Figure 10.1. Summary of prioritized barriers and issues



10.2 Data and Monitoring Barriers

The following are the data and monitoring barriers to greater adoption of electric vehicles in Nepal.

Barrier 15. Insufficient Data Collection and Access

Data are essential for implementation of the NDC, and overall management of greenhouse gas emissions in Nepal. However, there is a lack of reliable and useful data. This significantly complicates monitoring and undermines the evidence base required for good policy and decision making. In its place, policy decisions can become largely political, or influenced by special interest and lobby groups. In addition, emissions and air quality data help to justify increased investment in electric mobility.

ISSUE	**LACK OF DATA ON ELECTRIC VEHICLES**
Number	15.1
Category	Data collection
Summary	Data is collected on the number and make of vehicles imported into Nepal. However, data is not collected on the number of these that are electric, nor the total number of electric vehicles operating on the roads. This complicates the accomplishing of quantitative targets for electric vehicle penetration set out in the NDC. In the absence of such data, private sector distributors may be approached, or estimates may be made. Such data collection needs to be improved.
Result	Uncertainty on the number of electric vehicles in Nepal; lack of evidence base
Action	See Priority Action 1, Priority Action 2, Initiative 19 and Initiative 20

ISSUE	**LACK OF DATA ON CURRENT VEHICLE STOCK**
Number	15.2
Category	Data collection
Summary	Similarly, current data collection practices do not include the number of vehicles scrapped. Most scrapping happens informally, without government notification, in part due to the high-costs of scrapping or demobilizing a vehicle. As such, it is impossible to know the current vehicle fleet. Instead, average vehicle termination and lifecycle rates must be used to estimate current fleets.
Result	Uncertainty on the number of electric vehicles in Nepal; lack of evidence base
Action	See Priority Action 1, 2 and Initiative 20

ISSUE	**INADEQUACY OF AIR QUALITY AND EMISSIONS DATA**
Number	15.3
Category	Data collection
Summary	Several sources monitor air quality, including national government, local government, research institutes, foreign embassies and a civilian network. This has led to a fragmentation of data, and issues of reliability, understanding and access. Practices of air quality monitoring are not standardized and there are no guidelines in place, or necessarily aligned with international practice, making comparison difficult. In addition, national greenhouse gas emissions inventories are not well maintained, and therefore unreliable, with most recent using data from 2001 (Second National Communication to the UNFCCC). This absence of data, for example, creates problems for policy-setting bodies who struggle to ascertain baseline.
Result	National emissions performance is unknown; lack of certainty around air quality in major cities; erosion of evidence.
Action	See Priority Action 1, 2 and Initiative 20

ISSUE	**SUBOPTIMALITY OF ACCESS TO DATA**
Number	15.4
Category	Data access
Summary	There are no standard mechanisms of access to data, such as online portals or public data sharing agreements. As such, there is a tendency amongst data collection bodies to become proprietary, especially when data can be monetized or when data demonstrates an inconvenient truth. Some publicly available civilian sources of data are not recognized by government. Within this context, access to data becomes difficult.
Result	Data sharing is undermined; evidence base for policy and decisions is eroded
Action	See Priority Action 1, 2 and Initiative 20

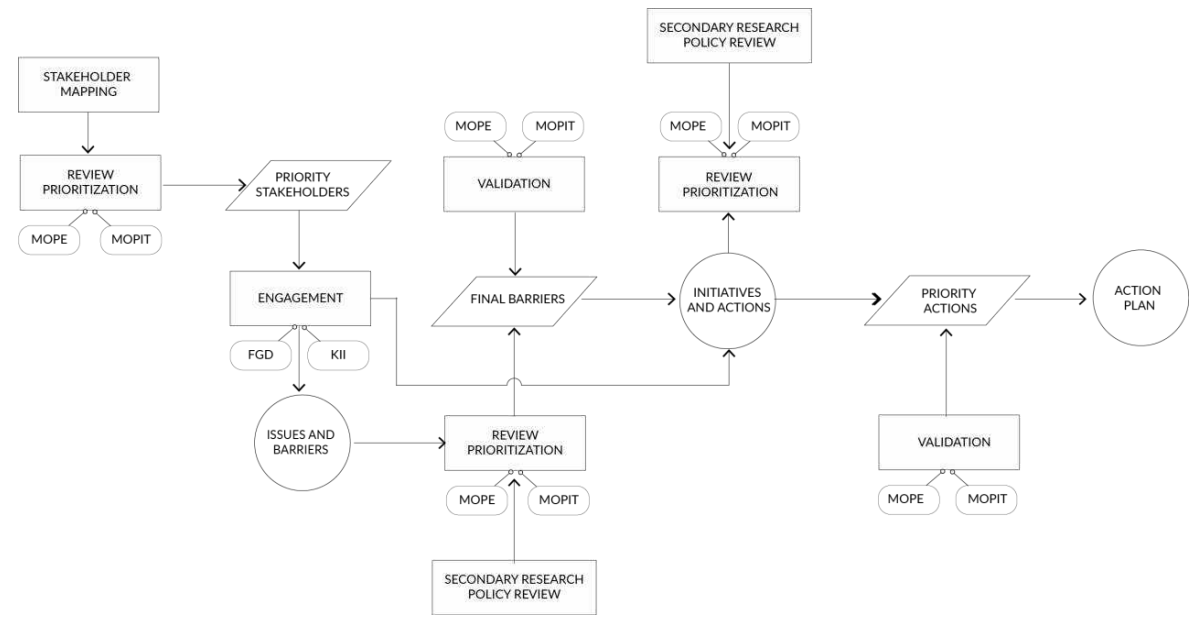
Part 4
Actions for Electric Mobility

Chapter 10
Goals and Objectives of Actions

10.1 Introduction

Building off Part 3, Part 4 of this report lays out the proposed actions and initiatives that need to be implemented in order to build and strengthen a wide, transformative switch to electric mobility in Nepal. These actions and initiatives were designed in direct response to the barriers and issues identified in Part 3, through sustained engagement and consultation with stakeholders (see Figure 10.1). Please refer to the Chapter 6 for a full list of stakeholders consulted.

Figure 10.1 Barrier and action formulation process



As a result of the wide scope and degree of stakeholder consultation, a huge number of activities were identified. However, in order to structure and manage these activities, a degree of prioritization and hierarch was introduced. This process resulted in two types of proposals:

- **Priority Actions** – Priority actions are high-level and involve the establishment of functional entities (i.e. an institution, a financing vehicle, an enterprise, a program etc). The four priority actions identified operate across both the supply- and demand-sides of the electric mobility markets. Each priority activity delivers solutions to multiple barriers, typically around 4-5 barriers, and many more issues, and delivers these solutions across categories (i.e. policy and governance, infrastructure and markets etc.). As such, priority actions are expected to receive the bulk of government and stakeholder effort, as they are designed to operate in a foundational and transformative way, stimulating a wide range of changes across the entire system for electric mobility.
- **Contributing Initiatives** – Initiative are activities of limited scope that typically respond to a single issue identified in Part 3. Priority actions, while proactive in themselves, are typically composed of several initiatives. Additional initiatives can of course be designed and integrated into the operations of priority actions in the future. Twenty initiatives were identified and prioritized in this report.

10.2 Goals and Objectives

While priority actions and initiatives were identified and designed to respond to the barriers and issues of Part 3, they are all structured around a broader goal of achieving the transport targets set out in the NDC (see Chapter 1 and Chapter 2 for full discussion). Box 10.1 summarizes these.

With this goal in mind, the several specific objectives of the priority actions and initiatives outlined in the subsequent chapters include:

- To systematically, proactively and cohesively address the barriers and issues restricting wider uptake of electric mobility
- To facilitate most effective utilization of financial, technical and human resources by identifying high priority activities into which resources can be channelized accordingly
- To lay out a logical and structured course of action or road map for a range of government, business, scientific and consumers stakeholders
- To facilitate cooperation across stakeholders

As such, the priority actions and initiatives which follow demonstrate a logic of 'problem-solution'. As noted, all barriers and issues identified in Part 3 have a corresponding priority action(s) or initiative(s) and visa-versa.

Box 10.1 The NDC and its transport related targets

Nepal's *Nationally Determined Contribution* includes 14 targets to support climate change mitigation and adaption in Nepal. Of these targets, four focus on climate change adaptation; three focus on energy sources and supply; two address the forestry sector; one addresses multi-sectoral mitigation; and four address the transportation sector.

The transportation sector NDC targets are:

- **NDC Target 9**: By 2020, Nepal aims to increase the share of electric vehicle up to 20% from 2010 level.
- **NDC Target 10**: By 2050, Nepal will decrease its dependency on fossils in the transport sector by 50% through effective mass public transport means while promoting energy efficient and electrical vehicles.
- **NDC Target 11**: Nepal will develop its electrical (hydro-powered) rail network by 2040 to support mass transportation of goods and public commuting.
- **NDC Target 14**: By 2025, Nepal will strive to decrease the rate of air pollution through proper monitoring of sources of air pollutants like wastes, old and unmaintained vehicles, and industries.

Source: Adapted from MOPE 2016.

10.3 Summary of Priority Actions and Initiatives

In this way, there are multiple levels of linkages across the barriers, issues, priority actions and initiatives outlined across Part 3 and Part 4 of this report. These linkages are summarized in Figure 10.2 below.

Table 10.1 Overview of Priority Actions and Initiatives in Relation to Barriers

	BARRIER	INITIATIVE	PRIORITY ACTION
POLICY AND GOVERNANCE	1. Limited operational action	1. Develop directive for electric mobility 2. Change legislation for police empowerment on polluting vehicles 3. Develop guidelines for vehicle conversion and/or hybridization	National program
	2. Insufficient management of vehicle operators	4. Reform route and permit management for electric public transport 5. Reconsider ban on additional electric three-wheelers	National program
	3. Limited governance of vehicle distributors	12. Incentivize new entrants on the electric mobility market	National program; National financing vehicle
	4. Restrained political support and coordination	[See Priority Action 2]	National unit
INFRASTRUCTURE AND MARKETS	5. Insufficient investment in facilities	7. Identify and co-fund charging infrastructure projects 8. Identify and co-fund battery recycling 19. Improve banking for electric mobility businesses	National program; National financing vehicle
	6. Limited investment in mass transportation	9. Advance electric rail initiatives 10. Advance electric urban mass transportation initiatives	National taskforce
	7. Electric vehicles priced as luxury goods	11. Support local electric vehicle assembly or manufacturing projects 12. Incentivize new entrants on the electric mobility market	National financing vehicle
	8. Uncertainty of electricity supply and cost	13. Promote the introduction of time-of-day metering at homes 14. Improve reliability of electricity supply, including voltage fluctuation	National program; National unit
	9. Under-development of markets	15. Develop informational campaign for electric mobility 16. Development government fleet of electric vehicles 19. Improve banking for electric mobility businesses	National program
	10. Under-development of electric two-wheeler market	6. Ease restrictions on electric two-wheelers 17. Foster supply of electric two-wheelers 19. Improve banking for electric mobility businesses	National program; National financing vehicle
FINANCING AND RESOURCES	11. Limited government incentive	18. Establish a national subsidy scheme	National financing vehicle
	12. Vulnerability of federal revenue	20. Undertake an economic analysis of long-term implications	National program
	13. Limited human resources	21. Establish centers of excellence 22. Develop training program for engineers	National program
	14. Restrained entrepreneurship	19. Improve banking for electric mobility businesses	National financing vehicle
DATA AND MONITORING	15. Insufficient data collection and access	23. Improve data collection on vehicle registration and sc4apping 24. Establish data collection and sharing protocol for air quality data	National program; National unit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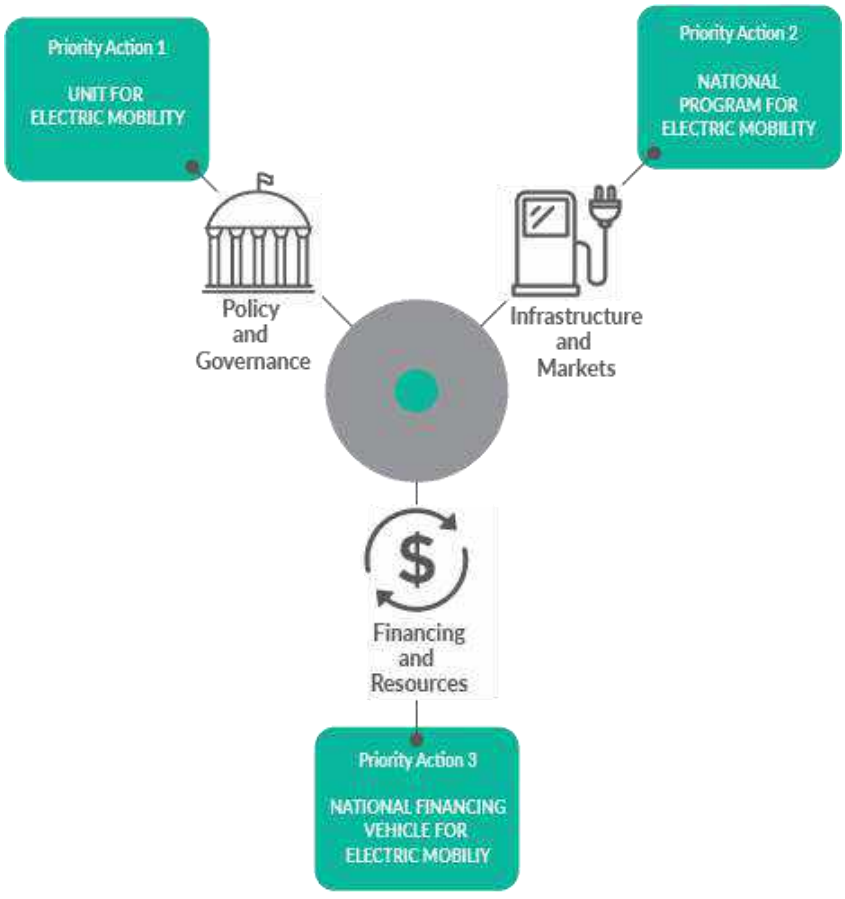
Chapter 11
Priority Actions for Electric Mobility

11.1 Introduction

Three priority actions are outlined below. These priority actions form a three-part framework designed to respond to and overcome barriers identified in Part 3. Priority actions are supported by contributing initiatives, outlined in the following chapter.

Figure 11.1. Overview of Priority Actions



11.2 Priority Action 1: National Unit

Action

Establish a national unit, center or taskforce for electric mobility

Rationale

Promotional and policy efforts to improve uptake of electric vehicles have tended to be split across a range of governmental and non-governmental organizations. A centralized government entity to act as the apex regulatory, oversight and promotional entity for electric vehicles and electric mobility is needed. Such an entity would be tasked with overseeing implementation of the proposed program (Priority Action 2), as well as a range of other initiatives related to electric mobility more broadly.

Goal and objectives

The overall goal of the national unit would be to coordinate national efforts for greater uptake of electric vehicles, and broader switching to electric mobility.

Within this goal, the unit would seek to achieve the following objectives:

- To promote a broad switch towards electric mobility across relevant transport systems;
- To lead the implementation of the proposed program, in collaboration with relevant government and non-governmental entities;
- To educate and raise the awareness of businesses, government and consumers on the advantages of electric vehicles;
- To facilitate discussions on the provision of all supply-side requirements of successful adoption of electric vehicles.

Summary

The proposed unit could be established, either as a unit within an existing government entity, or as a government entity that could be answerable to a board comprised of government, business and citizen representatives. The fundamental mandate of the unit would be the promotion of electric mobility across relevant transport systems in Nepal, in line with national policy, and oversight of electric mobility operations.

One of the principal activities of the unit would be to oversee the implementation of the proposed program. As part of this program, which consists of a package of measures, the unit would undertake to design and deliver a dedicated information campaign. The campaign would target business, government and consumers over a period of five years.

Initially, a core staff for the unit could be seconded from relevant government entities, relocated from inside MOPIT, or sourced internationally. Funding for unit would be expected though both national and international sources, including, at the national level, reprioritization of existing government funds, or re-utilization of an existing levy. At the international level, sources of climate financing could be tapped and experts.

Outcome

Greater awareness of the benefits and viability of electric vehicles; greater interest and demand for electric vehicles; cohesive and needed regulatory and legislative change; higher visibility advocacy and promotion of electric mobility across all areas of government; consolidation and coordination of government and private-sector efforts to boost electric mobility.

Barriers and Issues

This Priority Action responds to several key barriers identified in Part 3 of this Action Plan. These include

- Barrier 4, including Issues 4.1, 4.2, 4.3, and 4.4
- Barrier 2, including Issues 2.1 and 2.2
- Barrier 9, including Issues 9.1, 9.2 and 9.3
- Barrier 12, in particular Issue 12.1
- Barrier 13, including Issue 13.1, 13.2, 13.3 and 13.4
- Barrier 14, in particular Issue 14.2

11.2 Priority Action 2: National Program

Action: Establish and implement national program for electric mobility.

Rationale: While some incentives are in place to support adoption of electric vehicles in Nepal, a range of barriers are obstructing progress – many of which can be overcome through proactive government initiative. A comprehensive package of measures needs to be identified and implemented that successfully shift from policy to action and operationalize investment and activity for infrastructure and market development.

Goal and objectives: The overall goal of the national program should be to be promote and achieve greater uptake of electric vehicles across the domestic market, and design and undertake interventions for infrastructure and market development.

Within this overall goal, the proposed comprehensive umbrella program includes the following objectives:

- To raise public awareness of the benefits and advantages of going electric;
- To support consumer acquisition and operation of electric vehicles;
- To support government acquisition and operation of electric vehicles;
- To support investment in infrastructure, mainly public charging stations;
- To undertake legislative change required for greater electric vehicle adoption;
- To develop focused electric mobility implementation strategies and road maps at metropolitan level;
- To undertake markets assessments, preliminary and full feasibility studies and assessments for electric mobility initiatives;
- To develop guidelines, directives and other mechanisms to operationalize policy and targets.

Summary: The proposed program would comprise a suite of regulatory, institutional, financing and legislative measures designed to collectively provide focused support to boost electric vehicle adoption in Nepal. The government is aware of the numerous benefits, both shorter- and longer-term, of going electric and has put in place policy to enable widespread electric vehicle uptake. The package of measures that would be comprised within the national program include:

- Undertaking a promotional and awareness-raising campaign directed at businesses and households (see Initiative 15)
- Stimulating government procurement of electric vehicles into national and local government fleets (see Initiative 16)
- Investing in public charging infrastructure and supporting private investment (see Initiative 7)
- Establishing a financing vehicle that would co-fund a range of initiatives and investments to accelerate electric vehicle uptake (Priority Action 3)
- Undertaking changes to relevant legislation and regulatory frameworks to facilitate adoption of electric vehicles (see Initiatives 1, 2, 3)

Funding for this package of measures is expected to be secured though both national and international sources, including, at the national level, reprioritization of existing government funds, or re-utilization of an existing levy. At the international level, sources of climate financing could be tapped.

Outcome: Greater operational level action for electric mobility; greater demand for electric vehicles as a result of consistent efforts across all areas of infrastructure and markets; consolidation and coordination of government and private-sector efforts to boost electric mobility.

Barriers and Issues: This Priority Action responds to several key barriers identified in Part 3 of this Action Plan. These include

- Barrier 1, including Issues 1.1, 1.2, 1.3, 1.4 and 1.5
- Barrier 2, including issues 2.1 and 2.2
- Barrier 9, including Issues 9.1, 9.2 and 9.3
- Barrier 10, primarily Issue 10.2

It also facilitates action in response to Barrier 4, particularly Issue 4.1.

11.4 Priority Action 3: National Financing Vehicle

Action	Establish and operate a national financing vehicle to co-fund (with private sector) electric mobility projects
Rationale	Some barriers identified require joint government-industry investment in order to be overcome. For example, consumers may not take up electric vehicles until widespread charging stations are in place. And charging station operators may not invest until a critical mass of electric vehicles are on the roads. As such, there is a degree of fragmentation and a mismatch between supply and demand which needs to be overcome. To do this, the financing vehicle would co-fund projects that accelerate uptake of electric vehicles and also potentially provide a subsidy scheme. Such projects may not be economically justifiable without funding support. It is in order to spur action and boost private sector investment that the financing vehicle would be established.
Goal and objectives	The overall goal of the financing vehicle is to maximize government and industry efforts and stimulate innovation by co-funding industry and business projects for electric vehicles and providing consumer subsidy. In addition, the following specific objectives would guide the financing vehicle's operation: • To provide co-funding on infrastructure projects critical to widespread electric vehicle adoption, especially projects that might not otherwise get funding; • To provide financing and/or co-funding of price difference (viability gap) to business and government entities seeking to adopt electric vehicles into their fleets; • To potentially develop a subsidy to support consumer acquisition of electric vehicles; • To promote a culture of innovation and entrepreneurship within the electric mobility space, co-funding selected operations accordingly; • To occasionally distribute additional high-need financing, through various mechanisms (grants or loans).
Summary	The proposed financing vehicle would boost business and industry activity and investment in electric mobility and electric vehicles. Part of the role of the financing vehicle is to signal strong and consistent commitment from government to the market, reassuring entrepreneurs and investors. Through its funding decisions the financing vehicle would also help to put in place the necessary facilities and infrastructure for widespread electric vehicle adoption. The financing vehicle could be administered or overseen by the unit. Funding would be provided by both national and international sources. Nationally, funds accrued as a result of the pollution tax could be reprioritized into the electric mobility financing vehicle. These funds could be complemented via international grants. The financing vehicle's primary funding mechanism would take the form of co-funding to industry, business and householders. Examples of appropriate projects for such co-funding include: • Initiatives to support procurement, such as helping fleet buyers and consumers meet the viability gap (difference in purchase price between electric and equivalent conventional vehicles) • Creation and promotion of branded tourism routes using electric vehicles, for example tourist electric buses • Demonstration (pilot) projects of vehicle types, such as electric

	buses and electric vans, which are not yet operational in Nepal • Creation and development of electric taxi fleets, in particular, and support for hybridization or conversion of existing conventional vehicle taxi fleets • Initiatives aimed at commercializing useful facilities, such as charging facilities and battery swap and leasing schemes, to consumers and business users	**Barriers and Issues**	This Priority Action 3 responds to several key barriers identified in Part 3 of this Action Plan. These include • Barrier 2, including issues 2.1 and 2.2 • Barrier 5, including Issues 5.1 • Barrier 11, including Issues 11.1, 11.2 and 11.3 • Barrier 14, in particular Issue 14.2 and 14.3
Outcome	Increased entrepreneurship for electric mobility; increased investment and development of critical electric vehicle infrastructure.		

Chapter 12
Contributing Initiatives for Electric Mobility

12.1 Introduction

As noted in the introduction, each initiative is designed to achieve a specific change and responds to a specific issue. As for Part 3, change is structured into four categories, namely 1) Policy and Governance; 2) Infrastructure and Markets; 3) Financing and Resources; and 4) Data and Monitoring. As indicated in Figure 12.1, below, each initiative identified contributes to one or more Priority Actions.

12.2 Initiatives for Policy and Governance

Initiatives required to address key policy and governance barriers are outlined below. For more information on the respective policy and governance barriers, see Chapter 7.

INITIATIVE	**DEVELOP DIRECTIVES FOR ELECTRIC MOBILITY**
Number	1
Category	Regulation
Barrier	This initiative responds to Barrier 1, Issue 1.1
Summary	To support operationalization of national policy for electric mobility, including targets set under the NDC, directives need to be drafted and released with clear instructions, roles, responsibilities and principles for action.
Result	Greater operational clarity on who does what for electric mobility; greater operational action
Priority Action	This initiative would be part of the program (Priority Action 1)

INITIATIVE	**CHANGE LEGISLATION FOR POLICE EMPOWERMENT ON POLLUTING VEHICLES**
Number	2
Category	Legislation
Barrier	This initiative responds to Barrier 1, Issue 1.1
Summary	Currently, police cannot pull over or fine vehicles which are clearly polluting. Simple changes to legislation would enable police to do so, thereby arming frontline government officers with a mechanism to reduce air pollution in Nepali cities.
Result	Reduction in polluting vehicles on the road
Priority Action	This initiative would be part of the program (Priority Action 1)

INITIATIVE	**DEVELOP GUIDELINES FOR VEHICLE CONVERSION AND/OR HYBRIDIZATION**
Number	3
Category	Regulation
Barrier	This initiative responds to Barrier 1, Issue 1.5
Summary	Simple guidelines that set out correct and safe methods and performance standards for the conversion of hybridization of convention vehicles. These guidelines should result in legislative changes making

	converted and hybridized vehicles legal, given that they comply with guidelines specified.
Result	Conventional vehicles can legally, safely and correctly be converted to battery electric or hybrid
Priority Action	This initiative would be part of the program (Priority Action 1)

INITIATIVE	**REFORM ROUTE AND PERMIT MANAGEMENT FOR ELECTRIC PUBLIC TRANSPORT**
Number	4
Category	Governance
Barrier	This initiative responds to Barrier 2, Issue 2.1
Summary	Obtaining of routes and permits are critical for successful electric public transport operators. Improving management of routes and permits, especially for electric vehicle transport operators, would support greater investment from businesses. Electric public transport operators should receive special treatment, for example, exemption of permit costs; and targets for gradual replacement of conventional public transport vehicles with electric should be agreed with operators.
Result	Improved certainty and transparency of route and permit management; greater interest from vehicles and fleet operators and associated businesses
Priority Action	This initiative would be comprised within package of measures for the program (Priority Action 1); the national unit (Priority Action 2) would lead this regulatory change.

INITIATIVE	**RECONSIDER BAN ON ADDITIONAL ELECTRIC THREE-WHEELERS**
Number	5
Category	Regulation
Barrier	This initiative responds to Barrier 2, Issue 2.2
Summary	The current ban in place prohibiting the registration of additional three-wheelers needs to be repealed to allow for new electric three-wheelers to register.
Result	Greater investment in electric three-wheelers
Priority Action	This initiative would be part of the program (Priority Action 1)

INITIATIVE	**EASE TESTING AND RESTRICTIONS ON ELECTRIC TWO-WHEELERS**
Number	6
Category	Regulation
Barrier	This initiative responds to Barrier 10, Issue 10.2
Summary	Currently, testing and regulation of electric two-wheelers is particularly strict, reducing the viability of this type of vehicle for many consumers.
Result	Greater demand for electric two-wheelers
Priority Action	This initiative would be part of the program (Priority Action 1)

12.3 Initiatives for Infrastructure and Markets

Initiatives required to address key infrastructure and markets barriers are outlined below. For more information on the respective infrastructure and markets barriers, see Chapter 8.

INITIATIVE	**IDENTIFY AND CO-FUND CHARGING INFRASTRUCTURE PROJECTS**
Number	7
Category	Infrastructure
Barrier	This initiative responds to Barrier 5, Issue 5.1
Summary	The availability of a greater number of charging facilities is critical for widespread uptake of electric vehicles. Government needs to co-fund business investment, to help secure project viability.
Result	Increased availability of charging facilities
Priority Action	Such co-funding can be disbursed via the national financing vehicle for electric mobility (Priority Action 3).

INITIATIVE	**IDENTIFY AND CO-FUND BATTERY RECYLCING**
Number	8
Category	Infrastructure

Barrier	This initiative responds to Barrier 5, Issue 5.3
Summary	A facility to manage waste batteries needs to be established. In addition to environmental benefits, recycled batteries can be utilized in local manufacturing and in domestic back-up energy supply systems.
Result	Improved environmental management of battery waste; improved repurposing of battery products
Priority Action	Such co-funding can be disbursed via the national financing vehicle for electric mobility (Priority Action 3)

INITIATIVE	**ADVANCE ELECTRIC RAIL INITIATIVES**
Number	9
Category	Infrastructure
Barrier	This initiative responds to Barrier 6, Issue 6.1
Summary	Nascent rail systems in Nepal can be electrified before diesel-based rail systems become too widespread. It is cheaper to act now, than to retrofit later. Such infrastructure requires robust investment from national government and strong political support.
Result	Increased investment in electric rail
Priority Action	Such an initiative would require the dedicated promotion and efforts of the national taskforce for electric mobility, as well as a range of other stakeholders.

INITIATIVE	**ADVANCE ELECTRIC BUS MASS TRANSPORT (TROLLEY BUS) INITIATIVE**
Number	10
Category	Infrastructure
Barrier	This initiative responds to Barrier 6, Issue 6.2
Summary	Urban bus mass transport systems in Nepal need to be electrified and developed further in most metropolitan cities. These may include rapid bus transit and electric trolley bus systems. In particular, in Kathmandu, an electric trolley bus initiative should be considered. Such infrastructure requires robust investment from national government and strong political support. Demonstration initiatives designed to highlight the viability of electric buses for mass transport should be pursued and co-funded through the national financing vehicle for electric mobility, as well as international sources.
Result	Increased investment in electric bus mass transport
Priority Action	Such an initiative would require the dedicated promotion and efforts of the national unit for electric mobility, as well as a range of other stakeholders. Co-funding could be supplied via the national financing vehicle for electric mobility.

INITIATIVE	**SUPPORT LOCAL ELECTRIC VEHICLE ASSEMBLY OR MANUFACTURING PROJECTS**
Number	11
Category	Infrastructure
Barrier	This initiative responds to Barrier 7, Issue 7.2
Summary	Small electric vehicles can be assembled and/or manufactured in Nepal. This would support the supply of low priced electric vehicles on the domestic market, something currently needed. Such an assembly or manufacturing project could be launched by local entrepreneurs with experience in the manufacture of electric three-wheelers. Co-funding and/or improved bank financing would support start-ups to accommodate initial capital expenditure required for production.
Result	Improved commercial viability of local manufacturing of electric vehicles; improved supply of low-cost electric vehicles on the market
Priority Action	Such an initiative would require the dedicated promotion and efforts of the national taskforce for electric mobility, as well as a range of other stakeholders. Co-funding could be supplied via the national financing vehicle for electric mobility.

INITIATIVE	**INCENTIVIZE NEW ENTRANTS IN THE ELECTRIC MOBILITY MARKET**
Number	12
Category	Markets
Barrier	This initiative responds to Barrier 7
Summary	In order to stimulate the electric mobility market, incentives and support should be

	provided to new entrants, including local and international start-ups, suppliers, manufacturers and/or distributors, for increased activity in the market, and increased product offerings to consumers. Incentives may include tax breaks for new entrants and other regulatory incentives.
Result	Increased activity in the market; increased product availability
Priority Action	This initiative could be promoted by the national taskforce for electric mobility (Priority Action 2); the initiative can also be comprised within the package of measures of program (Priority Action 1).

INITIATIVE	**PROMOTE THE INTRODUCTION OF TIME-OF-DAY METERING AT HOMES**
Number	13
Category	Market
Barrier	This initiative responds to Barrier 8, Issue 8.2
Summary	Currently, electricity meters at homes do not measure time of usage. This results in a disincentive for consumers to optimize off-peak tariffs. By introducing time-of-day metering at homes, owners of electric vehicles can make the most of reduced nigh-time electricity tariffs to charge their vehicles.
Result	Lower operating costs for consumers of electric vehicles; better electric supply management
Priority Action	Comprised within package of measures for the program (Priority Action 1); the national taskforce (Priority Action 2) would lead this initiative in partnership with relevant power authorities.

INITIATIVE	**IMPROVE RELIABILITY OF ELECTRICITY SUPPLY, INCLUDING VOLTAGE FLUCTUATION**
Number	14
Category	Market
Barrier	This initiative responds to Barrier 8, Issues 8.1 and 8.3
Summary	Electricity supply disruptions and fluctuations in voltage are disincentives for prospective electric vehicle consumers. Improving both would stimulate demand. Such improvements are political, technical and managerial and can be promoted by special interest groups for electric mobility.
Result	Greater efforts to improve electricity supply and quality.
Priority Action	The national taskforce (Priority Action 2) would lead this promotional and advocacy campaign on behalf of the electric vehicle industry

INITIATIVE	**DEVELOP INFORMATIONAL CAMPAIGN FOR ELECTRIC MOBILITY**
Number	15
Category	Market
Barrier	This initiative responds to Barrier 9, Issue 9.1
Summary	Many consumers, businesses and government bodies lack awareness of electric vehicles, especially the benefits. An information and awareness-raising campaign is needed to address this. In particular, certain misconceptions around charging time, travel distance, and operational cost need to be addressed.
Result	Improved demand for electric vehicles.
Priority Action	This campaign should be launched and run by the national taskforce for electric mobility (Priority Action 2) for a period of five years.

INITIATIVE	**DEVELOP GOVERNMENT FLEET OF ELECTRIC VEHICLES**
Number	16
Category	Market
Barrier	This initiative responds to Barrier 1, Issue 4
Summary	Improving market demand for electric vehicles can be undertaken through leadership from businesses and governments, through the procurement choices these entities make for their vehicles fleets. Financial support could also be provided to offset price differences against conventional vehicles.
Result	Improved demand for electric vehicles.
Priority Action	Changes to procurement procedures should be promoted by the national taskforce for electric mobility (Priority

	Action 2), and co-funding provided via the national financing vehicle for electric mobility (Priority Action 3).

INITIATIVE	**FOSTER SUPPLY OF ELECTRIC TWO-WHEELERS**
Number	17
Category	Markets
Barrier	This initiative responds to Barrier 10
Summary	To support greater availability of electric two-wheelers, new entrants need to be incentivized (see Initiative 12 above). In particular, given the importance of two-wheelers for local intra-city transportation, electric alternatives need to be more plentiful. Local manufacturers, and importers/distributers, need to receive prioritized treatment.
Result	Increased availability of electric two-wheelers
Priority Action	This initiative can be comprised within the package of measures of national program for electric mobility (Priority Action 1).

12.4 Initiatives for Financing and Resources

Beyond the establishment of a national financing vehicle for electric mobility (Priority Action 3), a range of additional initiatives to address key financing and resources barriers are outlined below. For more information on the respective financing and resources barriers, see Chapter 9.

INITIATIVE	**ESTABLISH A NATIONAL SUBSIDY SCHEME**
Number	18
Category	Financing
Barrier	This initiative responds to Barrier 11, Issue 11.1
Summary	A national subsidy scheme is needed to directly support consumers and businesses seeking to purchase electric vehicles. Such a scheme, which could be administered by the national financing vehicle for electric mobility, would directly support acquisition of vehicles either through the proposed co-funding mechanism of the financing vehicle, or as a separate grant mechanism. Either way, it would be designed to offset the higher acquisition cost of electric vehicles and improve demand.
Result	Greater consumption of electric vehicles
Priority Action	The subsidy could be managed via the proposed national financing vehicle for electric mobility (Priority Action 3).

INITIATIVE	**IMPROVE BANKING FOR ELECTRIC MOBILITY BUSINESES**
Number	19
Category	Financing
Barrier	This initiative responds to Barrier 14, Issue 14.3
Summary	Commercial banking in Nepal does not prioritize electric mobility projects. However, the Reserve Bank can set new regulation allowing electric mobility business projects to access financing, be classified as a priority sector, and receive preferential rates to help stimulate private sector investment in the sector.
Result	Entrepreneurs more easily obtain financing for electric mobility projects
Priority Action	This initiative could be promoted by the national taskforce for electric mobility (Priority Action 2); the initiative can also be comprised within the package of measures of national program for electric mobility (Priority Action 1).

INITIATIVE	**UNDERTAKE AN ECONOMIC ANALYSIS**
Number	20
Category	Financing
Barrier	This initiative responds to Barrier 12
Summary	In order to more fully understand the long-term economic implications of a widespread switch to electric mobility, an economic analysis needs to be undertaken which would explore economic benefits as well as financial costs.
Result	Greater clarity on long-term economic costs and benefits of a switch to electric mobility
Priority Action	This initiative can also be comprised within the package of measures of national program for electric mobility (Priority Action 1).

INITIATIVE	**ESTABLISH CENTERS OF EXCELLENCE**
Number	21
Category	Human resources
Barrier	This initiative responds to Barrier 13
Summary	Electric mobility training units should be established within existing centers of excellence for engineering and associated disciplines. These units would provide training to interested engineering students, as well as upskilling engineers and other technicians already in the labor market.
Result	Dedicated training units for electric mobility are operational
Priority Action	This initiative can also be comprised within the package of measures of national program (Priority Action 1).

INITIATIVE	**DEVELOP TRAINING PROGRAM FOR ENGINEERS**
Number	22
Category	Human resources
Barrier	This initiative responds to Barrier 13, Issue 13.1, 13.2 and 13.3
Summary	Within the national taskforce for electric mobility, a series of courses would provide intensive short workshops on conversion, hybridization, servicing and maintenance, battery management, and other core components of electric vehicle engineering.
Result	Improved human resources for electric vehicles
Priority Action	Such an initiative would be a component of the proposed national program (Priority Action 1)

12.5 Initiatives for Data and Monitoring

Initiatives required to address key data and monitoring barriers are outlined below. For more information on the respective data and monitoring barriers, see Chapter 10.

INITIATIVE	**IMPROVE DATA COLLECTION ON VEHICLE REGISTRATION AND SCRAPPING**
Number	23
Category	Data
Barrier	This initiative responds to Barrier 15, Issue 15.1 and 15.2
Summary	Data on total electric vehicle stock does not exist. While vehicle import data is kept, there is no categorization for electric vehicles. Similarly, the scrapping of vehicles is not recorded so that current fleet numbers can only be estimated. Relevant agencies need to introduce additional data collection and management points.
Result	Improved understanding on current fleets, including electric vehicle fleet
Priority Action	Comprised within package of measures for the national program (Priority Action 1); the national taskforce (Priority Action 2) would lead this change

INITIATIVE	**ESTABLISH DATA COLLECTION AND SHARING PROTOCOL FOR AIR QUALITY DATA**
Number	24
Category	Data
Barrier	This initiative responds to Barrier 15, Issue 15.3 and 15.4
Summary	A national protocol for collection of air quality data needs to be established to support relevant bodies engaged in data collection and ensure compliance and compatibility of data across sources. Similarly, such data, under the proposed protocol, needs to be made publicly available at no cost.
Result	Improved understanding of air quality
Priority Action	Comprised within package of measures for the national program (Priority Action 1); the national taskforce (Priority Action 2) would lead this change

Conclusion

By identifying barriers and issues restricting the adoption of electric mobility in Nepal, this *National Action Plan* was able to present, in turn, a comprehensive set of actions and initiatives designed to boost uptake. These actions and initiatives were identified following intensive multilateral stakeholder consultations across government, business, scientific organizations and consumers. They are designed to support implementation and achievement of the transport targets outlined in Nepal's *Nationally Determined Contribution*.

Above all, the *National Action Plan* advocates for the viability of change. The Government of Nepal has already concluded much important policy and regulatory work to encourage electric mobility. This constitutes the first half of the work required. What remains is the operationalization of these efforts through three priority actions, and a suite of contributing initiatives.

The Ministry of Forests and Environment, the Ministry of Physical Infrastructure and Transport, with their partner the Global Green Growth Institute, firmly believe that the completion of these remaining actions and initiatives is within reach. Key enabling conditions are already in place to facilitate such efforts. Moving forward, both ministries and the GGGI stand ready to support the wider government and the development community to achieve this work for electric mobility in Nepal.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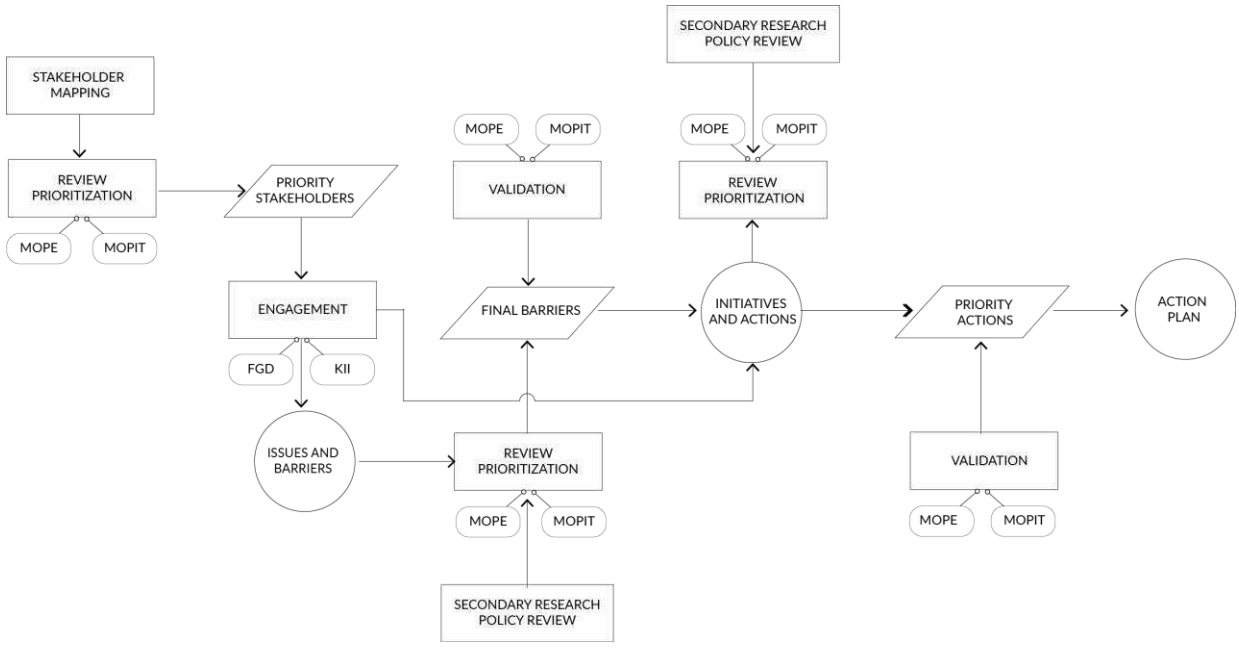
Annex 1 – Consultation Method

Overall process

The overall framework for the preparation of this Action Plan was set by a combination of GGGI knowledge and experience developing NDC implementation tools; globally emerging best practices advocated by Ricardo Energy and Environment and CDKN (Climate and Development Knowledge Network); and the United Nations Development Program (UNDP). The GGGI team gratefully acknowledges the work of both these agencies in this field and recognizes the precedent and best practices they have established. In particular, the work and methods of Ricardo Energy and Environment were built up in the methodological development of this Action Plan, under consultation with experts within the government and development community in Nepal.

Overall, a highly participatory approach was taken, blending qualitative and quantitative data, and using data gathering methods including key informant interviews with over twenty priority stakeholders, focus group discussions with transport operators and investors, and a small survey with current and prospective electric vehicle consumers.

Figure A1. Stakeholder engagement process



Source: GGGI

The preparation of this Action Plan followed the process outlined below, and presented in Figure 1:

- **Review of NDC Technical Literature –** A range of NDC technical documents and literature were reviewed, including UNFCCC, CDKN and UNDP documentation, and national action plans and strategies for NDC implementation globally.
- **Consultation Round 1:**
    - **Key Information Interviews –** Priority stakeholders were identified, and first round consultations were implemented using key informant interviews
    - **Focus Group Discussion -** focus group discussion methods to constitute a gap analysis.
    - **Consumer Interviews –** Current and prospective consumers of both electric car and electric motorbike were interviewed using a structured questionnaire.
- **Scenario Discussion –** Scenarios from a range of sources was discussed and analyzed.
- **Consultation Round 2**
    - **Stakeholder Workshop –** A second round of stakeholder consultations presented draft actions for NDC transport provision implementation to stakeholders for discussion and feedback. Actions were then revised based on stakeholder inputs, and prioritization.
- **Preparation of Draft Action Plan –** The draft Action Plan was prepared, and reviewed by both technical, private sector and government stakeholders.
- **Validation of Final Action Plan –** The finalized action plan was validated by lead government partners, including MOFE and MOPIT, through focused consultations.

Stakeholders and consultations

A comprehensive stakeholder mapping exercise was undertaken internally, with guidance and feedback from MOFE and MOPIT. In this way, MOFE and MOPIT, with GGGI, constituted an effective program management unit for the development of this work, under the formal oversight of a technical working group comprised of MOPIT, MOFE, Ministry of Finance, Ministry of Energy and GGGI.

In addition to their roles on the technical working group, both MOFE and MOPIT were active stakeholders during consultations, as reflected in Table 2 below. As a result of stakeholder mapping, priority stakeholders were identified for consultation and engagement, as outlined in Tables 1 and 2, below. Engagement and consultation then took place over the course of June – September 2017.

Table A1. Total stakeholders consulted by type

Type of stakeholder	Number consulted
Government bodies	8
Development partner organizations	2
Scientific and monitoring organizations	4
Consumers (individuals)	8
Private sector businesses and business groups	11
Total	**33**

Table A2. List of stakeholders and engagement modality

Stakeholder Name	Consultation 1		Consultation 2
	KII	FDG	
GOVERNMENT BODIES			
Kathmandu Metropolitan City	X		
Lalitpur Metropolitan City	X		
Ministry of Physical Infrastructure and Transport	X	X	X
Ministry of Environment	X	X	X
Department of Transport Management	X		X
Department of Customs	X		X
Nepal Electricity Authority	X		X
Department of Electricity Development	X		X
DEVELOPMENT PARTNERS			
KOICA	X		X
Asian Development Bank (ADB) Nepal	X		X
SCIENTIFIC AND MONITORING ORGANIZATIONS			
Environment Unit, KMC	X		
Environment Unit, LMC	X		
Department of Environment, MOFE	X		
ICIMOD	X		
CONSUMERS			
Individuals consulted	X		
BUSINESSES AND BUSINESS GROUPS			
Sajha Yatayat	X		X
Electric Vehicle Association of Nepal	X	X	X
National Fed. Eco-Friendly Transport Entrepreneurs		X	X
Clean Locomotive Entrepreneurs Association		X	X
Nepal Electric Vehicle Charging Station (Association)		X	X
Tata	X		
KPIT (India)	X		
Ashok Leyland (India)	X		
BYD (Nepal Representative)	X		X
Mahindra (Nepal Representative)	X		X
Kia Motors (Nepal Representative)	X		X

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