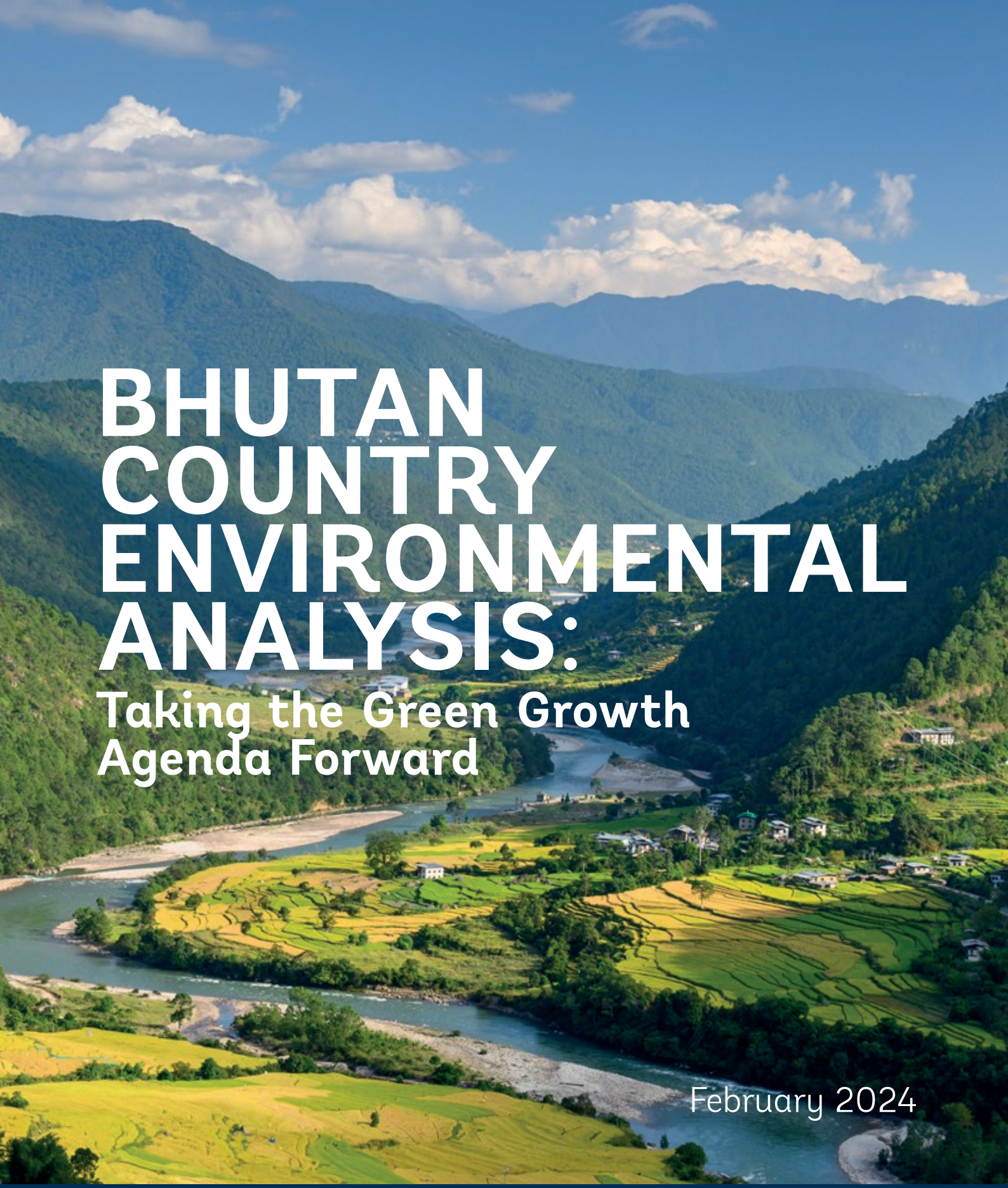

BHUTAN COUNTRY ENVIRONMENTAL ANALYSIS:

Taking the Green Growth Agenda Forward

February 2024

WORLD BANK GROUP

1818 H Street NW
Washington DC 20433
Telephone: 202-473-1000
Internet: www.worldbank.org

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Abbreviations

CAT	Climate Action Tracker
CCKP	Climate Change Knowledge Portal
COP21	Conference of the Parties
BAU	business-as-usual
BCF	Bhutan Climate Fund
CEA	Country Environment Analysis
CGE	Computable General Equilibrium
DGM	Department of Geology and Mines
DHPS	Department of Hydropower and Power Systems
DoE	Department of Energy
DECC	Department of Envuronment and Climate Change
DFPS	Department of Forests and Park Services
DW	Department of Water
ECP	Economic Contingency Plan
EE	Energy Efficiency
EE&C	Energy Efficiency and Conservation
EIA	Environmental Impact Assessment
EPI	Environmental Performance Index
FYP	Five Year Plan
GCF	Green Climate Fund
GDP	gross domestic product
GHG	greenhouse gas
GLOF	glacial lake outburst flood
GNH	Gross National Happiness
GNI	Gross National Income
GRID	Green, Resilient, and Inclusive Development
HDI	Human Development Index
IEMMP	Integrated Energy Management Master Plan for Bhutan
LEDS	Low Emission Development Strategy
LMI	Lower Middle-Income
LPG	Liquified Petroleum Gas
LTS	Long-Term Low GHG Emission and Climate Resilient Development Strategy
LULUCF	land use, land-use change and forestry
MDPR	minimum daily package rate
MEA	Multilateral Environmental Agreement
MJ	megajoules
MoAL	Ministry of Agriculture and Livestock
MENR	Ministry of Energy and Natural Resources
MoF	Ministry of Finance
DoL	Department of Labor
DoHS	Department of Human Settlement
MoIT	Ministry of Infrastructure and Transport
MW	megawatt
NAP	National Adaptation Plan
NAPA	National Adaptation Program of Action
NC	National Communication
NDC	Nationally Determined Contribution
NEC	National Environment Commission
NEPA	National Environmental Protection Act
Nox	nitrous oxide and nitrogen dioxide
NPK	nitrogen, phosphorus, potassium
NRDCL	National Resource Development Corporation Limited
NSB	National Statistics Bureau
NWFP	non-wood forest product
PA	protected area
PE	public expenditure
PEE	public environmental expenditure
PM	particulate matter
PPP	purchasing power parity
RGoB	Royal Government of Bhutan
RCP	Representative Concentration Pathway
RNR	renewable natural resource
SAM	Social Accounting Matrix
SDF	sustainable development fee
SDG	Sustainable Development Goal
SEA	Strategic Environmental Assessment
SFM	sustainable forest management
SHDP	Sustainable Hydropower Development Policy
TFP	total factor productivity
UNFCCC	United Nations Framework Convention on Climate Change
WaSH	Water, sanitation, and hygiene
WB	World Bank
WHO	World Health Organization
WWF	World Wildlife Fund

Acknowledgements

The Bhutan Country Environmental Analysis, "Taking the Green Growth Agenda Forward," aims to inform policymakers in the Royal Government of Bhutan, especially their efforts regarding public policies towards green, resilient, and inclusive development by highlighting the challenges and opportunities and, as much as possible, bridging knowledge gaps in this respect. A task team from South Asia Environment, Natural Resources, and Blue Economy Global Practice of the World Bank has prepared this report. Gayane Minasyan, Lead Environmental Specialist, led this team effort, supported by Andrea Kutter (Sr. Natural Resources Specialist), Adriana Damianova (Sr. Policy Advisor, Consultant), Arndt Feuerbacher, (Economist, Consultant), Prof. Pasquale Lucio Scandizzo (Economic Advisor, Consultant, University of Rome "Tor Vergata"), Naysa Ahuja (Consultant), Ana Luisa Gomes Lima (Sr. Environmental Specialist), Melanie Trost (Economist), Jason Daniel Russ (Sr. Economist), Devika Singh (Consultant), Gayatri Acharya (Program Leader). The CEA benefited from the guidance and inputs of Kseniya Lvovsky (Practice Manager), Urvashi Narain (Lead Economist), Helena Naber (Sr. Environmental Specialist), Klas Sander (Sr. Environmental Economist), Stefania Abakerli (Sr. Urban Specialist), Adama Coulibaly (Resident Representative), Tenzin Lhaden (Sr. Operations Officer). The team is grateful to Mercy Miyang Tembon (Country Director) and Christoph Crepin (Practice Manager), who provided the overall guidance throughout the completion of this work.

Abstract

Bhutan's natural environment is among the most pristine in South Asia. With a stellar performance on sustainability and carbon neutrality, Bhutan is a recognized global leader in forest and biodiversity conservation. At the same time Bhutan is highly vulnerable to climate change impacts. Some of the climate change effects are already increasingly visible. The fast pace of urbanization, pollution, and waste management are emerging environmental challenges and critical areas for mitigation and adaptation efforts. The Country Environmental Analysis takes a new look at Bhutan's development trajectory by integrating the country's impressive conservation and nature protection achievements in a discussion about new growth opportunities. The CEA looks at the country's sustainability profile and examines various socioeconomic indicators beyond GDP and growth rates. This approach echoes the development model and overarching philosophy engrained in Bhutan's GNH concept with the purpose of promoting good governance, socioeconomic growth, cultural preservation, and environmental protection. The CEA uses several analyical tools to identify key development challenges, knowledge gaps, and opprtunities for sustainable growth alternatives, including the GRID benchmarking, and 'green growth' policy scenario analysis using the Computable General Equilibrium model. The institutional and policy analysis narrows down on areas where removing existing barriers could raise the stakes for addressing the challenges and diversifying the country's economic base without negatively impacting Bhutan's environmental and climate neutrality agenda.

Bhutan's pristine nature, supported by a constant effort to safeguard the value of its natural capital, will remain the brand of Bhutan. While environmental policies and accomplishments have already helped to build the country's uniquely "green" image, in the long run, Bhutan's natural resources may be on the brink of excessive pressures despite the government's commitment to sustainable resource use and conservation. If no action is taken to reverse current trends, the emerging pressures will eventually continue to increase in the future.

Executive Summary

"Bhutan must follow the middle path development, that is development that recognizes the need to develop our economy, to progress technically, medically, and scientifically while still maintaining our rich cultural heritage and our traditional values, as well as preserving our natural resource base."

His Majesty, The 4th King Jigme Singye Wangchuck

Country Context

I. **A prolonged period of political and economic stability allowed Bhutan's economy to grow at an average annual rate of 7.2 percent between 2000 and 2019. Bhutan's per capita income increased threefold in purchasing power parity (PPP) terms over the same period.** Economic growth had been strong prior to the COVID-19 pandemic, fueled by the public sector-led hydropower sector and strong performance in the services sector, including tourism. As a result, extreme poverty based on $2.15/day was eliminated by 2022, and the population living below the $6.85/day poverty line for upper middle-income countries, decreased from 39.5 percent to 8.5 percent between 2017 and 2022. The economy has grown by 4.6 percent in FY22/23, supported by the reopening of borders for tourism in September 2022. Bhutan Nominal GDP Per Capita is forecasted to reach US$ 3,662.695 in 2024 (International Monetary Fund). The Gini index, which measures income inequality, decreased from 37 in 2017 to 28 in 2022. Despite this progress, vulnerability to poverty and spatial inequality remains a significant challenge. Bhutan's economic development policies are guided by sustainable development and environmental conservation-focused growth, which will not compromise its status as the global leader in environmental conservation and carbon neutrality.

II. **Heavy investments in hydropower have enabled strong and green economic growth in the past decades by ensuring a steady stream of revenue from electricity exports.** Bhutan has immense hydropower potential which is supported by a dense network of rivers. The sector accounted for 27 percent of total exports in 2019.[1] Bhutan claims that hydropower exports offset 4.4 million tons of annual CO_2 emissions and that by 2025, through increased hydroelectricity exports, the country will offset up to 22.4 million tons of CO_2 per year in the region.[2] Bhutan's electricity needs are almost entirely met by hydropower, with other energy needs met by thermal power. Medium-term growth is expected to be supported by a recovery in the non-hydro industry and services sectors, and by the commissioning of a new hydro plant (World Bank, 2023).

III. **The country's economy was strongly impacted by COVID-19 restrictions in 2020, with GDP**

growth contracting to -10.08 percent in 2020 from 5.75 percent in 2019.[3] Tourism, the service industry, and mining were the most impacted sectors with sectoral growth falling by 60 percent in 2020. Total tourist arrivals declined by 91 percent, from 173,000 in FY19/20 to 15,000 in FY20/21. After the major slowdown, in the medium term, output is expected to return to pre-pandemic levels in FY22/23, with a pick-up in services sector growth, reflecting a gradual recovery in tourism and a normalization in domestic activity patterns.

IV. **Bhutan's Gross National Happiness (GNH) is the country's guiding development philosophy for measuring socioeconomic development.** Since 2008, the country has used a metrics-based system in support of GNH implementation, with conservation of the environment as one of the nine domains of GNH. The GNH Index score was used for the first time in the 12th Five Year Plan (FYP) (2018–23) as one of the criteria for determining resource allocation to local government units.

V. **Unique culture, traditions, and landscapes determine Bhutan as the most exclusive travel destination in the world, enjoying a reputation for authenticity, remoteness, and a well-protected cultural heritage and natural environment.** The country's uniqueness in size, geography, cultural traditions, and natural capital is unparalleled in the world. Over 45 percent of Bhutan's land area lies 3,000 meters above sea level, with altitudes varying from 100 meters to 7,550 meters above sea level. There are over 2,500 glacial lakes, with multiple rivers running from east to west across the country. Bhutan has indispensable freshwater resources supported by four major rivers that are shared across the Asian continent. The government pursued a unique high-value and low-volume tourism policy based on a minimum daily package of US$200–250 per person.

VI. **Bhutan is a stellar performer on sustainability indicators, is carbon negative, and is a global leader in forest and biodiversity conservation.** Bhutan's economy and culture are inextricably linked to its forests. Over 70 percent of Bhutan's land area is covered by forests, making it the most well-preserved in the world. Bhutan's forests sequester more than 6.3 million tons of CO_2 annually, around three times its emissions, making it the one of the largest carbon sinks in the region. While the forest sector contributes around 3 percent to the GDP (2018), the real economic value of forests is much larger. Bhutan's ecosystem services are estimated to be valued at around US$15.5 billion/year, with at least 50 percent of this value accruing to people outside of Bhutan.

Emerging and Structural Challenges

VII. **Bhutan is highly vulnerable to climate change impacts, has lower resilience than other comparable lower middle-income (LMI) countries, with the effects of climate change are already increasingly visible.** Some of the most challenging climate risks which Bhutan faces are hydrological, making its most important economic sectors (hydropower and agriculture) highly vulnerable to climate impacts. While hydropower has kept Bhutan's emissions and sustainability agenda on track, high dependence on this sector leaves Bhutan's economy highly vulnerable. Changing climate patterns will further add pressure and increase vulnerability. Glacial lake flood outbursts, heavy and variable rainfall, droughts, and risk of loss of biodiversity and forest fires are already pressing concerns. Increasing climate variability will impact agricultural yield and productivity, while increased precipitation variability will trigger flash floods, landslides, and drought, already a recurring phenomenon in Bhutan.

VIII. **While Bhutan stands strong on environmental sustainability and is committed to remain**

3 National Statistics Bureau. Government of Bhutan. 2021. Accessed from https://www.nsb.gov.bt/gross-domestic-product-gdp-2020/.

carbon neutral, greenhouse gas (GHG) emissions are on the rise. Bhutan's energy intensity[4] was reported at 10.4 megajoules per USD (MJ/USD), higher than the neighboring China (6.9 MJ/USD), India (4.7 MJ/USD) and Nepal (7.4 MJ/USD) (World Bank, 2019). With current policies, Bhutan remains compliant with its Nationally Determined Contribution (NDC) targets, but the gap to the limit of emissions to stay carbon neutral may close with increasing emissions. GHG emissions were the highest from energy consumption per capita (707.917 Gg CO_2e in 2015), largely due to the inefficient use of energy. Emissions from the waste sector have increased by 126.7 percent compared to 1994 levels, three times the proportional increase in population for this time. Emissions from the forest sector have also increased by over 100 percent since 1994, largely due to biomass burning.

IX. **The fast pace of urbanization, pollution, and waste management are emerging environmental challenges and critical areas for mitigation and adaptation efforts**. Bhutan's urban population growth rate of 5.7 percent per year (2000–10) was the highest among the eight South Asian countries.[5] Urban population is expected to reach 56.8 percent by 2047, potentially creating increased stress on water resources and waste management. While Bhutan's indicators on access to clean water are currently high, development constraints related to urban sprawl, and inadequate quality of waste management and wastewater treatment services could challenge Bhutan's leadership on sustainability. Air pollution from domestic and cross-border pollution are an emerging national concern. Biomass burning, an expanding transport sector, and the inefficient use of energy have contributed to a significant increase in emissions and related mortality. Bhutan's municipal waste management is also a pressing issue, with over 861.36 tons of solid waste generated per week across the country, 51 percent of which comes from urban areas.

Objective, Scope, and Methodology

X. **The Country Environment Analysis (CEA) aims to identify challenges and knowledge gaps to inform the Royal Government of Bhutan's (RGoB) policies and support its efforts towards a Green, Resilient, and Inclusive Development (GR**ID)—key elements of the "building back better" path for Bhutan's post-COVID-19 recovery and continuing Bhutan's sustainable development aspirations. The outputs intend to inform the implementation of the Economic Contingency Plan (ECP) and the 21st Century Economic Roadmap of Bhutan, as well as the World Bank's (WB) policy dialogue.

XI. **The CEA attempts to take a new look at Bhutan's development trajectory by integrating its impressive conservation and nature protection achievements with new growth opportunities.** In a nutshell, the analysis aims to answer the following questions: (i) How can Bhutan increase its resilience and diversify its economy and support livelihoods and job creation without compromising its environmental record? and (ii) How can Bhutan transform its conservation of natural resources into a sustainable, economically viable model with creative market-based sustainable development approaches?

XII. **The CEA takes a holistic approach by looking at the country's sustainability profile and examining various socioeconomic indicators beyond GDP and growth rates.** This approach echoes the development model and overarching philosophy engrained in Bhutan's GNH concept with the purpose of promoting good governance, socioeconomic growth, cultural preservation, and environ-

4 Energy intensity level of primary energy (MJ/USD 2011 PPP GDP)
5 Ellis, Peter; Roberts, Mark. 2016. Leveraging Urbanization in South Asia : Managing Spatial Transformation for Prosperity and Livability. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/22549 License: CC BY 3.0 IGO.

mental protection (known as the four pillars of GNH). The CEA uses several analyical tools to identify key development challenges, knowledge gaps, and opprtunities for sustainable growth alternatives, including the GRID benchmarking; green growth policy scenario analysis using a Computable General Equilibrium (CGE) model (STAGE2); and the institutional and policy analysis narrows down areas where removing related barriers could raise the stakes for addressing significant challenges in diversifying the country's economic base without negatively impacting Bhutan's environmental and climate neutrality agenda.

Key Messages

XIII. **Looking forward, Bhutan's pristine nature, supported by a constant effort to safeguard the value of its natural capital, will remain the brand of Bhutan.** Bhutan's environmental policies and accomplishments have already helped to build the country's uniquely green image. While these achievements are widely acknowledged and celebrated, the emerging development challenges and lack of economic diversification, could hamper Bhutan's short-term recovery and growth prospects. The COVID-19 crisis highlighted the need to rethink Bhutan's development trajectory of sectors depending on natural capital. This includes policy choices and making data-driven decisions that will shape Bhutan's growth trajectory for decades to come. The country's commitment to carbon neutrality and "green" and "clean" branding, and the future net effects of rapid urbanization and economic development on emission levels, could be hard to estimate. If no action is taken to reverse current trends, the emerging pressures will eventually continue to increase in the future. At a point of no return, climate change will pose threats to the natural capital and livelihoods. Therefore, building Bhutan's resilience to adapt to climate change and sustain the natural base of sectors drivers of the economy will remain a priority.

(i) Sustainably harnessing/capitalizing on the natural resource base

XIV. **In the long run, Bhutan's natural resources may be on the brink of excessive pressures despite the government's political commitment to sustainable resource use and conservation.** Current development patterns, growing environmental pressures, and climate effects indicate the potential risks of degrading air and water quality, and landscapes that support important economic sectors. Linking conservation and protection with economic growth and capitalizing on the country's bountiful natural resources to link environmental protection, economic growth, and local development could improve economic and environmental resilience through economic diversification using natural assets for adding value to the economy and creating more jobs.

XV. **Despite the large forest cover that exceeds 70 percent of the country's total land area, Bhutan is a net importer of wood-based products, indicating untapped potential to increase the added value of the country's forests.** According to Bhutan's national accounts, forestry contributed between 2.9 percent and 2.4 percent to the GDP between 2013 and 2017.[6] Different Forest Resource Assessments show that Bhutan could substantially increase its forest utilization with the availability of advanced harvesting and processing technologies,[7] without compromising its forest cover targets. The CGE model assesses the potential contribution of investments in two wood-based products to promote higher value-added within this sector: the production of glue-laminated timber to reduce dependency on imported steel-based structures, and the production of domestic

6 NSB 2018; World Bank 2018. Bhutan Forest Note. Note: This does not include the contribution of the forestry sector in terms of rural timber subsidies, timber for disaster victims, timber for construction and renovation of important monuments, and other national projects.

7 MoAF 2014; Schindele 2004.

charcoal to reduce the carbon footprint of energy-intensive industries using charcoal and coke. The macro-level results from CGE modelling show that all policy scenarios result in positive economic impacts and welfare effects, boosting the production of glulam and charcoal while moderately increasing domestic employment and significantly reducing Bhutan's estimated GHG emissions by 3.2 percent.

XVI. **Bhutan's tourism sector could do better to fully capitalize on the country's pristine environment.** The majority (80 percent) of tourists only visit the hotspot locations in Western Bhutan, where overcrowding and high seasonality could jeopardize the sector's sustainability and future growth. Diversifying the tourism sector by improving the quality of supply of facilities and infrastructure, and by enhancing the ecotourism segment, for which Bhutan's environmental conservation efforts are a main input, will be a winning proposition and a long-term solution to (i) transform Bhutan's tourism industry and economy at large; and (ii) address the structural issues and vulnerabilities of the sector. The results of model simulations emphasize that diversification of the tourism sector towards a higher share of nature- and community-based products would result in a spatially and temporally more balanced distribution of tourist arrivals and positive economic growth (an increase in GDP of about 0.4 percent). Moreover, incentivizing tourists to spend days in regions outside of Western Bhutan will likely lead to an increase in average stays. The biggest setback experienced by the ecotourism industry in the fastest growing market, during the COVID-19 pandemic, indicates the need to look for opportunities and alternatives for future growth of diversified and community-based tourism.

(ii) Preserving the uniqueness of Bhutan and addressing the emerging challenges threatening "Brand Bhutan"

XVII. **Building the resilience of Bhutan's unique ecosystems to address growing pressures will help protect the country's pristine environment, which is the brand of Bhutan.** The country has preserved its unique ecosystems, but there are growing pressures that will continue to increase in the future. Drivers of environmental pressure need special and systematic attention to address emerging urbanization challenges and related air quality, water quality, and waste management issues. Maintaining Bhutan's unique tourism brand will also require minimizing unwanted impacts on biodiversity and landscapes, which are particularly attractive to ecotourists. Nonetheless, Bhutan's natural landscapes remain highly vulnerable to climate change impacts and natural disasters. Implementation of the National Climate Policy objectives need to factor adaptation actions into the local-level plans to mitigate the risks to nature-dependent livelihoods.

XVIII. **Addressing the emerging environmental risks that Bhutan is facing requires an effective management of environmental externalities and human capacity.** Low access to basic services like waste management, safely managed water and sanitation, and elevated threats of natural disasters in urban areas will weigh heavily on populations, leading to high mortality risks. Air quality issues and potential implications on human health have been on the rise and need integrated management solutions. Part of the solutions will be to reduce pollution from inefficient energy use and the expanding transport sector.

XIX. **Strengthening the institutional capacity to implement Strategic Environmental Assessment (SEA) in the hydropower sector and to institutionalize minimum environmental-flow capacity assessment will ensure that the National Guidelines for Strategic Environmental Assessment (NEC 2017) for Bhutan's hydropower sector take effect.** Bhutan is already experiencing the classical tension between economic development and environmental conservation by developing

sectors that require continuing environmental protection to remain on a sustainable track. Bhutan has developed immense capacity for "run-of-the-river" hydroelectricity production, which also requires the preservation of watersheds in natural forests. All existing hydropower projects in Bhutan spread across multiple river basins. While the Sustainable Hydropower Development Policy (SHDP) integrates climate resilience and mitigation in the policies and adaptation provisions for the sector, the current run-of-river hydropower schemes in Bhutan have become increasingly vulnerable to decreasing water flows in the dry season. Project-level Environmental Impact Assessments (EIAs) do not assess the potential cumulative effects on environmental resources at the basin level.

(iii) strengthening capacity for managing environmental risks

XX. **Bhutan's two biggest constraints to achieving its medium-term development goals and climate commitment are human capacity and access to finance.** There is significant potential for developing the national human capital and innovation as sources of growth, as the country is accelerating its efforts to diversify and promote human development and innovation in the upcoming 13th FYP. Further public support and policies informed by adequate pricing of environmental and climate externalities, scientific research, and innovation would help to factor in the knowledge and institutional capacity needs to support actions to mitigate the risks of emerging challenges. In the long run, this would help build the necessary human capital for sustaining Bhutan's green development path.

XXI. **Addressing institutional mandate overlaps will help improve the institutional effectiveness. A key challenge appears in situations when there is perceived conflict of interest,** and a regulatory body acts as a facilitator for production using mineral and natural resources. Clarity on institutional and regulatory mandates and streamlined government processes could create an enabling environment for government and private sector to contribute effectively to Bhutan's green and self-reliant growth priorities by balancing the environmental protection and economic development agenda. While Bhutan's strong environmental agenda is supported by adequate institutions and regulations, some level of deregulation might particularly foster private sector participation in the forestry sector.

XXII. **There is a need to reinforce internal partnerships and alliances and the capacity to implement climate solutions.** Further strengthening of the institutional structure for vertical and horizonal collaboration will facilitate the coordination on green growth policies and results monitoring within ministries, helps minimize duplication of investments and efforts, will improve efficiency and effectiveness in managing development and climate risks, and can leverage much larger financial flows in the affected sectors.

XXIII. **In the short term, Bhutan's public finance will take center stage when confronting the key social and environmental challenges, but there are opportunities to mobilize additional finance from other sources.** However, public finance could play a powerful market-shaping role, as it does not face pressure to deliver short-term returns, meaning it can provide lower-cost and longer-term financing, prioritize wider social objectives, and take a different approach to risks and rewards. Bhutan can develop a range of policies and regulations to promote climate change mitigation and adaptation and improved environmental performance by enabling policies for private "green" investments. Promoting green value chain development, capacity building for innovation, and using environmental certification and labels to access and benefit from growing markets for green products will go a long way by using the limited public finance to leverage green private investment to expand sustainability achievements.

XXIV. **As a carbon-negative country, Bhutan can also take advantage of the opportunity to mon-**

etize emission offsets through voluntary carbon markets, given the rapidly evolving carbon offset market and support its climate-relevant investment needs. Operationalization of the Bhutan Climate Fund would facilitate access to international climate finance, especially for monetizing Bhutan's net negative GHGs and carbon offsets. Management capacity will be expressly required to make the fund arrangements operational and start channeling climate finance into implementation planning and for increasing the viability of low carbon projects in Bhutan by providing an additional revenue stream.

(iv) Creating enabling conditions for private sector-led green growth

XXV. **The national aspirations for the private sector's wider contribution to Bhutan's green growth[8] could materialize with the support of policies to unlock commercial capital flows.** Further to that, stronger emphasis on enabling the growth of private sector, as well as promoting innovation and skills development, would help fulfill the national economic development aspiration while maintaining climate neutrality and accelerating the pace of recovery. Where possible and without weakening the environmental conservation regimes, reducing the burden of compliance by the government agencies would be effective when the licensing policy comes into effect and introduce e-clearance for licenses.

XXVI. **A more resilient economy with a green and diverse production base could not only fast track Bhutan's COVID-19 recovery but also its future developmen**t. Much of the country's recent growth has been driven by public sector-led hydropower development. Non-hydro sectors, facing constraints related to the country's challenging investment climate, including high trade costs and a small domestic market, remain less competitive. As a result, job creation outside of the public sector and agriculture has been limited. Developing a vibrant private sector to generate jobs and diversify the economy, while sustaining Bhutan's natural environment, will be crucial to build further resilience and sustain inclusive development.

8 The 2010 Economic Development Policy states that "green growth" will be encouraged in promoting industrial and private sector development. However, the 2016 version recognizes that unless the constraints to business growth are systematically addressed, the capacity of the private sector as the engine of growth cannot be enhanced. Further the 2016 policy aims to create an enabling environment for investment through eight high-level strategic directions.

Introduction

Background

Bhutan's natural environment is among the most pristine in South Asia. A small landlocked country, Bhutan is endowed with unique environmental resources—clean air and water, primeval forest, rugged mountain ranges, and breathtaking scenic landscapes. The Bhutanese people have lived for centuries in harmony with nature. The country pursues a development path that is based on the Bhutanese belief and premise that "true development takes place when social, economic, spiritual, and environmental well-being occur side by side to complement and reinforce each other."[9]

A prolonged period of political and economic stability allowed Bhutan's economy to grow at an average annual rate of 7.2 percent between 2000 and 2019, and its per capita income increased threefold in purchasing power parity (PPP) terms over the same period. Economic growth had been strong prior to the COVID-19 pandemic, fueled by the public sector-led hydropower sector and strong performance in the services sector, including tourism. As a result, extreme poverty based on $2.15/day was eliminated by 2022, and the population living below the $6.85/day poverty line for upper middle-income countries, decreased from 39.5 percent to 8.5 percent between 2017 and 2022. The economy has grown by 4.6 percent in FY22/23, supported by the reopening of borders for tourism in September 2022. Bhutan Nominal GDP Per Capita is forecasted to reach US$ 3,662.695 in 2024 (International Monetary Fund). The Gini index, which measures income inequality, decreased from 37 in 2017 to 28 in 2022. Despite this progress, vulnerability to poverty and spatial inequality remains a significant challenge. Bhutan's economic development policies are guided by sustainable development and environmental conservation-focused growth, which will not compromise its status as the global leader in environmental conservation and carbon neutrality.

The COVID-19 pandemic caused major disruptions to economic activity and reversed some progress. After a negative growth rate of 2.4 percent in FY19/20, the economy is projected to have further contracted by 3.7 percent in FY20/21, reflecting broad-based disruptions from the pandemic across the non-hydro industrial and services sectors. The industry sector contracted by 5.5 percent in FY20/21, despite growth in the hydropower sector. The contraction was most accentuated in tourism-related services, including the transport sector (mainly air transport, travel agencies, but also land transport), and hotels and restaurants, in line with a drop in international and regional tourist arrivals. Total tourist arrivals declined by 91 percent, from 173,000 in FY19/20 to 15,000 in FY20/21.

Gross National Happiness (GNH) is a guiding development philosophy of Bhutan that has gained wider recognition over the years. A system of metrics for measuring socioeconomic development supports GNH implementation. The GNH Index measures outcomes against 72 indicators from nine dimensions, which include psychological well-being, standard of living, health, time use, education, cultural diversity and resilience, good governance, community vitality, and ecological diversity and resilience.[10] The GNH Index score was used for the first time in the 12th Five Year Plan (FYP) (2018–23) as one of the criteria for determining resource allocation to the local government units. Findings of GNH surveys have been used to guide the five-year plans' formulation and monitoring since.

Bhutan is the world's first carbon-neutral country.[11] Its Constitution mandates maintaining at least 60 percent of land area under forest cover for all

9 The Middle Path. National Environmental Strategy 2020 © 2019 National Environment Commission Secretariat Royal Government of Bhutan
10 GNH Centre, Bhutan. GNH Index. Accessed from https://www.gnhcentrebhutan.org/gnh-happiness-index/#:~:text=The%20GNH%20index%20is%20a,supported%20by%20the%2033%20indicators.
11 This is the world's first carbon negative country | World Economic Forum (weforum.org)

time. This target has been exceeded with Bhutan's forest cover at 71 percent of total land area, and more than half the country is under protected area regime.[12] Bhutan's forest ecosystems provide services worth between US$394 million to US$1,269 million per year.[13] Conservation and sound management of forests and the environment remain key development priorities that are mainstreamed into national policies and plans.

Population growth, urbanization pressures, and economic development, coupled with climate change, are changing Bhutan's natural environment landscape. Bhutan stands out as a unique country where environmental dimensions of sustainable development are key elements of its development strategy. Nonetheless, concerns about pressures from increasing demands for water, energy, and food are exacerbated by the increasing frequency of climate change-related natural calamities. Bhutan's high vulnerability puts the economy and humans at high risk of exposure to adverse climate change impacts. [14] At the same time, state-led land reallocations are increasingly converting arable and forest land to meet development requirements through the construction of roads, electricity transmission and distribution lines, industry, mining, and urbanization. While deforestation and forest degradation rates are low overall, local hotspots and future development activities will put more pressure on forest resources.[15]

The 2022 Bhutan Country Environmental Analysis (CEA) assesses the challenges to socioeconomic development and sustainable future in light of the recent economic slowdown, growing demand for natural resources, urbanization and pollution, growing emissions, and climate vulnerability. The central theme for the discussions is green growth as an opportunity for adding more poles of growth while sustaining the benefits that environment and natural resources currently provide. The CEA analyzes Bhutan's development trajectory, by integrating the country's impressive conservation and nature protection achievements with new growth opportunities. In a nutshell, the CEA aims to answer the following questions:

a. How could Bhutan improve economic and environmental resilience without jeopardizing its environmental record?
b. How could Bhutan diversify its economy managing natural assets sustainably for supporting livelihoods and job creation?
c. How could Bhutan turn conservation to an economically viable yet sustainable growth alternative by adopting creative, market-based approaches to achieve sustainable economic development?

Methodology

The CEA takes a holistic approach by looking at the country's sustainability profile and examining various socioeconomic indicators beyond gross domestic product (GDP) and growth rates. This approach echoes the development model and overarching philosophy engrained in the GNH concept of Bhutan with a purpose of promoting good governance, socioeconomic growth, cultural preservation, and environmental protection (the four pillars of GNH). The CEA builds on previous analytical sector work done by the World Bank and that of other development partners, but mostly on strategic planning documents of the Royal Government of Bhutan (RGoB) which set a visionary and forward-looking context for sustainable development of the Kingdom of Bhutan. The CEA uses several analytical tools to identify key development challenges, knowledge gaps and opprtunities for sustainable growth alternatives. Due to a lengthy preparation time during the COVID 19 pandemic lockdown and access to primary data repository most data used in the CEA is before 2020 from publicly available peer reviewed sources. Please refer to Annex 2, Annex 3, and Annex 4 for more details on the Methodology.

12 World Bank. 2019. Bhutan Forest Note. © World Bank.
13 WMD, 2019. Forest$ in Bhutan: Economic Value of Forest Ecosystem Services in Bhutan. Watershed Management Division, Department of Forests and Park Services, Ministry of Agriculture and Forests, Bhutan.
14 Ibid 6.
15 World Bank, 2020.

GRID (Green, Resilient, and Inclusive Development) benchmarking analysis presents Bhutan's progress measured against GRID pillars by examining indicators other than GDP and growth rates. The GRID benchmarks Bhutan's performance across four GRID pillars—resilience, inclusiveness, sustainability, and efficiency—and against multiple comparator country groups. The GRID approach recognizes that traditional measures of progress like GDP which focus only on the quantity of growth are insufficient. While examining the many facets of society that impact the quality of growth, the benchmarking approach echoes the Bhutan's development philosophy of GNH.

The CEA models green growth policy scenarios in the forestry and tourism sectors, both important drivers of the economy of Bhutan and representative of "Brand Bhutan," i.e., what is Bhutan known for, by employing a Computable General Equilibrium (CGE) model that allows to quantify the economy-wide adjustments across markets and institutions following the simulation of "What if" scenarios. The modeling analysis aims to establish key questions that will allow to identify the most appropriate alternatives towards achieving the national objectives to maintain carbon neutrality and harness the potential of Bhutan's natural resources for growth and prosperity, and to construct a case for future policy change. Further details on the methodological approach are provided in Chapter 6 and Annex 4.

The institutional and policy analysis narrows down on areas where removing related barriers could raise the stakes for addressing the challenges to green development by diversifying the country's economic base without negatively impacting Bhutan's environmental resources and climate neutrality agenda.

Following an introduction, the CEA is organized in six thematic chapters. Chapter 1, Country Context, presents Bhutan's economy linking it to the country's natural endowment, highlighting economic contribution of nature-based sectors, and long terms risks of climate change impacts on sectors which are the users of the natural capital, and the effects of global pandemic on Bhutan's economy. Chapter 2, Bhutan's Sustainable Development Achievements, looks at Bhutan's achievements as a climate neutral country and beyond, emphasizing the relationship between GNH and future development goals; it presents the results of GRID analysis and benchmarking. Chapter 3, Challenges to Environmental Sustainability and Climate Neutrality, summarizes these challenges considering the emissions profile, their circumstances, risks, and vulnerabilities to emerging development setbacks. Chapter 4, Fostering the Foundations of Bhutan's Green Growth, analyzes the opportunities for more growth in post pandemic environment, examines key policies, and institutional mandates in support of current achievements and future aspirations to remain a carbon neutral country, sustain current conservation achievements and adhere to GNH as a center of the Bhutanese approach to sustainable development. The chapter also highlights important aspects of financing of green growth given the recent declining trend of the public environmental expenditure. Chapter 5, Opportunities for Harnessing Forest, and Diversified Tourism for Green Growth Potential, models the scenario alternatives towards achieving the national objectives to maintain carbon neutrality and harness the potential of Bhutan's natural resources for growth and prosperity in two important economic sectors, diversified tourism and forestry, both dependent on the Bhutan's natural capital. It aims to constructs a case for future policy changes to protect the unique Brand Bhutan. The last Chapter 6, Getting Ready for the Long Run, synthesizes the findings and recommendations for policy choices that could have a lasting effect on shaping and sustaining the country's green path and 'Brand Bhutan'.

Chapter 1: Country Context

Economy and the natural endowment

Bhutan has benefited from a stable political and economic environment during the past few decades. Bhutan's investment (gross fixed capital formation) exceeded 50 percent of GDP, one of the highest in the world.[16] Bhutan made tremendous progress in reducing extreme poverty and promoting gender equality, with continuing efforts to address social inequality issues and regional disparities. Bhutan's macro-fiscal stability has remained sound over the past decades.

Bhutan's human and renewable natural capital resources have progressively increased since the 2000s. Bhutan's human development performance has increased on all indicators based on the UN Human Development Report. Bhutan's Human Development Index (HDI) value for 2019 is 0.654—which puts the country in the medium human development category—positioning it at 129 out of 189 countries and territories. Between 2005 and 2019, Bhutan's HDI value rose from 0.520 to 0.654, an increase of 25.8 percent. The HDI Report 2020-2021 placed Bhutan under the medium human development category with an HDI value of 0.666 with a rank of 127.[17]

Figure 1: HDI for South Asia countries (2020)

South Asian Table of Human Development Index (HDI Value)

Rank	Country	
72	Sir Lanka	0.782
95	Maldives	0.74
129	Bhutan	0.654
131	India	0.645
133	Bangladesh	0.632
142	Nepal	0.602
154	Pakistan	0.557
169	Afghanistan	0.511

Source : UNDP

Compared to the neighbours in South Asia, Bhutan steadily overtook India and Bangladesh, both in the medium development category, positioning itself after Sri Lanka and Maldives and achieving greater outcomes on human development indicators, particularly in life expectancy, education, and gross national income (GNI) per capita. At the global level, Bhutan has moved up four places in the last seven years, thus making significant progress in less than a decade and posting positive average HDI growth of 1.25 for the period 2010-2020.

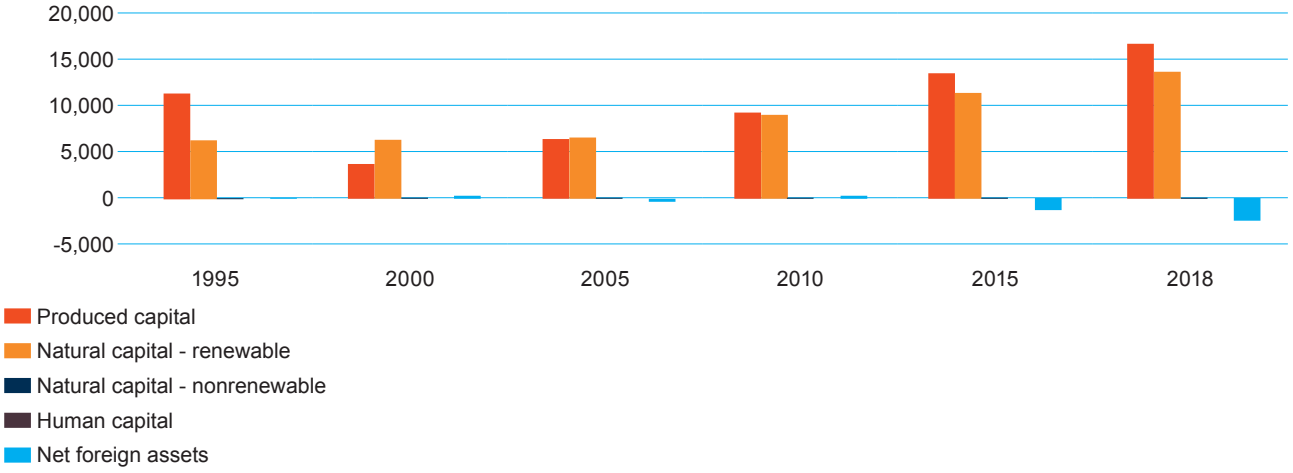
Bhutan's share of total wealth has more than doubled since 1995 to 2018, with its share of renewable natural capital also doubling (Figure 2). Bhutan has one of the largest shares of renewable natural capital per capita in the world (Figure 3). Over 50 percent of Bhutan's renewable natural capital

16 World Bank 2019.

17 According to UNDP Human Development Report 2020-21, Bhutan's HDI value can be attributed to the life expectancy rate of 71.8 years. Bhutan's expected years of schooling stand at 13.2 years and the mean years of schooling are at 5.2 years. The GNI per capita level is $9,438.

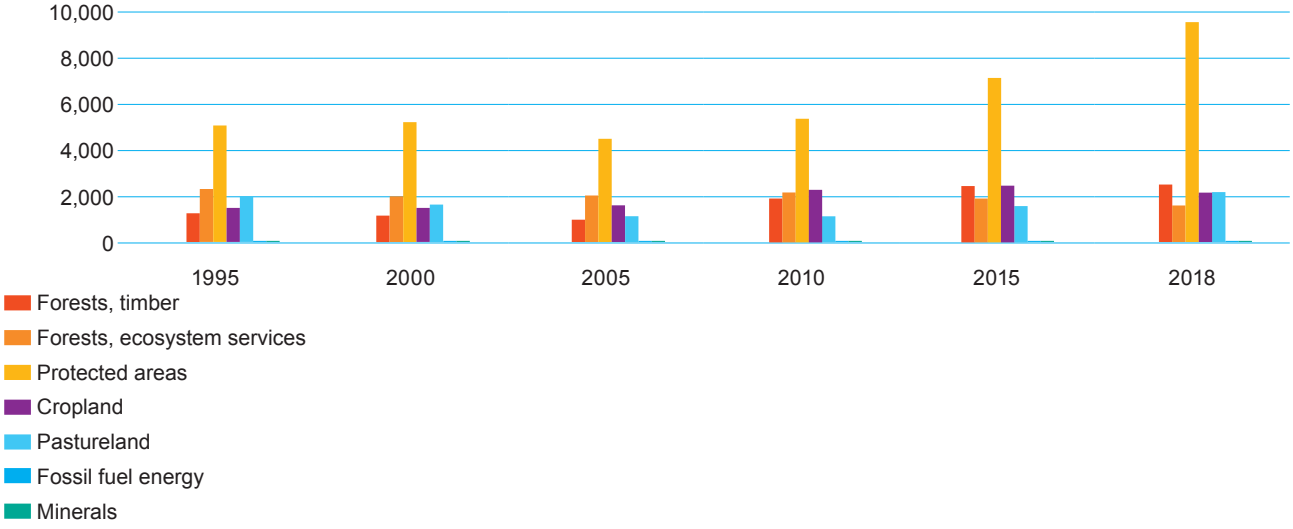
mix comes from protected areas, with the remaining contributed by forests and ecosystem services, crop and pastureland, and minerals. Bhutan's rich renewable natural resource base places it in a unique position to create economic opportunities from conservation and natural resource management practices.

Figure 2: Bhutan's share of total wealth (1995–2018)



Source: World Bank's Changing Wealth of Nations meta dataset.

Figure 3: Renewable natural capital per capita in Bhutan (1995–2018)



Source: World Bank's Changing Wealth of Nations meta dataset.

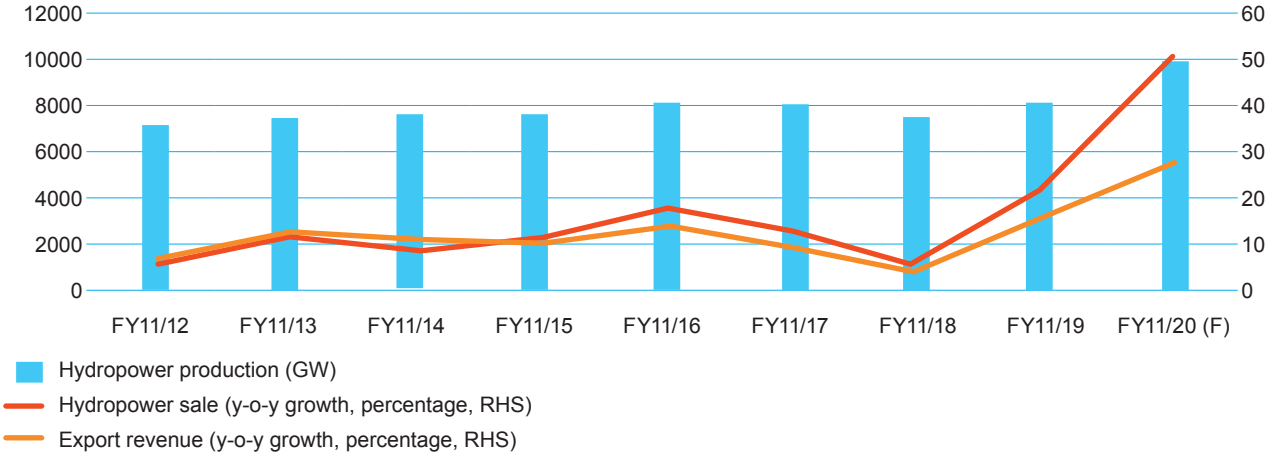
The economy started to recover after the RGoB announced on March 12, 2022, that it would start easing COVID-19 restrictions in April 2022. Output is expected to return to pre-pandemic levels with a pickup in services sector growth, reflecting a gradual recovery in tourism and a normalization in domestic activity patterns.[18] Nonetheless the outlook is for moderate slowing of economic growth from 4.7% in 2022 to 4.6% in 2023 and 4.2% in 2024.[19] The US$3.20 poverty rate is expected to decline from 2022 onwards, although a full recovery to poverty headcount rates estimated before the pan-

18 World Bank 2022.
19 Ministry of Finance; National Statistical Bureau, and Asian Development Bank

demic is not likely to be achieved until 2023. Hydro generation capacity is expected to double between 2023 and 2026 with the completion of four projects, which will support industry sector growth and result in a sharp increase in electricity exports. The service sector growth will be supported by a pick-up in tourism activities in the medium term, underpinned by the new tourism policy, which is focusing on increasing the quality, sustainability, and seasonal as well as geographic distribution of tourism. Reforms to boost economic diversification, digitalization, and private sector-led growth are expected to support non-hydro growth in the medium term.

Bhutan's natural and cultural environment and resources directly contribute to the economy and people's livelihoods. The country's uniqueness is unparalleled with regards to size, geography, culture, and natural capital endowment. Of the kingdom's total land area of 38,394 sq km, about 16,610 sq km lies 3,000 meters above sea level. Altitudes vary from 100 meters above mean sea level (msl) in the southern subtropical region to 7,550 msl in the northern alpine region. Glaciers cover about 900 sq km, and there are more than 2,500 glacial lakes. Rivers run from east to west, including the main river basins of Manas, Punatsangchhu/Sankosh, Wangchhu/Raidak, and the Amochhu/Torsa. Most rivers begin in Bhutan, while the Kurichhu, Gongri, and Amochhu headwaters are in Tibet, and flow into India. Bhutan's economy and culture are inextricably linked to the forests covering nearly 27,000 sq km. About 15 percent of Bhutan's forests are under management regimes and about 7.3 percent of forest areas have forest management plans. A wide range of rare and endangered animals live in the vast forests signifying the country's biodiversity "uniqueness." The value of Bhutan's ecosystem services provided by forests is estimated at about US$15.5 billion/year.[20] It is also estimated that more than 50 percent of the total benefits from ecosystem services accrue to people outside Bhutan.

Figure 4.Hydropower production and revenue



Source: MOF

Bhutan has immense hydropower potential supported by a dense network of rivers. Hydropower exports increased by a factor of five since the early 2000s and accounted for 27 percent of total exports in 2019,[21] while the revenues from hydropower accountedfor 18 percent of the total government revenues in 2017.[22] As hydropower development accelerated, the sectoral share of GDP shifted away from agriculture, whose relative contribution has fallen since 1981 from 45 percent to 13 percent.[23]

20 Bhutan and global top 10 biodiversity hotspots – A "fact" check | Kuensel Online and Kubiszewski I., Costanza R., Anderson S., Sutton P. 2016. The Future of ecosystem services in Asia and the Pacific. Published by Crawford School of Public Policy at the Australian National University and Wiley Publishing Asia Pty Ltd.
21 MoF 2020.
22 World Bank. 2019. Bhutan Forest Note. © World Bank.
23 NSB 2018.

This has driven GDP growth through an expansion of investment during the construction phase of new hydropower and revenue from hydropower exports. Hydropower exports have contributed to an appreciation of the real exchange rate and put upward pressure on domestic prices and wages, which has adversely impacted the competitiveness of non-hydro tradable sectors. Bhutan claims that hydropower exports offset 4.4 million tons of annual CO_2 emissions and that by 2025, through increased hydroelectricity exports, the country will offset up to 22.4 million tons of CO_2 per year in the region.[24]

The dominance of the hydropower sector has driven structural transformation in the economy. Much of recent growth has been fueled by public sector-led hydropower development. Non-hydro sectors, facing constraints related to the country's challenging investment climate, including high trade costs and a small domestic market, remain less competitive. As a result, job creation outside of the public sector and agriculture has been limited.[25] The RGoB plans to commission close to 12,600 MW of new hydropower by the end of the next decade, thus becoming the highest hydropower producer per capita in the world. Significant economic benefits are generated by the sector, but the economy's dependence on the hydropower sector and a lack of diversification have resulted in macroeconomic volatility and vulnerability. The share of hydropower sector is as high as 30 percent of total industry if hydropower construction is included.[26] Close to 85 percent of Bhutan's energy trade with India is hydropower.[27]

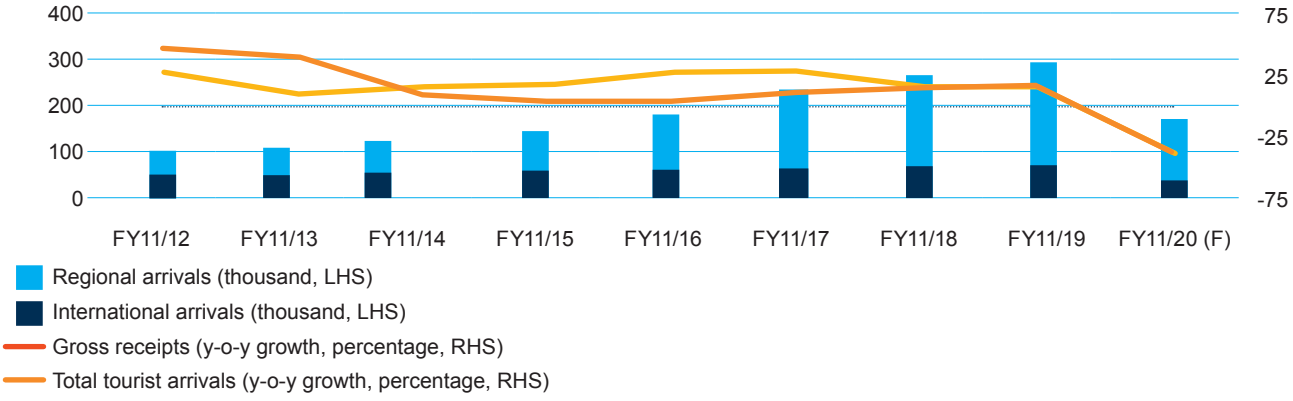
Bhutan's forest sector contributed around 3 percent to GDP (2018), but the real economic value of forests is much larger, considering the broad range of forest ecosystem services. Bhutan is a high-forest cover, low deforestation (HFLD) country[28] and is known globally for its efforts to conserve biodiversity, as embedded in the philosophy of GNH. Bhutan's effective and rigorous forest conservation framework has helped to increase forest cover over the past decades and to curb deforestation and forest degradation. However, the forestry sector has higher and unutilized potential to contribute to the economy and peoples' livelihoods. Bhutan's forest production potential is estimated at 16 percent of the total forest area, although only 7.3 percent of the area is currently under commercial management owing to the difficult terrain and limited wood processing technologies. Even within the 7.3 percent, only conifer areas are harvested and marketed, and the use of forest areas dominated by broad leaf species is limited due to lack of demand and poor processing technologies. Non-wood forest products (NWFPs) provide an important source of income for rural households. For example, the collection and trade of Cordyceps (Ophiocordyceps sinensis), a caterpillar fungus, makes up 50 percent of the income of people living in the highlands.[29] Other NWFPs include mushrooms, incense, essential oils, fruits, seeds, grass, and bark.[30]

Bhutan's 12th FYP highlights the importance of forests, including their role as carbon sinks. Forest ecosystems provide services worth between US$394 million to US$1,27 million per year.[31] Around 2.2 million tons of CO_2 are emitted every year by sectors other than forestry, but because of Bhutan's forests, more than 6.3 million tons of CO_2 are sequestered annually. In the NDC submitted to the COP21 (Conference of the Parties) of the United Nations Framework Convention on Climate Change (UNFCCC), Bhutan reaffirmed to remain carbon neutral and pursue a low-emission development path in support of the commitments of the Paris Agreement.[32] The National Forest Pol-

24 Mark Tutton and Katy Scott, 2019. What tiny Bhutan can teach the world about being carbon negative (CNN) https://www.cnn.com/2018/10/11/asia/bhutan-carbon-negative/index.html
25 World Bank 2022.
26 12th FYP 2018-2023 (Volume 1).
27 12th FYP 2018-2023 (Volume 1). Gross National Happiness Commission Royal Government of Bhutan Thimphu 2019; DRC, MOF. Bhutan Trade Statistics.
28 See https://newsroom.wcs.org/News-Releases/articleType/ArticleView/articleId/16528/WCS-Statement-on-the-Importance-of-High-Forest-Low-Deforestation-Countries-and-the-Need-to-Increase-Finance-for-Protection-of-Their-Forests.aspx#:~:text=High%20Forest%2C%20Low%20Deforestation%20(HFLD,low%20past%20rates%20of%20deforestation.
29 MoAF 2016.
30 FAO 1996.
31 WMD 2019.
32 NEC 2015.

icy (2011) requires all forests to have forest management plans focused on the sustainable supply of forest products or ecosystem services. Bhutan's Second NDC states a target to maintain 436 million tons of forest carbon stock outside protected areas by improving forest management and conservation.[33]

Figure 5.Tourist arrivals and gross tourist revenue



Source: MOF

Tourism is an important contributor to Bhutan's GDP, after agriculture and industry. It contributes significantly to the country's socioeconomic development through revenue and foreign currency generation and employment creation. In 2019 Bhutan recorded a total of 315,599 visitors, which is an increase of 15 percent over 2018 (Figure 6).[34] Direct revenues from tourism dropped from 23.42 million in 2019 to 2.76 million in 2020[35] under the pressure of COVID-19 lockdowns.

Bhutan's tourism sector is regarded as offering the most exclusive travel destinations in the world, and enjoys a reputation for authenticity, remoteness, well-protected cultural heritage, and natural environment. All of this makes the foundation of 'Brand Bhutan'. Tourism is also an important business that supports livelihoods and has potential for growth and further development. The government adheres strongly to a policy of "high value, low impact" tourism, which serves to create an image of exclusivity and high yield for Bhutan. With the rapid pace of socio-development in the country, in addition to high-end tourism, sustainable diversified tourism is seen as one of the most viable options to contribute to community development while incentivizing conservation of natural resources, including forests for tourism purposes.[36]

33 See https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Bhutan%20Second/Second%20NDC%20Bhutan.pdf
34 Tourism Policy of the Kingdom of Bhutan 2021.
35 See https://www.tourism.gov.bt/uploads/attachment_files/tcb_QIQPOSBr_TCB%20ANNUAL%20REPORT%202020-2021%20(WEB).pdf.
36 "World Bank. 2019. Bhutan Forest Note.

Chapter 2: Bhutan's Sustainable Development Achievements

Bhutan's national development policies are inherently linked to protecting its natural capital. The 12th FYP (2018–23) furthers the country's commitment to the 2030 Agenda for Sustainable Development. The 12th FYP aims to address critical challenges, particularly in improving key social outcomes, economic resilience, human capital development, managing impacts of climate change, and strengthening partnerships. It focuses on "consolidation, coordination, and collaboration," aims to solidify socioeconomic achievements and outcomes, and to ensure a strong basis for the continued pursuit of GNH. The 12th FYP has identified 17 National Key Result Areas (Figure 7) emphasizing economic resilience and productive capacity, and the remaining challenges to reduce poverty and inequality. Environmental sustainability is an important theme running throughout the Plan, focusing on important natural resources—land, air, and water—and related development challenges. The 13th FYP is under preparation and centered on addressing key development challenges and transitioning to a "sustainable and prosperous economy."

Box 1. !2th FYP the 17 National Key Result Areas

Bhutan continues to maintain a balance between development and environmental conservation objectives. Conservation is one of the nine domains of GNH. Geographically, Bhutan forms part of the Eastern Himalayan biodiversity hotspot. The protected areas (PAs) system covers about 51 percent of the country's total land area. There are human settlements within the PAs that play an essential role in conservation efforts, "unlike in other parts of the world, where communities in the PAs are relocated."[37] Bhutan has five national parks, four wildlife sanctuaries, one strict nature reserve, and eight biological corridors.[38] Currently, most PAs allow the sustainable use of natural resources by the communities living in the park, with the exception in core zones.

Bhutan is committed to remaining carbon neutral. This was confirmed at the 2009 Conference of Parties in Copenhagen and further reaffirmed in the 2015 Paris Agreement. Bhutan is implementing the UN 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs) by taking forward the sustainable development agenda and implementing it over the 2015 to 2030 period. This commitment resonates in the 2020 National Environmental Strategy[39] and the 2016 Economic Development Policy. The latter points to a conscientious choice made by the government to develop "a green and self-reliant economy sustained by a knowledge-based society guided by the philosophy of GNH." The approach of low-carbon development is set out in the 2012 National Strategy and Action Plan for Low Carbon Development. The latter outlines options to manage emissions from energy-intensive industries, crop production, livestock raising, municipal solid waste, road transport, and residential sectors, and is gradually becoming entrenched in public policies. Bhutan's 2015 NDC highlights the country's commitment to remain carbon neutral, whereby GHGs will not exceed carbon sequestration by forests. It will also aim to maintain a minimum of 60 percent of forest cover.

Bhutan has successfully implemented the 2012 National Adaptation Program of Action (NAPA) tackling important climate needs, while the National Adaptation Plan was being formulated. The objectives of the Bhutan NAPA are to (i) identify urgent and priority projects and activities that can help communities adapt to the adverse effects of climate change; (ii) seek synergies and combinations with existing Multilateral Environmental Agreements (MEAs) and developmental activities with an emphasis on the impacts of climate change; and (iii) integrate climate change risks into the national planning process. The National Adaptation Plan will focus on the medium to long term, to reduce vulnerability, by integrating adaptation into development planning and implementing priority adaptation actions. In addition, disaster management initiatives are underway at national and local levels to improve disaster preparedness and response. Keeping with the commitment of "carbon neutral" development, Bhutan has developed sectoral strategies on waste, transport, industry, and the elaboration of GHG mitigation measures in three sectors of human settlement, industry, and energy efficiency.[40]

Sustainability beyond GDP growth:

Key findings of GRID analysis

The GRID benchmarking tool measures Bhutan's performance against a set of indicators resilience, efficiency, sustainability, and inclusion, and compares the scores against other lower middle-income (LMI) countries. The indicators cover specific aspects of environmental health, pollution, and natural resource management, such as air quality, wastewater treatment, safe water, sanitation, and hygiene (WaSH) services, deforestation, land degradation, biodiversity, and habitat loss. The tool's utility is enhanced by the carbon decoupling metrics, measuring renewable energy consumption as a percentage of total energy consumption and changes in per capita GHG emissions. The results of the global benchmarking are summarized in Table 1, and allow for an at-a-glance view of the

37 Third National Communication from Kingdom of Bhutan to UNFCCC 2020.
38 DoFPS 2016.
39 The Middle Path - National Environment Strategy 2020.
40 ibid 6.

major areas where Bhutan is struggling. Unsurprisingly, sustainability is Bhutan's best pillar, where the country is on average in the top 66th percentile across all indicators, bolstered by high scores in natural resource sustainability and carbon decoupling. Resilience is Bhutan's weakest pillar, scoring on average in the 31st percentile. In inclusion and efficiency, Bhutan scores close to the global median.

Table 1: GRID global benchmarking: Bhutan's scores

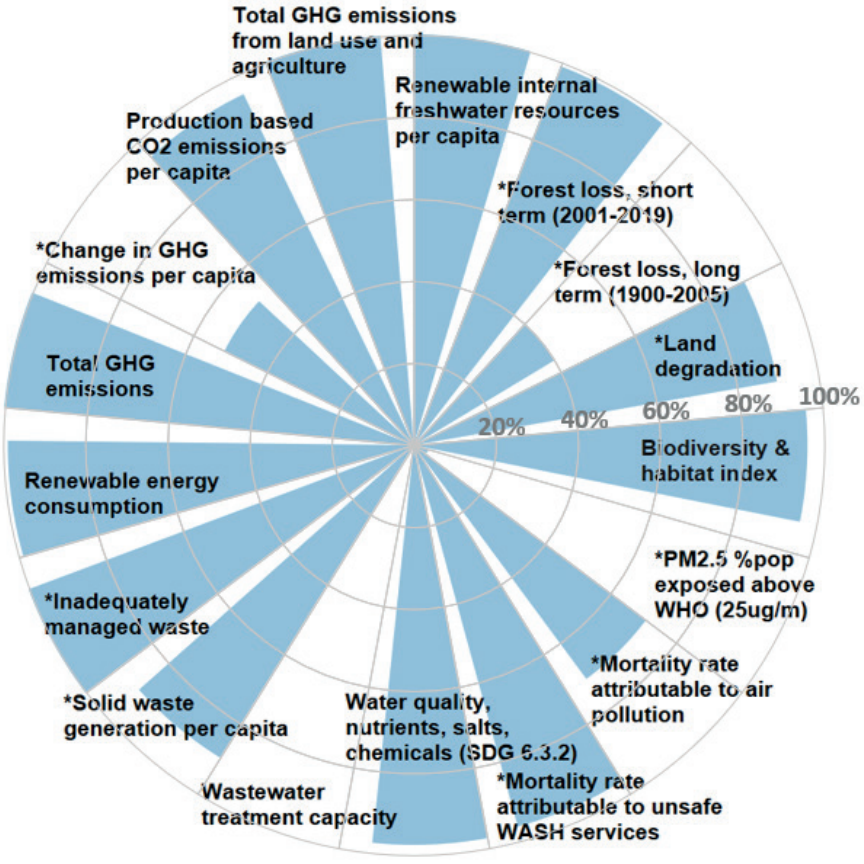
			Significantly below global median ▼ Significantly below global median ▲
Pillar	**Dimensions**		
Resilience	Natural disaster & Weather variability	37	▼
	Health disaster		
	Social variability	8	▼
	Average	31	▼
Inclusion	Distribution outcomes	44	▼
	Access to service	48	
	Access to markets and places	53	
	Social dimension of inclusion	36	▼
	Average	47	
Sustainability	Natural resource sustainability	80	▲
	Pollution	53	
	Carbon decoupling	69	▲
	Average	66	▲
Efficiency	Resource use	46	
	Governance	79	▲
	Transport and ICT	28	▼
	Average	47	

These results set Bhutan apart as a global model for sustainability. Deforestation has nearly come to a halt since 2000. Bhutan has relatively low rates of land degradation and is amongst the most biodiverse countries in the world, with a large range of habitat types. In terms of carbon decoupling, Bhutan performs exceedingly well in nearly all indicators. Bhutan's contribution to global GHG emissions is miniscule largely due to its low population, very high renewable energy consumption rate (over 80 percent), and comparatively minimal land conversion rates. Thus, while emissions per capita have increased by 50 percent over the past decade, this is not yet a major concern due to the very low baseline.

Nonetheless, there are emerging issues and concerns about environmental conditions. Air quality has been deteriorating in urban areas such as Thimphu and industrial areas. Since 2009, the PM10 levels have been consistently higher than the standards set by the World Health Organization (WHO).[41] The GRID tool looks at air pollution by using data gathered by remote sensing, and in mountainous countries like Bhutan this needs to be interpreted with caution. Specifically, this refers to the indicator measuring the population exposed to PM2.5 levels above the WHO recommended limit. Notwithstanding these concerns, the mortality rate attributable to air pollution equal to 124.5 per 100,000[42] in 2016 implies that Bhutan performed slightly better than average for an LMI country.

41 The Middle Path - National Environment Strategy 2020
42 World Bank, 2016. Mortality rate attributed to household and ambient air pollution, age-standardized (per 100,000 population) - Bhutan | Data (worldbank.org)

Figure 6. Benchmarking Bhutan against the LMI countries - Sustainability

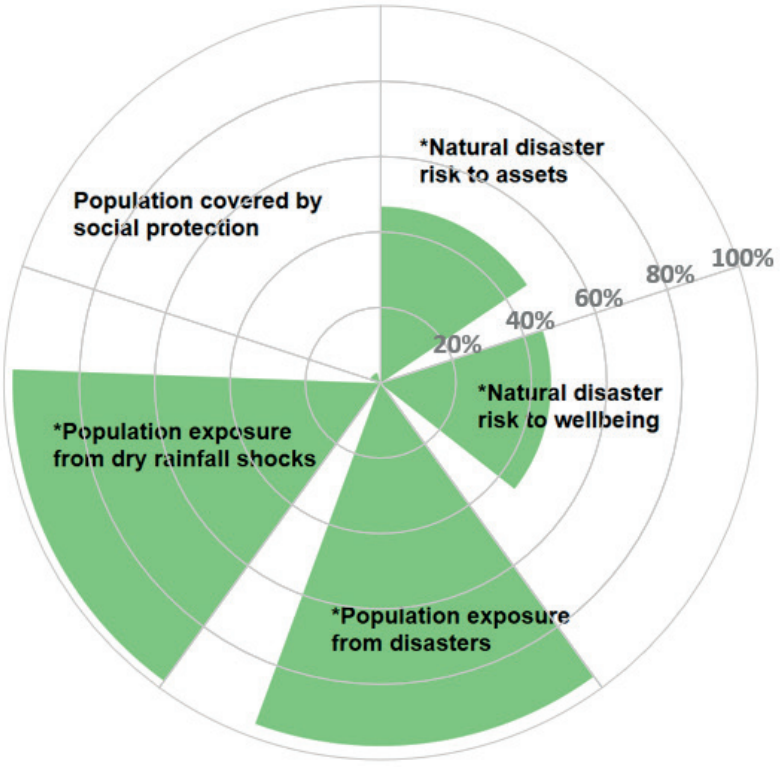


Bhutan also performs well on indicators of water availability and quality. Bhutan has abundant freshwater resources and is an upstream country in shared river basins with neighboring countries. Water pollution is generally not a problem, with Bhutan having a mortality rate due to unsafe WaSH (i.e., caused by diarrheal diseases, cholera, etc.) equal to 120 per 100,000[43] in 2016, which is lower than the LMI average. However, as Bhutan's population continues to grow more dense and more urban, the very low capacity for wastewater treatment may begin to put pressure on water quality and water-borne illnesses. More up to date research could shed light on the recent trends by analyzing urbanization trends and environmental infrastructure services.

The GRID benchmarking highlights significantly elevated threats from natural disasters that threaten lives and livelihoods. Low access to social protection programs could further increase the country's vulnerability to natural disasters, including earthquakes, floods, and landslides causing a significant amount of damage each year (Figure 8). Assets equivalent to approximately 2.3 percent of GDP are damaged each year due to natural disasters, which is more than twice the average for LMI countries. The 2nd NDC (2021)[44] aims to strengthen Bhutan's resilience to natural and climate change hazards. Annex 1 provides full details on the results of GRID analysis and benchmarking.

43 WHO, Global Health Observatory Data Repository, World Bank. http://apps.who.int/ghodata/; Mortality rate attributed to household and ambient air pollution, age-standardized, male (per 100,000 male population) - Bhutan | Data (worldbank.org)
44 See https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Bhutan%20Second/Second%20NDC%20Bhutan.pdf

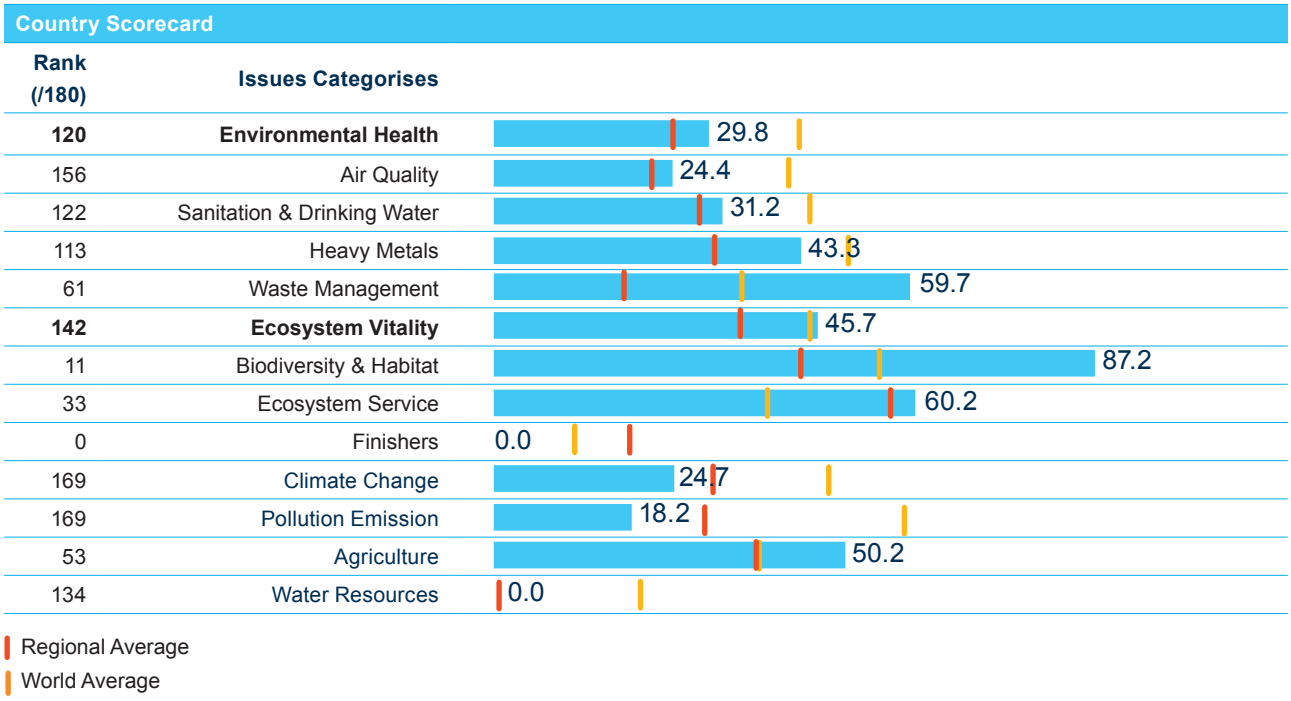
Figure 7. Benchmarking Bhutan against LMI countries - Resilience



Chapter 3: Challenges to Environmental Sustainability and Climate Neutrality

According to the Environmental Performance Index (EPI)[45] of 2020, Bhutan has moved up 24 points and raised to 107th place out of 180 countries compared to 2018. Like GRID, the EPI indicates that Bhutan stands strong on environmental sustainability, especially when it comes to biodiversity and forest conservation. The EPI also points to development challenges which call for tradeoffs so that economic targets are not attained at the expense of ecosystems. Emerging urbanization challenges could threaten environmental sustainability. Specifically, this is evidenced by the EPI score on "environmental health" which is lower (120) on performance categories such as air quality, sanitation and drinking water and heavy metals indicating an onset of environmental degradation. Figure 9 presents the score card for disaggregated EPI ranks and scores by issue category. It also provides details of Bhutan's 2020 and baseline EPI ranking by category and indicator.

Figure 8: EPI score card for Bhutan 2020



Source: https://epi.envirocenter.yale.edu/.

45 The EPI was first released in January 2018 during the World Economic Forum in Davos, Switzerland. It offers a scorecard for each country's performance relative to established environmental policy goals. The EPI ranks the countries using 32 performance indicators and two policy objectives environmental health and ecosystem vitality

Climate change vulnerability

Bhutan is vulnerable to climate change impacts. In 2021, it ranked the 38nd most vulnerable[46] country in and the 62nd most ready according to the Global Climate Change Adaptation index (ND-GAIN). Bhutan's climate is exceptionally diverse and two main factors determine climate variation in mean temperature and precipitation: vast differences in altitude in the country, and the influence of the North Indian monsoons.[47] The projected climate changes in Bhutan include: (i) an increase in average temperatures, a consistent warming trend in the Himalayas, and one that is approximately three times the global average; (ii) a decrease in precipitation during the dry season, and an increase during the wet season in the long term; (iii) increased intensity of rainfall events, erratic rainfall patterns, and a shift in monsoon timing; (iv) increased threats of hydro-meteorological and geological disasters due to climate risks, such as glacial lake outburst floods (GLOFs), landsides, earthquakes, river erosion, flashfloods, windstorms, and forest fires.

Climate vulnerability could potentially derail Bhutan's sustainable development path. The hydropower, agriculture, and tourism sectors,[48] which together account for roughly 35 percent of GDP, are all dependent on and affected by climate variability and other natural hazards. As a country located in the ecologically fragile Eastern Himalayas, Bhutan reports that its forests are being impacted by frequent rain and floods, which are causing landslides, and in the future, its hydropower sector could be adversely affected by disrupted hydrological flows due to melting glaciers in the Himalayas.[49] The future of hydropower, renewables, and carbon neutrality could be affected by climate change and projected change of rainfall and glacial melt in the Himalayas. With many hydropower projects being planned in major rivers, and several projects in cascades in each basin, aquatic ecosystems could come under severe stress and threats could be exacerbated by climate stressors. Bhutan's mountainous landscape and limited spatial and temporal data make it difficult to carry out adaptation measures. Extreme events are likely to increase the risks of higher floods and even dam safety. Threats posed by increasing frequency of GLOFs are serious.

Climate risks (differentiated by sector)

The effects of climate change are increasingly visible in Bhutan. The country experienced GLOF events in 1957, 1960, 1968, and 1994.[50] The 1994 GLOF event from Luggye Tsho killed 21 people and damaged 91 houses and 1,781 acres of land. The heavy rainfall brought about by Cyclone Aila in 2009 caused Bhutan to incur an estimated loss of US$17 million.[51] The country is also increasingly experiencing prolonged and extreme droughts in some parts of the country, which in turn increases the risk of loss of biodiversity, forest fires, and reduction of crop yield and agricultural productivity. Heavy rainfall triggering floods and flash floods are a recurring phenomenon in Bhutan, especially during the summer monsoon. In July 2016, the southern part of the country experienced a flash flood triggered by intense monsoon rainfall displacing more than 100 families and damaging infrastructure. Landslides are a major problem for the roads

46 See https://gain-new.crc.nd.edu/country/bhutan. The high vulnerability score and high readiness score of Bhutan places it in the upper-right quadrant of the ND-GAIN Matrix. It is on the road to responding effectively to climate change, but the adaptation needs and urgency to act are greater.
47 Bhutan's 3rd National Communication to UNFCCC 2020.
48 Agriculture without forestry contributed 13.5 percent in 2019. Hydropower 12.7 percent without construction of hydropower projects. Tourism contributes about 8.5 percent –13.6 percent.
49 Second National Communication from the Kingdom of Bhutan to the United Nations Framework Convention on Climate Change (UNFCCC).
50 RGoB-WB 2015.
51 National Center for Hydrology and Meteorology. Royal Government of Bhutan 2019. Report on the Analysis of Historical Climate and Climate Projection for Bhutan; Analysis of Historical Climate and Climate Change Projection.pdf (nchm.gov.bt); article First ever Bhutan climate report predicts a hotter and wetter Bhutan – The Bhutanese

sector, affecting road transport —a lifeline for Bhutan. Extreme weather events expose infrastructure assets (such as hydropower and road network) to increased risk of floods and landslides.[52]

The 2011 Climate Change Vulnerability Assessment predicts a warming trend in annual temperature and high levels of variability and uncertainty in annual precipitation. A more recent climate study[53] based on historical climate data on Bhutan assessed the possible future climate changes by using a small subset of climate projections available from the IPCC general circulation models (GCMs) (i.e., RCP 4.5 and RCP 8.5). The projections cover two future climate periods, 2021–50 and 2070–2100. The findings indicate an increasing trend in temperature both at mean seasonal and mean annual scales and a decreasing trend in rainfall at mean annual scales. The rainfall indicated a larger variability. Overall, the climate projection of surface temperature under the RCP4.5 scenario indicated an increase of about 0.8°C–2.8°C during 2021–2100 (Table 2).

Higher values projected under the RCP8.5 scenario, include climate projections for surface temperature indicating an increase of about 0.8°C to more than 3.2°C towards the end of the century. The mean annual rainfall over Bhutan is likely to increase in the future. Under the RCP 4.5 scenario, the mean annual rainfall over Bhutan indicates an increase of about 10–30 percent on the mean annual scale, with summer[54] rainfalls between 5–15 percent. Under the RCP 8.5 scenario, the mean annual rainfall indicates an increase of about 10–20 percent during 2021–50 and with more than 30 percent increase all over Bhutan towards the end of the century (2070–2100). Under both scenarios, there is an indication of a marginal increase in rainfall trend. Table 2 and Table 3 provide information on projected temperature daily and seasonal anomalies for the four RCPs presented against the reference period of 1986–2005.[55]

Table 2: Projected anomaly (changes °C) for maximum, minimum, and average daily temperatures in Bhutan for 2040–59 and 2080–99, from the reference period of 1986–2005 for all RCPs

Scenario	Average Daily Maximum Temperature		Average Daily Temperature		Average Daily Minimum Temperature	
	2040-2059	2080-2099	2040-2059	2040-2099	2040-2059	2040-2099
RCP2.6	1.3 (-0.6, 3.5)	1.3 (-0.6, 3.4)	1.3 (-0.1, 2.8)	1.2 (0.0, 2.9)	1.2 (-0.3, 3.2)	1.3 (-0.4, 3.2)
RCP4.5	1.7 (-0.3, 3.5)	2.5 (0.3, 4.8)	1.6 (0.2, 3.0)	2.4 (0.8, 4.0)	1.7 (0.0, 3.6)	2.3 (0.8, 4.5)
RCP6.0	1.5 (-0.6, 3.6)	2.8 (0.6, 5.2)	1.5 (0.1, 3.0)	2.8 (1.3, 4.5)	1.6 (-0.2, 3.4)	2.9 (1.2, 5.0)
RCP8.5	2.3 (0.2, 4.2)	4.7 (2.6, 3.5)	2.2 (0.8, 3.6)	4.5 (2.8, 6.5)	2.2 (0.7, 4.0)	4.6 (2.8, 7.1)

Note: The table shows the median of the CCKP model ensemble and the 10–90th percentiles in brackets. Source: WBG Climate Change Knowledge Portal (CCKP, 2021). Climate Data: Projections. URL: https://climateknowledgeportal.worldbank.org/country/Bhutan/climate-data-projection.

52 Climate Risk Country Profile: Bhutan (2021): The World Bank Group and the Asian Development Bank
53 Analysis of Historical Climate and Climate Projection for Bhutan. National Center for Hydrology and Meteorology Royal Government of Bhutan 2019. Strategic Program for Climate Resilience (SPCR).
54 June, July, August, and September.
55 Climate Risk Country Profile: Bhutan (2021): The World Bank Group and the Asian Development Bank.https://climateknowledgeportal.worldbank.org/sites/default/files/2021-08/15874-WB_Bhutan%20Country%20Profile-WEB.pdf

Table 3: Projections of average temperature anomaly (°C) in Bhutan for different seasons (three monthly time slices) over different time horizons and emissions pathways, showing the median estimates of the full CCKP model ensemble and the 10th and 90th percentiles in brackets

Scenario	2040-2059		2080-209	
	Jun - Aug	Dec - Feb	Jun - Aug	Jun - Aug
RCP2.6	1.0 (-0.3, 2.6)	1.4 (0.0, 2.7)	0.9 (-0.3, 2.6)	1.5 (0.1, 2.6)
RCP4.5	1.3 (0.1, 2.6)	1.8 (0.3, 2.9)	2.0 (0.6, 3.5)	2.6 (0.9, 4.3)
RCP6.0	1.1 (0.0, 2.6)	1.7 (0.1, 3.0)	2.3 (0.9, 4.0)	3.1 (1.5, 4.6)
RCP8.5	1.8 (0.7, 3.2)	2.5 (0.9, 3.9)	3.8 (2.4, 5.6)	4.9 (3.4, 7.1)

Source: Gasser, T., Kechiar, M., Ciais, P., Burke, E. J., Kleinen, T., Zhu, D., . . . Obersteiner, M. (2018). Path-dependent reductions in CO2 emission budgets caused by permafrost carbon release. Nature Geoscience, 11, 830-835. URL: https://www.nature.com/articles/ s41561-018-0227-0?WT.feed_name=subjects_carbon-cycle

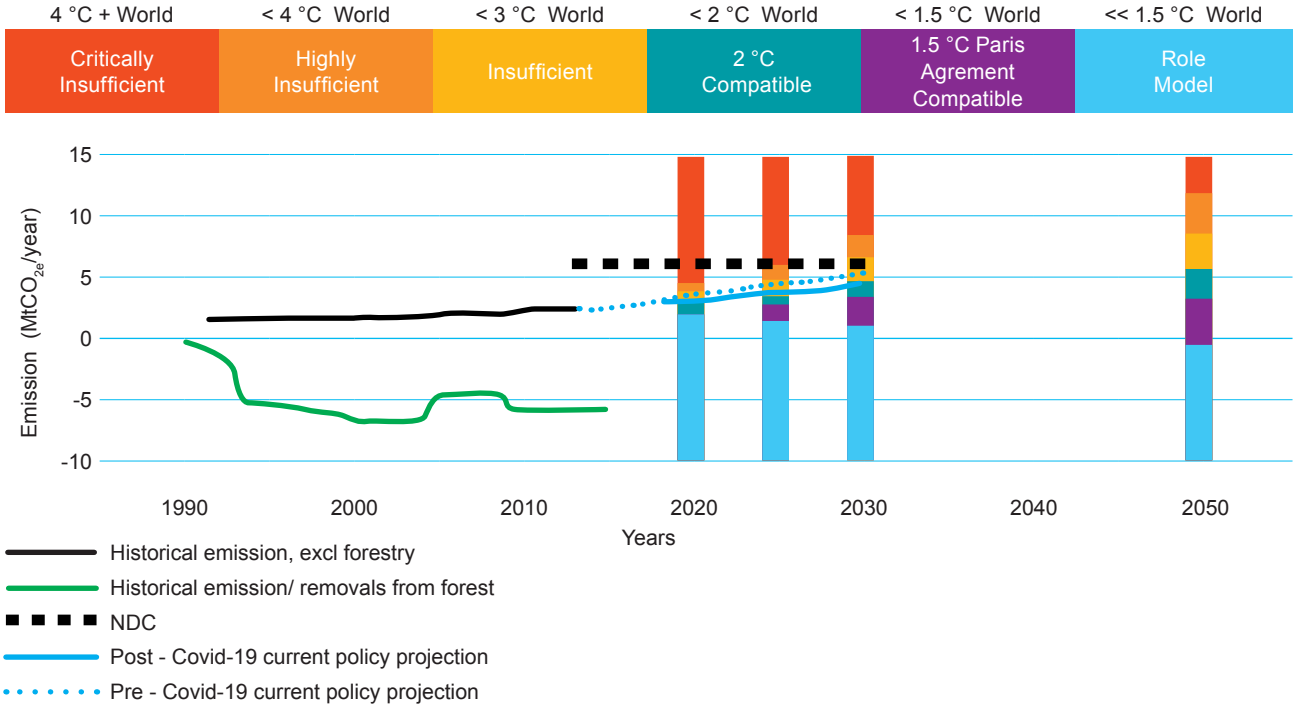
GHG emissions on the rise

Bhutan is committed to maintaining carbon neutrality and preserving its forests' carbon sequestration capacity. According to the third national GHG inventory, in 2015, Bhutan's forests sequestered 9.4 million tons of CO_2 and emitted 3.8MT of CO_2, resulting in net negative emissions of 5.6MT of CO_2. Although starting from a low GHG emission base, current trends of growing urbanization, increased energy use from fossil fuels, emissions from transport and waste could create challenges for the long-term, low-carbon outlook, risking a breakdown of Bhutan's carbon neutrality.

The Climate Action Tracker (CAT)[56] provides an independent scientific analysis indicating that Bhutan would be compliant with its NDC target of staying carbon (or GHG) neutral by adhering to current policies (Figure 9). However, with emissions increasing, the gap to the limit of emissions to stay within carbon or GHG neutrality will close (assuming a constant forestry sink of-6 $MtCO_2e/a$). Bhutan's current policy trajectory in 2030 is around 4.5 to 4.8 $MtCO_2e/a$, which is 100 percent to 117 percent increase from 2010 levels, excluding land use, land-use change, and forestry (LULUCF). The National Strategy on Low Carbon Development reconfirms the commitment to carbon neutrality[57] and offers several short- and medium-term recommendations and measures that may result in lower levels of emissions than those reported in the CAT current policy scenario and could be quantified in future assessment with availability of data. These measures include the National Environment Protection Act, the National Strategy and Action Plan for Low Carbon Development, Bhutan Transport 2040, and the 2010 Economic Development Policy.[58] In addition, Bhutan published a National Waste Management Strategy in June 2019 with the goal of zero waste by 2030.[59]

56 The CAT is an independent scientific analytical product produced by two research organizations (Climate Analytics Climate Analytics and New climate Institute Home - NewClimate Institute) in collaboration with The Potsdam Institute for Climate Impact Research Potsdam Institute for Climate Impact Research (pik-potsdam.de), tracking climate action since 2009. Progress is tracked towards the globally agreed aim of holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C.
57 National Environment Commission 2012.
58 ADB 2013; National Environment Commission 2012; RGoB 2010; RGoB 2007.
59 National Environment Commission 2019.

Figure 9: Climate change tracker, Bhutan 2020



Under the CAT's current policy scenario for Bhutan, absolute emission levels excluding LULUCF will reach 5.12 $MtCO_2e$ by 2025 and 6.28 $MtCO_2e$ by 2030, increases of 280 percent and 366 percent relative to 1990 levels (1.35 $MtCO_2e$), respectively. Compared to 2010 (2.01 $MtCO_2e$, excl. LULUCF), emissions in 2025 and 2030 will be 154 percent and 212 percent higher, respectively. No specific mitigation effort in the agriculture sector was considered in the CAT current policy projections, as there is no quantifiable emissions data of the policy impact. The NDC refers to promotion of climate smart livestock farming practices and organic agriculture, and the Second National Communication refers to a Sustainable Land Management Program (SLMP).[60]

Emissions from the forest sector had increased by 100.47 percent between 1994 and 2015, followed by a decrease of 43.78 percent between 2000 and 2015.[61] The trend is quite similar to non-CO_2 emissions from biomass burning, which increased and decreased by 174.46 percent and 54.29 percent between 1994 and 2015, and 2000 and 2015, respectively.[62] However, the situation is different regarding emissions from the conversion of forest land to non-forest land, which have been increasing posting a rise of 117.02 percent between 1994 and 2015, and 103.10 percent between 2000 and 2015.[63]

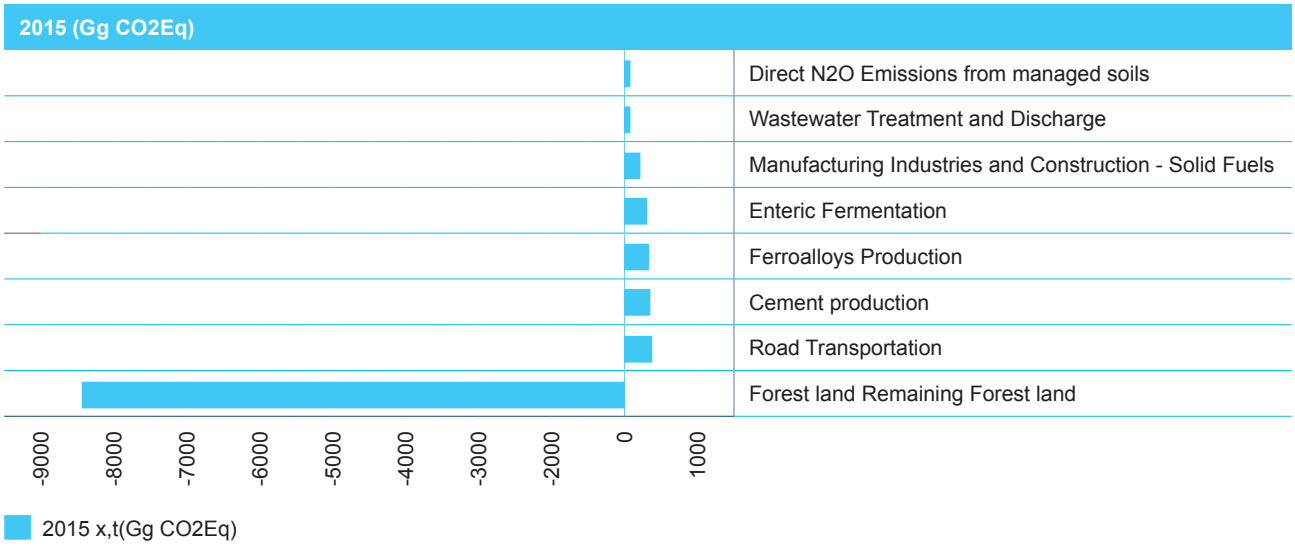
GHG emissions from the waste sector had increased by 126.79 percent and 86.21 percent in 2015 compared to the 1994 and 2000 levels.[64] Total GHG emissions from the waste sector in 1994, 2000, and 2015 were 55.789, 67.937, and 126.506 Gg CO_2e in national GHG inventory. It is assumed that an increase in waste generation will be directly proportional to the population growth (i.e., 1.9 percent per year until 2020). However, waste almost increased threefold between 1994 and 2015, while Bhutan's population grew only 30–50 percent in that time. According to the 2010 Integrated Energy Management Master Plan for Bhutan (IEMMP),[65] Thimphu and Phuentsholing generated 37 and 25 tons of solid waste per day, respectively, and the national waste generation figure was 81,119 t/year

60 RGoB 2011.
61 NEC 2019.
62 NEC 2019.
63 NEC 2019.
64 NEC 2019.
65 Department of Renewable Energy 2010.

in 2005. The 3rd National Communication to UNFCCC indicates that emissions from the waste sector will gradually increase from under 200 kt CO_2e in 2015 to about 500 kt CO_2e in 2045 for both the low and high growth scenarios.

Projected increase in emissions is to a large degree from the increasing per capita energy consumption.[66] Overall, energy intensity[67] of Bhutan's economy was reported at 10.4 megajoules per USD (MJ/USD) in 2015, which was higher than in neighboring China (6.9 MJ/USD), India (4.7 MJ/USD), and Nepal (7.4 MJ/USD).[68] A major contributing factor to rising GHG is the inefficient use of energy. Due to rapid economic growth over the last few decades, GHG emissions in the energy sector increased significantly from 93.60 Gg CO_2e in 1994 to 259.125 Gg CO_2e in 2000 and 707.917 Gg CO_2e in 2015. Other sectors with high energy consumption are the building and appliances sector with 270,356 tonnes of oil equivalent (TOE), the industry sector with 241,972 TOE, and the transport sector with 121,218 TOE.[69] The cement industry contributes 47.6 percent of GHG of all Industrial Processes and Product Use (2015).[70] Growing emissions from transport and industry sectors contributed to increasing air pollution (Figure 10).

Figure 10: Emissions Level assessment: Contributions by sector



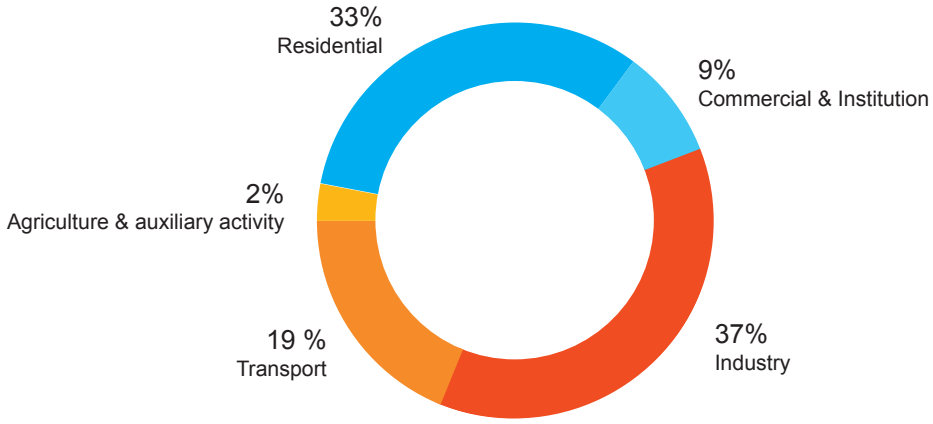
In 2018 Bhutan imported close to US$108 million worth of fossil fuel, which accounted for more than 67 percent of the earnings from hydropower exports.[71] Although Bhutan is a net exporter of energy in MJ terms, this number indicates that in terms of MJ/USD Bhutan is a strong importer. In other words, the cost of imported energy (measured in USD per megajoule) is considerably higher than the price of energy exported. With hydropower capacity doubling within the next five years, the absolute scale may appear negligible. However, in the long run, Bhutan might want to make better use of cheap hydropower, substituting it for expensive fossil fuel imports. Further extension of the existing capacity using fossil fuel-based plants will lead to higher GHG emissions. Higher fuel imports will increase the energy intensity and would threaten Bhutan's carbon neutrality status, or at least reduce it, all

66 3rd National Communication to UNFCCC.
67 Energy intensity level of primary energy (MJ/USD 2011 PPP GDP).
68 World Bank 2019.
69 MEA 2014.
70 Kingdom of Bhutan. Third National Communication to the UNFCCC. National Environmental Commission 2020.
71 The Middle Path National Environmental Strategy 2020; Bhutan launches national policy for energy efficiency, conservation" - www.xinhuanet.com 3 In 2014, the country consumed around 650,220 Tons of Oil Equivalent (ToE) of energy – DNR, 2017

other things remaining equal. These emissions will decline compared to business-as-usual (BAU) scenarios if the target of an additional 20 MW of renewable energy capacity, including solar, wind, and bioenergy, by 2025 were to be implemented.[72]

Bhutan's energy demand is dominated by thermal energy (72 percent), with only 28 percent of demand being serviced by electricity.[73] Biomass (fuelwood, biogas, and briquettes) is the largest source of thermal energy, meeting 36 percent of the total energy demand. It is followed by diesel, coal, and other petroleum products (petrol, kerosene, and liquified petroleum gas, LPG), which satisfy 16 percent, 15 percent, and 5 percent of demand, respectively.[74] The highest energy consumption is from the residential and commercial/institutional segment, accounting for 41.6 percent of the total energy consumption of the Bhutanese economy. The industrial sector accounts for 37 percent of total energy consumption, while transport accounts for 19 percent, followed by a much smaller share for agricultural and auxiliary activities (2.6 percent). The top energy-consuming sectors in Bhutan are the construction industry, cement, ferro-alloy, and carbide industries.[75]

Figure 11: Energy consumption by economic sector



Source: DRE-MOEA 2016.

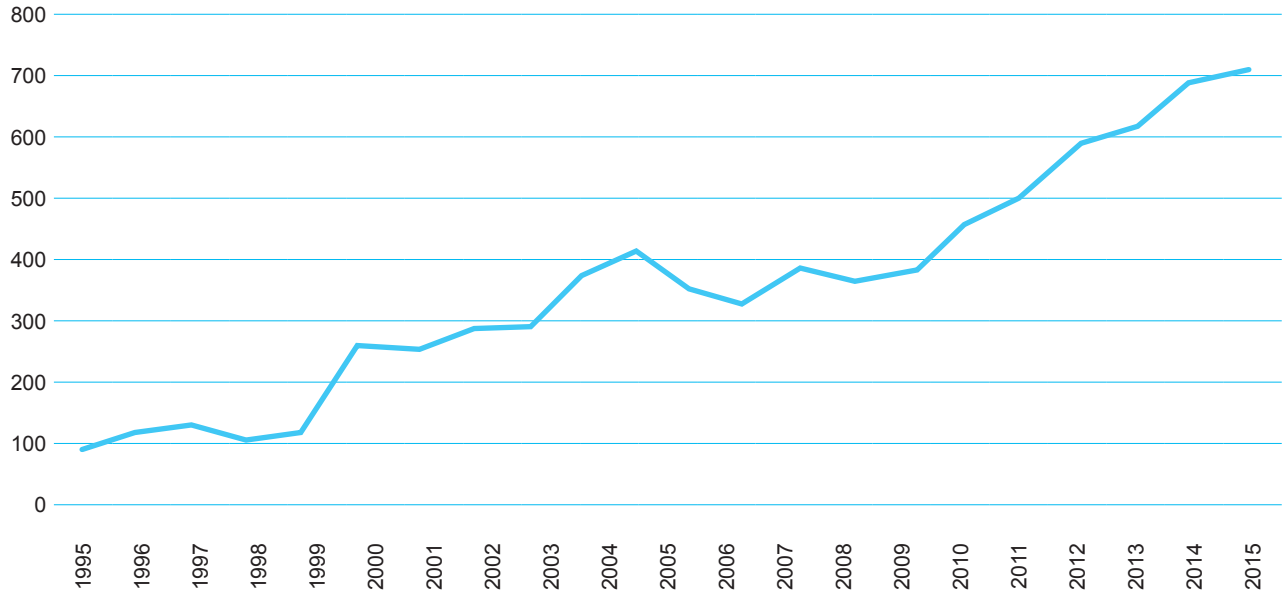
Bhutan has already reached its goal of achieving 100 percent electrification in 2014,[76] and the impact on emissions was negligible, as almost all the electricity is generated from hydropower plants. In 2020 the combined installed capacity in hydropower plants amounted to 2,326 MW. Over 99 percent of Bhutan's generation capacity is from large hydropower plants with installed capacity above 10 MW.[77] Most of the electricity generated—i.e., 80 percent in 2019—is exported to India.[78] Further development of hydropower projects can mitigate emissions beyond Bhutan in the region at large.[79] According to Bhutan's NDC, by 2025 the country can further offset 22 $MtCO_2e$ per year through export of clean electricity from hydropower projects.[80]

72 IRENA 2017.
73 Bhutan energy data directory 2015, DRE–MOEA, Thimphu. See www.moea.gov.bt/wp-content/ uploads/2018/07/Bhutan-Energy-Data-Directory-2015.pdf.
74 DRE–MOEA 2016.
75 Ibid 39 page 16.
76 World Bank 2017.
77 IRENA 2019.
78 Ministry of Finance (MoF). 2020. Trade Statistics 2019. Thimphu, Bhutan.
79 2nd NDC 2021.
80 The 2nd NDC refers to four hydropower projects under construction that are anticipated to be commissioned before 2030 viz. Punatsangchuu-I (1200 MW), Punatsangchhu-II (1020 MW), Kholongchhu (600 MW) and Nikachhu (118 MW) hydroelectric projects (HEP). In addition, the Sankosh HEP (2585 MW), Dorjilung HEP (1125 MW) and Nyera Amari (404 MW) are priority projects that will be pursued based on evolving national circumstances.

Expanding the energy efficiency measures in electricity transmission is outlined in the Energy Efficiency Roadmap 2030[81] estimating savings of 410 gigawatt hours (GWh) annually,[82] with potential for mitigation of GHG at 402 kt CO_2e per annum. In the manufacturing sector, fuel switching in the cement industry and food and agro-industries would raise the mitigation benefits.[83] Energy efficiency improvements could also bring substantial reductions in NOx, and other traditional air pollutants in sectors with high energy consumption. The roadmap establishes the impact of energy efficiency (EE) on the country's GHG emission in line with the first NDC targets with about 0.59 million MtCO_2e emission reduction potential from implementation of EE and conservation (EE&C) measures.[84]

In summary, despite being a leader in ecosystem conservation Bhutan needs to fully implement a plan for adaptation and mitigation actions in all sectors of the economy to maintain its carbon neutrality. The government understands the importance of integrating climate risk management in development activities, well demonstrated in the 12th FYP and NES 2020, but its practice and implementation were constrained by limited technical capacity and resources.

Figure 12: Trend in energy emissions (Gg CO2 e) (1994–2015)



Source: Bhutan 3rd National Communications to UNFCCC 2020 (p. 41).

The 3rd National Communication (NC) to UNFCCC 2020 (NEC) links energy sector emissions with GDP growth under the BAU.[85] Sectoral emissions in Bhutan show varying trends, with emissions from construction decreasing from 2018. According to the BAU scenario the emissions are projected to further decrease up to 2040 assuming that hydropower and mega infrastructure projects would be completed well before that. Emissions from the energy sector tend to increase, particularly from the growing road transport and service sectors, making up for the reduced emissions from construction

81 DEA 2016. The National Energy Efficiency & Conservation Policy and the Energy Efficiency Roadmap (NEECP) were adopted in 2019
82 Energy Efficiency Roadmap 2030 (Department of Renewable Energy, 2016. Savings based on the Indian Grid Emission Factor (S. Bhawan, 2014).
83 NEC 2017.
84 2nd NDC 2021.
85 The reference to BAU Scenario of both GDP and GHG emission is taken from the Draft CGE Model (Figure 21) GHG profile following IPCC 2006 (Figure 22) GHG profile on the economic analysis of carbon neutrality developed by the National Environment Commission. The Model has two BAU scenarios of High Growth (GDP growth rate of 8 percent) and Low Growth (GDP growth rate of 4.2 percent). Against this GDP Growth, emissions are projected from 2014 to 2050.

(Figure 12). Thus, the energy sector's net emissions were 18.56 % of the total national emissions, excluding the GHG removals by LULUCF. The transport category's energy emissions had the highest contribution to the sector with 60.01%, followed by manufacturing industries and construction 34.39%, other sectors 5.32%, solid fuels 0.27%, and energy industries (electricity generation) 0.002% only[86]. According to the 3rd NC to UNFCCC, future emissions from these sector categories will follow an increasing trend. However, if sustainable policy measures were adopted by the RGoB, this may mitigate increasing emissions from growing economic sectors. The National Environment Protection Act, the National Strategy and Action Plan for Low Carbon Development, Bhutan Transport 2040, and the 2010 Economic Development Policy include targets for improving sustainable waste management practices, promoting low-carbon transport and clean energy generation.[87]

Elevated exposure to natural disasters

Bhutan is prone to natural disasters, including earthquakes, floods, and landslides that cause significant damage each year. The Asian Development Bank[88] estimated that the mean value of the economic damage (BAU scenario) for the five South Asia countries will be around 2.3 percent of GDP in 2050, ranging between 0.9 percent and 5.0 percent of GDP within the 90 percent confidence interval. By 2050, annual GDP losses are projected under the BAU scenario for Bangladesh (2.0 percent), Bhutan (1.4 percent), India (1.8 percent), Nepal (2.2 percent), and Sri Lanka (1.2 percent). In the longer term, the total economic costs associated with climate change impacts are likely to increase in all countries. The relatively low access to social protection measures like child and maternity benefits, unemployment support, disability support, and social security payments further increases the vulnerability of Bhutan's population. In Bhutan, only 8.8 percent of the population has access to at least one of these benefit types, compared to 29.1 percent on average in LMI countries[89]. The effect of natural calamities could be multiplied by malnourishment assumed to be a critical challenge in Bhutan, affecting nearly 30 percent of the population.[90]

Environmental pressures

Bhutan has made good progress in meeting the imperative for sustainable resource management. The government has adopted a progressive yet pragmatic approach to address pressures associated with social and economic development. Largely, the emerging development pressures from urbanization, resource extraction, and growing consumptive needs have been contained at levels that do not cause immediate irreversible damage. In the long run, however, taking for granted that Bhutan's forest and water resources will remain pristine could be overly optimistic. Ongoing pressures on the natural environment fueled by development impetus arise from both traditional and modern sectors. The post-COVID-19 economic recovery and increasingly complex climate change challenges that have taken priority in the last couple of years could further exacerbate these pressures. Bhutan's relatively uncompromised natural resource base and currently sustainable practices, if harnessed wisely, could forestall future challenges. The challenges discussed below will require tradeoffs and compromise between competing development priorities to sustain achievements in the long run.

86 NEC Bhutan 3rd National Communication to UNFCCC 2020.
87 RGoB 2007; EA Energy Analyses & COWI 2012; ADB 2013a; RGoB 2010.
88 Ahmed, M. and S. Suphachalasai. 2014. Assessing the costs of climate change and adaptation in South Asia. Mandaluyong City, Philippines: Asian Development Bank, p. 76.
89 GRID estimates based on World Bank data accessed at Adequacy of social protection and labor programs (% of total welfare of beneficiary households) - Bhutan | Data (worldbank.org) and the World Bank. 2019. Poverty, Vulnerability, and Welfare in Bhutan: Progress and Challenges. © World Bank, Washington, DC. http://hdl.handle.net/10986/33366 License: CC BY 3.0 IGO
90 See https://blogs.worldbank.org/endpovertyinsouthasia/what-are-we-doing-improve-food-security-bhutan.

Water quality and resource management

The abundance of good quality water resources place Bhutan among the countries with the highest per capita water availability, albeit vulnerable to seasonal variations. With an average flow of 2,238 m3/s, Bhutan generates 70,572 million m3 per annum, i.e., 94,500 m3 per person per year, the highest in the region.[91] At the same time, these water resources are vulnerable to seasonal variations in precipitation which are exacerbated by climate change and impacts of human activities.

Water resources play an important role in Bhutan's economics and power a fifth of the economy.[92] Waters resources will continue to shape a prosperous future for Bhutan's people. Demand for water from the four major economic drivers—hydropower, agriculture, tourism, and small-scale industry—will face challenges under growing climate pressures. Bhutan's heavily monsoon-fed river systems already run low in the dry season.[93] National economic growth is highly dependent on hydropower fed by healthy Himalayan rivers, whereas hydropower potential is estimated at around 30,000 MW. Agriculture, in turn, consumes over 90 percent of water resources and employs over half the population and contributes to over 15 percent of the country's GDP.[94] Nearly 60 percent of the population relies on agriculture to make a living.

Concerns are growing about water quality in urban and rural areas. Results from the monitoring carried by the National Environmental Commission indicate that while Bhutan's water resources are deemed healthy, concerns are growing about the impacts of population growth and fast urbanization, the lack of adequate sewerage treatment and solid waste collection, mining, and construction, all of which already put at risk the infrastructure to maintain good water quality, especially in areas downstream of towns and cities, and could negatively impact aquatic biodiversity. In rural areas the impacts of agro-chemicals and fertilizers on land and water resources have not been systematically assessed,[95] although the use of agrochemicals in terms of nitrogen, phosphorus, and potassium per hectare is the lowest in the region. Over 97 percent of Bhutanese people have access to drinking water, but water quality is not always safe for drinking. A civil society water quality monitoring program started in 2017concluded that key rivers in Bhutan contained significant levels of E. coli bacteria.[96] Although some major towns in Bhutan have sewerage treatment plants, sanitation infrastructure in small towns and rural households comprise individual septic tanks and pit toilets. Access to safely managed sanitation services has improved reaching in 65% in 2019[97], however a study[98] on wastewater management in urban Bhutan points that 'only eight of the 35 classified towns (22.8%) have public sewerage systems, with an average coverage of 19.7% of Bhutan's total urban population, or 7.4% of Bhutan's entire population'. According to Thimphu City Corporation, less than 20 percent of total households in Thimphu were connected to sewer systems and the rest rely on individual septic tanks emptied by a vacuum tanker[99]. Domestic sewage, uncontrolled seepage, or overflows from septic tanks are some of the main sources of water pollution.[100]

Water quality issues are compounded by the effects of climate change on water availability. Despite high water availability per capita, Bhutan is confronted with localized and seasonal water shortages for drinking and agriculture, posing an obstacle

91 ADB & NEC 2016.
92 WWF and NEC. 2016. Water in Bhutan's economy. Importance to Government.
93 WWF NEC 2016.
94 WWF NEC 2016.
95 NEC. The Middle Path. The National Environmental Strategy 2020.
96 Ibid 31
97 People using safely managed sanitation services (% of population) - Bhutan | Data (worldbank.org)
98 Ugyen Dorji, Ugyen M. Tenzin, Pema Dorji, Ugyen Wangchuk, Gem Tshering, Cheki Dorji, Hokyong Shon, Kwabena Biritwum Nyarko, Sherub Phuntsho, Wastewater management in urban Bhutan: Assessing the current practices and challenges, Process Safety and Environmental Protection, Volume 132, 2019,
99 As Bhutan's economy grows, so does its waste problem | News | Eco-Business | Asia Pacific
100 Ibid 31

to development.[101] Bhutan's mountainous terrain makes for rapid surface runoff, and the rivers, running through deep gorges and ravines, receive huge volumes of water during the summer monsoon. As the climate changes with more frequent and heavier precipitation, flash floods are likely to become increasingly common.[102] Although overall access to safe drinking water has improved over the years, drinking as well as irrigation water shortages are a growing challenge.[103] In the face of these challenges, addressing poor demand management, inadequate infrastructure, poor distribution network, and ineffective enforcement of regulations will help increase the adaptive capacity of resources and decrease the water supply exposure risks.

As Bhutan continues to climb the development ladder, increased wealth and disposable income will increase the medium- and long-term pressures on water resources. Bhutan's NDC (2015, 2021) highlights the country's commitment to increasing the resilience of water resources by adopting integrated water resource management, including (i) water resource monitoring, assessment, and mapping; (ii) adoption and deployment of new, innovative technologies for water harvesting and efficient use; (iii) climate proofing of water distribution network; and (iv) integrated watershed and wetland management. The 3rd National Communication to the UNFCCC lists the following as key areas for adaptation measures: (i) drying water sources and spring decline; (ii) water induced disasters; (iii) limited access to water resources; and (iv) seasonal water shortages.

Growing urbanization and environmental pollution

Bhutan is one of the fastest urbanizing countries in South Asia, measured by the growing share of urban population.[104] By 2047, the share of the urban population is expected to reach 56.8 percent.[105] Urbanization affects the quality of the environment and livability outcomes. Difficulties in dealing with congestion pressures brought about by population growth, demand on land for housing, infrastructure, basic services, and the environment are at the heart of livability issues. Bhutan's rapid urbanization has led to increasing GHG emissions.[106] Therefore, looking at the urban sector for green growth opportunities will help Bhutan to remain carbon neutral beyond 2050. At the same time, many mitigation activities in urban areas have adaptation co-benefits that help improve urban residents' quality of life.

Fast growing urban areas where infrastructure services cannot cope with urban sprawl are characterized by traffic congestion, pollution, fragmentation of green cover, and reduced surface permeability, landslides, and storm-induced floods. The urban planning framework is challenged by the lack of modeling of demographic trends and identifying potential human settlements based on connectivity, potential economic prospects, suitable land for development, and access to vital resources, such as water. Lack of urban planning instruments to guide urbanization jeopardizes the unlocking of the unique comparative human, cultural, natural, and economic advantages of the country's diverse regions. Bhutan has recently adopted a cultural

101 Ibid 31
102 The Fifth Assessment Report of the Intergovernmental Panel on Climate Change estimates that by 2100, South Asian countries, including Bhutan, will experience an 11% overall increase in rainfall during the wet season.
103 Twelfth Five Year Plan 2018-2023 (Volume-I). Gross National Happiness Commission, Royal Government of Bhutan Thimphu
104 Indicates the speed at which a country is transitioning from a rural to an urban society, the growth rate of its urban population measures the speed at which the absolute number of people residing in towns and cities is growing; Ellis, Peter, and Mark Roberts. 2016. Leveraging Urbanization in South Asia: Managing Spatial Transformation for Prosperity and Livability. South Asia Development Matters. Washington, DC: World Bank. doi: 10.1596/978-1-4648-0662-9. License: Creative Commons Attribution CC BY 3.0 IGO.
105 National Statistics Bureau 2019; Low Emission Development Strategy for Human Settlement 2021, RGoB.
106 Michaelowa et al. 2018.

landscape approach,[107] with alternatives to the international standard planning procedures and tools which have not been able to fully grasp the country's innate values, societal norms, and ways of life, or properly contextualized them in planning. Following a cultural landscape approach is an opportunity to foster the Bhutanese way of life, put it in practice, and guide it while planning its future. Building upon nature and culture, which are embedded in Bhutan's Constitution and all its policies, the cultural landscape approach to regional planning is expected to help the country stay true to GNH.

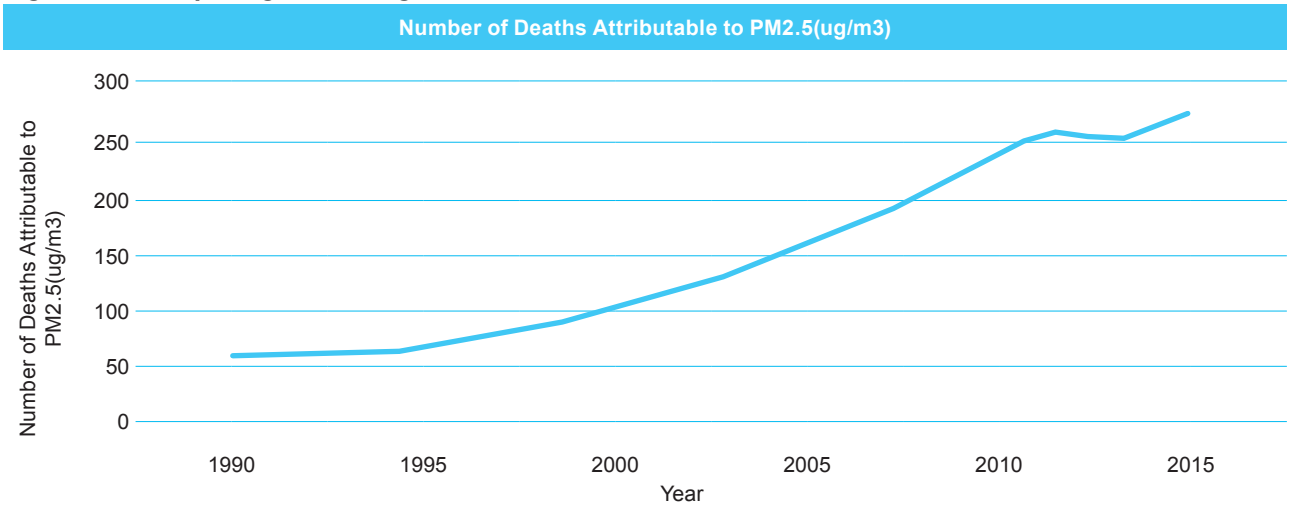
Air pollution from inefficient energy use and expanding transport sectors is an emerging national concern. Urban air pollution is caused by exhaust emissions from diesel and petrol vehicles, industrial emissions, chemical and mining processing, wind-blown dust from unpaved roads, quarries, and construction sites, forest fires, burning of household and farm waste, open fires at construction sites, and roadside woodfired heating of bitumen in open pans for road paving, as well as wood-burning stoves used for cooking and heating. Emissions from the transport sector are expected to rise by 1.25 $MtCO_2e$ by 2050 at an average year-on-year growth rate of 10 percent. A significant rise in emissions is expected from light vehicles followed by medium and heavy vehicles.

Air quality issues with potential implications for human health are the most recent environmental concern. The World Bank estimates that the global ambient PM2.5 population exposure for 2019 is over four times as high as the WHO's Air Quality Guideline value of 10 µg/m3 for annual average PM2.5. Ambient PM2.5 exposures in 2019 were highest in the South Asia[108] followed by the Middle East and Sub-Saharan region.[109] A recent study found that during the COVID-19 lockdown imposed in Bhutan, in 2020, only a marginal reduction of 4 percent in the PM2.5 concentrations was observed, indicating that nonlocal emissions dominate the PM2.5 concentrations in Thimphu, Bhutan.[110] The trajectories of originating sources were allocated to south or southwest, with India being the major contributor (~44 percent), followed by Bangladesh (~19 percent), Bhutan itself (~19 percent), and China (~16 percent). The same study indicated significant contributions from transboundary sources to PM2.5 concentrations in Thimphu, Bhutan, and recommends that these elevated PM2.5 concentrations need to be tackled with appropriate action plans and interventions.

Since 2009 the annual average level of PM10[111] in Thimphu had been increasing, with levels consistently higher than the WHO standard.[112] During the dry winter season, PM10 levels in the capital routinely exceeded the allowable limits of the national standard of 60 micrograms per cubic meter (µg/m3).[113] Increasing levels of PM2.5[114] are even more harmful for human health.[115] A global study found that localized air quality in Pasakha, center of ferrosilicon and steel factories, was around 150 µg/m3 of fine particle emissions[116] and higher than the notoriously smoggy ambient air of Delhi and Cairo. Although not significant when compared to other countries in the region, shows an increase in mortality due to outdoor air pollution (PM2.5) in Bhutan (Figure 13).[117]

107 The Cultural Landscape Framework for Regional Planning builds upon the Cultural Heritage Bill (CHB) formulated by MoHCA and enacted by Parliament in 2016.
108 Participating South Asian countries are Nepal, Bangladesh and India.
109 World Bank. The Global Health Cost of PM2.5 Air Pollution: A Case for Action Beyond 2021. International Development in Focus. Washington, DC: World Bank. doi:10.1596/978-1-4648-1816-5.
110 Sharma s. et al. 2021. Transboundary sources dominated PM2.5 in Thimphu, Bhutan. International Journal of Environmental Science and Technology.
111 Particulate matter with a diameter of 2.5-10 micrometers or µm
112 World Health Organization, 2016, Global Urban Ambient Air Pollution Database. WHO standard for annual average PM 10 is 20 µg/m 3.
113 The Middle Path 2020.
114 Fine particulate matter with a diameter of under 2.5µm.
115 The Middle Path 2020; WHO 2016.
116 Ibid 44 page 17.
117 https://www.stateofglobalair.org/data/#/health/plot. Health Effects Institute. 2020. State of Global Air 2020. Data source: Global Burden of Disease Study 2019. IHME, 2020.

Figure 13: Air quality: mortality attributable to PM2.5



Source: State of Global Air 2020

The use of firewood as a primary source of cooking energy results in high levels of indoor air pollution and adds pressure on forests. Fuelwood still prevails in the residential sector, although its use has declined from 91% of the total residential to 5 to 87% in 2014[118]. Firewood is the primary source of cooking energy in rural Bhutan, resulting in high per capita firewood consumption. Over the years the fuel mix has been changing, depicting an increasing share of clean fuel such as electricity and LPG. According to the Bhutan Living Standard Survey (2017), 95 per cent of households use gas, 99.1 per cent use electricity, and 0.7 per cent use wood for cooking in urban areas. In rural areas, 57.8 per cent of the rural population use gas, 92.5 per cent use electricity, 33.3 percent use firewood, and 2.2 percent use biogas. More recent results from the Population and Housing Census[119] showed that the proportion of households using firewood for cooking in rural areas decreased from 56.6 percent from 2005 to 36.7 percent in 2017.

Transition to clean household energy will generate important health co-benefits. Results from a study on indoor air pollution[120] in Thimphu, Bhutan, revealed higher indoor concentrations of PM2.5 and PM10 in households using firewood heaters, compared to households using electric, LPG, and kerosene heaters. High concentrations of CO were found in LPG, kerosene, and firewood from indoor combustion. Elevated concentrations of PM2.5 and PM10 from firewood indoor heaters commonly used in Thimphu households during winter could potentially worsen the health impacts on residents. Despite having access to electricity, 33 per cent of rural households use firewood as an energy source[121]. Two recent government documents emphasize the urgency to reduce indoor air pollution in rural households. First, the National Environment Strategy (2020) from the National Environment Commission (NEC) underlines indoor air pollution as a strategic objective to improve air quality in Bhutan. Second, the Multisectoral National Action Plan for the Prevention and Control of Non-Communicable diseases (2015-2020) focuses on four types of NCDs — cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes. The plan recognizes that cooking and heating with biomass fuels produce high levels of indoor smoke with health-damaging pollutants.

118 IRENA (2019), Renewables Readiness Assessment: Kingdom of Bhutan, International Renewable Energy Agency, Abu Dhabi.
119 Ibid 37 and Dendup, Phuntsho & Wangchuk, Pelden. (2022). Indoor Air Quality among the Rural Community of Bhutan. 10.24321/2454.325X.202204.
120 Thipsukon Khumsaeng; Thongchai Kanabkaew. Measurement of Indoor Air Pollution in Bhutanese Households during Winter: An Implication of Different Fuel Uses. Sustainability 2021, 13, 9601 (measurements were taken in Thimphu, Bhutan, for PM1, PM2.5, PM10, CO, temperature, air pressure and relative humidity in houses and offices with various fuels used for heaters and classified as the hospital, NEC, kerosene, LPG and firewood.
121 UNESCAP, (2021), Situational Assessment for Household Energy Needs in Bhutan, United Nations ESCAP, Energy Division, September 2021. Bangkok.

Heavy-duty transport vehicles are responsible for at least 70 percent of local pollutants and nearly 60 percent of GHGs in the country.[122] There is a significant increase in vehicular traffic due to Bhutan's steady economic development. The import of petroleum products has increased from Nu 1.1 billion in 2002 to Nu 8.97 billion in 2017[123] and is projected to rise further. Sustainable transportation that focuses on efficient fuel usage and promotes public modes of travel has significant energy savings potential and reduces emissions. If vehicle ownership keeps increasing at 15 percent per annum,[124] estimated pollution levels will triple by 2030. If no action is taken, this can increase air pollution levels and pose risks to human health and environment, as well as cause an increase in CO_2 emissions.[125] To mitigate this trend in emissions, Bhutan has implemented several initiatives and policies that target various developmental priorities and challenges. For example, the Bhutan Electric Vehicle (EV) Roadmap (2020–25) has been developed for a transition to zero emission mobility with targets for 2035, 2045, and 2050. The Bhutan Sustainable Low-emission Urban Transport System project is being implemented to initiate the transition to EV mobility by focusing on taxis as the primary target for market transformation.

Air quality and climate issues often display feedback loops. Actions for reducing GHG emissions and control of air pollutants need to follow a holistic approach, such as measures for energy efficiency improvements across all sectors, accelerated adoption of renewable energy, and fuel switching in end-use sectors to replace dirtier fuels. In summary, air quality policies may require an estimation of the range of projected air pollution reductions at an airshed level that will result from the various measures across all sectors to understand how any of the measures would reduce the risks from pollutants or air contaminant emissions.

Underdeveloped waste management system

Across the country, municipal waste management is one of the most pressing issues. The total quantity of solid waste generated from across the whole country was estimated at about 861.36 tons per week in 2018.[126] The recent National Waste Inventory Survey[127] revealed that households generate more than 80 tons of solid waste per day, out of which 51 percent are generated in urban areas.[128] Despite several policy advances, there is a lack of coordinated planning across institutions for integrated waste management, and a shortage of human and financial resources to implement and enforce legislation. According to the IEMMP, in 2010,[129] Thimphu and Phuentsholing generated 37 and 25 tons of solid waste per day, respectively. Although the collection rate is relatively high, around 95 percent, open dumping is common due to lack of proper infrastructure. Policies are in place to promote recycling, but there are few proper waste segregation systems at source, and no treatment of greywater for reuse. Apart from Pasakha, industrial areas lack dedicated industrial waste sites. Medical waste and electronic or e-waste pose special challenges, due to lack of capacity, facilities, and resources.

Segregated waste collections in the capital city focus on collecting two to three waste streams (wet, dry, and hazardous waste). There are pilots for replicating this example nationwide, in areas where there is no waste collection. The new national waste strategy sets an ambitious goal to reduce to less than 20 percent waste disposed to landfills by 2030.

122 ADB 2019 policy brief "Bhutan Vehicle Emission Reduction Road Map and Strategy, 2017–2025."
123 EE and Conservation Policy of Bhutan 2019; POL Section, DoT, MoEA.
124 The Middle Path 2020; Road Safety and Transport Authority, www. rsta.gov.bt
125 Ibid 46 page 17.
126 12th Five Year Plan, 2018–2023.
127 NSB 2019.
128 Low Emission Development Strategy for Human Settlement 2021 RGoB.
129 NSB 2019.

Table 2: Municipal solid waste collection in Bhutan

Area	Urban	Rural	Bhutan
Yes	75.12	14.9	36.86
No	24.88	85.1	63.14
Total	**100**	**100**	**100**

Do you use it	Urban	Rural	Bhutan
Yes	95.76	85.55	93.14
No	4.24	14.45	6.86
Total	**100**	**100**	**100**

Note: Proportion of households with access to waste collection (left, %) and proportion using waste collection service (right, %). Source: NSB 2019.

Emissions from the waste sector had increased by 127 percent compared to 1994–2015, compounded by another increase of 86 percent in 2000–15. According to the GHG inventory[130] there are two main sources of GHG emissions: wastewater treatment and waste discharge accounted for 87 percent of total waste related GHG emissions, while 13 percent are emissions only from solid waste disposal.[131] The remaining amounts are from waste disposal sites, mostly shallow and open dump yards. Measures for mitigating GHG emissions in urban areas inter alia involve integrating low emission strategies in urban and rural settlements and strengthening municipal waste management. The 2019 National Waste Management Strategy aims to address barriers to improved water management.

The National Environmental Strategy[132] prioritizes waste minimization, reuse, and recycling. The Zero Waste Bhutan by 2030[133] initiated by the government aims to strengthen waste prevention and management and sets a goal to achieve zero waste by curbing current trends of disposing over 80 percent to the landfill and reducing waste going to landfills to less than 20 percent by 2030, based on the principles of circular economy. The GHG mitigation target will be achieved by reducing the municipal waste going to landfill to 28.3kt/year by 2025 (from 46.3kt/year in 2020) and to 9.9 kt/year in 2030.[134] The program implementation has been delayed due to COVID-19 lockdowns. It is planned to start it in four Thromdes (Thimphu, Phuentsholing, Gelephu, and Samdrup Jongkhar) and gradually scale it up across all 20 dzongkhags.

Bhutan lacks proper waste disposal solutions, including sanitary landfill infrastructure or a waste-to-energy facility. In urban areas, collected waste is disposed to common dumpsites due to a lack of solid waste management infrastructure (including engineered landfill sites), including in the most populated areas (Thimphu and Phuentsholing). Dumpsites are often located close to waterways, increasing the risk of waste (including plastic) leakage into the (aquatic) environment. Waste collection in rural areas is very low, and most of the waste is burnt in household backyards. Each Thromde has an identified dumpsite for disposing of waste (in Memelakha for Thimphu and in Perkarzhing for Phuentsholing).

Plastic leakage is an emerging risk to Bhutan's pristine environment and aquatic ecosystems. Bhutan's plastic consumption is estimated as 18,000 tons per year and plastic waste generation as 14,000 tons per year.[135] The largest proportion of this is packaging, which represents 52 percent of the consumption and 63 percent of the plastic waste generation. Plastic waste generation is concentrated around Thimphu and Phuentsholing, where population density is the highest. The plastic generation rate is particularly high in Thimphu at 29.7 kg/person, compared to the Bhutan average of 16.63 kg/person. Bhutan has no plastic production and limited manufacturing capacity. All plastic (as feedstock or product) is imported mainly from India. In 2017 Bhutan introduced import taxes for plastic products as well as fiscal incentives to support the development of recycling, collection, and processing enterprises.

130 2nd National Communication to UNFCCC.
131 NEC. Emissions were estimated using a bulk waste approach with activity data of population/ GDP.
132 2019 National Environment Commission Secretariat Royal Government of Bhutan. 2019. The Middle Path. The National Environmental Strategy 2020.
133 See http://www.nec.gov.bt/necs/2020/10/30/press-release-on-waste-management-flagship-program.
134 Low Emission Development Strategy for Human Settlement 2021, RGoB.
135 Baseline Assessment for Plastic Debris flowing into Rivers and Seas of South Asia Annex 3: Country Profile for Bhutan.

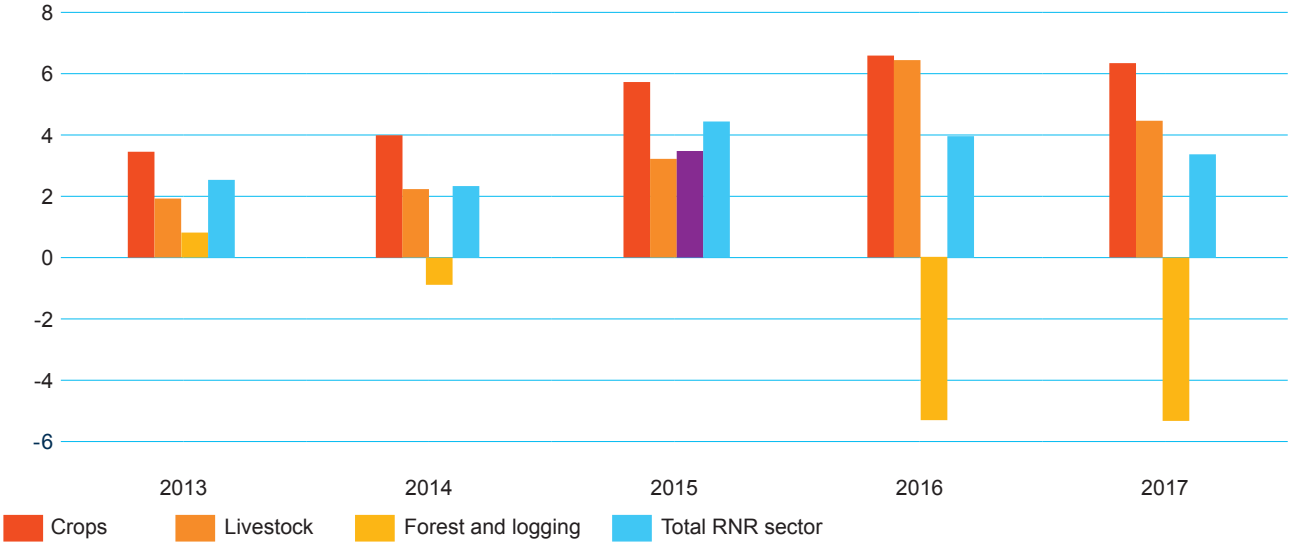
Rationalization and simplification of the customs duty rate was part of COVID-19 measures to encourage trade and contain inflation. Such a measure without proper management of plastic waste could potentially increase plastic use. The 2021 Customs Duty Act reduced the customs duty to 10 percent from existing rates of up to 50 percent on about 500 goods (including polyethylene; plastic waste) from countries other than India (no duty is levied on imports from India due to the bilateral free trade agreement). How this fiscal policy have impacted plastic consumption and waste generation in the country needs further analysis.

Forest sector

Bhutan's economy, culture, and livelihoods are inextricably linked to the forest landscapes. Bhutan has one of the highest percentages of forest covers in the world and is a leader in forest and biodiversity conservation. The four pillars of GNH—equitable and sustainable socioeconomic development (SED), cultural preservation and promotion (CUL), environmental conservation (ENV), and good governance (GOV)—along with the four categories of forest ecosystem services—regulating, provisioning, cultural, and supporting—are related in many ways. Bhutan's forests naturally link people's well-being with the environment. Many of the country's cultural traditions depend on maintaining knowledge of the environment and on protecting forest resources (e.g., mountain closure, sokshing). National environmental conservation policies aiming at enhanced forest ecosystem services directly and indirectly support the country's socioeconomic development. Provision of goods and regulation of water services support the hydropower sector. Forest ecosystem services are critical for soil and slope stability, water retention and flood mitigation, and carbon sequestration.

Since the 2000s the share of Bhutan's forestry sector to GDP marked a steady decline. This is also reflected in the low employment numbers. In 2012, only 0.5 percent of Bhutan's labor force (1,500 workers) worked in forestry, according to the 2012 Bhutan Living Standard Survey.[136] Different Forest resource assessments show that Bhutan could substantially increase its forest utilization with the availability of advanced harvesting and processing technologies[137] without compromising the national forest cover targets and ecosystem health.

Figure 14: Renewable natural resources (RNR) sector growth (at constant price, %)



Source: MoAF 2019.

136 NSB and ADB 2012; World Bank. 2019. Role of Forests in the National Economy.
137 MoAF 2014; Schindele 2004.

Bhutan must deal with various challenges in the forest sector to maintain at least 60 percent of its land area under forest cover, as mandated by the Constitution. Four groups of challenges were identified in a World Bank study[138] on the opportunities for furthering sustainable development aspirations for Bhutan's forest sector. These include: (i) drivers of deforestation and forest degradation; (ii) vulnerability to climate change and natural disasters; (iii) underdeveloped wood and non-wood industries; and (iv) a challenging policy and institutional environment.

The Ministry of Agriculture and Livestock[139] has identified six major drivers of deforestation ranking them by weight of impacts (Table 5). In total, the annual rate of deforestation equals 6,714 hectares, or 0.2 percent of the total forest cover. This loss in forest cover is overcompensated for by gains in forest cover elsewhere.

Table 3: Drivers of deforestation

Area	Area affected annually (ha)	Annual greenhouse gas emission because of forest area loss (tCO2e)
State reserved forest land allotment for various purposes	1,923	604,852
Hydropower projects	1,880	591,327
Agriculture	778	244,709
Roads	820	257,919
Mines and quarries	633	199,101
Electricity transmission lines	542	170,478
Total	**6,576**	**2,068,386**

Source: MoAF 2017.

Roads and power transmission lines alone account for more than 70 percent of the total forest area converted to other land use.[140] Timber and fuelwood harvesting deviating from sustainable forest management (SFM) practices account for 67 percent of total degradation of forests in Bhutan.[141] Forest fires can be caused by natural or manmade activities. The number of forest fires have fluctuated over time, from 34 in 2012–13 to 72 incidences in 2016 and 37 in 2017–2018.[142] Because of climate change, fire incidences are projected to increase. Pressure from livestock grazing in the forest was addressed by the government's initiatives to improve livestock management through cross-breeding, enhancing pasture, and feed and fodder development programs.[143] However, the magnitude of the interventions' impacts remains unclear.

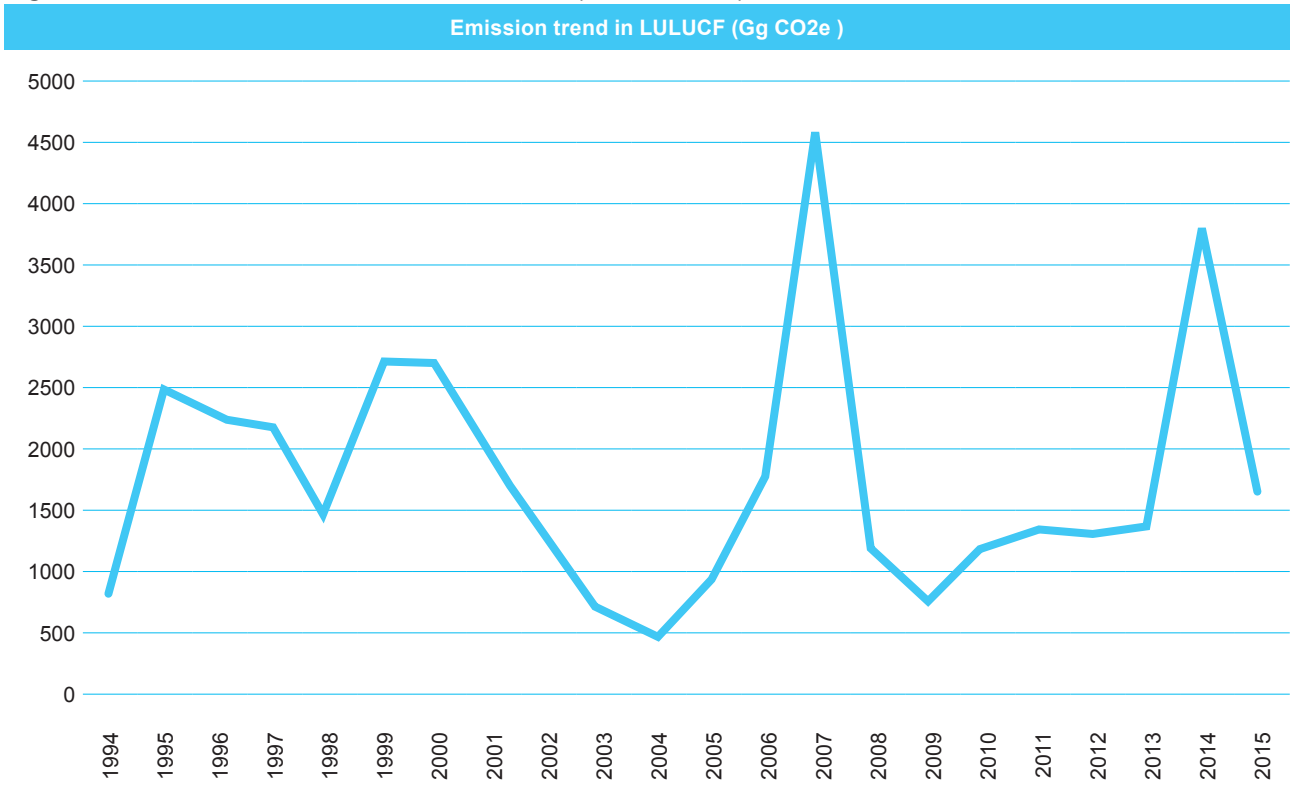
Climate change impacts on forests in high elevations occur during heavy precipitation, supersaturates soil, and cause river overflows and flash floods. The National Adaptation Program of Action 2021 lists new climatic hazards such as windstorms, fires, and cyclones. Climate change impacts could lead to shifts in seasonal stream flow, ecosystems, and distributions of species depending on habitat shifts. It is expected that forests and trees will be increasingly affected by new diseases, pests, and parasites, and by shifting phenological and seasonal changes induced by climatic changes.

138 World Bank. 2019. Bhutan Forest Note. © World Bank
139 Earlier the Ministry of Agriculture and Forests: MoAF (Ministry of Agriculture and Forests). Forest Facts and Figures 2018. Thimphu, Bhutan.
140 RGoB 2019; Review of Road Sector Master Plan (2007-2027) (Review of RSMP 2007-2027-FINAL.doc) https://www.mowhs.gov.bt/wp-content/uploads/2017/04/Review-of-RSMP-2007-2027-FINAL.pdf
141 Priorities SARI Meeting on Sustainable Forestry in South Asia – Current Status, Science and Conservation Priorities. Presentation by Institute for Studies in Industrial Development Vasant Kung, New Delhi 7□9th November 2019; and MoAF, (2017). Drivers of Deforestation and Forest Degradation in Bhutan, Watershed Management Division Department of Forests and Park Services Ministry of Agriculture and Forests Bhutan March 2017. See https://static1.squarespace.com/static/58d6cc1e17bffcffb801edde/t/59ed1fa6e45a7c27e93bc02c/1508712427664/Bhutan+driver+assessment.pdf.
142 MoAF 2017.
143 MoAF 2017.

Incidences of mega-drought would affect the tree responses to drought and the adaptive capacity of major species.[144] Excessive glacier melts resulting in glacial lake outburst floods could have damaging effects on vegetation cover.

Emissions from the forestry sector (timber removal, firewood, and disturbance) are the highest contributor to net national emissions contributing 42.75 percent or 1,630.37 Gg CO_2e. As presented within LULUCF sector, emission from forest (wood removal, fuelwood, and disturbance) accounts to 73.93 percent totaling to 1,205.40 Gg CO_2e; non-CO_2 emission from biomass burning in forest land represents 13.58 percent or 221.37 Gg CO_2e, and emission from deforestation (conversion of forest land to cropland, grassland, settlements, and other land) accounts to 12.49 percent or 203.58 Gg CO^2e in 2015. Bhutan's per capita fuelwood consumption is one of the highest in the world, since it remains the dominant source of energy for cooking and heating in rural areas.[145] The country's carbon sink has increased over the period, and this is due to change in definition of managed forest and increase in forest area (natural expansion in forest area and forest plantation) from last national inventory.[146]

Figure 15: Trend in emissions from LULUCF (1994–2015)



Source: 3rd National Communication to UNFCCC 2020 National. Environment Commission Royal Government of Bhutan.

144 Wangdi 2016.
145 The Middle Path.
146 3rd National Communication to UNFCCC 2020 National. Environment Commission Royal Government of Bhutan

Diversified tourism

The RGoB has pursued a unique high-value and low-volume tourism policy based on a minimum daily package rate (MDPR) and the sustainable development fee (SDF).[147] Bhutan's sacred mountains have been banned, preventing the kind of ecological degradation and pollution seen on busy climbing routes in other Himalayan countries.[148] The policy of imposing a Minimum Daily Package rate of US$200 to US$250-per-person-per-night has succeeded in providing a source of government income for education, health, and building tourism and transport infrastructure, while at the same time making tourism in Bhutan an exclusive and distinctive experience.[149] However, this policy makes it also less attractive for tourists to stay long enough to visit areas outside the Western tourist hotspots. While the tourism sector has been heavily hit by the effects of the COVID-19 pandemic, it has also inspired a newfound interest in domestic tourism. About 80 different entrepreneurs are looking to expand their work into domestic tourism. Glamping, ecotourism, and homestays are also new ventures they are hoping to offer for both international and domestic travelers.[150]

Bhutan's pristine environment is among the key tourist attractions. While tourism in Bhutan has so far been a success story, ecotourism sector is already facing growth challenges.[151] For example, as visitor numbers grow, the high value components earnings and the percentage of total spending decrease. According to the 2019 Tourism Council of Bhutan Final Draft Tourism Policy, Bhutan received more than 200,000 regional tourists not subject to the minimum daily spending requirements, who can stay in budget accommodations, and were not required to employ guides. This helps to provide year-round occupancy in hotels but causes overcrowding at popular sites in the more heavily visited area from Paro to Bumthang. In addition to social impacts, a lack of proper management of tourist sites based on their "carrying capacity" can cause environmental pressure. High concentrations of visitors put pressure on fragile ecosystems and can cause an increase in waste and litter.[152] Improved coordination between all sectors involved in developing new tourism products will be critical to prevent environmental impacts that could harm the value of natural heritage.

Protecting the value of nature heritage assets

Bhutan is a world leader in using "wildlife corridors" as cost-effective and reliable ways to conserve globally threatened species, promote gene flow, and allow species to adapt to climate change. Bhutan has five national parks, four wildlife sanctuaries, one nature reserve, and nine biological corridors. Protected areas and biological corridors cover 19,751 sq km or 42.7 percent of total surface.[153] Bhutan's consistent conservation efforts to protect its rich and diverse ecosystems and wildlife have not come without a price.[154] Farmers in rural communities claim that human-wildlife conflict causes social disharmony and constraints to agricultural sustainability and food security.[155] According to the National Environment Commission (NEC) there are indications that in some areas, clearing forest for infrastructure causes the loss of wildlife habitats and disrupts animal behavior, forcing wild animals into human settlements in search of food that is easily accessible.[156] Direct impacts on forests from human activities and climate change extend onto

147 Tourism Council of Bhutan (TCB) 2020.
148 The Middle Path.
149 The Middle Path.
150 Tourism in Bhutan and COVID-19's Lasting Impacts - BORGEN (borgenmagazine.com)
151 The COVID-19 crisis is expected to have significant and possibly long-lasting effects on Bhutan's economy. Economic growth is expected to slow markedly, averaging around 2.5 percent per year over the medium term – well below the pre-COVID five-year average of 5.5 percent. The tourism sector is not expected to return to its pre-COVID-19 level in the short term given that travel restrictions in Bhutan will likely hold past 2021, dampening services sector growth.
152 The Middle Path.
153 Bhutan Biological Conservation Complex | WWF (wwfbhutan.org.bt)
154 The Middle Path.
155 Ibid 68 page 27.
156 Ibid 68.

Bhutan's biodiversity. Although this area is not yet well researched,[157] increases in temperature and changing rainfall patterns are expected to cause shifts in species ranges—as animals move to new habitats, and plants shift to higher elevations to escape warming trends.[158] Increased temperatures and changing rainfall patterns may also allow for new invasions by alien species that are well adapted to the new climatic conditions, including pests and micro-organisms that cause disease.

157 NEC 2020.
158 NEC 2020.

Chapter 4: Fostering the Foundations of Bhutan's Green Growth

Weathering the COVID-19 pandemic storm

The impacts of the COVID-19 pandemic on growth gave an impetus to policy discussions on the need to diversify Bhutan's economic asset base. This is unveiled in discussions on the concept of the 13th FYP. As the permanent impact on sectors becomes clearer, the need to reallocate resources to other viable sectors could become an imperative. This is an opportunity to form a development model that is currently driven by exports of hydropower to one in which domestic and regional demand play a greater role, reducing reliance on exports to drive growth. Bhutan's abundant natural capital offers multiple economic opportunities to build back better and sustain the foundations of future growth. There are opportunities to tap into the development potential for sustainable forest use, nature-based tourism, organic agriculture, hydropower, traditional herbal medicine, and much more. There is room to maintain and leverage Bhutan's brand by addressing the emerging challenges related to climate change and environmental degradation.

In the recovery period from post pandemic impacts the economy of Bhutan is projected to slow from 4.7% in 2022 to 4.6% in 2023 and 4.2% in 2024[159]. A return to normal hydropower production after 2 years of decline will underpin growth in 2023, while expected production from two newly commissioned hydropower plants will help sustain growth in 2024. As India is Bhutan's main trade partner, its robust economic growth prospects in 2023 and 2024 will boost exports and growth[160]. An International Monetary Fund (IMF) report[161] on the global recovery points that countries such as India, Nepal, and Sri Lanka can build on their existing production facilities; in others, where product space is clustered in specific industries—such as Bangladesh, Bhutan, and the Maldives—would need to undertake a more concerted push. On the demand side, aggregate consumption expenditure will drive growth. It is forecast to expand by 25.4% in 2023 and 12.3% in 2024, mainly on strong private consumption, as is consistent with the experience of past government election cycles. A more resilient economy with a green and diverse production base can support the economic recovery and future development in Bhutan.

The RGoB's COVID-19 policy measures were aligned with the 12th FYP and its flagship programs. The 12th FYP is dedicated to creating a "Just, Harmonious, and Sustainable Society through enhanced Decentralization." The government will advance flagship programs under the 12th FYP through the budget. Programs including Digitalizing Bhutan, which aims to increase the use of digital technologies in schools, Growing Organic, Redefining Tourism, and Managing Waste have been leveraged through the COVID-19 response and could increase future resilience. The RGoB is currently drafting the 21st Century Economic Roadmap, which will outline Bhutan's long-term vision. The overall objective is to create economic opportunities for the next generation and become a high-income GNH society by 2030.

159 Bhutan - Asian Development Outlook April 2023 (adb.org)
160 Ibid 6
161 IMF Working Paper Asia and Pacific Department. A Diversification Strategy for South Asia. Weicheng Lian, Fei Liu, Katsiaryna Svirydzenka, Biying Zhu. July 2021. WP/21/202. © 2021 International Monetary Fund.

Institutional and policy foundation for sustaining Green, Resilient, and Inclusive Development

Bhutan's national development policies support the sustainability of its renewable resources as critical for ensuring that forests, air, land, and water are managed in a way that economic dividends can pay off for future generations. The 2030 Agenda plays a major role in guiding and facilitating Bhutan's climate-neutral development. Bhutan's post COVID-19 recovery and growth challenges call for economic diversification and alternative growth opportunities, fostering productivity, and creating a virtuous cycle between sustainable development achievements and future green, resilient, and inclusive growth. The effects of climate change are profound and potentially adverse, especially on future productivity of sectors dependent on water resources, forests, land, and ecosystems. Bhutan's sectoral strategies and economic policies will continue to do so as primary entry points for fostering sustainable growth. The complexity of natural systems and irreversibility of some environmental and climate-induced changes may carry risks for replacing the natural capital with other forms of capital.

Bhutan's longstanding commitment to protect the environment dates to the Nature and Conservation Act from 1995. In 2007, the National Environmental Protection Act (NEPA) envisaged, among other provisions, the fundamental right to a safe and healthy environment, intergenerational justice, the precautionary principle, the adoption of "3Rs" principle (reduce, reuse, and recycle), and the "polluter pays" principle. The law has provisions for rights to access information and environmental justice for individuals whose right to a safe and healthy environment are affected. An array of financial instruments is foreseen by the NEPA, including fiscal incentives for environmental protection and compliance, tax incentives, reductions in customs and other duties for the importation of environmentally friendly and energy-efficient technologies; charging levies and fees for utilization of natural resources; and mechanisms for valuation of and compensation for natural resources.

According to the Economic Development Policy of 2016, Bhutan's commitment to remain carbon neutral is important for realizing the country's aspiration for developing Brand Bhutan. In this endeavor Bhutan will capitalize on the opportunities arising from global trends towards low emission development, while at the same time "leapfrogging" towards global best practices in key sectors of the economy.

The Middle Path. The National Environmental Strategy 2020 is in line with the concept of sustainable development and articulates three economic poles of growth: (i) hydropower development based on integrated watershed management; (ii) agricultural development based on sustainable land management practices; and (iii) industrial development based on effective pollution control measures and environmental legislation. Several cross-cutting principles inform Bhutan's architecture of policies, laws, and regulation underpinning sustainable development: cultural valuation and integration, sustainable consumption and production, low carbon development, gender-responsive development, and poverty and environment mainstreaming. This strategy contains policy goals to tackle climate change and energy issues, create new growth engines through investment in environmental sectors, including forests, and develop an ecological infrastructure.

The Climate Change Policy of the Kingdom of Bhutan 2020 acknowledges that climate change poses a threat to sustainable development and to the pursuit of GNH. Therefore, measures to build resilience and reduce vulnerability are necessary to adapt to the adverse impacts of climate change and minimize future climate risks.

Bhutan's 2019 National Energy Efficiency and Conservation Policy emphasizes adopting energy-efficient production processes and technologies for enhancing the national economy and for establishing value chains for energy-efficient goods and services. EE&C targets transport, building sectors, and

industries for improved productivity and competitiveness, including by lowering operating costs and improving their environmental footprint. Fuel-efficient transportation systems and electric/ hybrid vehicles could lead to savings in fuel consumption in the transport sector and significantly reduce traffic congestion and mitigate vehicular pollution (SOx, NOx, total hydrocarbon, and PM emissions).

The Second NDC (2021) charts a way for Bhutan to continue pursuing a low emission development pathway towards national objectives for sustainable development while meeting obligations under the Paris Agreement. The second NDC pledges the country to remain carbon neutral. Implementation targets are further refined with quantifiable monitoring indicators. To implement the NDC's priority programs, several Low Emission Development Strategies (LEDS) were developed to prioritize mitigation actions in key sectors of agriculture, human settlement, industry, and transport. These LEDS will serve as the basis for the sectors to integrate low carbon measures into development priorities. Further support for implementation is required to realize the identified priority programs and actions in the various LEDS.[162] A study on gender and climate change in Bhutan with a focus on three NDC sectors (agriculture, energy, and waste) unpacks the gender climate nexus, gender roles, and gender-differentiated impacts of climate change.[163] The study has been instrumental in informing gender mainstreaming opportunities in the preparation of the LEDS and the 2nd NDC.

Low Emission Development Strategy (LEDS) for Human Settlement 2021 was prepared by Ministry of Works and Human Settlement (MoWHS)[164] in collaboration with the NEC as part of a series of LEDS for several sectors. LEDS for Human Settlements is in line with the Climate Change Policy of the Kingdom of Bhutan 2020 as "a sectoral or national level development strategy aimed at ensuring socioeconomic growth with minimum level of related GHG emissions."

Box 2: Bhutan's Nationally Determined Contribution (NDC)

Bhutan submitted its first NDC in September 2015, which looked at mitigating GHG emissions through several sectoral interventions (NEC, 2015): (i) pursuing sustainable forest management and conservation of biodiversity to ensure sustained environmental services; (ii) promoting low carbon transport system; (iii) minimizing GHG emissions through the application of zero waste concepts and sustainable waste management practices; (iv) promoting a green and self-reliant economy towards carbon-neutral and sustainable development; (v) promoting clean, renewable energy generation; (vi) promoting climate-smart livestock farming practices to contribute to poverty alleviation and self-sufficiency; (vii) promoting climate-smart agriculture to contribute towards achieving food and nutrition security; (viii) pursuing energy demand-side management by promoting energy efficiency in appliances, buildings, and industrial processes and technologies; and (ix) integrating low emission strategies in urban and rural settlements through green buildings, sustainable construction methods, and climate-smart cities.

The 2nd NDC (2021) further emphasized the commitment to enhance action in priority mitigation areas: (i) forest conservation and management under the National REDD+ Strategy; (ii) low emission development strategy for food security; (iii) low emission development strategy for human settlement; (iv) low emission development strategy for industries; (v) low emission development strategy for surface transport; (vi) waste management; (vii) sustainable hydropower development; (viii) alternative renewable energy; (ix) green hydrogen roadmap; (x) National Energy Efficiency & Conservation Policy 2019 and Energy Efficiency Roadmap 2019; and (xi) cooperative mechanisms to achieve sustainable development and mitigation ambitions.

Bhutan has started the process of formulating its National Adaptation Plan (NAP) as part of the NAP readiness support. It is expected to put in place essential elements to support the medium- to long-term process for adaptation planning and implementation by enhancing institutional coordination, management of climate change data and information, and capacity building of key institutions including academia, civil society, and the private sector. Bhutan's first NAP is expected to be completed and submitted in 2021 and will be the basis of its Adaptation Communication to convey the country's priorities, plans, actions, and support needs for adaptation. The NAP will cover priority needs and actions in the areas of water, agriculture, forests and biodiversity, and health.

Source: Communication of the Second Nationally Determined Contribution of the Kingdom of Bhutan from June 23, 2021.

162 Bhutan 2nd NDC 2021.
163 Ibid 102
164 As of 2023, under the Bhutan Civil Service Reform Act, this is now the Department of Human Settlement which falls under the Ministry of Industry and Transport

The National Strategy and Action Plan for Low Carbon Development was prepared to enable Bhutan to fulfill its commitment of remaining carbon neutral. In other words, it will help ensure that national emissions of GHG remain less than the national sequestration capacity.[165] The strategy is comprised of various scenarios analyzing development paths from 2005 through 2040.[166] As a supplement to the scenarios, the action plan presents several short- and medium-term interventions to achieve sustainable economic development through green growth.[167]

Bhutan has started preparing the Long-Term Low GHG Emission and Climate Resilient Development Strategy (LTS). The LTS will provide overall direction and guidance for Bhutan in the long-term efforts for remaining carbon neutral. The development of the LTS has been hampered by the COVID-19 pandemic and is expected to be completed in 2022.[168]

Bhutan's Sustainable Hydropower Policy 2008 aims to mobilize funds and attract investments for accelerated hydropower development and to enhance revenue contribution. The policy promotes sector development as an engine for clean energy to mitigate problems related to global warming and climate change. Huge energy demand in the region offers a big opportunity for Bhutan to develop its rich hydropower resources for the export market and to mitigate climate change in the importing countries. By acknowledging these opportunities, the policy provides a framework for furthering the sector potential for increased electricity export and, consequently, generating substantial revenues.

The Environmental Assessment Act of 2000 and the Regulation for the Strategic Environmental Assessment (2001), changed to RECOP 2016, provide for the implementation of strategic environmental assessment on policies, plans, programs, and procedures for approval. All existing hydropower projects in Bhutan are run-of-river and spread across multiple river basins. Project-level EIA does not assess the potential cumulative effects on environmental resources at the basin level. Since dams, reservoirs, and the operation of hydroelectric generators can affect the environment, a combination of hydro projects within the same river basin could intensify these impacts. Therefore, the scope of the impact assessment should not be limited to one project but analyze the impacts with a view towards other existing and planned projects. Since 2017 Bhutan has introduced national SEA guidelines that provide sectors with procedures for conducting SEA., including formulating SEA reports and the overall process for receiving NEC approval on SEA.

The Sustainable Hydropower Development Policy (SHDP) 2021 enhances the previous hydropower policy by integrating climate resilience and mitigation, among other updates. As current run-of-river hydropower schemes in Bhutan have become increasingly vulnerable to decreasing water flows in the dry season, the SHDP emphasizes adaptation measures such as reservoir/pumped storage schemes. In addition, the new policy mandates hydropower value chain through ventures in energy storage technologies such as hydrogen fuel, green ammonia, and other emerging technologies. These energy storage and diversification measures for adaptation also contribute directly to Bhutan's carbon neutral efforts by providing clean energy for zero carbon transport and mobility.[169]

165 Third National Communication to the UNFCCC.
166 Ibid 21 page 9.
167 Ibid 21 page 9.
168 Bhutan 2nd NDC.
169 Bhutan 2nd NDC 2021.

Box 3: EIA Practices in Bhutan's Hydropower Sector

Methodology: There are several factors weighted in using a multi-criteria analysis for new hydropower development in Bhutan. The main criteria include technical, economic, social, environmental, and balanced overall regional development. Each of these criteria are further analyzed through the lens of subcriteria, which the Department of Energy (DoE), under the Ministry of Energy and Natural Resources uses to rank the overall feasibility and prioritization of a new hydropower projects. Environmental and social assessment together carry 30 percent weight in overall ranking of hydropower development. Social assessment is conducted using sub criteria, including improved access to socioeconomic benefits, access to reliable and adequate power supply, employment benefits, resettlement and rehabilitation, and tourism. Environmental assessment includes subcriteria such as intrusion into protected areas, loss of primary forest, dewatering impacts, access road erosion, and fish migration. In addition, a separate main criterion, representing 15 percent of the total score, is dedicated to balanced regional development, which favors distributing hydropower to regions currently less developed.

Legal procedures related to EIA in Hydropower
Environmental Impact Assessment (EIA) is legislated under the Environmental Assessment Act (2000) and regulated by NEC. For hydropower development in Bhutan, separate guidelines (Environmental Assessment Guideline for Power Transmission Line Guideline (2012) and Environmental Assessment Guideline for Hydropower Development (2012)) were also published. In addition to these broad regulations related to the environment, the regulatory framework also comprises specific rules and regulations related to water use, biodiversity, fisheries, and forestry.

Law and guidelines	EIA Practices
Environmental Assessment Act, 2000	Establishes procedures for assessment of policies, plans, and projects on the environment; environmental clearance by the National Environment Commission (NEC) or a competent authority required and mandatory; public consultation made mandatory; provisions included for noncompliance, including penalties. The clearance process concludes with the release of the umbrella environmental clearance (EC) from NEC, once all other clearances are obtained, including EIA, land acquisition, vegetation removal clearance.
Regulation for the Environmental Clearance of Projects, 2002	NEC and/or "competent authority" given the responsibility for issuing environmental clearance; public consultations mandatory.
The Water Act of Bhutan, 2011	It follows the "polluter/user pays principle" while also requiring a number of measures to be adopted, including formulation of a "National Integrated Water Resources Management Plan" and a "River Basin Management Plan" for each river basin. It stipulates water use priorities—drinking water and sanitation and agriculture being prioritized overuse in energy production.
Environmental Assessment—Guidelines for Hydropower (2012) **&** **Environmental Assessment—Guidelines for Power Transmission Line Projects**	The guidelines include measures to identify, assess, and mitigate environmental impacts from hydropower development, as well as provide a framework for the preparation of good assessment reports. It offers recommended outline for EMPs, R&R Plans, Compensatory Afforestation Plans, e-flow assessments, Dam Break Analysis and Disaster Management Plan, and Biodiversity Conservation & Wildlife Management Plan, among others. Six key steps are recommended: (i) screening; (ii) scoping; (iii) baseline data generation; (iv) impact assessment; (v) measures for mitigation of impacts; and (vi) Environmental Management Plan. The guidelines also emphasize the need for consultations with affected Communities; to assess impacts downstream, on ecological flows as well as cultural heritage.

The Tourism Policy of the Kingdom of Bhutan from 2021 is built on branding Bhutan as a green, sustainable, inclusive, and a high-value tourism destination which is guided by a "high-value, low volume" policy for tourism believed to significantly contribute to the country's overall socioeconomic development. The policy sets the agenda and direction for sustainable tourism development in the country through key reform measures and institutional strengthening. It aims to keep number of tourists within manageable limits to avoid issues and concerns associated with mass tourism. The policy foresees adoption of appropriate pricing and other mechanisms such as an SDF and a MDPR.

Sustainable Forest Management is part of the 12th Five-Year Plan (2018–23) projecting an increase of the area under the SFM regime from 357,915 hec-

tares to 425,495 hectares.[170] The forest area under scientific thinning will be increased from 381 to 15,000 hectares and the number of SFM plans from 46 to 96. While the plan focuses on strengthening the existing Community Forests (CF) and Non-Wood Forest Products (NWFPs), it also commits to increasing the number of CFs and NWFP groups. Implementation and achievement of these goals will require capacity development to various stakeholder groups, investments in modern technology and infrastructure for timber and NWFP production; and support to value-chain addition activities.[171]

The Renewable Natural Resources (RNR) Strategy 2040, covering the forests, agriculture, and livestock sectors, was adopted in 2021 and covers the Agriculture, Forests, and Other Land Use (AFOLU) sector under the IPCC emissions source category. The RNR strategy integrates resilience to climate change and low emission development as one of the key strategies to actualize transformational change in this integrated sector by building on the REDD+ Strategy, LEDS for Food Security 2021, and the National Strategy for Sustainable Socioeconomic Development through the Commercialization of Organic Farming 2019.

Bhutan implemented the REDD+ readiness program and produced Bhutan's National REDD+ Strategy and Implementation Framework, including the National Forest Monitoring System, Forest Reference (Emission) Level, a Monitoring, Reporting, and Verification (MRV) Mechanism, and Safeguard Information System (SIS) for REDD+. With the establishment of the National REDD+ Framework, Bhutan is awaiting support to proceed to implementation of the strategy, which includes policies and measures that will contribute to continued conservation and sustainable management of forests.

Bhutan's national policies are complemented by its commitment to all major multilateral environmental agreements. See Box 3.

Box 4: Bhutan's Multilateral Environmental Agreements

UN Convention on Biological Diversity (CBD), August 1995
UN Framework Convention on Climate Change (UNFCCC), August 1995
Convention for International Trade in Endangered Species (CITES), August 2002
Vienna Convention for the Protection of the Ozone Layer, April 2004
UN Convention to Combat Desertification (UNCCD), August 2003
International Plant Protection Convention, June 1994
UN Convention on the Law of Sea, December 1982
RAMSAR Convention on Wetlands, January 2012
South Asian Wildlife Enforcement Network (SAWEN), January 2010

Source. The Middle Path - National Environment Strategy 2020

The above strategic underpinnings usefully inform Bhutan's future policies for green growth. As Bhutan charts a growth path that includes maintaining its carbon neutrality, future policies could focus on addressing emerging development challenges, curbing further emissions, efficiently allocating resources, developing value chains that do not result in overexploitation of resources, encouraging technology choices that are efficient and minimize environmental pressures, and expanding private sector opportunities.

Institutions for steering up green growth

Sustainability is the overarching governance philosophy of Bhutan embodied in the GNH Index and in the spirit of national development policies. The Cabinet Secretariat coordinates the public agencies with the purpose of promoting the four pillars of GNH—i.e. sustainable economic development; preservation and promotion of culture and tradition; conservation of environment; and good governance (Box 4). Annex 2 provides details of the Governance and Institutional Framework for Green Growth: composition, coordination center, lead agencies, focus areas, communication with society groups, and recommendations.

170 This includes all forest management regimes with local forest management plans, including FMUs and CFs.
171 World Bank. 2019. Bhutan Forest Note. © World Bank.

Box 5: Bhutan's GNH Index[172]

The GNH Index has 9 domains and 33 indicators that measure sustainability-based growth and development. The following domains of the GNH Index are used to measure green, resilient, and inclusive growth: good governance, ecological diversity, living standards, community vitality, and education. For example, the *living standards domain* refers to the level of material comfort as measured by income, conditions of financial security, and housing and asset ownership. The *good governance domain* evaluates how people perceive various governmental functions in terms of their efficacy, honesty, and quality. Indicators help to evaluate the level of participation in government decisions at the local level and the presence of various rights and freedoms.[173] Bhutan has a unique approach of 'middle path' development that considers GDP as an accounting system, not an indicator of overall growth and well-being. The Cabinet Secretariat brings this unique approach to its development policy and practice by using GNH indicators. Apart from the GNH Index indicators, the National Key Results Areas (NKRAs) and Sectoral Key Results Areas (SKRAs) were employed as specific targets and indicators in the formulation of the 11th FYP. This strategic results framework that was designed at that time is still being used for planning and programming of the central, sectoral, and local development plans and programs. However, detailed understanding and capacity to align sector/agency plans and programs to the SDG targets and indicators remain limited. [174]

The national coordination of climate change actions across key agencies and stakeholder groups is carried out by the Department of Environment and Climate Change, under the Ministry of Energy and Natural Resources. A climate change "one stop platform" helps to facilitate the multi-stakeholder dialogue and to implement climate-related work in Bhutan. Particularly, the aim is improving coordination between the different climate-sensitive sectors, enhance knowledge management, and improve reporting and monitoring of all climate actions in Bhutan.[175]

Bhutan is committed to green growth as a core thrust of its future economic development. The Economic Development Policy of 2010 states that "green growth" will be encouraged in promoting industrial and private sector development. However, the 2016 version of the policy does not refer to "green growth"; rather, it envisions to build Bhutanese economy as "green and self-reliant economy" that is guided by the GNH philosophy.[176] This policy recognizes that unless the constraints to business growth are systematically addressed, the capacity of the private sector as an engine of growth cannot be enhanced. In this context, the 2016 policy aims to create an enabling environment for investment through eight high-level strategic directions. This includes diversifying the economic base with minimal ecological footprint, harnessing and adding value to natural resources in a sustainable manner, and promoting industries through a cluster effect and championing approach, among others.

Priority growth areas (the "five jewels") identified in the 2016 Economic Development Policy include hydropower, cottage and small industries, mining, tourism, and agriculture. Other sectors include High Quality Green Services such as education, waste management, energy, transportation, construction, and manufacturing. These sectors are identified as having the highest potential to generate wealth, employment, and sustainable growth with minimal ecological footprint within the framework of GNH and to establish the Brand Bhutan image as a source of organic and traditional products and aligned with GNH's ecological and cultural preservation objectives. These areas were prioritized to receive encouragement and support from the government and the private sector.

Clear institutional mandates without overlaps will help improve institutional effectiveness. A key challenge appears in situations where there is perceived conflict of interest and a regulatory body acting as a facilitator for production using mineral and natural resources. An example is found in the mining sector. The newly established Department of Geology and Mines in the MENR is the regulatory body () which oversees and facilitates mines' operations. To mitigate this a new Mineral Resources Agency was proposed to be established under the Mines and Mineral Bill of Bhutan 2020. The bill has not yet passed due to several controversies. In addition, there is a lack of monitoring of

172 Within-country differences reflected in the Gross National Happiness Index are valuable for planning government programs, both in terms of geographic and demographic targeting. However, recently the government has established some goals based on Gross Domestic Product, just like any other country.
173 See https://www.gnhc.gov.bt/en/wp-content/uploads/2017/05/GNH_9DOMAINS-AND-INDICATORS.pdf
174 See https://www.gnhc.gov.bt/en/wp-content/uploads/2021/09/2nd-VNR-Report-SDGs.pdf.
175 RKB 2nd NDC 2021.
176 See https://www.moea.gov.bt/wp-content/uploads/2017/07/Economic-Development-Policy-2016.pdf.

public consultation process and on corporate social responsibility (CSR) actions. Effective community involvement and ensuring strict monitoring of the public consultation process could address this gap. Furthermore, formulating a Mining CSR Strategy and Action Plan can enhance community access to socioeconomic benefits.

Bhutan 2020: A Vision for Peace, Prosperity, and Happiness is foundational for the country's development and emphasizes the importance of private sector development. With this vision, the RGoB aims to transform Bhutan's economy into a private sector-led economy. To concretize this vision, a Private Sector Development Committee (PSDC) has been transferred from the Ministry of Economic Affairs to Bhutan Chamber of Commerce and Industry. in . The government had revised two policies, the Foreign Direct Investment (FDI) policy and Cottage and Small Industry (CSI) policy in July 2019. The new structure of approved domestic electricity tariff grants subsidies to low and medium voltage consumers to encourage use of electric cookers and appliances to replace non-renewable energy sources like LPG and wood-based ones. The government also had approved 2019 Energy Efficiency and Conservation Policy (EECP) to enable various actors in the economy such as building, industry, and transport sectors to adopt EECP measures and create an enabling environment for private sector participation in adopting EECP measures. The government has also implemented reforms in several areas to improve access to finance, especially for CSIs.

Bhutan's sustainable future and green development path are considered in Bhutan's 21st Century Economic Roadmap, which is being drafted as a national initiative to chart out Bhutan's long-term economic direction and to guide short- and medium-term plans, programs, and policies.[177] The roadmap will articulate the main strategies in key economic priority areas for the country over the next 10 years while maintaining Bhutan's effective social and environmental safeguards and integrate climate resilience and mitigation. The roadmap builds on the recovery measures for the COVID-19 pandemic and is expected to reconfirm the commitment to leverage resources to support Brand Bhutan that will feed into the upcoming LTS and transformative green financing.

Financing green growth

In the short term, Bhutan's public finance will take center stage when confronting the key social and environmental challenges. Yet public finance could play a powerful market-shaping role as it does not face pressure to deliver short-term returns, meaning it can provide lower-cost and longer-term financing, prioritize wider social objectives, and take a different approach to risks and rewards. In the medium term, Bhutan can develop a range of policies and regulations to promote climate change mitigation and adaptation and improved environmental performance by enabling policies for private green investments. Promoting green value chain development, capacity building for innovation, using environmental certification and labels to access and benefit from growing markets for green products will go a long way by using the limited public finance to leverage green private investment to expand sustainability achievements.

Public environmental expenditures

The CEA made an attempt to conduct a quick analysis of Bhutan's public environmental expenditures (PEE) between FY16/17 and FY20/21 within all public institutions at the national, Dzongkhag, and Gewog levels. To ensure consistency of the approaches, the methodology used for the PEER 2014, prepared by the RGoB[178], has been adopted for carrying out the analysis, with slight modifications, subject to data limitations[179]. A full description of the PEER findings is presented in Annex 3.

177 RKB 2nd NDC 2021.
178 Public Environmental Expenditure Review of the Royal Government of Bhutan, Department of Public Accounts, 2014
179 Worksheets of data analysis for the 2014 PEER has not been available.

Total PEE has been fluctuating over different periods of fiscal years. In general, the share of PEE to GDP remained below 6 percent while its share of public expenditures (PE) ranged between 9–16 percent. The contribution of PEE as a percentage of GDP plunged to 2.3 percent in 2019–20 from 4.7 percent in 2017–18. In 2019–20, the contribution of PEE to GDP rose to 3.3 percent. Furthermore, considering the decline of PEE as a percentage of public expenditure (from 10.0 percent in 2019–20 to 8.8 percent in 2020–21), the total environmental spending to GDP is likely to decline during future periods. Table 6 provides a summary of GDP, public expenditures, and public environmental expenditures from 2013–14 to the 2020–21.

Table 6: GDP, total PE and PEE from FY13/14 to FY20/21

Million Nu	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
GDP	109,649.3	122,461.6	136,803.7	152,322.3	163,455.8	172,950.9	175,067.3	NA
Public Expenditure (PE)	34,609.9	36,475.9	44,688.5	49,966.6	56,331.4	44,054.1	57,572.3	71,091.8
Total Public Enviromental Expenditure (PEE)	2,811.4	2,593.0	3,728.0	4,310.0	4,326.5	2,535.8	3,667.3	3,561.1
Core PEE	1,115.8	935.5	1,473.2	1,696.2	2,085.9	1,233.7	1,722.0	1,893.4
PE as % of GDP	0.3	0.3	0.3	0.3	0.3	0.3	0.3	NA
PEE as % of GDP	2.6%	2.1%	2.7%	2.8%	2.6%	1.5%	2.1%	NA
PEE as % of PE	8.1%	7.1%	8.3%	8.6%	7.7%	5.8%	6.4%	5.0%
Core PEE % of PE	3.2%	2.6%	3.3%	3.4%	3.7%	2.8%	3.0%	2.7%
Core PEE % of GDP	1.0%	0.8%	1.1%	1.1%	1.3%	0.7%	1.0%	NA
Core PEE % of Total PEE	39.7%	36.1%	39.5%	39.4%	48.2%	48.7%	47.0%	53.2%

As per the review,[180] the PEE is broken down into 9 environmental clusters and 38 subclusters by applying environmental classifications. It should be noted that this classification makes it slightly difficult to compare Bhutan's PEE with other countries. Of the total 9 environmental clusters, the first 4 clusters (clusters 1–4) constitute the core PEE. The corresponding share of the core PEE to the total PEE is comparatively low. It accounted for just 22.0 percent in FY16/17 but increased to 30.4 percent in FY20/21.

Table 7: PEE by main cluster (million Nu)

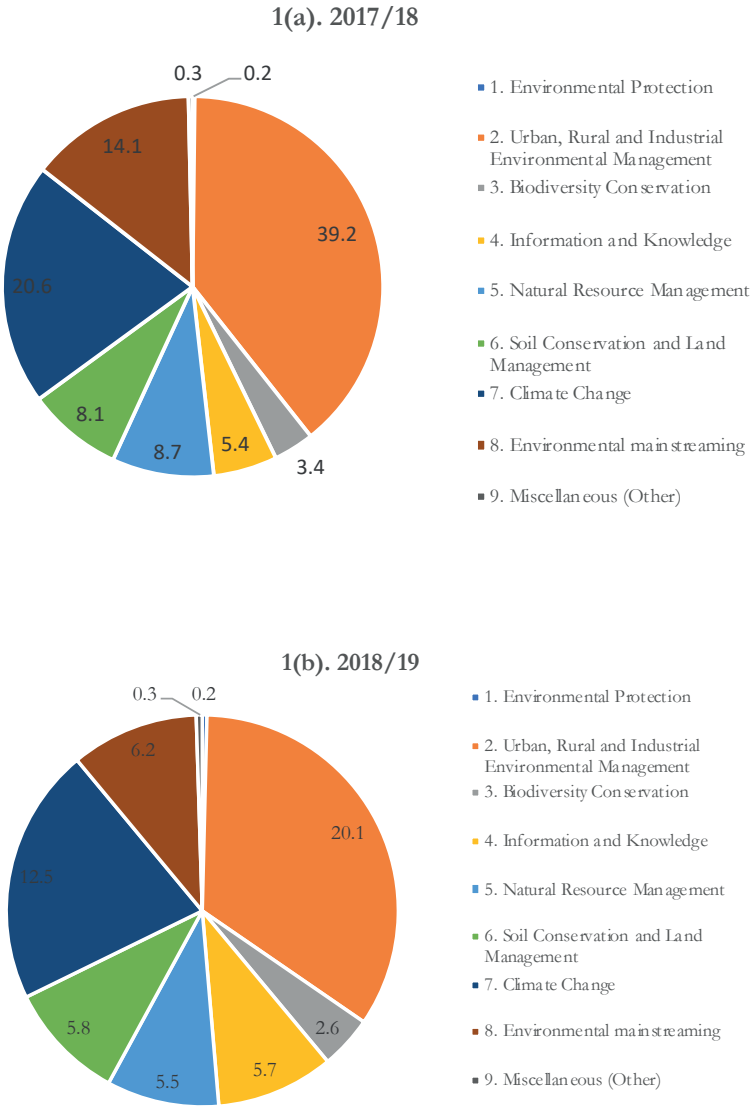
Environmental Clusters	2016/17		2017/18		2018/19		2019/20		2020/21	
	Mill. Nu	%	Mill. Nu	%	Mill. Nu	%	Mill. Nu	%	Mill. Nu	%
1. Environmental Protection	17.2	0.4	7.8	0.2	9.7	0.2	16.5	0.4	12.8	0.4
2. Urban, Rural and Industrial Environmental Management	1,150.7	26.7	1,694.9	39.2	867.3	20.1	1,229.1	33.5	1,424.4	40.0
3. Biodiversity Conservation	331.4	7.7	148.9	3.4	110.6	2.6	217.2	5.9	155.8	4.4
4. Information and Knowledge	196.9	4.6	234.3	5.4	246.0	5.7	259.1	7.1	300.3	8.4
Total Core PEE (Cluster 1-4)	**1,696.2**	**39.4**	**2,085.9**	**48.2**	**1,233.7**	**48.7**	**1,722.0**	**47.0**	**1,893.4**	**53.2**
5. Natural Resource Management	377.9	8.8	374.3	8.7	235.3	5.5	312.6	8.5	195.7	5.5
6. Soil Conservation and Land Management	397.4	9.2	350.1	8.1	249.0	5.8	241.6	6.6	233.3	6.6
7. Climate Change	1,212.6	28.1	891.4	20.6	538.0	12.5	963.8	26.3	719.3	20.2
8. Environmental mainstreaming	614.0	14.2	610.0	14.1	267.1	6.2	397.9	10.8	476.5	13.4

180 MoF 2014.

Environmental Clusters	2016/17		2017/18		2018/19		2019/20		2020/21	
	Mill. Nu	%	Mill. Nu	%	Mill. Nu	%	Mill. Nu	%	Mill. Nu	%
9. Miscellaneous (Other)	11.8	0.3	14.9	0.3	12.6	0.3	29.5	0.8	43.0	1.2
Total Non-Core PEE (Cluster 5-9)	**2,613.8**	60.6	**2,240.6**	**51.8**	**1,302.1**	**51.3**	**1,945.4**	**53.0**	**1,667.7**	**46.8**
Total PEE (Cluster 1-9)	**4,310.0**	**100.0**	**4,326.5**	**100.0**	**2,535.8**	**100.0**	**3,667.3**	**100.0**	**3,561.1**	**100.0**

The ratio of PEE to total PE has almost halved, from 15.43 percent in 2016–17 to 8.75 percent in 2020–21, with the share of PEE funded by the RGoB and external funds also decreasing by approximately 50 percent. The PEE Review also finds wide disparity in spending on a range of environmental activities (Figure 16). Since 2016 over 40 percent of PEE consistently goes towards environmental mainstreaming (which is primarily "mainstreaming in road project"), over 20 percent to urban, rural, and industrial environmental management (waste, water and sanitation), and over 11 percent towards climate change.

Figure 16: Composition of PEE by environmental cluster (2020–21)



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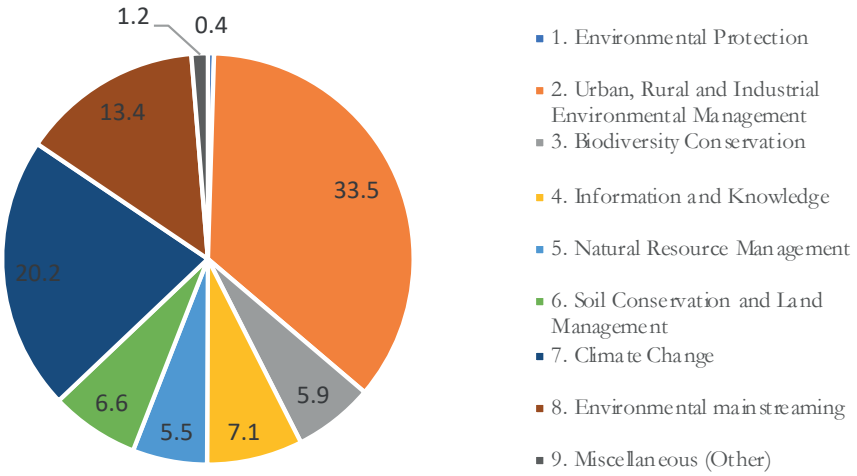
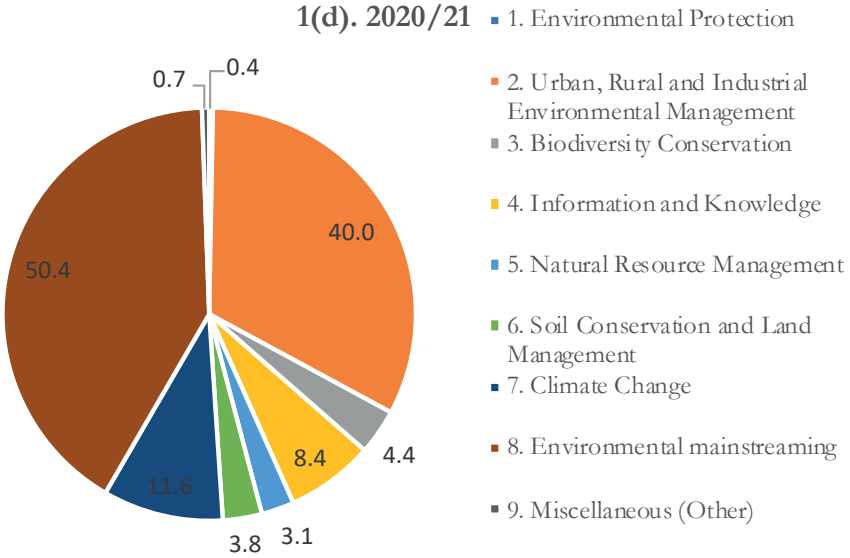


1(d). 2020/21



The analysis of PEE by RGoB programs shows that the share of forestry services to PEE accounted for just 1.1 percent, which is one of the lowest among all the programs. The share of the RGoB programs in PEE for each of the environmental programs is presented in Table 8. The "Agriculture Services" and "Roads and Bridge Services" are consistently the highest recipients of public funding. In contrast, "Urban Development and Engineering Services" accounted for the lowest share of total PEE over the period. During FY20/21, the share of forestry services to PEE accounted for just 1.1 percent, which is one of the lowest among the RGoB programs.

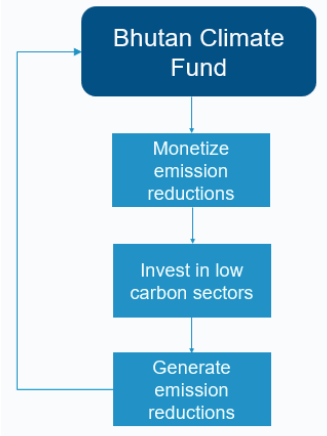
Table 8: PEE by RGoB program

RGoB Program	2016/17		2017/18		2018/19		2019/20		2020/21	
	Mill. Nu	%	Mill. Nu	%	Mill. Nu	%	Mill. Nu	%	Mill. Nu	%
Forestry services	296.8	8.4	251.5	7.5	121.2	5.7	118.7	4.9	27.1	1.1
Roads and bridge services	822.9	23.3	973.9	29.1	562.7	26.3	370.7	15.2	277.3	11.0
Agriculture services	1,025.6	29.1	839.3	25.1	449.0	21.0	895.8	36.7	1,027.8	40.7
Urban Development and Engineering services	5.5	0.2	43.9	1.3	44.4	2.1	65.7	2.7	19.6	0.8
General administration & Direction Services	650.8	18.4	604.3	18.1	470.5	22.0	525.0	21.5	420.4	16.7
Health services	167.4	4.7	132.5	4.0	96.5	4.5	22.0	0.9	189.2	7.5
Energy services	16.3	0.5	0.9	0.0	1.2	0.1	22.2	0.9	56.9	2.3
Other programmes	543.7	15.4	501.5	15.0	397.5	18.5	420.8	17.2	505.0	20.0
Total	**3,529.0**	**100.0**	**3,347.9**	**100.0**	**2,143.0**	**100.0**	**2,441.0**	**100.0**	**2,523.2**	**100.0**

The gap created by increasing environmental degradation and reducing PEE spending requires finding other financing mechanisms for Bhutan's environmental conservation agenda. Interestingly, the programmatic distribution of PEE funds shows maximum spending on agricultural services, which increased from 29 percent of PEE spending in 2016 to over 40 percent in 2020. Large chunks of PEE spending go into general administration, roads and bridge services, and other programs. Forests and urban development have consistently received the lowest proportions of PEE spending, and the largest share of external funding goes into "miscellaneous (other)" categories, sometimes ranging from 65 percent of external PEE sources to over 99 percent. Yet there remain a number of emerging challenges and neglected sectors that could benefit from funding for improved management, including municipal and solid waste management, urban development, soil conservation, and land management.

Establishment of the Bhutan Climate Fund (BCF) is proposed as a vehicle to aggregate and monetize emission reductions under the Paris Agreement (Figure 17). Starting with the hydropower sector, the BCF would aggregate emission reductions generated from projects in Bhutan and sell them internationally to raise revenues.[181] The proposed BCF is envisioned as a US$50 million fund, capitalized by international climate finance buyers (referred to as "BCF Participants"). The BCF would support the preparation of project design documents for emission reductions from hydropower projects under the Inter-Governmental Agreement (IGA) or Joint Venture (JV) structure with India. These emission reductions may be held by the BCF until a suitable buyer, or an attractive price is found.

Figure 17: Bhutan Climate Fund



The BCF would reduce the transaction costs associated with participating in climate markets through aggregation of emission reductions and identify potential buyers through a commercialization strategy to generate greater value for Bhutan. It will also allow the resources mobilized to be channeled towards low carbon development activi-

181 The hydropower sector was chosen for piloting due to its scale, simplicity of methodologies, and Bhutan's experience with selling emission reductions from such projects. However, this does not preclude the possibility of including other sectors going forward.

ties in Bhutan, in addition to increasing the viability of hydropower projects by providing an additional revenue stream.

The World Bank will support the establishment and transitioning of the BCF. At the outset, the World Bank aims to provide help to establish a Trust Fund based on the feedback of the Task Force, established by the RGoB specifically for the purposes of the BCF, providing capacity support and development of its operating procedures. The BCF would be a Bank-executed trust fund and transition to a Royal Charter trust fund after two years. To monetize emission reductions from hydropower and other renewable natural resources, NEC would adopt rules for Article 6 of the Paris Agreement, including a national monitoring, reporting, and verification (MRV) system and establish an emission reductions credit registry consistent with the requirements of Article 13 of the Agreement.

Bhutan has made concerted efforts to increase the flow of funds for environment and climate. Specifically, for the implementation of the NDC and adaptation priorities, Bhutan pursued funds from the Green Climate Fund (GCF), (Bhutan's Country Work Program in 2020). Direct access modalities for climate finance had been fulfilled by the accreditation of the Bhutan Trust Fund for Environmental Conservation (BTFEC) as National Implementing Entity to both the GCF and the Adaptation Fund. In addition, Bhutan is pursuing access for the private sector with three financial institutions (Bhutan Development Bank, Ltd., Bank of Bhutan, Ltd., and the Bhutan National Bank, Ltd.) undergoing the accreditation process for access to the Private Sector Facility of the GCF[182].

The Green Finance Roadmap has been launched to mainstream and herald the transformative changes in the financing economic investments and sustainable development in Bhutan for the 21st century. The initiative aims to (i) make Bhutan's financial system more robust and resilient to external vulnerabilities in the wake of the COVID-19 pandemic; (ii) channel lending towards products and services that can deliver both investible returns and environmentally positive outcomes; (iii) ensure green investments are prioritized over business-as-usual investment and to mobilize additional investments in Bhutan's green sectors; and (iv) accelerate the financial sector's contribution to transitioning to a low carbon economy by leveraging modern technology and innovations.

182 RKB 2nd NDC 2021.

Chapter 5: Opportunities for Harnessing Forest and Diversified Tourism Green Growth Potential

The CEA offers an analysis of green growth policy scenarios in the forestry and tourism sectors, both dependent on the natural resource base and important drivers of the economy of Bhutan.[183] To this end, a CGE model is employed that allows users to quantify the economy-wide adjustments across markets and institutions following the simulation of "what if" scenarios. The modeling analysis aims to establish key questions that will allow users to identify the most appropriate alternatives towards achieving national objectives to maintain carbon neutrality and harness the potential of Bhutan's natural resources for growth and prosperity, and to construct a case for future policy change. Annex 4 provides the details of the modeling analyses.

The CGE model is based on the estimate of a detailed social accounting matrix for 2019 and is a multisector-multifactor representation of Bhutan's economy, assuming broad equilibrium conditions on commodity and factor markets, with four socioeconomic groups as focus variables for income distribution monitoring. Investment, population, and productivity growth, as well as international prices, taxes, and subsidies and other policy variables are exogenous to the model. The model aims to provide insights on the impact of selected policy changes, by simulating "as if" scenarios over five years of economic activity, under moderate growth hypotheses reflecting recent economic analyses and projections by the World Bank and the IMF. Model estimates from different simulations include contributions to real GDP, personal incomes, and relative price changes resulting from direct and indirect effects of the policies analyzed. Please note that the simulations are not forecasts but projections of possible outcomes from counterfactual scenarios compared against the outcomes of the reference scenario.

The key results of the reference scenario simulation are summarized in Table 9. Household consumption stagnates despite the strong growth in GDP due to increases in government expenditure and the improving current account balance. The exchange depreciates in real terms by 0.6 percent annually. Total factor productivity increases by 1.2 percent annually—a result that is obviously dependent on the growth assumptions for the labor force and capital stock. The direct tax rates increase by more than 7.2 percent annually in order to finance the rise in government expenditures and savings (i.e., the capital expenditure by the government).

Table 9: Summary results of the reference scenario simulation

Macro descriptor	% share of GDP		% change	
	Base	Reference	2019–24	Annually
GDP	100.0%	100.0%	15.2%	2.9%
Government expenditure	19.8%	19.9%	16.1%	3.0%
Investment	37.4%	37.8%	16.4%	3.1%
Household consumption	57.3%	56.1%	12.9%	2.5%
Exports	31.8%	31.9%	15.6%	3.5%
Imports	47.0%	46.8%	14.9%	3.1%
Current account balance	12.5%	12.5%	15.3%	2.9%

183 While hydropower, organic agriculture, and other sectors could have also been candidates for the analysis, it was decided at the time of the Concept Note review to focus on forestry and diversified tourism, which would complement other sector analysis envisaged under CEM.

Macro descriptor	% share of GDP		% change	
	Base	Reference	2019–24	Annually
Real exchange rate[a]			0.5%	0.1%
Producer price index			0.6%	0.1%
Total factor productivity (TFP)			5.4%	1.1%
(Average) direct tax rate			2.0%	0.4%
Skilled labor wages			6.9%	1.3%
Unskilled labor wages			8.7%	1.7%
Agricultural wages			6.1%	1.2%
Private capital			7.4%	1.4%
Public capital			5.1%	1.0%
Hydropower capital			2.4%	0.5%

[a] The real exchange rate is the nominal exchange multiplied by the ratio of the price index in tradable goods and services over the producer price index.

Modelling green growth policies to diversify Bhutan's tourism sector

Tourism plays a pivotal role in Bhutan's economy, and Bhutan's strong track record in environmental conservation is a major draw for international tourists. In 2019, gross tourism receipts are estimated at US$209 million, comprising 8.5 percent of GDP.[184] Tourism in Bhutan has so far been a success story. Since the end of the country's isolation in the 1970s, the RGoB has pursued a unique high-value and low-volume tourism policy based on a MDPR and the SDF.[185] These policy instruments are applied to two tourism markets—the regional and international market. The regional market comprises tourist arrivals from India, Bangladesh, or the Maldives. In 2019—before the COVID-19 pandemic—these visitors from the South Asia region comprised approximately 76 percent of all nights spent by leisure tourists. However, they are estimated to only spend US$62.2/bed-night, and due to their low average daily expenditure, this market is only responsible for 39 percent of total gross receipts. Regional tourists are exempted from the MDPR policy and since 2021, they are levied a reduced SDF of approximately US$16/day (before 2021 no fee was charged). The international market comprises visitors from all other countries (commonly referred to as "USD paying visitors" in Bhutan). These have to pay an SDF of US$65/night/person and are subject to the MDPR policy requiring a daily expenditure of at least US$250/day. While they represent only 24 percent of all tourist nights, they contribute 61 percent of total tourism gross receipts.

Bhutan's international tourism segment is facing a myriad of challenges jeopardizing its market position and long-term sustainability. The World Bank's tourism policy note[186] identified that the lack of geographical spread of tourists and the high spatial and temporal concentration on attractions and cultural festivals predominantly visited in Western Bhutan is a key challenge. Moreover, the report highlighted problems of declining quality of services in the hotel and restaurant sector and providing an adequate portfolio of experiences to

184 This estimate is conservative. For 2019, the Tourism Monitor reports gross tourism receipts at US$345 million or 13.6 percent of GDP Tourism Council of Bhutan (TCB) 2020. This estimate had to be down scaled to make it consistent with tourism expenditure data and Bhutan's national account statistics.
185 Tourism Council of Bhutan 2020.
186 World Bank 2017.

be attractive to different demographics. Therefore, while potential demand for nature-based tourism in Bhutan is high, because of the country's unique blend of a pristine environment and distinctive eastern culture, supply side constraints hinder tourism development due to the poor quality of services and facilities offered. Value chains also appear to be underdeveloped with a few connections with domestic agriculture and artifacts and low backward and forward connections (for example, most of the food for the hospitality value chain is imported). Demand-oriented price policies aimed to diversify and ration tourist presences, and therefore may not be an effective policy instrument for tourism development and diversification unless accompanied by appropriate improvements of the quality of supply. The diversification of the tourism sector can be an important component of a strategy to improve supply through targeted investment and, at the same time, achieve higher sector performance by increasing the share of nights within the diversified and community-based tourism segments. These segments are less prone to seasonality, offer a more diverse portfolio of tourist experiences and activities, and increase the regional equality of tourism benefits. Moreover, given Bhutan's strong environmental stewardship and its pristine landscape and nature, these segments allow it to capitalize on environmental conservation efforts by generating tourism revenues from it.

The tourist scenario aims to diversify the tourism sector by strengthening those segments for which Bhutan's environmental conservation efforts are a main input. The international tourism market is dominated by tourists that only visit the main hotspots in Bhutan (proxied by the four districts Paro, Thimphu, Punakha, and Bumthang), where cultural attractions dominate. This "mainstream tourism" segment makes up 71 percent of nights within the international market. In contrast, the "diversified tourism" segment includes nights spent outside the Western hotspot areas with a more diversified portfolio of tourist experiences. This segment has a market share of 26 percent. The "community-based" segment comprises all nights spent in rural communities and has a market share of 3 percent. The CGE model for Bhutan is employed to simulate the scenario Tour_Invest, which considers a private investment in the diversified and community-based lodging infrastructure worth US$1.5 million (equivalent to 0.5 percent of total annual public capital rents). The cost of this investment is reflected in the model by reducing the availability of private capital allocated elsewhere accordingly. A summary of Tourism investment assumptions and scenario results is presented in Table 10.

Table 10: Summary of the tourism investment scenario analysis

Motivation
Bhutan's tourism sector does not fully capitalize on the country's pristine environment. The majority (80 percent) of tourists only visit the hotspot locations in Western Bhutan, where overcrowding and high seasonality are jeopardizing the sector's sustainability and future growth. Improving sustainability is thus an important area of policy actions. In fact, if significant improvements in the supply of infrastructure and modern facilities are not provided, the country's logistic capacity does not appear adequate to support tourism even at the present level of demand, without increasing urban overcrowding and threatening the delicate balance between the population and the country's fragile ecosystem. The main challenges noted in the literature arise both from supply side constraints and lack of diversification, thus generating the following problems: (i) the impact of tourism on the natural environment; (ii) the socioeconomic impact of tourists on local communities; and (iii) logistic problems related to the management of protected areas under conditions of tourist pressure. Investments that improve the quality and the attractiveness of diversified tourism experiences could help to better attract more tourists to Central and Eastern Bhutan. This would allow for the diversification of the tourism sector and a better linking of efforts in environmental conservation with tourist revenues.
Objective
The tourist scenario aims to diversify the tourism sector by improving the quality of supply and by strengthening those tourism segments, for which Bhutan's environmental conservation efforts are a main input. The model simulation has the objective of assessing whether an investment in the lodging infrastructure of diversified and community-based tourism segments is economically viable and whether it results in a diversified tourism sector.

Approach

The tourism sector is divided into four segments: mainstream, diversified, community-based, and regional tourism. A private investment in the lodging infrastructure serving the diversified and community-based segments of US$1.5 million (equivalent to 0.5 percent of total annual public capital rents) is simulated. The cost of this investment is reflected in the model by reducing the availability of private capital allocated elsewhere accordingly.

Results

The investment would result in positive economic growth (an increase in GDP of about 0.4 percent). Household welfare would particularly increase for urban households and to a lower degree for rural households. Employment increases by about 0.5 percent which is equivalent to 2,000 jobs. The overall economic benefits therefore exceed the economic costs of the investment. The magnitude of impacts is dependent on how strongly the international tourism market responds to an improvement in the tourism infrastructure. Diversifying the tourism market could incentivize tourists to increase the total days spent in Bhutan, thereby lowering the footprint and alleviating bottlenecks at Paro airport, the international port of entry for most international tourists.

Analyzing green growth policies in the forestry sector

Despite its large forest endowment, Bhutan is a net importer of wood-based products.[187] According to the 2019 Social Accounting Matrix (SAM), US$52.4 million of wood-based products were imported to Bhutan, yet only US$0.9 million were exported. Following the 2019 SAM, the output of Bhutan's forestry sector is estimated at US$68.7 million, of which logs (or construction timber) make up 56 percent, fuelwood 38 percent, and non-wood forest products 6 percent.

Various studies claim that Bhutan does not realize the full sustainable potential of its forests amid concerns of jeopardizing the stability of crucial forest ecosystem services.[188] Studies have shown that a large share of forest area complying with strict spatial criteria, i.e., in areas with acceptable topography and outside of protected areas, is currently not under management.[189] The model analysis uses alternatives to increases in forest area, represented by investment in wood-based sectors and technologies that generate higher value-added within the forestry sector.

Alternative options to increases in forest area are investment in wood-based sectors and technologies that could generate higher value-added within the forestry sectorKlicken oder tippen Sie hier, um Text einzugeben..[190] Instead or in addition to possible increases in forest expansion, the World Bank's forest policy note for Bhutan has identified areas of investment in the wood-based manufacturing sectors that could generate higher value-added within the forestry sector. Adopting the glue-laminated (glulam) timber technology at larger scale could supply wooden beams that can substitute steel-based structures in the construction sector.[191] Glulam is a globally well-established technology. In Bhutan, a pilot glulam factory has been setup with the help of Swiss company Häring AG, a global leader in timber construction technology.[192] Investments in glulam technology could help reduce the construction sector's dependency on steel-based structures. It would also reduce dependency on imports, as an estimated 43 percent of fabricated steel is sourced from India.[193] The demand for glulam depends on the degree to which the construction sector can adopt it as a substitute for steel. So far, glulam has been successfully used in the construction of various projects in government buildings.[194] The cost to produce glulam in 2019 was reported at US$317 m^{-3}, which is substantially below world market prices (estimated at US$500 m^{-3} by Haring 2022). This shows that the necessary domestic demand for glulam exists; however,

187 NSB 2021.
188 Narain et al. 2014; World Bank 2019; Siebert und Belsky 2015.
189 Schindele 2004; Feuerbacher et al. 2021.
190 World Bank 2019.
191 Petersen und Solberg 2002; Winchester und Reilly 2020.
192 NRDCL 2021.
193 MoF 2020.
194 Fritz Baumgartner 2022.

the government needs to provide the necessary investment environment (adequate regulations and development of academic curricula) to overcome the present adoption barriers of unclear regulations and limitations in skilled personnel.

A further option would be investments in establishing a mid-scaled production of charcoal within Bhutan.[195] This could allow for a higher value-added use of fuelwood, which is currently largely used by rural households for heating, cooking, and agro-processing with little opportunity cost, particularly given the subsidies on rural electricity and the achievement of 100 percent rural electrification.[196] In addition, charcoal can substitute coke[197] as a carbon reduction agent in the process of metallurgical production and thereby could reduce the carbon footprint of these energy-intensive industries.[198] Hence, in either substituting imported charcoal or coke, there is ample domestic demand for charcoal. However, domestic charcoal production currently faces the barrier of fuelwood availability. So far, rural households are not allowed to sell their harvest quota for alternative uses. Reforms that gradually liberalize the fuelwood market could help to overcome these adoption barriers.

Six green growth policy scenarios are modelled that either stimulate the substitution of construction steel with domestically produced glulam timber or the substitution of both imported charcoal and coke with domestically produced charcoal. Scenario C1_Glulam simulates a US$2.7 million public investment in the establishment of a glulam industry. Variants of this scenario include a 10 percent expansion of the commercial forestry sector (C2_GlulamExp) and, in addition, a 10 percent sales tax levied on construction steel (C3_GlulamExpTax). Scenario C4_charcoal simulates a US$2.7 million public investment in the establishment of a charcoal industry and the allowance for rural households to sell 50 percent of their fuelwood harvest quota. Variants of scenario C4_charcoal include a 10 percent expansion of the commercial forestry sector (C5_CharcoalExp) and, in addition, a 10 percent sales tax levied on coke (C6_CharcoalExpTax). The public investment volume is equivalent to 0.85 percent of total public-capital rents. The cost of the investments is simulated by reducing the public capital allocation in the remaining sectors accordingly.

Table 11: Description of forestry green growth scenarios

Scenario Name	Description
C1_Glulam	The Royal Government of Bhutan invests US$2.7 million in the establishment of a mid-sized glulam production sector (investment is equivalent to 0.85% of total public-capital rents). The cost of this scenario is simulated by reducing the public capital allocation in the remaining sectors accordingly. No expansion in managed forest area.
C2_GlulamExp	In addition to scenario C1_Glulam, forest area utilized by rural households and the commercial forestry sector (NRDCL) expands by 10%.
C3_GlulamExpTax	In addition to scenario C2_GlulamExp, a sales tax of 10% is levied on construction steel.
C4_Charcoal	The Royal Government of Bhutan invests US$2.7 million in the establishment of a mid-sized charcoal production (investment is equivalent to 0.85% of total public-capital rents). The cost of this scenario is simulated by reducing the public capital allocation in the remaining sectors accordingly. No expansion in managed forest area. Rural households are allowed to market 50% of their fuelwood harvest quota (i.e., 4 m³/household).
C5_CharcoalExp	In addition to scenario C4_Charcoal, the forest area utilized by rural households and the commercial forestry sector (NRDCL) expands by 10%.
C6_CharcoalExpTax	In addition to scenario C5_CharcoalExp, a sales tax of 10% is levied on coke.

195 Feuerbacher et al. 2016.
196 Yangka und Diesendorf 2016.
197 Coke used in metallurgical is known as “coke oven coke” or “metallurgical coke” see also IPCC 2006, 1.14.
198 Norgate und Langberg 2009; Suopajärvi und Fabritius 2013.

The macro-level results show that all six policy scenarios result in positive economic impacts and welfare effects. The scenarios boost the production of glulam and charcoal in line with expectations and moderately increase domestic employment. However, without an expansion of forests, the scenarios are accompanied by increases in the imports of logs and fuelwood. Expanding the commercial forest use by 10 percent does not have strong effects on the macro level but helps to source more of the required inputs from the domestic forestry sector. Without accompanying taxes on carbon-intensive substitutes, the potential to reduce GHG emissions is limited in case of the glulam investment scenarios. In case of the charcoal investment scenario, GHG emissions even slightly increase as the chemical and metallurgical industry benefits from a general reduction in input prices. Taxing construction steel or coke substantially increases the substitution of these inputs with either glulam or charcoal. Still, the domestic production of glulam does only provide a small GHG emissions saving potential (0.5 percent of industrial emissions reported for 2015). In contrast, the charcoal production scenario with a tax on coke could result in a 7.6 percent reduction of industrial emissions. The magnitude of simulated investment scenarios is equivalent to 0.85 percent of total public-capital rents and thus relatively small. Larger-scale investments in these sectors could yield higher absolute benefits. However, the establishment of these industries requires specialized skills and training, which presents a barrier and challenge that cannot be reflected straightforwardly in the economic model. Hence, the model results point towards a potential which is also subject to risks and unknowns not considered in this analysis.

Investments in the glulam or charcoal technology could contribute to Bhutan's 100 percent carbon neutrality scenario. Scenario C6 results in the highest quantity of avoided GHG emissions, 126,917 tons of CO_2 equivalents. According to the third national GHG inventory, this would roughly reduce Bhutan's total estimated GHG emissions by 3.2 percent. The remaining scenarios would not result in a substantial impact in terms of avoided GHG emissions. Either investment would need to be increased or, alternatively, carbon need to be priced (as done indirectly in scenarios C3 and C6).

Table 12: Summary box for green growth forestry scenario analysis

Motivation
More than 70 percent of Bhutan's land area is under forest cover, but at present Bhutan is only using a small fraction of it productively. Consequently, the country is a considerable net importer of wood-based products. There are different ways Bhutan could use its forests more productively, reducing its dependence on imports and contributing to its objective of carbon neutrality. Two technologies have been identified to promise higher value-added within Bhutan's forestry sector. Investments in the production of glue-laminated timber could allow it to reduce the construction sector's dependency on steel-based structures. Investments in domestic charcoal production could reduce the carbon footprint of energy-intensive industries, where charcoal and coke are used.
Objective
Assess the economic effects of public investments in the glulam and charcoal technologies with either no or modest (10 percent) increases in forest use, and no or a 10 percent tax on carbon-intensive substitute products (construction steel or coke).
Approach
The forestry sector is divided into commercial forestry and rural forestry, both supply fuelwood and logs. The supply of forest products is subject to the area of forest use that the government allows to be put under management. A public investment in the glulam or charcoal production sector of US$2.7 million (equivalent to 0.85 percent of total annual public capital rents) is simulated. The cost of this investment is reflected in the model by reducing the availability of public capital allocated elsewhere accordingly.
Results
All scenarios result in positive economic impacts and welfare effects. The scenarios boost the production of glulam and charcoal in line with expectations and moderately increase domestic employment. However, without an expansion of forests, the scenarios are accompanied by increases in the imports of logs and fuelwood. The scenarios have the highest potential to reduce GHG emissions if they are accompanied by taxes on their respective carbon-intensive substitutes. This particularly holds for investments in charcoal production, which could roughly reduce Bhutan's total estimated GHG emissions by 3.2 percent. Larger-scale investments in these sectors could yield higher absolute benefits. However, the establishment of charcoal and especially glulam industries require specialized skills and training, which presents a barrier and challenge that cannot be reflected straightforwardly in the economic model.

Chapter 6: Getting Ready for the Long Run

A more resilient economy with a green and diverse production base could fast track Bhutan's COVID-19 recovery and future development. Much of recent growth has been driven by public sector-led hydropower development. Non-hydro sectors, facing constraints related to the country's challenging investment climate—including high trade costs and a small domestic market—remain less competitive. As a result, job creation outside of the public sector and agriculture has been limited. Bhutan is also highly susceptible to the adverse impacts of climate change. For instance, climate-induced changes to glacial-fed rivers will reduce hydropower production and government revenues. Developing a vibrant private sector to generate jobs and diversify the economy, while sustaining Bhutan's natural environment, will be crucial to build further resilience and sustain inclusive development. As a carbon-negative country, climate change also creates an opportunity to monetize emission offsets through voluntary carbon markets, which can in turn support climate-relevant investment needs.

Undoubtedly, Bhutan's long-term socioeconomic vision is aligned with sustainability. The report on 13th FYP unveils the GORB intent to implement strategies aimed at achieving "sustainable, safe, inclusive, resilient, and livable human settlements" and "safe, secure, reliable, affordable, and sustainable transportation" within the next decade[199]. To build on the present achievements and realize the long-term development vision, the CEA offers a set of forward-looking recommendations with the aim of informing future actions to address the emerging country-specific challenges. Leveraging the power of strategic direction towards green, resilient, and inclusive growth could help address emerging development challenges. This is applicable to the forest and tourism sectors, both intertwined by their dependence on the vitality of the natural capital where multiple low-carbon initiatives are currently underway. The recommendations are grouped into four categories aligned with Bhutan's development priorities, achievements thus far, and emerging challenges to help the country stay climate neutral and reassert its position as a global leader on sustainability and climate neutrality.

(i) Sustainably harnessing/capitalizing on the natural resource base

In the long run, Bhutan's natural resources may be on the brink of excessive pressures despite the government's political commitment to sustainable resource use and conservation. Current development patterns, growing environmental pressures, and climate effects indicate potential risks of degrading air and water, and landscapes all of which support important economic sectors. Linking conservation and protection with economic growth, capitalizing on the country's bountiful natural resources to link environmental protection, economic growth and local development could improve economic and environmental resilience through economic diversification using natural assets for adding value to the economy and creating more jobs.

Continuing to strengthen the conservation of existing forests and increasing adaptive capacity to climate change impacts without compromising the opportunities for future economic development and prosperity is a priority of the RGoB. In the face of emerging pressures, balancing conservation and development goals in the forest sector could be achieved through (i) strengthening forest management practices; (ii) climate-smart primary production; (iii) integrated land use planning; and (iv) improved rural livelihoods. CGE analysis provides some quantitative insights from combining forestry and tourism scenarios on the need and difficulties of designing development "middle path" policies. This balancing strategy, whose concept is at the core of government policies with full support by the Bank, aims to find an environmentally sustainable pattern that combines higher efficiency in resource use with expansion of better-quality tour-

199 Presented by the Prime Minister in October 2023 in the State of The Nation (SOTN) Report during the Tenth Session of the Third Parliament of Bhutan. Unveiling ambitious 13th Five-Year Plan for Infrastructure – The Bhutanese

ism focused on diversification of offerings and regional coverage.

Among the possible options to sustain and augment the benefits from forests are investments in wood-based sectors and in technologies that generate higher value-added. The green growth policy scenarios in the CGE model for the wood-based sectors and technologies modeled aim at generating higher value-added within the forestry sector and indicate positive economic impacts and welfare effects. This translates into positive impacts measured both in changes of GDP and household consumption.

Adopting glulam timber technology at a larger scale could supply wooden beams that can substitute steel-based structures in the construction sector. Glulam[200] technology is globally a well-established technology. Investments in the glulam technology would allow to reduce the construction sector's dependency on steel-based structures. It would also reduce dependency on imports as an estimated 43 percent of fabricated steel is sourced from India. A slightly higher increase in log production is sufficient to even reduce the imports of logs. The net imports of wood-based products would consequently decline.

Investments in establishing a mid-scaled production of charcoal within Bhutan could allow for a higher value-added use of fuelwood. Fuelwood is currently largely used by rural households for heating, cooking, and agro-processing with little opportunity cost, particularly given the subsidies on rural electricity and the achievement of 100 percent rural electrification. This fuelwood could be used for the domestic production of charcoal, which is currently exclusively imported from India comprising 2.3 percent of all imports in 2019. Charcoal is demanded by the chemical and metallurgical industries in Bhutan as a carbon reduction agent. In addition, charcoal can substitute coke[201] as a carbon reduction agent in the process of metallurgical production and thereby could reduce the carbon footprint of these energy-intensive industries.

Combining investments in forest and charcoal technologies with implicit introduction of carbon tax would result in highest reduction of GHG emissions, thus contributing to carbon neutrality. The green growth forest policy scenarios stimulate either the substitution of construction steel with domestically produced glulam timber or the substitution of both imported charcoal and coke with domestically produced charcoal. The highest quantity of avoided GHG emissions—123,717 tons of CO_2-equivalents—is in the scenario where carbon is priced (C6). According to the third national GHG inventory, this would roughly reduce Bhutan's total estimated GHG emissions by 3.2 percent. Thus far, Bhutan has managed to achieve both economic growth and carbon neutrality. If some pillars of Bhutan's sustainable governance come under pressure of the growing manufacturing sector, the cost of implementation of climate mitigation technologies may become expensive. Even though a carbon taxation model may seem premature for Bhutan, a future discussion on pros and cons of fiscal incentives for businesses and industries to develop more environmentally friendly production processes could prove insightful.

(ii) Preserving the uniqueness of Bhutan and addressing emerging challenges threatening Brand Bhutan

Building the resilience of Bhutan's unique ecosystems to address growing pressures will help protect the country's pristine environment, which is the brand of Bhutan. The country has preserved its unique ecosystems but there are growing pressures that will eventually continue to increase in the future. Drivers of environmental pressure expressly need special and systematic attention to address emerging urbanization challenges and related air quality, water quality, and waste management issues. Climate change poses fundamental threats to the natural capital and livelihoods, therefore building resilience for adaptation to climate change and sustaining the natural base of sectors drivers of the economy will remain a priority.

200 In Bhutan, a pilot glulam factor has been setup with the help of Swiss company Häring AG, a global leader in timber construction technology.

201 Coke used in metallurgical is known as "coke oven coke" or "metallurgical coke" see also IPCC 2006, 1.14.

Strengthening the institutional capacity to implement SEA in the hydropower sector and institutionalizing the minimum environmental-flow capacity assessment for rivers will ensure that the National Guidelines for Strategic Environmental Assessment[202] for the hydropower sector in Bhutan will take effect. Bhutan is already experiencing the classical tension between economic development and environmental conservation by developing sectors that require continuing environmental protection to remain on a sustainable track. Bhutan has developed immense capacity for "run-of-the-river" hydroelectricity production, which also requires the preservation of watersheds in natural forests. All existing hydropower projects in Bhutan spread across multiple river basins. While the SHDP integrates climate resilience and mitigation in the sector's policies and adaptation provisions, the current run-of-river hydropower schemes in Bhutan have become increasingly vulnerable to decreasing water flows in the dry season. Project-level EIAs do not assess the potential cumulative effects on environmental resources at the basin level.

Maintaining Bhutan's unique tourism brand will require minimizing unwanted impacts on biodiversity and landscapes that are particularly attractive to ecotourists. Bhutan's policies for "low-impact/high-value" tourism guard against some of the negative, culturally destructive aspects of mass tourism in South Asia. Nonetheless, Bhutan's natural landscapes remain highly vulnerable to climate change impacts and natural disasters. Implementation of the NCP objectives need to factor in adaptation actions into local level plans to mitigate the risks to nature-dependent livelihoods.

Turning conservation into an economically viable alternative by adopting creative, market-based approaches to achieve economic development is an opportunity to consider. Diversifying the tourism sector by improving the quality of supply of facilities and infrastructure, and by enhancing the ecotourism segment, for which Bhutan's environmental conservation efforts are a main input, will be a winning proposition and a long-term solution to (i) transform Bhutan's tourism industry and economy at large; and (ii) address the structural issues and vulnerabilities of the sector. The results of model simulations emphasize that diversification of the tourism sector towards a higher share of nature- and community-based products would result in a spatially and temporally more balanced distribution of tourist arrivals. Moreover, incentivizing tourists to also spend days in regions outside of Western Bhutan will likely lead to an increase in average stays. The biggest setback experienced by the ecotourism industry in the fastest growing market, during the COVID-19 pandemic, indicates the need to look for opportunities and alternatives for future growth of diversified and community-based tourism. COVID-19 has made clear that the tourism industry must be resilient and sustainable to thwart future health and climate crises.

(iii) Strengthening the capacity for managing environmental risks

The two biggest constraints to Bhutan in achieving its medium-term development goals and climate commitment are human capacity and access to finance. There is significant potential for developing the national human capital and innovation as sources of growth, as the country is accelerating its efforts to diversify and promote human development and innovation in the upcoming 13th FYP. Further public support and policies informed by adequate pricing of environmental and climate externalities, scientific research, and innovation would help to factor in the knowledge and institutional capacity needs to support actions for mitigating the risks of emerging challenges. In the long run this would help build the necessary human capital for sustaining Bhutan's green development path.

The GRID analysis on efficiency indicates that Bhutan can improve the efficiency of resource use. In anticipation of a more resource constrained future—where debts are higher due to the response to the COVID-19-induced recession, as well as emerging environmental pressures—Bhutan could allocate fiscal resources and utilize its natural resources in more efficient manners. Productive use of agricultural lands, forests, and more competitive cities are key to achieving prosperity and improving lives and livelihoods.

202 NEC 2017.

Addressing institutional mandate overlaps will help improve institutional effectiveness. A key challenge appears in situations where there is perceived conflict of interest and regulatory bodies act as facilitators for production using mineral and natural resources. Clarity on institutional and regulatory mandates and streamlined government processes could create an enabling environment for government and private sector to effectively contribute to Bhutan's green and self-reliant growth priorities by balancing environmental protection with the economic development agenda.

There is a need to reinforce internal partnerships and alliances for capacity to implement climate solutions. Further strengthening the institutional structures for vertical and horizonal collaboration will facilitate coordination on green growth policies and results monitoring within ministries, help minimize duplication of investments and efforts, improve efficiency and effectiveness in managing development and climate risks, and leverage much larger financial flows in the affected sectors.

Addressing the emerging environmental risks that Bhutan is facing calls for the need for an effective management model of environmental externalities and human capacity. Low access to basic services like waste management, safely managed water and sanitation, and elevated threats of natural disasters in urban areas will weigh heavily on populations, leading to high mortality risks. Air quality issues and potential implications on human health have been on the rise and need integrated management solutions. Solutions will include reducing pollution from inefficient energy use and from the expanding transport sector. Bhutan could benefit from partaking and/or initiating regional approaches to addressing transboundary air pollution. Air pollution cutting across the national boundaries of several South Asian countries requires regional airshed approaches to addressing pollution from PM2.5 supported by federal and international collaboration of governments across multiple administrative jurisdictions and geographical boundaries to ensure effective air quality management.

In the short term, Bhutan must deal with the waste challenge by prioritizing waste minimization, reuse, and recycling. Implementation of the Zero Waste Bhutan by 2030[203] initiative will emphasize strengthening waste prevention and management and the goal of achieving zero waste by curbing current trends of disposing over 80 percent to the landfill aligned with the principles of circular economy. Implementation of existing policies for reducing landfilling of municipal waste will help to achieve the national GHG mitigation targets. Furthering the development of a Master Plan for Sustainable and Emission Free Urbanization will translate into both short-term goals and long-term strategies for maintaining low-carbon urbanization and address the growing urban environmental challenges.

In the short term, Bhutan's public finance will take center stage when confronting the key social and environmental challenges, but there are opportunities to mobilize additional finance from other sources. Yet public finance could play a powerful market-shaping role, as it does not face pressure to deliver short-term returns, meaning it can provide lower-cost and longer-term financing, prioritize wider social objectives, and take a different approach to risks and rewards. Bhutan can develop a range of policies and regulations to promote climate change mitigation and adaptation and improved environmental performance by enabling policies for private green investments. Promoting green value chain development, capacity building for innovation, and using environmental certification and labels to access and benefit from growing markets for green products will go a long way by using limited public finance to leverage green private investment to expand sustainability achievements.

Bhutan can increase the level of public financing for NDC implementation. Public environmental expenditure gradually declined between 2014 and 2020, falling by 1.2 percent to 3.3 percent of GDP (2020). Likewise, PEE as a share of the total public expenditure fell to 8.4 percent from 14.3 percent in 2014. There are many sources of finance that can be tapped to meet the estimated financial needs of more than US$225 million for priority

203 See http://www.nec.gov.bt/necs/2020/10/30/press-release-on-waste-management-flagship-program.

low-carbon development in the forest conservation and management, and for strategies for food security, human settlements, industry, infrastructure, and transport.[204] However, the modest increase in external funding in total PEE for the same period, from 19.87 to 20.88 percent, indicates that mobilizing domestic resources and directing them to effectively support green growth priorities could not only sustain Bhutan's sustainability profile but also create more jobs.

Operationalizing the Bhutan Climate Fund would facilitate access to international climate finance, especially for monetizing Bhutan's net negative GHG emissions and carbon offsets. Management capacity will be expressly required to make the fund arrangements operational and start channeling climate finance into implementation planning, and for increasing the viability of low carbon projects in Bhutan by providing an additional revenue stream.

(iv) Create enabling conditions for private sector-led green growth

The national aspirations for the private sector's wider contribution to Royal Kingdom of Bhutan's green growth[205] could materialize with the support of policies to unlock commercial capital flows. Further to that, stronger emphasis on enabling the growth of private sector and promoting innovation and skills development would help fulfill the national economic development aspiration while maintaining climate neutrality and accelerating the pace of recovery. Where possible and without weakening the environmental conservation regimes, reducing the burden of compliance by the government agencies would be effective when the licensing policy comes into effect and introduce e-clearance for licenses. Bhutan has strong institutions and conservation regulations. Further developing the institutional capacity to assess environmental risks in conjunction with economic development policies[206] could foster private sector participation in key economic sectors, investments, and job growth.

Looking forward, Bhutan's pristine nature, supported by constant efforts to safeguard the value of its natural capital, will remain the brand of Bhutan. Bhutan's environmental policies and accomplishments have already helped to build the country's uniquely green image. While these achievements are widely acknowledged and celebrated, the emerging development challenges and lack of economic diversification, including lingering effects of the COVID-19 pandemic, could hamper Bhutan's short-term recovery and growth prospects. The COVID-19 crisis highlighted the need to rethink Bhutan's development trajectory of sectors that depend on natural capital. This includes policy choices and making data-driven decisions that will shape Bhutan's growth trajectory for decades to come. If no action is taken to reverse current trends, the emerging pressures will eventually continue to increase in the future. At a point of no return, climate change will pose fundamental threats to natural capital and livelihoods; therefore, building Bhutan's resilience for adaptation to climate change and sustaining the natural base of sectors driving the economy will remain a priority. In summary, despite being a leader in ecosystem and biodiversity conservation, Bhutan needs to fully implement a plan for adaptation and mitigation in all sectors of the economy in order to maintain its carbon neutrality.

204 RKB 2nd NDC 2021

205 The Economic Development Policy of 2010 states that "green growth" will be encouraged in promoting industrial and private sector development. However, the 2016 version recognizes that unless the constraints to business growth are systematically addressed, the capacity of the private sector as the engine of growth cannot be enhanced. Furthermore, the 2016 policy aims to create an enabling environment for investment through eight high-level strategic directions.

206 It is foreseen that the World Bank will support an assessment of Bhutan's Country Framework for Assessing and Managing Environmental and Social Risks and Impacts, complemented by a Capacity Development Program in this area.

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Annexes

Annex 1: Bhutan—Diagnostic for Green, Resilient, Inclusion Development (GRID)

In 2021, the World Bank adopted a new operational strategy, calling for Green, Resilient, Inclusive Development (GRID). The GRID approach came out of a recognition that growing imbalances are threatening global progress towards achieving the Bank's Twin Goals of eliminating poverty and increasing shared prosperity. Increasing threats of natural disasters from a changing climate; rising inequalities within national borders, and increasing feelings of marginalization and exclusion by disadvantaged groups; a sustainability crisis that is shortening lives and reducing livelihoods, diminishing the fertility of land, and stripping away critical ecosystem services; all threaten to reverse the enormous development gains that have been made over the past century. On top of this, the Covid-19 crisis was a game changer, demonstrating the ever-present risks to zoonotic diseases in an increasingly globalized and connected world.

The GRID approach pursues the twin goals of poverty eradication and shared prosperity with a sustainability lens. GRID is a recognition that traditional measures of progress, like gross domestic product, which focus on the quantity of growth are insufficient. If one is to truly measure development, it must include an examination of the many facets of society that impact the quality of growth as well. Given the multidimensionality of the issue, a dashboard of economic, social, and environmental indicators is therefore required. To that end, a diagnostic has been developed to help countries examine where they fall along the dimensions of GRID and identify pinch-points which are impacting both their quality and quantity of growth.

This document describes the results of the GRID benchmarking diagnostic that was carried out for Bhutan. The benchmarking diagnostic is based on a global database of over 40 indicators which measure countries' performances across the different dimensions of GRID. Indicators are organized into 4 pillars—Resilience, Inclusivity, Sustainability, and Efficiency (see box 1)—as well as various sub-pillars within each. The benchmarking tracks progress in each indicator relative to a chosen peer group. The purpose is not to provide a ranking and scorecard, but rather to use comparator countries to define achievable frontiers for Bhutan given its level of development and other constraints.

Box A1.1.: Four critical pillars for achieving GRID—resilience, inclusivity, sustainability, and efficiency

The movement towards building a better future—whether termed, growth, green growth, green, resilient, inclusive development (GRID), climate smart development, resilience, inclusivity, sustainability, and efficiency (RISE), or a just transition—has become the predominant idea for turning challenges into opportunities for the benefit of people and the environment. This diagnostic can be viewed as an implementation tool to enable such a transition. There is no one-size-fits-all approach to building better, and strategies should vary across countries, reflecting local contexts and preferences. Nevertheless, improvement along the four pillars of Resilience, Inclusivity, Sustainability, and Efficiency will be critical for ensuring short- and long-term, broad based growth.

Resilience, in order to be prepared for natural disasters and unexpected catastrophes, such as another pandemic, climate change, floods, vector-borne diseases, etc. Resilience allows countries to avert adverse outcomes from negative shocks, which would allow countries to continue to grow instead of diverting resources to multiple recovery efforts.

Inclusion, in order to reduce disparities in opportunities and outcomes and ensure that historically excluded groups realize the economic benefits that much of the world has seen. An inclusive society protects the fundamental dignity of each person and incorporates this protection in its institutions. Left unaddressed, the exclusion of disadvantaged groups can have a high cost, affecting economic performance and fostering dissent and social discord.

fisheries, forests, and other natural resources are key to achieving prosperity and improving lives.

Sustainability, to do no future harm and grow in such a way to ensure that future generations are no worse off than the current generation (the so-called "golden rule" of economic growth). Amongst other things (such as managing debt optimally) this also implies that countries must become better stewards of their renewable and non-renewable resources to prevent overuse and pollution. Greater caution is called for when decisions have long-term and irreversible consequences, particularly when it comes to climate change and the need to reduce carbon emissions.

Efficiency, in order to spend better and use better, maximizing the returns to society while minimizing the financial, social, and environmental costs. Better spending can deliver the infrastructure and services that countries need, creating more competitive cities. The productive use of agricultural lands,

The GRID benchmarking compares Bhutan's performance across each of the 4 pillars against multiple comparator country groups. Comparators are chosen not to create a "horse race" between Bhutan and any other country, but to determine a reasonable frontier against which we can measure Bhutan's performance in each of the indicators. In this diagnostic, 3 comparator groups are chosen: 1) Bhutan's income group of lower-middle income countries; 2) the global community, and; 3) the South Asia region and income group averages. The methodology for benchmarking and definitions of each of the indicators is given in the Annex of the accompanying presentation.

The benchmarking draws from a database of global, national level indicators. Three criteria are used to determine inclusion into the benchmarking database. First, the indicator must be related to one of the 4 pillars described in Box 1. It is often the case that an indicator could be relevant for 2 or more indicators.[207] Thus, judgements must be made to map each indicator to a single pillar. Second, indicators must come from global, public databases. This is to ensure openness and transparency in the benchmarking. Finally, indicators must be available for at least 100 countries. This is because, when benchmarking, the result will depend highly on which countries one benchmarks against. If data is only available for a small selection of countries, the result will be biased based on what countries are available. The full benchmarking database has data for over 60 indicators. For Bhutan, data is available for 48 of those indicators.

Income Group Benchmarking

The following subsection presents the results when Bhutan is benchmarked against lower-middle income (LMI) countries for the 4 pillars. In each section, a flower diagram is presented. Each petal of the flower shows performance in a different indicator for the pillar. The benchmarking shows Bhutan's performance against the best performing country in the LMI group. As petals approach the outer circle of the diagram, it signifies that Bhutan is performing closer to its presumed frontier. A longer petal therefore always indicates better performance in that indicator.

Resilience: Bhutan is regularly impacted by extreme weather and geological events. It is therefore instructive to begin by investigating how Bhutan performs on resilience to the threats that it faces. A country's resilience depends not only on the exogenous threats (risks) but also on its coping and avoidance strategies.

Indicators that are critical for measuring a country's resilience therefore comprise those that measure: (i) exposure to natural disasters, including risk to assets, wellbeing, people, and rainfall shocks; (ii) exposure to epidemics; and (iii) social vulnerability, including percentages of urban slum population, population covered by social protection and the food security index.[208]

Bhutan's performance in the Resilience indicators is relatively poor compared to other LMI countries (Figure A1.1). Bhutan is prone to a range of natural disasters, including earthquakes, floods, and landslides which cause a significant amount of damage each year. Assets totaling approximately 2.3 percent of GDP are damaged each year due to natural disasters, which is more than twice the

207 For instance, urban slum population would be relevant for: Resilience, as residents of informal housing are more vulnerable to natural disasters; Inclusion, as the lack formality can impact one's agency and access to critical basic services, and; Efficiency, as informality can reduce urban productivity

208 Unfortunately, benchmarking data on urban slum population, food security, and epidemics is missing for Bhutan and therefore excluded from the Resilience benchmarking.

average for LMI countries[209]. Further increasing vulnerabilities of Bhutan's population is the relatively low access to social protection measures like child and maternity benefits, unemployment support, disability support, and social security payments. In Bhutan only 8.8 percent of the population has access to at least one of these types of benefits, compared to 29.1 percent on average in LMI countries[210]. Notably, data on urban slum population is unavailable for Bhutan, though this is presumed to be high given rapid urbanization that the country is undergoing, with urban population shares increasing from 34 percent to 42 percent in only the last 10 years. Finally, while the indicator on food security is also unavailable, malnourishment is a critical challenge in Bhutan, affecting nearly 30 percent of the population.[211]

Inclusion: means ensuring people have the ability, opportunity, and dignity to take part in society, regardless of the basis of their identity. Bhutan is well known for having made laudable gains in poverty reduction over the past few decades. Nevertheless, inclusivity must account for more than just income-based poverty. Improving inclusion in a society also means increasing access for disadvantaged groups to markets and assets (land, housing, labor, credit, etc.), services (electricity, healthcare, water, social protection, etc.), and spaces (political, physical, cultural, or social).

Indicators that are critical for measuring a country's inclusiveness encompass: (i) indicators that track distributional outcomes, including poverty headcount and inequality measurements; (ii) access to basic services including to electricity, health services, safely managed drinking water, education, and transport systems,; (iii) access to markets and places, including protections for sub-group populations such as women, refugee, and LGBT groups, and crime rates; and (iv) measures of social resilience, such as in human capital and social trust.

Bhutan performs well in many inclusion indicators, though some notable exceptions do exist (Figure A1.2). In terms of distribution outcomes, Bhutan's poverty headcount based on the international poverty line of US$1.90/day is exceptionally well for its income group. Only 1.5 percent of the population falls below this line, compared to an average of 15.6 percent of LMI countries. In terms of inequality, Bhutan's Gini coefficient is slightly less than the LMI average, implying an income distribution that is slightly more equal than the average LMI country.

When it comes to access to basic services, Bhutan performs extraordinarily well in terms of access to electricity (100 percent of the population) and education (90 percent enrollment rate). Other indicators like access to safely managed drinking water and sanitation and healthcare coverage are significantly below the LMI benchmark. Similarly, Bhutan performs poorly in terms of rural transportation access, though this is largely a product of Bhutan's rough and mountainous terrain that puts it at a natural disadvantage.

When it comes to measures of discrimination, Bhutan does relatively well in on gender equality, with a female labor force participation rate above the LMI average (59 versus 50.5 percent), and a relatively good score on the Women, Business, and the Law index, which measures gender inequality in the legal system. Bhutan also scores relatively well in the personal rights index, which measures political rights, freedom of expression, freedom of religion, access to justice, and property rights for women. The area where Bhutan lags its peers is in the rights of LGBTQ+ populations.

Finally, the pillar tracks indicators on the social dimensions of inclusion including pressures from refugees and internally displaced persons (IDPs), crime as proxied by the country's homicide rate,

209 Climate Risk Country Profile: Bhutan (2021): The World Bank Group and the Asian Development Bank WRI (2018); AQUEDUCT Global Flood Analyzer. URL: https://floods.wri.org/# [Accessed: 22/11/2018] Flooding is the most significant climate-related hazard faced by Bhutan, with most of the country's agricultural land and infrastructure located along drainage basins that are highly vulnerable to heavy monsoon rains and glacial-lake outbursts. The impact of flooding on human health and livelihoods is expected to grow and could be 4% of GDP by the 2030.

210 Authors' GRID estimates are based on World Bank data: Adequacy of social protection and labor programs (% of total welfare of beneficiary households) - Bhutan | Data (worldbank.org); 2019. Poverty, Vulnerability, and Welfare in Bhutan: Progress and Challenges. © World Bank, Washington, DC; http://hdl.handle.net/10986/33366 License: CC BY 3.0 IGO; http://hdl.handle.net/10986/33366; Poverty, Vulnerability, and Welfare in Bhutan: Progress and Challenges (worldbank.org)

211 https://blogs.worldbank.org/endpovertyinsouthasia/what-are-we-doing-improve-food-security-bhutan

and the Human Capital Index. In terms of refugees and IDPs, Bhutan struggles largely due to the fact that over 105,000 Bhutanese were expelled in the 1990's and were forced to live in UNHCR-run refugee camps in Nepal. Many of these refugees have been resettled in countries around the world. Bhutan has a relatively low homicide rate, which is currently nearly half the LMI average. Human capital is about average compared to LMI countries.

Sustainability: Using resources sustainably is critical for ensuring that growth today does not come at the expense of growth tomorrow. Renewable resources like forests, air, and water, ought to be managed in a way that ensures their economic dividends can pay off for generations into the future. And the dividends of non-renewable resources, like minerals or fossil fuels need to be reinvested in society rather than simply consumed, so the country can reap their benefits for years to come.

Indicators for measuring a country's sustainability are predominantly around measures of environmental health and pollution management, and natural resource management, including: air pollution, access to (and quality of) freshwater and coastal water, wastewater treatment, safe WASH services, deforestation, land degradation, and biodiversity and habitat loss. This also comprises of carbon decoupling metrics, such as renewable energy consumption as a percentage of total energy consumption and changes in GHG emissions per capita.

Bhutan has long been recognized as a global model for sustainability, and this is reflected in its benchmarking performance (Figure A1.3). In terms of natural resource sustainability, although Bhutan faced high deforestation rates in the 20th century, deforestation has nearly come to a halt since 2000. Relatedly, Bhutan has relatively low rates of land degradation, and is amongst the most biodiverse countries in the world with a large range of habitat types.

In terms of air pollution, data gathered by remote sensing can sometimes be unreliable in mountainous countries like Bhutan. Thus, the indicator on the population exposed to PM2.5 levels above the WHO recommended limit must be interpreted with caution. A perhaps better indicator, the mortality rate attributable to air pollution, implies that Bhutan performs slightly better than average for an LMI country.

Bhutan also performs quite well on indicators of water availability and quality. Bhutan has abundant freshwater resources and is the upstream country in its shared basins. Water pollution is generally not currently a problem, with Bhutan having a mortality rate due to unsafe WASH (i.e. caused by diarrheal diseases, cholera, etc.) that is one-sixth the LMI average. However, as Bhutan's population continues to grow denser and more urban, the very low capacity for wastewater treatment may begin to put pressure on water quality and water-borne illnesses.

In terms of carbon decoupling, Bhutan performs exceedingly well in nearly all indicators. Bhutan's contribution to global GHG emissions is miniscule largely due to its low population, very high renewable energy consumption rate (over 80 percent), and minimal land conversion rates. Thus, while emissions per capita have increased by 50 percent over the past decade, this is not a major concern as it is increasing from a very low baseline.

Efficiency: It is now more critical than ever that Bhutan improves its efficiency of resource use as well as their efficiency of government and the private sector. In anticipation of a more resource constrained future—where debts are higher due to the response to the COVID19-induced recession, and natural resource depletion continues—Bhutan must spend its fiscal resources and utilize its natural resources in more efficient manners. Productive use of agricultural lands, fisheries, forests, and more competitive cities are key to achieving prosperity and improving lives and livelihoods.

Indicators for measuring a country's efficiency encompass measures of: (i) governance, including effectiveness of government, control of corruption, and tenure insecurity; (ii) transport and ICT, such as percentage of population using the internet, a digital penetration index and logistics performance index; and (iii) efficiency of resource use, such as

agricultural land productivity and labor productivity, energy intensity and GHG emissions, and efficiency of other natural resources like water and air (Figure A1.4).

Bhutan's performance in the efficiency pillar is quite mixed, with a very strong performance across governance indicators, but weaker performances elsewhere that can largely be attributed to geography. Beginning with the efficiency of natural resource use, Bhutan has very low agricultural land productivity, water productivity, and carbon efficiency. Agricultural land productivity is only half the LMI average, though this can be largely attributed to Bhutan's high elevation and rugged terrain which hampers its agricultural potential. Low water productivity, which would be a concern in many other countries is not a major impediment to growth or sustainability in a country as water abundant as Bhutan. And while carbon efficiency is very low relative to the best performer in the LMI income group, Bhutan does perform better than the average LMI country. Energy intensity in Bhutan (energy produced per unit of GDP) has declined by nearly 30 percent from 2005-2015, implying Bhutan is become much more energy efficient.

In the two indicators on governance quality included in the analysis, Bhutan is the best performer in the LMI income group. A third indicator, measuring tenure insecurity is unfortunately unavailable for Bhutan and thus excluded from the analysis.

Finally, when it comes to efficiency of transport and information and communication technology Bhutan underperforms its peer group. Access to the internet sits at under 50 percent, and according to the World Bank's Digital Penetration Index, digital adoption in both the public and private sectors as well as within households is low. Trade logistics in Bhutan are also relatively poor, driven by a lack of modern infrastructure and a large number of Customs formalities that are necessary to allow goods to enter or exit the country. As with the resource efficiency indicators, Bhutan's geography does hinder Bhutan's performance in these indicators.

Global Benchmarking

Next, we compare Bhutan's performance in each of the 4 pillars against the rest of the world. Here, rather than comparing Bhutan to the best performer in the world, as is done in the income group benchmarking, we instead show percentile rankings. To do so, in each indicator countries are ranked from best performer to worst performer. Bhutan's score is then its percentile ranking amongst countries with data available. Thus, if Bhutan performs better than 60 percent of countries in the world in a particular indicator, it receives a score of 60 for that indicator. Results are shown in Figure A1.5.

The results show that the global benchmarking is largely consistent with peer group benchmarking. At a quick glance, one notices that Bhutan struggles most in the Resilience indicators, where it is in the bottom 10th percentile in risks to assets and wellbeing from natural disasters, and the population covered by social protections. In the Inclusion pillar, critical basic services like safely managed drinking water, health care coverage, and rural transportation fall in the bottom 40th percentiles globally, as do the Refugee and IDP index and Human Capital Index. Notably, whereas amongst LMI countries Bhutan performed relatively well in the Woman, Business, and the Law Index, when compared globally, Bhutan comes out in the bottom tercile of countries.

Bhutan performs exceedingly well in the Sustainability pillar, with 7 of the 17 indicators falling in the top 10 percent of countries globally. Bhutan is a global leader in terms of solid waste management, water quality from nutrients, salts, and chemicals, biodiversity preservation, renewable energy consumption, and forest management. Nevertheless, global benchmarking does identify challenges in low wastewater treatment, rising GHG emissions per capita, and high mortality rates from air pollution and unsafe WASH. Finally, the Efficiency pillar also largely follows the income group benchmarking where Bhutan performs very well in the gov-

ernance indicators but falls short in efficiency of resource use indicators like water and agricultural land productivity, as well as the transport and ICT measures.

The results for the global benchmarking are summarized in Figure A1.6. Here, pillar scores, and sub-pillar scores are calculated by taking the percentile ranking in each indictor from the global benchmarking and averaging it across pillars and sub-pillars. It allows one to see at a glance, the major areas where Bhutan is struggling. Unsurprisingly Sustainability is Bhutan's best pillar, where the country is on average in the top 66th percentile across all indicators, bolstered by high scores in natural resource sustainability and carbon decoupling. Resilience is Bhutan's weakest pillar, scoring on average in the 31st percentile. In Inclusion and Efficiency, Bhutan scores close to the global median.

Pillar Score Comparisons

As a final way of benchmarking Bhutan, pillar scores from the prior section are compared against other country groups and comparators to give a high-level view for Bhutan's performance across the 4 pillars. Figure A1.7 shows the comparison of Bhutan's pillar scores against income group averages. For Resilience, Bhutan performs lower than even the low-income group average. In both Inclusion and Efficiency, Bhutan outperforms its own income group and is about even to an average upper-middle income countries. With Sustainability, Bhutan performs significantly better than even the average high-income country. Figure A1.8 then compares Bhutan's pillar scores against those of its South Asian neighbors. The results emphasize that while Bhutan struggles with the Resilience pillar, it is not too dissimilar from other countries in the region like Nepal, Bangladesh, and Afghanistan, which also perform in the bottom tercile of countries. With Inclusion and Efficiency, Bhutan leads most of the other SAR countries, tying Sri Lanka and India, respectively. Finally, with Sustainability, Bhutan significantly outperforms all of its neighbors.

Summary and Conclusions

The benchmarking that is presented here is intended to identify, at a high level, Bhutan's performance along the dimensions of GRID. In many ways, the results demonstrate that macroeconomic indicators like GDP per capita do a poor job at measuring Bhutan's level of development. In many key areas of growth quality, Bhutan is outperforming its income group. Particularly when it comes to the sustainability pillar, Bhutan's score reflects its reputation as a world leader in conservation.

Nevertheless, the benchmarking does highlight several key challenges that Bhutan is facing. Bhutan faces significantly elevated threats from natural disasters, which threaten the lives and livelihoods of its people. Low access to social protection programs further increases vulnerability. Despite having very low income-based poverty, low access to basic services like safely managed water and sanitation weigh heavily on populations, leading to high mortality risks and also likely contributing to Bhutan's mediocre performance in the Human Capital Index. Finally, Bhutan faces an uphill battle in many remaining challenges due to its geography. Connectivity in communications and transportation is impeded by high altitudes and rugged terrain, as is agricultural productivity.

The Covid-19 crisis highlighted the need for countries to rethink their development trajectory. The setbacks caused by COVID-19 are forcing governments, the private sector, and institutions to reassess their strategy as they move forward. Decisions made now will have lasting effects that will shape Bhutan's growth for decades to come. For this reason, it is imperative that data-driven strategies form the backbone of decision-making around investments and policy choices.

Figure A1.1: Benchmarking Bhutan against LMI countries—Resilience

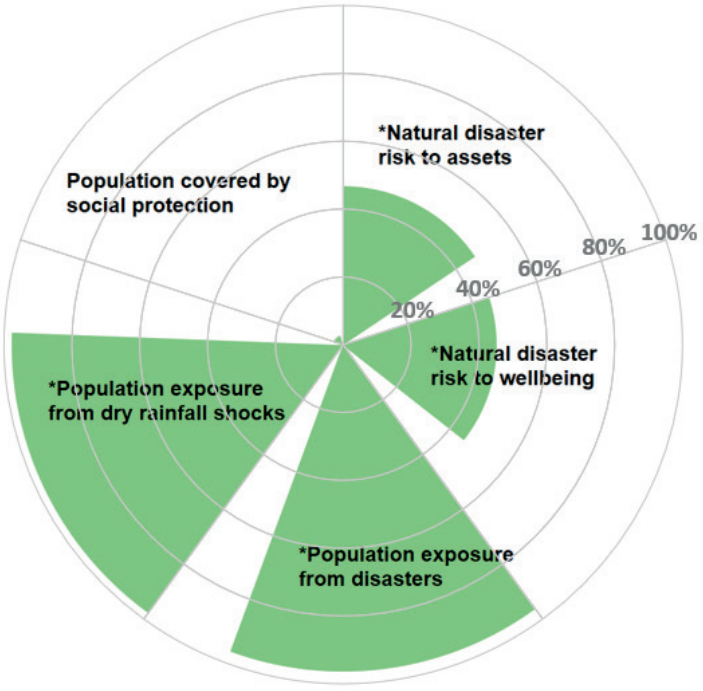


Figure A1.2: Benchmarking Bhutan against LMI countries—Inclusion

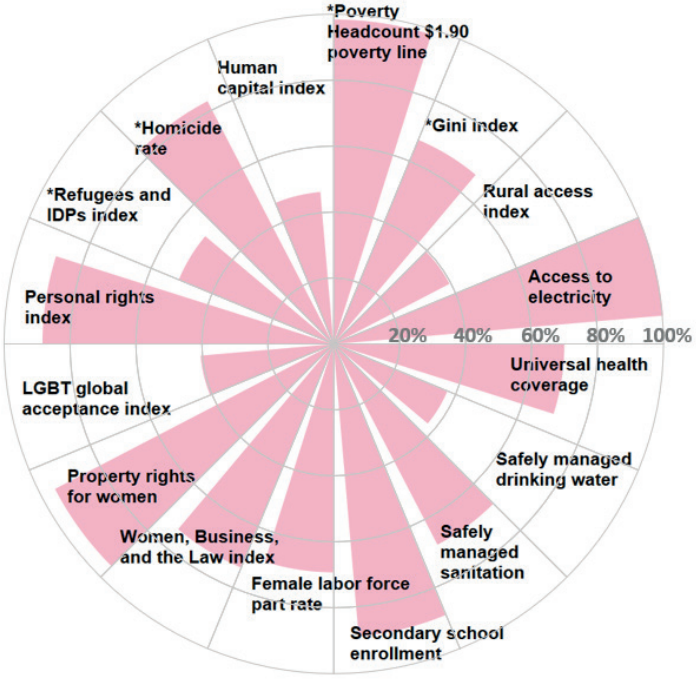


Figure A1.3: Benchmarking Bhutan against LMI countries—Sustainability

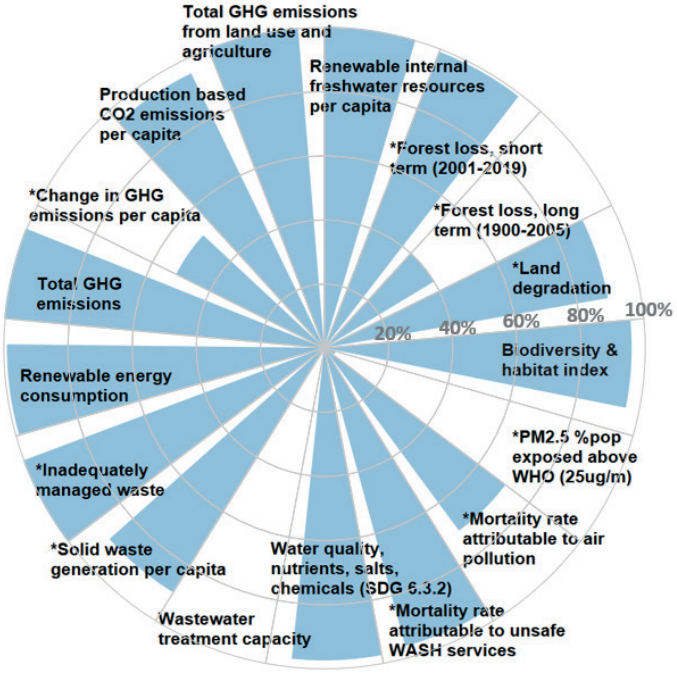


Figure A1.4: Benchmarking Bhutan against LMI countries—Efficiency

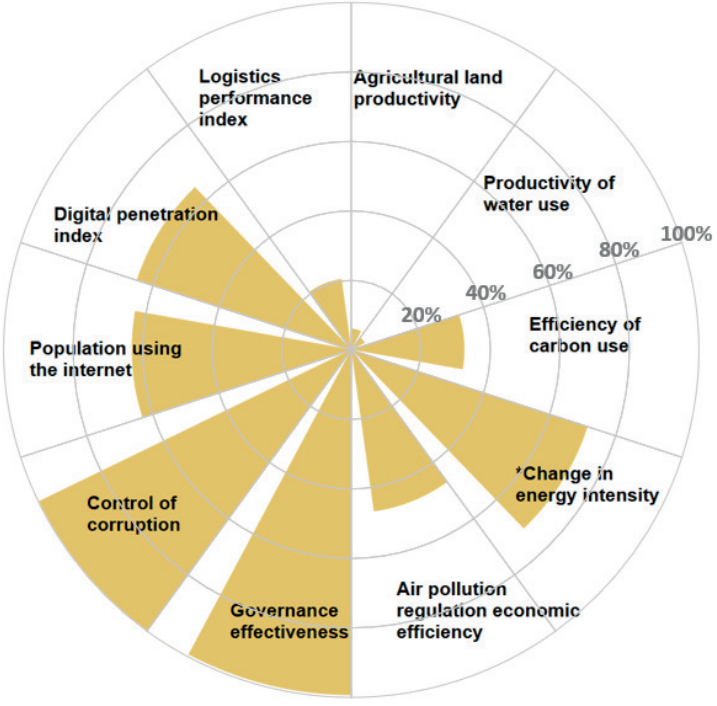


Figure A1.5: Benchmarking Bhutan against the world

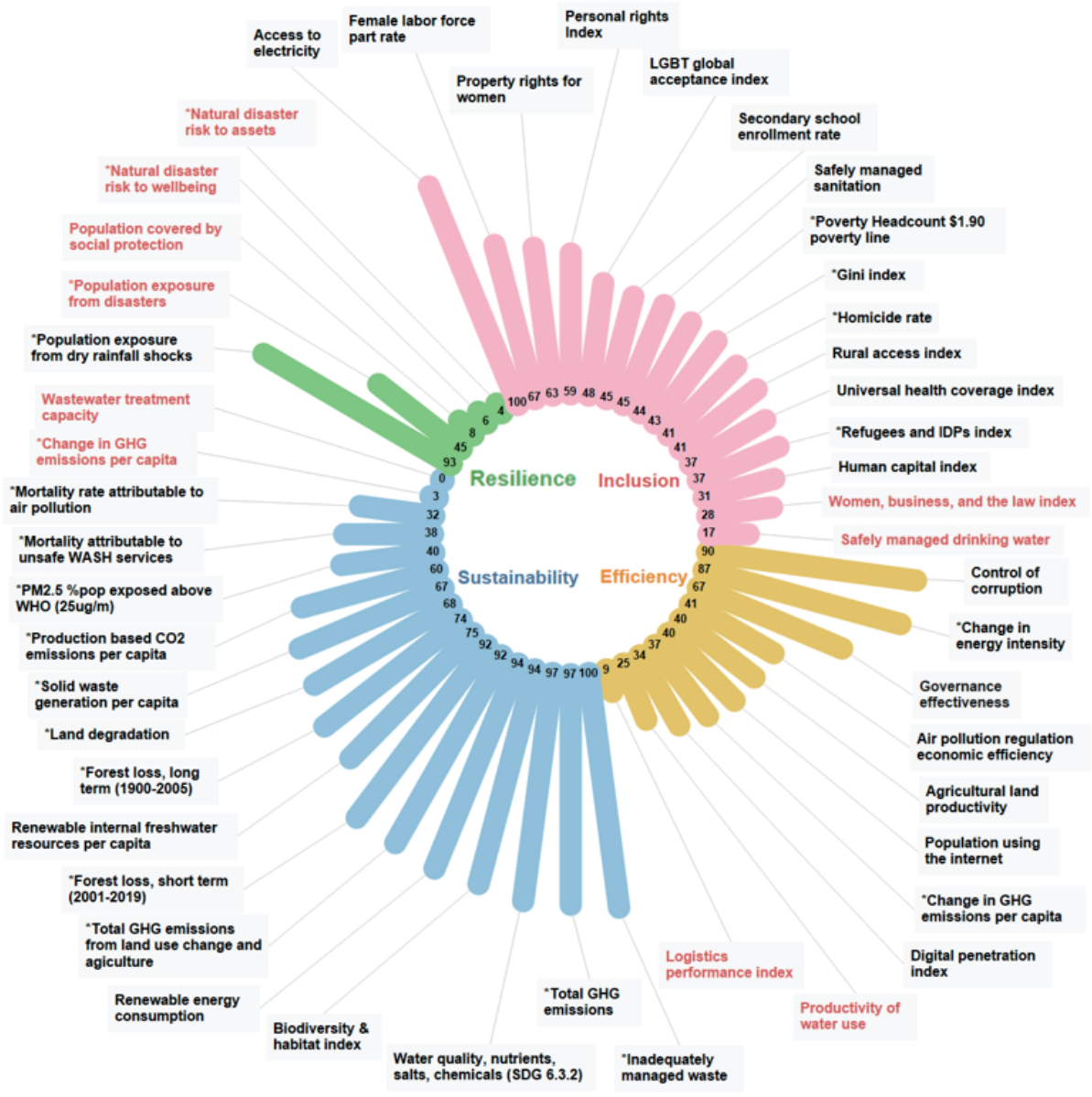


Figure A1.6: Bhutan's pillar scores

Significantly below global median ▼
Significantly below global median ▲

Pillar	Dimensions		
Resilience	Natural disaster & Weather variability	37	▼
	Health disaster		
	Social variability	8	▼
	Average	31	▼
Inclusion	Distribution outcomes	44	▼
	Access to service	48	
	Access to markets and places	53	
	Social dimension of inclusion	36	▼
	Average	47	
Sustainability	Natural resource sustainability	80	▲
	Pollution	53	
	Carbon decoupling	69	▲
	Average	66	▲
Efficiency	Resource use	46	
	Governance	79	▲
	Transport and ICT	28	▼
	Average	47	

Figure A1.7: Percentile ranking of Bhutan against all income groups

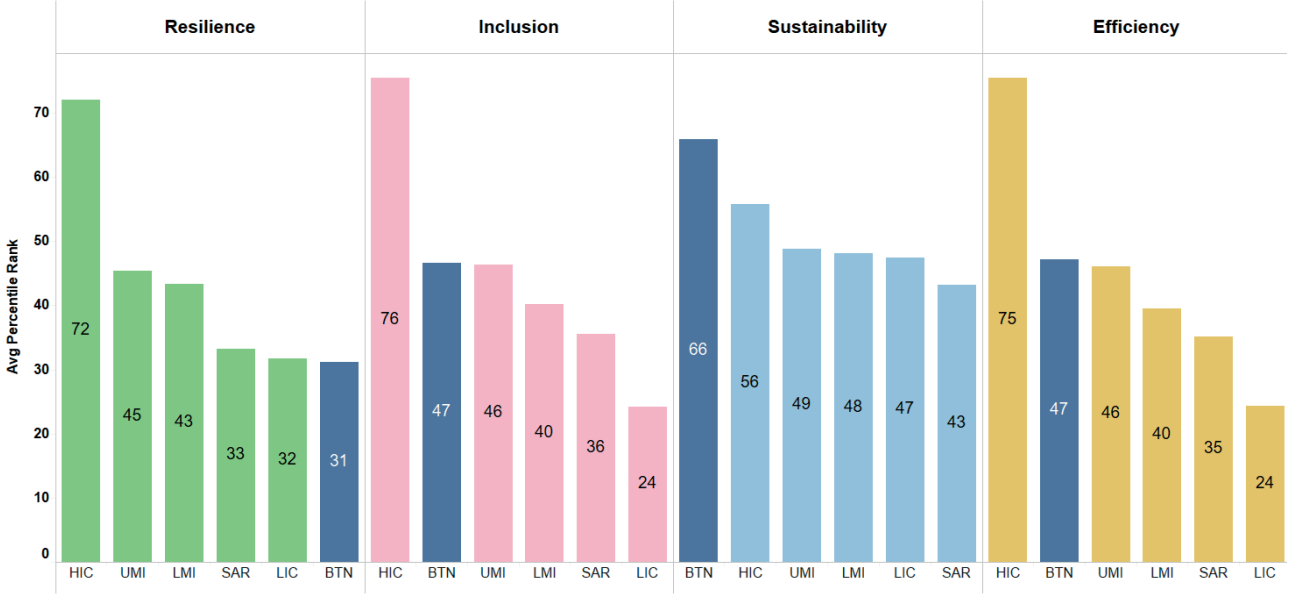
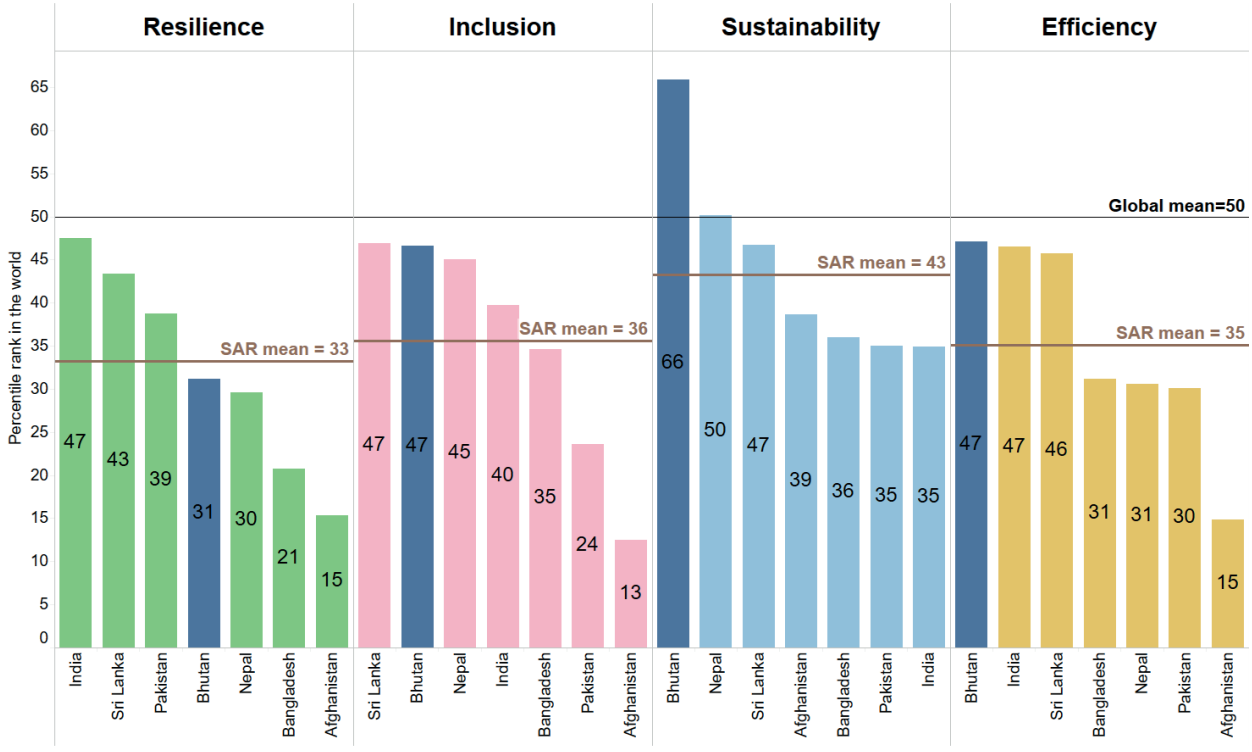


Figure A1.8: Percentile ranking of Bhutan against South Asian countries



Annex 2: Policy and Institutional Analysis: Bhutan's institutional underpinnings for green growth

Bhutan's institutional underpinnings for green growth

i. National Green Growth Governance and Institutional Framework: composition, coordination center, lead agencies, focus areas, communication with society groups, and recommendations.

As a development model and overarching governance philosophy, GNH has been translated into a number of policy-making and screening tools (Schroeder, 2014) and the Cabinet Secretariat coordinates all the government agencies with the purpose of promoting good governance, socio-economic growth, cultural preservation, and environmental protection (known as the four pillars of GNH). Bhutan has committed to green growth to guide the country's economic development. In a way, it can be said that green growth is at the heart of Bhutan's development philosophy that influences every sector and its governance in the country. The five-year planning framework of Bhutan provides the process for integrating and mainstreaming the international development goals such as the SDGs and green growth both at the national as well as at the sub-national level.

The key institutions, their composition, focus areas, and engagement with local community are summarized below:'

Institution	Composition	Focus area	Engagement with communities and CSOs	Recommendations
Cabinet Secretariat: key national agency for planning, coordinating and monitoring long- and short-term development plans in consultation with relevant line ministries and local governments.	Commission Members include Prime Minister (Chairperson), Cabinet Secretary, Office of Cabinet Affairs and Strategic Coordination (headed by EX), Office of the Prime Minister (headed by EX), the Strategic Planning Division, National Policy Coordination Division, Strategic Evaluation Division, Cabinet Affairs Division, Public Service Delivery Division, and PM Aides and Media. The function of external (grant) financing is led by the Ministry of Finance, and the function of research is carried out by the Center for Bhutan and GNH Studies.	>> multi-sectoral engagement for development planning >>Policy coherence between sectoral policies, national development objectives, SDGs, and GNH values >> coordinating, overseeing, monitoring, and reporting progress on national development goals	>> ensures inclusion of all the stakeholders including various government departments, parliamentarians, local government, civil society, private sector, among others in the policy making and planning processes >> extensive consultations process led by the Cabinet Secretariat to create ownership at all levels	Improve collaboration and research with think tanks and universities to generate data and policy issues on specific Green Growth sectors and their contribution to GNH objectives

Institution/ lead agencies	Composition	Focus area	Engagement with communities	Recommendations
Ministry of Energy and Natural Resources (MENR) headed by the Minister, and a secretary. The National Environment Commission (NEC) approves the plans, policies and regulations, and the Electricity Regulatory Authority (ERA) is the Technical Board for all Departments under MENR. (See organization chart below)	Department of Energy (Renewable and Hydro) Department of Geology and Mines (DGM) Department of Forest and Park Services (DFRS) Department of Water DW) Department of Environment and Climate Change (DECC)	Formulate policy, regulations, strategy and guidelines, including technical assistance (all Departments) Conduct geological mapping of mineral resources and geoscientific studies. Sustainable management of forest resources and conservation of wild flora and fauna. Conduct national inventory of surface and underground water resources, their mapping and maintain data on water resources.		Upfront investments required to modernize the country's hydro-meteorological sector to produce high-quality climate data (historical and real time) will be worthwhile, as the cost-benefit ratio in the long-term is favorable both monetarily and socio-economically. Facilitate market ecosystem for green construction, and to dismantle perception that green buildings are expensive through innovative financing, to build credibility and growth of a green construction sector in the country

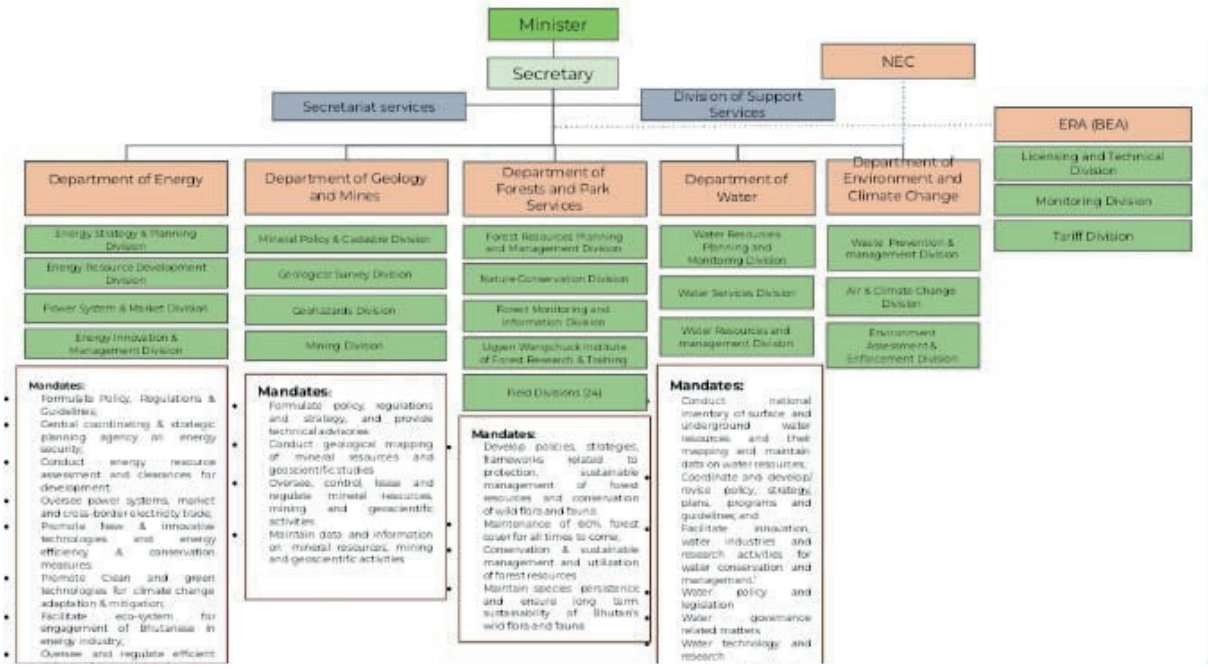
Institution/ lead agencies	Composition	Focus area	Engagement with communities	Recommendations
Department of Environment and Climate Change (DECC): Functions as the Secretariat to the National Environment Commission and falls under the Ministry of Energy and Natural Resources. It is responsible for developing and implementing policies, regulations, etc., which are approved by the NEC.	Includes Civil Society representative in the NEC membership	Environmental Protection and Sustainable use of natural resources >> to coordinate on all matters relating to the environmental protection and sustainable use of natural resource in Bhutan; >> responsible for issuing environmental clearances for all public and private projects >>to bring environmental issues at the center of Bhutan's development agenda through appropriate policies, legislations, institutions, and technologies. >>to conduct environmental monitoring and enforce and control compliance; and enhance awareness and access to environmental information	Promotes access to environmental information through education, advocacy, and awareness. Established system for gathering and disseminating environmental information. Ensures decentralization and participation of sectoral ministries and local government in environmental management	Separation of powers necessary as DECC is empowered to legislate on environment, execute implementation and enforcement, and hear cases relating to environmental matters. A separate tribunal on environmental matters could ensure independent judicial decisions. Environmental reporting to be institutionalized at the dzongkhag levels for more sub-national information to inform policy and action.
Department of Forests and Park Services (DFPS) within the Ministry of Energy and Natural Resources. (see organizational chart below)	DFPS Staff are located in the central office, 14 field offices, and 9 park offices	Department of Forests and Park Services focuses on: >> Conservation and management of Bhutan's forest, natural resources and biodiversity; including a minimum of 60% forest cover. >> Responsible for ensuring suitable watershed management through catchment protection and other nature conservation	Engagement of community in forestry is ensured through community forest management groups established across the country.	

Institution/ lead agencies	Composition	Focus area	Engagement with communities	Recommendations
Ministry of Agriculture and Livestock is one of the 9 Ministries in Bhutan.	It is headed by the Minister and Secretary. It houses the Department of Agriculture (DoA), Department of Livestock, Department of Agricultural Marketing and Cooperatives (DAMC), and the National Biodiversity Centre. DoA has 3 divisions: i) Agriculture Production Division; ii) Agriculture Research and Extension Division; iii) Agriculture Engineering Division. DoA is supported by 4 Agriculture Research and Development Centers and 6 support service oriented Central Programs stationed across the country. These wings further provide technical backstopping to the Dzongkhag Agriculture Section and the Gewog Extension Officers. DAMC Staff is divided between the directorate, Cooperative Development Division, Market Information & Research Division, Marketing Development Division, and regional offices.	Department of Agriculture >> responsible for enabling a self-reliant, productive, diverse, resilient and sustainable agriculture food system by liaising with national and international institutions for program coordination. >> Responsible for promoting sustainable and climate resilient agriculture development, income generation, employment opportunities and enterprise development by establishing commodity value chains >> Responsible for developing sustainable irrigation and water management system, and sustainable utilization of agricultural land. Department of Agricultural Marketing & Cooperatives (DAMC) >>Facilitates agricultural produce marketing and the development of the co-operative sector. >> Responsible for Ministry- or sector-wide coordination, prioritizing and evaluation of marketing and cooperative activities	Dzongkhags and Gewogs extension are in the forefront of agriculture extension system working directly with farming community and agri-entrepreneurs. To institutionalize a system of farmers training, the Ministry of Agriculture established Rural Development Training Centre with 3 main training programs: i) Skills based Farm Business Training ii) Community Leaders Training for groups and cooperatives and iii) School Agriculture Program for school children. The center aims to fulfill the mandate with continued dedication to provide skills-based training for the farmers to enhance their capacity to participate in commercial farming on an economically and environmentally sustained basis. Supports development of marketing cooperatives and inclusion of new farmers into commodity organizations. Generally, aims to extend participation of smallholder farmers in mainstream agricultural markets.	Utilize specialized funds or trust funds to support PES, and other agricultural marketing support measures for new and smallholder farmers Monitoring the number of commodity groups and marketing cooperatives supported and their effectiveness since the approval of the policy. Develop a database to monitor growth and development of agricultural logistics components such as collection and auction facilities, cold store chain, air freight and road transport.

Institution/ lead agencies	Composition	Focus area	Engagement with communities	Recommendations
The Department of Tourism falls under the Ministry of Industry, Commerce and Employment. It guides overall tourism development, including tourism planning and policy, regulation and monitoring, facilitation and coordination, and marketing, promotion, and development of tourism products and services	Nine council members, chaired by the minister for the Ministry of Foreign Affairs. Includes reps from the Ministry of Home and Cultural Affairs, Tourism Council of Bhutan, Hotel & Restaurant Association, Association of Bhutanese Tour Operators, Guide Association of Bhutan, Bhutan Sustainable Tourism Society	>>establishment of new tourism clusters with appropriate services and activities >>Spread tourism benefits to a larger proportion of the population through the creation of forward and backward linkages. >>diversification of livelihood opportunities especially for contribution to rural economy >>establish standards and code of ethics for tourism service providers	Informed participation from all relevant stakeholders, including local government, is envisaged in the Tourism policy of Bhutan to: - Assess absorptive capacity for tourism in a region - identify and develop tourism products and services in which the tourism deficient regions enjoy a comparative advantage over other regions It promotes integrated and inclusive tourism by enhancing opportunities/ participation for women, youth, and person with disabilities in the sector	Align alternative employment and re-skilling programs with the future requirement of labor and skills as per the economic vision for the country and recover from the loss of livelihood due to scenarios like pandemic outbreak.
The Ministry of Infrastructure and Transport is in charge of formulating policies and developing plans related to the countries physical infrastructure. The Bhutan Construction and Transport Authority (BCTA) performs the regulatory functions under existing laws for the Department of Surface Transport.	Consists of four departments: i) Department of Surface Transport ii) Department of Air Transport iii) Department of Human Settlement iv) Department of Infrastructure Development The ministry also has the following Corporations and Authorities working under the ministry to facilitate infrastructure development in both in the growing urban towns as well as in the rural areas including the remotely located villages: 1. Construction Development Board (CDB) 2. National Housing Development Corporation (NHDC) 3. Phuentsholing City Corporation (PCC) 4. Thimphu City Corporation (TCC)	>> Formulate policies and develop plans related to physical infrastructures, including zoning. >>Development of dynamic and highly motivated pool of technical workforce to create safe, reliable, and sustainable physical infrastructure for human settlement and transportation. >>Promote appropriate construction industry standards >> Develop plans and policies for proper human settlement through growth centers	Develops strategies to help build technical capacity at Dzongkhag and thromde-level for improving quality in construction sector since at the local government's level, the engineers are responsible for up to 90% of the development works	Need to establish and strengthen the spatial planning system to inform planning, implementation and policy. Institute an appropriate and independent mechanism to review human settlement issues from technical, social development angle. Constitute a tribunal or a fast-track court to consider, negotiate and resolve disputes and cases on land use and settlements planning and development.

Institution/ lead agencies	Composition	Focus area	Engagement with communities	Recommendations
The National Statistics Bureau is the parent agency for all the statistical officers posted in agencies/Ministries and Dzongkhags since 2017. It is the central authority for the collection, compilation and release of any official data and its custodian.	The Bhutan Statistical System (BSS) is a decentralized system with a central agency, the National Statistics Bureau. It involves most of the ministries and several agencies, which collect, compile, and disseminate statistics related to their own field and for their own analytical and policy needs. In most Ministries, the Policy &Planning Division is undertaking or coordinating the statistical data production and dissemination. The Ministry of Finance has also a mandate for compiling and disseminating fiscal statistics. NSB operates through five Divisions mentioned below:- 1) National Accounts & Price Division 2) Coordination and Information Division 3) Survey/Census and Data Processing Division 4) Socio-economic Analysis and Research Division 5) Administrative and Finance Division	>>provides key statistical products and services on economics, environmental, population and social aspects to support social and economic development. >>promote greater use of statistical information, contributing to informed decision making by the government agencies, businesses, households and individuals	Because of the decentralization process there is an increasing demand of local data, mainly at Dzongkhag and Gewog levels. NSB has posted one Dzongkhag Statistical Officers (DSOs) in each Dzongkhag. The DSOs are responsible and mandated to gather data/ information in coordination with other sector officials within the Dzongkhag. The DSOs have a key role in gathering data at those levels.	Improve the coordination and strengthen the capacity of the Bhutan Statistical System to meet international and national requirements, especially on post-COVID economic recovery of priority sectors. NSB needs a coordinated framework of statistical development in terms of data gaps, duplications, professionalism, coordination, data accessibility, and dissemination issues. This can provide strong support to the line ministries and agencies to streamline data publication and update approaches. With the emerging need for a wide variety of information both at the national and sub-national local levels, existing mandate of the DSOs needs to be strengthened and clearly separated from administrative functions with separate budget allocation for statistical work.

Proposed structure and organization of Ministry of Energy and Natural Resources



ii. Existing coordination mechanism at multi-sectoral level for implementation of Green Growth priorities, and recommendations.

A more comprehensive view of green growth emphasizes sustainable use of natural capital, along with managing environmental risks cost-effectively and in an institutionally sound manner to limit risks to human health and of irreversible degradation of the natural environment. A significant part of Bhutan's current and prospective economic gains come from the use of natural resources, or the green sectors. These natural resource-dependent sectors, such as agriculture, livestock, and forestry contribute to Bhutan's GDP. Similarly, water, minerals, and tourism sectors are directly linked to environmental management in Bhutan. Bhutan's high rate of growth has been largely public sector-driven and future of the country's economy is dependent on the ability to facilitate GNH-aligned private sector growth.

National coordination mechanism: Bhutan's economic development policy continues to be guided by the overarching philosophy of Gross National Happiness (GNH) based on the four pillars of sustainable economic development; preservation and promotion of culture and tradition; conservation of environment; and good governance. All sectors are coordinated through Cabinet Secretariat, which is Bhutan's planning commission, to align development with Bhutan's GNH philosophy. It includes Bhutan's interpretation of green growth.

GNH Index has nine domains and 33 indicators that measure sustainability-based growth and development framework. The following domains of GNH Index could be used to measure green, resilient, and inclusive growth: good governance, ecological diversity, living standards, community vitality, and education. For example, the 'living standards' domain refers to the level of material comfort as measured by income, conditions of financial security, housing and asset ownership. The domain of good governance evaluates how people perceive various governmental functions in terms of their efficacy, honesty and quality. Indicators help to evaluate the level of participation in government decisions at the local level and the presence of various rights and freedom.[212] Bhutan has a unique approach of 'middle path' development that considers GDP as an accounting system, not an indicator of overall growth and wellbeing. The Cabinet Secretariat brings this unique approach into its development policy and

212 https://www.gnhc.gov.bt/en/wp-content/uploads/2017/05/GNH_9DOMAINS-AND-INDICATORS.pdf

practice by using these GNH screening tools and indicators.

Apart from the indicators identified under GNH Index, there are National Key Results Areas (NKRA) and Sectoral Key Results Areas (SKRA) with specific targets and indicators that have been identified for the formulation of the Eleventh FYP. This strategic results framework is designed to aid the planning and programming of the central, sectoral and local development plans and programs for the Eleventh FYP period in a manner that is coherent, structured and focused, and shows clear linkages with the GNH and SDGs at various levels. However, detailed understanding and capacity to align sector/agency plans and programs to SDG targets and indicators remain limited. [213]

Lead Agency: For all purposes, NEC, a multisectoral autonomous apex body that carries out its wide-ranging functions, including to issue directives to relevant agencies for mainstreaming environment into the country's developmental policies, plans and programs, with an aim to strike a balance between economic growth and environmental conservation. The Economic Development Policy of 2010 states that "green growth" will be encouraged in promoting industrial and private sector development. However, the 2016 version of the policy does not refer to 'green growth', rather envisions to build Bhutanese economy as 'green and self-reliant economy' that is guided by GNH philosophy.[214] This policy recognizes that unless the constraints to business growth are systematically addressed, the capacity of the private sector as the engine of growth cannot be enhanced. In this context, the 2016 Policy aims at creating an enabling environment for investment through eight (8) high -level strategic directions. This includes diversifying the economic base with minimal ecological footprint, harnessing and adding value to natural resources in a sustainable manner, and promoting industries through a cluster effect and championing approach, among others.

There has been a slight policy shift from purely well-being-driven development approach to one that is trying to ensure that economy takes the center stage of development initiatives. Based on Bhutan's USP, resource endowments, developmental focus and desired outcomes of economic development, some priority growth areas were identified in the 2016 Policy: "Five Jewels" which includes Hydropower, Cottage and Small Industries, Mining, Tourism, and Agriculture. Other sectors include High Quality Green Services such as education, waste management, etc., energy, transportation, construction, and manufacturing. These sectors identified above are those that have the highest potential to generate wealth, employment, and sustainable growth with minimal ecological footprint within the framework of GNH. It also aims to develop 'Brand Bhutan' image as a source of organic and traditional products which aligns with GNH's ecological and cultural preservation objectives. Therefore, these areas were prioritized to receive encouragement and support from the government and the private sector.

To fulfill the above economic aspiration, a few general policy reforms to support ease of doing business and human resource development are introduced or are underway:

- Private sector investment to be allowed in all areas except those listed in the Prohibited List
- Establishment of an autonomous Entrepreneurship Development Institute by 2018 to promote entrepreneurship
- Implementation of the Public Private Partnership (PPP) Policy to facilitate public private partnership in infrastructure projects
- Ensuring that any foreign service provider wishing to participate in major works must engage local firms for transfer of technology/skills
- In collaboration with the private sector, Royal Government to identify critical skilled labor deficiency areas and support skills development to address the needs of the labor market including addressing gender gaps, where necessary

213 https://www.gnhc.gov.bt/en/wp-content/uploads/2021/09/2nd-VNR-Report-SDGs.pdf
214 https://www.moea.gov.bt/wp-content/uploads/2017/07/Economic-Development-Policy-2016.pdf

iii. Sectoral agencies for implementation of economic recovery/ Green Growth agenda Related to that the linkage between sectoral agencies.

Hydropower Sector

The Ministry of Energy and Natural Resources (MENR) is the highest government authority responsible for environmentally sustainable economic growth and development of Bhutan. It is responsible for creating an enabling environment, including institutions and infrastructure for the environmentally sustainable growth of the economy through public & private sector development. MENR houses departments that are responsible for coordinating priority growth sectors in the country, including hydropower, renewable energy, and mining. For instance, the Department of Energy (DoE) which serves as the central coordinating agency and focal point for all matter related to hydropower, is housed under MENR. DoE also coordinates with NEC, Department of Forest and Park Services, public-owned corporation including, Druk Green Power Corporation and Bhutan Power Corporation for planning and for overseeing and monitoring implementation of plan, program, and projects on hydropower, transmission, and cross-border electricity trading.

Recommendations: Enabling private sector investment in the sectors negatively affected by the pandemic, such as tourism and commodity export could be a way of economic recovery. The royal government may pursue corporatization of its entities where feasible and also outsource/privatize such functions which can be delivered more efficiently and economically by private entrepreneurs. It is also considered that reducing the burden of compliance by the government agencies would be effective once the agencies are mandated to adopt the Licensing Policy.

Mines and Mineral sector

Mineral deposits in Bhutan include a vast wealth of resources such as coal, dolomite, limestone, slate, talc, gypsum, coal, marble, quartzite, and copper. According to the 2017 Mineral Development Policy, 33 percent of the country has been geologically mapped on a scale detailed enough to enable exploration. Currently, only 0.04 percent of land is used for mining activities. Despite its relatively small size, the sector is due to play a significant role in in supply of raw material for the mineral based industries, infrastructure and other development projects, and the government is determined to tap into the potential of its unexplored resources, following the principles of intergenerational equity.

Department of Geology and Mines (DGM) is responsible for enabling optimal development of mineral resource in a scientific manner compatible with the social and economic policy of the Royal Government and within the framework of sustainable development, protection of environment, mineral conservation and preservation of country's precious religious and cultural heritage. DGM is de facto regulatory authority to lease and regulate all mining and related activities. It is also responsible for levying and collecting royalty, mineral rent, surface rent, fees and applicable charges as well as for oversight and management of Mining plans and in ensuring mine reclamation. Apart from the primary minerals (which includes strategic minerals and industrial minerals) DGM also issues and administer permits for construction materials such as surface collection of minerals, sand and stones. It has the following divisions: Mineral Development Division, Mining Division (which includes Mines Leasing section), Geological Survey Division (which includes mapping, prospecting, and mineral exploration), and Earthquake and Geophysics Division.

All of these departments dedicated to coordinating the top three priority green growth sectors are housed under the Ministry of Energy and Natural Resources (MENR) which also has a representation in the National Environment Commission (NEC) along with private sector and civil society organizations. A strong coordination between MENR and NEC with streamlined government processes could create enabling institutional and policy environment for government and private sector to contribute effectively to the green and self-reliant growth priorities in Bhutan by balancing the environmental and economic development agenda.

In addition, DGM coordinates with multiple agencies for mining works such as, NEC (processing for environmental clearance), Department of Forest

and Park Services (DoFPS for Forestry Clearance), Department of Local Governance and Disaster Management (DLGDM responsible for social clearance), Department of Labor (for Forestry Clearance), Dzongkhag Land Lease Committee (DLLC for sectoral and land clearance), National Land Commission (approval of DLLC report and granting of Land Lease Certificate) each with different mandates. At the operational level, there is unclear roles and responsibilities in each process of mining lease of the different stakeholders involved, leading to delays or low quality service. This can be mitigated by developing simple and clear roles and responsibilities of the agencies involved in the mine lease process and develop service delivery standard.

Recommendations: For improved coordination across the government agencies responsible for providing clearances, the 2016 Economic Development policy instructed the agencies to determine and adhere to the "turnaround time" for providing the clearances/licenses by 2017. It is also recommended that a One-Stop-shop for regulatory clearances could be established through the use of IT among government agencies responsible for providing clearances, with the Ministry/agency that is responsible for issuing the final approval/license shall be the only point of contact for the applicant.

The key challenge with DGM is conflict of interest as a regulatory body while at the same time facilitator for the production in the mines. Pursuant to the Mines and Mineral Management Regulations of Bhutan 2022, , theMineral exploitation Gudelines for exploration permit, rights and obligations of permit holders and compalince monitoring have been adopted in August 2023. In addition, there is lack of monitoring on public consultation processes and CSR actions. It is recommended to strengthen guidelines for effective community involvement by ensuring strict monitoring of the public consultation process by DGM. Furthermore, formulating a Mining CSR Strategy and Action plan can enhance access to benefits among the communities.

Annex 3: Public Environmental Expenditure

1. Budget Planning

The budget plays a key role in the development process. The budget is the estimation of the expenses that a government expects to incur in the future. To achieve government objectives and goals, an efficient allocation of financial resources is necessary. This is because resources are limited. To optimize the budget, it is guided by five-year development plans covering all the central as well as local government bodies. The Ministry of Finance (MoF) does the budgeting based on the pre-determined priority programs of various agencies in the country. Therefore, it is imperative to have a sound budgeting system for efficient and effective budget allocation across the agencies.

The Budget Manual 2016 provides the legal framework for Bhutan's budget alongside the Constitution of Bhutan and the Public Finance (Amendment) Act of Bhutan 2012. The Budget Manual 2016 is part of Financial Rules and Regulations (FRR) 2016. Budgeting stands on five main principles – the concept of balance (limiting money spent to resources available); maintaining fiscal deficits at the sustainable level as determined in the macroeconomic framework; the concept of budgeting as per the program budget model based on functions/programs/activities/projects; budget control and accountability; and principal concepts of frugality and prioritization.

The structure of the budget follows the program budget model; the program is further divided into sub-program, activity, sub-activity, financing item code to object code. Object classification/line-item budgeting is extensively used. Line-item budgeting is only applied for RGoB funded activities and does not apply for externally funded activities.

1.1. Budget Cycle

Budget Cycle refers to the steps or phases that a government needs to go through to come up with a budget. The budget cycle can be divided into five distinct phases: budget preparation, budget approval, budget execution, interim revisions, and budget accountability (see Figure A3.1).

Figure A3.1. Phases of Budget Cycle

1.2. Budget Preparation

The budget preparation phase generally occurs from November to May. The MoF prepares a budget in consultation with other ministries and agencies. This involves forecasts of receipts and expenditures, endorsement of resource envelope, budget call, preparation and submission of budget proposals, including budget discussions, budget report preparation and finalization, and budget report submission to Cabinet for endorsement. During the beginning of the year, agencies start developing budget proposals based on the given budget ceiling. The top-down budget ceiling is prepared by Macroeconomic Framework Coordination Committee (MFCC) chaired by Finance Secretary with representatives from MoF and its relevant departments, Royal Monetary Authority, the Cabinet Secretariat, National Statistics Bureau, Tourism Council of Bhutan and relevant departments of Ministry of Economic Affairs.

As per the budget ceiling determined by MFCC, the budget call notification is circulated to prepare budget proposals from agencies, which is a bottom-up budget proposal. The completed proposal is required to be submitted to the Department of Planning, Budget and Performance (DPBP) of MOF and Cabinet Secretariat together with valid justification by the month of February. If agency fails to adequately justify the proposed budget in line with planned programs, it will be either disapproved or reduced. Finalization and submission to Cabinet for endorsement is done by no later than May.

1.3. Budget Approval

The budget approval phase occurs during the month of June. Following the decisions by Cabinet on the budget package, the budget appropriation bill along with the budget report is forwarded to the National Assembly (NA), where it is debated. The Economic & Finance Committee of Parliament – members consisting of all Members of Parliament – discuss, review and submit recommendations and resolutions to the parliament for deliberation. Simultaneously, the report is presented to the National Council for review. Then, it is finally deliberated in the parliament and approval is sought from His Majesty. If approved, the bill becomes the law – Budget Appropriation Act.

1.4. Budget Execution

With the approval of the budget, the next step is to start executing it. The budget execution phase starts in July through budget notification by MoF. Agencies should then implement the planned activities during the course of a fiscal year. The fiscal year runs from July 1 through June 30.

1.5. Budget Accountability

An agency should regularly evaluate the budget to make timely revisions, reallocations or re-appropriation to the budget based on internal and external factors. The budget accountability phase encompasses the submission of a quarterly financial/physical progress report and a mid-term review of the budget. The review could bring about changes in the reallocation of resources from one agency to another if there is any deviation of the actual spending from budget funding. DPBP monitors efficient and effective utilization of budget in line with agency's planned activities through physical visits and document analysis.

1.6. Interim Revisions

The interim revisions phase involves technical adjustment and supplementary budgets. Technical adjustments include the incorporation of new activity/code, the transfer from the reserve, re-appropriation, the transfer of funds (e.g. deposit work), the transfer of personnel appropriations, the incorporation of external assistance, and the creation of the budget head for the booking of the previous year advances are made. However, in the case of a supplementary budget, the process is quite lengthy. It has to be submitted to the Parliament as a supplementary budget appropriation bill, irrespective of the current or capital budget. It is important to note that, unlike capital expenditure, the current expenditure has to be met from internal resources.

2. Methodology and Data Sources

This public environmental expenditure review (PEER) report provides an analysis of Bhutan's public environmental expenditures between FY2016/17 and 2020-2020 within all public institutions at the national, Dzongkhag, and Gewog levels.

To get the consistent understanding of the PEE, this report adopted the methodology used for the PEER 2014, the Royal Government of Bhutan, that follows a three-step approach but slightly modified:

Step 1: Transferring excel based RGoB expenditure data in to STATA software. Using a broad definition of environmental expenditures and PEE classifications, sub-activities are grouped in to nine PEE clusters.

Step 2: Organization of PEE in accordance with the classification of environmental clusters. The classification of environmental data and organization of the PEE data based on the data available in step 1.

Step 3: Analysis of the PEE data. The identified PEE activities are tabulated using STATA. It includes the budgetary allocations and expenditures for each of the 'green' budget codes under nine environmental classification clusters.

3. Analysis of Results

3.1. Public Environmental Expenditure (PEE)

Total public environmental expenditure (PEE) has been fluctuating over different period of fiscal years. Total PEE in real terms grew from Nu 2,811.4 million in 2013/14 to Nu 4,326.5 million in 2017/18 but it then declined to Nu 2,535.8 million in FY 2020/21 before increasing to Nu 3,667.3 million in the following FY before decreasing again to Nu 3,561.1 million in FY 2020/21.

The PEE for FY 2014/15 (2,593.0 million) decreased compared with FY 2013/14 (2,811.4 million), accounting for 8% drop during this period. Nonetheless, from 2014-2015, the environmental spending increased steadily for three consecutive years (FY 2015/16 to 2017/18). The highest spending is recorded during FY 2017/18. The total PEE for the FY 2017/18 is Nu 2,535.0 million, equivalent to 7.7% of the total public expenditure of Nu 56,331.4 million and 2.6% of the GDP (Nu 163,455.8 million). In FY 2018/19, the total PEE was Nu 2,535.8 million which accounted for 5.8% of the total expenditure and 1.5% of the GDP. In FY 2018/19, PEE decreased by 41.4% before picking up during FY 2019/20 and 2020/21. In FY 2019/20, the total PEE is Nu 3,667.3 million which accounted for 6.3% of the total expenditure and 2.1% of the GDP.

In general, the share of PEE to GDP remained low below 3% over the years, while its share of total public expenditure ranged between 5.0%-8.6%. The contribution of PEE as a percentage of GDP plunged to as low as 1.5% in 2018/19 from 2.8% in 2016/17, resulting in a difference of 1.3 percentage points. In 2019/20, the contribution of PEE to GDP increased slightly to 2.1%. Furthermore, considering the decline of PEE as a percentage of public expenditure (from 6.4% in 2019/20 to 5.0% in 2020/21), the total environmental spending to GDP is likely to decline during the period 2020/21.

In the case of total public expenditure (PE), in the FY 2013/14, the government public expenditure totaled Nu 34,609.9 million, which rose to Nu 56,331.4 million in FY 2017/18 until it dropped to Nu 44,054.1 million in 2018/19; and in FY 2019/20 to 2020/21, it again grew to Nu 57,572.3 million and Nu 71,091.8 million, respectively. However, the

PEE as a percentage of PE never grew beyond 8.6% between the period FY2013/14 to 2020/21. The core PEE that covers the first four clusters (Table A3.1 & TableA3.2a), which is based on the international definition of PEE, grew to Nu 1,893.4 million in FY 2020/21 from Nu 1,722.0 million in FY 2019/20. The core PEE as a percentage of GDP for the FY 2019/20 is 1%. The highest core PEE as a percentage of GDP is recorded in the FY 2017/18 with 1.3% and the lowest of 0.7% in the FY 2018/19. The core PEE as a percentage of total PEE increased to 53.2% in 2020/21 from 39.7% in FY 2013/14.

Table A3.1. GDP, Total Public Expenditure and Public Environmental Expenditure, from FY 2013/14 to FY 2020/21

Million Nu	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
GDP	109,649.3	122,461.6	136,803.7	152,322.3	163,455.8	172,950.9	175,067.3	NA
Public Expenditure (PE)	34,609.9	36,475.9	44,688.5	49,966.6	56,331.4	44,054.1	57,572.3	71,091.8
Total Public Enviromental Expenditure (PEE)	2,811.4	2,593.0	3,728.0	4,310.0	4,326.5	2,535.8	3,667.3	3,561.1
Core PEE	1,115.8	935.5	1,473.2	1,696.2	2,085.9	1,233.7	1,722.0	1,893.4
PE as % of GDP	0.3	0.3	0.3	0.3	0.3	0.3	0.3	NA
PEE as % of GDP	2.6%	2.1%	2.7%	2.8%	2.6%	1.5%	2.1%	NA
PEE as % of PE	8.1%	7.1%	8.3%	8.6%	7.7%	5.8%	6.4%	5.0%
Core PEE % of PE	3.2%	2.6%	3.3%	3.4%	3.7%	2.8%	3.0%	2.7%
Core PEE % of GDP	1.0%	0.8%	1.1%	1.1%	1.3%	0.7%	1.0%	NA
Core PEE % of Total PEE	39.7%	36.1%	39.5%	39.4%	48.2%	48.7%	47.0%	53.2%

3.2. Analysis of PEE by environmental clusters

As per the PEE Review (MoF, 2014), PEE is broken down into nine environmental clusters and 38 sub-clusters by applying environmental classifications. Table A3.2(a) and A3.2(b), including Figure A3.2(a), 2(b) and 2(c) presents summary results of the nine environmental domains over the period of different fiscal years.

Of the total nine environmental clusters, first four clusters (clusters 1-4) constitute the core PEE. In FY 2016/17, the core PEE accounted for Nu 1,696.2 million of the total PEE. Further, looking at the core PEE of Nu 2,085.9 million in the FY 2017/18, Nu 1,253.7 million in the FY 2018/19, Nu 1,722.0 million in the FY 2019/20, and Nu 1,893.4million in the FY 2020/21, the corresponding share to the total PEE is comparatively low. It accounted for 39.4% in FY 2016/17; 48.2% in the FY 2017/18; and 48.7% in 2018/19. The share of core PEE declined slightly in FY 2019/20 to 47.0% from FY 2018/19; but it increased to 53.2 % in FY 2020/21.

Wide disparity exists in PEE made by type of environmental activities. Overall, looking at the share of PEE among the nine clusters, the PEE on environmental mainstreaming has the highest share out of the total PEE throughout different periods (Table A3.2(a) and A3.2(b)). Environmental mainstreaming includes all environmental related activity costs for road construction, including farm road, access road and feeder road.

The total environmental expenditure is dominated by three major clusters over the period. They are (1). Environmental mainstreaming; (2) Urban, rural and industrial environmental management; and (3.) Climate change. These three clusters made up a combined percentage of 69.1%, 73.9%, 70.7% and 73.6% during the FY 2016/17, FY 2017/18, FY 2019/20 and FY 2020/21, respectively. However, their combined share was only 38.8% in FY 2018/19. On average, the urban, rural and industrial environmental management was the cluster with the majority of expenditure. Among the core PEE, urban, rural and industrial environment recorded the highest increase of Nu 1,424.4 million in 2020/21 from Nu 1,150.7 million in 2016/17, which is equal to 8.0% increase.

Table A3.2(a). Public Environmental Expenditures by Main Clusters (Million Nu)

Environmental Clusters	2016/17-2017/18	
	Absolute	Relative (%)
1. Environmental Protection	-9.4	-0.2
2. Urban, Rural and Industrial Environmental Management	544.2	12.5
3. Biodiversity Conservation	-182.4	-4.2
4. Information and Knowledge	37.4	0.8
Total Core PEE (Cluster 1-4)	389.7	8.9
5. Natural Resource Management	-3.7	-0.1
6. Soil Conservation and Land Management	-47.4	-1.1
7. Climate Change	-321.3	-7.5
8. Environmental mainstreaming	-4.1	-0.1
9. Miscellaneous (Other)	3.1	0.1
Total Non-Core PEE (Cluster 5-9)	-373.3	-8.9
Total PEE (Cluster 1-9)	16.5	

Environmental Clusters	2017/18-2018/19	
	Absolute	Relative (%)
1. Environmental Protection	1.9	0.0
2. Urban, Rural and Industrial Environmental Management	-827.6	-19.1
3. Biodiversity Conservation	-38.3	-0.9
4. Information and Knowledge	11.7	0.3
Total Core PEE (Cluster 1-4)	-852.3	0.4
5. Natural Resource Management	-138.9	-3.2
6. Soil Conservation and Land Management	-101.0	-2.3
7. Climate Change	-353.3	-8.1
8. Environmental mainstreaming	-342.8	-7.9
9. Miscellaneous (Other)	-2.4	-0.1
Total Non-Core PEE (Cluster 5-9)	-938.5	-0.4
Total PEE (Cluster 1-9)	-1790.7	

Environmental Clusters	2018/19-2019/20	
	Absolute	Relative (%)
1. Environmental Protection	6.8	0.2
2. Urban, Rural and Industrial Environmental Management	361.8	13.4
3. Biodiversity Conservation	106.6	3.4
4. Information and Knowledge	13.1	1.4
Total Core PEE (Cluster 1-4)	488.3	-1.7
5. Natural Resource Management	77.3	3.1
6. Soil Conservation and Land Management	-7.4	0.8
7. Climate Change	425.8	13.8
8. Environmental mainstreaming	130.7	4.7
9. Miscellaneous (Other)	16.9	0.5
Total Non-Core PEE (Cluster 5-9)	643.3	1.7
Total PEE (Cluster 1-9)	1131.6	

Environmental Clusters	2019/20-2020/21	
	Absolute	Relative (%)
1. Environmental Protection	-3.6	-0.1
2. Urban, Rural and Industrial Environmental Management	195.3	6.5
3. Biodiversity Conservation	-61.4	-1.5
4. Information and Knowledge	41.2	1.4
Total Core PEE (Cluster 1-4)	171.5	6.2
5. Natural Resource Management	-116.9	-3.0
6. Soil Conservation and Land Management	-8.3	0.0
7. Climate Change	-244.6	-6.1
8. Environmental mainstreaming	78.6	2.5
9. Miscellaneous (Other)	13.6	0.4
Total Non-Core PEE (Cluster 5-9)	-277.6	-6.2
Total PEE (Cluster 1-9)	-106.2	

Environmental Clusters	2019/20-2020/21	
	Absolute	Relative (%)
1. Environmental Protection	-4.3	0.0
2. Urban, Rural and Industrial Environmental Management	273.7	13.3
3. Biodiversity Conservation	-175.6	-3.3
4. Information and Knowledge	103.5	3.9
Total Core PEE (Cluster 1-4)	197.2	13.8
5. Natural Resource Management	-182.3	-3.3
6. Soil Conservation and Land Management	-164.2	-2.7
7. Climate Change	-493.4	-7.9
8. Environmental mainstreaming	-137.5	-0.9
9. Miscellaneous (Other)	31.2	0.9
Total Non-Core PEE (Cluster 5-9)	-946.1	-13.8
Total PEE (Cluster 1-9)	-748.9	

Table A3.2(b). Difference in Public Environmental Expenditures by Main Clusters (Million Nu)

Environmental Clusters	2016/17	
	Mill. Nu	%
1. Environmental Protection	17.2	0.4
2. Urban, Rural and Industrial Environmental Management	1,150.7	26.7
3. Biodiversity Conservation	331.4	7.7
4. Information and Knowledge	196.9	4.6
Total Core PEE (Cluster 1-4)	**1,696.2**	**39.4**
5. Natural Resource Management	377.9	8.8
6. Soil Conservation and Land Management	397.4	9.2
7. Climate Change	1,212.6	28.1
8. Environmental mainstreaming	614.0	14.2
9. Miscellaneous (Other)	11.8	0.3
Total Non-Core PEE (Cluster 5-9)	**2,613.8**	60.6
Total PEE (Cluster 1-9)	**4,310.0**	**100.0**

Environmental Clusters	2017/18	
	Mill. Nu	%
1. Environmental Protection	7.8	0.2
2. Urban, Rural and Industrial Environmental Management	1,694.9	39.2
3. Biodiversity Conservation	148.9	3.4
4. Information and Knowledge	234.3	5.4
Total Core PEE (Cluster 1-4)	**2,085.9**	**48.2**
5. Natural Resource Management	374.3	8.7
6. Soil Conservation and Land Management	350.1	8.1
7. Climate Change	891.4	20.6
8. Environmental mainstreaming	610.0	14.1
9. Miscellaneous (Other)	14.9	0.3
Total Non-Core PEE (Cluster 5-9)	**2,240.6**	**51.8**
Total PEE (Cluster 1-9)	**4,326.5**	**100.0**
Environmental Clusters	**2018/19**	
	Mill. Nu	**%**
1. Environmental Protection	9.7	0.2
2. Urban, Rural and Industrial Environmental Management	867.3	20.1
3. Biodiversity Conservation	110.6	2.6
4. Information and Knowledge	246.0	5.7
Total Core PEE (Cluster 1-4)	**1,233.7**	**48.7**
5. Natural Resource Management	235.3	5.5
6. Soil Conservation and Land Management	249.0	5.8
7. Climate Change	538.0	12.5
8. Environmental mainstreaming	267.1	6.2
9. Miscellaneous (Other)	12.6	0.3
Total Non-Core PEE (Cluster 5-9)	**1,302.1**	**51.3**
Total PEE (Cluster 1-9)	**2,535.8**	**100.0**

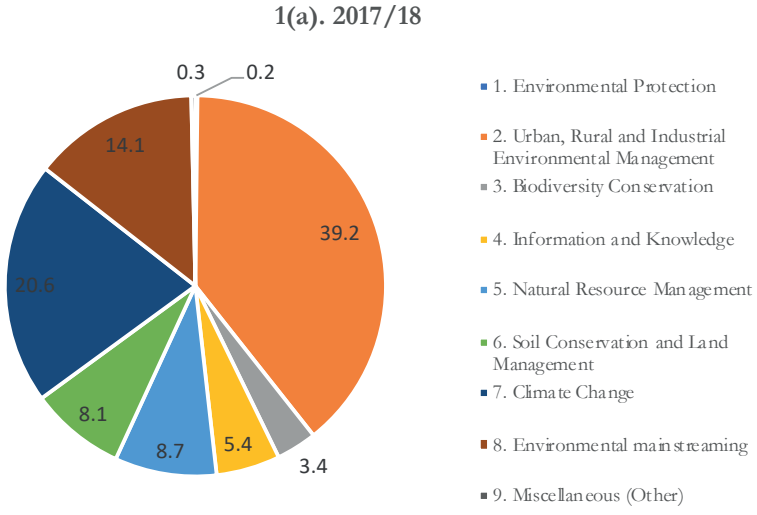
Environmental Clusters	2019/20	
	Mill. Nu	%
1. Environmental Protection	16.5	0.4
2. Urban, Rural and Industrial Environmental Management	1,229.1	33.5
3. Biodiversity Conservation	217.2	5.9
4. Information and Knowledge	259.1	7.1
Total Core PEE (Cluster 1-4)	**1,722.0**	**47.0**
5. Natural Resource Management	312.6	8.5
6. Soil Conservation and Land Management	241.6	6.6
7. Climate Change	963.8	26.3
8. Environmental mainstreaming	397.9	10.8
9. Miscellaneous (Other)	29.5	0.8
Total Non-Core PEE (Cluster 5-9)	**1,945.4**	**53.0**
Total PEE (Cluster 1-9)	**3,667.3**	**100.0**

Environmental Clusters	2020/21	
	Mill. Nu	%
1. Environmental Protection	12.8	0.4
2. Urban, Rural and Industrial Environmental Management	1,424.4	40.0
3. Biodiversity Conservation	155.8	4.4
4. Information and Knowledge	300.3	8.4
Total Core PEE (Cluster 1-4)	**1,893.4**	**53.2**
5. Natural Resource Management	195.7	5.5
6. Soil Conservation and Land Management	233.3	6.6
7. Climate Change	719.3	20.2
8. Environmental mainstreaming	476.5	13.4
9. Miscellaneous (Other)	43.0	1.2
Total Non-Core PEE (Cluster 5-9)	**1,667.7**	**46.8**
Total PEE (Cluster 1-9)	**3,561.1**	**100.0**

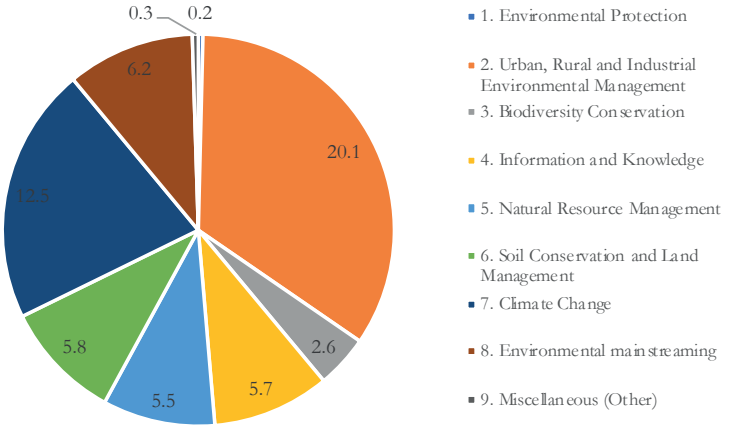
Other clusters also saw growth during the 2016/17 to 2020/21 period. Information and knowledge grew from 2.6% (Nu 196.9 million) in 2016/17 to 4.8% (Nu 300.3 million) in 2020/21.

The PEE on environmental mainstreaming in real terms declined to as low as Nu 267.1 million in FY 2018/19 from Nu 6,14.0 million in FY 2016/17; it then gradually grew to Nu 397.9 million in FY 2019/20 and to Nu 4,76.5 million in FY 2020/21. In absolute terms, the highest drop in PEE on urban, rural and industrial environment Nu 827.6 million in 2017/18 – 2018/19 while it recorded the highest increase of Nu 544.2 million in 2016/17 – 2017/18 (Table A3.2(b)). Also, there was an increase of Nu 361.8 million from FY 2018/19 to FY 2019/20; with relative increase of 13.4% (Table A3.2(b)).

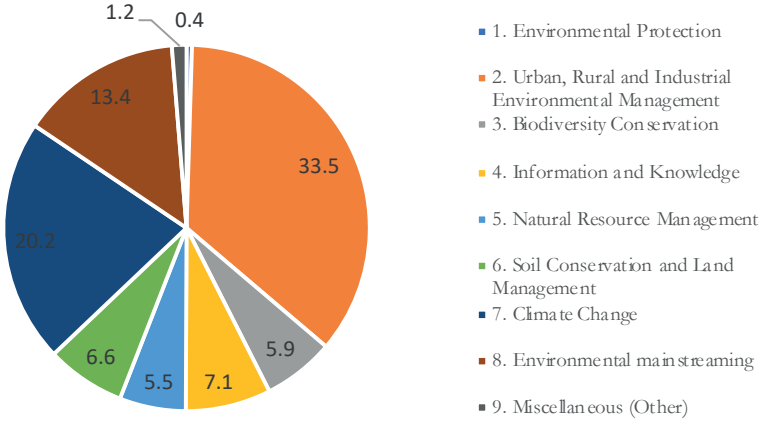
Figure A3.2 (a,b,c,d): Composition of PEE by Environmental Clusters



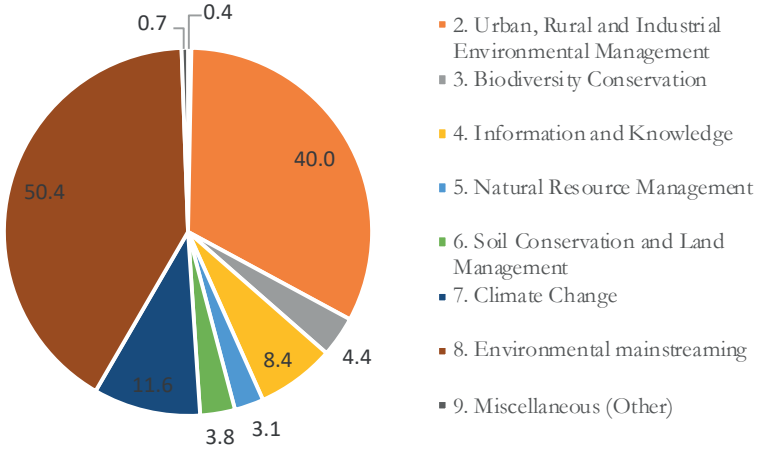
1(b). 2018/19



1(c). 2019/20



1(d). 2020/21



3.3. Analysis of PEE by RGoB programs

The analysis of PEE based on RGoB programs reveals further interesting results. The share of the RGoB programs of the PEE for each of the environmental clusters is presented in Table A3.3. The 'General Administration and Direction Services' accounted for the highest share of total PEE with 25.0% in FY 2016/17, closely followed by 'Other programs' (24.6%) and 'Agriculture Services' (21.4%) (Figure A3.2). These three RGoB programs, including 'Other programs', hold the majority share of total PEE in the following Fys as well. However, the share of 'Agriculture Services' has been decreasing over the years until FY 2019/20 while the shares for other two programs have been increasing during the same period. 'Urban Development and Engineering Services' and "Energy Services' accounted for the lowest share of total PEE over the period (Table A3.3 and Figure A3.3).

Table A3.3. PEE by RGoB Programs

RGoB Program	2016/17	
	Mill. Nu	%
Forestry services	296.8	8.4
Roads and bridge services	822.9	23.3
Agriculture services	1,025.6	29.1
Urban Development and Engineering services	5.5	0.2
General administration & Direction Services	650.8	18.4
Health services	167.4	4.7
Energy services	16.3	0.5
Other programmes	543.7	15.4
Total	**3,529.0**	**100.0**

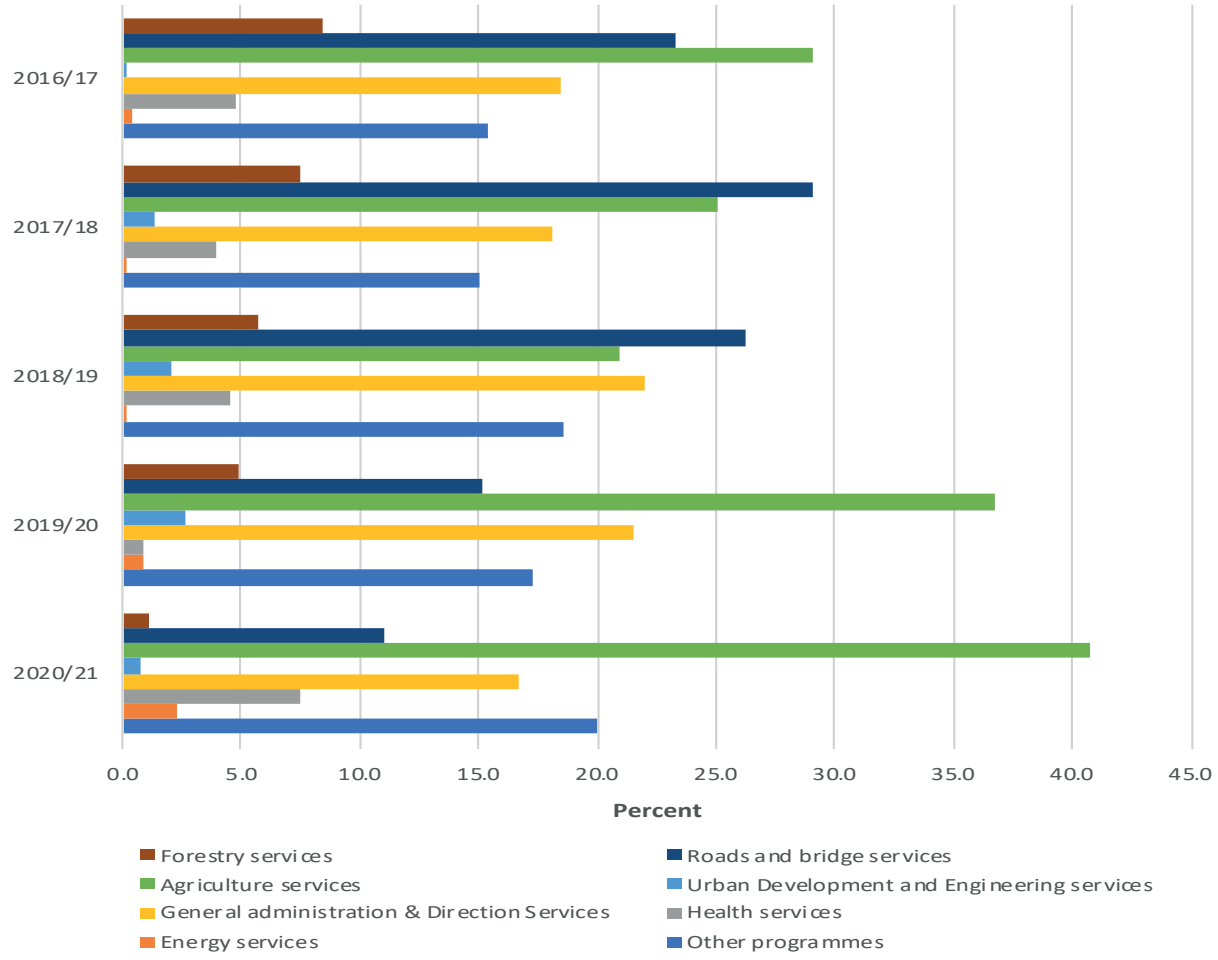
RGoB Program	2017/18	
	Mill. Nu	%
Forestry services	251.5	7.5
Roads and bridge services	973.9	29.1
Agriculture services	839.3	25.1
Urban Development and Engineering services	43.9	1.3
General administration & Direction Services	604.3	18.1
Health services	132.5	4.0
Energy services	0.9	0.0
Other programmes	501.5	15.0
Total	**3,347.9**	**100.0**

RGoB Program	2018/19	
	Mill. Nu	%
Forestry services	121.2	5.7
Roads and bridge services	562.7	26.3
Agriculture services	449.0	21.0
Urban Development and Engineering services	44.4	2.1
General administration & Direction Services	470.5	22.0
Health services	96.5	4.5
Energy services	1.2	0.1
Other programmes	397.5	18.5
Total	**2,143.0**	**100.0**

RGoB Program	2019/20	
	Mill. Nu	%
Forestry services	118.7	4.9
Roads and bridge services	370.7	15.2
Agriculture services	895.8	36.7
Urban Development and Engineering services	65.7	2.7
General administration & Direction Services	525.0	21.5
Health services	22.0	0.9
Energy services	22.2	0.9
Other programmes	420.8	17.2
Total	**2,441.0**	**100.0**

RGoB Program	2020/21	
	Mill. Nu	%
Forestry services	27.1	1.1
Roads and bridge services	277.3	11.0
Agriculture services	1,027.8	40.7
Urban Development and Engineering services	19.6	0.8
General administration & Direction Services	420.4	16.7
Health services	189.2	7.5
Energy services	56.9	2.3
Other programmes	505.0	20.0
Total	**2,523.2**	**100.0**

Figure A3.3. RGoB Programs' share of PEE for FY 2016/17 to FY 2020/21



3.4. Analysis of PEE by agency

Public expenditure is executed at three levels of government: the central, which includes spending by the ministries, autonomous agencies, council and authorities; Dzongkhag; and Gewog. For the purpose of the analysis, it is further re-grouped into (i) Autonomous agencies, (ii) Ministries, and (iii) Local level (Dzongkhag and Gewog). With decentralized reforms in the country, funds are directly allocated to local government for implementing various developmental activities, including expenditures for environmental activities.

Table A3.4 and Figure A3.4(a,b,c,d) shows the distribution of PEE by Government spending agencies further broken down at the central, Dzongkhags and Gewog levels in FY 2016/17 to 2020/21. Most of the expenditure was incurred at the central level, followed by Dzongkhag and Gewog level. In FY 2016/17, central government executed 60.9% of the total PEE (Nu 4,310.0 million), followed by Gewogs at 21.8%, and Dzongkhags, which spent the least, at 17.3% of the total PEE. Similar trend of spending was observed in FY 2017/18 with slight increase in central and Dzongkhag level spending at the cost of declining PEE by the Gewog. In FY 2018/19, central government PEE grew to 65.4% from 62.3% in FY 2017/18, while it slightly dropped at Dzongkhag (from 23.8% in 2017/18 to 22.4% in 2018/19) and gewog (from 13.9% in 2017/18 to 12.2% in 2018/19) level. However, the situation in FY 2019/20 and 2020/21 shows a decline in PEE at the central level, which has been associated with corresponding increase at Dzongkhag and Gewog level. In FY 2019/20, the PEE incurred at the central (51.8%, Nu 1,901.0 million) declined with increase at Dzongkhag (32.2%, 1,182.5 million) and

Gewog (15.9%, Nu 583.8 million) level compared to FY 2018/19. PEE by the central government further declined to 39.4% in 2020/21, while expenditure by the Dzongkhag and Gewog rose to 42.2% and 18.4% respectively during the same period.

Figure A3.4 (a,b,c,d). Distribution of PEE by level of government

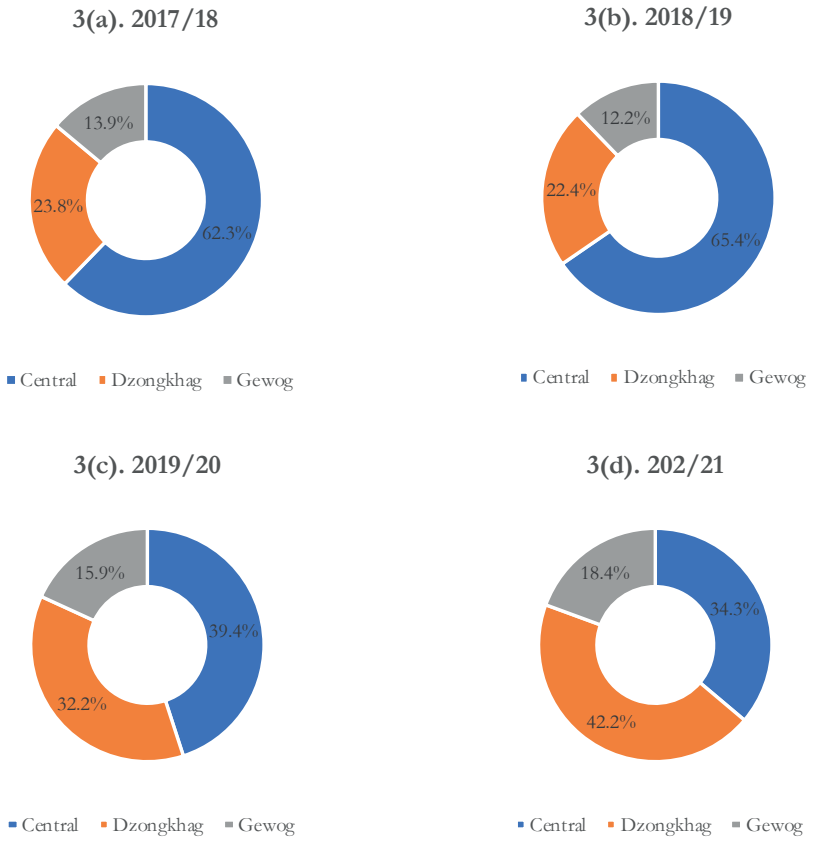


Table A3.4. Public Environment Expenditure by Central and Local Government

Environmental Clusters	2016/17				
	Agency				
In Million Nu.	Cen.	Dzo.	Geo.	Total	%
1. Environmental Protection	10.4	1.0	5.7	17.2	0.4
2. Urban, Rural and Industrial Environmental Management 397.0 549.3			204.5	1,150.7	26.7
3. Biodiversity Conservation	258.9	67.7	4.7	331.4	7.7
4. Information and Knowledge	155.4	20.1	21.4	196.9	4.6
5. Natural Resource Management	178.0	54.7	145.2	377.9	8.8
6. Soil Conservation and Land Management	376.3	9.2	12.0	397.4	9.2
7. Climate Change	834.1	196.4	182.1	1,212.6	28.1
8. Environmental mainstreaming	403.9	42.0	168.1	614.0	14.2
9. Miscellaneous (Other)	10.9	0.9	0.0	11.8	0.3
Total Public Environmental Expenditure2,625.0		**941.3**	**743.7**	**4,310.0**	**100.0**
Percentage	**60.9%**	**21.8%**	**17.3%**		

Environmental Clusters	2017/18				
	Agency				
In Million Nu.	Cen.	Dzo.	Geo.	Total	%
1. Environmental Protection	3.1	0.7	4.0	7.8	0.2
2. Urban, Rural and Industrial Environmental Management 397.0 549.3	942.0	579.4	173.5	1,694.9	39.2
3. Biodiversity Conservation	86.7	59.2	3.1	148.9	3.4
4. Information and Knowledge	185.1	33.5	15.7	234.3	5.4
5. Natural Resource Management	209.8	56.7	107.8	374.3	8.7
6. Soil Conservation and Land Management	324.7	5.9	19.4	350.1	8.1
7. Climate Change	522.0	226.6	142.7	891.4	20.6
8. Environmental mainstreaming	414.4	58.6	136.9	610.0	14.1
9. Miscellaneous (Other)	5.5	9.1	0.3	14.9	0.3
Total Public Environmental Expenditure2,625.0	**2,693.4**	**1,029.6**	**603.5**	**4,326.5**	**100.0**
Percentage	**62.3%**	**23.8%**	**13.9%**		

Environmental Clusters	2018/19				
	Agency				
In Million Nu.	Cen.	Dzo.	Geo.	Total	%
1. Environmental Protection	5.5	1.3	2.9	9.7	0.4
2. Urban, Rural and Industrial Environmental Management 397.0 549.3	409.9	360.4	97.0	867.3	34.2
3. Biodiversity Conservation	86.9	20.8	2.9	110.6	4.4
4. Information and Knowledge	213.3	26.8	5.8	246.0	9.7
5. Natural Resource Management	137.8	42.7	54.9	235.3	9.3
6. Soil Conservation and Land Management	224.3	12.0	12.7	249.0	9.8
7. Climate Change	350.8	97.4	89.9	538.0	21.2
8. Environmental mainstreaming	219.8	4.1	43.3	267.1	10.5
9. Miscellaneous (Other)	10.4	2.2	-	12.6	0.5
Total Public Environmental Expenditure2,625.0	**1,658.8**	**567.6**	**309.4**	**2,535.8**	**100.0**
Percentage	**65.4%**	**22.4%**	**12.2%**		

Environmental Clusters	2019/20				
	Agency				
In Million Nu.	Cen.	Dzo.	Geo.	Total	%
1. Environmental Protection	9.2	5.6	1.7	16.5	0.4
2. Urban, Rural and Industrial Environmental Management 397.0 549.3	524.9	512.2	192.1	1,229.1	33.5
3. Biodiversity Conservation	115.5	97.5	4.2	217.2	5.9
4. Information and Knowledge	212.5	40.2	6.5	259.1	7.1
5. Natural Resource Management	131.8	75.3	105.5	312.6	8.5
6. Soil Conservation and Land Management	201.8	25.8	14.0	241.6	6.6
7. Climate Change	550.3	252.5	161.0	963.8	26.3
8. Environmental mainstreaming	143.9	155.1	98.9	397.9	10.8
9. Miscellaneous (Other)	11.2	18.3	-	29.5	0.8
Total Public Environmental Expenditure2,625.0	1,901.0	1,182.5	583.8	3,667.3	100.0
Percentage	**51.8%**	**32.2%**	**15.9%**		

Environmental Clusters	2020/21				
	Agency				
In Million Nu.	Cen.	Dzo.	Geo.	Total	%
1. Environmental Protection	5.9	5.5	1.5	12.8	0.4
2. Urban, Rural and Industrial Environmental Management 397.0 549.3	387.8	803.0	233.6	1,424.4	40.0
3. Biodiversity Conservation	35.8	107.8	12.1	155.8	4.4
4. Information and Knowledge	286.6	10.9	2.8	300.3	8.4
5. Natural Resource Management	64.0	47.2	84.4	195.7	5.5
6. Soil Conservation and Land Management	202.9	10.2	20.2	233.3	6.6
7. Climate Change	259.5	281.6	178.1	719.3	20.2
8. Environmental mainstreaming	136.0	217.6	122.8	476.5	13.4
9. Miscellaneous (Other)	25.1	17.9	-	43.0	1.2
Total Public Environmental Expenditure2,625.0	1,403.7	1,501.8	655.6	3,561.1	100.0
Percentage	**39.4%**	**42.2%**	**18.4%**		

3.5. Analysis of PEE by economic activity

The analysis is carried out at the highest level of aggregation, i.e. current and capital budget and expenditure. Table 5 shows the expenditure modalities of PE and PEE by economic activity. An overwhelming 87.5% of the aggregated PEE (18,400.7 million) made between 2016-2027 and 2020/21 were capital expenditures and just 12.5% current expenses. This is evident when current and capital expenditure is broken-down by fiscal years. Out of total Nu 4,310.0 million spent on PEE in FY 2016/17; 83.6% (Nu 3,605.1 million) was capital expenditure. The proportion of capital expenditure grew over the years and peaked at 95.1% in FY 2020/21. On the contrary, the share of current PEE declined over the years and reached 4.9% in FY 2020/21 compared to 16.4% in FY 2016/17.

Table A3.5. Analysis of PE and PEE by Current and Capital Expenditure

Budget/Expenditure	2016/17					
	Current		Capital		Total	
	Mill. Nu.	%	Mill. Nu.	%	Mill. Nu.	%
Public Environmental Expenditure (PEE)						
Budget	736.0	13.4	4,755.3	86.6	5,491.3	100.0
Expenditure	704.9	16.4	3,605.1	83.6	4,310.0	100.0
Public Expenditure						
Budget	25,054.9	43.4	32,660.0	56.6	57,714.8	100.0
Expenditure	24,129.6	48.3	25,837.0	51.7	49,966.6	100.0

Budget/Expenditure	2017/18					
	Current		Capital		Total	
	Mill. Nu.	%	Mill. Nu.	%	Mill. Nu.	%
Public Environmental Expenditure (PEE)						
Budget	711.7	13.8	4,455.0	86.2	5,166.7	100.0
Expenditure	684.1	15.8	3,642.3	84.2	4,326.5	100.0
Public Expenditure						
Budget	28,550.7	45.6	34,093.0	54.4	62,643.6	100.0
Expenditure	27,494.7	48.8	28,836.7	51.2	56,331.4	100.0

Budget/Expenditure	2018/19					
	Current		Capital		Total	
	Mill. Nu.	%	Mill. Nu.	%	% Mill. Nu.	%
Public Environmental Expenditure (PEE)						
Budget	415.9	13.6	2,651.4	86.4	3,067.3	100.0
Expenditure	396.8	15.6	2,138.9	84.4	2,535.8	100.0
Public Expenditure						
Budget	29,171.7	58.9	20,355.8	41.1	49,527.6	100.0
Expenditure	27,768.7	63.0	16,285.5	37.0	44,054.1	100.0

Budget/Expenditure	2019/20					
	Current		Capital		Total	
	Mill. Nu.	%	Mill. Nu.	%	Mill. Nu.	%
Public Environmental Expenditure (PEE)						
Budget	376.1	7.8	4,450.4	92.2	4,826.5	100.0
Expenditure	338.5	9.2	3,328.8	90.8	3,667.3	100.0
Public Expenditure						
Budget	37,309.1	54.2	31,510.4	45.8	68,819.5	100.0
Expenditure	35,525.4	61.7	22,046.9	38.3	57,572.3	100.0

Budget/Expenditure	2020/21					
	Current		Capital		Total	
	Mill. Nu.	%	Mill. Nu.	%	Mill. Nu.	%
Public Environmental Expenditure (PEE)						
Budget	177.9	3.1	5,567.9	96.9	5,745.8	100.0
Expenditure	175.8	4.9	3,385.4	95.1	3,561.1	100.0
Public Expenditure						
Budget	44,490.6	52.1	40,890.8	47.9	####	100.0
Expenditure	43,515.8	61.2	27,576.0	38.8	####	100.0

Table A3.6 shows the source of funding for each environmental cluster. Though the amount was not much, the largest share of external funding was provided for 'miscellaneous (other)' in all years, ranging from 66.8% (FY 2016/17) to as high as 99.4% (FY 2020/21). The second highest share was provided for 'Biodiversity Conservation' with 64% in FY 2016/17 (Nu 213.3 million). In FY 2017/18, the second highest share was for 'Urban, Rural and Industrial Environmental Management' with 68.9% share.

The external funding provided for 'soil conservation and land management' has consistently remained at the lowest throughout the last five FY's with as low as 5.8% (in FY 2018/19).

3.6. PEE and budget efficiency

Budget efficiency is gauged by the ratio of actual expenditure to budget allocation. Table 7 shows the overall budget efficiency for five years of the total public expenditure and for PEE. During the FY 2016/17, the PEE budget absorption rate was 78.5% with expenditure totaling to Nu 4,310.0 million out of a total budget allocation of Nu 5,491.3 million. During the FY 2017/18, the ratio increased to 83.7 % with expenditure amounting to Nu 4,326.5 million against the budget allocation of Nu 5,166.7 million. In the FY 2018/19, the PEE budget absorption rate remained almost same at 82.7 % with expenditure amounting to Nu 2,535.8 million. However, in FY 2019/20 and FY 2020/21, the PEE budget absorption rate reduced to 76.0% and 62.0%, respectively.

In contrast, the budget efficiency in case of total public expenditure is 86.6 %, 89.9% and 88.9 % in FY 2016/17, 2017/18 and 2018/19 respectively. In FY 2019/20 and FY 2021, the budget efficient dropped to around 83% (Table 7). The PEE budget efficiency is lower than the PE by at least six percentage points during these periods. A comparative analysis of budget efficiency among central ministries, autonomous agencies, and local governments indicates that the PEE efficiency of local government is the highest in all FY.

Table A3.6: Source of Funding according to Environmental Clusters

Expenditure	2016/17				
	Source			External	RGoB
Milliom Nu.	RGoB	External	Total	%	%
1. Environmental Protection	12.6	4.6	17.2	26.9	73.1
2. Urban, Rural and Industrial Environmental Management	504.7	646.1	1,150.7	56.1	43.9
3. Biodiversity Conservation	118.1	213.3	331.4	64.4	35.6
4. Information and Knowledge	113.9	83.0	196.9	42.2	57.8
5. Natural Resource Management	257.6	120.4	377.9	31.9	68.1
6. Soil Conservation and Land Management	371.0	26.5	397.4	6.7	93.3
7. Climate Change	587.6	625.0	1,212.6	51.5	48.5
8. Environmental mainstreaming	238.5	375.6	614.0	61.2	38.8
9. Miscellaneous (Other)	3.9	7.9	11.8	66.8	33.2
Total Public Environmental Expenditure	**2,207.7**	**2,102.3**	**4,310.0**	**48.8**	**51.2**

Expenditure	2017/18				
	Source			External	RGoB
Milliom Nu.	RGoB	External	Total	%	%
1. Environmental Protection	4.8	3.0	7.8	38.8	61.2
2. Urban, Rural and Industrial Environmental Management	526.6	1,168.3	1,694.9	68.9	31.1
3. Biodiversity Conservation	107.5	41.4	148.9	27.8	72.2
4. Information and Knowledge	132.0	102.2	234.3	43.6	56.4
5. Natural Resource Management	226.7	147.5	374.3	39.4	60.6
6. Soil Conservation and Land Management	329.5	20.6	350.1	5.9	94.1
7. Climate Change	454.8	436.6	891.4	49.0	51.0
8. Environmental mainstreaming	237.1	372.9	610.0	61.1	38.9
9. Miscellaneous (Other)	4.3	10.6	14.9	71.4	28.6
Total Public Environmental Expenditure	**2,023.3**	**2,303.2**	**4,326.5**	**53.2**	**46.8**

Expenditure	2018/19				
	Source			External	RGoB
Milliom Nu.	RGoB	External	Total	%	%
1. Environmental Protection	3.7	6.0	9.7	62.0	38.0
2. Urban, Rural and Industrial Environmental Management	365.6	501.7	867.3	57.8	42.2
3. Biodiversity Conservation	95.6	15.1	110.6	13.6	86.4
4. Information and Knowledge	104.3	141.7	246.0	57.6	42.4
5. Natural Resource Management	151.1	84.2	235.3	35.8	64.2
6. Soil Conservation and Land Management	234.7	14.4	249.0	5.8	94.2
7. Climate Change	264.7	273.3	538.0	50.8	49.2

8. Environmental mainstreaming	141.1	126.0	267.1	47.2	52.8
9. Miscellaneous (Other)	3.3	9.2	12.6	73.5	26.5
Total Public Environmental Expenditure	**1,364.2**	**1,171.6**	**2,535.8**	**46.2**	**53.8**

Expenditure	2019/20				
	Source			External	RGoB
Milliom Nu.	RGoB	External	Total	%	%
1. Environmental Protection	7.0	9.5	16.5	57.4	42.6
2. Urban, Rural and Industrial Environmental Management	379.0	850.1	1,229.1	69.2	30.8
3. Biodiversity Conservation	177.8	39.4	217.2	18.1	81.9
4. Information and Knowledge	128.0	131.1	259.1	50.6	49.4
5. Natural Resource Management	136.4	176.2	312.6	56.4	43.6
6. Soil Conservation and Land Management	206.7	34.9	241.6	14.4	85.6
7. Climate Change	194.9	768.9	963.8	79.8	20.2
8. Environmental mainstreaming	182.0	215.8	397.9	54.2	45.8
9. Miscellaneous (Other)	3.5	26.0	29.5	88.1	11.9
Total Public Environmental Expenditure	**1,415.5**	**2,251.8**	**3,667.3**	**61.4**	**38.6**

Expenditure	2020/21				
	Source			External	RGoB
Milliom Nu.	RGoB	External	Total	%	%
1. Environmental Protection	1.6	11.2	12.8	87.4	12.6
2. Urban, Rural and Industrial Environmental Management	470.2	954.2	1,424.4	67.0	33.0
3. Biodiversity Conservation	112.7	43.1	155.8	27.7	72.3
4. Information and Knowledge	63.7	236.6	300.3	78.8	21.2
5. Natural Resource Management	122.2	73.4	195.7	37.5	62.5
6. Soil Conservation and Land Management	218.4	14.9	233.3	6.4	93.6
7. Climate Change	411.6	307.7	719.3	42.8	57.2
8. Environmental mainstreaming	169.8	306.6	476.5	64.4	35.6
9. Miscellaneous (Other)	0.3	42.8	43.0	99.4	0.6
Total Public Environmental Expenditure	**1,570.6**	**1,990.6**	**3,561.1**	**55.9**	**44.1**

Table A3.7. Budget efficiency of Autonomous Agencies, Central and Local Government

Budget/Expenditure	2016/17			
	Autonomus Agencies	Ministry	Dzongkhag & Gewog	Total
AU Codes				
Public Environmental Expenditure (PEE)				
Budget	262.7	3,262.7	1,965.9	5,491.3
Expenditure	188.7	2,436.3	1,685.0	4,310.0
Effeciency	71.9%	74.7%	85.7%	78.5%
Public Expenditure				
Budget	8,287.1	33,112.9	16,314.8	57,714.8
Expenditure	7,126.5	27,790.2	15,050.0	49,966.6
Efficiency	86.0%	83.9%	92.2%	86.6%
Effeciency difference % point	-14.1%	-9.3%	-6.5%	-8.1%

Budget/Expenditure	2017/18			
	Autonomus Agencies	Ministry	Dzongkhag & Gewog	Total
AU Codes				
Public Environmental Expenditure (PEE)				
Budget	181.6	3,248.6	1,736.5	5,166.7
Expenditure	140.0	2,553.4	1,633.1	4,326.5
Effeciency	77.1%	78.6%	94.0%	83.7%
Public Expenditure				
Budget	8,452.3	38,709.7	15,481.6	62,643.6
Expenditure	7,570.9	33,752.4	15,008.0	56,331.4
Efficiency	89.6%	87.2%	96.9%	89.9%
Effeciency difference % point	-12.5%	-8.6%	-2.9%	-6.2%

Budget/Expenditure	2018/19			
	Autonomus Agencies	Ministry	Dzongkhag & Gewog	Total
AU Codes				
Public Environmental Expenditure (PEE)				
Budget	127.8	1,998.2	941.4	3,067.3
Expenditure	113.2	1,545.5	877.0	2,535.8
Effeciency	88.6%	77.3%	93.2%	82.7%
Public Expenditure				
Budget	7,753.6	28,365.6	13,408.4	49,527.6
Expenditure	7,166.8	24,003.9	12,883.4	44,054.1
Efficiency	92.4%	84.6%	96.1%	88.9%
Effeciency difference % point	-3.8%	-7.3%	-2.9%	-6.3%

Budget/Expenditure	2019/20			
	Autonomus Agencies	Ministry	Dzongkhag & Gewog	Total
AU Codes				
Public Environmental Expenditure (PEE)				
Budget	181.5	2,436.3	2,208.6	4,826.5
Expenditure	125.5	1,775.4	1,766.3	3,667.3
Effeciency	69.2%	72.9%	80.0%	76.0%
Public Expenditure				
Budget	8,754.8	37,703.0	22,361.8	68,819.5
Expenditure	7,496.5	29,817.2	20,258.5	57,572.3
Efficiency	85.6%	79.1%	90.6%	83.7%
Effeciency difference % point	-16.5%	-6.2%	-10.6%	-7.7%

Budget/Expenditure	2020/21			
	Autonomus Agencies	Ministry	Dzongkhag & Gewog	Total
AU Codes				
Public Environmental Expenditure (PEE)				
Budget	537.3	1,923.1	3,285.5	5,745.8
Expenditure	243.9	1,159.8	2,157.4	3,561.1
Effeciency	45.4%	60.3%	65.7%	62.0%
Public Expenditure				
Budget	9,072.9	48,480.0	27,828.5	85,381.4
Expenditure	7,489.0	40,262.3	23,340.5	71,091.8
Efficiency	82.5%	83.0%	83.9%	83.3%
Effeciency difference % point	-37.1%	-22.7%	-18.2%	-21.3%

3.7. Changes in PEE from FY 2016/17 to FY 2020/21

As shown in Table 8, the ratio of PEE in total public expenditure decreased from 8.6% in FY 2016/17 to 7.7% in FY 2017/18 and further decreased to 5.8% in F 2018/19. However, the ratio of PEE in total public expenditure slightly increased from 5.8 % in FY 2018/19 to 6.4%. This is mainly because of the increase in external fund from 13.3% to 14.1% during the period.

The percentage of PEE that was funded by the RGoB decreased over the years – from 6.4% in FY 20169-2017 to 3.6 % in FY 2020/21.

In terms of external funding, the ratio of PEE in total public expenditure which was 13.8 % in FY 2016/17 decreased by around half, to 7.3 % in FY 2020/21. However, during the FY 2019/20, the ratio of PEE in total public expenditure slightly increased by one percentage point.

Table A3.8. Share of PEE in Total Expenditure

Expenditure	2016/17		
In Million Nu.	PE	PEE	%
External Fund	15,213.0	2,102.3	13.8%
RGoB (domestic)	34,753.6	2,207.7	6.4%
Total	**49,966.6**	**4,310.0**	8.6%

Expenditure	2017/18		
In Million Nu.	PE	PEE	%
External Fund	17,134.1	2,303.2	13.4%
RGoB (domestic)	39,197.3	2,023.3	5.2%
Total	**56,331.4**	**4,326.5**	**7.7%**

Expenditure	2018/19		
In Million Nu.	PE	PEE	%
External Fund	8,837.1	1,171.6	13.3%
RGoB (domestic)	35,217.0	1,364.2	3.9%
Total	**44,054.1**	**2,535.8**	**5.8%**

Expenditure	2019/20		
In Million Nu.	PE	PEE	%
External Fund	15,965.9	2,251.8	14.1%
RGoB (domestic)	41,606.4	1,415.5	3.4%
Total	**57,572.3**	**3,667.3**	**6.4%**

Expenditure	2020/21		
In Million Nu.	PE	PEE	%
External Fund	27,184.8	1,990.6	7.3%
RGoB (domestic)	43,907.0	1,570.6	3.6%
Total	**71,091.8**	**3,561.1**	**5.0%**

Annex 4: economy-wide model analyses of green growth scenarios for Bhutan's tourism and forestry sectors

1. Model and data

The model employed for the subsequent analyses is a modified version of STAGE2, a single-country, comparative-static computable general equilibrium (CGE) model (McDonald and Thierfelder, 2015). A CGE model allows to quantify the economy-wide adjustments across markets and institutions following the simulation of "What if" scenarios. Such simulations cannot be understood as forecasts but as projections of possible outcomes from counterfactual scenarios compared against the outcomes of a reference scenario which reflects the state of the economy in absence of the simulated scenario.It provides a comprehensive view of the economy, including linkages between production and the income it generates, households, the government, and the balance of payments. The different agents – producers, household, government, and the nation in its dealings with the outside world – make decisions on the basis of rules subject to constraints imposed by budgets and markets for products and factors. Households are assumed to maximize utility, while firms (or producers) maximize profits. Trade with the rest of the world is modelled using constant elasticity of transformation (CET) functions based on the assumption of imperfect substitution between domestically produced and imported commodities using constant elasticity of substitution (CES) functions (Armington, 1969) and between commodities produced for domestic and world markets (i.e., exports).

The model is modified to capture the detailed depiction of the forestry and tourism sector of the Bhutanese economy in the underlying model database, the 2019 Social Accounting Matrix. Tourism is for instance modelled as an exported service with an explicit export demand function. Given the detailed disaggregation of forest products, commercial fuelwood and charcoal from different sources are respectively aggregated as homogenous goods. Even though most features of the model are rooted in neo-classical microeconomic theory, it is modified to reflect market failures (e.g., unemployment) and regulatory constraints. The former is reflected in the model used below by incorporation of a wage-curve. The latter is relevant for modelling the changes in the forestry sector, where the government defines how much land area is allowed to be harvested. This is achieved by exogenously defining the area of forest area under management.

More detailed documentation of the model modifications is provided in the respective sections below.

2. Model Database

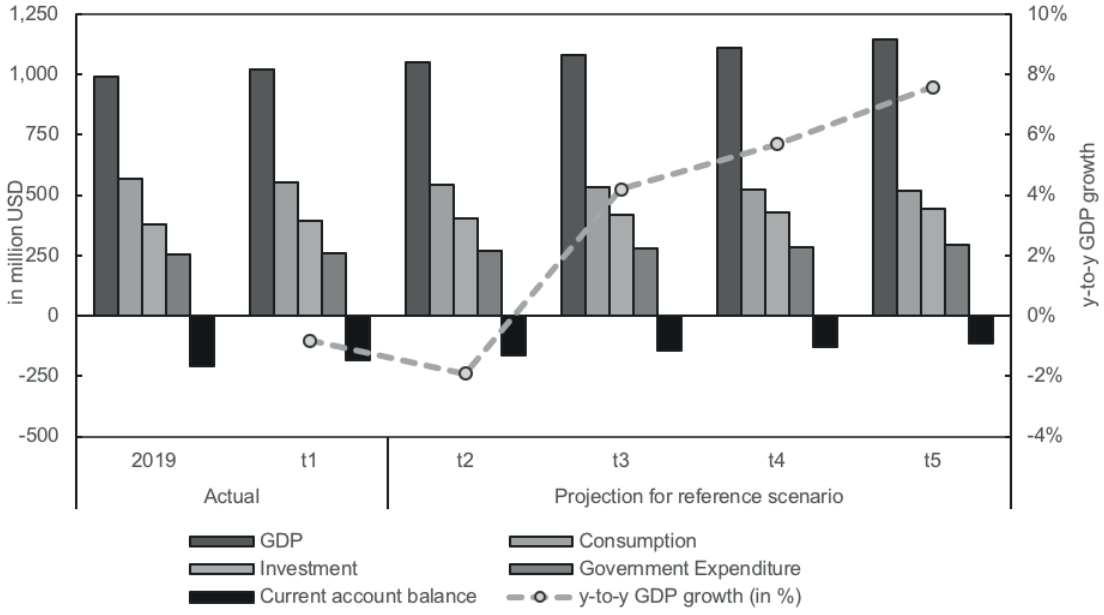
A recently estimated 2019 Social Accounting Matrix (SAM) for Bhutan serves as the underlying model database. The SAM was estimated using various secondary data sources, most notably the national accounts data for 2019 (NSB, 2021), the 2014 Supply-Use Table provided by the Asian Development Bank (ADB, 2017), the Bhutan Living Standards Survey 2017 (NSB, 2017), the Labor Force Survey 2018 (MoLHR, 2013) and 2019 trade statistics (MoF, 2020). Some sectoral disaggregation and input shares were derived from the 2012 Social Accounting Matrix for Bhutan (Feuerbacher, Dukpa and Grethe, 2017). Such data sources based on rather old data are still valuable when obtaining structural shares and information about distributions.

3. Reference scenario

The reference scenario simulates Bhutan's likely growth trajectory in absence of any change in policy or economic shock. The reference scenario covers a five-year horizon starting in the year 2019 (the model's base year) and is implemented in comparative-static mode. Historically, Bhutan has experienced strong economic growth. Between 2009 and 2019, Bhutan's gross domestic product (GDP) (measured in constant prices) increased at

an annual average rate of 6.1% between 2009 and 2019. A large share of economic growth is owed to development of large-scale hydropower projects, which are financed by the government of India. The assumptions of Bhutan's growth path in the reference period are derived from the macroeconomic projections of the International Monetary Fund (IMF) World Economic Outlook database.1 Bhutan's GDP is expected to increase by 15.2% within a five-year time period starting from 2019 (Figure 1) corresponding to an annual average growth rate of 2.9%. This growth rate is comparatively low compared to historic rates and the COVID-19 pandemic has resulted in negative growth rates in the two years following 2019, respectively. Three years after 2019,GDP growth is projected to return to pre-COVID levels with a growth in GDP of 4.4%. In the following, we refer to the end of the five-year projection horizon as "t5".

Figure A4.1. Macroeconomic descriptors for Bhutan's growth path between 2019 and 2024 based on IMF projections.



The projected growth path foresees higher relative levels of government expenditure. According to the IMF, the share of governments expenditure (current and capital expenditure) is projected to increase from 25.5% to 29.7% (a total increase of 34%). while the share of the current account deficit (i.e., foreign savings) is expected to decrease from 21.1% in 2019 to only 4.7% by period t5. These projections would result in very strong contraction of household consumption from a share of 57% of GDP in 2019 to only 42% in t5. The reference scenario deviates from the IMF projections as follows. The current account deficit (i.e., foreign savings) are determined endogenously in the model, i.e., it cannot be determined from outside. Instead, the exchange rate is fixed – reflecting the one-to-one peg of the Bhutanese Ngultrum with the Indian Rupee. In addition, the reference scenario assumes half the magnitude in the increase in government expenditure.2 Transfers paid and

1 Please note, that at the time of writing this report revisions of the IMF's World Economic Outlook database were being prepared. Minor changes in the projection would however not have any substantial impact on the subsequent scenario analyses, as they would equally impact the reference and policy scenario alike.

2 The commissioning of new hydropower projects is the largest driver of economic growth, but also will entail interest payments to foreign capital owners (government of India) and imports of machinery and construction goods. This seems to be inconsistent with the projections for government expenditure and the current account balance.

received from the rest of the world such as remittances and budget transfers to the government are assumed to remain constant. The share of investments in GDP is expected to increase from 38.3% in 2019 to 38.7% in t5. The government of Bhutan has also decided to introduce a sustainable development fee (SDF) of approximately US$16 per night for tourist arrivals from regional countries (India, Bangladesh and Maldives). This policy change is also reflected in the reference scenario.

Following the IMF, Bhutan's population is projected to grow by 1% between 2019 and t5. The skilled, unskilled and agricultural labor force is assumed to increase by 1.4%, 1.2% and 0.7% annually, respectively. Annual growth in capital stock (and the supply of capital services) is estimated at 1.8% based on the gross capital formation in 2019, assuming a 5% return on capital rate and depreciating the existing capital stock at the rate of fixed capital consumption reported in 2019 (2.7%). Hydropower capital (comprising an estimated 15.6% of total capital returns in 2019) increases by 5.8% annually. These assumptions result in an increase of hydropower capital of 32.5% between 2019 and t5.3 Capital not invested in hydropower is assumed to grow at 1% annually. The reference scenario assumes the same utilization rates of rural and commercial forest area as in 2019.

4. Model closure

A Keynesian model closure is implemented in which total investment (and savings) is determined exogenously with endogenously determined households' marginal propensity to save (saving rates). The exchange rate is exogenously fixed to the base level, while the current account balance is flexible (endogenous). Transfers between Bhutanese institutions (households, enterprises and the government) and the rest of the world are assumed to remain at the base levels. The government expenditure and savings (internal account) is exogenously fixed. The direct tax rates of households are allowed to adjust multiplicatively to balance the government account. In the reference scenario, the changes in GDP are determined exogenously based on IMF projections, while total factor productivity (TFP) and factor rents between 2019 and t5 are determined endogenously. This allows to estimate the change in TFP given the constraints presented above. The later policy simulations use this TFP estimate, while GDP changes are then determined endogenously (i.e., a model closure swap). The consumer price index (CPI) is used as the model numéraire

The factor market closure assumptions are as follows: The supply of capital across all types is fixed and the allocation across activities within the capital segments is perfectly mobile, except for the construction and utility sector, where capital allocation is exogenously determined (experiencing average increase in capital allocation). The model code allows for changes in activity specific capital allocation in the policy simulation runs. Labor demand by activity is modelled endogenously within the reference scenario. Labor supply is exogenously increased following the above presented projections. In addition, a wage curve specification reflects the current level of unemployment, which is assumed to remain unchanged within the reference scenario.4 The unemployment rate in the reference scenario are 5.8%, 2.5% and 1.0% for skilled, unskilled and agricultural labor, respectively. The wage curve is modelled as shown in equation 1 (Blanchflower and Oswald, 1995):

$$\log\left(\frac{WF_l}{PPI}\right) = \gamma_l + \varepsilon_l * \log\left(UNEMP_l\right) \qquad l \in L \quad (1)$$

where WF_l is the wage of labor type l deflated by the Producer Price Index PPI, γ_l is a scale parameter and ε_l is the elasticity of the unemployment rate ($UNEMP_l$) with respect to the real wage rate. The wage curve is calibrated with an elasticity of $\varepsilon_l = -0.2$, which is within the range of reported elasticities for most countries.

3 This would reflect a scenario in which the hydropower plants Khonlongchu (600 MW) and Nikachu (118 MW) are commissioned by 2024, but not the currently constructed and delayed projects Punatsangchu I (1200 MW) and Punatsangchu II (1020 MW).

4 To achieve this technically, the lower bound of the unemployed quantity of labor is set equal to the current level of unemployment. Hence, the assumption is that the reference scenario does not result in any decrease in the currently observed unemployment levels. Any increase in the total labor force is already reflected in the exogenous increase of labor supply.

The demand for arable, pasture and forest land originate only from the agricultural, livestock and forestry sector. Supply of arable land is determined by a land supply curve (see Feuerbacher et al., 2020 for more details), accounting for the high share of fallow cropland in Bhutan. Pasture land is set fix. Supply of rural forest land follows a horizontal supply curve, but access is restricted using a harvest quota regime (see Feuerbacher et al., 2021).

5. Results reference scenario

The key results of the reference scenario simulation are summarized in Table 1. Household consumption increases at the lowest annualized rate (2.5%) despite the strong growth in GDP due to the increases in government expenditure and the improving current account balance. Total factor productivity increases by 1.1% annually - a result that is obviously dependent on the growth assumptions for the labor force and capital stock. The direct tax rates increase by 2% in order to finance the rise in government expenditures and savings (i.e., the capital expenditure by the government).

Table A4.1: Summary results of reference scenario simulation

Macro Descriptor	% share in GDP		% change	
	Base	Reference	t05	Annually
GDP	100.0%	100.0%	15.2%	2.9%
Government expenditure	19.8%	19.9%	16.1%	3.0%
Investment	37.4%	37.8%	16.4%	3.1%
Household consumption	57.3%	56.1%	12.9%	2.5%
Exports	31.8%	31.9%	15.6%	3.5%
Imports	47.0%	46.8%	14.9%	3.1%
Current account balance	12.5%	12.5%	15.3%	2.9%
Real Exchange Rate[a]			0.5%	0.1%
Producer Price Index			0.6%	0.1%
Total factor productivity (TFP)			5.4%	1.1%
(Average) direct tax rate			2.0%	0.4%
Skilled labor wages			6.9%	1.3%
Unskilled labor wages			8.7%	1.7%
Agricultural wages			6.1%	1.2%
Private capital			7.4%	1.4%
Public capital			5.1%	1.0%
Hydropower capital			2.4%	0.5%

[a] The real exchange rate is the nominal exchange multiplied by the ratio of the price index in tradable goods and services over the producer price index.

6. Nature-based solutions for a diversified tourism sector

6.1 Background

Tourism plays a pivotal role for Bhutan's economy. In 2019, gross tourism receipts are estimated at US$209 million comprising 8.5% of GDP.5 Tourism in Bhutan has so far been a success story. Since the end of the country's isolation in the 1970s, the Royal Government of Bhutan (RGoB) has pursued a unique high-value and low-volume tourism policy based on a minimum daily package rate (MDPR) and the SDF (Tourism Council of Bhutan, 2020). The MDPR work similarly as a price-floor policy, in which the supplier (effectively a monopolist) determines market prices by restricting the quantity supplied. The SDF is a royalty charged per bed-night and within the economy-wide model is implemented as a tax on tourism.

Given this market environment, the export of tourism services is modelled using an export demand function. The export demand function for tourism services is presented in equation 2:

$$QE = econ(PWE / pwse)^{(-\varepsilon)} \quad (2)$$

where QE is the quantity of tourism commodities exported, econ is a scaling parameter, PWE is the endogenous world price for tourism services supplied by Bhutan, pwse is the world price of exports in the base year, and ε is the export demand elasticity.

Tourism is the only commodity exported via the export demand function. In the following, we will conduct the policy simulations with different assumptions about the export demand elasticity, assuming an inelastic elasticity of ε = 0.5 and elastic elasticity of ε = 2.

The model does not capture any domestic tourism activities, as there is no data and the magnitude of domestic tourism is likely to be still negligible.6 The model differentiates between two markets – the regional and international market. The regional market comprises tourists from India, Bangladesh or Maldives. They comprise approximately 76% of all nights spent by leisure tourists, but due to their low average expenditures are only responsible for 39% of total gross receipts. Regional tourists are exempted from the MDPR policy and are only levied a reduced SDF of approximately US$16/day (before 2021 no fee was charged). The international market comprises visitors from all other countries, who have to pay a SDF of US$65/night and person. In addition, they are subject to the MDPR policy requiring a daily expenditure of at least US$250/day.

The tourism bed nights of the international market are further subdivided into three segments: the "mainstream tourism" segment comprises bed-nights of tourists spent in the tourist hotspot areas proxied by the districts Paro, Thimphu, Punakha and Bumthang. This segment is dominated by cultural activities but may also include non-cultural experiences. It is characterized by strong seasonality, geographic concentration in Western Bhutan and problems of overcrowding at country's most well-known attractions. The "diversified tourism" segment comprises those bed-nights spent outside the Western hotspot areas (but not nights spent in community-based tourist settings). It comprises considerably more diversified portfolio of tourist experiences ranging from trekking, wildlife watching and visiting remote cultural attractions such as monasteries and dzongs.7 The "community-based tourism" segment has a similar profile but comprises all bed-nights spent in rural communities, where accommodation is provided by rural households directly. This segment has a very small market share.

5 This estimate is conservative. For 2019, the Tourism Council of Bhutan (2020) reports gross tourism receipts at US$345 million or 13.6% of GDP. This estimate had to be down scaled to make it consistent with tourism expenditure data and Bhutan's national account statistics.

6 Nevertheless, there has been a rise in domestic tourism during the COVID-19 pandemic. It is difficult to assess to what degree this increase in domestic tourism will persist once prices of hotel and restaurants return to pre-COVID levels when Bhutan re-opens its borders to international tourism.

7 A "dzong" is a fortified monastery and serves as the religious, military, administrative, and social center of a "dzongkhag", i.e. one of 20 districts in Bhutan. Dzongs are often the site of cultural and religious festivals.

The four tourism segments and their market share in terms of nights spent and revenue generated differ substantially (Table 2). The regional market is most important in terms of absolute volume and receipts, yet this segment is not well aligned with Bhutan's "low-volume high-value" paradigm as reflected by the low average receipt per night. In this respect, the mainstream segment is most attractive, but suffers from the above-mentioned challenges of high seasonality, local overcrowding and high regional concentration. The diversified and community-based segments do not suffer from these problems. Yet, combined they only comprise about 16% of total gross receipts or 26.6% of gross receipts generated by international tourists.

Table A4.2: Tourism segments and economic significance in Bhutan

Segment	Annual person nights	% share in total nights	Gross receipts (In million USD)	Average gross receipt per person night
Mainstream tourism	298,546	17.3%	94.0	314.83
Diversified tourism	108,416	6.3%	31.4	289.86
Community-based tourism	10,589	0.6%	2.6	250.01
Regional tourism	1,306,601	75.8%	81.3	62.20
Total	**1,724,152**	**100.0%**	**209.3**	**121.41**

Note: Estimated based on the 2019 Tourism Monitor (Tourism Council of Bhutan, 2020)

The international tourism segment in Bhutan is facing myriad challenges jeopardizing its market position and long-term sustainability. The World Bank's tourism policy note (World Bank, 2017) identified that the lack of geographical spread of tourists and the high spatial and temporal concentration on attractions and cultural festivals predominantly visited in Western Bhutan is a key challenge. Moreover, the report highlighted problems of declining quality of services in the hotel and restaurant sector and provided an adequate portfolio of experiences to be attractive to different demographics. Hence, measures are needed that strengthen the "brand Bhutan" and lead to larger geographic spread of tourism. The diversification of the tourism sector can be achieved by increasing the share of nights within the diversified and community-based tourism segments. These segments are less prone to seasonality, offer a more diverse portfolio of tourist experiences and activities and increase the regional equality of tourism benefits. Moreover, given Bhutan's strong environmental stewardship and its pristine landscape and nature, these segments allow to capitalize on environmental conservation efforts by generating tourism revenues from it. It goes without saying, that necessary safeguards have to be put in place that ensure a sustainable operation of nature-solution based tourist experiences. This may include measures to improve waste management and urban planning and to mitigate risks of spatial concentration, pollution and other risks such as soil erosion along trekking routes.

Against this background, the policy scenario Tour_Invest simulated in the following aims to strengthen the diversified and community-based tourism segments. This scenario entails an exogenous and amortized private investment in the lodging infrastructure of US$1.5 million that is serving these segments. This investment is equivalent to 0.5% of total annual public capital rents. This investment is split among the two segments using their relative capital allocation share in the base. Accordingly, only 2.6% of the investment is channeled to the community-based lodging sector and the remainder to the diversified lodging sector. In total, the capital allocation in the diversified and community-based lodging sector increases by 75% given the very low initial capital intensity within these sectors. The cost of this scenario is simulated by reducing the private capital allocation in the remaining sectors accordingly.

As mentioned above, the demand for tourism is modelled using an export demand function. However, data to estimate tourists' willingness to pay is not available. Instead, the scenario is simulated in two variants assuming either an inelastic ($\varepsilon = 0.5$), or elastic demand ($\varepsilon = 2$) for tourism

demand from the rest of the world. The results of the scenario simulations are presented in comparison to the reference scenario.

6.2 Tourism scenarios: Macro-level results

The Tour_Invest would result in slight increases of GDP accompanied by reductions in foreign savings (i.e., the current account balance is improving). The gross receipts earned from tourism when measured at the price of the reference scenario, increases between 0.4% to 1.6% depending on the elasticity of tourism demand. Household welfare increases in all cases, especially for urban households and less for rural households. This reflects a main characteristic of the tourism sector, its dependence on intermediate inputs largely provided by sectors that require skilled or semi-skilled labor (e.g., tour operating services, transportation, hotels and restaurants).

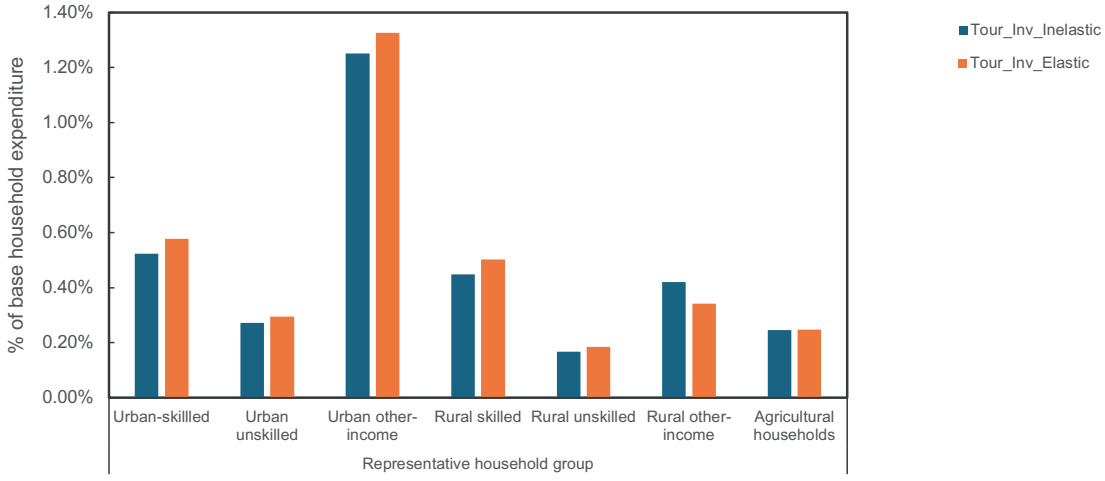
Table A4.3: Macro-level changes for tourism scenarios

Indicator	Tour_Invest (% changes)	
	Inelastic	Elastic
GDP[1]	0.35	0.36
Absorption[1]	0.23	0.20
Investment[1]	0.21	0.20
Government expenditure[1]	0.00	0.00
Household consumption[1]	0.32	0.26
Domestic savings	0.39	0.60
Foreign savings	-0.85	-1.21
Exports[1]	1.08	1.26
Export of tourism services[1]	0.37	1.58
Export of other goods and services[1]	1.29	1.18
Imports[1]	0.58	0.58
Real exchange rate[2]	0.11	0.10
Producer Price Index	0.17	0.16
Factor rents		
Skilled labor wages	-1.27	-1.23
Unskilled labor wages	-0.87	-0.85
Agricultural wages	-0.14	-0.18
Private capital	0.30	0.31
Public capital	0.36	0.42
Hydropower capital	0.17	0.16
Welfare changes[3]		
All households	0.46	0.48
Urban households	0.64	0.69
Rural households	0.32	0.32
Agricultural households	0.28	0.28
Employment changes		
Employment (in % changes)	0.5%	0.6%
Employment (in # of jobs)	1,967	2,017

Note: 1Real changes calculated based on constant prices from the reference scenario.
2 The real exchange rate is the nominal exchange multiplied by the ratio of the price index in tradable goods and services over the producer price index.
3 Welfare is measured as the share of equivalent variation in initial household expenditure in the reference scenario. Equivalent variation can be understood as being equal to the monetary amount that must be added (subtracted) to (from) the household's initial income in order to make it as well off as in the base (the reference scenario). Changes in household savings (i.e., deferred consumption) are included in the welfare measure.

The returns to capital are increasing throughout, especially for public capital. The increase in capital returns is particularly benefitting urban households with high shares of their income dependent on capital. This is also reflected in the household specific welfare changes shown in Figure 2. Urban households dependent on other income (i.e., capital) experience the highest increase in household income. Agricultural households experience a stable increase in their household welfare.

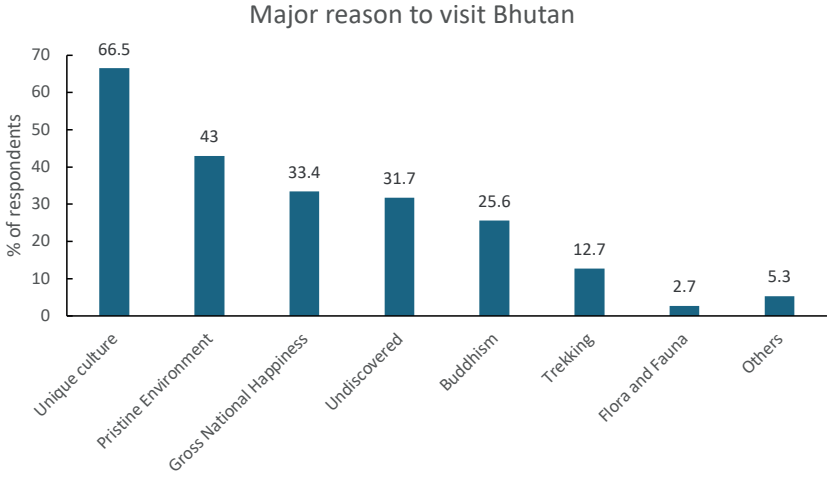
Figure A4.2. Welfare changes measured as equivalent variation in initial household expenditure for representative household groups



7. Environmental Conservation Efforts and Tourism Benefits

"Happiness is a place" is a slogan with which Bhutan has advertised itself as a tourist destination. In 2012, the tourist exit survey conducted by the Tourism Council of Bhutan (TCB) included questions on Bhutan's major draw cards, i.e., tourists were asked to mention what motivated them to visit Bhutan. The results of this survey have shown that visitors' perceptions about Bhutan as a destination are primarily based on the country's unique culture, pristine environment and gross national happiness (GNH) philosophy.

Figure A4.3. Results of survey on the main reasons to visiting Bhutan



Note: Multiple responses were possible. Source: Tourism Monitor 2012, Tourism Council Bhutan

The GNH development paradigm is based on the conservation of culture and environment as well as socio-equitable development. The philosophy is well aligned with the main reasons of tourists visiting Bhutan. Many of the country's environmental policies, e.g., the 100% organic agriculture policy, the carbon neutrality target and the country's strict forest conservation policy, are also motivated to strengthen the brand Bhutan in the international tourism market. For this reason, it is plausible to assume that any deviation from these environmental conservation efforts would result in a weakening of the "green brand Bhutan". This is the motivation of the scenario investigated in the following. We simulate a scenario in which the current sustainable forestry policy is suspended as forest use is increased beyond the sustainable limits motivated by achieving short-term economic gains. The resultant change in the economic value of forest ecosystem services is estimated using a benefit-transfer approach by Kubiszewski et al. (2013). The proportion of the change in forest ecosystem services that accrues to tourism and recreation services is linked via a feedback mechanism to the demand for tourism services exported by Bhutan.

For this purpose, the model uses estimates for the cultural ecosystem service provided by temperate forests that accrue to tourism and recreation related services as reported in Table 4 below. The value of this forest ecosystem service is provided in US$ per hectare of forest and Kubiszewski et al. (2012) report a mean, minimum and maximum value drawing from eleven different studies. It should be noted that there are further ecosystem services provided by forests. It is assumed that the provision of these ecosystem services is not compromised by a possible increase in forest use. The degree to which forest ecosystem services are reduced due to forest management is dependent on myriad factors (e.g., differences in silvicultural practices ranging from clear cutting to selective logging). The value of forest ecosystem services that accrue to tourists may be very independent of the actual state of Bhutan's. Possibly, even under very strict criteria for forest expansion and possibly positive environmental outcomes, negative publicity (whether justified or unjustified) could nevertheless damage the "green brand" of Bhutan and reduce the willingness to pay of tourists to visit Bhutan.

Table A4.4.Estimates of forest ecosystem services

Forest Ecosystem Service	Mean	Min	Max	No. of studies
	in US$ per hectare			
Provisioning services	475.31	66.55	888.09	13
Regulating services	3,524.06	1,259.67	13,657.02	36
Cultural Service related to cultural values, education and science/research	2.33	NA	NA	3
Cultural services related to Tourism and Recreation	1,038.52	0.81	7,152.89	11

Source: Based on Kubiszewski et al. (2013)

We estimate the change in the value of forest ecosystem services for tourism and recreation based on the total amount of unutilized forest area, as shown below (equation 3).

$$dFEV_{t,d} = \overline{PES}_d * \left(FC_{Base} + \left(\sum_a For_{Base,a} - \sum_a For_{t,a} \right) \right) - FEV_{Base,d} \qquad (3)$$

where t is an index for different scenarios, d is an index for the varying degree in forest ecosystem value per hectare (mean, max and min), $\Delta FEV_{t,d}$ is the absolute change (in US$), in forest ecosystem services related to tourism and recreation, $\overline{PES}_d$ is the (constant) price of forest ecosystem services as reported in Table 5 , FC_{Base} is the forest cover in the base period, $For_{t,a}$ is the forest area demanded in scenarios t by different forestry activities a and $FEV_{Base,d}$ is the base level value of

forest ecosystem services related to tourism and recreation.

Any absolute change in the provision of FEV in a scenario d due to changes in the area of forest utilization is then modelled through variable, $\lambda_{s,d}$, , which is a preference shift in the demand for tourism services exported by Bhutan to the rest of the world specific to each of the four tourism segments (denoted by index ***s***). This shift depends on $mshr_s$, which is the market share of each segment of total tourism exports (in US$) in the base:

$$mshr_s = \frac{TE_{Base,s}}{\sum_s TE_{Base,s}} \quad (4)$$

where $TE_{Base,s}$ is the export value of a tourism segment in the base.

Since each segment has a different dependency on intact forest ecosystem services, we calculate a forest ecosystem service dependency parameter, dep_s, which is normalized to one:

$$dep_s = \frac{mshr_s\ \omega_s}{\sum_s mshr_s\ \omega_s} \quad \text{with } \omega_{Regional} = 0.5,\ \omega_{Cultural} = 1,\ \omega_{Nature/Community} = 2 \quad (5)$$

where ω_s is a weighting parameter to reflect a tourism segment's specific dependency towards changes in forest ecosystem services. We assume that diversified- and community-based tourism segments are twice as dependent as cultural-based tourism, while regional tourism is assumed to be half as dependent as the cultural-based segment.

The segment specific dependency parameter is multiplied with the total change in forest ecosystem services related to tourism and recreation. To calculate the preference shift, $\lambda_{s,d}$, it is divided by the respective base value of exports in tourism services:

$$\lambda_{s,d} = \frac{dep_s\ dFEV_{t,d}}{TE0_s} \quad (6)$$

The shift parameter enters the export demand function for tourism services as follows:

$$QE_{s,d} = (1+\lambda_{s,d})\ econ_s (PWE_s / pwse_s)^{(-\varepsilon_s)} \quad (7)$$

Using this approach, three simple scenarios are simulated. In all three scenarios, a forest policy is implemented that results in an 20% expansion of forest use which is achieved through the implementation of unsustainable forestry practices (e.g., clear-cut, inadequate reforestation, etc.). The forest expansion will thus lead to a loss in ecosystem-services, affecting the recreational value of forest ecosystem services. In line with the framework described above, this loss in ecosystem service will be accompanied by the following maximum preference shifts in tourism exports (Table 5). The final magnitude of these shocks will depend to what degree the model will endogenously increase the forest use, as the forest use by rural households is constrained by a harvest quota, which may not be fully exploited. The magnitude of shocks across segments s depends on ω_s .

Table A4.5. Maximum preference shift shock on tourism demand following an exogenous 20% increase in forest use

Scenario / Segment	Regional tourism	Mainstream	Diversified	Community-based
ForTour1_mean	-2.41%	-4.82%	-9.64%	-9.64%
ForTour2_min	-0.00%	-0.00%	-0.01%	-0.01%
ForTour3_max	-16.59%	-66.37%	-66.37%	-33.19%

7.1 Results

The model results show that the decrease in forest ecosystem services due to unsustainable forestry practices can lead to declines in tourism that substantially reduce or even offset economic gains from increases in forest use. Table 6 shows the resulting changes in forest use expansion and changes in tourism exports dependent on whether the mean, minimum or maximum estimate for the value of forest ecosystem services for tourism and recreation is assumed. The forest use expansion increases the higher the linkage with tourism exports. Unlike in an optimization model, where agents may optimize resource allocation across activities maximizing total income (or GDP), an economy-wide model does not (by default) adjust the resource allocation of an expanding sector (forestry) if its economic gain is generated at the disproportionate expense of another sector (tourism). Changes in factor allocations are driven changes in relative prices. The expansion in forest use lowers the relative price of forest land, which increases the competitiveness of these sectors attracting further allocation of resources in these sectors.

Table A4.6: Changes in endogenous forest use and tourism export

		Scenario		
		ForTour1mean	ForTour2min	ForTour3max
Change in forest use	Rural forestry	13.3%	12.9%	15.6%
	Commercial forestry	20.0%	20.0%	20.0%
	Total	**16.1%**	**15.8%**	**17.4%**
Change in tourism export	Regional	-1.99%	-0.08%	-14.33%
	Mainstream	-7.78%	-0.09%	-57.71%
	Diversified	-7.8%	-0.1%	-57.7%
	Community-based	-3.9%	-0.1%	-28.8%
	Total	**-3.9%**	**-0.1%**	**-28.7%**

However, increase in forest use lowers the exports of tourism services. The higher the value is for forest ecosystem services for recreation and tourism the stronger the link is between forestry and tourism resulting in higher factor price declines. These, again, trigger higher increases in forest use, which reinforces the cycle. Overall, if the forest-tourism link is minimal (ForTour2min) or calibrated at the mean level of forest ecosystem service value (ForTour1mean) the macro-level results show that the economy would still experience positive, albeit very modest economic growth. In these cases, the economic benefits from the increase in forest use offsets the decline in tourism exports. The scenarios would generally lead to a deterioration of the current account balance due to the decline in exports in ForTour1mean and particularly ForTour2max. In both scenarios, skilled and unskilled labor wages increase which increase prices of government services (health, education and public administration) requiring an increase in government revenues in form of direct tax rate changes. In the case of ForTour1mean, there is also a decline in tourism royalties explaining the higher increase in tax rates).

Table A4.7: Macro-level results of the forest-tourism scenarios

Indicators	ForTour-1mean	ForTour-2min	ForTour-3max
GDP	0.06%	0.10%	-0.21%
Absorption[1]	0.41%	0.25%	1.47%
Investment[1]	0.20%	0.17%	0.42%
Government expenditure[1]	0.00%	0.00%	0.00%
Household consumption[1]	0.69%	0.38%	2.64%
Domestic savings	-1.30%	-0.58%	-5.90%
Foreign savings	3.54%	1.57%	16.09%
Exports[1]	-0.47%	0.10%	-4.08%
Export of tourism services[1]	-3.90%	-0.08%	-28.66%
Export of other goods and services[1]	0.39%	0.14%	2.09%
Imports[1]	0.52%	0.45%	1.01%
Real exchange rate[2]	0.10%	0.06%	0.31%
Producer Price Index	-0.08%	-0.04%	-0.33%
(Average) direct tax rate	10.70%	6.86%	35.27%
Factor rents			
Skilled labor wages	0.12%	0.27%	-0.81%
Unskilled labor wages	0.25%	0.33%	-0.23%
Agricultural wages	0.21%	0.08%	1.06%
Private capital	0.25%	0.25%	0.26%
Public capital	-0.01%	0.23%	-1.53%
Hydropower capital	0.00%	-0.04%	0.25%
Welfare changes[3]			
All households	0.01%	0.06%	-0.33%
Urban households	-0.04%	0.11%	-1.03%
Rural households	0.05%	0.02%	0.24%
Agricultural households	-0.04%	-0.10%	0.31%

Note: 1Real changes calculated based on constant prices from the reference scenario.
2 The real exchange rate is the nominal exchange multiplied by the ratio of the price index in tradable goods and services over the producer price index.
3 Welfare is measured as the share of equivalent variation in initial household expenditure in the reference scenario. Equivalent variation can be understood as being equal to the monetary amount that must be added (subtracted) to (from) the household's initial income in order to make it as well off as in the base (the reference scenario). Changes in household savings (i.e., deferred consumption) are included in the welfare measure.

Bhutan would experience negative change in its GDP if there was a very strong linkage between forestry and tourism (ForTour3max), resulting in a GDP decline of 0.2%. (Table 7) Exports of tourism services would strongly decline (-28.7%) and the real exchange rate (measured as the nominal exchange multiplied by the ratio of the price index in tradable goods and services over the producer price index) would slightly depreciate. The strong decline in tourism exports would lower the wages of skilled and unskilled labor wages, which benefits the forestry and manufacturing sector, explaining the higher increase in forest and manufacturing output. Tax rates increase strongly, caused by the strong decline in tourism royalties.

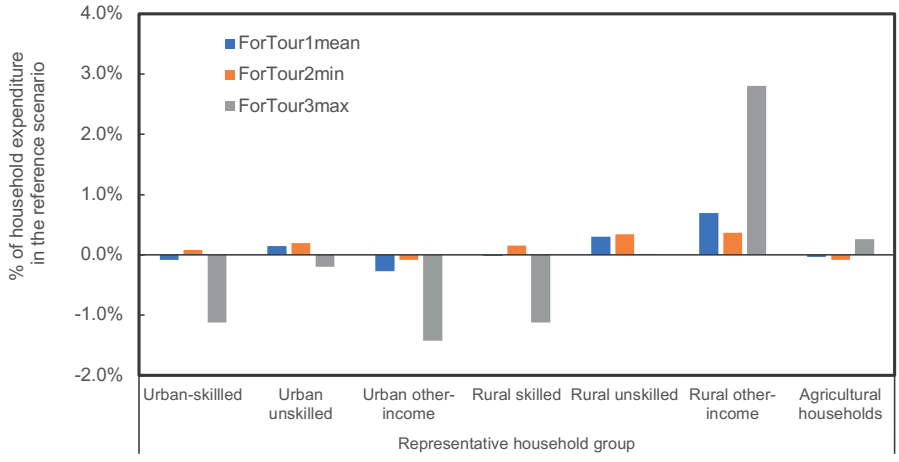
Table A4.8: Percent changes in output and purchaser prices

	Output changes in %			Purchaser price changes in %		
	ForTour1mean	ForTour2min	ForTour3max	ForTour1mean	ForTour2min	ForTour3max
Agriculture	0.1%	0.1%	0.1%	0.2%	0.1%	0.7%
Forestry	3.0%	2.8%	4.2%	-7.2%	-7.3%	-6.5%
Mining	-1.0%	-1.4%	1.5%	0.2%	0.2%	0.0%
Manufacturing	1.6%	1.0%	5.4%	0.0%	0.1%	-0.2%
Utilities	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Construction	0.2%	0.2%	0.5%	-0.3%	-0.3%	-0.6%
Trade	0.6%	0.4%	2.4%	0.2%	0.3%	-0.4%
HotelsRestaurant_local	-0.1%	0.0%	-1.3%	0.2%	0.2%	0.0%
HotelsRestaurant_reg	-2.0%	-0.1%	-14.3%	0.2%	0.2%	0.0%
HotelsRestaurant_nat	-7.8%	-0.1%	-57.7%	0.2%	0.2%	0.0%
HotelsRestaurant_com	-7.8%	-0.1%	-57.7%	0.1%	0.1%	0.6%

	Output changes in %			Purchaser price changes in %		
	ForTour1mean	ForTour2min	ForTour3max	ForTour1mean	ForTour2min	ForTour3max
HotelsRestaurant_cult	-3.9%	-0.1%	-28.8%	0.2%	0.2%	0.0%
Land transportation	0.4%	0.4%	1.1%	0.2%	0.2%	0.0%
Air transportation	-1.4%	0.0%	-10.9%	0.0%	0.2%	-0.9%
Travel agency services	-1.9%	0.0%	-14.1%	0.2%	0.2%	0.0%
Other services	0.4%	0.2%	1.6%	0.1%	0.2%	-0.4%
Public services	0.0%	0.0%	0.3%	0.1%	0.2%	-0.6%
Touristanagemes_reg	-2.0%	-0.1%	-14.3%	0.1%	0.2%	-0.2%
Touristanagemes_nat	-7.8%	-0.1%	-57.7%	0.1%	0.2%	-0.3%
Touristanagemes_com	-7.8%	-0.1%	-57.7%	0.1%	0.1%	-0.3%
Touristanagemes_cult	-3.9%	-0.1%	-28.8%	0.1%	0.2%	-0.3%

There are differences in the distributional implications of the forestry-tourism scenarios. The welfare of urban households are largely negatively impacted, particularly if the forestry expansion results in a decline in tourism arrival as under the scenario ForTour1mean and ForTour3max. Rural households that rely on skilled labor would face a similar pattern in their welfare changes. An exception are rural households which rely on other income sources, i.e., transfers from the government and other households. They would benefit in all scenarios. Conversely, agricultural households would benefit under a strong tourism-forestry linkage. The higher forestry output increases agricultural wages (Table 7), while the lower exports of tourism services hardly impact agricultural livelihoods.

Figure A4.4.Welfare changes approximated by equivalent variation as a % of household expenditure in the reference scenario



Overall, the results show that any reforms of natural resource policies in Bhutan must be implemented with care considering their potential in changing the provision of tourism related ecosystem services potentially jeopardizing the green brand of Bhutan. So far, Bhutan is a champion in conserving forests and any unsustainable forest expansion is only a hypothetical case. Moreover, it should be strongly emphasized that there is substantial potential for sustainable forest expansion in Bhutan that due to entail the above reported trade-offs between forestry and tourism. This potential is also explored in the following chapter.

8. Value-added forestry scenarios

8.1 Background

Forests make up an estimated 70% of Bhutan's land area (Gilani et al., 2015). About 15% of forest area is utilized and the forestry's sector contributed 2.3% to Bhutan's GDP (NSB, 2021). Despite the large endowment with forest area, Bhutan is a net importer of wood-based products. According to the 2019 Social Accounting Matrix (SAM), US$52.4 million of wood-based products were imported to Bhutan, yet only US$0.9 million were exported. Following the 2019 SAM, the output of Bhutan's forestry sector is estimated at US$68.7 million, of which logs (or construction timber) make up 56%, fuelwood 38% and non-wood forest products 6%.

Logs are used as intermediate inputs in wood-based manufacturing and construction. The wood manufacturing sector comprises a wide variety of industries including sawmills, joineries, manufacturers of veneer sheets and plywood, lamination boards, furniture and wood crafts. However, only 9.0% of harvested logs are estimated to be demanded by the wood-based sector in Bhutan. The construction sector demands the highest share (81.8% or USD 40.7 million) of log supply. Final demand for logs by households comprise a further 7.3%. Exports of log were virtually zero (0.03%), as exports of timber is banned and only allowed in exceptional circumstances.

The largest share of fuelwood is directly consumed by households (89.2% or US$28.0 million). Particularly the metallurgical industry uses fuelwood (and wood chips) as an intermediate input, but this only makes up 7.5% of total fuelwood supply. An important, wood-based intermediate input is charcoal, which is demanded as a chemical reduction agent by chemical (calcium and silicon carbide producers) and metallurgical industries (ferro-alloy producers) located along the Southern border of Bhutan. Virtually, all charcoal is imported from India, predominantly from Southern India (Feuerbacher et al., 2016).

The World Bank's forest policy note (World Bank, 2019) showed that Bhutan does not realize the full sustainable potential of its forests. This is based on findings from various earlier studies which also highlight a forest expansion is principally possible without jeopardizing the stability of crucial forest ecosystem services (Narain, Toman and Jiang, 2014; World Bank, 2019; Siebert and Belsky, 2015). The concern about preserving forest ecosystem services is generally warranted given Bhutan's highly mountainous terrain and high dependency on hydropower and intact watersheds (Sears et al., 2017). Nevertheless, studies have shown that a large share of forest area complying with strict spatial criteria, i.e., in areas with acceptable topography and outside of protected areas, is currently not under management (Schindele, 2004; Feuerbacher et al., 2021). Moderate increases in forest utilization could allow for employment opportunities in rural areas and could reduce the dependency on wood-based imports (Feuerbacher et al., 2016).

Instead, or in addition to possible increases in forest expansion, the forest policy note has identified areas of investment in the wood-based manufacturing sectors that could generate higher value-added within the forestry sector. One example are investments in the domestic production of glue-laminated (short: glulam) timber. Glulam is a technology that allows to utilize a higher share of timber logs to supply wooden beams for the construction sector substituting steel-based structures in the construction sector (Petersen and Solberg, 2002; Winchester and Reilly, 2020). The glulam technology is globally a well-established technology. In Bhutan, a pilot project has been setup that is supplying glulam timber to be used for the construction of the Royal Academy in Paro, Western Bhutan (NRDCL, 2021). The pilot production of glulam timber has been supported by the Swiss Company Häring AG, which is a global leader in this technology. Investments in the glulam technology could allow to reduce the dependency on steel-based structures in the construction sector. It would also reduce dependency on imports as an estimated 43% of fabricated steel is sourced from India (MoF, 2020).

The demand for glulam depends on the degree to which the construction sector can adopt it as a substitute for steel. So far, glulam has been suc-

cessfully been used in the construction of various construction projects of government buildings (Fritz Baumgartner, 2022). The cost of production of glulam in 2019 was reported at US$317 m^{-3}, which is substantially below world market prices (estimated at US$500 m^{-3} by Chris Haring (2022)). Hence, there is considerable scope for a domestic glulam industry facing sufficient domestic demand.

A further option identified by the forest policy note (World Bank, 2019) are investments in establishing a mid-scaled production of charcoal within Bhutan. This could allow for a higher value-added use of fuelwood, which is currently largely used by rural households for heating, cooking and agro-processing with little opportunity cost, particularly given the subsidies on rural electricity and the achievement of 100% rural electrification (Yangka and Diesendorf, 2016). A recent study also found that offering rural households alternative use for their fuelwood harvest quota could result in higher allocation efficiency of fuelwood (Feuerbacher et al., 2021). In addition, charcoal can substitute coke8 as a carbon reduction agent in the process of metallurgical production and thereby could reduce the carbon footprint of these energy-intensive industries (Norgate and Langberg, 2009; Suopajärvi and Fabritius, 2013). Hence, in either substituting imported charcoal or coke, there is ample domestic demand for charcoal.

8.2 Wood-based GHG mitigation scenarios

Against this background, six wood-based GHG mitigation scenarios are considered in the subsequent analysis that either stimulate the substitution of construction steel with domestically produced glulam timber or the substitution of both imported charcoal and coke with domestically produced charcoal. The description and details of scenarios are presented in Table 9. They are simulated using a comparative-static economy-wide model for Bhutan which is calibrated on the 2019 SAM for Bhutan. The cost of the investments
Reflecting the current structure of Bhutan's forestry, the model distinguishes between forestry activities conducted by rural households primarily meeting subsistence needs and commercial forestry activities in forest management units under the control of the state-owned Natural Resource Development Corporation. The extraction of fuelwood by rural households is, by law, regulated by an annual maximum extraction quantity of 8 m^3 of stack volume per household. Households may only sell a part of this quota if they are members of a community forest management group, which holds for about 20% of rural households (Ministry of Agriculture and Forests, 2019). Quotas for the extraction of logs is granted to households every 25 years for house construction and every 12 years for house renovations. Both, the fuelwood harvest and marketing quota is implemented in the model following Feuerbacher et al. (2021)

Table A4.9: Description of wood-based GHG mitigation scenarios

Scenario Name	Description
C1_Glulam	The Royal Government of Bhutan invests US$2.7 million in the establishment of a mid-sized glulam production sector (investment is equivalent to 0.85% of total public-capital rents). The cost of this scenario is simulated by reducing the private capital allocation in the remaining sectors accordingly. No expansion in managed forest area.
C2_Glulam-Exp	In addition to scenario C1_Glulam, forest area utilized by rural households and the commercial forestry sector (NRDCL) expands by 10%
C3_Glulam-ExpTax	In addition to scenario C2_GlulamExp, a sales tax of 10% is levied on construction steel
C4_Charcoal	The Royal Government of Bhutan invests US$2.7 million in the establishment of a mid-sized charcoal production sector (investment is equivalent to 0.85% of total public-capital rents). The cost of this scenario is simulated by reducing the private capital allocation in the remaining sectors accordingly. No expansion in managed forest area. Rural households are allowed to market 50% of their fuelwood harvest quota (i.e., 4 m^3 / household).
C5_CharcoalExp	In addition to scenario C4_Charcoal, the forest area utilized by rural households and the commercial forestry sector (NRDCL) expands by 10%
C6_CharcoalExpTax	In addition to scenario C5_CharcoalExp, a sales tax of 10% is levied on coke

8 Coke used in metallurgical is known as "coke oven coke" or "metallurgical coke" see also IPCC (2006: 1.14).

8.3 Satellite account for selected commodities

Table 10 presents a satellite account recording the physical units of the commodities of interest for better interpretation of the model results and to estimate changes in greenhouse gas emission. It presents the physical quantities, prices and value for the domestic for glulam timber and construction steel, as well as for the reduction agents coke and charcoal. Domestic demand is also split in domestic supply and imports. Coke is exclusively imported, 77% coming mainly from India. Domestic production of charcoal is also still negligible and 100% of charcoal is imported from India. For both the domestic production of glulam and charcoal, the model database assumed an initial production output value of US$0.3 million to avoid problems of scaling when solving the model.

Table A4.10. Satellite account for key commodities

Commodity	Unit	Supply	Imports	Production	Unit Price (in USD/unit)	Supply value in million USD	Comment
Glulam	m3	150	0	150	316.6	0.05	Production and price based on NRDCL, 2020
Charcoal	tons	110,073	109,938	135	243.3	26.78	Domestic production based on latest estimate from 2016, see MoAF, 2019
Coke	tons	71,225	71,225	0	301.7	21.49	
Construction steel	tons	24,703	24,703	0	1,091.3	26.96	The unit price was only derived from imports whose quantity was reported in kg

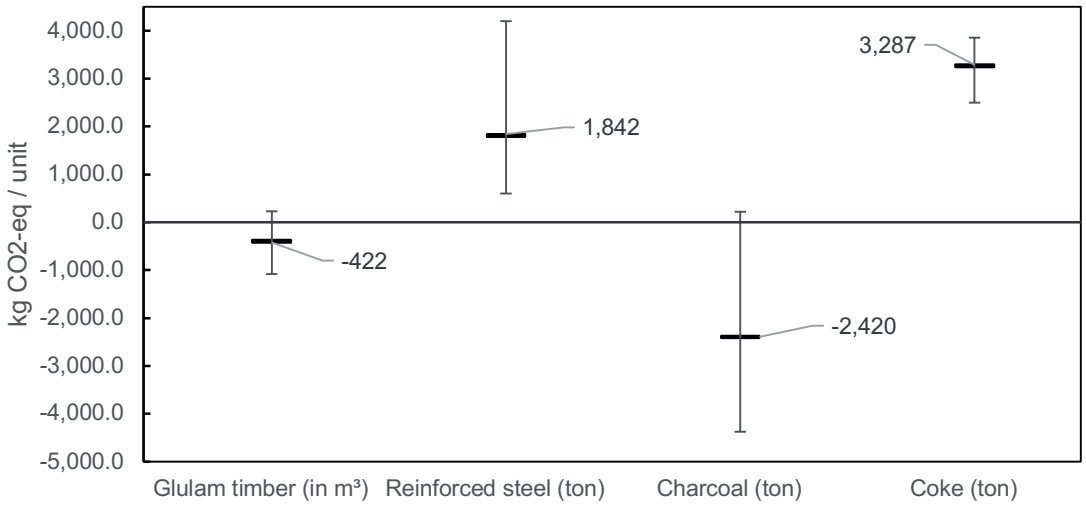
Source: MoF, 2020

8.4 Comparison of carbon footprints

Figure 6 presents carbon footprint data for the above-mentioned commodities. The underlying data has been derived from literature, predominantly from life-cycle assessments. On average, glulam timber is estimated to have a negative carbon footprint of -422 kg CO2-eq m-3. If one cubic meter of glulam timber replaced one ton of steel, then about 2,264 kg CO2-eq are avoided. However, the true GHG emission reduction potential of glulam will of course depend on the substitutability of glulam timber and construction (Winchester and Reilly, 2020). Generally, it is plausible to assume that a certain minimum share of total steel used in construction can principally be replaced by glulam. For our analysis, we assume a conservative share of 10%. Based on Table 10, the maximum market size for glulam timber is US$2.7 million, which is about factor 57 of the current production value of glulam. This will serve as a maximum market size of glulam timber in Bhutan. Petersen and Solberg (2002) found that for the construction of the Oslo airport roof the use of glulam timber instead of steel resulted in a range of avoided tons of CO2e 0.24 to 0.31 for every m^3 of sawn wood used in the glulam production. Including carbon fixation on forest land, this estimate increases to 0.40 – 0.97.

The lower and upper bounds reported in Figure 6 account for the uncertainty in the carbon footprint estimates, which are highly dependent on the actual production process and nature of inputs. For example, the carbon footprint of steel will highly depend on the emission factor of the electricity used in the manufacturing process. The footprint of charcoal production is particularly sensitive towards the sustainability of forest inputs used and the efficiency achieved during the carbonization process. Certain factors will also not be reflected in these footprints, for instance that charcoal imported from Southern India will likely have higher transportation associated greenhouse gas emissions compared to domestically produced charcoal (ceteris paribus). The estimates from Figure 6 will be used to report a range of possible GHG emission reductions when reporting the model results.

Figure A4.5. Global warming potential in kg CO2-equivalents per unit. Source: Own assessment based on sources listed in appendix A



8.5 Model modifications

The production structure of the model has been extended to depict substitution possibilities between glulam timber and construction steel in the construction sector and between charcoal and coke in both the chemical and metallurgical sector. The substitution between these production inputs is modelled using a constant elasticity of substitution technology specification, in which the substitution elasticity governs the degree of substitutability. An elastic substitution elasticity is assumed in all cases setting . This suggests a very elastic substitution relationship which is in line with similar studies. Since the glulam sector's size is relatively small compared to other manufacturing activities, one faces the technical problem of "small shares stay small". This can be mitigated by assuming a rather high substitution elasticity. The degree to which this assumption holds is also dependent on the overall size of the glulam production expansion, as arguably not all construction steel used can be substituted with equal ease. Domestically produced and imported charcoal are treated as homogenous commodities following Feuerbacher et al. (2021).

8.6 Results of value-added forestry scenarios

Table 12 presents the changes in output, prices and trade flows for the forestry and manufacturing sectors across all five scenarios. The investment in the glulam sector increases the glulam timber production more than six-fold. The expansion is higher when this scenario is combined with an expansion in managed forest area (scenario C2). The purchaser price of glulam timber falls strongly (22.9% to 23.7%). As a result, domestic output of construction steel decreases by 1.9% and imports decline at an even higher rate (3.4%). The export of construction steel declines but is negligible in size.

The impact on the forestry sector is rather moderate in scenario C1. Output of aggregate forest products increases between 1.2%. This is largely driven by increased demand for logs due to the glulam timber investments. Imports of logs increase by 4.5% when there is no expansion in forest area. The net imports of wood-based products would increase in scenario C1, since exports of forest products are limited to non-wood forest products. This changes in scenario C2. A slightly higher increase in log production is sufficient to even reduce the imports of logs. The net imports of wood-based products would consequently decline. The introduction of a sales tax on construction steel in scenario C3 increases the price of glulam timber and leads to a strong reduction in the import of construction steel (13.7%). As construction steel and basic metals are produced by the same production activity (using a flexible multi-product approach), we also observe a moderate decline in basic metal production and exports.

The investment in domestic charcoal production, scenarios C4-C6, would have a stronger impact on both the forestry and manufacturing sector. Domestic charcoal production experiences a very strong boost, which is accompanied by a strong increase in fuelwood extraction and imports. The net imports of wood-based products would decrease due to the very strong drop in charcoal imports. The marked relative increase in fuelwood is negligible in absolute numbers. An important insight is that in scenario C4 and C5, there are no reductions in the use of coke realized if domestic charcoal production is boosted. This is because the level of domestic charcoal production does not lead to a substantial change in the import price of charcoal, but leads to overall lower input prices for the charcoal demanding activities. The price of charcoal remains stable, since the model is based on a perfect substitution assumption between domestic and imported charcoal. This assumption is plausible given that both are chemically almost identical products (the carbon content of Bhutanese charcoal is unknown, which could justify a lower or higher price). Coke is exclusively imported and its import price is also stable. Already a slight decline in production cost (due to lower prices for other inputs such as firewood and mining products), however, increases the output and export of metal products.

Coke imports only drop once the price of coke is increased by levying a sales tax. The 10% additive change in the sales tax has a pronounced effect. The price of coke increases by 9.4%9 and the imports of coke are reduced by 43.5%. The price of charcoal still remains unaffected. However, this policy comes at a price. The tax on coke increases the price of basic metals and construction steel and thus reduces the competitiveness of these industries demonstrated by the 14.7% decline in exports. The import of basis metals decline, as these are used as intermediate inputs in the metallurgical industries. In contrast, the import of construction steel increases, as the domestic production became less competitive given the tax on coke.

Table A4.11: Output, price and trade flow changes for forestry, manufacturing and utility sectors

	C1	C2	C3	C4	C5	C6
			Output changes			
Forestry	1.2	1.6	1.6	1.3	1.9	1.9
Firewood Subsistence	-0.1	-0.3	-0.3	-7.3	-4.9	-3.7
Firewood Market	0.6	0.7	-1.2	39.9	41.2	36.6
Logs	2.1	3.0	3.2	0.1	0.1	0.2
Manufacturing	1.0	1.1	-1.3	3.1	3.3	-3.1
Glulam production	659.9	719.1	1062.9	-0.2	-0.3	1.6
Charcoal	0.3	0.4	0.3	2720.8	2729.1	2730.8
Coke						
Chemical products	0.3	0.4	0.5	0.3	0.3	0.9
Construction steel	-1.9	-1.9	-11.1	1.0	1.2	-5.1
Basic metals	1.4	1.4	-5.1	4.7	5.4	-14.1
Utilities	0.0	0.0	0.1	-0.1	-0.1	0.2
			Purchaser price changes			
Forestry	0.3	-1.1	-0.9	1.1	0.6	0.7
Firewood Subsistence	0.1	0.2	0.4	4.8	2.9	3.0
Firewood Market	-0.4	-0.5	-0.6	-1.7	-2.9	-2.9

9 The 10% sales tax is levied with respect to the base price level. Since the price of coke also slightly increases in the reference scenario, the subsequent price increase does not equal 10%.

	C1	C2	C3	C4	C5	C6
Logs	0.5	-1.8	-1.6	0.3	0.3	0.4
Manufacturing	-0.1	-0.1	0.2	-0.1	-0.1	0.1
Glulam production	-22.9	-23.7	-22.4	-0.4	-0.5	0.6
Charcoal	0.0	0.0	0.0	0.0	0.0	0.0
Coke	0.0	0.0	0.0	0.0	0.0	9.4
Chemical products	0.0	0.0	-0.2	-0.1	-0.1	-0.2
Construction steel	-0.4	-0.4	7.2	-0.4	-0.5	1.1
Basic metals	-0.1	-0.1	0.1	-0.2	-0.3	0.5
Utilities	0.0	0.0	0.0	0.0	0.0	-0.1
			Import changes			
Forestry	3.1	-2.6	-1.9	3.2	3.2	4.1
Firewood Subsistence						
Firewood Market	-0.6	-1.3	-3.7	28.7	21.3	17.8
Logs	4.5	-4.1	-3.2	1.7	1.7	2.4
Manufacturing	0.2	0.2	-1.1	-0.6	-0.6	-2.2
Glulam production						
Charcoal	1.0	1.0	-5.6	-21.7	-21.1	-13.3
Coke	1.0	1.0	-4.7	3.6	4.2	-43.5
Chemical products	0.6	0.7	-0.3	0.1	0.1	0.0
Construction steel	-3.4	-3.4	-13.7	-0.9	-0.9	0.9
Basic metals	0.6	0.6	-3.1	2.1	2.4	-5.8
Utilities						
			Export changes			
Forestry	0.7	-0.5	-1.5	-4.0	-6.9	-7.8
Firewood Subsistence						
Firewood Market						
Logs						
Manufacturing	1.3	1.2	-3.5	3.7	4.2	-10.2
Glulam production						
Charcoal						
Coke						
Chemical products	0.3	0.4	0.9	0.5	0.5	1.4
Construction steel	-0.2	-0.2	-8.3	3.1	3.5	-10.4
Basic metals	1.5	1.5	-5.3	5.0	5.7	-14.7
Utilities	-0.2	-0.2	0.3	-0.1	-0.1	1.1

8.7 Direct changes in greenhouse gas emissions

The simulated forestry scenarios can contribute to the Bhutan's 100% carbon neutrality policy objective, particularly if they are accompanied with policies that levy taxes on carbon intensive substitute goods.

Table 13 presents the changes in the domestic use of physical quantities of key commodities (glulam, charcoal, coke and construction steel) and related GHG emissions. All glulam scenarios would contribute to Bhutan's carbon neutrality goal. However, the GHG emission reduction potential is minimal if the investment in the glulam technology is not linked to a policy that taxes construction steel. When a 10% sales tax is levied on construction steel the GHG reduction potential is 8 kt CO2-eq per year, corresponding to almost 1% of total GHG emissions in 2015 according to the third national GHG inventory. Conducting a sensitivity analysis, this potential could be 14 kt CO2-eq per year if a 20% sales tax is levied instead.

Notably, the charcoal production scenarios without taxation of coke would not reduce GHG emissions, since basic metal and chemical production benefit from lower input costs resulting in export increases and higher demand for imported coke and charcoal. As a consequence, these scenarios result in slight increases of net GHG emissions. However, when combined with a 10% sales tax on coke, total GHG emissions can be reduced by about 124 kt CO2-eq per year (192 kt CO2-eq per year in case of a 20% sales tax). This is more than 3% of the total GHG emissions in 2015. When only considering industrial GHG emissions (excl. those from land-use changes and agriculture), the relative reduction potential is about 8%. The absolute magnitude of reducing GHG emissions through substituting coke with charcoal is substantially lower than the estimated potential of 235 kt CO2-eq per year as stated in the third national GHG inventory. This indicates that the results are on the lower bound, pointing to the possibility of assuming a more elastic substitution elasticity between coke and charcoal or simulating a higher tax rate on coke (as shown by means of sensitivity analysis).

Table A4.12: Changes in physical quantities of key commodities and related changes in GHG emissions

	Commodity	Unit	Reference	C1	C2	C3	C4	C5	C6
Domestic use	Glulam	m3	150	1,136	1,225	1,739	149	149	152
	Charcoal	tons	110,073	111,214	111,204	103,933	114,591	115,276	123,861
	Coke	tons	71,225	71,937	71,938	67,865	73,799	74,181	40,265
	Construction steel	tons	24,703	24,046	24,036	21,623	24,704	24,718	24,227
Greenhouse gas emissions by commodity	Glulam	tons CO_2-eq	-62	-472	-508	-722	-62	-62	-63
	Charcoal	tons CO_2-eq	-154,778	-156,382	-156,368	-146,144	-161,131	-162,094	-174,166
	Coke	tons CO_2-eq	238,156	240,537	240,538	226,920	246,761	248,040	134,635
	Construction steel	tons CO_2-eq	41,792	40,680	40,663	36,581	41,793	41,817	40,985
	Total	tons CO_2-eq	125,108	124,363	124,324	116,635	127,361	127,701	1,391
Total greenhouse gas emissions by commodity	Avoided GHG compared to base	tons CO_2-eq	*0*	*-745*	*-783*	*-8,472*	*2,254*	*2,593*	*-123,717*
		% of total GHG emissions in 2015	*0.00*	*-0.02*	*-0.02*	*-0.22*	*0.06*	*0.07*	*-3.24*
		% of total GHG industrial emissions in 2015	0.00	-0.05	-0.05	-0.52	0.14	0.16	-7.59

8.8 Macro-level changes

Table 14 presents the macro-level changes for all six forestry scenarios. GDP is only moderately impacted by the simulated scenarios, which is primarily owed to the small economy-wide relevance of the domestic glulam and charcoal sectors in the base. GDP increases most in the last scenario GDP, where the charcoal investment is combined with forest expansion and a sales tax on coke. The welfare of rural and agricultural households increases particularly in those scenarios when forest expansion is combined with a tax on carbon-intensive substitutes. Throughout all scenarios, foreign savings decline, as both domestically produced glulam or charcoal result in the substitution of imports either directly or indirectly. As mentioned previously, scenarios C4 and C5 result in increasing exports of basic metals, which is accompanied with slight increases in coke imports running counter to the intended effect of the investment.

Table A4.13: Macro-level results for wood-based GHG mitigation scenarios

	% changes					
	C1	C2	C3	C4	C5	C6
	Glulam	Glulam_exp	Glulam_exp_tax	Charcoal	Charcoal_exp	Charcoal_exp_tax
GDP[1]	0.26	0.29	0.25	0.31	0.32	0.39
Absorption[1]	0.14	0.16	0.03	-0.31	-0.31	0.14
Investment[1]	0.31	0.38	-0.41	0.29	0.30	0.21
Government expenditure[1]	0.00	0.00	0.00	0.00	0.00	0.00
Household consumption[1]	0.07	0.07	0.35	-0.80	-0.82	0.13
Domestic savings	0.60	0.60	0.60	2.70	2.77	0.38
Foreign savings	-1.54	-1.53	-1.54	-6.90	-7.09	-0.97
Exports[1]	0.50	0.49	-0.55	1.17	1.27	-1.68
Export of chemical products	0.33	0.41	0.86	0.49	0.52	1.37
Export of basic metals	1.50	1.48	-5.28	4.97	5.72	-14.72
Export of electricity	-0.16	-0.16	0.35	-0.10	-0.11	1.06
Imports[1]	0.12	0.12	-0.82	-0.58	-0.54	-1.67
Import of charcoal	1.04	1.03	-5.63	-21.70	-21.15	-13.29
Import of construction steel	-3.36	-3.40	-13.66	-0.86	-0.93	0.88
Import of coke	1.00	1.00	-4.72	3.61	4.15	-43.47
Real Exchange Rate[1]	0.21	0.25	0.03	0.23	0.23	0.20
Producer Price Index	-0.20	-0.24	-0.02	-0.22	-0.23	-0.22
Welfare changes[2]						
All households	0.33	0.33	0.60	0.47	0.48	0.29
Urban households	0.46	0.47	0.83	0.77	0.75	0.28
Rural households	0.23	0.22	0.42	0.23	0.27	0.30
Agricultural households	0.25	0.22	0.40	0.22	0.28	0.42

Note: 1Real changes calculated based on constant prices from the reference scenario.
2Welfare is measured as the share of equivalent variation in initial household expenditure in the reference scenario. Equivalent variation can be understood as being equal to the monetary amount that must be added (subtracted) to (from) the household's initial income in order to make it as well off as in the base (the reference scenario).

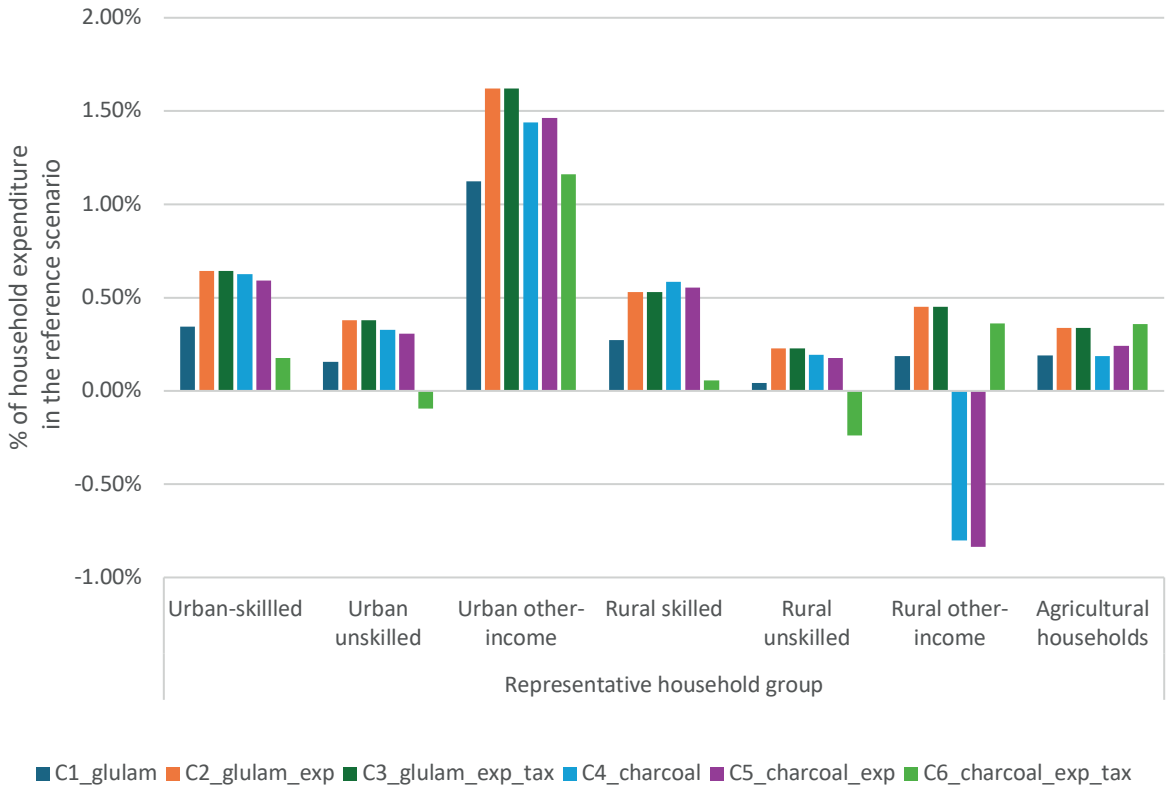
8.9 Changes in employment and factor rents

Agricultural wages increase throughout all scenarios (Table 15), particularly in the charcoal investment scenarios C4-C6 which are combined with an introduction of a commercial fuelwood quota for rural households. Private capital returns increase throughout, and all capital returns increase in scenarios C4-C5, while in the last scenario, C6, publicly hold capital faces a slight drop. The scenarios result in higher employment levels throughout, which particularly holds for skilled labor where the base level of unemployment is also known to be highest.

Table A4.14: Changes in factor rents and employment

	C1	C2	C3	C4	C5	C6
						Factor rent changes
Skilled labor wages	-1.38	-1.40	-1.32	-1.40	-1.42	-1.73
Unskilled labor wages	-1.00	-0.98	-0.42	-0.89	-0.91	-1.09
Agricultural wages	0.14	0.34	0.49	0.79	1.30	1.73
Private capital	0.23	0.26	0.32	0.18	0.19	-0.08
Public capital	0.04	-0.04	-0.16	1.59	1.56	1.65
Hydropower capital	0.18	0.19	0.12	0.19	0.19	0.19
						Employment changes
Total labor	0.82	0.82	0.82	0.83	0.83	0.80
Skilled labor	1.21	1.22	1.19	1.22	1.21	1.14
Unskilled labor	0.67	0.67	0.70	0.68	0.68	0.66
Agricultural labor	0.17	0.18	0.18	0.20	0.21	0.23

Figure A4.6.Changes in household welfare by representative household group



8.10 Literature values for carbon footprints

Technology	Source	Unit	Mean	Lower bound	Upper bound	Comment
Glulam	Bowers *et al.*, 2017	kg CO_2-Eq / m³	-1,010.2	-1082.7	-937.7	All include sequestration
	Thünen-Institut für Holzforschung, 2018	kg CO_2-Eq / m³	-257.06	-486.0	228.97	Upper bound without carbon sequestration; lower bound with sequestration
	Total	kg CO_2-Eq / m³	-422.41	-1082.7	228.97	
Reinforcing steel	Zabalza Bribián, Valero Capilla and Aranda Usón, 2011	kg CO_2-Eq / ton	1,526	-	-	
	Frischknecht *et al.*, 2019	kg CO_2-Eq / ton	1857.5	600	4200	Visually extracted from Fig. 3
	Total	kg CO_2-Eq / ton	1841.7	600	4200	
Charcoal	Leme *et al.*, 2021	kg CO_2-Eq / ton	-2,237.7	-3418.1	-122.0	Estimates from various carbonization technologies
	Bailis *et al.* (2013)	kg CO_2-Eq / ton	-3056.5	-4375.0	-1997.7	Visually extracted from Fig. 7. Converted from emissions per ton of carbon in charcoal assuming a 72% share.
	Norgate and Langberg (2009)	kg CO_2-Eq / ton	220.0	-	-	Excludes carbon sequestration
	Total	kg CO_2-Eq / ton	-2419.5	-4375.0	220.0	
Coke	Norgate and Langberg, 2009	kg CO_2-Eq / ton	3670			
	IPCC, 2006	kg CO_2-Eq / ton	3124.49	2497.8	3855.6	Carbon footprint estimated for coke oven coke multiplying the default carbon content (TJ/ton) times the effective CO_2 emission factor (tons/TJ)
	Total	kg CO_2-Eq / ton	3286.9	2497.8	3855.6	

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Annex 5: Bhutan's EPI Ranking

Country Profile: Bhutan
Region: Southern Asia

Environmental Performance Index

	Rank	EPI Score	10-Year Change	Regional Rank	Regional Average
Environmental Performance Index	**107**	**39.3**	**-9.6**	**1**	**32.7**
Environmental Health	**120**	**29.8**	**+2.2**	**3**	**26.8**
Air Quality	154	24.4	-	3	23.7
Household solid fuels	128	18.6	+4.4	3	19.4
PM25 exposure	125	30.6	-3.2	3	27.8
Ozone exposure	177	2.1	-0.3	5	12.2
Sanitation & Drinking Water	122	31.2	+4.9	3	30.8
Unsafe sanitation	124	30.8	+5,9	3	32.9
Unsafe drinking water	120	31.4	+4.1	3	29.4
Heavy Metals / Lead exposure	113	43.3	+5.3	3	33.2
Waste Management / Controlled solid waste	61	59.7	-	1	19.6
Ecosystem Vitality	**87**	**45.7**	**-17.3**	**1**	**36.7**
Biodiversity & Habitat	11	87.2	+2.2	1	45.7
Terrestrial biomes (nat'l)	1	100	-	1	47.3
Terrestrial biomes (global)	1	100	-	1	53.6
Marine protected areas	0	0	-	8	7.8
Protected Areas Representativeness Index	31	50.7	+20.8	1	19.8
Species Habitat Index	16	96.6	-3.3	2	88.8
Species Protection Index	22	98.3	-	1	64.1
Biodiversity Habitat Index	93	52.3	+0.3	3	47.8
Ecosystem Services	33	60.2	-6.3	5	59,4
Tree cover loss	29	56.4	-8.4	5	58.0
Grassland loss	22	88.1	+24.2	2	64.3
Wetland loss	1	100	-	1	79.1
Fisheries	0	0	-	8	20.4
Fish Stock Status	0	0	-	8	15.7
Marine Trophic Index	0	0	-	8	19.0
Fish caught by trawling	0	0	-	8	32.6
Climate Change	169	24.7	-35.4	6	32.6
CO2 growth rate	176	0	-56.1	6	14.4
CH4 growth rate	62	80	+11.5	2	67.8
F-gas growth rate	0	0	-	8	93.5
N2O growth rate	40	74.4	+7.1	2	49.8
Black Carbon growth rate	124	39.8	-14.7	5	40.2
CO2 from land cover	131	31.9	-	5	56.9
Greenhouse gas intensity growth rate	107	44.5	-40.3	6	45.9
Greenhouse gas emissions per capital	74	61.1	-10.8	8	77.7
Pollution Emissions	169	18.2	-33.2	6	31.7
SO2 growth rate	157	31.7	-38,7	6	36.7
NOx growth rate	170	4.7	-27,7	6	26.7
Agriculture / Sustainable Nitrogen Management Index	53	50.2	+5.3	2	39.3
Water Resources / Wastewater treatment	134	0	-	4	0.8


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