Global Green Growth Institute

Green Growth Potential Assessment Nepal Country Report

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List of Abbreviations

AEPC	Alternative Energy Promotion Centre
APP	Agriculture perspective plan
CFUG	Community Forest User Group
COP	Conference of the Parties
CPF	Country Planning Framework
CRG	Climate Resilient Growth
CSA	Climate Smart Agriculture
EFG	Eco-Friendly Growth
EFLG	Environment-Friendly Local Governance
EPI	Environmental Performance Index
GGGI	Global Green Growth Institute
GGPA	Green Growth Potential Assessment
GoN	Government of Nepal
INDC	Intended Nationally Determined Contribution
IWRM	Integrated Water Resource Management
LAPA	Local Adaptation Plan of Action
LDC	Least Developed Country
LIC	Low-Income Country
LMIC	Lower Middle-Income Country
MFSC	Ministry of Forest and Soil Conservation
MoAD	Ministry of Agricultural Development
MoE	Ministry of Energy
MoFALD	Ministry of Federal Affairs and Local Development
MoIR	Ministry of Irrigation
MoL	Ministry of Livestock
MoLRM	Ministry of Land Reform and Management
MoPE	Ministry of Population and Environment
MoST	Ministry of Science and Technology
NAPA	National Adaptation Plan of Action
ND-GAIN	Notre Dame Global Adaptation Index
NEA	Nepal Electricity Authority
NWP	National Water Plan
PES	payment for ecosystem services
REDD+	Reducing Emissions from Deforestation and Forest Degradation
REG	resource efficient growth
SAARC	South Asian Association for Regional Cooperation
SDG	Sustainable Development Goal
SIG	socially inclusive growth
VDC	Village Development Committee
WECS	Water and Energy Commission Secretariat
WRS	Water resource strategy

Foreword

Nepal's development process is frequently stalled by its challenging terrain, political instability, and natural disasters. The catastrophic earthquake in 2015, followed by a series of landslides, added to the development challenges of the country. Our country is largely dependent on its neighbors for resources. In an effort to realign its development after such major setbacks, many steps have been taken to drive the country forward. Nepal is gaining momentum in achieving its target of graduating from Least Developed Country status by 2022 and attaining Middle-Income Country status by 2030.

The Government of Nepal (GoN) is determined to achieve the Sustainable Development Goals (SDGs) and the country's Nationally Determined Contribution (NDC). We are also in the process of developing plans and committing the resources necessary to cope with rapid urbanization. In this respect, increasing the productivity of resources in urban areas is essential for sustainable economic growth.

Beyond these commitments, it is of utmost importance for our government to identify and prioritize areas where green growth interventions are needed most. For this purpose, with GGGI's support the GoN carried out the Green Growth Potential Assessment (GGPA) during 2016 and 2017. As part of this assessment, extensive consultations were held with relevant stakeholders, including the Government of Nepal. For us, it was important to have an active role in the assessment to give direction to the analysis and to determine priority recommendations from within the country.

This report highlights four sectors where green growth can contribute most to support the development of Nepal, i.e., in forestry and land use, agriculture, energy, and water. Within each of these sectors, this report focusses on areas that were identified by national stakeholders as the most urgent issues, including energy, agriculture, technological readiness, and adaptive capacity to the impacts of climate change. The recommendations point out opportunities within each sector to address those issues and contribute to the country's path towards sustainable development.

The Government of Nepal is dedicated to efficiently allocate and use its resources to develop our country's economy while at the same time making it more sustainable. In order to achieve this aim, planning and implementing green growth practices is crucial. I wish to thank GGGI for supporting us on this promising journey. Furthermore, I am optimistic that our common work will enhance the capacity of the GoN for building a country prepared to fulfill the needs of its future generations.

Dr. Bishwa Nath Oli
Secretary, Ministry of Population and Environment
Government of Nepal

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Jan Stelter, Senior Analyst, GGGI Office of Thought Leadership, was the project leader and had overall responsibility for the design and the development of the assessment. Feelgeun Song, Modeling Officer, GGGI Office of Thought Leadership, was responsible for data compilation and visualization. For this project GGGI worked with a team of consultants led by Centro de Allianzias para el Desarrollo (Ms. Ashanapuri Hertz and Mr. Steffen Schwoerer), collaborating with WE&B (Beatriz Martinez) and MinErgy (Mr. Suyesh Prajapati). The report benefited from the input of Prasoon Agarwal, GGGI Country Representative for Nepal. GGGI staff Brendan Coleman, Peter Voss, Orestes Anastasia, Kamal Banskota, Vikram Basyal, Anantaa Pandey, Rowan Fraser, Shomi Kim, and Marshall Brown also contributed to this report. Darren Karjama and Daniel Munoz-Smith of the GGGI Communications Unit provided production assistance. Editing support from Sujeung Hong is also gratefully acknowledged.

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Executive Summary

Nepal is a landlocked country, located in highly rugged and mountainous terrain facing complex development challenges. Political instability in a period of transition combined with recurring natural disasters, including those related to climate variability and change, form a key barrier to social and economic development in Nepal. Despite these challenges, Nepal envisages becoming a lower middle-income country (LMIC), graduating from its status as Least Developed Country (LDC) by 2022, and to be an active player in the international community on climate change. Domestically, Nepal plans to adopt a Strategy of Low Carbon Economic Development and is actively pursuing climate change adaptation. To be able to fully realize its potential, this requires a strong and meaningful paradigm shift from an economy degrading the country´s natural assets to an economy embracing the principles of sustainability, competitiveness, and social inclusion. Green growth offers a development model to realize this paradigm shift.

To support the Government of Nepal (GoN) in building a solid analytical foundation for defining areas relevant to green growth, this report presents the results of conducting the Green Growth Potential Assessment (GGPA). (See Box 1 below on *Green Growth Potential Assessment of Nepal*.) It provides guidance for policymakers on the appropriate interventions in the context of Nepal´s broader development landscape.

So, what are Nepal's priorities and possible agenda through the green growth lens?

Nepal is a least developed country with a weak industrial base. This explains the country's good performance in areas such as energy intensity or waste generation. However, while limited resources are used in absolute terms, their use is inefficient. The country's low water and labor productivity, the lack of formal waste recycling, and high electricity losses illustrate this assessment. A case in point is the country's staggering electricity losses, amounting to almost one-third of total generation. Such inefficient use of resources poses a major constraint to development.

Green growth can help to alleviate such inefficient use of resources. First, green growth interventions would help to address existing shortages of vital resources. For example, some regions are facing severe water stress, despite the fact that Nepal is a water-rich country. Second, green growth measures can improve the quality of essential resources. For example, water quality can be improved by reducing pollution from untreated wastewater, solid waste dumping, and run-off from agricultural fields. Similarly, air pollution and low soil health are concerns where green growth interventions offer a high potential for improvement. Third, green growth can help to address Nepal's high exposure to the impacts of climate change and strengthen the county's low adaptive capacity.

Considering Nepal's current performance in these and other areas related to green growth, the following issues were identified as priorities for Nepal:

- Reducing electricity losses and energy intensity while increasing the use of renewable energy;
- Improving agricultural productivity while ensuring soil health and water quality;
- Enhancing technological readiness; and
- Strengthening the country's adaptive capacity towards the impacts of climate change.

To address the above-mentioned priorities, GGGI's GGPA analysis identified four sectors as key entry points for green growth interventions. These sectors include (1) forestry and land-use, (2) agriculture, (3) energy, and (4) water.

- **Forestry and Land-Use:** Forest and shrub land are integral parts of Nepal's agriculture and rural livelihoods, serving as an important resource for income and employment. Given the strong interdependence between forestry, land-use, and agriculture, the GGPA assessment recommends that Nepal (1) strengthen the institutional and policy linkages between the forest and agriculture sectors. Further recommended interventions include: (2) the establishment of integrated land use planning, (3) the development of procedures and guidelines for payment for ecosystem services, and (4) the promotion of agroforestry and biotrade.
- **Agriculture:** This sector is crucial for Nepal's economy, employing almost two-thirds of the total workforce. Therefore, it is directly linked to poverty reduction and rural development. Recommended interventions include: (1) promoting of climate smart agriculture, (2) introducing financial incentives for adopting sustainable farming practices, and (3) promoting change in irrigation practices.
- **Energy:** The energy sector in Nepal is characterized by the use of traditional biomass as the primary source of energy, low per capita energy consumption, low electricity access, and energy demand greatly exceeding supply. The GGPA assessment yields the following recommended interventions: (1) development of an implementation plan for renewable energy, (2) introduction of a flexible electricity tariff scheme, (3) promotion of off-grid renewable energy in rural areas, and (4) research on the impacts of climate change on the electricity sector.
- **Water:** Despite being a water rich country, water management is a major challenge, particularly with regard to agriculture and electricity generation. Key recommendations include: (1) strengthening institutions and policies related to river basin management, (2) developing and enforcing standards on minimum environmental flows, (3) introducing community-based water management, and (4) developing and enforcing standards for water harvesting in buildings.

Box 1: Green Growth Potential Assessment (GGPA) of Nepal

The Global Green Growth Institute (GGGI) is supporting the Government of Nepal (GoN) in the implementation of its Nationally Determined Contribution (NDC) under the Paris Agreement, as well as the process for developing a Country Planning Framework (CPF) to identify areas where GGGI's contributions could be most relevant for the country. In this context, the GGPA identifies priority areas for green growth interventions and suggests specific recommendations to address those priorities. The GGPA is a diagnostic tool which consists of a combination of data analysis and stakeholder consultation in three components in order to identify a country's green growth priorities.

Component 1: Based on 33 comparative indicators covering the economic, environmental and social dimensions of green growth, the GGPA identifies priority areas for green growth interventions.

Component 2: An essential part of the GGPA process is to gather input from a broad range of stakeholders through an interactive Delphi-based workshop. This workshop serves to validate and/or revise the initial findings from the data analysis. Presenting the results of the data analysis, coupled with a systematic participatory process (Delphi survey), is essential to ensure broad stakeholder consensus on green growth priorities. The consultation process also serves to compensate for any lack of relevant data and ensures the alignment of GGPA results with existing policies.

Component 3: Based on the priorities identified, GGGI conducts a literature review and qualitative analysis to assess underlying causes and to identify a specific interventions considering existing policy targets. Interviews with sector experts play a crucial role at this stage of the assessment.

Introduction

Nepal is a landlocked country, located in highly rugged and mountainous terrain. Despite its small area, the country has diverse climatic conditions, ranging from tropical in the south to alpine in the north. Nepal is one of the poorest countries in the world with a gross domestic product (GDP) per capita of USD 438 and a Human Development Index score of 0.428.[1] The country faces development challenges in various areas. The lingering effects of recent internal conflict and continued political instability combined with recurring natural disasters (including those related to climate) are a key barrier to social and economic development in the country.

Despite these challenges, Nepal envisages becoming a Lower Middle-Income Country (LMIC), graduating by 2022 from its status as Least Developed Country (LDC), and to be an active player on the international stage in the area of climate change. The Government of Nepal (GoN) is developing a Strategy of Low Carbon Economic Development and is actively pursuing measures to adapt to the impacts of climate change. In order to realize the country's potential, Nepal requires a shift from an economic model based on degrading the country's natural assets to a development path that embraces the principles of sustainability, competitiveness, and social inclusion. The Global Green Growth Institute (GGGI) has recently started to support the GoN to make green growth an essential part of the country's development strategy. GGGI's Green Growth Potential Assessment (GGPA) process together with GGGI's Country Planning Framework (CPF) is the first step to identify relevant green growth interventions, based on a solid understanding of Nepal´s most important development challenges.

This report presents the process and findings of the GGPA of Nepal. The report synthesizes the results of all three elements of the assessment process, including the findings of the initial data analysis, the outcome of the stakeholder consultation (see workshop summary in Annex 3), and with the expert opinions provided during the focus group discussions forming an essential input to the recommendations (see Annex 4). It provides critical inputs to support the GoN in prioritizing areas and sectors relevant to green growth, to identify effective interventions, and to highlight areas where further research is required. The assessment outlines how green growth can help the GoN achieve its broader development goals. Based on the results of this assessment, GGGI aims to support the GoN in translating its findings and recommendations into concrete policies and bankable projects.

1.1 Green Growth and Development in the Global Context

The 2030 Development Agenda has set ambitious and comprehensive goals covering a wide range of interlinked targets, sectors, and actors. Goals such as promoting long-term inclusive and sustainable economic growth, taking actions to combat climate change, and strengthening the means of revitalizing and implementing the global partnership for sustainable development represent the fundamental pillars of green growth.

Moreover, the landmark entry into force of the Paris Agreement in 2016 has highlighted the nexus between the Sustainability Development Goals (SDGs) and Intended Nationally Determined Contributions (INDCs), which is proving to be an important driving factor for further commitments. For example, during the Twenty-Second Conference of the Parties (COP22), the countries that form the

[1] Nepal Vision 2030: http://www.nccr.org.np/uploads/publication/433e2451bffe70c5e14fad329c2ed484.pdf

Climate Vulnerable Forum—including Nepal—announced their plans to shift their energy supply to renewables, demonstrating how the global development landscape is converging toward common goals that further elevate the relevance of green growth on national as well as global agendas.

Given the complexity and breadth of green growth as a concept in academic and policy discourse, any initiatives to adopt policies and measure that fall under the label of green growth should be context-specific. Successful initiatives and lessons learned from experiences all over the world provide growing evidence of the concept's benefits and synergies. Green growth is increasingly regarded as a viable development model. It presents opportunities to accelerate transformation towards sustainable development by:[2]

1. Increasing the quantity and quality of natural resources and environmental services. Given that these are factors of production, their availability is critical to higher and sustainable economic growth.
2. Increasing the productivity of resources, i.e., generating higher economic growth with less resources.
3. Driving new technologies or innovative applications of existing technologies. Innovation is a key driver of economic growth as previous economic revolutions have shown.
4. Focusing on removing market failures impeding the achievement of economic, environmental, and social goals, contributing to more efficient allocation of resources in the economy.
5. Pursuing an inclusive and participatory approach, putting in place mechanisms for benefit sharing, in particular to benefit those who are dependent on natural resources and are most vulnerable to climate change.

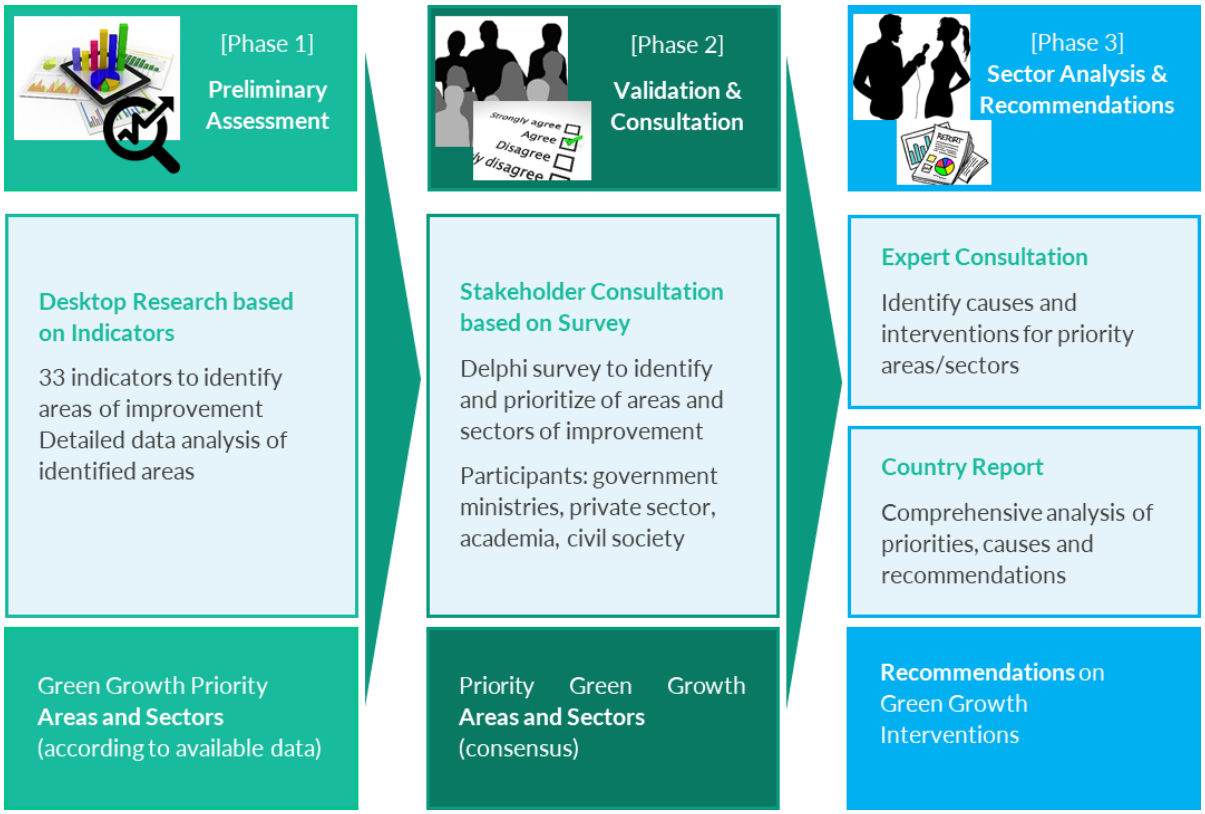
1.2 Application of GGPA Framework in Nepal

The GGPA is a diagnostic tool which consists of a combination of data analysis and stakeholder consultation in order to identify and prioritize a country's opportunities for green growth. The GGPA process consists of the following three stages: (1) preliminary assessment based on data analysis; (2) validation of the preliminary assessment and consultation with stakeholders; and (3) sector analysis and the development of recommendations. This design aims to ensure that the assessment process is systematic, objective, and participatory.

Preliminary Assessment
First, based on 33 comparative indicators covering the economic, environmental, and social dimensions of green growth, the GGPA identifies priority areas for green growth interventions. The aim is to identify areas of underperformance, as these are regarded as offering opportunities for high-impact green growth interventions at modest costs. For that purpose, Nepal's performance in each of the indicators was compared with peer countries within the same income group (low-income countries as per World Bank classification[3]). In addition, the data for Nepal was compared to middle-income countries in order to assess Green Growth performance in light of Nepal's aspiration of becoming a middle-income country by 2030.

[2] See also the GGGI Strategic Plan 2015-2020: http://gggi.org/strategic-plan-2015-2020/
[3] World Bank Country and Lending Groups: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

Figure 1: Overview of the GGPA Process



Validation and Consultation

An essential part of the GGPA process is to gather input from a broad range of stakeholders through an interactive Delphi-based workshop. This workshop serves to validate and/or revise the initial findings from the initial data analysis. Presenting the results of the data analysis, coupled with a systematic participatory process (Delphi survey), is essential to ensure broad stakeholder consensus on green growth priorities. The consultation process also serves to compensate for any lack of relevant data and ensures the alignment of GGPA results with existing policies.

GGGI held a consultation workshop on October 4, 2016 in Kathmandu, involving more than 50 participants mainly representing different Ministries and Departments of the Government of Nepal. As a result of the workshop, several areas were identified as green growth priorities for Nepal. In addition, participants identified the four most relevant sectors[4] related to these priority areas. (see Table 1)

4 For the purposes of this GGPA, the term sector is utilized as it is by the OECD to denote thematic areas that may have several ministries and/or entities involved with policy implementation.

Table 1: Priority Sectors and Related Areas

	Priority Sector	Green Growth Area
1	Forestry and land-use	Agricultural land productivity and soil health Adaptive capacity
2	Agriculture	Agricultural land productivity and soil health Water productivity and water quality Adaptive capacity Technological readiness
3	Energy	Renewable energy Energy intensity Electricity losses Adaptive capacity
4	Water management	Agricultural land productivity and water productivity Renewable energy Water quality and soil health Adaptive capacity

Source: GGGI

Sector Assessments and Recommendations

Based on the priorities identified, GGGI conducted a literature review and qualitative analysis to assess underlying causes and to identify specific interventions considering existing policy targets. As part of this process, GGGI analyzed the linkages between priority areas and sectors, identified existing gaps in Nepal's policy framework and the governance structure, and developed interventions to address the current shortcomings. Crucial input to this analysis included a series of expert interviews, which GGGI conducted on November 22 and 23, 2016 in Kathmandu in the form of four focus group discussions with experts from each of the four priority sectors.

GGGI assessed the recommendations from these group discussions for their potential to contribute to green growth and the wider sustainable development objectives, including aspects of social inclusiveness. The final recommendations fall into the following four categories: (1) policies, strategies, and plans; (2) market instruments; (3) voluntary public or private action; and (4) strengthening institutions and capacity building.

Box 2: Vocabulary of the GGPA

The GGPA provides a method to identify priorities for green growth interventions. Throughout the assessment a number of terms are used, referring to this standardized approach.

- **Indicators:** Thirty-three indicators have been selected by GGGI for comparing a country's performance to selected peers on a range of green growth aspects. These indicators, covering the economic, environmental, and social dimensions of green growth, are derived from global data sources.
- **Areas:** Each indicator represents a topic relevant to green growth that includes more than the corresponding data point captured by an individual GGPA indicator. In the consultation workshop, votes for a specific indicator are interpreted as recognition that the related area is of high concern in a country. For example, votes for the indicator *electricity losses* are assumed to translate to a concern about the reliability of the energy system overall as a barrier to development and well-being.
- **Sectors:** In the second half of the consultation workshop, participants identify sectors of the economy that are most relevant for addressing the highest ranked areas.[5] These 14 sectors represent the domestic economy within a country and help to target expert interviews in the subsequent stage of the GGPA process. Many areas are affected by more than one sector. Identifying the sectors most connected to priority areas can help to guide policies, projects, and investments aiming at promoting green growth in a country.

[5] For the purposes of this GGPA, the term sector is utilized as it is by the OECD to denote thematic areas that may have several ministries and/or entities involved with policy implementation.

Country Assessment

2.1 Country Profile

Nepal is a landlocked country in South Asia, bordering with India in the south and China in the north. Its five physiographic regions, which correspond to a variety of climatic conditions, result in rich natural resources, fertile lands, and an abundance of water. Nepal has varied landscapes, which include forests, areas of cultivation, water bodies, and glacier ecosystems, characterized by high floral and faunal diversity (MFSC 2014a). Nepal's natural setting combined with its cultural diversity make it highly attractive for tourism.

Nepal's population has grown from 8.5 million in 1960 to 28.5 million in 2015 (UN 2015), putting pressure on the country's limited basic infrastructure. Although more than 90% of the population has access to water and about 76% has access to electricity (WDI 2016), the quality and extent of this access is questionable. It is documented that until 2015 less than 50% of Nepalis had access to improved sanitation facilities (ibid.). Moreover, a growing population also increases pressure on and exploitation of natural resources, which is not met with effective management strategies. The country therefore suffers from severe environmental degradation.

Nepal has managed to make significant improvements in terms of human capital since the 1980s. However, absolute levels remain comparatively low as the country started from a very low base. In 2015, Nepal ranked 145 out of 188 in the Human Development Index, and is still the lowest ranking country among members of the South Asian Association for Regional Cooperation (SAARC) (UNDP 2015). Even though Nepal has advanced in terms of life expectancy at birth and improved quality of education, its per capita income is still low. Inequality continues to be a major issue. Income inequality is apparent between the different castes and ethnicities. Meanwhile, gender disparities in life expectancy, education, and income remain major challenges across Nepal.

Nepal's economic growth is highly dependent on the service sector (accounting for more than half of the economic output in 2014), mainly as a result of the inflow of remittances as the biggest driving force of Nepal's growth (ADB 2016) as well as income from the tourism sector. The agricultural sector, as the main source of livelihood in the country, is placed second in terms of contribution to the country's total GDP (34% in 2014). However, limited availability of arable land, low labor productivity, the lack of advanced technology, difficult topography, and changing climate are the main drivers behind decreased agricultural productivity. Industry and manufacturing contribute about 16% to the total GDP. These two sectors have been declining mainly due to a lack of investment as a result of political instability, lack of good governance, and limited access to basic infrastructure.

Nepal's location within the collision zone of the Indian and Eurasian tectonic plates makes the country highly prone to earthquakes. The earthquake that hit Nepal in early 2015 highlights this vulnerability and its severe consequences for the country's development. The 7.6 magnitude earthquake impacted all dimensions of life in Nepal. Approximately 9,000 casualties were reported and more than 20,000 people were injured. Economic losses and damages were estimated at USD 7 billion, which is equivalent to a third of the GDP in the fiscal year of 2013-2014 (NPC 2015b). Moreover, it pushed an additional 3% of Nepalis, about 700,000 people, into poverty (ibid.). Such a setback happened just as the country was making continued progress in reducing the share of the population living in poverty, from approximately 75% in the 1980s to around 50% in the early 2000s to 15% in 2010 (WB 2016). This shows how achievements in human development are at risk of failing in the light of external factors.

In addition to exogenous factors, the lingering effects of recent internal conflict and continuing political instability has dampened any development efforts. In this regard, links between economic development, institutional weaknesses and the destruction of natural resources are starkly visible in Nepal. The projected adverse impacts of climate change will exacerbate the already challenging socio-economic situation in the country. The figures of Nepal´s development mentioned in this chapter are included in Nepal's dashboard indicators that are presented in Annex 1.

2.2 Policy Context

Despite these challenges, Nepal aims to graduate from its status of least developed country (LDC) by 2022 and aims to reach middle-income country status by 2030. To achieve those goals, the GoN is focusing on poverty reduction and improving human development, while reducing the country's vulnerability towards exogenous factors such as impacts of climate change or natural disasters. The GoN is currently implementing its 13th Three-Year Plan as an overarching national development-planning instrument. A major objective of the plan is to improve living standards of the population, with the target of reducing the number of people under the poverty line to 18% (from the current 24%). In terms of graduating from LDC status, the country will, based on the current trend, likely achieve its goal with regard to human assets and economic vulnerability. However, it currently still lags behind with regard to per capita gross national income (NDC 2015 a).

At the same time, the Government of Nepal is committed to combating climate change. Regarding adaptation, the government approved a Climate Change Policy in 2011 and developed a national framework on Local Adaptation Plans of Action (LAPAs) as well as a National Adaptation Plan of Action (NAPA) in 2010. Regarding mitigation, a so-called Low Carbon Development Strategy is currently under development. The commitments developed as part of the relevant climate change policies and plans are in line with the objectives of the National Development Plans and have been included in relevant plans for individual sectors (GGBP 2014).

With regard to international commitments, Nepal has developed an ambitious SDG agenda that is very relevant for any green growth interventions. Targets include a 95% access rate to piped water and improved sanitation, 99% of households with access to electricity, and only 10% of households using firewood for cooking (NPC 2015a).

The Paris Agreement, which was ratified by the Government of Nepal on October 6, 2016, is another potential driver for green growth. Nepal, as part of the Climate Vulnerable Forum, has announced the intention to change its energy supply to renewable energy as soon as possible. The corresponding national climate and energy policy objectives will have to be rewritten by 2020 at the latest to reflect this commitment.

Any shift towards green and inclusive growth will happen in the context of the current decentralization process. According to the 2015 constitution, Nepal's political system is to be converted from a centralized constitutional monarchy into a federal republic. This poses many challenges to policy making, but also bears opportunities for integrating green growth policies on multiple governance levels.

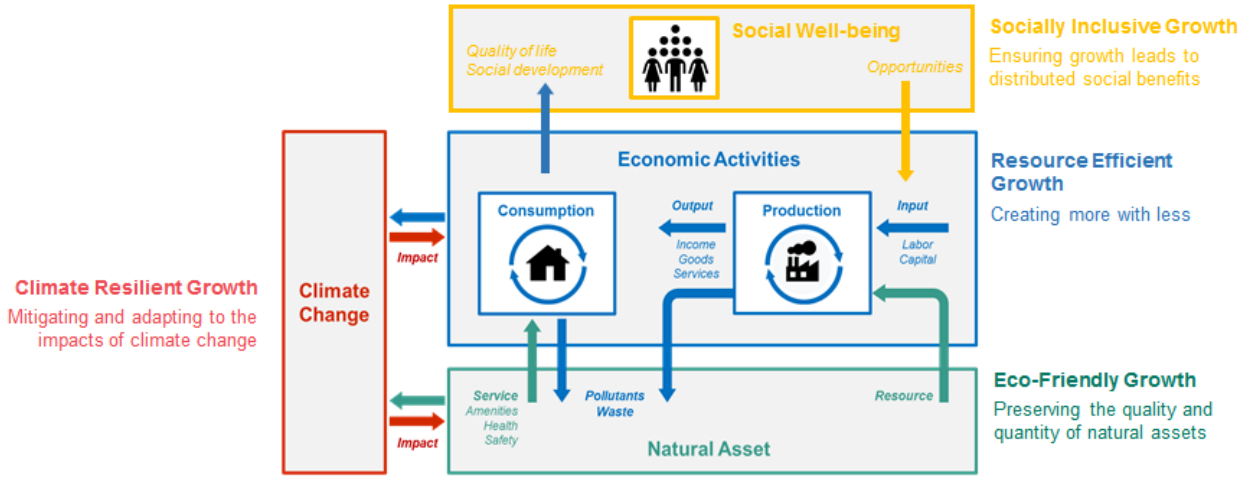
The commitments undergone by the GoN show that there is an overall understanding for the need for a development path that fosters economic growth while considering environmental sustainability and

social inclusion. There appears to be a shared view that a more sustainable development is in the national interest.[6]

2.3 Diagnostic Analysis of Green Growth Areas

To analyze Nepal´s current performance on green growth, the following section compares Nepal to low-income countries (LIC) and lower middle-income countries (LMIC). This comparison is based on 24 indicators across three green growth dimensions, namely: Resource-Efficient Growth; Eco-Friendly Growth; and Climate-Resilient Growth. Figure 2 presents these green growth dimensions (see Annex 2 for more detailed information on each indicator).

Figure 2: GGPA Framework



Source: GGGI

For each indicator, Nepal's performance is compared to LICs and LMICs and presented in the form of so-called "spider diagrams," each covering one of the three green growth dimensions. These diagrams visualize the country's performance in percentile scores (between -50% and 100%), based on a two-point normalization for data collected from more than 200 countries and territories.[7] Using such a common scale allows comparing a country's performance in different areas (e.g., Water Productivity vs. Water Quality).

- A score of 100% (Good) implies that the country's performance is within the global top 10 percentile;
- A score of 50% (Average) implies that the country's performance is on par with the global average;
- A score of 0% or lower (Poor) implies that the country's performance is within the global bottom 10 percentile.

The following section provides an overview of the performance of Nepal in all three dimensions. The discussion focuses on the indicators in which Nepal is underperforming compared to low-income countries (LIC), as those indicators represent the areas with the highest potential for green growth interventions.

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[6] When asked during the stakeholder consultations as part of the GGPA process, almost two thirds of the participants stated that the underlying motives for pursuing sustainable development and green growth are national interests rather than global commitments. See Annex 3 for more detailed information on the stakeholder consultation workshop

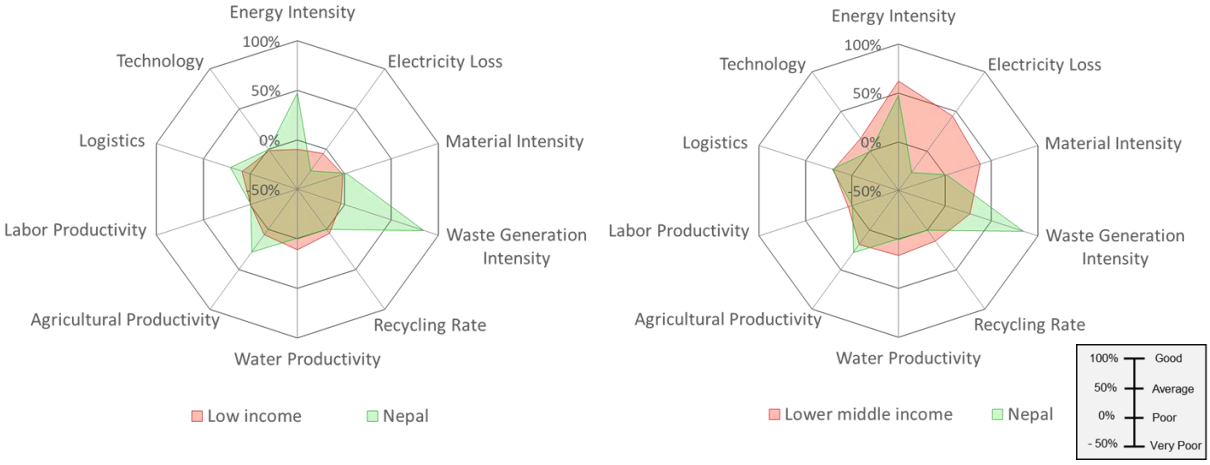
[7] Following World Bank country classification.
https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

2.3.1 Resource Efficient Growth

With regard to Resource Efficient Growth, Nepal's performance is mixed in comparison to its peer countries:[8]

- Nepal performs better than both LICs and LMICs in three out of ten areas, i.e., Waste Generation Intensity, Agricultural Land Productivity, and Logistics Performance.
- Nepal performs better than LICs but worse than LMICs in three out of ten areas, i.e., Energy Intensity, Material Intensity, and Technological Readiness.
- Nepal performs worse than both LICs and LMICs in four out of 10 areas, i.e., Energy Loss, Waste Recycling, Labor Productivity, and Water Productivity.

Figure 3: Resource Efficient Growth



Source: GGGI

Nepal's above average performance in terms of Energy Intensity and Waste Generation Intensity reflects the country's development status, with a weak industrial base (Material Intensity is dominated by biomass). Waste Generation Intensity is low as the indicator measures the amount of waste that is collected by or on behalf of municipal authorities and disposed of through the municipal waste management system. In Nepal, where substantial informal waste disposal occurs, a significant share of generated waste may not be reflected in the indicator. The performance in Agricultural Land Productivity above peer countries is positive, but stand at a low value in absolute terms when compared with global trends.

Nepal's performance on logistics (2.59 on an index from 1 to 5) is at a level shown by lower middle-income countries (2.57/5) and above other low-income countries (2.40/5). This is particularly encouraging as Nepal is a landlocked country.

[8] For definitions and sources of all ten indicators, please refer to Annex 2.

Electricity Losses

Electricity Losses refer to **transmission and distribution losses**. This includes both technical and non-technical losses. Technical losses are caused by physical characteristics of the grid and the electricity-generating system. The amount of losses is mainly dependent on the size of the country (length of power lines), voltage of transmission and distribution, and quality of network. Transmission and distribution losses comprise all losses due to transport and distribution of electrical energy, including losses in overhead transmission lines and distribution networks as well as losses in transformers which are not considered as integral parts of the power plants. Non-technical losses mainly refer to electricity theft.

Unit: % of output

Transmission and distribution losses of electricity amount to almost a third of the total electricity generated in Nepal (31%). Losses are higher than in other low-income countries (27%), and twice as high as in lower middle-income countries (17%).

Transmission and distribution losses include technical losses as well as non-technical losses. Technical losses refer to losses as the result of inefficient and poorly maintained transmission and distribution infrastructure, as well as losses incurred by the length of the distribution lines that go beyond its technical limits.[9] Non-technical losses mainly refer to electricity theft (meter tampering and illegal connections to power lines). The largest losses occur in electricity distribution—between 17 and 20% according to figures published by the Nepal Electricity Authority (NEA)—while transmission losses account for approximately 4 to 6% (NEA 2014; NEA 2016; Nepal Energy Forum 2015).

Against the low access rates, rapidly increasing demand, frequent power cuts and load shedding,[10] electricity losses in Nepal are an important constraint to development and constitute a major burden for the country's economy.

Waste Recycling

Recycling Rate of municipal solid waste refers to the amount of Municipal Solid Waste (MSW) recycled as a proportion of total MSW generated and collected within the formal waste sector.

Unit: % of waste generated

Recycling of municipal solid waste in Nepal is reported at 0%, compared to a rate of 1.5% in low-income countries and 4.1% in lower middle-income countries. It needs to be noted that the indicator only covers the Recycling Rate in the formal waste management sector. In Nepal, a significant amount of recycling takes place informally, particularly in urban areas (ADB 2013).

Nevertheless, the validity of the indicator result is confirmed by other sources. While programs for waste management exist in Nepal, they do not deliver the desired results. An Asian Development Bank survey found that waste minimization programs that include aspects of re-use and recycling were in place in 32 of the then 58 municipalities[11] (ADB 2013). However, such existing solid waste management systems are inefficient due to a lack of statistical monitoring, planning capacities, and resources. Particularly urban areas are suffering from inadequate waste disposal (Ibid.). As a case in

[9] Distribution lines extended over a long-distance result in increased line resistance, thus causing higher losses.
[10] Load shedding refers to utilities' method of reducing demand (load) towards the electricity generation system by temporarily switching off distribution of energy to different geographical areas.

point, in Kathmandu, which is one of only three municipalities with a formal solid waste management system, the waste problem is considered chronic. (Ibid.)

While there is considerable potential to reduce the amount of waste in landfills and enhance waste recycling in Nepal, this potential remains largely untapped. For example, the same ADB survey mentioned above found that more than 25% of household waste and an even higher share of industrial and commercial waste (excluding organic waste) could be either reused or recycled. However, so far, even with international support the recycling sector shows little improvement. In particular, international aid programs that support municipal solid waste management in the Kathmandu area have been found to be largely unsuccessful (Dangi et al. 2015).

Water Productivity

Water Productivity indicates how water intense a country's economy is. It is defined as GDP divided by the total annual freshwater withdrawal.

Unit: Unit GDP (in constant 2010 USD) per m3 of freshwater withdrawal

Water Productivity in Nepal is at USD 2 per m^3 of withdrawn freshwater, an alarmingly low level. Low-income countries on average generate more than 8 times as much economic output per cubic meter (USD 16.75 /m^3), and lower middle-income countries generate more than 11 times as much (USD 23.06 /m^3).

Surface water availability in the country is estimated to be approximately 225 billion m^3, of which 15 billion m^3 are withdrawn annually for consumption (WECS 2011). By far the largest share of freshwater is used in agriculture (95.9%), while domestic (3.8%) and industrial (0.3%) uses account for low shares (ibid.). Given this dominance of water use for agriculture, Water Productivity in Nepal is mostly determined by the level of agricultural water productivity. Despite the fact that irrigation levels are relatively low—42% of the cultivated area is under irrigation, and only 17% has year-round irrigation (WECS 2011)—the main drivers for the low Water pProductivity in the sector are inefficient irrigation practices and systems, dominated by surface water irrigation.

Labor Productivity

Labor Productivity is defined as the total volume of output (measured in terms of GDP) produced per unit of labor (measured in terms of the number of employed persons) during a given time reference period. The economically active population comprises all persons of either sex, ages 15 and older, who furnish the supply of labor for the production of economic goods and services as defined by the United Nations System of National Accounts during a specified time-reference period.

Unit: USD per worker (in constant 2005 USD)

Labor Productivity at USD 802 per worker is significantly lower than in other low-income countries, where a worker generates USD 1,152 per year on average. A worker in a lower middle-income country on average generates more than 4 times as much as a Nepali worker (USD 4,463).

A positive trend is that Labor Productivity has significantly improved in Nepal over recent decades. It is among the LDCs in Asia with the highest growth rate, almost doubling its Labor Productivity over the past 25 years (UNCTAD 2015). However, Labor Productivity in Nepal is unevenly distributed throughout the country. In Kathmandu, productivity is three times above the national average, while most of the districts are below the national average, some of them considerably (GoN and UNDP

2014). This gap between urban and rural areas is reflected in the high concentration of the overall workforce in the least productive sector, with two thirds of the workforce (66.5%) being employed in agriculture. The workforce in this sector is characterized by low skill levels and a lack of extension services. Industry has a relatively high level of Labor Productivity, but only employs 11.2% of the workforce. The service sector shows the highest Labor Productivity, with 22.4% of the workforce creating half of the country's GDP (ILO 2015; GoN and UNDP 2014).

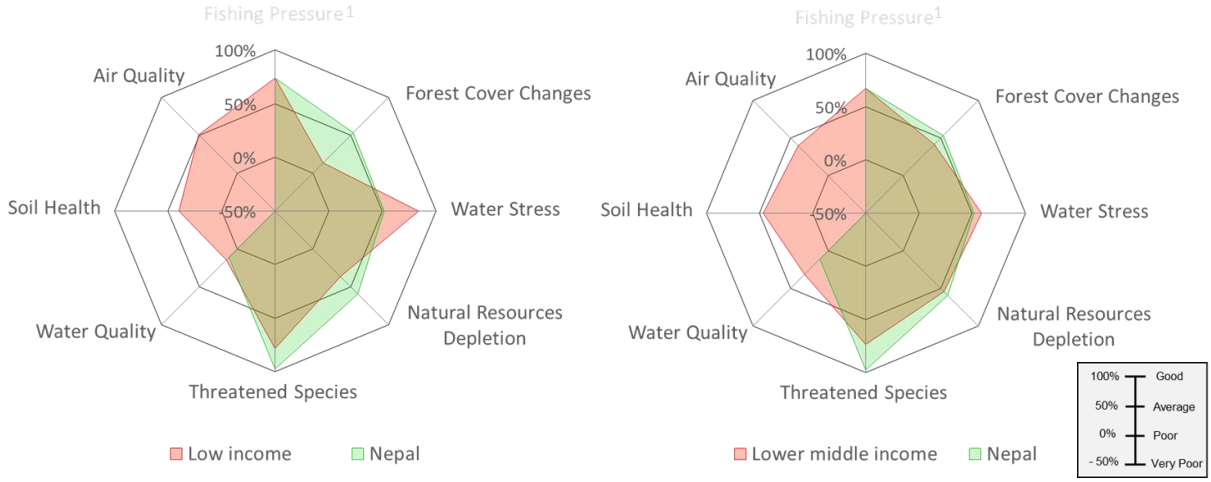
Generally, education and training are key factors for a productive labor force. However, low levels of Labor Productivity in Nepal are rather driven by the dominance of the agricultural sector, as well as capital factors such as a lack of infrastructure, outdated technology, and low investments (Basnett et al. 2014). This assessment is corroborated by the fact that Nepali workers reach higher productivity levels when working abroad. Remittances play a key role for family income and economic development in Nepal. However, labor migration out of Nepal is affecting the domestic labor market and productivity negatively, with a large portion of the skilled and well-educated Nepali workers employed in foreign countries resulting in the so called "brain drain".

2.3.2 Eco-Friendly Growth

Regarding Eco-Friendly Growth, Nepal's performance can be summarized as follows:

- Nepal's performance is higher than both LICs and LMICs in three out of seven areas, i.e., Forest Cover Changes; Natural Resources Depletion; and the Number of Threatened Species.
- Nepal's performance is lower than both LIC and LMIC in four out of seven areas, i.e., Soil Health; Water Quality; Air Quality, and with a smaller gap, Water Stress.

Figure 4: Eco-Friendly Growth[1]



[1] Fishing pressure refers to coastal shelf fishing which is defined as the total catch from trawling and dredging equipment divided by the total area of a country's exclusive economic zone. This indicator is not applicable in the case of Nepal.

Source: GGGI

The relatively good performance concerning Forest Cover Changes (0.0% in Nepal compared to -0.81% in LICs and -0.2% in LMICs), Natural Resource Depletion (5.81% of GNI in Nepal compared to 8.98% in LICs and 6.5% in LMICs) and the Number of Threatened Species, measured in number of species per population density (0.54 in Nepal compared to 3.93 in LICs and 4.73 in LMICs) is closely

associated with Nepal's development level, i.e., an economy with a large rural population that mainly depends on small-scale agriculture with little resource-intensive industries. However, while Nepal's development path has not led to a decline in terms of quantity of natural resources compared to peer countries, the quality of those natural resources (air, soil, water) is of serious concern.

Water Stress

The baseline **Water Stress** index measures water stress is defined as the ratio between total annual water withdrawals (municipal, industrial, and agricultural) and total renewable supply. The index is based on a scale ranging 0 to 5. The index serves as a proxy for the level of competition among users and depletion of the resource. Focusing on competition and depletion makes this indicator an effective way to measure the hydrological context at the catchment scale.

Unit: 0-5 (higher means greater competition among users)

Nepal's Water Stress is in the range from medium to high (2.4 on an index from 0 to 5), somewhat higher than in lower middle-income countries (2.06/5), but well above low-income countries (0.86/5). Water Stress in Nepal is in the medium-high range for all relevant sectors, i.e., agricultural (2.4/5), domestic (2.5/5) and industrial water uses (2.5/5). However, the level of Water Stress varies across different regions throughout the country, with lower Water Stress in the north-western and south-eastern regions, and higher Water Stress in the central part of the country, where most of the population is located.

The largest part of agricultural land in Nepal is rain-fed, and shortages of water availability for farming occur mainly because of the lack of storage capacity and irrigation infrastructure (Jha et al. 2016). Existing infrastructure consists mainly of surface irrigation with low water use efficiency (ibid.). Hydropower, although a non-consumptive user, is also highly dependent on river runoff, and has potentially competing interests with consumptive uses and environmental flows. For example, the timing and volume of water releases from hydropower dams for energy production affects downstream use for irrigation and the environment.

Although Nepal is considered a water-rich country in terms of per capita freshwater availability, growing demands may change this situation (UNEP 2008). Additionally, climate change will have impacts on the hydrological regime (especially glacier melting and changes in precipitation patters), affecting water availability (WECS 2011).

Water Quality

The **Water Quality** Index uses three parameters to determine the water quality of a country's fresh water bodies, measuring nutrient levels (Dissolved Oxygen, Total Nitrogen, and Total Phosphorus) and two parameters measuring water chemistry (pH and Conductivity). (*Note, this indicator does not measure drinking water quality.*)

Unit: 0-100 (higher figure means a better Water Quality Index)

The quality of Nepal´s water resources is low (46 on an index from 0 to 100). This is below the average value of low-income countries (48/100) as well as the average exhibited by lower middle-income countries (56/100). It should be noted that both groups do not perform well on the water quality index either.

Water Quality monitoring is weak in Nepal (ADB 2014), and available data is sparse. Individual studies carried out in various locations across the country suggest that the main drivers for low Water Quality

are pollution from untreated wastewater (municipal and industrial), solid waste dumped into rivers and carried by storm water, as well as run-off from agricultural fields carrying agro-chemicals and contamination of water bodies from livestock (Manfredi et al. 2010; Sharma et al. 2005; Shrestha et al. 2015; Shukla n.d.). Treatment of sewage waste is especially concerning in the Kathmandu area where the water treatment infrastructure cannot cope with a rapidly growing population. Few wastewater treatment plants exist in this area, many of which are partially or completely out of operation (Shrestha et al. 2015). According to the ADB (2014), all rivers in the Kathmandu Valley are biologically dead.

Soil Health

The Trends in **Soil Health** Index measures the physical part related to loss of soil mass and structure; and the long-term chemical well-being of the soil in terms of nutrients and absence of toxicities built up.

Unit: 0-50 (higher figures indicate better soil health)

On a global scale, Nepal ranks at the bottom in the Trends in Soil Health Index (14 on a scale from 0 to 50). Nepal is significantly underperforming in comparison to both, low-income countries (38/50) and lower middle-income countries (40/50).

According to the ADB (2014), land degradation is a problem in all geographical areas of Nepal. Major causes are water-induced erosion, landslides, surface exposure, topsoil wastage, riverbank cutting, floods, silt deposition, water logging, deforestation, and wind erosion. About half of the country's total land area has been affected by water-induced erosion (6.7 million ha) or wind erosion (0.6 million ha) (ibid.).

Nepal's mountainous topography, together with the high rainfall intensity, make many parts of the country prone to soil erosion, which acts as a natural driver for physical soil degradation. The main human-induced factor regarding soil health is poor agricultural management, which has effects on physical (soil compaction through grazing) and chemical (nutrient loss, toxicities) soil parameters (Nachtergaele et al. 2011). This is driven by a trend towards agricultural intensification and commercialization away from subsistence farming in recent decades, resulting in increased use of fertilizers, pesticides, and hybrid seeds (Schwab et al. 2015).

Air Quality

The indicator measures the **average exposure to** fine particulate matter (**$PM_{2.5}$**), ambient particles less than 2.5 micrometers in diameter. Three-year rolling population-weighted average of the $PM_{2.5}$ values are used to calculate indicators for national annual average exposure to $PM_{2.5}$ in micrograms per cubic meter. Population-weighted average exposure values are calculated using population data from the Global Rural Urban Mapping Project (2011) database.

Unit: $\mu g/m^3$

Exposure to $PM_{2.5}$ in Nepal is 30.54 micrograms per m^3. This level of exposure is more than four times higher than the average level across low-income countries (7.17 $\mu g/m^3$) and 3.5 times higher than that of lower middle-income countries (8.54 $\mu g/m^3$). Exposure levels in Nepal also significantly exceed the WHO standard of 10 $\mu g/m^3$. In 2016, only the rapidly developing and industrializing economies of China, India, and Bangladesh performed lower than Nepal in this indicator (EPI 2016).

Major sources of fine particulate matter are emissions form vehicles, diesel generators, industry (cement, bricks), and re-suspension of dust (from poor or unsurfaced roads) (Clean Energy Nepal

2014). Overall, almost 75% of the Nepali population is exposed to fine particulate matter (EPI 2016). 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 (Kurmi et al. 2016; Gurung and Bell 2013).

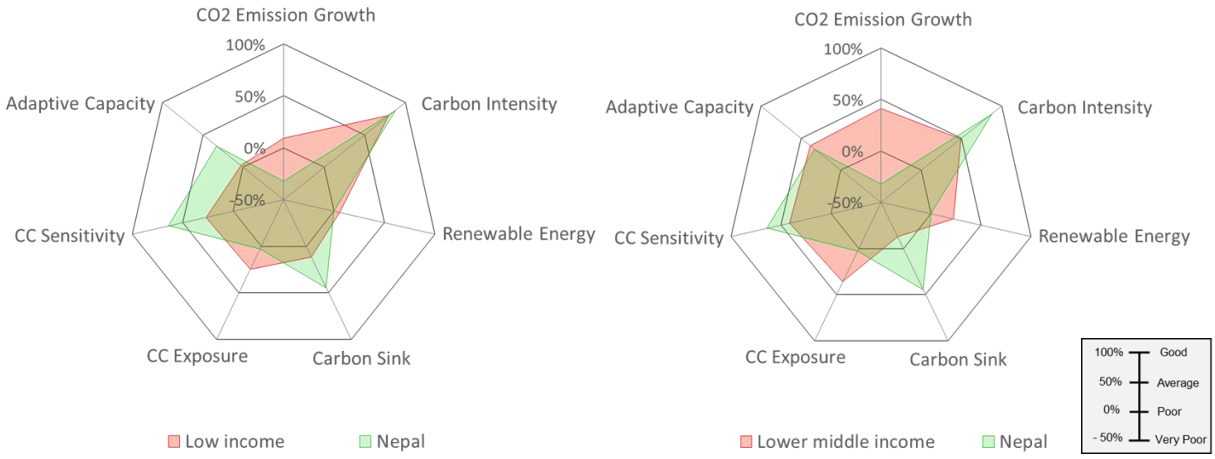
The Kathmandu Valley, the fastest growing metropolitan area in South Asia, is particularly affected by air pollution, due to haphazard urbanization (to absorb the 4.3% annual population growth), rapid motorization (12% annual growth over the past ten years), an ineffective public transport system, its valley centric industrialization, and its topography (restricting wind movement and retaining the pollutants in the atmosphere). Many of the policy initiatives on air pollution that were introduced so far have not been effectively implemented. As a result, Kathmandu is today one of the most polluted cities in Asia with regard to levels of fine particulate matter ($PM_{2.5}$ as well as PM_{10}) (Clean Energy Nepal 2014).

2.3.3 Climate Resilient Growth

Regarding Climate Resilient Growth, Nepal's performance is as follows:

- Nepal's performance is higher than both LICs and LMICs in three out of seven areas, i.e., Carbon Intensity, Carbon Sink, and Climate Change Sensitivity.
- Nepal's performance is higher than LICs but lower than LMICs in one out of seven areas, i.e., Adaptive Capacity.
- Nepal's performance is lower than both LICs and LICMs in three out of seven areas, i.e., CO_2 Emissions Growth, Renewable Energy Production, and Climate Change Exposure.

Figure 5: Climate Resilient Growth



Source: GGGI

Nepal's performance is especially notable in terms of Carbon Intensity (0.26 tCO_2/USD). This can be largely explained by the fact that the country's economy is mostly based on agriculture, services, and remittances, with no significant energy intensive or other large-scale emitting industries. The relatively good performance regarding carbon sink (stable carbon stock in Nepal, while in comparison carbon stocks in LICs and LMICs have been declining by -5.54m and -9.48m tons per year, respectively) reflects the importance of forests in Nepal, covering approximately 40% of the total land area (DFRS 2015).

Nepal's contribution to global GHG emissions is negligible. However, the relatively high growth rate of CO_2 emissions due to transport and manufacturing (although from a low base) and the low share of renewables (excluding large hydropower) in the electricity mix show that there is potential for climate change mitigation action.

In terms of vulnerability to the impacts of climate change, the Notre Dame Global Adaptation Index (ND-GAIN) categorizes Nepal as a country that is highly vulnerable. According to the IPCC (2007), vulnerability to climate change is defined as "the degree to which geophysical, biological, and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of climate change." In line with this definition, vulnerability can be disaggregated into three dimensions: (1) sensitivity, referring to how susceptible a country is to climate change hazards; (2) exposure, referring to the degree to which a country is prone to be affected by climate change from a biophysical perspective; and (3) adaptive capacity, referring to ability of a country to cope with the effects of climate change. Nepal shows a comparatively low sensitivity (scoring 0.383 ND-GAIN, with 1 being the worst). Therefore, the country's vulnerability is mainly determined by its high exposure (scoring 0.56 ND-GAIN) and its low adaptive capacity (scoring 0.602 ND-GAIN) to climate change. This highlights the importance of increasing adaptation efforts in the country.

Renewable Energy Production

Renewable Energy Production refers to the share of electricity generated from renewable sources of energy within total electricity generation, including geothermal, solar, tidal, and wind power, as well as electricity generated from biomass and biofuels. It excludes hydroelectric sources.

Unit: % of total electricity production (excluding hydropower)

Nepal's electricity generation from renewable sources other than hydropower (both large- and small-scale) is negligible. While low-income countries generate on average 1% of their electricity from alternative renewable sources, and lower middle-income countries about 4%, the share in Nepal is close to zero.

The country's electricity sector is largely based on hydropower, which is not considered as a source for renewable energy within the GGPA methodology.[12] There is a potential for about 46,610 MW of electricity generation from large-scale hydropower in Nepal, of which currently only a small fraction is being exploited (WECS 2014). Hence, hydropower is regarded as the main driver for electricity generation in the future (MoPE 2016b). However, expanding hydroelectricity has remained, to a large degree, an unfulfilled promise, as the development of large hydropower dams has been stalled due to economic, political, and technical challenges.

Besides large-scale hydropower, micro- and small-scale hydropower is of significance in Nepal. While there is no agreed definition of renewable sources of energy among Nepalese authorities, the

[12] Although hydroelectricity is a renewable source of energy, the construction of large-scale hydroelectric facilities can have significant and unavoidable negative environmental and social impacts. The most important of which are generally related to the flooding of land in the impoundment zone upstream of a dam, and changes to water flows and water levels downstream of a dam. For instance, forced land acquisition and population displacement; changes in river regimens (which can affect fish, plants and wildlife); and flooding of land and wildlife habitats (through the creation of reservoirs). While the nature and severity of such impacts are highly site-specific and tend to vary in scale according to the size and type of the project, due to its generally environmentally disruptive impact, large-scale hydropower is counted separate from other renewable energy sources.

country's energy statistics and policies often consider small and micro hydropower as part of the renewable energy mix.

As of 2012, 45.18 MW of electricity has been generated from solar PV and small-scale hydropower plants. (WECS 2014), representing about 5.5% of the total electricity generation in Nepal.[13] According to government statistics 1.5 million households, or more than 25% of the total households in Nepal, have access to renewable energy sources[14] if both lighting and non-lighting (cooking, heating and productive end uses) applications are taken into account (MoPE, 2016a).

These renewable energy sources are developing at a very slow pace, mainly due to geographical, technical, political, and economic reasons (MoSTE 2014a). However, there is a vast potential to increase the role of electricity generation from renewable sources, both from small-and micro-scale hydropower as well as from non-hydro sources. This would likely allow for a more reliable supply of electricity, increased access to electricity and a lower dependency on fossil fuel and electricity imports.

Nepal's electricity demand is driven mainly by the residential, industrial, commercial, and agricultural sectors (WECS 2014). Official statistics show that in 2012, 76% of the population had access to electricity (WDI 2016). By 2030, the GoN aims at achieving universal access to clean, reliable, and affordable renewable energy solutions (MoPE 2016a), which is in line with its SDG target to achieve 99% accessibility of households to electricity (NPC 2015a).

CO_2 Emissions Growth

The **CO_2 Emissions trend** captures a country's annual growth rate in national emissions of CO_2 over the latest five years available.

Unit: annual growth rate in %

Although Nepal's contribution to global carbon dioxide emissions from fuel combustion is negligible, 0.02% in 2014 (UNFCCC 2016), the country's CO_2 emissions have been growing at a high rate of more than 12% annually over the last five years. CO_2 Emission Growth in Nepal has been 70% higher than the average of low-income countries (7%), and almost four times higher than in lower middle-income countries (3%). However, this rapid growth rate can mainly be attributed to the fact that overall emissions started from a very low base.

The transport and manufacturing sectors are the principal contributors to Nepal's CO_2 emissions (UNFCCC 2016), followed by the commercial, residential, and agricultural sectors. The average annual growth of emissions from the transport sector is the highest of all sectors, contributing more than 7% to overall emission growth (MoSTE 2014a). The main reason behind this trend is an increasing use of private vehicles, due to higher incomes and the low quality of public transport. The remaining sectors contribute between 2 and 3% (ibid.), with CO_2 emissions in the manufacturing sector driven mainly by the use of old energy-inefficient technologies.

Absolute CO_2 emission levels are low due to the fact that energy supply in Nepal is largely dominated by traditional energy sources such as cow dung, wood, and agricultural residue (87%). The share of fossil fuels (13%) in the energy mix is low (MoSTE 2014a). Carbon dioxide emissions only contributed

[13] This figure does not reflect the share of electricity generated from renewable sources under the GGPA methodology as it includes electricity generated by small-scale hydropower plants.
[14] Based on figures from the Ministry of Population and Environment, including all renewable energy sources except large hydropower (MOPE 2016).

to approximately 28% of Nepal's total GHG emissions in 2010 and are projected to increase to 36-40% by 2030 (CAT 2016). The largest share of GHG emissions in Nepal consist of non-CO_2 GHG emissions from agriculture (which are not covered by the indicator), such as methane and nitrous oxide. These emissions accounted for 67% of the country's total GHG emissions in 2010 (ibid.).

Climate Change Exposure

Climate Change Exposure indicates the degree to which a society and its supporting sectors (defined as food, water, health, ecosystem, human habit, and infrastructure) is exposed to significant climate change from a biophysical perspective. It is a component of vulnerability independent of socioeconomic context. Exposure reflects projected impacts for the coming decades and are therefore invariant overtime.

Unit: 0-1 (lower figures indicate less exposure)

According to the Notre Dame Global Adaptation Index (ND-GAIN), Nepal scores 0.56 (on a scale from 0 to 1) in terms of Climate Change Exposure. This value is slightly higher than the average from both, LICs (0.52/1) and LMICs (0.5/1), indicating a relatively high degree of exposure to the impacts of climate change.

The main climate related hazards in Nepal include changes in temperature, precipitation, and the frequency and intensity of storms, floods, droughts, and landslides (MoSTE 2014a). The effects of these changes will be decreasing cereal yields, changes in biome distribution, an increase in deaths from climate induced diseases, and changes in river runoff (ND-GAIN 2015).

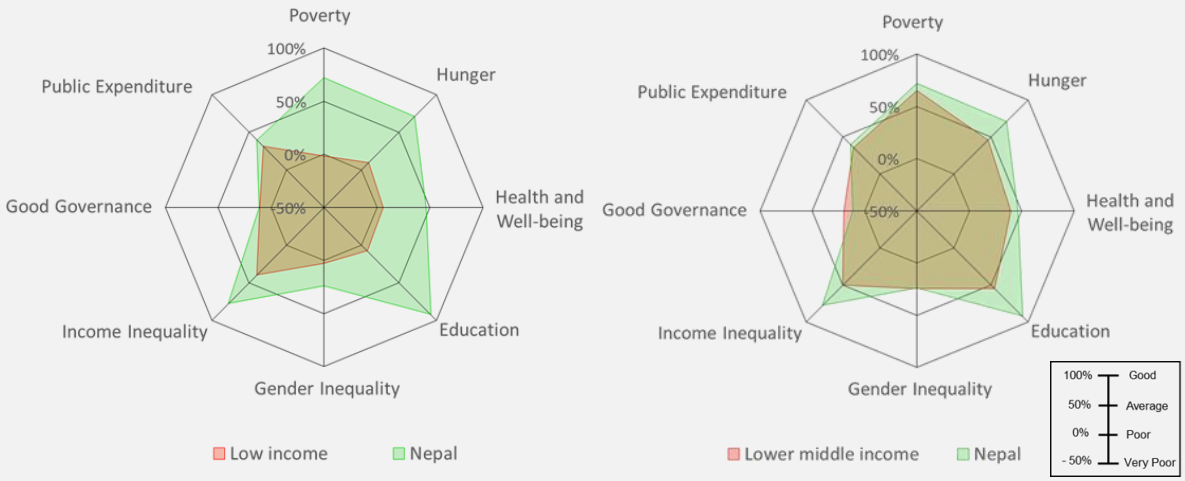
In the ND-GAIN index, Nepal ranks 122nd out of 180 nations, putting the country in the group of the most vulnerable countries in the world (ND-GAIN 2015). This is in line with the finding of the country's Second National Communication, in which Nepal is considered to be the fourth most vulnerable country to climate change, 30th with respect to water-induced disasters and 20th with respect to multiple hazards (MoSTE 2014a). Moreover, Nepal's NDCs document has outlined that "*the estimated direct cost of the current climate variability and extreme events in key sectors is equivalent to 1.5 to 2% of the current GDP/year or approximately USD 270-360 million /year in 2013 prices and much higher in extreme years*" (MoPE 2016b). Thus, Nepal is in great need and urgency to adapt to these challenges (ND-GAIN 2015).

Box 3: The Relevance of Socially Inclusive Growth

Besides Resource Efficient, Eco-friendly and Climate Resilient Growth, the analytic framework of the GGPA incorporates a fourth dimension, Socially Inclusive Growth. This dimension of growth is especially important in the context of Nepal. As described in section 2.2, Nepal's development policy is geared towards reducing poverty as well as increasing human wellbeing and social equality. Figure 6 illustrates that Nepal is doing remarkably well on indicators related to Socially Inclusive Growth in comparison to both low-income countries and lower middle-income countries.

When comparing Nepal to low-income countries, Nepal scores higher in all indicators, with the country's performance being significantly above the LIC average for most of the indicators. For a definition of the indicators and sources, please refer to Annex 2.

Figure 6: Socially Inclusive Growth



The areas related to socially inclusive growth were not taken into account during the prioritization of green growth areas as part of the stakeholder consultation. Within the GGPA, socially inclusive growth is regarded as a cross-cutting area that is relevant for all sectors when moving toward green growth. Based on this rationale, recommendations for all sector interventions take this dimension into account.

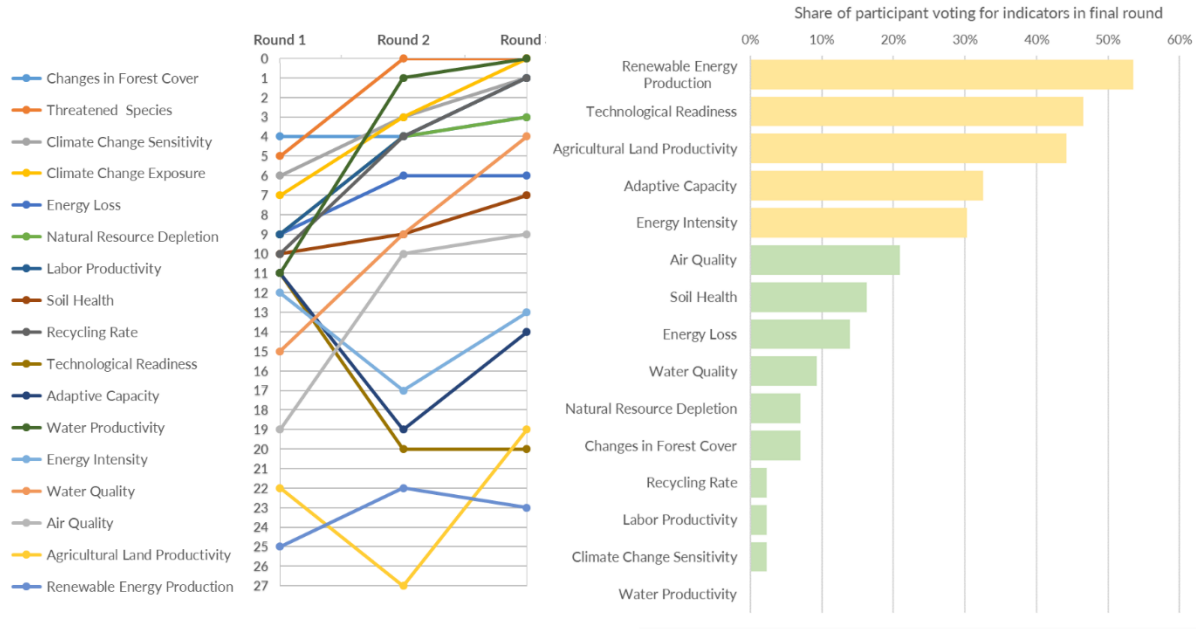
2.3.4 Prioritization of Areas by Stakeholders

An essential part of the GGPA process is to gather input from a broad range of stakeholders through an interactive Delphi-based workshop. As part of this workshop, GGGI conducted three survey rounds and four parallel group discussions. The objective was to validate the findings of the preliminary assessment, to select priority areas and to identify the relevant sectors related to each of the areas. After each survey round, the results were discussed among participants, with the discussion results serving as a starting point for the following survey round.

The sequence of surveys and discussions proved very successful reaching consensus on the priority areas and sectors across the different government ministries and departments. A final list of the relevant areas and sectors was defined after the workshop by combining the result of the Delphi surveys with the inputs from individual discussion groups as well as the findings of the preliminary assessment.

The five areas that were prioritized are, in the order of number of votes obtained: Renewable Energy Production, Technological Readiness, Agricultural Land Productivity, Adaptive Capacity, and Energy Intensity (see Figure 7).

Figure 7: Identified Priority Areas



Source: GGGI, based on the results of the workshop

Four of the five prioritized areas are related to the economic aspects of green growth. Technological Readiness, Agricultural Land Productivity, Renewable Energy, and Energy Intensity are all related to the future economic development of Nepal, considering greener solutions. Adaptive Capacity is an area that has emerged as an important driver for Nepal to guarantee the sustainability of its development as well as the resilience of its economy and communities.

The results of the stakeholder consultation show a certain mismatch compared to the results of the preliminary assessment. Participants did not prioritize any area related to eco-friendly growth among the five areas receiving the highest number of votes, whereas the preliminary assessment identified several potential priorities in this dimension of green growth. Stakeholder's prioritization of Agricultural Land Productivity, Energy Intensity, and Adaptive Capacity among the top 5 voted issues is contrary to the results of the preliminary assessment, which did not identify these areas as underperforming compared to LIC. One potential reason for this mismatch was that stakeholders considered energy intensity and renewable energy in broader terms than the indicators used in the preliminary assessment.

In order to ensure that results of both the preliminary assessment and the stakeholder consultation are adequately reflected in the analysis and recommendations, four broader clusters (see Table 2) have been defined. This ensures that important aspects are not excluded from further analysis.

Table 2: Priority Sectors and Related Areas

	Cluster	Green Growth Area
1	Energy	Renewable Energy Production Energy Intensity Electricity Losses
2	Agriculture	Agricultural Land Productivity Water Productivity Water Quality Soil Health
3	Technological Readiness	Technological Readiness
4	Adaptive Capacity	Adaptive Capacity

Source: GGGI

In addition to the top five areas prioritized by stakeholder and presented above, several aspects were added to form these clusters. Based on the results of the preliminary assessment, GGGI included Energy Loss, Water Productivity, Water Quality, and Soil Health in the analysis. Energy Loss forms part of a wider cluster relating to energy (together with Renewable Energy Production and Energy Intensity). Water Productivity, Water Quality, and Soil Health are considered in the context of agriculture, alongside Agricultural Land Productivity.

It is important to highlight that Air Quality was identified as an area of major concern in the preliminary assessment. It has been ranked 6th in the final prioritization by stakeholders. Therefore, while not being discussed in detail as part of the sector assessments, Air Quality is addressed in a separate exercise.

Sector Assessment

3.1 Prioritized Sectors for Green Growth

This chapter provides an assessment of four sectors that are responsible for, or related to, the selected green growth priority areas (identified in chapter 2.3.4). Further, this chapter presents a number of recommendations for high impact green growth interventions to address the priority areas in each of the respective sectors.

Priority sectors have been identified based on economic sectors as per the OECD classification.[15] The selection has been based on the sector-area linkages identified during the consultation workshop. The sectors chosen are presented in Table 3.

Table 3: Priority Sectors and Related Areas

	Sector	Green Growth Area
1	Forestry and land-use	Agricultural land productivity and soil health Adaptive capacity
2	Agriculture	Agricultural land productivity and soil health Water productivity and water quality Adaptive capacity Technological readiness
3	Energy	Renewable energy Energy intensity Electricity losses Adaptive capacity
4	Water Management[16]	Agricultural land productivity and water productivity Renewable energy Water quality and soil health Adaptive capacity

Source: GGGI

It needs to be highlighted that further sectors are considered of strategic importance and of high potential for green growth in Nepal. One example is urbanization (see Box 4: Air Pollution—A Major Concern in Urban Areas).

3.2 Forestry and Land-Use

The total forest area of Nepal is estimated to be approximately 5.96 million hectares, which together with other wooded lands accounts for nearly 45% of Nepal's total area (DFRS 2015).

[15] For purposes of this GGPA, the term *sector* is utilized as by the OECD to denote thematic areas and does not refer to ministries or departments of the Nepalese government.
[16] Note, as a result of the stakeholder consultation, it was decided that for the water sector, this report focuses on Water Resources Management only, excluding the provision of drinking water and sanitation services. Furthermore, based on stakeholder priorities, this report looks at water management related to hydropower as a source of renewable energy, even though the GGPA indicator on renewable energy explicitly excludes hydropower.

Box 4: Air Pollution—A Major Concern in Urban Areas

Although it is not addressed as part of the sector assessments of the country's Green Growth Potential Assessment, air quality is an important development issue in Nepal. Air quality is an area of concern in Nepal, with only China, India, and Bangladesh performing lower in a global comparison. In recent years, air quality has been receiving a high level of attention at the international level. Prominent reports all published during 2016 by major international organizations such as the World Bank, OECD, WHO, IEA, UNICEF show that air quality is a major concern for environmental quality and human health, with severe economic implications. In the view of GGGI, air quality falls squarely within the international green growth agenda.

Nepal is one of the least urbanized countries in the world. However, at the same time, Nepal is one of the fastest urbanizing countries, with annual urbanization growth being projected at 1.9% from 2014 to 2050 (UNDESA 2014). At an urban growth rate of 3.6% Kathmandu Valley is one of the fastest-growing urban agglomerations in South Asia (MoUD 2015). The valley represents 24% of the total urban population in Nepal (MoUD 2015). Economic opportunities, the possibility to sell underdeveloped land, the political situation (Kathmandu is deemed the safest place in Nepal), and access to public services such as transportation, electricity, water, health services, etc., are among the driving factors behind Kathmandu's rapid urbanization (Thapa and Murayama 2010). As a result, air quality has become an important issue in the Kathmandu Valley.

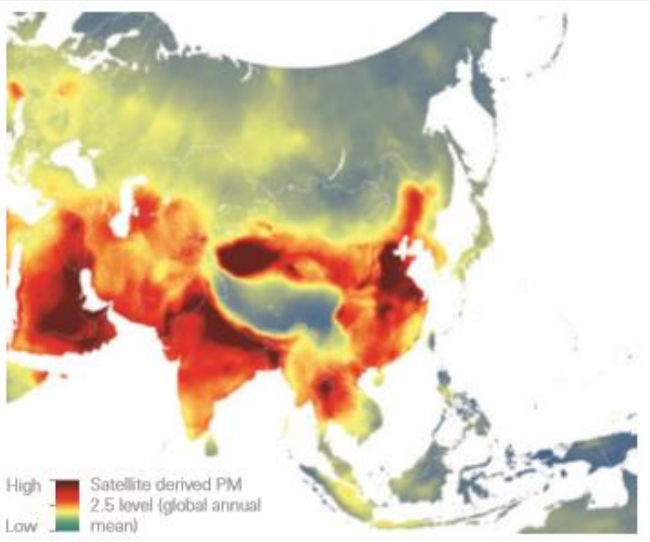
In light of the Nepal 2030 vision, detailing the country's aspiration to graduate from its least developed country status to join the ranks of the middle-income countries, urbanization plays a prominent role in transforming the country's economy and improve both prosperity and livability. However, urbanization also leads to struggles over access to services such as infrastructure, electricity, water and sanitation, land and housing, and imminent environmental problems arising from uncontrolled urbanization (WB 2016a).

According to the Environmental Performance Index (EPI), the average exposure to $PM_{2.5}$ for Nepal in 2014 was 30.40 $\mu g/m^3$, three times higher than the WHO standard of 10 $\mu g/m^3$ (EPI 2016). In 2016, the annual average exposure of $PM_{2.5}$ in Kathmandu Valley was nearly five times higher than the WHO standard (WHO 2016), and more than four times higher than in the entire country on average (WB 2016b). The concentration has almost doubled within the past three decades and is exacerbated by the changing climate. Satellite images taken between 2012 and 2014 show that Nepal is among the countries with the highest $PM_{2.5}$ concentrations in Asia.

There are several causes for air pollution in urban areas of Nepal, particularly in the Kathmandu Valley. The list of sources includes rapid motorization combined with a lack of public transportation; valley centric industrialization (industrial activities are mostly centered 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), and the widespread use of diesel generators for electricity generation (Clean Energy Nepal 2014). The use of diesel generators is particularly critical in times of power cuts due to load shedding. Estimates suggest that during the times of planned power cuts, air quality drops by 40% due to the widespread use of diesel generators.

In 2013, more than 22,000 deaths in Nepal were attributed to air pollution (Clean Energy Nepal 2014). In that same year, air pollution-induced loss of welfare was recorded at USD 2.8 billion, which is equivalent to nearly 5% of the country's GDP (ibid.). This is equivalent to approximately 40% of the losses and damages caused by the 2015 earthquake, estimated at USD 7 billion (NPC 2015b). However, it is 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, e.g., healthcare cost will increase, lost working days will affect labor productivity, and crop yields will decline (OECD 2016).

Figure 8: Annual Average of $PM_{2.5}$ Levels 2012-2014



Source: UNICEF 2016

The Government of Nepal's Resilient Urban Development Strategy emphasizes inclusiveness, aiming to ensure that vulnerable groups, such as the poor, women and children, are not left behind. However, neglecting air pollution control and mitigation as part of this strategy could have the opposite effect. The exposure to toxic levels of air pollution is particularly detrimental to women, causing miscarriages, premature delivery, and low birth weight (UNICEF 2016). Moreover, air pollution accounts for almost 1 in 10 of all child fatalities under the age of five, while ultrafine airborne pollutants can lead to permanent impaired cognitive development in children (ibid.).

While efforts to address water stress and degrading soil quality are gradually being undertaken more systematically, air pollution control in urban areas has not been a priority. Failure to address air pollution could hinder Nepal from fully tapping into the opportunities that urbanization offers when managed well. In this respect, mainstreaming air pollution control as part of the country's Urban Development Strategy is regarded as instrumental. This could include measures such as developing better spatial and connectivity plans, introducing and improving the quality of (green) public transportation, as well as investing in public urban spaces to enhance pedestrian and streetscapes. Issues such as the use of diesel generators during planned power cuts and the emission of fine particulate matter need to be addressed in parallel in order to create a lasting impact. Such measures present policy options that address both air pollution as well as other basic needs, such as transportation or reliable access to electricity.

In this context, it is noteworthy that the Government of Nepal has already committed to pursue the SDGs, addressing air pollution in 10 of the 17 goals. Actions targeted at air quality improvement (such as public transportation, electric mobility, reduction in fossil fuel for transport, etc.) are also identified as a priority under Nepal's Nationally Determined Contributions under the Paris Agreement. Furthermore, the issue of air pollution is attracting international attention. This momentum should be used as an opportunity to address the deterioration of air quality more systematically and to mobilize already existing opportunities for international financing.

Forest products and services significantly contribute to the Nepalese economy. In official economic statistics, forestry is included under the agricultural sector. Recent and disaggregated data of the contribution of the forestry sector to GDP is not available due to a lack of systematic accounting. Estimates of the contribution of the forestry sector to the national GDP range from 3.5% to 15% (see e.g., Paudel et al. 2011; Amatya 2013).

Forest and shrub land are integral parts of Nepal's agriculture and rural livelihoods, serving as an important resource for livelihoods, income and employment (ADB 2014). About 70% of the population depends directly on forest products (timber, fuel, fodder, compost, and other non-timber forest products, NTFPs) for household and subsistence farming as well as commercial and industrial use (Magrath et al. 2013). Additionally, forests supply more than three quarters of rural energy needs in the form of fuelwood (Paudel et al. 2011).

The Government of Nepal has recognized the importance of forests to rural livelihoods. A community forest program (focused on the middle mountains) has been in place for two decades, and is recognized by many international institutions to be an innovative and largely successful approach. It has brought approximately 23% of the country's forests under community management and has delivered livelihood benefits for around 40% of the country's population (Paudel et al. 2011). The Department of Forests has indicated that more than two million households are part of community forest groups, managing 1.7 million ha of forest (RECOFTC 2016).

Beyond their importance for the country's economy, forests also play an important role in climate regulation, carbon sequestration, nutrient cycling, and water regulation (Magrath et al. 2013).

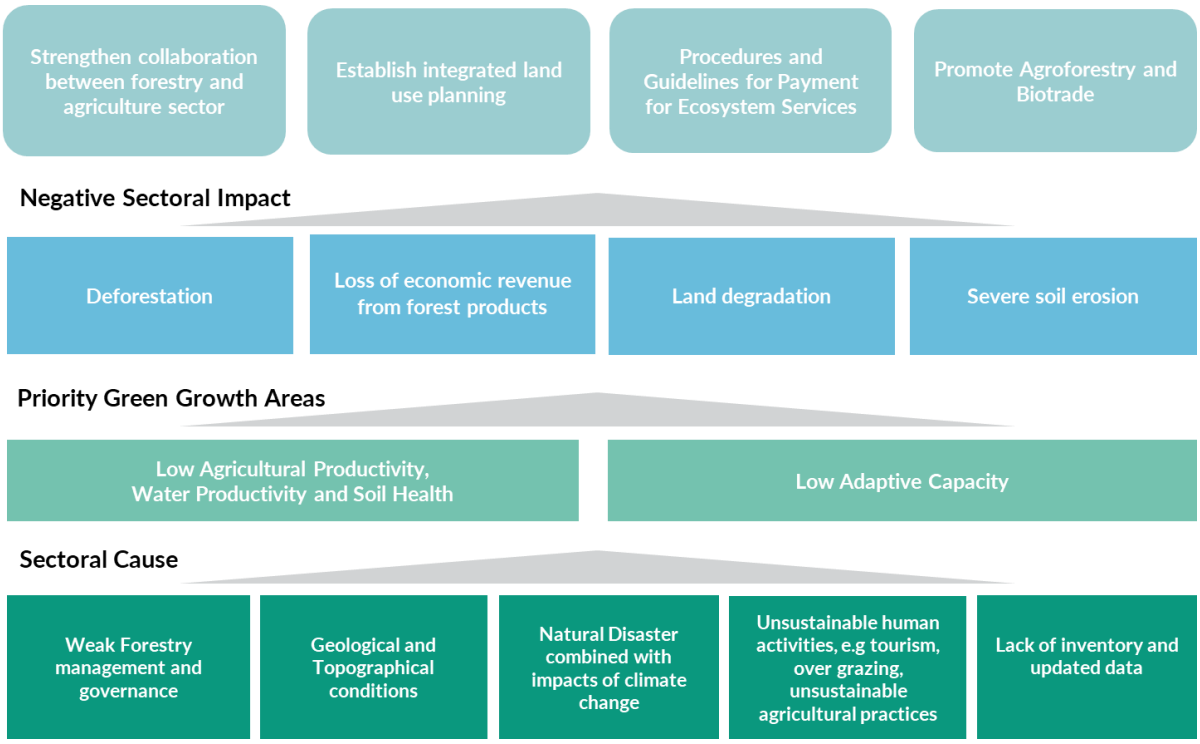
Although the deforestation rate has slowed down through the last decades (estimated at 1.4% by Paudel et al. 2011), it continues to be a serious threat for Nepal's forests and its local communities (Magrath et al. 2013).[17] There are nine major reasons for ongoing deforestation and forest degradation in Nepal: (1) the high dependence of a large share of the population on forest and forest products due to poverty, a lack of livelihood alternatives and limited access to alternatives for fuel and timber, (2) illegal harvesting of forest products, (3) unsustainable harvesting practices, (4) forest fires, (5) encroachment, especially due to issues like the expansion of agricultural lands or unclear land tenure, (6) overgrazing, (7) infrastructure development without environmental impact assessments etc., (8) resettlement, as well as (9) expansion of invasive plant species (MFSC 2009).

Regarding land use, land degradation is a problem in all geographical areas of Nepal. A wide range of factors cause land degradation from water-induced erosion, floods and landslides to deforestation and wind erosion. In 2008, about half of the country's total land area was affected by water-induced erosion (6.7 million ha) and/or wind erosion (0.6 million ha). The national agriculture sample census in 2011/12 indicated that 2.4% of cultivable land had been rendered uncultivable due to flood and erosion (ADB 2014). In addition, deforestation in combination with overgrazing and poorly maintained marginal lands contributes to the degradation of watersheds which in turn effect soil health.

The following section discusses the relevance of the forestry and land use sector to the priority areas identified in Chapter 2.3.4. A set of green growth interventions is recommended to address the identified priority areas. These recommendations are based on the identified causes, their negative impacts, as well as on an assessment of the existing governance structure and the policy framework within the forestry and land-use sector. A summary is provided in Figure 9.

[17] Note that due to a difference in definitions (as well as due to a lack of comprehensive monitoring in Nepal), the deforestation rate in this section differs from the rate of Change in Forest Cover discussed as part of the preliminary assessment in chapter 2.3.2. Deforestation refers to the permanent destruction of forests in order to make land available for other uses. The Change of Forest Cover indicator measures the change in forest cover between 2005 and 2015, defining of forest as "land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ," which also includes areas under afforestation (see definition in Annex 2).

Figure 9: Overview of the Forestry and Land-Use Sector



Source: GGGI

3.2.1 Relevance of the Forestry and Land-Use Sector to the Priority Areas

Three areas have been identified as relevant for the forestry and land-use sector, i.e., (1) Agricultural Land Productivity, (2) Soil Health, and (3) Adaptive Capacity.

Agricultural Land Productivity and Soil Health

The Forestry and Land-Use sector has a direct impact on both Agricultural Land Productivity and Soil Health in several ways. Improper land-use, such as non-scientific cultivation practices, overgrazing, high livestock stocking rate, as well as construction without integrating conservation measures have all exacerbated the problems of soil erosion, landslides, flooding, and environmental degradation.

In Nepal's lowlands, improper land-use is strongly related to migration from rural areas, with implications for land productivity as well as soil health. First, insufficient incomes from farming activities can lead to abandonment of agricultural land, which reduces the country's overall agricultural productivity. (However, abandonment of agricultural land can have positive impacts on soil health if reforestation occurs in the abandoned areas.) Second, the pressure on land and soil health increases in those areas where migrants settle. In cases where fertile land is converted into settlements without proper planning, the potential for higher agricultural productivity is lost. In cases where forestland is converted into settlements or agricultural land, agricultural productivity might increase to the detriment of soil health.

In the mountainous regions, the threat of land degradation and reduced soil health stems from both natural drivers and unsustainable human activities, such as overexploitation of forest products and mineral resources, unplanned and unregulated construction of rural roads, and inappropriate farming

practices (MFSC 2015). Agriculture in the mountainous areas depends heavily on forest resources such as the nutrients provided by leaf litter, fodder, and fuel wood, among other things (Balla et al. 2014). According to estimates dating from the early 1990s, between 3 and 6.5 ha of forestland are required to support each hectare of cropland (ibid.). The main challenge with regard to land-use and forestry in Nepal is how to improve productivity and income generating activities for local communities through the use of existing land and water resources, while simultaneously maintaining forest integrity and maximizing agricultural productivity.

While a large percentage of the population relies on forest resources to secure their livelihoods, the economic benefits of forest conservation are being underestimated. Therefore, one of the main challenges in the forestry sector is to demonstrate how forest products can contribute to the economy and reduce poverty. Making use of non-timber forest products (NTFP) more effectively could lead to an improvement of rural livelihoods. It could also ease the pressure on forests in such a way that conversion to agricultural land or overharvesting of timber is not economically more attractive than the sustainable use of forest products.

NTFPs in Nepal can be classified into those used and traded locally for subsistence purposes, and those that are commercially traded. Case studies show that currently, communities are not necessarily collecting the economically most valuable forest products. Often, they rather focus on leaf litter and fuel wood as the basic necessities either for agricultural purposes or as a source of energy (Baral et al. 2014). There is variety of NTFPs that have a promising potential for commercialization and increasing local incomes. However, challenges exist to tap this potential. First, prices are low and highly determined by the international and regional markets. Second, local communities often lack the knowledge and information to successfully harvest non-timber forest products. Third, the communities are not able to establish the necessary market linkages, nor to put processes in place for value addition to fully tap into the potential of these products (Banjade 2008).

Another important challenge to Agricultural Land Productivity and Soil Health is tourism related to mountain trekking. This has caused adverse environmental impacts due to forest clearance for trekking routes and tree felling to meet the demand for cooking and heating wood along the routes. It also creates competition with local inhabitants for natural resources due to overcrowding in destinations. The introduction of the concept of eco-tourism has increased awareness among the local communities to conserve natural resources while attracting tourists. However, the concept has not yet been widely adopted enough to show discernible results.

Adaptive Capacity

Forestry-dependent communities are susceptible to changes in climate, with potentially negative effects on wellbeing and food security. Changes in rainfall patterns and shifts in local climatic conditions are expected to change the distribution of plants, alter the cycles of fruiting and flowering, and cause a loss of soil moisture. This would lead to a loss in forest resources on which local communities depend, such as fodder grasses. Furthermore, declining water levels in rivers are expected to have a negative impact on forest productivity (MFSC 2014b). An increased risk of droughts has negative impacts on food security, particularly for those communities that complement their agricultural activities with forest products (WRI n.d.).

In areas of increasing aridity, forest fires are a major risk, particularly in forests that are managed by local communities. Regions affected by those fires are more prone to further erosion and land degradation. Furthermore, forest fires additionally could have impacts on the glaciers and snow melt rates and in that way locally exacerbate the already occurring negative impacts of climate change (WRI n.d.).

With a high dependency on natural resources, lack of access to basic infrastructure and widespread poverty, the rural population in forest areas is among the most vulnerable communities in Nepal. On the positive side, Nepal already has a functioning approach for community based forest management. This entails a huge potential to reach out to and support rural forest communities in enhancing their adaptive capacity in the face of climate change.

3.2.2 Governance Structure and Policy Framework

The Ministry of Forests and Soil Conservation (MFSC) as well as the Ministry of Land Reform and Management (MoLRM) are the key ministries in charge of the Forestry and Land-Use sector. Under the MFSC, the Department of Forests manages the country's forest resources with the stated objective of conserving the natural environment and supplying forest products to the people. Meanwhile, the Department for Soil Conservation and Watershed Management is in charge of implementing programs to combat soil erosion and watershed degradation.

On the local level, community forests are managed by Community Forest User Groups (CFUGs), with relatively little involvement from the national government. Nepal's community-based forest management is generally considered a major success story, having contributed to job creation and income generation for local communities, while protecting and restoring forest resources (Anup 2016). The program has brought approximately 23% of the country's forests under community management and has delivered livelihood benefits to around 40% of the country's population (Paudel et al. 2011). However, despite the success of community-managed forests, governance in the forestry sector is still recognized as being weak. There are a number of challenges being faced by CFUGs, such as ineffective use of community revenues and benefits being mostly channeled to local elites (Magrath et al. 2013).

With regard to the policy framework for land use, the GoN has adopted the National Land-Use Policy in 2012, and issued the Land-Use Program Implementation Directives in the same year. Both policy and directives are currently in the process of implementation, involving public engagement and awareness raising regarding the zoning and planning process. While the national Land-Use Policy introduced strong regulatory measures, its implementation is facing challenges due to a long history of a non-regulated land use system in Nepal and little awareness among the public regarding the need for stronger regulation (Paudel et al. 2013). However, in the wake of the 2015 earthquake, implementation of policies and programs for land-use planning is increasingly seen as necessary for successful reconstruction as well as for enhancing resilience to natural disasters.

Concerning forestry, in 2015 the GoN updated its Forest Policy with the main objective of contributing to local and national development through sustainable management of forests, biodiversity, and watersheds. The policy further aims at creating employment opportunities and to increase income of poor and vulnerable communities by promoting sustainable use of forests and forestry resources, including the introduction of payment for eco-system service schemes (MFSC 2015).

A ten-year Forest Sector Strategy is currently being developed, which is alleged to support the adaptive capacity of local communities and forest ecosystems, as well as to promote community-based resilience and mitigation measures. Furthermore, the strategy aims to establish forest carbon trade mechanisms by linking forests, biodiversity and watershed conservation with markets. Finally, the strategy envisions the development and strengthening of mechanisms for payment for ecosystem services (MFSC 2015). As the strategy is still pending finalization, the concrete implementation mechanisms are yet to be established.

The critical importance of forests as carbon sinks and as potential sources of carbon emissions, when forests are lost or become degraded, is recognized by the ongoing REDD+[18] process in Nepal. This process aims at mitigating climate change through reducing net emissions of greenhouse gases through improved forest management. Since 2008, the Forest Carbon Partnership Facility of the World Bank provides assistance for the preparation of Nepal's REDD+ strategy, which will form an integral part of the Forest Sector Strategy. How REDD+ is implemented will have a significant impact on the adaptive capacity at local level. Therefore, it is crucial that REDD+ and adaptation processes are coordinated at the national level (West 2012).

Although important plans and policies are in place, implementation remains an issue. Government agencies responsible for the Forestry and Land-Use sector need to strengthen enforcement, as well as legal provisions and transparency mechanisms. The need for strengthening is clear from examples of non-transparent allocations of permits for logging, ecosystem services, conservation, and eco-tourism in protected areas (Subedi 2014), as well as the lack of updated land surveys.

3.2.3 Recommendations

The Forestry and Land-Use sector has the potential to address several of Nepal's priority green growth areas, including Water and Agricultural Land Productivity, Soil Health, and Adaptive Capacity. Four concrete green growth interventions in the forestry and land use sector are proposed in order to address these areas.

1. *Strengthen the Collaboration Between the Agricultural and Forestry Sectors*

Agriculture and forestry in Nepal are strongly interlinked. Strengthening the agriculture-forestry nexus as well as the alignment of policies and programs is crucial to enable local communities to be more resilient to climate change and to improve food security. Such collaboration would also improve sustainability. It is crucial to better align strategies and policies in the agricultural and forestry sectors, particularly for the benefit of small-scale farmers and others whose livelihoods depend on forest resources. One example where such collaboration would be useful is in the area of protected forests. There, small-scale farmers are currently not allowed to take out leaf litter that can be used for subsistence agriculture.

2. *Establish Integrated Land-Use Planning*

On the policy level, land-use planning remains one of the major challenges in Nepal. The Government of Nepal has made land-use reform a priority and is trying to raise awareness for land use planning and zoning. However, so far, integrated land-use planning that combines zoning with land management is not being implemented. This becomes increasingly urgent, as urbanization in Nepal advances rapidly with a growing number of people migrating towards urban areas and, as a result, a considerable amount of fertile agricultural land being converted into settlements.

The cycle of land degradation, reduced agricultural productivity and food insecurity cannot be broken without proper land-use planning that takes into account the criteria of sustainability. To break this cycle, the process of land categorization should be prioritized. Land-Use should be defined based on scientific evidence and criteria regarding soil and surface conditions such as fertility, erosion, exposure to floods and landslides, among other things.

[18] Reducing Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.

In light of the ongoing decentralization process, the responsibilities and mandates for land-use planning need to be clearly defined on different governance levels in order to ensure accountability and transparency. In this context, it is recommended that municipalities are given the authority to develop local land-use plans in collaboration with relevant stakeholders. The consultation of stakeholders is essential to ensure that the zoning and planning process occurs in an inclusive and integrated manner. This will allow for the recuperation of fertile soils for farming, which are not currently used for agricultural purposes. Finally, municipalities developing their local land-use plans provides an opportunity to address the need of housing alternatives for low-income communities. It is recommended that the decentralized planning be piloted in the Kathmandu valley, where the need for land-use planning is greatest.

3. Establish Procedures and Guidelines for Payment for Ecosystem Services

Various practical experiences of payment for ecosystem services (PES) exist in Nepal through individual pilot projects. While many of these projects are considered successful, a systematic up-scaling based on good practices is missing. As a step in this direction, the Government of Nepal has recently formulated its policy on PES and amended the Forest Act accordingly.

In order to ensure effective implementation of PES, it is necessary to provide concrete regulations and technical guidance for implementation. Based on existing good practices, the GoN should put in place general procedures and guidelines for PES schemes. These guidelines should include a clear definition of the specific services, the service providers, and the beneficiaries that are to be compensated, e.g., how water users benefit from water conservation by forest user groups. Forest and water user groups often have overlapping memberships. Therefore, it is recommended to involve both groups in the development of PES schemes. Furthermore, the government should consider applying PES beyond the forestry sector.

It is suggested to consider the establishment of a platform that allows for networking and knowledge exchange between the different actors on the local and national level. Such a platform offers an opportunity to capitalize on the existing experiences and to be able to upscale what is working well.

4. Promote Agroforestry and Biotrade

There is a significant untapped potential for sustainable local development with regard to non-timber forest products, such as indigenous and medicinal plants. To take advantage of this potential, improved coordination among the Forestry and Agricultural sectors is required. This coordination should be enshrined in the national Agroforestry Policy that is currently under development. However, changes only at the policy level are not sufficient to capitalize on the full potential of agroforestry and biotrade. Market linkages as well as local value chains will also have to be supported in order to allow for local economies to thrive with new and sustainable products.

Furthermore, farmers require concrete technical and financial support. Apart from promoting the adoption of sustainable agroforestry practices, support programs for business development, the creation of market linkages etc. for producers are required. Such programs would enable them to bring added value to their products and to market them, both domestically and internationally. The Chamber of Commerce as well as industry associations can play a key role in this respect. This recommendation is closely related to the recommendation on the promotion of climate smart agriculture (see section 3.3.3).

3.3 Agriculture

Agriculture contributes approximately one third of Nepal's GDP (WB 2016). The sector retains the majority of the labor force, offering employment to about two-thirds of the economically active population (NPC 2010). Agricultural activities are characterized by subsistence needs rather than commercial production. Over 70% of farmers are small-holders, cultivating land of less than one hectare, and approximately 80% of Nepalis living in rural areas are dependent on subsistence farming (IFAD 2013).

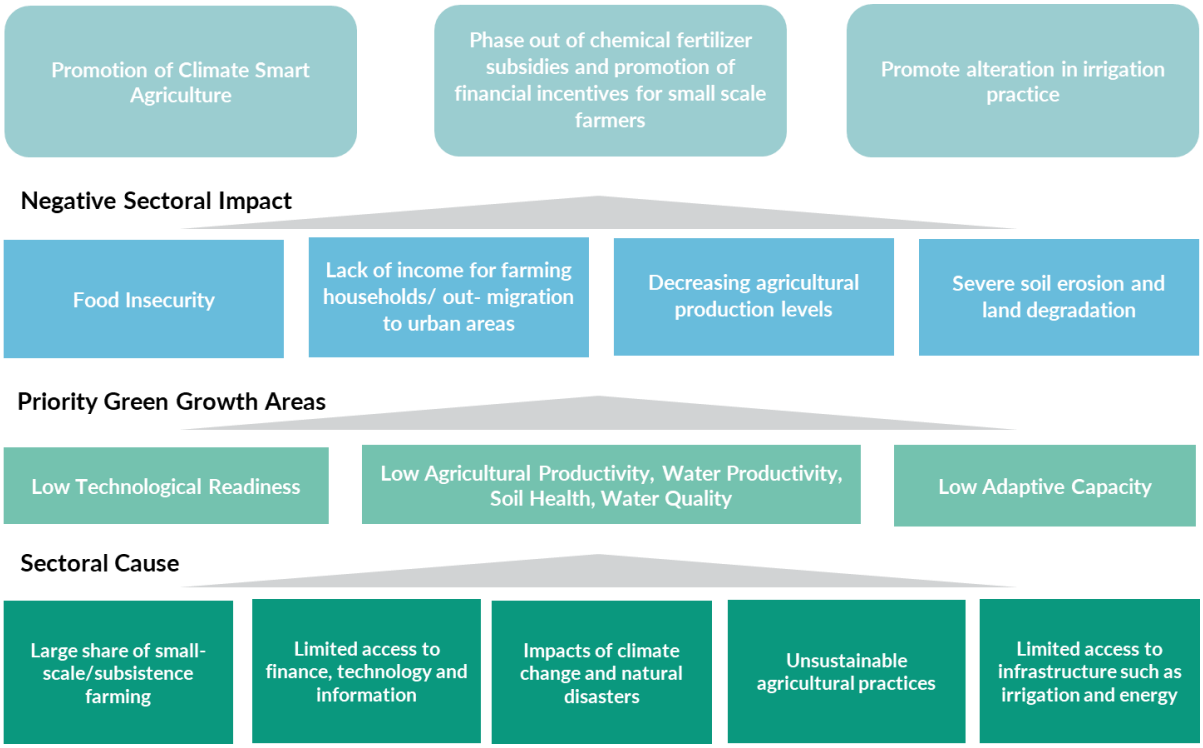
This is reflected in the low productivity of agricultural labor in Nepal, amounting to USD 794 per worker in 2014. This is only about one fourth of the productivity level of the rest of the economy. Low-income in the agricultural sector has created strong incentives for a large part of the most productive labor force (the ones in 20 to 40 age group) to seek employment abroad or to migrate to the cities. As a result, farmlands are abandoned, and Nepal has become a net food importer in recent years.

Agricultural land in Nepal is mostly rain-fed, highly dependent on the monsoon season, climate sensitive, and relatively unproductive. Cereal crops including rice, wheat, maize, millet, barely, and buckwheat are the most relevant crops in the Nepali agriculture. Food insecurity is a major concern, mainly due to natural disasters, the impacts of climate change, poor soil quality, food price inflation, and the lack of technology and irrigation facilities.

The Agricultural sector has experienced growth, albeit at a slow pace of less than 3% per year, since the Agriculture Perspective Plan (APP) became effective in 1995 (USAID 2008). This growth can largely be attributed to the expansion of the country's rural road network and improvements in irrigation cover. However, the increase is not sufficient to lift a large number of people engaged in agriculture out of poverty, to reduce malnutrition, and to ensure food security. Ultimately, growth in agricultural output has to accelerate in order to cope with the growing population, to contribute to poverty reduction, and to improve food security.

The following sections discuss the relevance of the agricultural sector to the priority areas identified in Section 2.3.4. A set of green growth interventions is recommended to address the identified priority areas. These recommendations are based on the identified causes, their negative impacts, as well as on an assessment of the existing governance structure and the policy framework within the agriculture sector. A summary is provided in Figure 10.

Figure 10: Overview of the Agricultural Sector



Source: GGGI

3.3.1 Relevance of the Agriculture Sector to the Priority Areas

Six areas have been identified as being relevant for the agricultural sector. Those areas are discussed in three clusters, namely (1) Technological Readiness; (2) Agricultural Land Productivity, Water Productivity, Soil Health and Water Quality; and (3) Adaptive Capacity.

Technological Readiness

The use of modern technologies in the agricultural sector remains limited, which is one of the main reasons behind the slow growth rate in agricultural productivity. Agricultural technologies are mainly accessible and used in the regions adjacent to urban centers, leaving farmers in the rural and remote areas lagging behind. In this context, high illiteracy is an important factor, caused by limited access to basic services including education among the rural population. The majority of farmers are unskilled and lack knowledge on updated cultivation techniques and practices, let alone on sustainability. Furthermore, universities as centers of excellence for advancing agricultural practices in Nepal are teaching outdated knowledge in their curricula.

In cases where technologies have been introduced, farmers were often unable to take advantage of them due to a lack of financial resources (i.e., farmers could not afford to pay for the equipment) and a lack of services to operate the technology (i.e., electricity or fuel).

Agricultural Land Productivity, Water Productivity, Soil Health, and Water Quality

Farming activities, in Nepal, are generally water intensive, and over 95% of the country's water consumption is for agricultural purposes (MoSTE 2014a). Approximately two-thirds of cultivated areas are heavily dependent on monsoon rainfall, and only 42% of Nepal's agricultural land is irrigated (WECS 2011; Karki and Gurung 2012). Therefore, climate-induced water stress directly affects

agricultural productivity. Increased temperature and rainfall variability have resulted in shifts in agro-ecological zones, prolonged dry spells, and higher incidences of pests and diseases (MoSTE 2014a). Increasing efforts are being made in research and education to use water more efficiently by bringing together modern science and indigenous knowledge. An example for such efforts is the concept of 'more crop per drop' to increase crop water productivity (FAO 2002).

Common agricultural practices in the country are based on the close relationship between crop production, livestock, and forestry, especially in the mid-hills. Trees and crops provide fodder and bedding materials for livestock, which in turn provides draft power and manure. Traditionally, soil fertility has been maintained through the use of compost and manure. However, Nepal has witnessed a decline in soil fertility in the last two decades (e.g., Shrestha et al. 2000). As of yet, very few studies have been conducted to analyses the reasons for this decline. Information on biological soil quality is almost non-existent (Bajracharya et al. 2006).

Some reasons for changes in soil properties and soil fertility losses are forest degradation and conversion of forests into land for agricultural use. Organic carbon, total nitrogen, and cation exchange capacity decreased after natural productive forests were converted to agriculture.

Also, the excessive use of fertilizer has negative impacts on soil health and fertility, as well as on water quality. This overuse is stimulated by government subsidies for chemical fertilizer and pesticides, accounting for up to one third of the agricultural budget. In addition to the excessive use of fertilizers, farmers also use banned but easily available pesticides. The impact of this practice is compounded by a general lack of control and monitoring concerning the use of fertilizers.

Adaptive Capacity

Agriculture-dependent livelihoods are susceptible to changes in climate. Increasing frequency in floods, droughts, hailstorms, thunderstorms, and cold and heat waves, as well as rising temperatures and changing precipitation patterns, have significant impacts on agricultural production, especially on rice yields. Estimates suggest that with every degree that the temperature rises during the period between July to September, rice production decreases by 235 kg/ha, or the equivalent of about 10% of the average production (MoSTE 2014a).

The impact of climate change is expected to be particularly severe in the mountainous regions. In the higher altitude, populations rely entirely on agriculture for their subsistence. Therefore, changes in climatic conditions that affect agricultural production and consequently food security will put these areas under particular economic and social stress.

Approximately 90% of crop loss in Nepal is due to weather- and climate-related events. Between 1971 and 2007, nearly 850,000 ha of crops were lost to such events (UNDP 2009). Of all hydro-meteorological hazards, drought has had the most severe impact accounting for nearly 40% of agricultural crop loss, followed by floods with 23% (ibid.). Pest and disease outbreaks among plants and animals, due to the changing climate, are another major concern.

3.3.2 Governance Structure and Policy Framework

In Nepal, agriculture is linked to a multitude of government branches. The key ministries engaged in the agricultural sector are the Ministry of Agricultural Development (MoAD), the Ministry of Livestock (MoL), the Ministry of Forests and Soil Conservation (MoFSC), the Ministry of Environment and Population (MoPE), the Ministry of Science and Technology (MoST), the Ministry of Federal Affairs and Local Development (MoFALD) and the Ministry of Irrigation (MoIr). Additionally, the Department of

Agriculture, universities, as well as other research and development institutions play an important role in this sector. Insufficient coordination among these actors combined with limited access to up-to-date knowledge is a major cause for the stagnation in agricultural development in Nepal.
There are a multitude of policies and strategies related to agricultural development in Nepal, such as the Irrigation Policy (2014), the Rangeland Policy (2012), the National Land Use Policy (2013) and the Agricultural Mechanization Promotion Policy (2014), among others. These policies are mainly based on the National Agricultural Policy, published in 2004, which retained the basic aspects of older plans, such as the Agriculture Perspective Plans (APP) from 1995 and 1997. Both, the National Agricultural Policy and the Agriculture Perspective Plan focused on food security, commercialization of agriculture, and sustainability through natural resource management. The 2004 policy reiterated that the improvements in living standards were to be achieved through transforming Nepal's subsistence oriented farming system into a commercial and competitive farming system.

However, these policies are yet to be implemented properly. This is reflected in the low coverage of irrigation, the lack of monitoring on the use of chemical fertilizers and pesticides, the limited use of modern technology, and the dwindling amount of agricultural land in the country due to conversion of fertile agricultural land into settlements.

Accompanying the numerous policies, the GoN has set up various plans and programs promoting efforts for the agriculture sector to cope with the projected impacts of climate change. Such efforts include establishing farmer schools to promote more resilient varieties of crops, the use of relevant local and indigenous knowledge, and the use of more efficient technologies. In addition, efforts are being undertaken to gradually move towards commercial agriculture. Finally, crop insurance has been introduced in the country. In 2015, the GoN spent USD 1.4 million to cover 75% of the insurance premiums for the farmers, while insurance companies covered the other 25%. The actual impact of this insurance policy has yet to be evaluated.

As part of the Environment-Friendly Local Governance (EFLG) framework, the GoN promotes rainwater harvesting and pond construction, organic farming, and reducing the use of agro-chemicals. Although the framework is not legally binding, the financial support associated with it has created a sense of constructive competitiveness among the Municipalities and Village Development Committees (VDCs).

3.3.3 Recommendations

The agricultural sector has the potential to enhance several of Nepal's priority green growth areas, including Water and Agricultural Land Productivity, Soil Health, Water Quality, Adaptive Capacity, and Technological Readiness. Three concrete green growth interventions in the sector are proposed in order to address these areas.

1. *The Promote of Climate Smart Agriculture*

Climate Smart Agriculture (CSA) is a concept that involves farming practices to improve productivity, climate change adaptation, and mitigation. CSA aims at adopting farming practices, technologies, and crops that are less water dependent, more resistant to climatic shifts, and put less pressure on forests and soils. Relevant examples of CSA are initiatives related to water efficiency, efficient use of chemical fertilizers, carbon sequestration agroforestry, and ancestral adaptation forestry.

In Nepal's case, CSA can be used to address aspects related to the link between agriculture and forestry, the production of forestry based products, and using trees to avoid erosion and land degradation. In addition, CSA incorporates practices to improve soil quality, for example through vermicomposting, zero-tilling or bio-char. Finally, the recuperation of traditional indigenous knowledge

and its adaptation to modern practices is regarded as beneficial to empower local communities, and to make agriculture more resilient to the impacts of climate change.

However, there are a number of preconditions for CSA to work on a large scale. Access to information, finance, and technology, the development of improved extension services, and a change in policies and practices with regard to the use of chemical fertilizers are necessary to help farmers switch their production processes.

2. Establish Financial Incentives for Adopting Sustainable Farming Practices

Shifting towards more sustainable and climate resilient agricultural practices requires providing financial support and targeted incentives. Approximately 30% of the annual Agriculture Ministry budget is currently used for subsidizing chemical fertilizers. Phasing out or reducing these subsidies would reduce adverse incentives and free up financial resources to support farmers to shift towards more sustainable farming practices.

Financial incentives need to be carefully designed. First, the existence of a clear and predictable policy framework that provides certainty for long-term business planning is essential for financial support to be effective. Second, a coherent incentive scheme needs to be developed, based on a mapping of and an alignment with existing financial incentives that are to be maintained. Existing and potential disincentives have to be identified and removed, such as subsidies for chemical fertilizers. Suitable new incentives have to be identified, e.g., credits for investments towards strengthening climate resilience.

Third, practical questions of which aspects to include in an incentive scheme and how to introduce the scheme need to be considered. These questions include whether and how to support crop diversification, access to markets, shift in technologies, as well as whether to offer direct support for production and agricultural inputs, to name just a few. Any change in technologies would require support for farmers, through an improved delivery of agricultural extension (i.e., agricultural advisory services) that is able to create awareness and provide farmers with the necessary knowledge and skills. It is recommended that any direct financial incentive should be complemented by improved access to financial services, such as micro credit programs that allow farmers to invest in technology to increase productivity and sustainability.

Finally, it is important to ensure that farmers are financially more independent and have the possibility to diversify their income. Access to micro credits and other financial schemes should be closely linked to CSA and/or organic agriculture. Attempts should also be made to create new income opportunities for farmers, for example through the support of rural entrepreneurship or through the development of value-added activities.

3. Promote Change in Irrigation Practices

Given the high seasonal variability of rainfall and river flows, irrigation is a key requirement for enhanced agricultural production in Nepal, especially in the dry season. However, the existing irrigation practices—mainly consisting of flood irrigation—are characterized by low efficiency. This is a result of a lack of technology, combined with a lack of knowledge and awareness among farmers about more water-efficient irrigation practices, such as micro-irrigation techniques. As a side effect, replacing flood irrigation will reduce the need for fertilizers, as organic matter is not washed from the field.

Different local conditions require different solutions for suitable irrigation systems. Behavioral change can only be expected if the benefits are demonstrated to the farmers on site. Therefore, reaching out to individual farmers and offering tailored irrigation schemes is essential for promoting green growth in the agricultural sector.

There are examples of such alternative irrigation schemes being piloted in Nepal. Entrepreneurs, after returning from abroad, have introduced new technologies such as drip or sprinkler irrigation. Organizing programs for farmer visits to observe such technologies in practice could motivate more farmers to adopt these technologies. Such activities could be implemented with the support of existing interest groups, such as the Water Users Associations.

3.4 Energy

The energy situation in Nepal is characterized by the widespread use of traditional biomass[19] as the primary source of energy, low per capita energy consumption, as well as low electricity access. Total primary energy supply amounts to 11.69 Mtoe and total energy supply per capita is 0.41 (toe/capita), one of the lowest in the world (IEA 2016). The country's energy mix is dominated by biomass (78%), followed by petroleum products (12%), coal (4%), electricity from large-scale hydropower[20] (3%) and other renewables (3%). The residential sector represents 80% of the total energy consumption (Nakarmi 2016). Fuel wood remains the primary source of energy for cooking in households, though the share of liquid petroleum gas (LPG) has quadrupled in the last decade (NPC 2015a).

Nepal shows a significant imbalance between electricity generation and demand. According to the Nepal Electricity Authority (NEA), peak demand for electricity in 2015 amounted to 1,291.8 MW, whereas the total supply, including 224 MWs imported from India, only provided 706.8 MW (ibid.). Insufficient supply has severe impacts on the country's economic performance. For example, a recent study shows that the share of the manufacturing sector in GDP has declined from 9% to 6% since 2000 mostly because of unreliable electricity and power shortages (NEEP 2016). Furthermore, while three-quarters of the population has access to electricity[21], this figure does not reflect the intermittent nature of the supply due to widespread power shortages and frequent interruptions (NPC 2015a). With electricity demand growing by more than 7% per year in the fiscal year 2014 and 2015(NEA 2015a), the imbalance between supply and demand of electricity is likely to get worse.

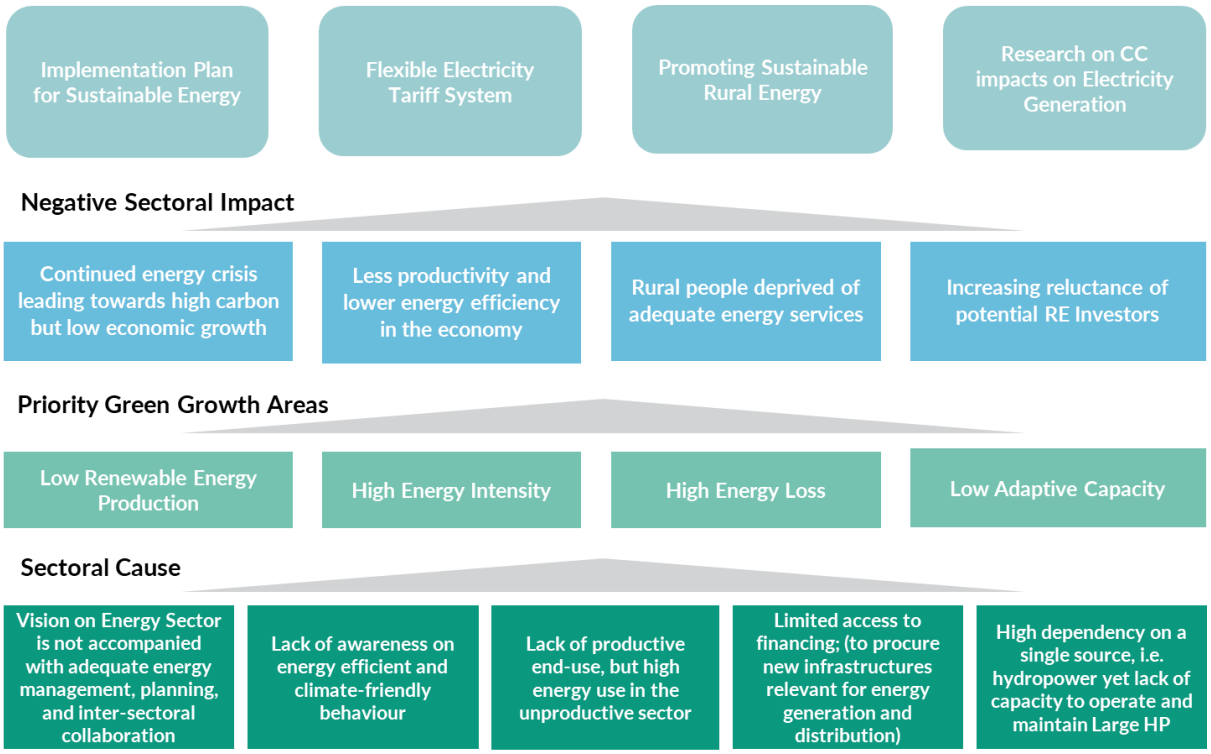
To address the situation, the GoN has set an ambitious target of installing 17,000MW of electricity generation capacity by 2030. In line with this goal, the country aims to increase the share of electricity generated from hydropower and renewable energy to 22% of the country's total final energy consumption as well as to provide electricity access to 99% of all households by 2030 (NPC 2011).

One way to achieve these goals lies in Nepal's potential for generating electricity from hydropower and renewable energy sources. The country has the potential to harness 42,000 MW of hydropower, over 100 MW of micro hydropower, 2,100 MW of solar power and 3,000 MW of wind power in a commercially viable way (NPC 2011). Current installed electricity generation capacity uses very little of this potential. The installed hydropower capacity amounts to just above 800 MW (NEA 2016). Grid connected solar PV and wind power for electricity generation is almost non-existent.

The following section discusses the relevance of the energy sector to the priority areas identified in Chapter 2.3.4. A set of green growth interventions is recommended to address the identified priority areas. These recommendations are based on the identified causes, their negative impacts, as well as on an assessment of the existing governance structure and the policy framework within the energy sector. A summary is provided in Figure 11.

[19] Firewood, agriculture residue and cattle dung
[20] Hydropower plant with more than 1MW installed capacity.
[21] The target includes both, on- and off-grid.

Figure 11: Overview on the Energy Sectors



Source: GGGI

3.4.1 Relevance of the Energy Sector to the Priority Areas

Four areas have been identified as being relevant for the energy sector. These four areas are (1) Renewable Energy Production, (2) Energy Intensity, (3) Energy Loss, and (4) Adaptive Capacity.

Renewable Energy

In 2014, more than 99% of electricity in Nepal was generated from hydropower plants (WDI 2016), making Nepal's electricity sector one of the cleanest in the world with emissions factoring at just 3 grams of CO_2 per kWh (Ellis et al. 2013). Most hydropower plants in Nepal are of the run-of-the-river type. Therefore, the country's electricity output depends strongly on river flows. In the dry season, when river flows are lowest, most of the country's hydropower plants operate only at 40-50% of their nameplate capacity. As a result, up to 12 hours of daily load shedding are common during that season.[22]

To cope with these regular electricity shortages, consumers rely on diesel generators as a backup for power generation. In 2012, the Nepal Oil Corporation estimated that the total capacity of installed diesel generators amounted to 531 MW, with use of these generators representing 40% of the country's total diesel consumption (Ellis et al. 2013). Approximately 340 GWh of electricity was generated in 2012/2013 from captive generators to overcome shortages in Kathmandu Valley alone (World Bank 2014b). Import of diesel has doubled from 300 million liters to 600 million liters within

[22] The 2016 dry season was the first that has not witnessed load shedding in the Kathmandu Valley, owing to higher electricity imports from India and effective load management. However, it remains to be seen whether this was an exception or can be sustained in coming years.

three-years (2008-2010) (Nakarmi 2016). In addition to creating a significant financial burden,[23] the use of diesel generators is also one of the major sources of air pollution in the Kathmandu Valley. Nepal's topography poses a significant challenge to providing universal access to electricity via the national grid, with approximately 85% of Nepal's territory consisting of hills and mountains. Extending the national grid to these remote areas with their difficult topography, dispersed settlements and limited financial resources would be expensive and time-consuming. Without access to the electricity grid, a large share of the rural population has currently no choice other than to use biomass or fossil fuels for cooking and lighting. In addition to contributing to greenhouse gas emissions, excessive use of biomass for cooking is one of the major causes of indoor air pollution in rural hamlets in Nepal, causing more than 7,500 premature deaths every year (Practical Action 2008). Off-grid renewable energy sources such as biogas, small-scale hydropower plants, wind, and solar, in combination with modern technologies such as improved cooking stoves, represent a clean and reliable option for electricity generation in rural areas. Currently contributing a negligible share of the total energy supply, the use of electricity from off-grid renewable sources represents a high potential as well as an economically viable option to overcome the challenge of topography (WECS 2014).

Energy Intensity

Nepal's overall energy intensity is higher than that of its neighboring countries as well as of many low-income and lower middle-income countries. This translates into the country's economy being less productive and less energy efficient.

Nepal's overall energy intensity has declined from 46.14MJ/USD in 1990 to 27.42MJ/USD in 2010. However, energy intensity in key sectors of the economy—industry, agriculture and commerce—has increased (Kandel 2013; NPC 2011). In the commercial sector, energy intensity is rising due to the increasing use of diesel generators. This caused the use of energy per unit of GDP to more than double between 1990 and 2011 (NPC 2015a). It demonstrates that the issue of energy intensity in Nepal is as much related to the fuel mix as it is to efficient end-use of energy.

The GoN aims to reduce energy intensity by 0.8% annually and to limit the consumption of petroleum products to 15% of total energy consumption by 2030 (NPC 2015a). As mentioned in Nepal's Sustainable Development Goals 2016-2030, this is to be achieved by both demand and supply-side measures. These measures include fostering the use of efficient lighting systems and appliances (in residential and commercial sectors), the use of efficient thermal and motive power technologies in the industrial sector, and the promotion of electric vehicles for public transportation.[24]

Electricity Losses

In 2011, transmission and distribution losses of electricity in Nepal amounted to as much as 34% of its total electricity supply. The figure decreased to about 25% within the period of 2015/2016.[25] These losses reflect a value of about USD 44 million annually.[26] Globally, the country ranks fourth in terms of electricity losses (NEF 2015).

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[23] For reference, while no disaggregated data for the monetary value of diesel imports alone is available, import costs of petroleum products amounted to 6% of Nepal's GDP in 2012 (Nakarmi 2016).
[24] Nepal has experience with electric public transport, including a trolley bus system in Kathmandu. This system is not operational anymore.
[25] For the period 2015/16, the National Electricity Authority (NEA) officially reported a total system loss of 25.78% (NEA 2016).
[26] Own calculation (see Annex 5)

High electricity losses are one of the main causes of the imbalance between electricity supply and demand in the country, leading to acute power shortage and hindering economic growth. Electricity losses are the result of technical shortcomings as well as non-technical factors. Major causes of technical losses include inefficient distribution lines extended over long distances, insufficient transmission capacity, old grids, improper load management, and inadequate maintenance of distribution lines, transformers, and substations. These technical losses are exacerbated by considerable non-technical losses, most of which can be attributed to theft and pilferage of electricity.

The NEA has undertaken several measures to reduce electricity losses such as closing distribution centers with losses of more than 50%, improved monitoring of the grid, establishing loss-reduction committees,[27] and penal actions against violators. However, these measures have not been successful in significantly curtailing losses (ADB 2013). Rather, system losses appear to have increased in the fiscal year 2015/16 compared to the previous fiscal year (NEA 2016).

Adaptive Capacity

Nepal is considered to be among the most vulnerable countries to the impacts of climate change (NPC 2015a). Climate change will particularly effect river flows and, as a result, the country's hydropower-dependent electricity supply (Ahmed and Suphachalasai 2014).

Most hydropower installations in Nepal are run-of-the-river, designed for dry season flow. Increasing temperatures are rapidly melting the Himalayan glaciers, leading to changes in river flows. River flows during the wet season as well as flows in snow fed rivers are increasing whereas dry season flows are decreasing (WECS 2011). Furthermore, melting glaciers increase the risk of floods from glacial lake outburst. Siltation from landslides during flood events is likely to further reduce power generation efficiency (Ahmed and Suphachalasai 2014)

While analysis shows that hydropower potential is expected to increase initially due to climate change, it is projected to decrease by one quarter at end of the century (Chaulagain 2006).

3.4.2 Governance Structure and Policy Framework

Several ministries and departments are involved in the management and development of the energy sector in Nepal. Responsibilities between the different entities are not clearly defined and overlapping. Coordination among different institutions is an area that requires utmost attention to avoid uncertainty and delay in decision-making. Coordination is also required to attract needed foreign investment to boost development of the energy sector, and attain the government's ambitious targets.

The Ministry of Energy (MoE) is the key line ministry responsible for the generation and distribution of electricity in Nepal. The Department of Electricity Development (DoED) is acting as the technical arm under the Ministry of Energy. It is responsible for the licensing and development of hydropower projects. Under the authority of the MoE, the Water and Energy Commission Secretariat (WECS) is formulating policies and collecting data for the energy sector. The Nepal Electricity Authority (NEA) is

[27] The sectoral committees were formed by the Ministry of Energy at different distribution centers headed by a Chief District Officer. Their duties include the collection of loss related data, analysis of the collected data, and they are the office responsible to improve the situation.

the sole government owned institution that owns most of the country's electricity generation and the entire transmission and distribution network.[28]

The procurement of hydropower projects above 500MW falls under the jurisdiction of the Investment Board.[29] It was established to attract investments for large infrastructure projects (ADB 2012). However, it is not fully functional due to political interferences, overlapping responsibilities as well as a lack of human and capital resources.

The Alternative Energy Promotion Centre (AEPC) under the Ministry of Population and Environment (MoPE) is responsible for developing and promoting renewable energy technologies in Nepal, including small-scale hydropower projects of less than 1MW as well as off-grid power generation up to 1MW. In addition, a number of other ministries are also engaged at different stages of hydropower development.

Nepal has a number of policies and acts that regulate electricity generation and distribution.[30] However, there is a lack of implementation and enforcement of these policies. The country has set a clear vision for its energy sector in various documents, outlining very ambitious targets.[31] However, the GoN is yet to make concrete plans to reach those targets. Furthermore, there is a need to compare and align targets in different policy documents developed by different government institutions. The need for adequate data and resources as well as a systematic approach to identify and prioritize actions to achieve these targets yet to be realized.

In response to the high electricity losses, NEA has set the target to reduce electricity losses to 10% by 2020 (NEF 2015). This would translate into annual savings of 4.14 billion Rs (over USD 38 million) (Nepal Energy Forum 2015). In order to achieve this target, NEA plans to implement a range of technical measures such as introducing automated meter reading for households, GIS-based monitoring of electricity supply and management, adding substations and transformers, as well as

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[28] Although NEA is considered as an autonomous entity, it does not have independency to craft its own financial and corporate policies (ADB 2012). The NEA also does not have the authority to determine the electricity tariffs and other charges, which is done through a permanent Electricity Tariff Fixation Commission.

[29] Main function of the investment board is to create an investor friendly environment for large infrastructure projects, including large-scale hydropower. The board provides services such as registration, licensing, immigration support, and bill clearance for potential investors.

[30] The main legislation consists of the Electricity Act (1992), the Hydropower Development Policy (2001), the National Water Resource Strategy (2002) and the Rural Energy Policy (2006).

[31] A number of goals for the energy sector are stated as part of Nepal's vision for 2030 as well as the country's SDG targets. These goals include providing electricity access to 99% of Nepali households, reducing the share of households using firewood for cooking to 10%, enhancing the country's capacity for electricity generation to at least 10 thousand megawatts, and decreasing energy intensity by 0.8% per annum (NPC 2015a). In addition, through its NDC Nepal has committed internationally to expand the share of renewables in the energy mix to 20% by 2020, as well as to increase the use of energy in the more productive sectors such as industry and commerce (MoPE 2016b). By 2050, Nepal aims to achieve 80% electrification through renewable energy sources including large hydro, and by doing so reducing its dependency on fossil fuels by 50% (ibid.). The NDC, under its mitigation actions also sets specific clean energy targets:

- 4,000 MW of hydroelectricity by 2020 and 12,000 MW by 2030;
- 2,100 MW of solar energy by 2030 with arrangements to distribute it through the grid;
- Additional 220 MW of electricity from bio-energy by 2030;
- Additional 50 MW of electricity from small and micro hydropower plants;
- Increase the share of biogas up to 10% as energy for cooking in rural areas; and

Equip every household in rural areas with smokeless (improved) cooking stoves (ICS) by 2030.
The GoN is currently drafting a Low Carbon Economic Development Strategy. In addition to the objectives stated above, the strategy aims to make Nepal self-dependent in clean energy by 2022 and increase economic growth through promotion of green technologies (Pokhrel 2015).

installing additional conductors. On the policy side, NEA aims to prepare a distribution master plan and a system loss reduction master plan. All these activities are being undertaken as a part of the Nepal Grid Solar and Energy Efficiency Project funded by World Bank (World Bank 2016c).

3.4.3 Recommendations

The energy sector has the potential to enhance several of Nepal's priority green growth areas, including Renewable Energy Production, Energy Intensity, Energy Loss and Adaptive Capacity. The following four concrete green growth interventions in the energy sector are recommended to address the identified areas.

1. Develop an Implementation Plan for Renewable Energy

As described above, the GoN has set very ambitious targets in the energy sector. However, a roadmap and implementation plan to achieve these goals is yet to be formulated. Therefore, the GoN is recommended to develop an implementation plan for renewable energy. This plan should streamline the existing targets and provide a coherent action plan. It should set out specific projects with the associated cost and priorities for the short, medium and long term. Furthermore, it is recommended for this plan to include a financing plan for the envisioned projects, containing provisions for monitoring and risk mitigation. Finally, it should establish a clear division of roles and responsibilities across different government entities.

Such implementation plans could be piloted on a municipal and city level, with projects that could include energy aspects in areas such as buildings, transportation, renewable energy from solar and wind, as well as waste-to-energy projects. For example, the promotion of electric vehicles is an initiative that addresses several of the priorities identified in this report. It would contribute to slow down the rapid growth of the country's CO_2 emissions. Furthermore, it represents an effective means to address the issue of air quality in urban areas and its severe implications on health. Finally, introducing electric vehicles for public transportation also aligns with the aim of the GoN to limit the use of petroleum products, which are entirely imported and therefore might undermine the country's energy security. Since the issue of air pollution is currently high on the international agenda, it also presents an opportunity to gain access to international financing.

2. Introduce a Flexible Electricity Tariff System

Adjusting the electricity tariff system can be regarded as a timely, efficient and low cost solution to address several of the issues within the electricity sector. Therefore, it is recommended for the GoN to consider the introduction of a more flexible, market-based electricity pricing system.

Currently, the Electricity Tariff Fixation Commission (ETFC) determines the electricity tariff in Nepal. This tariff generally remains fixed over long periods of time, completely decoupled from demand and supply in the system.[32] First, a more flexible, market-based tariff system would allow for prices to be adjusted based on demand and supply. To ensure that electricity remains affordable for low-income households and small businesses, government support should be provided for low-income consumers in a transparent manner.[33]

[32] The most recent changes occurred in 2012 and 2016 after more than a decade without any changes (NEF 2016).
[33] Past experiences in other countries suggest that a direct government support scheme might be preferable to a preferential tariff.

Second, a more flexible tariff system would also allow to address the regular electricity shortages to some extend by modifying consumer behavior. For example, demand for electricity peaks in the morning and in the evenings, when electricity is used for various household activities. Higher electricity prices at times of peak demand are an effective way to reduce consumption and stress in the system.

Finally, a market-based tariff system would also address the increasing financial losses of NEA by reflecting the actual cost of generating and distributing electricity.

3. Promote Renewable Energy in Rural Areas

Providing affordable and reliable access to clean energy for households and businesses is a key component of green inclusive growth. Building on existing plans and programs, it is recommended for the GoN to maximize its efforts to provide electricity access in rural areas.[34] Given the difficult topography and limited financial resources of many of the rural areas in Nepal, electrification in these areas will require decentralized systems, based on renewable energy sources.

It is recommended that appropriate technologies are selected based on the specific local conditions. Moreover, it is recommended that benefits of decentralized renewable energy systems are assessed taking into consideration the infrastructure's contribution to climate change mitigation as well as its resilience to potential natural and climate-induced disasters.

Providing electricity in rural areas bears considerable potential for increasing their productivity. For such small-scale off-grid solutions to be successful, two essential conditions have to be fulfilled. First, there needs to be access to affordable finance to realize any such projects. Second, there is a need for capacity building to ensure that communities have the relevant skills for operating and maintaining these systems.

Access to electricity is not the only challenge in rural areas. A large majority of the population—in particular in rural areas—depends on biomass for heating and cooking. Its inefficient use is the major cause for indoor air pollution and leads to environmental degradation. Furthermore, the use of biomass often entails a considerable financial cost for poor households.

To address these concerns, it is recommended to promote efficient use of biomass as well as fuel switching. First, this entails creating awareness among rural population. Second, it is recommended to support the uptake of more efficient technologies, such as efficient cook stoves, as well as the switching to cleaner fuels, such as biogas. As with off-grid renewable energy, capacity building and access to finance will be essential to successfully disseminate cleaner biomass technologies in rural areas.

4. Undertake Research on the Impacts of Climate Change on the Electricity Sector

Climate induced water stress and disasters are expected to affect the reliability and to reduce the efficiency of hydropower generation Nepal. Most studies and research on the impact of climate change on electricity generation in Nepal are in their initial phase. Therefore, the current understanding is inadequate.

The development of a reliable long-term database on water resources as well as relevant climate models would allow for improved monitoring, risk assessment, as well as identifying appropriate

[34] This recommendation is very much in line with a policy recently published by the GoN on renewable energy that includes provisions on promoting further electrification in rural areas.

adaptation plans to increase resilience within the electricity sector. All of this is essential to provide policy makers with the knowledge to make informed decisions.

3.5 Water Management

Water is not only a basic human necessity, but also a key resource for economic and human development. Nepal, possessing 2.27% of the world's freshwater supply, is one of the world's most water-abundant countries, with 6,000 rivers, a total mean annual runoff of 224 km^3 and a per capita water availability of 9,000 m^3 (Suhardiman et al. 2015). However, the hydrology of Nepal is primarily monsoon-driven, and approximately 85% of the rainfall occurs between June and September.

Water resources are directly linked to the agriculture and energy sectors in Nepal. Agriculture is by far the largest user of freshwater resources in the country, accounting for more than 95% of the total water use annually (WECS 2011). The country's hydropower plants are major non-consumptive water users. This is reflected in the government's perception of water management. The GoN does not regard water management as a sector in itself, but rather as a means to provide water resources for generating electricity and for cultivating crops.

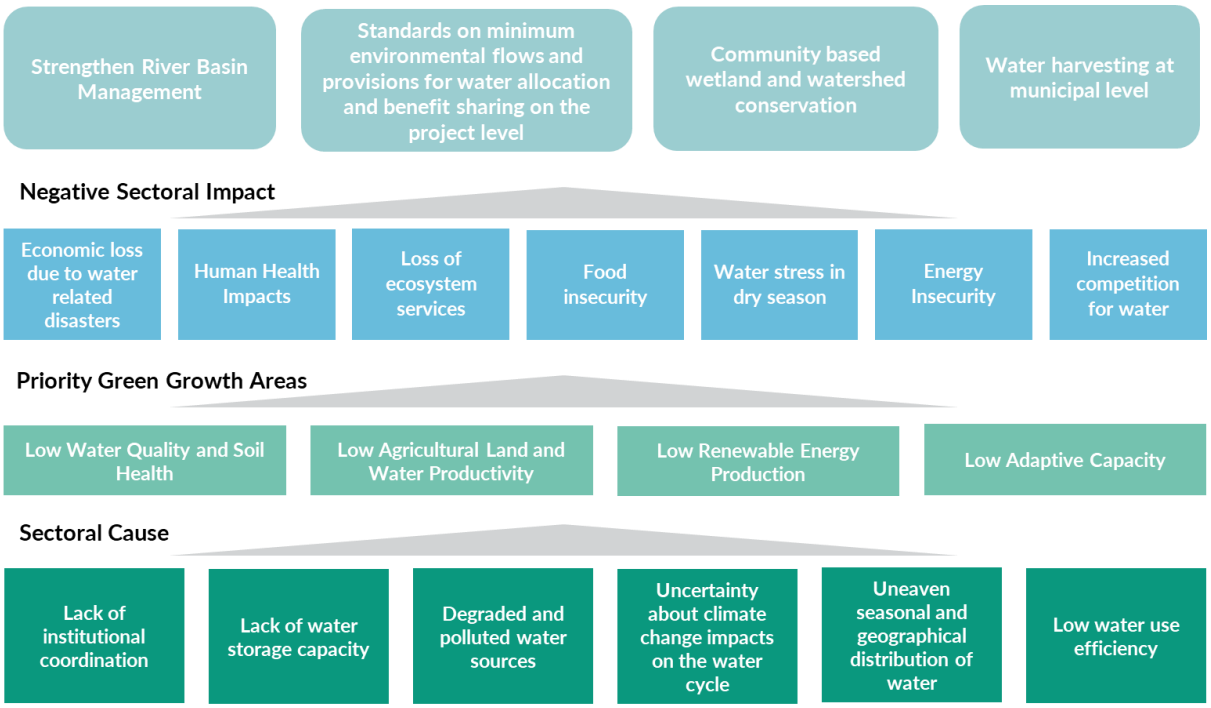
In line with the government's priorities in relation to water management, as well as based on the results of the stakeholder consultation workshop, water management in this chapter refers to managing the country's freshwater resources, related to water use in the agriculture and hydropower. Regarding the importance of reconstruction after the 2015 earthquake, the relevance of water management related to building standards is addressed as well. However, for the purpose of this report, water management does not address the provision of drinking water and sanitation services, nor industrial water use.

The GoN engages in Integrated Water Resource Management (IWRM)[35] as an approach to sustainably manage water resources. However, this largely been driven by international donors. A variety of perceptions exist among the government and other stakeholders in Nepal regarding the meaning of and the need for IWRM (Suhardiman et al. 2015). Non-Governmental Organizations (NGOs) view the implementation of IWRM in Nepal positively as a bottom-up approach to water management. The national government views IWRM mainly in relation to river basin planning and management within the context of large-scale infrastructure development, e.g., hydropower and irrigation dams (ibid.). Both perspectives are relevant to green growth and are considered within the following analysis.

The following section discusses the relevance of water management to the priority areas identified in Chapter 2.3.4. A set of green growth interventions is recommended to address the identified priority areas. These recommendations are based on the identified causes, their negative impacts, as well as on an assessment of the existing governance structure and the policy framework within the water management sector. A summary is provided in Figure 12.

[35] Although there are many definitions for IWRM, the Global Water Partnership's (GWPs) definition of IWRM is widely accepted. It states that "*IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.*"

Figure 12: Overview of the Water Sector



Source: GGGI

3.5.1 Relevance of the Water Management Sector to the Priority Areas

Six priority areas have been identified as being relevant for water management in Nepal. These six areas are: (1) Agricultural Land, (2) Water Productivity; (3) Water Quality; (4) Soil Health; (5) Renewable Energy Production; and (6) Adaptive Capacity. In line with the priorities described in section Chapter 2.3.4, the; areas of Water Productivity, Water Quality and Soil Health are discussed in the context of agricultural water use.

Agricultural Land Productivity and Water Productivity

As the large majority of freshwater resources in Nepal are used in agriculture, efforts to increase water productivity in Nepal need to focus on this sector. Water productivity in the agricultural sector is defined as the amount of agricultural production over the volume of water depleted or diverted (FAO 2013). As such, Agricultural Land Productivity and Water Productivity both depend on the use of water for irrigation, and are therefore directly linked to water management.

Furthermore, agriculture cultivation in Nepal is highly dependent on the monsoon rains. The high seasonal variability of water availability together with frequent and intense droughts and floods makes water management a key determinant for agricultural land productivity. During the dry season, agricultural production decreases due to a lack of irrigation infrastructure. This directly affects up to the three quarters of households that are dependent on agriculture (JICA 2012). As a consequence of limited irrigation systems, crop productivity is significantly lower than in the rest of South Asia.

This is exacerbated by the fact that many existing irrigation systems in Nepal are water inefficient. At present, only 42% of the country's cultivated land is irrigated and only 41% of the irrigated land is irrigated year-round. At the same time, agricultural water productivity is affected by old infrastructure, poor performance of existing irrigation systems, poor system efficiency, as well as underutilization of

canal water (World Bank 2014). Because of Nepal's low agricultural productivity, the country relies heavily on food imports, especially from India.

Water Quality and Soil Health

For the purpose of this report, water management in the agricultural sector is looked at in relation to water quality and soil health, which mutually affect one another. Agriculture as a sector is a source of chemical and physical water pollution and can cause poor soil health. In return, the agriculture sector is negatively affected by poor water quality and poor soil health.

Among the main sources of water and soil pollution is the excessive use of fertilizer and pesticides in agriculture (Raut et al. 2012). Pollution affects both, surface water as well as groundwater resources. For example, in the Terai region of Nepal, high concentrations of groundwater ammonium are likely to be the result of the use of ammonium-based fertilizers (Chappell et al. 2001). Furthermore, unsustainable agricultural practices lead to soil erosion, causing sedimentation and soil loss. This has a negative impact on soil quality and as a result agricultural yield.

Many freshwater bodies throughout Nepal are heavily polluted. Due to the lack of wastewater treatment facilities, contaminated wastewater is used for irrigation. This represents a major health risk. A thorough assessment of pollution levels is not possible, as no comprehensive water quality data exists due to a lack of monitoring. Despite the severe implications of water pollution, improving water quality has not received much attention from policy makers, civil society or the general public. Rather, the topic of water security is associated with concerns about water quantity and access, especially related to the lack of water supply and irrigation infrastructure.

Renewable Energy[36]

Electricity generation in Nepal is dominated by hydropower. However, Nepal only uses a fraction of its hydropower potential, with the current installed capacity of 878MW representing only 10% of the exploitable potential (NPC 2015a).

Water management plays a crucial role in securing reliable electricity supply. First, the majority of hydropower plants in Nepal are run-of-the-river plants. Therefore, electricity generation from hydropower is directly affected by seasonal river flows. The existing fleet of hydropower plants is ill-designed to accommodate for these variations in river flows. Second, sedimentation is another water management challenge that affects the hydropower plants operation and maintenance. Both challenges are exacerbated by the impacts of climate change on the hydrological regime.

Moreover, the operation of hydropower plants compounds water management challenges along a river course. For example, water discharges from hydropower plants affect river flows and can have a significant impact on ecosystems and water users further downstream.

Adaptive Capacity

Although there is increasing scientific evidence on the trends of climate change and its likely impacts in Nepal, predicting and quantifying the exact effects on Nepal's water resources is subject to

[36] Apart from hydropower, this report does not explore linkages with other sources of renewable energy. This reflects stakeholder's rationale for selecting water management as being relevant for the use of renewable energy, expressed during the consultation workshop.

considerable uncertainty. One of the main reasons behind this uncertainty is a lack of hydro-meteorological monitoring.

Regardless of this uncertainty, water management is at the core of climate change adaptation, as most climate change impacts occur through the water cycle. This includes changes in precipitation patterns, floods and droughts, and glacier melt. The consequences of these impacts are felt across sectors, including energy and agriculture. Therefore, water management is crucial for ensuring water, energy, and food security in the context of climate change and is a key element of green growth.

As rainfall is becoming more erratic due to climate change, seasonal droughts are already more pronounced in Nepal, constraining water availability for food production and domestic consumption (WRI, n.d.). Two of the major concerns for adaptation in Nepal's water sector are the limited reservoir and storage capacity, as well as the lack of irrigation infrastructure. The limited reservoir capacity makes drinking water supply vulnerable to changes in precipitation, while the lack of irrigation makes agriculture particularly vulnerable to climate-induced water stress.

Conversely, agricultural production, human well-being, settlements, and infrastructure are all exposed to increased flood risk, and existing structural control measures are already proving inadequate (WRI, n.d.). These water-related disasters already pose a considerable economic burden on Nepal. A recent study estimates the annual costs of climate-related extreme weather events to be between USD 270 and 360 million per year, equivalent to about 1.5 to 2% of annual national GDP (MoSTE 2014b). Climate change impacts are predicted to be more severe in the future, with higher associated economic costs, if the country does not respond effectively (CDKN 2014).

3.5.2 Governance Structure and Policy Framework

Setting up effective institutions and policies for an integrated management of water resources that considers the different demands and addresses social, economic, and ecological considerations is a challenge in Nepal. Major work still needs to be done in defining the mandates for water resources management across governance levels, as well as strengthening horizontal (cross-sector) coordination. While a number of policies and strategies exist that address issues related to sustainable water management, capacities for implementation and compliance need to be strengthened.

The institutional set-up disregards the river basin as the appropriate level for water resources planning and management. The ongoing decentralization process in Nepal poses a further challenge to an integrated management of water resources. At the same time, this process can be an opportunity to more strongly promote local solutions for managing water supply and demand. This can occur in the context of urban development plans and policies, such as the Environment Friendly Local Governance Framework.

The two main ministries tasked with water management in Nepal are the Ministry of Energy (MoE) and the Ministry of Irrigation (MoIr). While MoE addresses water management for the purpose of hydropower generation, MoIr focuses on irrigation. None of them has the responsibility to consider the sustainability of water resources as such.

In addition to these two ministries is the Water and Energy Commission Secretariat (WECS). This was established by the GoN to promote integrated water and energy management in the country, driven by the government's objective to negotiate trans-boundary water and energy issues with India. However, funding and staffing requirements of WECS have not been met. Furthermore, it is yet to be provided with the mandate to perform the functions of a water authority to plan, regulate and manage the country's water resources.

Additional ministries and entities engaged in the water sector are the Ministry of Population and Environment (MoPE), the Ministry of Forestry, and Water User Associations (WUAs). MoPE is responsible for pollution control including water quality. However, it does not have a mandate for water resources management. The Department of Soil Conservation and Watershed Management in the Ministry of Forestry deals with water resources management at the watershed level. However, the department focuses on promoting soil fertility for forestry and agriculture. Therefore, it lacks the necessary expertise and mandate for watershed management. Finally, water management for irrigation at the local level is implemented by Water User Associations. In many cases, significant challenges exist for the WUAs due to weak participation and low institutional capacity (World Bank 2014).

Generally, institutions as well as policies for sustainable river basin management need to be strengthened in Nepal. The GoN has formally adopted a policy of integrated water resource management (IWRM) with the 2002 Water Resource Strategy (WRS) and the 2005 National Water Plan (NWP).[37] However, the implementation of both, policy and strategy need to be strengthened. The institutional set-up is unfit and mechanism to effectively implement the principles of IWRM are lacking (Suhardiman et al. 2015). In 2012, the GoN drafted the National Water Resources Policy, which has yet to be endorsed by Parliament. In line with the NWP, it emphasizes the need for cross-sectoral coordination to develop and manage the country's water resources in a comprehensive way (Taylor et al. 2014). There is a need to refine the policy in order for it to properly address existing gaps.

First, although policies are in place, there is a need to effectively translate these into laws and regulations to strengthen capacity for implementation and enforcement. Second, there is a need to clarify responsibilities and accountability in Nepal's water sector by sifting through policies to avoid legislative and regulatory conflict as well as providing clear authority to and strengthening coordination among different institutions (NPC 2015a). Regulatory frameworks need to effectively balance environmental and economic needs. Third, the current set of water policies, laws, and regulations are outdated and require thorough revision to make them harmonized with the current situation in Nepal. Issues such as climate change, disaster risk management, environmental impact assessments, as well as IWRM at basin and sub-basin levels need to be integrated (ADB 2014).

Nepal's policy on minimum environmental river flows requires a holistic perspective on water management, combined with strong regulatory backing and enforcement. According to the Hydropower Development Policy (2001), operators of hydropower plants are required to ensure a release of 10% of the mean monthly flow, or a higher rate if an environmental impact assessment demonstrates that this is necessary. However, stakeholders affirm that the establishment of the 10% rule bears no scientific evidence and does neither consider ecological functions nor existing downstream water uses. Furthermore, compliance depends on the hydropower operator's willingness to comply, as monitoring is virtually non-existent and not required by law. Finally, under the current electricity tariff system hydropower operators have a strong price incentive to disregard adherence to minimum environmental flows. Currently, higher electricity prices in the dry season present a strong incentive for hydropower operators to disregard minimum environmental flow requirements in order to maximize profit.

[37] Nepal's policy objectives and targets regarding water management are summarized in the SDG National Preliminary Report (NPC, 2015), consisting of (1) granting access to adequate and equitable sanitation and hygiene for all and to end open defecation; (2) improving water quality by reducing pollution, eliminating dumping, and minimizing the release of hazardous chemicals and materials; (3) substantially increasing water-use efficiency across all sectors; (4) implementing integrated water resources management at all levels; and (5) protecting and restoring water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and glacial lakes.

3.5.3 Recommendations

The water sector has the potential to enhance many of Nepal's priority green growth areas, including water quality and soil health, agricultural land productivity and water productivity, renewable energy production, and adaptive capacity. Four specific green growth interventions in the water sector are proposed in order to address these areas.

1. *Strengthen River Basin Management*

Given the gaps in the institutional and policy framework for river basin management in Nepal, it is recommended that the government carry out water governance reform, keeping in mind three key cnsiderations. First, reform should be driven from within the country. Second, it should avoid creating any additional institutions and mandates. Third, reforming the water governance framework will need to take into account the ongoing decentralization process in Nepal.

It is recommended that the Water and Energy Commission Secretariat (WECS) act as a national river basin authority. This requires strengthening the WECS mandate and its resources. The main role for the WECS should be to ensure that water allocations and water-related developments take place within a wider planning framework and consider aspects of ecological, economic, and social sustainability. This mandate should also include transboundary cooperation on water resources management, which is particularly relevant for hydropower dams given their impact beyond political boundaries.

Water resources management should take place at the lowest possible level, while respecting the river catchments as the unit for management for an integrated management of water and land resources. For that purpose, it is recommended that the linkages between the Ministry of Forestry and water management be strengthened, introducing water management expertise within the Ministry's watershed management programs, and setting up a program to protect water towers.

2. *Establish Standards for Minimum Environmental Flows*

The concept of ensuring minimum environmental river flows, i.e., the minimum water flow required to sustain downstream ecosystem functions, has already been introduced in Nepal. Despite the fact that it is a more complex regulation, in practice, it sets a 10% minimum flow requirement. However, this is insufficient in many cases and does not consider the high variability of river flows. This is exacerbated by weak monitoring and an electricity tariff system that allows hydropower operators to disregard requirements for minimum environmental flows.

It is recommended that the GoN introduce a mandatory standard for the assessment of minimum environmental flows. This should be done in combination with site-specific hydrological and ecological studies providing evidence on the water needs of the respective aquatic ecosystem. It is further recommended that a strengthened WECS (see recommendation 1) is given the authority to monitor and enforce the adherence to minimum flows.

Applying minimum environmental flows is closely associated with the wider allocation of water for different uses. Therefore, in addition to monitoring and enforcing adherence to minimum environmental standards, WECS should further be given the authority over water allocation and benefit sharing at the catchment and project level. For example, it should be tasked with ensuring that water needs of local communities are considered in the design and operation of hydropower projects (especially for irrigation).

3. *Introduce Community-Based Water Management Projects*

As described above, the implementation capacity for sustainable management of water resources is weak. In contrast, community-based management of forest resources through Community Forestry User Groups (CFUG) has been largely successful in Nepal. It has increased forest productivity while strengthening sustainability, including water resource conservation.

Based on existing good practices in the forestry sector, it is recommended that the GoN introduce community-based water management projects. These community groups should have the clear goal of conserving water-related ecosystems. Among other things, such conservation initiatives can enhance natural water storage and reduce erosion, with positive effects on water availability for domestic and agricultural use. The community groups should be set up at key watersheds, wetlands, and lakes that lie outside the boundaries of community forests. Incentives should be provided for communities that are interested in forming a user group. These incentives should entail financial support (such as loans or grants for initial investments), institutional support (including legal recognition of user groups), and technical support (such as market studies, development of management plans). They could also include a provision on the use of these areas for ecotourism.

It is suggested to develop pilot projects in selected priority areas with support from the GoN and international development partners.

4. *Establish Standards for Water Harvesting in Buildings*

Complementary to the policy recommendations described above, it is recommended for the GoN to include rainwater harvesting in buildings in its urban development planning. On the municipal level, it is recommended that local authorities introduce standards for water harvesting into building codes, to be applied for all new buildings. Pilot applications could start with government buildings to provide best practice examples and demonstration sites.

The installation of water harvesting equipment is an effective solution to enhance water storage capacity on the local level and increase adaptive capacity. In the light of climate change uncertainty, this recommendation represents a low cost initiative with potentially high impact. Through rainwater harvesting, the vulnerability to acute water shortages on the household level can be reduced significantly.

Technical guidance and support should be provided to municipalities for drafting the regulations, and for housing developers to implement them. Standards can be part of a broader revision of building codes, including aspects with regard to energy (see recommendations for the energy sector).

Overall Recommendations

The recommendations on Agriculture, Forestry and Land-Use, Energy, and Water Management are intended to address priority areas related to green growth in Nepal. However, they do not represent an exhaustive list of recommendations to implement a national green growth agenda for Nepal.

In many of the sectors, the GoN has already identified or initiated a number of related policies, programs, or projects. In addition, GGGI's Country Planning Framework provides further and complementary assessment of priority interventions for green growth in Nepal.

Complementary to the sector recommendations are the following overall recommendations:

1. *Build a National Green Growth Vision*
   Green growth is a new concept in Nepal. Therefore, it is strongly recommended to continue to define the meaning of green growth for the country, and to create a joint vision among government and non-government stakeholders on green growth for Nepal. The aim of this definition process would be to ensure that green growth becomes a concept with practical relevance. It should build on existing strategies and plans, but also offer options for the government to achieve some of the country's development targets. This report is a contribution to this endeavor, together with GGGI's CPF.

2. *Pursue Green Growth as an Integrated Development Paradigm*
   It is essential to build ownership concerning the idea of green growth beyond individual sectors. Only if the government embraces the concept of green growth as a cross-cutting approach to development planning and policy making, can its benefits be fully realized. It should be avoided to impose new initiatives from the outside or in parallel to ongoing programs, particularly considering Nepal's limited resources and institutional capacity.

3. *Mainstream Green Growth Institutionally*
   As green growth cuts across different sectors, it is important to identify the adequate institutional set-up for steering and monitoring green growth initiatives. A chosen institutional mechanism should have sufficient convening power to enable a broad participation of sectors. In this regard, it is suggested for the Steering Committee on Green Growth also oversee green growth-related programs beyond GGGI.

4. *Undertake Concrete Action to Advance Green Growth*
   It is recommended that Nepal puts its focus on local level interventions to begin to harness the benefits offered by green growth in practice. Local level interventions appear particularly relevant against the backdrop of the country's ongoing decentralization process. The political uncertainty associated with this process may constitute a major challenge to green growth in Nepal, but can at the same time be regarded as an opportunity to advance green growth at the municipal level, with tangible benefits for local communities. This idea is already embraced by the CPF, which is geared towards local interventions with its focus on Green Cities.

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Annex 1: Dashboard Indicators

Theme	Sub-Theme	Indicator	Data Period	Latest Value	Unit	Latest Values	Trend
Natural Drivers	Geography & Climate	Land size	1990-2014	2014	Land area (km^2)	143350	↔
		Renewable internal freshwater resources	1992-2014	2014	Per capita (cubic meters)	7034.67	↘
		GEF benefits index for biodiversity	2005, 2008	2008	0-100 (low potential - maximum)	2.14	↘
		Average precipitation	1992-2014	2014	mm/year	1500.00	↔
	Demography	Total population	1990-2014	2014	Million	28.17	↗
		Urban population	1990-2013	2013	% of total	18.24	↗
		Urban population growth	1990-2013	2013	Annual growth %	3.24	↗
Human Induced Drivers	Economy	Total GDP	1990-2014	2014	Million USD	19769.6	↗
		Agriculture sector share of GDP	1990-2014	2014	% of GDP	33.69	↘
		Manufacturing sector share of GDP	1990-2014	2014	% of GDP	6.51	↘
		Services & others share of GDP	1990-2014	2014	% of GDP	50.68	↗
		GDP Growth Rate	1990-2014	2014	Annual %	5.38	↗
		GDP per Capita	1990-2014	2014	USD	701.68	↗
		Unemployment rate	1992-2014	2014	% of total labor force	2.70	↗
	Governance & Finance	Foreign direct investment, net flow	1996-2014	2014	% of GDP	0.03	↘
		Ease of doing business index	2015	2015	(1=most business-friendly regulations)	90.00	↘
		Corruption Perception Index	2015	2015	Country ranking (out 175)	130.00	↗
	Human Well-being	Improved water source (% rural)	1990-2014	2015	% of total population	91.60	↗
		Improved sanitation facilities	1990-2015	2015	% of total population	45.80	↗
		Access to electricity	1990-2012	2012	% of total population	76.30	↗
		Human Development Index	2010-2015	2015	Country ranking (out of 188)	145	↗
		Population under Absolute Poverty Line ($ 1.25/day)	1990-	2010	% of total population	14.95	↘
		Gini Coefficient	1990-	2010	0-100 (perfect equality -perfect inequality)	32.75	↘

Source: GEF, IEA, Transparency International, UNDP, UNICEF, WHO, World Bank

Annex 2: Diagnostic Indicators

Theme	Sub-theme	Indicator	Unit	Nepal	Low-Income Countries	Lower Middle-Income Countries
Resource Efficient Growth	Energy Efficiency	Energy intensity	MJ/USD	7.27	11.78	6.09
		Distribution losses of electricity	% of total	31.49	27.03	16.73
	Resource Productivity	Material Intensity	kg of domestic consumption / unit GDP	8.90	9.25	5.77
		Municipal Solid Waste Generation Intensity	kg of waste / unit GDP	0.03	0.15	0.11
		Recycling Rate of Solid Waste	% of waste generated	0.0	1.5	4.3
		Water Productivity	GDP/ m^3 of freshwater withdrawal	2.00	16.75	23.06
		Agricultural Land Productivity	USD / km^2	0.11	0.03	0.07
	Other Productivity Factors	Labor productivity	GDP (USD 1,000) per worker	802.02	1,152	4,463
		Logistics performance index	1—5 (higher the better)	2.59	2.40	2.57
		Technological readiness	1—7 (higher the better)	2.62	2.57	3.16
Eco-Efficient Growth	Quantity of Natural Assets	Coastal Shelf Fishing Pressure	Tonnes / km^2	N/A	20.43	24.91
		Changes in forest cover	Annual rate of change (%)	0.00	-0.81	-0.2
		Water stress	0—5 (Higher the greater competition among users)	2.40	0.87	2.06
		Natural resources depletion	% of GNI	5.81	8.98	6.50
	Quality of Natural Assets	Threatened Species	Number of species / population density (people/Km^2)	0.54	3.92	4.73
		Water quality index	0—100 (Higher the better)	45.96	47.60	55.71
		Trends in soil health	0—50 (Higher the better)	13.57	38.44	39.52
		Population-weighted exposure to $PM_{2.5}$	micrograms per m^3	30.40	7.17	8.54
Climate Resilient Growth	Climate Change Mitigation	CO_2 emission trends	Annual growth rate (%)	12.16	7.16	3.24
		Carbon Intensity	tCO_2. per unit GDP (USD)	0.26	0.33	0.60
		Renewable energy production	% of total electricity production	0.00	1.01	4.08
		Carbon stock in living forest biomass	million tonnes / yr	0.00	-5.54	-9.48
	Climate Change Adaptation	Climate change exposure	0—1 (lower the less exposed)	0.56	0.52	0.50
		Climate change sensitivity	0—1 (lower the less sensitive)	0.38	0.55	0.48
		Adaptive capacity to climate change	0—1 (lower the higher adaptive capacity)	0.60	0.74	0.57

Description of Diagnostic Indicators

Theme	Sub-theme	Area	Indicator	Unit	Description	Source
Resource- Efficient Growth	Energy Efficiency	Energy Intensity	Energy Intensity of the Economy	MJ / unit GDP	Energy Intensity indicates of how much energy is used to produce one unit of economic output. It is the ratio between total primary energy supply (TPES) and GDP. TPES is defined as energy production plus energy imports, minus energy exports, minus international bunkers, minus stock changes. GDP is measured at purchasing power parity. (GDP: 2011 USD PPP) http://data.worldbank.org/indicator/EG.EGY.PRIM.PP.KD	WB
		Electricity Loss	Transmission and Distribution Losses of Electricity	% of output	Electricity losses refer to transmission and distribution losses. This includes both technical and non-technical losses. Technical losses are caused by physical characteristics of the grid and the electricity-generating system. The amount of losses is mainly dependent on the size of the country (length of power lines), voltage of transmission and distribution and quality of network. Transmission and distribution losses comprises all losses due to transport and distribution of electrical energy, including losses in overhead transmission lines and distribution networks as well as losses in transformers which are not considered as integral parts of the power plants. Non-technical losses mainly refer to electricity theft. http://data.worldbank.org/indicator/EG.ELC.LOSS.ZS	
	Resource Productivity	Material Intensity	Material Intensity	kg of domestic consumption / unit GDP	Material intensity refers to the quantity of material used to produce goods and services. It is the ratio between GDP and the total amount of domestically extracted/produced materials (construction/industrial minerals, metal, ores, fossil fuels and biomass). It does not account for any amounts of imported and exported materials. http://www.materialflows.net/data/datadownload (flow type "Extraction" flow sub-type "Used" reference parameter "Per GDP", GDP in constant 2005 USD)	SERI
		Waste Generation	Municipal Solid Waste Generation Intensity	kg of waste / unit GDP	Municipal solid waste is defined as the waste produced by households. It further includes similar waste generated by commerce, offices and public institutions. The indicator is defined as the ratio between GDP (at constant 2010 USD) and the amount of municipal solid waste collected by or on behalf of municipal authorities and disposed of through the waste management system. The indicator does not capture any informal waste collection. http://www.atlas.d-waste.com/ (for municipal solid waste generation) http://data.worldbank.org/indicator/NY.GDP.MKTP.KD (for GDP)	Dwaste, WB
		Waste Recycling	Recycling Rate of Solid Waste	% of waste generated	Recycling rate of municipal solid waste refers to the amount of Municipal Solid Waste (MSW) recycled as a proportion of total MSW generated and collected within the formal waste sector. http://www.atlas.d-waste.com/	Dwaste

		Water Productivity	Water Productivity	GDP/ m^3 of freshwater withdrawal	Water productivity indicates how water intense a country's economy. It is defined as GDP (in constant 2010 USD) divided by the total annual freshwater withdrawal. http://data.worldbank.org/indicator/ER.GDP.FWTL.M3.KD	WB
		Land-Use Productivity (Agricultural)	Agricultural Land Productivity	USD / km^2	Agricultural land productivity is defined as agricultural production divided by total area of arable land under permanent crops, and under permanent pastures. The economic value of agricultural output has been calculated by multiplying gross production in physical terms by output prices at the farm gate. Since intermediate uses within the agricultural sector (seed and feed) have not been subtracted from production data, this value of production aggregate refers to the notion of "gross production". http://faostat3.fao.org/download/Q/QV/E (gross production value constant 2004-2006) http://data.worldbank.org/indicator/AG.LND.AGRI.K2 (for further description of agricultural land)	FAO WB
	Other Productivity Factors	Labor Productivity	Labor Productivity	GDP / worker	Labor productivity is defined as the total volume of output (measured in terms of Gross Domestic Product, GDP) produced per unit of labor (measured in terms of the number of employed persons) during a given time reference period. The economically active population comprises all persons of either sex, ages 15 and older who furnish the supply of labor for the production of economic goods and services as defined by the United Nations System of National Accounts during a specified time-reference period. http://www.ilo.org/global/statistics-and-databases/research-and-databases/kilm/lang--en/index.htm https://stats.oecd.org/glossary/detail.asp?ID=730 Indicator: Output per worker (GDP constant 2005 USD)	ILO
		Logistics Performance	Logistics Performance Index	1-5 (higher scores indicate better performance)	Logistic performance measures countries' performance in six areas that capture the most important aspects of the current logistics environment (efficiency of customs clearance process, quality of trade- and transport-related infrastructure, ease of arranging competitively priced shipments, quality of logistics services, ability to track and trace consignments, as well as frequency with which shipments reach the consignee within the scheduled time). http://data.worldbank.org/indicator/LP.LPI.OVRL.XQ http://siteresources.worldbank.org/INTLAC/Resources/ConnectingtoCompete.pdf	WB
		Technology	Technological Readiness	1-7 (higher scores indicate higher readiness)	Technological readiness is a proxy to measure the agility with which an economy adopts existing technologies to enhance the productivity of its industries, with specific emphasis on its capacity to fully leverage information and communication technologies (ICTs) in daily activities and production processes for increased efficiency and enabling innovation for competitiveness. Whether the technology used has or has not been developed within national borders is irrelevant for its ability to enhance productivity. The central point is that the firms operating in the country	WEF

					need to have access to advanced products and blueprints and the ability to absorb and use them. Among the main sources of foreign technology, FDI often plays a key role, especially for countries at a less advanced stage of technological development The index covers the following areas: (1) technological adoption (availability of latest technologies, firm-level technology absorption, FDI and technology transfer), and (2) ICT use (internet users, broadband internet subscriptions, internet bandwidth, mobile broadband subscriptions, mobile telephone subscriptions, fixed telephone lines). http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf	
Eco-Efficient Growth	**Quantity of Natural Assets**	Fishing Pressure	Coastal Shelf Fishing Pressure	tonnes/ km^2	Coastal shelf fishing pressure is defined as the total catch from trawling and dredging equipment divided by the total area of a country's exclusive economic zone. http://epi.yale.edu/sites/default/files/2016EPI_Raw_Data_0.xls	EPI
		Forest Cover Changes	Changes in Forest Cover	annual change (%)	Changes in forest cover capture the annual percent change in forest cover between 2005 and 2015. Forests are defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. Areas that are predominantly under agricultural or urban land use is not included. http://faostat3.fao.org/download/R/RL/E	FAO
		Water Consumption	Water Stress	0-5 (higher scores indicate greater competition among users)	The baseline water stress index measures water stress is defined as the ratio between total annual water withdrawals (municipal, industrial, and agricultural) and total renewable supply. The index is based on a scale ranging 0 to 5. The index serves as a proxy for the level of competition among users and depletion of the resource. Focusing on competition and depletion makes this indicator an effective way to measure the hydrological context at the catchment scale. http://www.wri.org/sites/default/files/aqueduct_coutnry_rankings_010914.pdf	WRI
		Natural Resource Depletion	Natural Resource Depletion	% of GNI	Natural resource depletion is defined as the sum of net forest depletion, energy depletion, and mineral depletion, as a percentage of gross national income (GNI). Net forest depletion is unit resource rents times the excess of round wood harvest over natural growth. Energy depletion is the ratio of the value of the stock of energy resources to the remaining reserve lifetime (capped at 25 years). It covers coal, crude oil, and natural gas. Mineral depletion is the ratio of the value of the stock of mineral resources to the remaining reserve lifetime (capped at 25 years). It covers tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate. http://data.worldbank.org/indicator/NY.ADJ.DRES.GN.ZS	WB
		Endangered Species	Threatened Species	Number of species/ population density	The number of threatened species, which are defined by IUCN divided by population density (people/km^2) http://cmsdocs.s3.amazonaws.com/summarystats/2016-	IUCN

				(people/ km^2)	1_Summary_Stats_Page_Documents/2016_1_RL_Stats_Table_5.pdf (Threatened Species) http://data.worldbank.org/indicator/EN.POP.DNST (Population Density)	
	Quality of Natural Assets	Water Quality	Water Quality Index	0-100 (higher scores indicate higher quality)	The Water Quality Index uses three parameters to determine the water quality of a country's fresh water bodies, measuring nutrient levels (Dissolved Oxygen, Total Nitrogen, and Total Phosphorus) and two parameters measuring water chemistry (pH and Conductivity). http://www.epi.yale.edu/files/2010epi_data.xls	EPI
		Soil Quality	Trends in Soil Health Index	0-50 (higher scores indicate better soil health)	The Trends in Soil Health Index measures the physical part related to loss of soil mass and structure; and the long-term chemical well-being of the soil in terms of nutrients and absence of toxicities built up. http://www.fao.org/nr/lada/index.php?option=com_docman&task=doc_download&gid=773&lang=en	FAO
		Air Quality	Population-Weighted Exposure to $PM_{2.5}$	µg/ m^3	The indicator measures the average exposure to $PM_{2.5}$, particles less than 2.5 micrometers in diameter. Three-year rolling population-weighted average of the $PM_{2.5}$ values are used to calculate indicators for national annual average exposure to $PM_{2.5}$ in micrograms per cubic meter. Population-weighted average exposure values are calculated using population data from the Global Rural Urban Mapping Project (2011) database. http://epi.yale.edu/sites/default/files/2016EPI_Raw_Data_0.xls	EPI
Climate- Resilient Growth	Climate Change Mitigation	CO_2 Emissions	CO_2 Emission Trend	annual growth rate (%)	The CO_2 emission trend captures a country's annual growth rate in national emissions of CO_2 over the latest five years available. http://data.worldbank.org/indicator/EN.ATM.CO2E.KT	WB
		Carbon Intensity	Carbon Intensity	tCO_2/ unit GDP	Carbon intensity is defined as the amount of carbon dioxide emissions (stemming from the burning of fossil fuels and the manufacture of cement) per unit of gross domestic production (GDP in constant 2010 USD). http://data.worldbank.org/indicator/NY.GDP.MKTP.KD (for GDP) http://data.worldbank.org/indicator/EN.ATM.CO2E.KT (for CO_2)	
		Renewable Energy	Renewable Energy Production	% of total electricity output	Renewable energy production refers to the share of electricity generated from renewable sources of energy within total electricity generation, including geothermal, solar, tidal, and wind power, as well as electrify generated from biomass, and biofuels. It excludes hydroelectric sources. http://data.worldbank.org/indicator/EG.ELC.RNWX.ZS	
		Carbon Stock Changes	Carbon Stock in Living Forest Biomass	annual change in million tonnes	Annual changes in carbon stock, which is a quantity of carbon contained in a reservoir or system of living forest biomass which has the capacity to accumulate or release carbon. http://www.fao.org/3/a-i4808e.pdf http://www.fao.org/docrep/013/i1757e/i1757e14.pdf	FAO
	Clima te Chan	Exposure	Climate Change Exposure	0-1 (higher scores indicate	Climate change exposure indicates the degree to which a society and its supporting sectors (defined as food, water, health, ecosystem,	NDGAIN

				higher exposure)	human habit and infrastructure). is exposed to significant climate change from a biophysical perspective. It is a component of vulnerability independent of socio economic context. Exposure reflects projected impacts for the coming decades and are therefore invariant overtime. http://index.gain.org/ranking/vulnerability/exposure	
		Sensitivity	Climate Change Sensitivity	0-1 (higher scores indicate higher sensitivity)	Climate change sensitivity indicates the degree to which a society and its supporting sectors (defined as food, water, health, ecosystem, human habit and infrastructure) are affected by climate related perturbations. The factors increasing sensitivity include the degree of dependency on sectors that are climate-sensitive and proportion of populations sensitive to climate hazard due to factors such as topography and demography. http://index.gain.org/ranking/vulnerability/sensitivity	
		Adaptive Capacity	Adaptive Capacity to Climate Change	0-1 (higher scores indicate lower adaptive capacity)	Adaptive capacity to climate change reflects the ability of society and its supporting sectors to adjust in order to reduce potential damage and to respond to the negative consequences of climate events. In ND-GAIN adaptive capacity indicators seek to capture a collection of means, readily deployable to deal with sector-specific climate change impacts. Indicators used for this index include (1) electricity access and (2) disaster preparedness. http://index.gain.org/ranking/vulnerability/capacity	
	Quality of Life	Poverty	Poverty headcount ratio at $1.90 a day (2011 PPP)	% of population	The poverty headcount ratio indicates the percentage of the population living on less than $1.90 day. http://data.worldbank.org/indicator/SI.POV.DDAY	WB
		Hunger	Prevalence of undernourishment	% of population	Prevalence of undernourishment is defined as the percentage of population whose calorific intake is insufficient to meet dietary energy requirements continuously (at least one year). http://data.worldbank.org/indicator/SN.ITK.DEFC.ZS	WB
Socially Inclusive Growth		Health and Well-being	Healthy Life Expectancy at birth, total	years	The Healthy life expectancy (HLE) is used as a proxy to measure the overall health for a population. The HLE indicates the average equivalent number of years of full health that a newborn could expect to live if they were to pass through life subject to the age-specific death rates and average age-specific levels of health states for a given period. http://apps.who.int/gho/data/view.main.HALEXv	WHO
		Education	Net Primary Enrolment Rate	%	The net primary enrollment rate is defined as the number of children enrolled in primary school who belong to the age group that officially corresponds to primary schooling, divided by the total population of the same age group. http://data.uis.unesco.org/Index.aspx?queryid=145	UNESCO
	Inequality	Gender Inequality	Gender Inequality Index (GII)	0—1 (higher scores indicate	The Gender Inequality Index measures gender inequality across three aspects of human development: (1) reproductive health, measured by maternal mortality ratio and adolescent birth	UNDP

				greater inequality)	rates; (2) empowerment, measured by proportion of parliamentary seats occupied by females and proportion of adult females and males aged 25 years and older with at least some secondary education; and (3) economic status, expressed as labor market participation and measured by labor force participation rate of female and male populations aged 15 years and older. http://hdr.undp.org/en/composite/GII	
		Income Inequality	GINI Index	0-100 (higher scores indicate greater inequality)	The GINI index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. http://data.worldbank.org/indicator/SI.POV.GINI	WB
	Governance	Good Governance	Corruption Perception Index (CPI)	0-100 (higher scores indicate lower levels of corruption)	The Corruption Perception Index scores and ranks countries/territories based on how corrupt a country's public sector is perceived to be. It is a composite index based on a combination of surveys and assessments of corruption, compiled by a variety of reputable institutions. https://www.transparency.org/cpi2015/results	TI
		Public Expenditure	Public Expenditure on Health and Education	% of GDP	Public health expenditure consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds. Public expenditure on education (current, capital, and transfers) consists of government expenditure for all levels of education, and includes expenditure funded by transfers from international sources to government. http://data.worldbank.org/indicator/SH.XPD.PUBL.ZS (Public health expenditure) http://data.worldbank.org/indicator/SE.XPD.TOTL.GD.ZS (Government expenditure on education)	WB

Annex 3: Workshop Report

3.1 Introduction

The workshop, held on 4 October 2016, in Kathmandu, had the objective to validate the findings of desktop research of Nepal's green growth potential. The workshop validated the areas and sectors through a consultation process with key stakeholders from the Nepali government and private sector through a Group Delphi Method

A total of 51 stakeholders mainly representing the Government of Nepal participated in the workshop. The Preliminary Assessment identified 11 areas as green growth priorities. The results of the preliminary assessment were presented to key stakeholders who were then asked to provide their input on a number of survey questions in the form of a Group Delphi method. The Group Delphi method is a structured consultation method, relying on a panel of experts. Surveys to reach consensus are undertaken in up to 3 rounds (see Figure 1 for the validation and consultation process).

Workshop Methodology

The workshop followed a **Group Delphi method**, which consisted of three identical surveys and a breakout group session, aiming at reaching consensus over the selection of priority issues and sectors. After each round, a facilitator provided a summary of the anonymous stakeholders' answers from the previous round. Between round 1 and round 2, the stakeholders were encouraged to revise their earlier answers in light of the replies of the other members in the form of breakout groups. Between round 2 and round 3, a deliberation in a form of a plenary was also encouraged to provide discussion on the results of the previous rounds and the breakout session.

The Group Delphi method relies on the assumption that during the discussion group process, the range of answers will decrease and the group will converge towards a more accurate answer. The Delphi method is based on the principle that decisions from a structured group of individuals are more accurate than those from unstructured groups.

This Group Delphi method was framed within the following steps:
Step 1. The **first round survey** was conducted directly after the presentation of the results of how Nepal is performing in green growth (results from the Preliminary Assessment). Participants were asked to select up to 5 priority issues from all the issues combined Green Growth pathways.

Step 2. A **group consensus building** process was conducted after showing participants the results of the first survey round. This consisted of a breakout session of four discussion groups which were given two hours in order to: 1) prioritize three issues, and 2) collectively identify key sectors for the selected issues.

Step 3. The **second survey round**, addressed the same questions as the first survey. It was conducted following the presentation of the results of the discussion groups.

Step 4. In a form of an informal **plenary session**, the participants discussed the results of steps 2 and 3, and the differences between the priorities identified by the participants compared to those identified by the preliminary assessment.

Step 5. The **third survey round** included the same questions as in the first and second round. In addition, in this final step further questions were asked regarding participants understanding of green growth in Nepal. These questions are not part of the Delphi process but help the consultant team to gain a better understanding about the perception and priorities for green growth in Nepal.

Based on the workshop results and the preliminary assessment, 4 clusters of areas most relevant to green growth (covering a total of 9 areas) and 4 sectors were prioritized (see Table 4). These results will now feed into Phase 3 of the GGPA process.

Table 4: Selected Areas and Sectors for the GGPA

Prioritized Areas /Sectors	Energy Generation and Supply	Agriculture	Water Management	Forestry and Land-Use
1. Energy issues cluster: • Renewable Energy Production • Energy Intensity • Energy Loss	●		●	
2. Technological Readiness		●		
3. Agricultural issues cluster: • Agricultural Land Productivity • Water Productivity • Water Quality • Soil Health		●	●	●
4. Adaptive Capacity	●	●	●	●

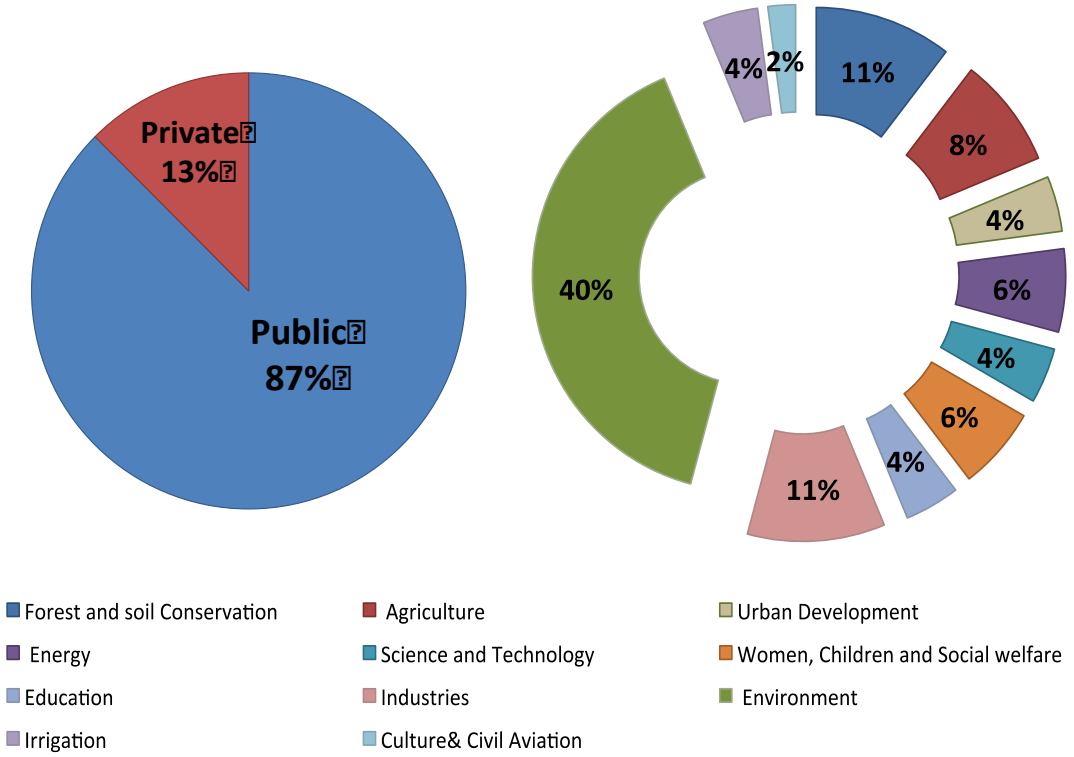
Energy Loss, Water Productivity, Water Quality and Soil Health were not among the top 5 prioritized areas, but will be addressed in the next phase of the GGPA within the clusters of issues on Energy and Agricultural themes, as these issues showed considerable poor performance based on the results of the Preliminary Assessment.

While the Preliminary Assessment indicated very low performance of Air Quality in Nepal, the area was not prioritized in the validation workshop, as there was dissent on the magnitude of the problem among participants. Therefore, in addition to the areas and sectors displayed in Table 1, Phase 3 of the GGPA final report will address Air Quality and the related sectors to the issue including Urban Development and Industry.

3.2 Workshop Results

The participants of the workshop were key stakeholders from a variety of Nepali government institutions (87%) as well as stakeholders from the private sector (13%). The distribution of the key stakeholders is presented in figure 5 below. A full list of participants, the institutions and the sectors that they represent is included at the end of this document. A brief summary of the participants and the sectors they represent is presented below.

Figure 13: Distribution of Participants by Sector



The following sub chapters outline the results of the three survey rounds undertaken during the workshop. A multi-step process according to the Group Delphi method was employed to provide participants with the opportunity to discuss the results of the first survey round and the preliminary assessment in a group discussion, aiming at producing responses that resulted in greater consensus between the participants.

3.3 Prioritizing Green Growth Areas

With regard to prioritizing areas that should be tackled by Nepal's green growth strategy, the stakeholders were asked to choose the most important areas based on the indicators as defined under the GGPA methodology. This sub-chapter details the results of the areas prioritized within Resource-Efficient Growth, Eco-Friendly Growth and Climate Resilient Growth based on the results of the Workshop and comparing it with the results of the preliminary assessment. The final areas selected under each area reflect the consensus that was reached following the observations of the preliminary assessment, the results of the 3 survey rounds and the discussion groups.

From a total of 51 attendees, 41 participated in the first survey round, 28 in the second round and 27 in the third round. To make the results of the surveys statistically comparable, results are shown as weighted means from each of the three rounds.

- **Resource Efficient Growth**

Areas with Resource Efficient Growth are the ones most chosen by the participants. Therefore, Resource Efficient Growth is interpreted to represent a key driver for green growth in Nepal:

– Round 1: 44% / Round 2: 49% / Round 3: 48%

Among the areas with Resource Efficient Growth, the ones that received most votes were Agricultural Land Productivity and Technological Readiness. **Agricultural Land Productivity** (Round 1: 10%, Round 2: 16%, Round 3: 15%) received most votes as a priority area over the 3 survey rounds and was extensively discussed during the breakout discussion groups. This is despite the fact that Agricultural Land Productivity was not identified as a priority issue in the Preliminary Assessment, as Nepal's performance is above that of low-income countries.

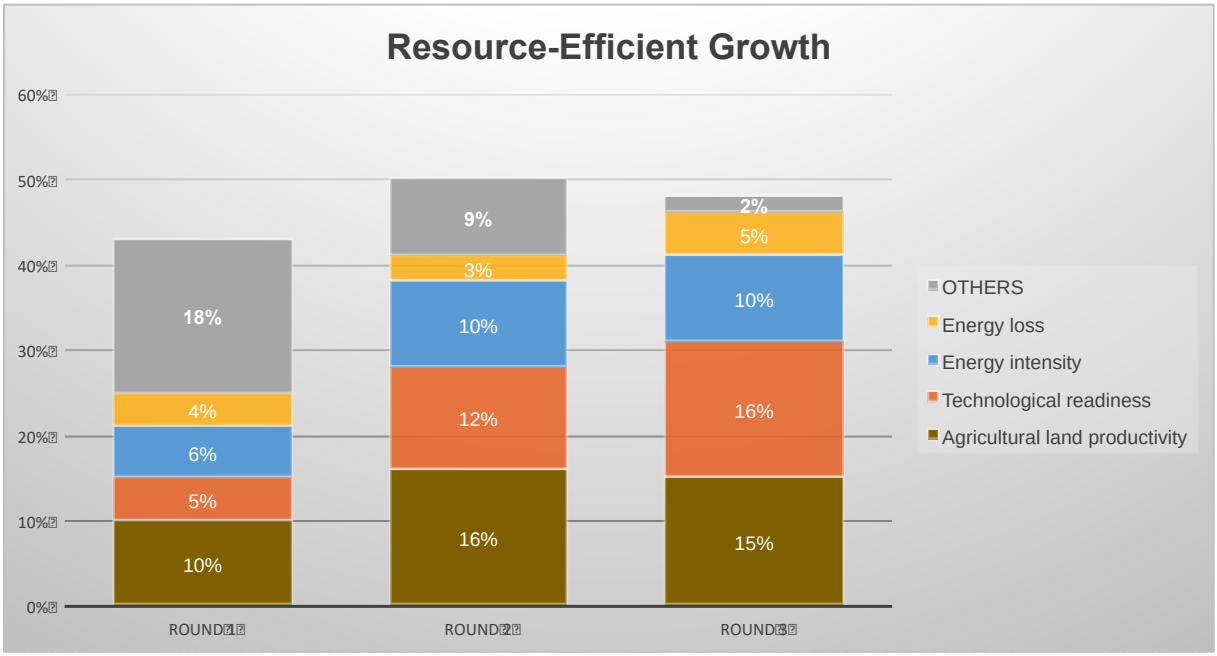
Technological Readiness was the second area identified as a priority over the three Delphi Rounds (Round 1: 5%, Round 2: 12%, Round 3: 16%) and two of the four discussion groups chose it as a key driver for green growth in Nepal. The group discussions highlighted the cross-cutting nature of Technological Readiness in Nepal, as stakeholders regarded this as an option to improve on many other underperforming issues.

In the Preliminary Assessment, **Electricity Losses** (Round 1: 4%, Round 2: 3%, Round 3: 5%) were revealed as an underperforming area when comparing Nepal with its peer countries. However, Electricity Losses (Round 1: 4%, Round 2: 3%, Round 3: 5%) was not among the top 5 most voted issues in the survey, mainly because participants considered that high electricity losses are not very relevant as grid electricity only represents less than 3% of the total energy consumption in Nepal (WECS, 2014).

On the contrary, **Energy Intensity** (Round 1: 6%, Round 2: 10%, Round 3: 10%) was among the top 5 selected areas though it was not identified as an underperforming issue by the preliminary assessment. Results from the discussion showed that the Energy Intensity was prioritized largely due to supply side concerns (although in the GGPA methodology the Energy Intensity indicator relates to the demand side of energy efficiency). Therefore, participants agreed that areas related to energy should be addressed in combined way in the assessment.

Water Productivity (Round 1: 5%, Round 2: 1%, Round 3: 0%) has been identified as an underperforming area compared to Nepal's peer countries. However, it was not identified as a priority area during the Delphi survey. Therefore, the final report will address Water Productivity only in the context of Agricultural Land Productivity.

Figure 14: Workshop Results for Resource Efficient Growth



The table below presents the five areas prioritized and their reasons for prioritization for the GGPA phase 3.

Table 5: Discussion Group Results for Resource Efficient Growth

Selected priority areas for Resource Efficient Growth in the discussion groups	# of groups that selected
Agricultural Land Productivity	4
Energy Intensity	1
Technological Readiness	1

Result of selected priority areas for Resource Efficient Growth	Reasons for prioritization for GGPA phase 3
Agricultural Land Productivity	The third top priority area selected over the Delphi surveys The priority area was selected in four of the four discussion groups
Technological Readiness	The second top priority area selected over the Delphi surveys The priority area was selected in one of four discussion groups
Energy Intensity	The fifth top priority area elected in the Delphi surveys The priority area was selected in one of the four discussion groups
Energy Loss	Strong underperformance based on preliminary assessment Electricity Losses were seen as related to Energy Intensity in the group and plenary discussion sessions.
Water Productivity	Strong underperformance based on preliminary assessment Water Productivity is relevant for the priority area of Agricultural Land Productivity and will be considered in this context.

- ***Eco-Friendly Growth***

The participants in round 1 selected the most number of issues for prioritization within the "Eco-Friendly Growth" pathway. However, when consensus was reached in the last survey round, none of the priority areas came from this pathway.

- Round 1: 30% / Round 2: 23% / Round 3: 22%

Air Quality (Round 1: 9%, Round 2: 6%, Round 3: 7%) was selected as one of the top five areas to be prioritized in survey round 1. However, it became less relevant during the discussion groups and was not among the areas with the highest green growth priorities during rounds 2 and 3. Nevertheless, the importance of air pollution, especially in urban areas has been highlighted by participants in the discussion groups as well as in the preliminary assessment.

While the perception of some individual participants was that the area might be a temporary one ("*the issue of Air Quality only concerns Kathmandu",*[…] *"only a temporary issue as a lot of road expansion and reconstruction is going on in the city" [following the earthquake], "with air pollution mainly coming from re-suspension of dust"),* data from the EPI shows that almost 75% of the Nepali population is exposed to fine particulate matter, and historical data shows that air pollution has been an important issue even before the reconstruction started. It has therefore been decided to include Air Quality in the final report.

A similar trend was observed for the areas of **Water Quality** (Round 1: 7%, Round 2: 5%, Round 3: 3%) and **Soil Health** (Round 1: 5%, Round 2: 5%, Round 3: 5%). Both were not identified as priority areas in the Delphi survey, as the consensus reached in the third round indicated low levels of prioritization.

However, both areas were highlighted during the discussion groups, notably for their potential to improve sustainable development in the agricultural sector.

Figure 15: Workshop Results for Eco-Friendly Growth

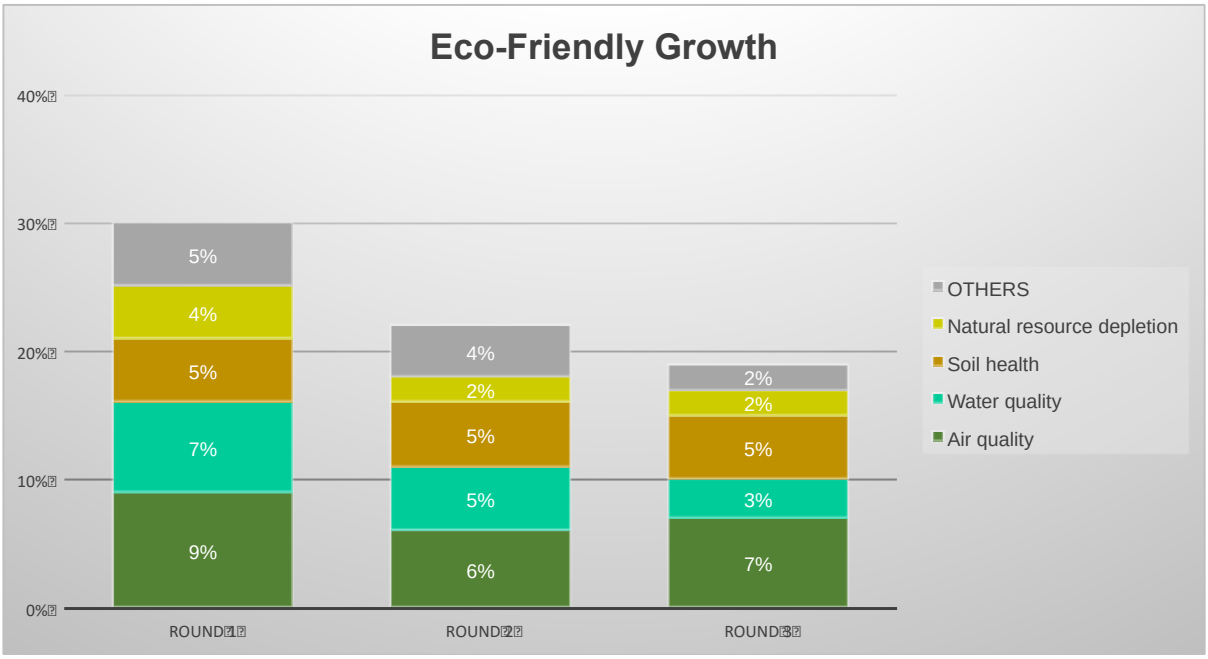


Table 6: Discussion Group Results for Eco-Friendly Growth

Selected priority areas for Eco-Friendly Growth in the discussion groups	# of groups that selected
Water Quality	

Result of selected priority areas for Eco-Friendly Growth	Reasons for prioritization for GGPA phase 3
Water Quality	Strong underperformance based on the preliminary assessment Selected area in one of four discussion group Water Quality is relevant for the priority area of Agricultural Land Productivity and will be considered in this context.
Soil Health	Strong underperformance based on the preliminary assessment Soil Health is relevant for the priority area of Agricultural Land Productivity and will be considered in this context.

- **Climate Resilient Growth**

Areas related to Climate Resilient Growth were assigned a growing importance during the survey rounds.

– Round 1: 26% / Round 2: 28%/ Round 3: 30%

Capacity to Adapt to Climate Change and **Renewable Energy Production** are the two priority areas falling under Climate Resilient Growth. In the second survey round, other areas within Climate Resilient Growth received considerably fewer votes, reinforcing the consensus for these two areas as priorities.

Renewable Energy Production (Round 1: 12%, Round 2: 13%, Round 3: 18%) aligned well between the preliminary assessment and the three survey rounds. Related to Renewable Energy Production, participants highlighted the importance of hydropower due to its high share within the country's energy supply mix as well as its potential for further development, even though the indicator itself does not count hydropower as part of renewables.

Although Climate Change Exposure (Round 1: 3%, Round 2: 2%, Round 3: 0%) was presented as one of the underperforming areas in the preliminary assessment, the area of **Adaptive Capacity** (Round 1: 5%, Round 2: 11%, Round 3: 11%) gained consensus as one of the top five priority areas in the final two survey rounds. Exposure, Sensitivity and Adaptive Capacity define Nepal's vulnerability to climate change, and participants tended to regard increasing Adaptive Capacity as the highest priority for reducing the country's vulnerability. This prioritization of Adaptive Capacity over Exposure is in line with the results from the NGAIN index (see section 2 on Climate Change Exposure), which shows that while Nepal is more exposed to climate change than its peer countries, it is mostly its low adaptive capacity that drives the vulnerability.

Figure 16: Workshop Results for Climate Resilient Growth

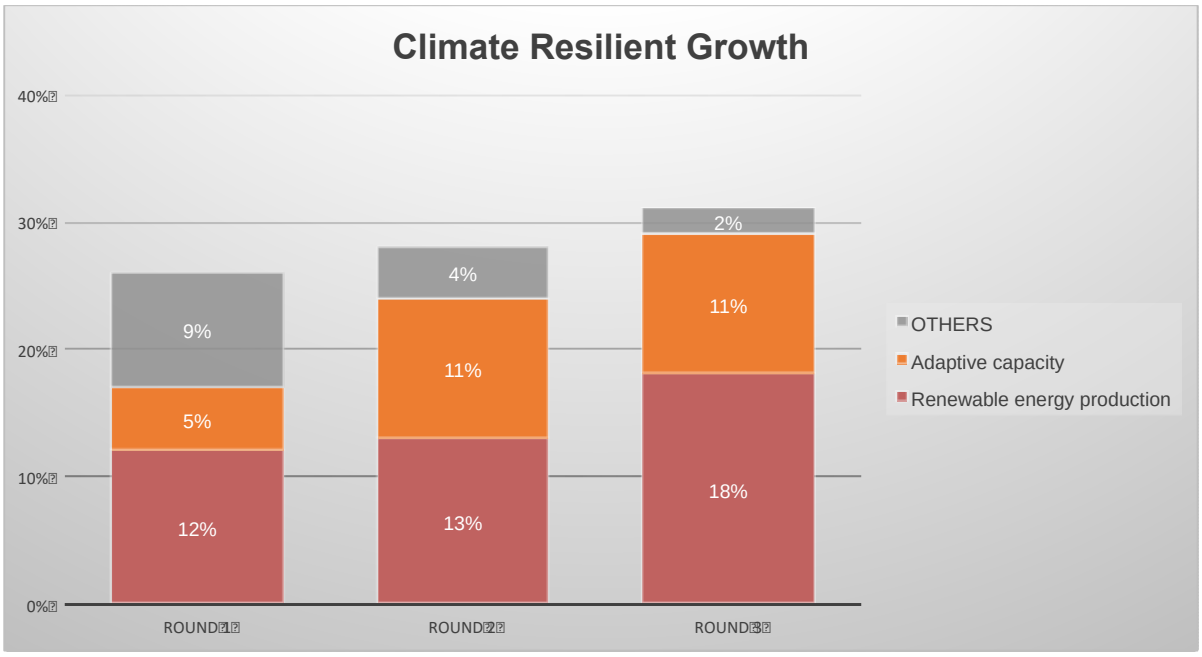


Table 7: Discussion Group Results for Climate Resilient Growth

Selected priority areas for Climate Resilient Growth in the discussion groups	# of groups that selected
Adaptive Capacity	2
Renewable Energy Production	2

Result of selected priority areas for Climate Resilient Growth	Reasons for selection
Renewable energy production	Second priority area selected over the Delphi surveys Selected issue in two of four discussion group Selected priority area in the preliminary assessment
Adaptive capacity	Fourth priority area selected over the Delphi surveys Selected area in two of four discussion group

3.4 Consensus Building on Priority Areas

A graph of all the areas that were prioritized between survey rounds 1, 2 and 3 is presented below. Participants identified five main areas in Nepal for green growth. The areas receiving the highest number of votes during the three survey rounds are “Renewable Energy Production”, “Technological Readiness”, “Agricultural Land Productivity”, “Adaptive Capacity” and “Energy Intensity” (see Figure 17 below).

Figure 17: Consensus Building on Priority Areas

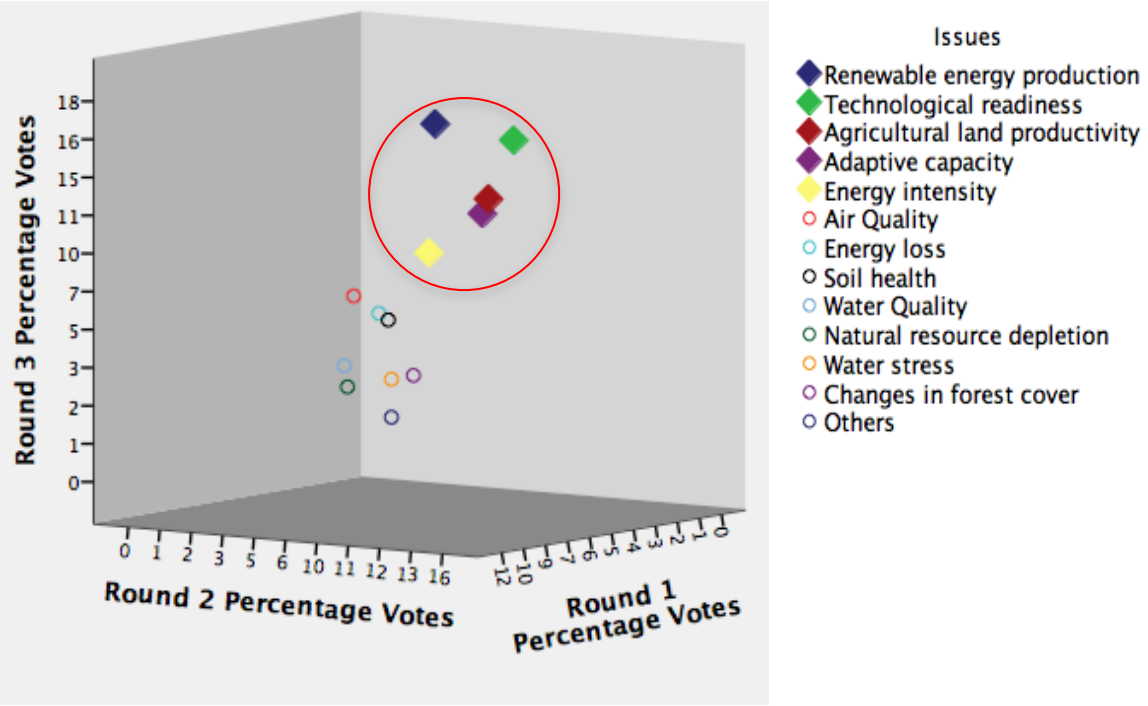
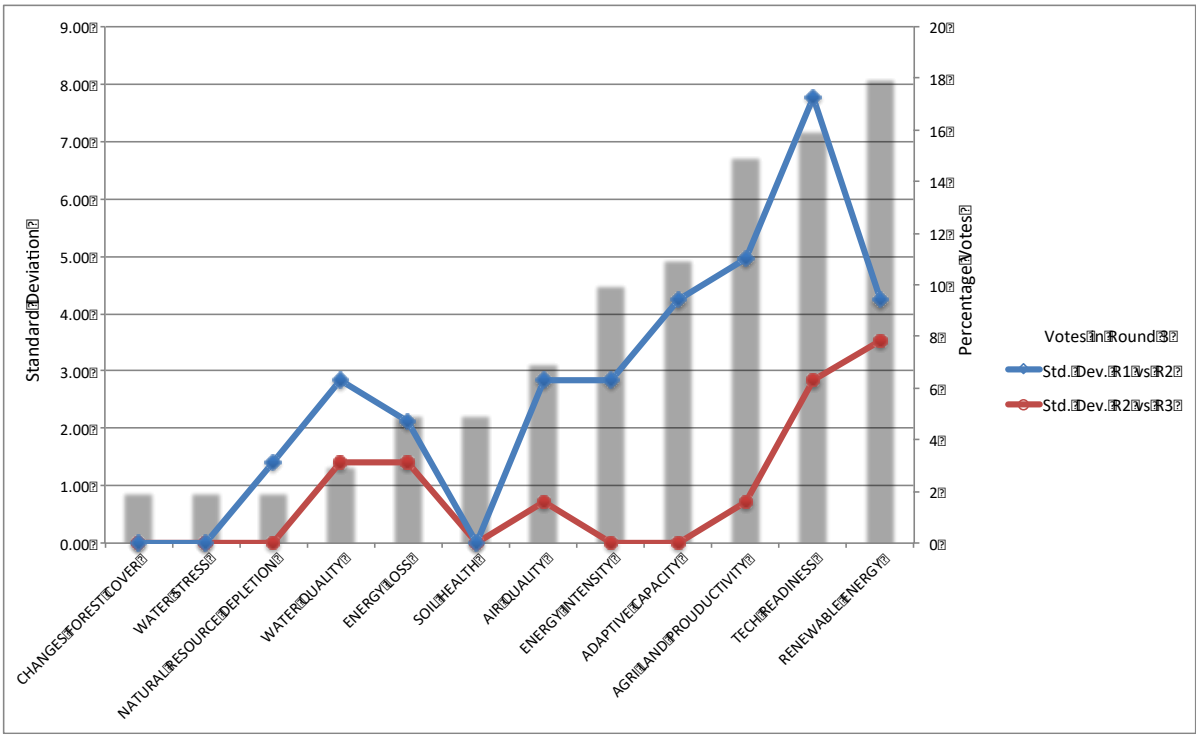


Figure 18 shows the level of consensus reached on the prioritized areas selected by the participants. Standard Deviation (SD) shows the spread (i.e., the disagreement of the survey responses) around that result. As the SD approaches zero it shows greater agreement between the survey rounds, for example between survey round 1 and survey round 2 and between survey round 2 and survey round 3. In the graph below, it can been seen that as votes began to converge (identifying the priority areas) the SD decreased as rounds progressed. These results show that Renewable Energy, Technological Readiness, Agricultural Land Productivity, Adaptive Capacity and Energy Intensity were the five areas receiving the most votes in the final survey round. Furthermore, all five areas have shown increasing percentages from one round to the next, underlining the convergence of views on these five areas.

Figure 18: Final Results and Standard Deviation between Voting Rounds



The table below illustrates the top five priority areas based on the results of the Delphi Survey as detailed above as well as a further four areas that have been selected based on the Preliminary Assessment.

It is worth noting that the prioritized areas are mostly related to the economic side of green growth. Technological Readiness, Agricultural Land Productivity, Renewable Energy and Energy Intensity are all related to the future economic development of Nepal, possibly in a greener way. They are focusing on advancing the country's progress, using renewable energy and improving energy intensity, as well as using technology transfer, while at the same time improving the agricultural sector through higher levels of productivity. The area that sticks out is Adaptive Capacity, which is another important driver for Nepal to maintain its current situation and guarantee the sustainability of its development as well as the resilience of its economy and communities.

Table 8: Priority Areas Based on the Delphi Survey and the Preliminary Assessment

Area	Selected as priority areas during the consultation workshop	Importance assigned by the Preliminary Assessment
Renewable Energy Production	X	
Energy Intensity	X	
Electricity Losses	X	
Agricultural Land Productivity	X	
Water Productivity		X
Water Quality		X
Soil Health		X

Technological Readiness		X
Adaptive Capacity	X	

Therefore, when combining the results from the preliminary assessment and the consultation workshop, the following 9 areas were prioritized, and clustered into 4 groups:

1. Energy cluster:
    - Renewable Energy Production
    - Energy Intensity
    - Electricity Losses
2. Agriculture cluster:
    - Agricultural Land Productivity
    - Water Productivity
    - Water Quality
    - Soil Health
3. Technological Readiness
4. Adaptive Capacity

3.5 Priority Sectors for Green Growth

During the breakout session, stakeholders were asked to select the top 3 areas and then assign the related **key sectors** linked to each. Table 9 below summarizes the selected priority areas with the associated sectors. The table also includes the sectors selected as part of the preliminary assessment.

Table 9: Matrix of Priority Areas and Related Sectors

Area / Sector	Energy: energy intensity, electricity losses, renewable energy	Agriculture: Agricultural Land Productivity, Water Quality, Water Productivity, Soil Health	Technological Readiness	Adaptive Capacity
Agriculture	x	●		○
Industry	●	x	○	
Commerce	●			
Energy Supply	●			○
Transportation		○		
Water & Sanitation	●	●		
Waste Management		●		
Forestry & Land-Use		○		○
Urban Development	○	x		
Housing & Buildings				
Education			○	○

Health Services		○	
Public Administration			○
Household Consumption	●		

● Both from preliminary assessment and discussion groups /

○ Discussion groups selection / x Preliminary assessment selection

Based on the results of the discussion groups as well as the results from the preliminary assessment, as seen in the table above, the following selection of sectors is proposed for further analysis:

1. AGRICULTURE—is highly relevant to the Agricultural cluster, as well as to Adaptive Capacity and Technological Readiness.
2. ENERGY SUPPLY—is highly relevant to the Energy cluster, as well as to Adaptive Capacity.
3. FORESTRY AND LAND-USE—has high relevance to the Agricultural cluster (especially Agricultural Land Productivity and Soil Health) and Adaptive Capacity.
4. WATER AND SANITATION (related to Water Management)—high relevance for Agricultural cluster (especially Agricultural Water Productivity and Water Quality), and Adaptive Capacity.

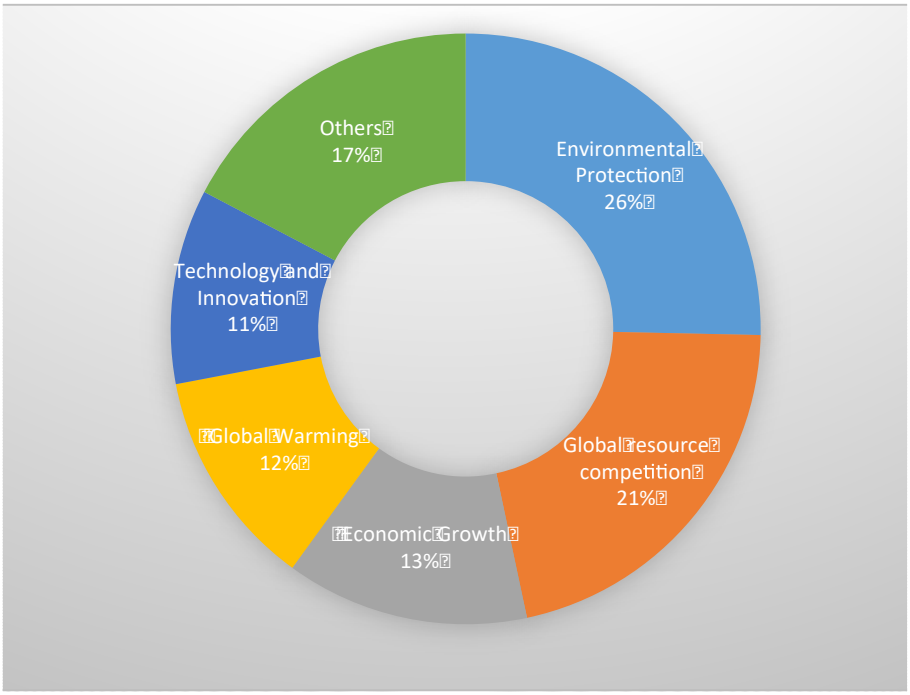
The Industry and Urban Development sectors have not been selected as priority sectors, although the preliminary assessment suggests that they strongly link to Air Quality. Therefore, these two sectors will be transversally addressed in Phase 3 of the GGPA for the sector analysis.

3.6 Participants' Understanding of Green Growth

In the last survey round, participants were also requested to provide an opinion on their understanding of green growth in Nepal. The most important concepts that have been chosen were environmental protection, global resource competition and economic growth.

Concept	Survey Rank
Environmental protection	1
Global resource flows and trade	2
Economic growth	3
Low carbon development	4
Technology and Innovation	5

Figure 19: Participants' Understanding of Green Growth



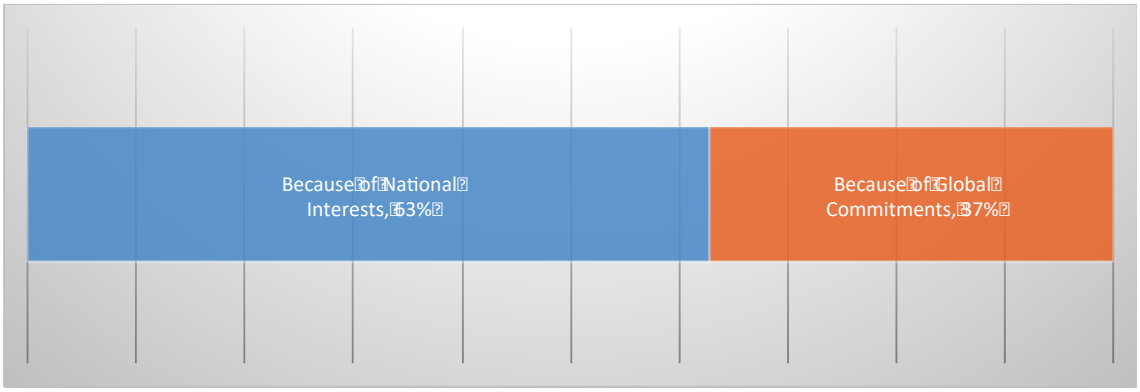
3.7 The Main Drivers to Adopt Green Growth

Stakeholders prioritized national interests over global commitments as the main driver to adopt green growth policies in Nepal. A total of 63% prioritized national interests over international commitments. Participants agreed or strongly agreed that green growth policies are mainly needed to address major development challenges, including:

- Poverty and large disparities within the country
- Weak domestic basis for economic development
- Rapid urbanization challenging existing infrastructure and basic services
- Strong needs for preserving the rich natural endowment
- Climate change impacts

Nepal's international commitments and aspirations include, among others, the Sustainable Development Agenda, the global climate change negotiations and Nepal's INDC, the aim to achieve middle-income status by 2030, and generally the global standing in the international arena.

Figure 20: Why Should Nepal Adopt Green Growth Policies?



The reduction of natural resource extraction and the promotion of resource efficient forms of production and consumption (Resource-Efficient Growth) has been defined as the most important focus area for green growth interventions. Enhancing environmental sustainability (Eco-Friendly Growth) and the reduction of GHG emissions and increasing resilience to climate change impacts (Climate-Resilient Growth) are perceived as relevant, but to a lesser degree. These results are confirmed by the selection of the priority areas.

Figure 21: Which Pathway Should Nepal Emphasize for Green Growth?

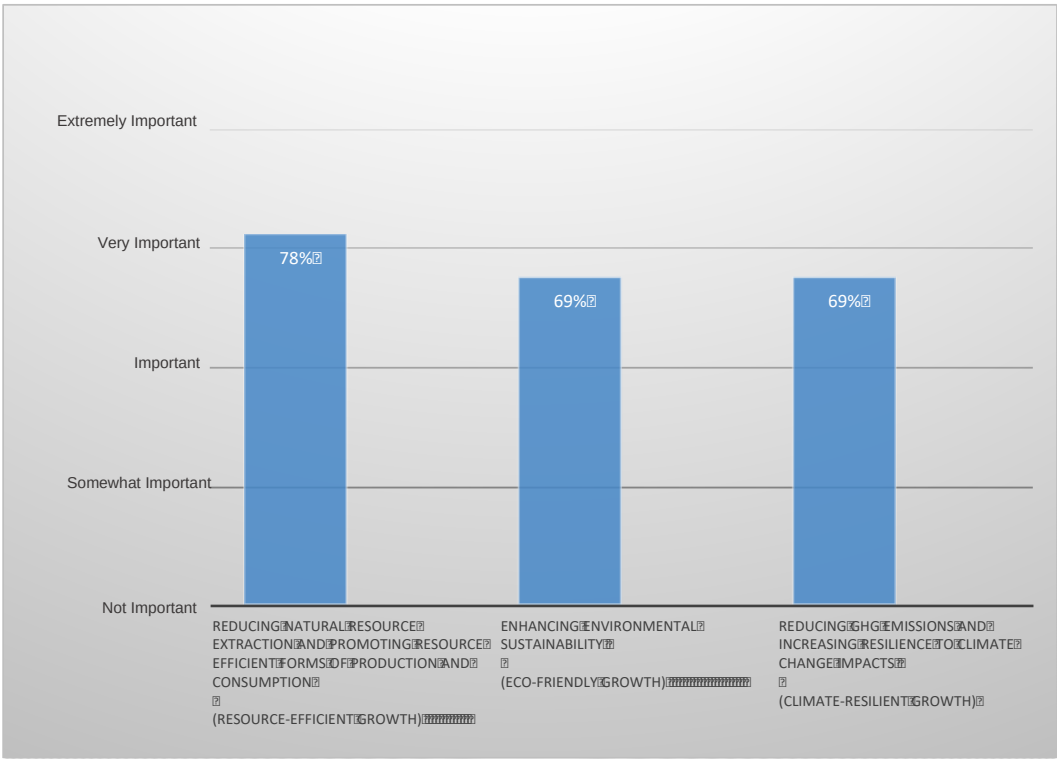
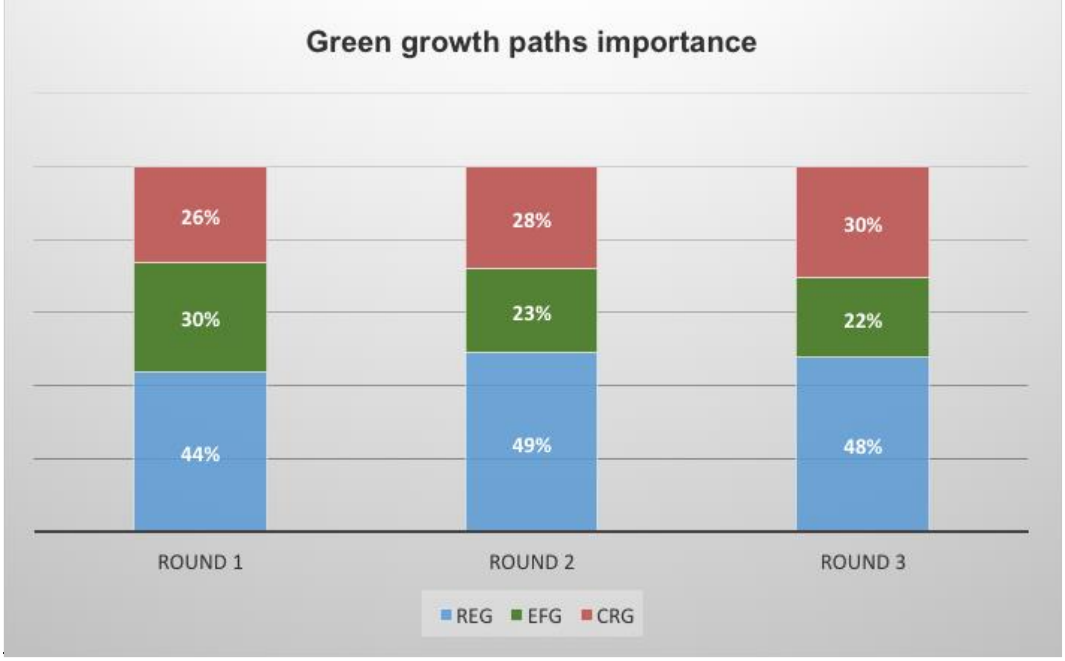


Figure 22: Prioritization of Green Growth Pathways



Based on the selected priority areas, participants identified the REG pathway as the most important green growth dimension. This is confirmed by participants choosing the key areas where Nepal should focus green growth interventions, i.e., the reduction of natural resource extraction and the promotion of resource efficient forms of production and consumption.

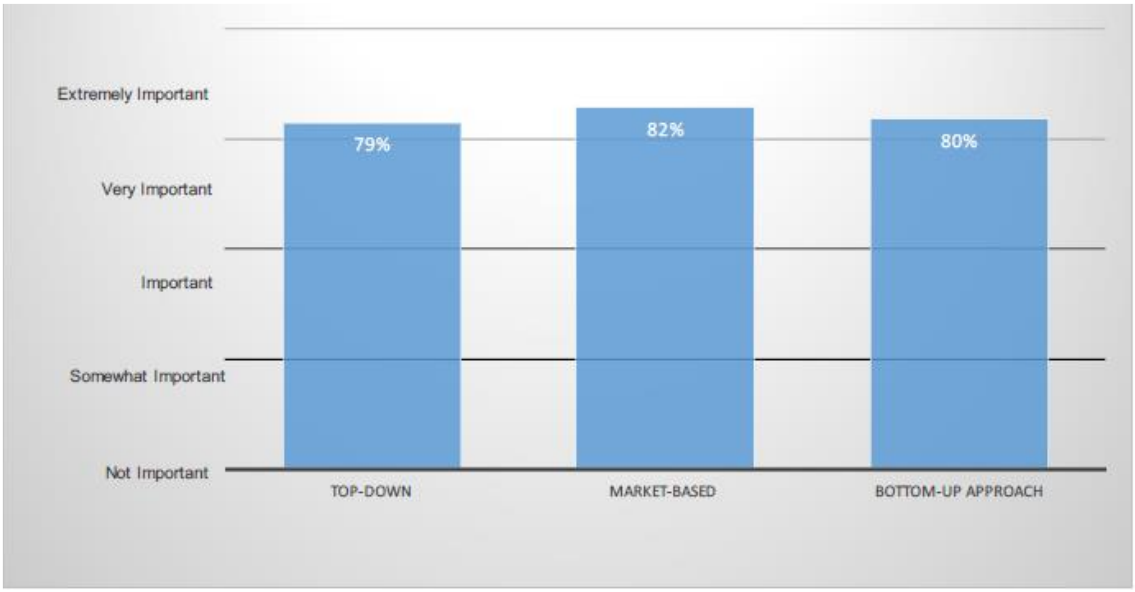
Enhancing environmental sustainability and promoting climate resilient growth are perceived as equally important, when only taking into account the importance of the pathways as such. However, when participants were asked to prioritize specific areas during the Delphi surveys, the importance of areas related to these pathways were rated as less important. In the last survey round climate resilient growth issues were rated with 30% and eco-friendly growth issues with 22%. So while rated as very important overall, when having to choose specific areas, participants prioritized areas related to REG..

These results are in line with the prioritization of national interests over international commitments. International commitments have an important focus on climate change and the Sustainability Development Goals, while national interests are more related to the economic structure of Nepal. On a national level, Nepal faces a weak domestic basis for economic development coupled with rapid urbanization and a strong need to preserve the rich national endowment.

3.8 Types of Strategies and Policies to Lead Nepal's Green Growth

When analyzing the types of strategies and policies perceived as relevant to achieve green growth in Nepal, stakeholders perceive all three types of policy instruments as very important. They rate market based instruments, such as financial incentives and tax levies to stimulate public and private sector involvement with 82%. Voluntary participation through a bottom-up approach by public, private, and government entities receives 80%, directly followed by regulation (79%). This shows that a policy mix that combines the different aspects, taking into account the different angles to promote green growth from the policy side, would be one important aspect to take into account when designing green growth interventions.

Figure 23: Strategies and Policies to Lead Nepal's Green Growth



3.9 List of Participants

Nr.	Name	Surname	Institution	Sector
1	Kishor	Shrestha	Department of Urban Development and Building Construction (DUDBC)	Public/ Urban Development
2	Mahesh	Dhungana	Department of Soil Conservation and Watershed Management (DSCWM)	Public/ Forest and soil Conservation
3	Yamuna	Kandel	Department of soil Conservation Watershed Management (DSCWM)	Public/ Forest and soil Conservation
4	Kamal	Shah	Nepal Agriculture Research Council (NARC)	Public/ Agriculture
5	Er. Shambhu	K.C	Ministry of Urban Development	Public/ Urban Development
6	Hemant Raj	Ghimire	Department of Electricity Development	Public/ Energy
7	Khim Bahadur	K.C	Department of Forest	Public/ Forest and soil Conservation
8	Bhadran N.	Upadhya	Panchakanya Upper Mai Hydropower	Private/ Energy
9	Ghanashyam	Malla	Nepal Agriculture Research Council (NARC)	Public/ Agriculture
10	Jai Shreee	Sijapati	Nepal Academy of Science and Technology (NAST)	Public/ Science and Technology
11	Kailash	Neupane	Ministry of Women, Children and Social Welfare	Public/ Women, Children and Social welfare
12	Amar	Nakarmi	Centre for Energy Studies (CES)	Public/ Education
13	Prabhat Kumar	Singh	Ministry of Industry (MoI)	Public/Industries
14	Ritu	Partha	Ministry of Population and Environment (MOPE)	Public/ Environment
15	RewatiPrashad	Sapkota	Ministry of Population and Environment (MOPE)	Public/ Environment
16	R.P.	Lamsal	Ministry of Population and Environment (MOPE)	Public/ Environment
17	Surendra	Thapa	Ministry of Population and Environment (MOPE)	Public/ Environment
18	Raj Kumar	Rimal	Department of Forest (DoF)	Public/ Forest and soil Conservation
19	YogendraBijaya	Dhamal	Department of Forest (DoF)	Public/ Forest and soil Conservation
20	Krishna	Oli	Sichwan University	Private/Education
21	BishwaNath	Oli	Ministry of Population and Environment (MOPE)	Public/ Environment
22	Neesha	Rana	Nepal Academy of Science and Technology (NAST)	Public/ Science and Technology
23	Prativa	Manandhar	Ministry of Population and Environment (MOPE)	Public/ Environment
24	Madhukar	Upadhaya	Freelance Consultant	Private / Water
25	Dr.Mohadeb	Pandit	Department of Agriculture	Public/ Environment
26	Samjhana	Maharjan	Department of Irrigation	Public/Irrigation
27	Bikash	Nepal	Department of Hydrology and Meteorology (DHM)	Public/ Environment

28	Laxmi	Basnet	Ministry of Population and Environment (MOPE)	Public/ Environment
29	Mr. Binaya	Joshi	Ministry of Population and Environment (MOPE)	Public/ Environment
30	Amit	Acharya	Ministry of Industries (MoI)	Public/Industries
31	Prakash Ram	Adhikari	MOHD	
32	Achanda	Sharma	Ministry of Population and Environment (MOPE)	Public/ Environment
33	Parmita	ChapagainNeupane	Federation of Nepalese Chambers of Commerce and Industry (FNCCI)	Private/Industries
34	Bhawana	Neupane	Federation of Nepalese Chambers of Commerce and Industry (FNCCI)	Private/Industries
35	Shiv Kumar	Banskota	Department of Mines & Geology	Private/Industries
36	Archana	Shrestha	Department of Hydrology and Meteorology (DHM)	Public/ Environment
37	Basu Dev	Kafle	Ministry of Agriculture	Public/Agriculture
38	Narayan B.	Kunwar	Ministry of Women, Children and Social Welfare	Public/ Women, Children and Social welfare
39	Swasti	Shrestha	Department of Environment	Public/ Environment
40	Vinod	Gautam	Ministry of Culture & Civil Aviation	Public/Culture& Civil Aviation
41	Kiran	Gautam	Water and Energy Commission Secretariat (WECS)	Public/Energy
42	Dinesh	Bhuju	MinErgy Pvt Ltd	
43	Sabitry	Paudel	Department of Women and Child Welfare (DWC)	Public/ Women, Children and Social welfare
44	Keshav Raj	Joshi	Department of Environment	Public/ Environment
45	Santosh K	Singh	Department of Agriculture Fisheries Dev, Hariharbhawan	Public/ Agriculture
46	Manoj	Pantha	Department of Irrigation	Public/Irrigation
47	Manita	Karki	Ministry of Population and Environment (MOPE)	Public/ Environment
48	Hari Prasad	Ghimere	Ministry of Population and Environment (MOPE)	Public/ Environment
49	Shambhu	Thapaliya	Ministry of Population and Environment (MOPE)	Public/ Environment
50	Krishna Pd.	Pandey		
51	Shamkav	Sapkota	Ministry of Population and Environment (MOPE)	Public/ Environment

3.10 Agenda

Time	Activity
8:30-9:00	**Arrival Registration**
9:00-9:30	**Opening Session** Welcome Remarks and Presentation on Nepal's Green Growth Policy Vikram Basyal, Moderator, GGGI Dr. Bishwa Nath Oli, Secretary, Ministry of Population and Environment (MOPE)
9:30-9:45	**Green Growth Potential Assessment—Methodology** Jan Stelter, Green Growth Analyst, GGGI
9:45-10:15	**Green Growth Diagnosis of Nepal** Part 1: How Is Nepal performing in Key Green Growth Areas? Steffen Schwörer, Green Growth Specialist, GGGI
10:15-10:45	**Stakeholder Consultation—Round1** Beatriz Medina, Facilitator, GGGI
10:45-11:00	*Coffee Break*
11:00-12:00	**Green Growth Diagnosis of Nepal** Part 2: Why should Nepal pursue Green Growth? / Results of Stakeholder Consultation Steffen Schwörer, Green Growth Specialist, GGGI / Beatriz Medina, Facilitator, GGGI
12:00-13:00	*Lunch*
13:00-14:30	**Group Discussion of Results and Consensus Building** Beatriz Medina, Facilitator, GGGI
14:30-14:45	**Stakeholder Consultation– Round2** Beatriz Medina, Facilitator, GGGI
14:45-15:00	*Coffee Break*
15:00-16:15	**Plenary Discussion and Stakeholder Consultation– Round3** What does Green Growth mean for Nepal? Dinesh Raj Bhuju, Suyesh Prajapati, Beatriz Medina, Facilitators, GGGI
16:15-16:30	**Closing Remarks and Next Steps** Dr. Yong Sung Kim, Senior Green Growth Specialist, GGGI Dr. Ram Prasad Lamsal, Joint Secretary & Chief, Climate Change Management Division, Ministry of Population and Environment (MOPE)

Annex 4: Summary of Focus Group Discussions

4.1 Introduction

The Focus Group Discussions (FGD) were held in the framework of Phase 3 of the Green Growth Potential Assessment in Nepal, and have been based on the results of the Preliminary Assessment as well as the consultation workshop. The Preliminary Assessment highlighted 11 priority areas for green growth in Nepal. The consultation workshop identified four clusters of priorities (containing a total of 9 areas) and 4 (see Table 10). These results fed into Phase 3 of the GGPA process, which started with in-depth sector analysis and the FGDs in Nepal.

Table 10: Selected Priority Areas and Sectors for the GGPA

Priority Area / Sector	Energy Supply	Agriculture	Water Management	Forestry and Land-Use
1. Energy cluster: • Renewable Energy Production • Energy Intensity • Electricity Losses	●		●	
2. Technological Readiness		●		
3. Agricultural cluster: • Agricultural Land Productivity • Water Productivity • Water Quality • Soil Health		●	●	●
4. Adaptive Capacity	●	●	●	●

4.2 Objective

The FDGs sought to engage in-country experts from the different priority sectors, to work on the priority areas as defined during the workshop, in discussing what actions are needed for Nepal to maximize green growth gains.

The objectives of the FDGs were:

- To gain comprehensive understanding of the relationship between the prioritized areas and the corresponding key sectors;
- To collect information and gain understanding of the country's existing and planned policies and strategies in the relevant sectors, related to the priority areas;
- To identify the key governance challenges and policy gaps in the respective sectors, related to priority areas;
- To provide a set of key policy recommendations to address the priority areas in the respective sectors;

4.3 Methodology

Four FGDs focusing on each prioritized sector, namely i. Energy Generation and Supply, ii. Water Management, iii. Forestry, and Land-Use and iv. Agriculture were organized on 22-23 November 2016 in Kathmandu, Nepal. The FGDs were convened in partnership with the Central Department of Environmental Science (CDES) of Tribhuvan University, Kathmandu.

Table 11: Schedule of Focus Group Discussions

Date	Time	Agenda
22 November 2016	10.00—12.30	FGDs Sector Energy Supply and Generation
	14.00—16.30	FGDs Sector Water Management
23 November 2016	10.00—12.30	FGDs Sector Forestry and Land-Use
	14.00—16.30	FGDs Sector Agriculture

Each of the FGD lasted for 2.5 hours and the resource persons/participants discussed in detail on each of the sectors across the prioritized areas. In each group, six to eight selected participants representing government institutions, academic, NGOs and private sector gathered to discuss on prioritized areas and potential solutions. The names of participants in each FGD are provided in the subsequent FGD summary below.

FGDs were facilitated by Dr. Dinesh Raj Bhuju, a member of the consulting team. The FGD started with a brief round of introduction of all participants. The facilitator welcomed the participants and briefly explained the GGPA process and the objectives of the FGD session. Dr. Kamal Banskota, a local GGGI consultant, introduced GGGI and its objectives. He highlighted the need for green development and how the inputs of the FGD will feed into Country Planning Framework (CPF) GGGI was preparing at the time. Steffen Schwörer of CAD then presented a quick overview on the GGPA methodology and explained briefly the sectors and areas prioritized for the analysis.

To initiate the discussion session, participants were asked to write their understanding on green growth on meta cards. This was then followed by an open discussion where participants were asked to analyse the causes of each cluster of prioritized issues and suggest potential solutions to address those issues. The discussion was captured by a note taker on paper as well as on meta-cards. The notes were later transcribed and systematized to clearly present the findings.

4.4 List of Participants

Energy

S.N	Name	Organization	Position
1	Ms. Kiran Gautam	Water and Energy Commission Secretariat	Senior Divisional Engineer
2	Mr. Rajendra Koirala	Nepal Electricity Authority	Assistant Manager
3	Mr. Narayan Prasad Adhikari	Alternative Energy Promotion Centre	Assistant Director
4	Mr. Akhanda Sharma	Ministry of Population and Environment	Senior Divisional Engineer
5	Mr. Sumant Shah	Ministry of Energy	Engineer
6	Mr. Iswor Bajracharya	Nepal Academy of Science and Technology	Hydrologist
7	Dr. Shree Raj Shakya	Centre for Energy Studies	Deputy Director
8	Mr. Suyesh Prajapati	MinErgy	Consultant
9	Dr. Dinesh Raj Bhuju	Central Department of Environmental Science	Consultant
10	Mr. Steffen Schwoerer	CAD	Consultant
11	Ms. Ashanapuri Hertz	CAD	Consultant
12	Mr. Kamal Banskota	Global Green Growth Institute	Senior Economist
13	Mr. Vikram Basyal	Global Green Growth Institute	Green Growth Specialist
14	Ms. Reshma Nakarmi	Centre Department of Environment Science	Research Associate

Water Management

S.N	Name	Organization	Position
1	Mr. Sumant San	Ministry of Energy	Engineer
2	Mr. Iswor Bajracharya	Nepal Academy of Science and Technology	Engineer
3	Dr. Sadhana Pradhanang	Central Department of Environmental Sciences	TU, Professor
4	Mr. Udhab Raj Khadka	Central Department of Environmental Sciences	TU, Faculty Member
5	Mr. Hari Krishna Shrestha	Nepal Engineering College	Professor, Hydrologist
6	Ms. Anju Air	Jalsrot Vikas Sanstha / JVS	Programme Officer
7	Mr. Yagartha Pokharel	Butwal Power Company Ltd	Manager - Generation
8	Mr. Suyesh Prajapati	MinErgy	Consultant
9	Dr. Dinesh Raj Bhuju	Central Department of Environmental Science	Consultant
10	Mr. Steffen Schwoerer	CAD	Consultant
11	Ms. Ashanapuri Hertz	CAD	Consultant
12	Mr. Kamal Banskota	Global Green Growth Institute	Senior Economist

13	Mr. Vikram Basyal	Global Green Growth Institute	Green Growth Specialist
14	Ms. Reshma Nakarmi	Centre Department of Environment Science	Research Associate

Forestry and Land-Use

S.N	Name	Organization	Position
1	Rabindra Maharjan	Department of Forest	Under Secretary
2	Parbata Gautam	Federation of Community Forestry User Nepal	Executive Member
3	Kamal Adhikari	Resources Himalaya	Director
4	Buddi Poudel	Department of Forest Research and Survey	Under Secretary
5	Mr. Suyesh Prajapati	MinErgy	Consultant
6	Dr. Dinesh Raj Bhuju	Central Department of Environmental Science	Consultant
7	Mr. Steffen Schwoerer	CAD	Consultant
8	Ms. Ashanapuri Hertz	CAD	Consultant
9	Mr. Kamal Banskota	Global Green Growth Institute	Senior Economist
10	Mr. Vikram Basyal	Global Green Growth Institute	Green Growth Specialist

Agriculture

S.N	Name	Organization	Position
1	Gopal Bahadur K.C.	Institute of Agriculture and Animal Science	Professor
2	Samid Ahamad	Nepal Agriculture Research Council	Sr. Scientist
3	Parashu Adhikari	Ministry of Agriculture Development	Sr. Agriculturist
4	Roshan M. Bajracharya	Kathmandu University	Professor (visiting)
5	Krishna Poudel	Forest Action	Team Leader
6	Mr. Suyesh Prajapati	MinErgy	Consultant
7	Dr. Dinesh Raj Bhuju	Central Department of Environmental Science	Consultant
8	Mr. Steffen Schwoerer	CAD	Consultant
9	Ms. Ashanapuri Hertz	CAD	Consultant
10	Mr. Kamal Banskota	Global Green Growth Institute	Senior Economist
11	Mr. Vikram Basyal	Global Green Growth Institute	Green Growth Specialist
12	Ms. Reshma Nakarmi	Centre Department of Environment Science	Research Associate

Annex 5: Estimate of Economic Costs Due to Electricity Losses

Item	Value	Source
Total electricity generation (in kWh)	2,168,490,000	NEA, 2015
Electricity losses (in %)	25%	
Total loss (kWh)	2,168,490,000 kWh x 25% = 542,122,500 kWh	
Average electricity cost (in Rs/KWh)	8.14	http://thehimalayantimes.com/opinion/electricity-development-let-us-correct-the-price/
Value of total electricity losses (in NPR)	542,122,500 kWh x 8.14Rs/kWh = 4,412,877,150Rs	
Value of total electricity losses (in USD), with 100Rs = 1USD	44,128,772	

About the Global Green Growth Institute

The Global Green Growth Institute (GGGI) is a treaty-based international, inter-governmental organization established in 2012, at the Rio+20 United Nations Conference on Sustainable Development.

Founded to support and promote the mainstreaming of green growth, GGGI programs and projects target economic growth that is environmentally sustainable and socially inclusive. GGGI works across four priority areas considered to be essential to transforming national economies, including energy, water, sustainable landscapes and green cities.

GGGI envisions a resilient world achieved through strong, inclusive and sustainable green growth, and is dedicated to supporting the transition of GGGI Member countries toward a green growth model. In pursuit of these goals, GGGI works with Least Developed Countries and emerging economies to design and deliver programs and services that demonstrate new pathways to pro-poor, sustainable economic growth.

GGGI supports stakeholders through the delivery of comprehensive products and services designed to assist in developing, financing and mainstreaming green growth into national economic development plans.

Member Countries: Australia, Cambodia, Costa Rica, Denmark, Ethiopia, Fiji, Guyana, Hungary, Indonesia, Jordan, Kiribati, Republic of Korea, Lao PDR, Mexico, Mongolia, Norway, Papua New Guinea, Paraguay, Peru, Philippines, Qatar, Rwanda, Senegal, Thailand, United Arab Emirates, United Kingdom, Vanuatu, Viet Nam

Operations: Cambodia, China, Colombia, Costa Rica, Ethiopia, Fiji, India, Indonesia, Jordan, Kiribati, Lao PDR, Mexico, Mongolia, Morocco, Mozambique, Myanmar, Nepal, Peru, Philippines, Rwanda, Senegal, Thailand, Uganda, United Arab Emirates, Vanuatu, Viet Nam

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