World Bank Group

CLIMATE CHANGE ACTION PLAN 2021-2025

SOUTH ASIA ROADMAP

Cover design: Simone McCourtie
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Foreword

South Asia is one of the most vulnerable regions to climate change. Its people are living through a "new climate normal," where intensifying heat waves, cyclones, droughts, and floods are testing the limits of governments, businesses, and citizens to adapt. Jacobabad in Pakistan's Sindh province was, this year, the hottest city on the planet with temperatures higher than the human body can handle. In 2020, more than three million people were evacuated to safety from the fury of Super Cyclone Amphan.

At the same time, South Asia has an unfinished development agenda with legitimate aspirations to reach middle income status in the foreseeable future, which will include increasing access to energy, increasing rural incomes and managing large scale urbanization, among others. The success with which South Asian countries navigate these development transitions, while also reducing emissions and increasing climate resilience, will determine the region's ability to lift millions from the threat of poverty and vulnerability, and help the world to secure the overall climate transition.

There are many examples of where South Asia is already leading the way in sustainable and resilient development. India is one of the world's leaders in installed solar energy. Bangladesh is a model for the world in terms of building coastal resilience. However, now more than ever, more urgent transformational climate action will pave the way for a resilient, sustainable recovery in South Asia. Emerging "green" sectors like battery technologies, e-mobility, climate smart agriculture and water management, and climate-friendly housing, and industrial decarbonization offer South Asian countries a new paradigm to generate growth and create sustainable jobs.

Our South Asia Climate Roadmap is an explicit pivot to better integrate and ramp up World Bank Group support for mitigation and adaptation efforts with development activities over the next five years. The Plan builds on the global Climate Change Action Plan by offering concrete steps to help the region accelerate transitions in three key areas that will be critical to increasing incomes, reducing emissions, and building resilience to the rapidly warming climate in the region.

First, the Bank Group will help scale up climate-smart food system strategies and investments and deepen its support to increase farm productivity and lower emissions, while also conserving water and energy.

Second, decarbonizing the energy sector—while ensuring universal access to electricity—is critical to avoid the greatest impacts from climate change. The Roadmap is designed to help countries across South Asia transition to zero-carbon energy system that not only drive growth but are also equitable and just.

Third, the Roadmap fosters the growth of low-carbon and climate resilient urban centers. South Asia, the second-fastest urbanizing region of the world, will add nearly 600 million people to urban areas in the next thirty years. The Bank Group will support competitive, livable cities in South Asia that are designed and built for people not cars, that use urban density and form in a smart manner, and that are reliant on well-functioning, clean, integrated public transport systems.

Delivering on this commitment will also require systemic resilience for people, including climate-smart social protection systems and incorporating climate considerations upstream into infrastructure planning. It will also require robust, fit-for-purpose public and private financial systems that can fund the transitions away from carbon-emitting sectors and incentivize resilience. That means working with our partners across the region to green the financial sector, improve the efficiency of public expenditures, and use scarce public resources to leverage private finance.

This Roadmap will evolve over time. The new Climate Change and Development Reports, developed collaboratively with key stakeholders, will elaborate in more detail the priority reforms and investments that will be needed to accelerate these transitions.

I invite policy makers, the private sector, development partners, and civil society stakeholders to work with us to ensure that South Asia accelerates its climate smart-development, helping to save millions of lives from the impacts of climate change. Let's embrace this lifetime opportunity together to put South Asia on a more equitable, prosperous, and cleaner path.

—Hartwig Schafer
Vice President, South Asia Region
World Bank Group

Abbreviations

BAU	business-as-usual
BESS	battery energy storage systems
Cat DDO	Catastrophe Deferred Drawdown Option
CBFM	community-based forest management
CCDR	Country Climate and Development Report
CFF	Climate Fiscal Framework
CIF	Climate Investment Fund
CPF	Country Partnership Framework
CSA	climate-smart agriculture
CSAIP	Climate-Smart Agriculture Investment Plan
CSF	Climate Support Facility
DPC	Development Policy Credit
DPF	Development Policy Financing
DPL	Development Policy Loan
EV	electronic vehicle
GDP	gross domestic product
GHG	greenhouse gas
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IDSR	Integrated Disease Surveillance and Response
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
IPF	Investment Project Financing
LULUCF	land use, land-use change and forestry
MIGA	Multilateral Investment Guarantee Agency
MRV	monitoring, reporting, and verification
MSME	micro, small and medium enterprise
MTFF	medium-term fiscal framework
NBS	nature-based solutions
NAP	National Adaptation Plan
NDCs	Nationally Determined Contributions
PPP	Public Private Partnership
PV	photovoltaic
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SAR	South Asia Region
SDGs	Sustainable Development Goals
SME	small and medium enterprise
UNFCCC	United Nations Framework Convention on Climate Change
WBG	World Bank Group

A woman harvests wheat in central India. Water and food shortages linked to rising temperatures, extreme heat, and drying trends are already evident in South Asia.

—PHOTO: SCOTT WALLACE / WORLD BANK

PART I: OVERVIEW

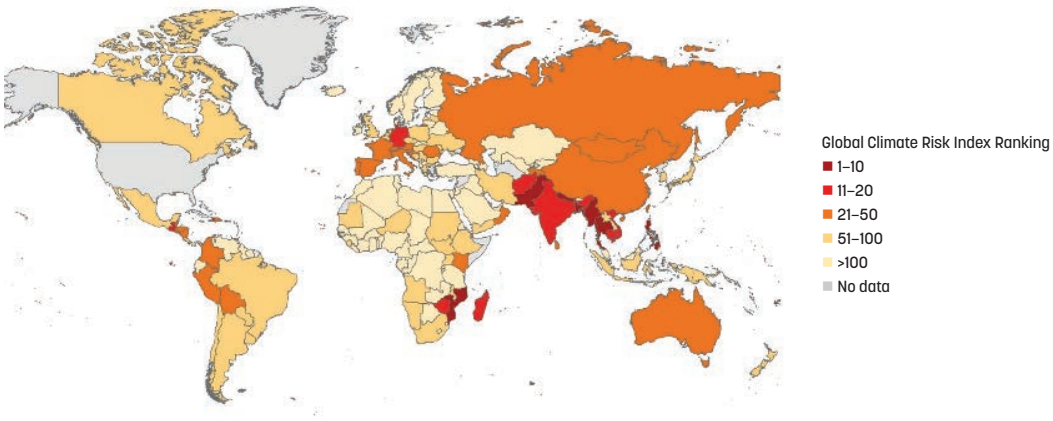
Climate Context in South Asia

With an extended period of robust economic growth before the global COVID-19 pandemic, the South Asia Region (SAR) has achieved impressive improvements in human development and declines in poverty in the past few decades.[1] The extreme poverty rate fell from 58 percent to 15 percent from 1981 to 2014, while the primary school completion rate rose from 50 percent in 1980 to 90 percent in 2019.[2, 3] However, to continue economic growth and increase shared prosperity, South Asia must enhance economic and social inclusion while alleviating increasing threats to its natural resource base. One of three children in South Asia are stunted, pointing to the immense need to feed more than 1.8 billion children and adults.[4] With the world's second-largest number of people living off the grid—more than 150 million people without electricity—South Asia also has hundreds of millions more who live with insufficient or unreliable access to energy.[5, 6] Cities in South Asia are expected to welcome more than 200 million more residents (or about the entire population of Pakistan) by 2030, necessitating reliable access to basic services, productive livelihoods, and livable and resilient housing. Job creation in South Asia is essential, with an estimated 1.5 million people entering the job market every month over the next two decades.[7, 8] Going forward, South Asia will need to transition to a green, resilient, and inclusive development trajectory that enables high-value, high-productivity growth and diversification away from natural resource-dependent livelihoods to ensure competitiveness in the global economy.

South Asia already suffers from climate disasters and is one of the most vulnerable regions to climate risks (*see Figure 1*). Aggressive action at the country and regional level is needed to better adapt and enhance resilience. More than half of all South Asians, or 750 million people in the eight countries—Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka—were affected by one or more climate-related disasters in the last two decades.[9] The primary climate-related risks in South Asia are flood damages, food and water insecurity, and extreme heat from rising temperatures.[10] The changing climate could sharply diminish living conditions for up to 800 million people in a region that already has some of the world's poorest and most vulnerable populations.[11] Projected losses from climate change in GDP per capita for South Asian countries are higher than the global average of about seven percent, with Bhutan facing a potential loss of 18 percent, Nepal 13 percent, India 10 percent, and Pakistan 10 percent in 2100.[12]

Accelerating climate adaptation is critical to building resilience to the rapidly warming climate in the region. South Asia, along with the rest of the world, is encountering a "new climate normal" in which intensifying heat waves, cyclones, droughts, and floods are beginning to test the limits of citizens, businesses, and governments to deal with climate change, particularly with its disproportionate impacts on the poorest and most vulnerable.[13] With sea level rise likely to make parts of highly populated coastal areas uninhabitable in the future, estimates predict 40 million climate migrants in South Asia by 2050.[14] South Asia's unique climate context—the uncertainty of future monsoon patterns, the melting of the Himalayan glaciers, and the vulnerability of low-lying coastal cities—point to the urgency of adaptation.

FIGURE 1: Global Climate Risk Index 2021: Country Rankings (2000-2019)[15]



In light of South Asia's acute climate vulnerabilities, the most effective long-term solution to protect the region from climate risks is a global reduction in greenhouse gas (GHG) emissions to keep temperature increases below 2 degrees Celsius (C), if not below 1.5 degrees C, showing the region's stake in ensuring the overall success of the Paris Agreement.[16] Delaying climate action only increases unavoidable costs—the Intergovernmental Panel on Climate Change (IPCC) states that postponing mitigation efforts until 2030 could increase total mitigation costs by 50 percent.[17]

Recovery and reconstruction efforts from the COVID-19 pandemic offer South Asian countries a unique opportunity to adapt to and mitigate climate change by investing in resilient infrastructure, re-skilling their populations for high-productivity jobs, and rebuilding their economies around cleaner energy. To date, governments have committed more than $10 trillion in economic stimulus measures around the world, with large post-COVID recovery plans in South Asia (India: $93 billion; Pakistan: $5.2 billion, and Bangladesh: $4.6 billion) offering a rare chance to invest in systemic resilience to climate change and decouple growth from GHG emissions.[18] When designed around climate resilience and decarbonization, post-COVID recovery plans and policies can deliver both economic growth and climate action. Climate-positive policies, such as investments in renewable energy, energy efficiency, natural capital restoration, and green jobs training, generate more long-term growth than traditional fiscal stimulus measures.[19] Shifting to a resilient and low-carbon growth trajectory will require significant investments with strong private sector engagement. There is a sizeable potential market: an International Finance Corporation (IFC) study identified $3.4 trillion in climate-smart investment opportunities in South Asia, with energy-efficient green buildings representing an investment potential of more than $1.5 trillion from 2018 to 2030, and green transport infrastructure and electric vehicles having an investment potential of over $950 billion in the same period.[20]

South Asia's emissions are comparatively low but are rapidly rising with urbanization and the growing middle class. Total GHG emissions for the region equaled 8.6 percent of the global total in 2018, but showed a 58.5 percent growth in emissions over the preceding decade.[21, 22, 23] Given the region's high emission intensity, or emissions per GDP, South Asia needs to avoid locking in high-emitting investments that will be costly to reverse later.[24] India is now the third-largest emitter in the world and accounts for 80 percent of the region's emissions (*Figure 2*), reflecting the country's large

population and economic activity. Decarbonizing economic growth will be key to reducing emissions in the region and reducing South Asia's share of global emissions.

FIGURE 2: SAR Total GHG Emissions, by Country and Sector[25]

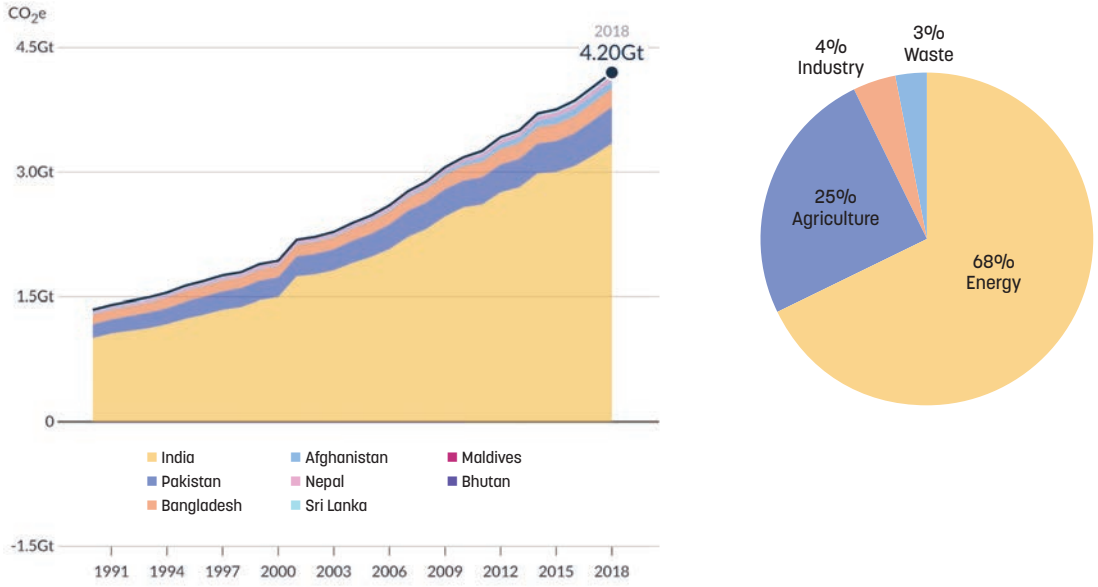


FIGURE 3: SAR GHG Emissions per Capita (1990–2018), by Country, with China, US, and UK[26]

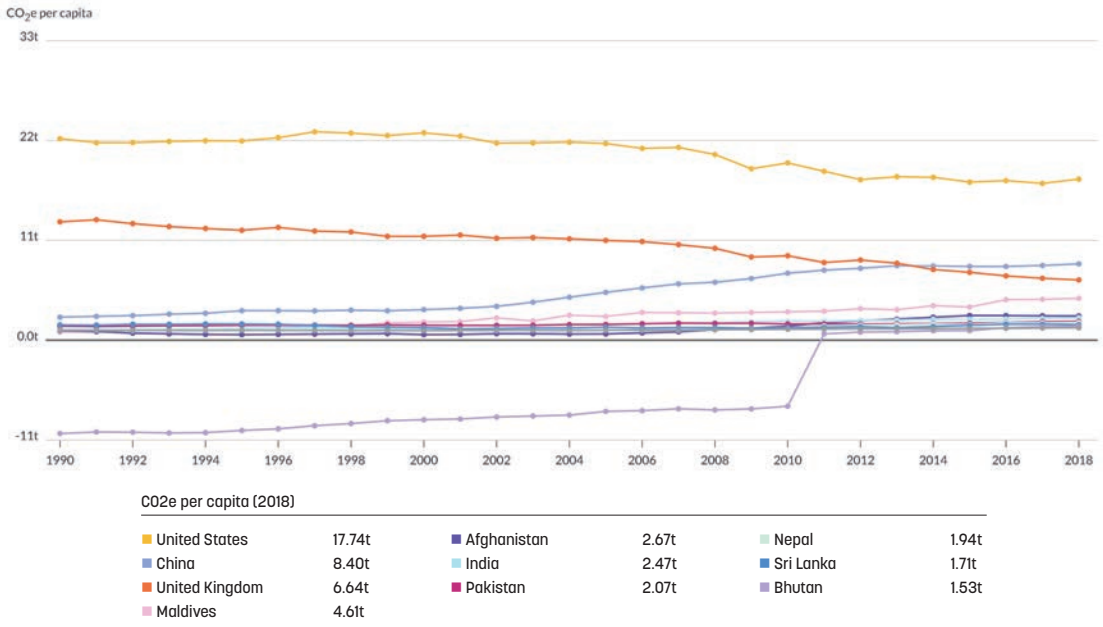


FIGURE 4: SAR GHG Emissions per GDP (1990–2018), by Country, with China, US, and UK[27]

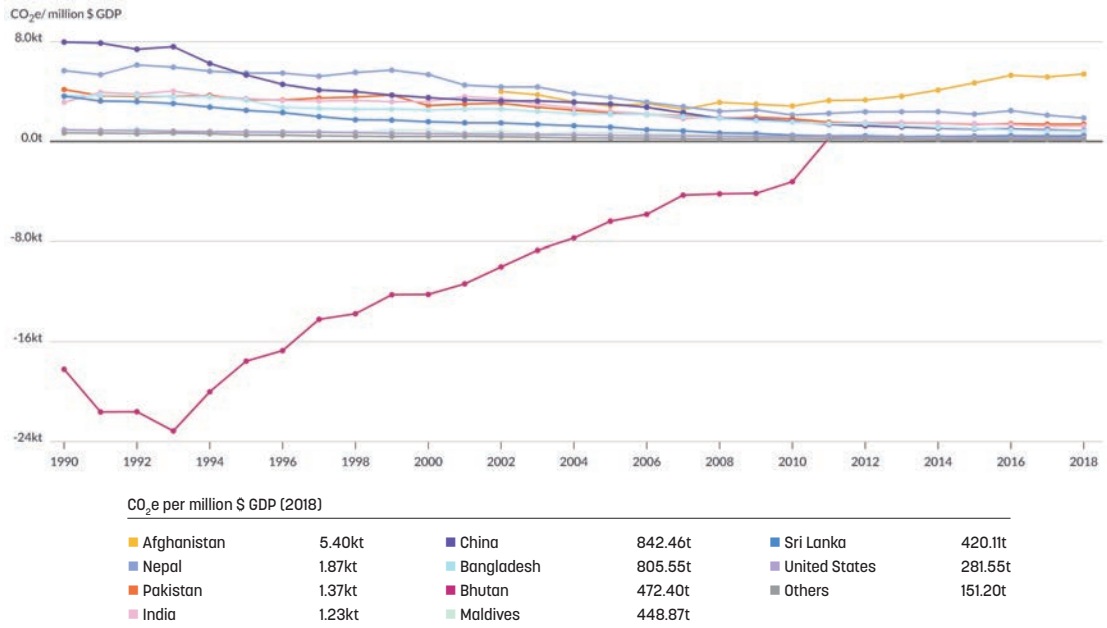


TABLE 1: Summary Table of Emissions and Sectoral Breakdown in SAR Countries (2018)[28]

					SHARE OF GHG EMISSIONS BY SECTOR (%)				
Country	GHG Emissions ($MtCO_2e$)	Share of Global GHG Emissions	Emissions per Capita (tCO_2e/ capita)	Emissions per GDP (tCO_2e/ mil $GDP)	Energy	Agriculture	LULUCF (land use, land-use change and forestry)	Industry	Waste
Afghanistan	99	0.2%	2.7	5400	80%	15%	0%	1%	4%
Bangladesh	221	0.5%	1.3	806	39%	40%	10%	2%	9%
Bhutan	1	0.0%	1.5	472	126%	46%	-113%	34%	7%
India	3347	7.1%	2.5	1230	72%	21%	-1%	4%	2%
Maldives	2	0.0%	4.6	449	82%	0%	0%	13%	6%
Nepal	55	0.1%	1.9	1870	43%	47%	6%	2%	2%
Pakistan	438	0.9%	2.1	1390	48%	42%	2%	6%	2%
Sri Lanka	37	0.1%	1.7	420	64%	16%	5%	6%	9%

All South Asian countries have ratified the Paris Agreement, committing to Nationally Determined Contributions (NDCs) that specify their plans to reduce national GHG emissions and adapt to the impacts of climate change. As part of the Paris Agreement, countries agreed to submit new or updated NDCs every five years, starting in 2020. Countries were also invited to present mid-century, long-term, low-GHG emissions development strategies, known as long-term strategies (LTS). Five SAR countries have announced intentions to enhance ambitions and actions in their second NDCs, but Nepal and Bhutan are the only countries to submit a second NDC, while Bangladesh and Maldives have submitted updates to their first NDCs. No South Asian country has announced plans to submit a LTS (*Figure 6*).

TABLE 2: Status of South Asian Countries' NDC Updates[29]

Country	Pre-2020 Pledge	Intended NDC	NDC	Updated First NDC	2nd NDC	LTS	Climate Framework Laws or Policies	Sectoral Laws or Policies
Afghanistan	✓	✓	✓	✗	✗	✗	✗	✓
Bangladesh	✗	✓	✓	✓	✗	✗	✗	✓
Bhutan	✓	✓	✓	✗	✓	✗	✗	✓
India	✓	✓	✓	✗	✗	✗	✗	✓
Maldives	✓	✓	✓	✓	✗	✗	✓	✓
Nepal	✗	✓	✓	✗	✓	✗	✗	✓
Pakistan	✗	✓	✓	✓	—	✗	✗	✓
Sri Lanka	✗	✓	✓	✓	✗	✗	✗	✓

● = Submitted; ● = Not submitted; ● = Intends to submit

South Asia can showcase successful development-centered climate action and highlight globally important issues related to climate risks and opportunities. India is the world's third largest emitter, but also now has the world's fifth largest solar photovoltaic (PV) market with almost 50 GW of total installed capacity.[30] Bangladesh is often cited as one of the most vulnerable countries to climate change but is gaining recognition for its progress on drastically reducing deaths from cyclones and other extreme events. Bhutan is the world's first carbon-negative country, with 60 percent of the land area as officially mandated forest cover, while Nepal's community-based forest management (CBFM) program has led to about a 40 percent reduction in deforestation while also reducing poverty by four percent.[31, 32, 33]

Enhanced regional cooperation is necessary to address climate risks that do not respect national borders, and for transboundary issues in weather forecasting, air pollution reduction, water resource management, and regional power market development. Countries in South Asia share the Himalaya, Karakoram, and Hindu Kush mountain range and its associated river basins, linking provision of water, food, and energy to more than 1.9 billion people in the region. Five out of eight countries in South Asia share coastlines with rapidly rising sea levels. The shared annual monsoon and the projected reductions in pre-monsoon river flows and changes in the monsoon pose similar challenges to South Asian countries. Regional cooperation will allow South Asian countries to share data on collective risks, reform and harmonize climate policies, and build trust through shared infrastructure and technical know-how. The World Bank Group (WBG) will continue to harness its experiences in facilitating regional cooperation in hydrometeorological and climate services and river basin management to strengthen its support in air quality management and regional power market development, through increased knowledge-sharing of best practices, shared data platforms and systems on common risks, and integrated regional infrastructure projects.

Both climate adaptation and mitigation, when integrated with development objectives, can generate long-term growth and jobs, along with other significant local co-benefits. For instance, air pollution generated by burning fossil fuels is attributed to 4.5 million premature deaths worldwide every year, with over 1 million occurring in South Asia in 2018.[34] Transitioning to renewable energy addresses air pollution, enhances public health, improves energy security, and reduces fossil fuel imports. Many global studies demonstrate how concerted climate adaptation and mitigation efforts will lead to long-term growth and job creation. Investing $1.8 trillion in early warning systems, climate-resilient infrastructure, improved dryland agriculture, mangrove protection, and water security could generate $7.1 trillion in global net benefits.[35, 36]

There will be short-term costs to bear before realizing long-term benefits. Climate adaptation and decarbonization entail moving away from climate-vulnerable and carbon-intensive sectors at a time when budgets are tight, with widening fiscal deficits from reduced growth and tax revenues. These sectoral re-allocations will result in negative impacts on some workers, businesses, and investors, such as coastal farmers and coal miners, requiring a better understanding of the social and spatial distribution of these projected losses to enable a just transition for those affected, especially to avoid concentrating losses within specific groups and/or regions.[37] While global analyses on the costs and benefits of climate action exist, more country-specific analytics are needed to probe the short- and medium-term trade-offs in the transition to a green economy at a more granular level, to ensure solutions are designed to reduce disproportionate costs to certain groups or areas over others, and to maximize aggregate benefits of climate action in South Asia.[38]

The South Asia Region Climate Roadmap

Climate action is intricately linked to fulfilling the core mission of the WBG: ending extreme poverty and boosting shared prosperity. Climate change presents enormous challenges as well as opportunities for development in South Asia, making it essential that climate and development be addressed in an integrated manner. The SAR Climate Roadmap fully integrates climate and development objectives and focuses on development-centered climate action through its emphasis on food, energy, cities, transport, and financial systems.[39]

As the largest multilateral provider of climate finance both globally and in South Asia, the WBG has devoted around 35 percent of its lending portfolio for climate adaptation and mitigation in the region in the last few years.[40, 41] The SAR Climate Roadmap aims to move beyond quantitative targets for climate-relevant financing and enable the region to focus on climate actions that deliver the largest impact in terms of enhancing systemic resilience to climate change and/or reducing GHG emissions.

The SAR Climate Roadmap was developed with the following guiding principles:

» The objective of the SAR Climate Roadmap is to increase climate ambition in South Asia, in close cooperation with South Asian policy makers, development partners, civil society, the private sector, and other key stakeholders.

» The SAR Climate Roadmap presents targeted and distinct climate action plans that prioritize areas that can maximize impact at the country level. It builds on and strengthens country climate priorities and commitments, such as the NDCs. It also is guided by the WBG Climate Change Action Plan's commitment to alignment with the Paris Agreement and the development of new Country Climate and Development Report (CCDR) diagnostics.

» The SAR Climate Roadmap prioritizes climate adaptation and resilience in all South Asian countries and at a regional level, with a focus on water scarcity and excess. For decarbonization, the SAR Climate Roadmap provides targeted activities in India, Pakistan, and Bangladesh, along with low-carbon initiatives in other countries that present strong local co-benefits, such as reduced air pollution and enhanced access to public transit.

» The SAR Climate Roadmap drives private investment and mobilization by creating markets for climate business solutions through policies, financial innovations, and business models targeted at sector-specific local conditions.

Supporting Key Transitions in South Asia

The SAR Climate Roadmap enables countries in South Asia to focus on the actions that can deliver substantial outcomes in key transition areas. The food, energy, cities, and transport systems account for over 90 percent of regional GHG emissions (see *Figure 2*) and are critical to shifting towards a high-value, high-productivity growth trajectory and alleviating insecurities involving food and nutrition, energy, housing, and employment. These areas are also essential to enhancing the resilience of households, communities, and infrastructure to climate change, as well as reducing GHG emissions. In addition, the WBG will work to increase systemic resilience and financing to support the transitions.

1. The Agriculture, Food, Water, and Land Systems Transition

Water and food shortages linked to rising temperatures, extreme heat, and drying trends are already evident in South Asia.[42] The cascading effects of more variable rainfall and higher temperatures will lead to overall lower water availability and crop productivity, impacting food prices and living costs, nutrition, and agriculture-related livelihoods. Saltwater intrusion from sea-level rise in low-lying agricultural plains is further expected to exacerbate these issues.

Compounding these risks are the region's heavy reliance on the monsoon for agriculture, with over 70 percent of South Asia's annual precipitation in a four-month period, and increasing rainfall variability both within the rainy season and between years.[43, 44] Changing patterns of rainfall or melting snow and ice are altering freshwater systems, affecting the quantity and quality of water available in a region that already is one of the world's most water-stressed. Agriculture is particularly vulnerable to rainfall variations and heat effects, while precipitation variations also affect water resources management by necessitating dynamic planning of storage and water allocation across various end-use requirements.

Rising temperatures are already disrupting the growing season for regions in Pakistan, India, and Bangladesh. According to the International Food Policy Research Institute, average yields for crops

in South Asia, such as wheat, rice, and maize will shrink by 50 percent, 17 percent, and six percent, respectively, by 2050 compared to 2000. As a result, the IPCC projects that the South Asia region will have the largest number of food-insecure people by 2050 because of climate change.[45]

Increasing the resource efficiency of agriculture is imperative to ensuring food and nutrition security in a water-stressed and energy-poor region. With 90 percent of the available water in the region used in agriculture, and nearly half of groundwater used for irrigation in the region, inefficient use of water in agriculture is a key issue. For example, India uses double or triple the amount of water to produce a single unit of major food crops compared to China, Brazil, and the United States.[46] In addition, agriculture is also a significant source of GHG emissions (*Figure* 2, 25 percent). Higher mechanization, the increased use of groundwater irrigation, and cold chain development could significantly increase energy demands, requiring improved energy efficiency and low-carbon energy utilization.

Forests, with their ability to act as carbon sinks, can play a critical role in both climate adaptation and decarbonization. Across the region, there is potential for forest restoration in over 20 million hectares that would support sequestration of 250-500 Mt of carbon, generate about 20 million short-term jobs, and provide livelihoods to more than 5 million households with few alternative off-farm employment options.[47] Improving forest and agricultural land management is among the most cost-effective ways to reduce GHG emissions and ensure a continuous flow of ecosystem services.[48] Forests play an important role in watershed health as well, through the filtering and regulation of water flows. In many South Asian countries, forests are a major dimension of NDCs and remain a key pathway for building natural capital and resilience.

Climate-smart agriculture (CSA) increases productivity and incomes, strengthens resilience to climate change, and reduces GHG emissions. Agricultural water productivity can be greatly enhanced by increasing the water efficiency of existing land uses, shifting to land use patterns with lower water needs, and investing in high-efficiency irrigation systems. Crop species and varieties should be adapted to the expected impacts of climate change for any specific location and farming system to safeguard harvests against climate-driven extreme weather events and surges in pests and diseases. Selecting diverse species capable of resisting specific extreme weather conditions, such as certain root and tuber crops in cyclone-prone areas, or species with short growing cycles from seed to yield, leads to less variation in crop production and higher crop revenues. Increased crop diversity has also been shown to make local landscapes more resilient to floods and droughts, with higher yields and lower yield variability. Resource-efficient farming practices, such as zero-tillage wheat production, direct seeding of rice, laser land leveling, and alternate wetting and drying, reduce both water and energy use, and can greatly reduce GHG emissions from agriculture in South Asia.[49] Ensuring sustained agriculture productivity in the face of climate pressures also requires attention to degraded landscapes, drylands, and ranges, and not just productive irrigated land; protection or development of related natural habitats, ecosystems, and wetlands to ensure water quantity and quality; and management of soil quality and diversity/composition to better manage water-holding capacity, carbon retention, and resistance to drought and erosion, as well as crop and range productivity. CSA also has enormous potential to attract private investment, with IFC estimating a $209 billion climate investment opportunity in South Asia.[50]

South Asia needs to address the water-agriculture-energy nexus. Existing policy support to increase cereal production, including water and energy subsidies and grain price guarantees, has disincentivized resource efficiency and emission reductions in agriculture in the region, leading to groundwater depletion and an over-reliance on diesel to pump groundwater for irrigation.[51] CSA policies such as agricultural subsidy reforms, water resource management policies, and water pricing reforms will need to focus on the interdependencies of agriculture, water, and energy, and facilitate overall sectoral coordination.[52] For instance, solar-powered irrigation has much potential to increase farm productivity and lower emissions, but will need to be coupled with water-efficient irrigation systems, and where possible, net-metering with the option of selling surplus electricity back to the grid to incentivize water and energy conservation.[53]

The WBG has developed CSA country profiles and Climate-Smart Agriculture Investment Plans (CSAIP) in South Asia to systematically assess the opportunities to simultaneously deliver higher agricultural productivity, improve resilience, and lower GHG emissions. The WBG has developed CSA country profiles for Bangladesh, Bhutan, Nepal, Pakistan (also for Sindh and Punjab Province), and Sri Lanka, and CSAIPs for Nepal and Bangladesh.[54] The CSA profiles and CSAIPs helped to build awareness of the countries' options, identify good practices for the most important food production and distribution systems as well as potential for improvement, and facilitate dialogue among stakeholders in South Asian countries.

With the SAR Climate Roadmap, the WBG will scale up CSA strategies and investments. In Bangladesh, Bhutan, and Nepal, the WBG will support the development of a CSAIP, while in Bangladesh, Bhutan, and Nepal, the World Bank and IFC will strengthen private sector engagement and CSA innovation in agri-food value chains. In both India and Pakistan, the SAR Climate Roadmap aims to strengthen the water-agriculture nexus through technical assistance on agricultural subsidy reforms, water resource management policies, and water pricing reforms. A notable proposed activity is performance-based lending with a focus on resource efficiency in an upcoming irrigation project in India. The WBG will also support watershed planning and restoration of agro-forest landscapes in Sri Lanka.

2. The Energy and Transport Transition

Transitioning to low-carbon energy is critical for enhancing energy security, improving public health, and limiting emissions in South Asia. With fossil fuels—petroleum, natural gas, and coal—accounting for about 80 percent of total primary energy production in South Asia, GHGs from energy production dominate the sectoral composition of regional emissions (*Figure 2*, 68 percent). More than 1 million deaths a year in South Asia are attributed to air pollution from fossil fuels, and 33 percent of the total energy used in the region is imported.[55, 56] Energy demand is also growing rapidly, with overall demand increasing by over 50 percent since 2000. Projected economic growth in coming decades, with currently low per-capita consumption levels and high population growth, indicate that South Asia will heavily impact global energy demand, with the need for grid-connected power (currently 420 GW installed capacity) expected to more than double within a decade.[57, 58] India will account for 25 percent of global energy demand growth in the next two decades and is set to overtake the European Union as the world's third-biggest energy consumer by 2030.[59]

With abundant renewable energy resources and the increasing competitiveness of solar and wind energy, South Asia can significantly boost its zero-carbon power generation capacities.

Rapid technological innovation and economies of scale have driven down renewable electricity costs sharply over the last decade, with power from new renewables now cheaper than power from new fossil fuels in many applications.[60] The price of electricity from solar PV, for instance, declined by 89 percent from 2009 to 2019, while the price of onshore wind energy fell by 70 percent.[61] Over the past five years, solar PV capacity in India has grown 60 percent and wind 10 percent, significantly outpacing the seven percent growth in overall installed capacity. Solar and wind now constitute about 20 percent of India's total installed capacity (93.5 GW in 2020).[62] In Bangladesh, floating solar PV panels are increasingly being considered where land is scarce, while Sri Lanka and India share some of the best potential for offshore wind energy in the world. Regional power trading is emerging as a promising means to optimize the fuel mix and support renewable energy expansion. Scaling up renewable energy will lead to cheaper energy prices for households, more high-skilled jobs, and a stabilized climate. In some countries in the region, gas will continue to play a role as a transition fuel. The WBG may consider opportunities to increase the efficiency of gas supply in existing systems, without increasing the life span of these systems, as part of an overall strategy to ensure that GHG emissions are minimized.

Increased energy efficiency is also vital to alleviating energy poverty and reducing emissions. Energy efficiency is referred to as "the first fuel of a sustainable energy system," pointing to its role in reducing the need for primary energy.[63] As current electric power transmission and distribution losses amount to about 20 percent of total output in the region, energy efficiency on both the supply and demand sides also will improve energy access by increasing the available bandwidth in existing generation, transmission, and distribution networks.[64, 65]

Transitioning away from fossil fuels increases the risk of coal, oil, and gas projects becoming unable to recover their investment costs. In South Asia, Pakistan announced a moratorium on new coal power in December 2020, and Bangladesh is reducing the number of planned coal plants in the planned update to its power sector master plan.[66, 67] The potential for stranded fossil assets and livelihoods looms large, especially for new installed capacity, with infrastructure expected to last for at least several decades. Accordingly, the WBG will increase its support for a move away from coal to lower carbon growth through a just transition in South Asian countries that request assistance. The WBG can help accelerate the closure and repurposing of coal mines and plants, with an eye on distributional effects, and foster new sources of employment and economic growth for the affected communities and regions.

The WBG will support differentiated strategies around decarbonization of electricity, energy storage, energy efficiency, and just transitions in South Asian countries that vary according to context and the importance of each element within each context. In India, the WBG will accelerate efforts to decarbonize the growing economy, with an emphasis on reducing end-use emissions from transport and heavy industries like steel and cement. The WBG will support the expansion of solar and wind technologies in line with the Indian government's intention to increase renewable energy's share of total electricity production from about 35 percent today to 40 percent by 2030, increase energy storage infrastructure, enhance supply side efficiency, and support a just transition from coal. In Pakistan and Bangladesh, the WBG will continue to support energy access expansion, catalyze necessary energy and fiscal policy reforms, and foster coordinated deployments of renewable energy, battery storage, and energy efficiency on both supply and demand sides to increase the reliability and

efficiency of electricity systems. In the rest of the SAR countries, the WBG will place an increased emphasis on hydropower, solar, and wind energy production, with the aim of increasing affordability, reliability, and efficiency and reducing energy imports.

The SAR Climate Roadmap will support efficient mobility solutions to decarbonize the transport sector. Decarbonizing transport will require a comprehensive set of coordinated actions around three key pillars: (i) decarbonizing passenger transport by encouraging use of sustainable multi-modal public transport (including non-motorized transport) and better integrated land-use and transport planning; (ii) decarbonizing logistics by encouraging the use of more carbon-efficient (and generally lower-cost) modes like rail and inland waterways where available and modernizing trucking fleets; and (iii) facilitating the transition towards zero-emission vehicles through e-mobility, green fuels and hydrogen fuel cells. With passenger transport, the WBG will support countries in developing integrated public transport systems, including efficient bus services, bus rapid transits (BRTs) and metros, shared mobility, walking, and cycling to transition away from high-polluting private transport services. The WBG will also support strategies that aim to reduce the number of kilometers traveled though more efficient urban growth, compact cities, and transit-oriented development to avoid costly and near irreversible carbon lock-ins. For passengers in interurban and rural areas, mode shift to rail and bus transport through quality services will play a critical role. For freight transport, the WBG will also support countries in decarbonizing the freight sector with an emphasis on modernizing the trucking sector to utilize greener and fuller vehicles with lower fossil fuel intensities, as well as more energy- and cost-efficient modes like rail, waterways, and inter-modal transport. Bigger, newer, fuller trucks with reduced empty back hauls are critical for the region to decarbonize freight. Lastly, the WBG will support countries in preparing and implementing zero-emission vehicle transition solutions, including electric mobility, green fuels, and use of hydrogen fuel cells. Economies of scale are leading to rapidly shifting prices, as in the case of batteries, and each technology has a different time frame for implementation with varying challenges to ensure broad-based uptake. Accelerating electric vehicle adoption in the region will require a combination of prioritizing the development of charging networks, making increased amounts of concessional financing available at flexible terms, and creating an enabling framework through required policy and regulatory changes.

In addition, the SAR Climate Roadmap will enable industrial decarbonization through electrification and use of alternative fuels. Reducing emissions from heavy industry such as iron and steel is more challenging due to the chemistry of production processes and limited options to replace fuel and heat sources and reduce byproduct emissions. With rapid growth in the building stock and other infrastructure, increasing demand for a range of construction materials, notably steel and cement, highlights the need for a low-carbon transition in manufacturing activities through the electrification of processes, greater material and energy efficiency, the use of technologies like carbon capture, and a switch to progressively lower-carbon fuels such as green hydrogen.

In South Asia, the WBG will also continue to support the development of a conducive investment environment for the private sector and commercial financing of renewable energy power generation through policy reforms and more efficient distribution of electricity. India has been minimizing the use of public resources for capital investment in renewable generation capacity, with government policies enabling private sector investment at scale, such as reverse auctions, lower corporate tax rates for developers, and project guarantees, and these lessons can be translated to relevant programs in Pakistan, Bangladesh, and Sri Lanka. Also, while financing for renewables has improved significantly,

the WBG will continue to develop innovative financing and de-risking instruments, especially in countries with less-developed financial markets.

The WBG will work to expand and strengthen the regional power grid. Interconnected power systems can reduce the need to build reserve capacity in individual systems and create economies of scale, allowing for a more optimal matching of the demand for and supply of energy using differences in capacity and low-carbon energy resources available in the region. For example, wet seasons in Bhutan and Nepal, which have abundant hydropower resources, coincide with summer peak demand in India and Bangladesh, creating power export opportunities for Bhutan and Nepal, while integrating intermittent renewables in India and Bangladesh. The WBG will support development of transmission lines and a transboundary market in electricity, along with appropriate support for hydropower development to facilitate increased integration of solar and wind energy.[68]

3. The Urban Transition

South Asia is the second-fastest urbanizing region in the world and will add over 580 million people in urban areas by 2050. This will increase the 34 percent urbanization rate in 2018 to close to 50 percent by 2050— almost doubling the current urban population in the next three decades. The region is also expected to have 10 megacities with around 200 million people by 2030.[69]

South Asian cities are already among the most exposed to climate risks and will need to enhance their resilience to climactic changes.[70] Asian cities possess a combination of high climate hazard risks, high concentration of critical infrastructure and population density in risk zones, high rates of multidimensional poverty and subsequent low coping capacities, and large informal settlements serving about 20 percent of the urban population.[71] In particular, the urban poor, who live in riskier environments such as floodplains or unstable slopes, are most at risk from exposure to increasing climatic changes.[72] Around 80 percent of major South Asian cities are exposed to floods, and sea level rise and resulting coastal inundation and salt intrusion pose significantly higher flooding and storm surge risks for low-lying, densely populated coastal areas, particularly when coupled with projected changes in cyclone frequency and/or intensity.[73] Under business-as-usual (BAU) emission scenarios, megacities in India, Bangladesh, and Pakistan could be among the first places in the world to experience extreme heat that exceeds the survivability threshold of 35 degrees C.[74]

South Asian cities will need to undertake long-term planning that integrates land-use and zoning, transportation, and energy. Cities in the region will need to enhance service delivery for livability, inclusivity, and overall increased resilience to adverse events. Moreover, South Asian cities will also need to translate projections of future climate conditions into tangible impacts on the local context, prepare and/or update master plans to incorporate climate change, and prioritize climate-resilient and low-carbon investments with robust knowledge and data. Climate risks need to be considered at all stages of the urban infrastructure lifecycle, from the planning phase to engineering, operations, maintenance, and contingency programming, particularly for critical infrastructure to increase continuity of services during and after a crisis. Given that most of the infrastructure needed for the year 2050 has yet to be built, this represents a significant opportunity to develop more sustainable, efficient, and low-carbon infrastructure. Promising climate-smart interventions include building envelope improvements through codes, standards, and mandatory retrofits to ensure resilience and resource efficiency, and the use of nature-based infrastructure solutions to lower emissions and reduce flooding and heat risks.

Effective local institutions are instrumental to enhance climate resilience and enable low-carbon growth. Cities need to strengthen their service delivery systems, execute urban development projects, and manage the built environment and the local economy. Cities require adequate resources for infrastructure and service delivery, accountable institutions, reliable climate risk information to use in spatial planning and urban service delivery, and data-driven metrics to prioritize climate adaptation and mitigation solutions.[75]

Secondary cities can play an important role in addressing climate migration in South Asia, as over 40 million climate migrants are expected in the region by 2050.[76] With one in every seven people in Bangladesh expected to be displaced by climate change by mid-century, Dhaka, the most densely populated city in the world housing over half of the country's population, is unlikely to be able to absorb the future influx of migrants. Rural-urban migration, amplified by climate impacts on natural resource-dependent livelihoods, increases risks of poorly planned expansion and the growth of slums in South Asian cities. While urban form and land-use patterns can be locked in for decades in existing cities, secondary cities tend to be behind on the infrastructure development curve, making it easier for long-term integrated climate planning efforts. South Asia should proactively invest in secondary cities by identifying climate havens, facilitating low-carbon and climate-resilient development, and ensuring access to basic services and productive livelihoods in these cities.

With the SAR Climate Roadmap, the WBG aims to increase the effectiveness of cities to respond to climate change by enhancing service delivery and infrastructure systems and investing in risk reduction and disaster preparedness efforts. In India, the WBG will support multi-sectoral urban service delivery efforts in Chennai, with an emphasis on mobility and spatial development, water resource management and flood risk management, and urban governance and finance. Similarly, in Pakistan, the SAR Climate Roadmap will support solid waste management infrastructure and service delivery investments in Karachi, where urban flooding is frequent. In addition, the WBG will provide technical assistance for climate-resilient and resource-efficient design features in the government's housing program.

The WBG will support cities in South Asia in developing climate plans to accelerate low-carbon, climate-resilient investments and prioritize climate action in hotspots. The SAR Climate Roadmap will focus on a few select cities to pilot and demonstrate climate-smart approaches and expand on these experiences to catalyze climate-smart urban transitions in the region.[77]

South Asian cities will need to manage transportation demand and building performance, two of the biggest determinants of energy consumption and GHG emissions in urban settlements. Although South Asian cities currently account for relatively low emissions per capita, private vehicle use is increasing rapidly due to inadequate infrastructure and transit services. South Asia will need to increase transit-oriented development and low-carbon public transport to facilitate climate-smart growth. The complex governance arrangements and policies currently in place do not tend to foster transit-oriented development or the use of non-motorized transport infrastructure for integrated mobility services, constraining low-carbon urban development. Moreover, buildings are also a critical part of the climate change problem—about 40 percent of all energy generated is used for cooling, heating, and lighting buildings. Using proven and commercially available technologies can reduce energy consumption in buildings by 30-80 percent.[78] Climate-resilient and resource-efficient housing

development, in particular, can support post-COVID recovery processes through job creation for the newly poor in high-performance construction, while also making buildings better adapted to higher temperatures and increased extreme events in the future.[79, 80]

4. Shifting to Systemic Resilience

South Asia's acute climate vulnerabilities necessitate a shift away from asset-level resilience toward systemic resilience that accounts for people, infrastructure, and service delivery systems. Geographically, coastal deltas in the region are vulnerable to climate impacts, with sea level rise likely to make parts of highly populated coastal areas uninhabitable in the future. While deaths from climate-related extreme events have been drastically reduced with investments in early warning and evacuation systems in the past few decades, South Asian countries will need to also accelerate enhancing the resilience of their populations and infrastructure to prepare for rising seas, worsening floods, higher temperatures, and other slow-onset climate impacts. Climate change is also a major threat to public health, necessitating policies to address both the direct health impacts of climate change (heat, extreme events, and sea-level rise), and indirect (infectious diseases, food, and nutrition insecurity, and forced displacements).[81]

South Asian countries will need to focus on people's resilience to climate change through increased adaptive social protection, economic inclusion, and community-led climate efforts.[82] Climate-responsive social protection measures aim to: (i) build the resilience of the poorest and most vulnerable people to climate change before shocks occur; (ii) prevent people from falling into poverty (or deeper poverty) after the shocks occur; and (iii) support livelihoods that can reduce the impact on climate through up-skilling and income diversification. Economic inclusion programs can build resilience to climate shocks by helping households invest in productive assets and diversify their livelihoods away from climate-vulnerable activities, especially into non-agricultural activities. In addition, while there is potential for climate policies and investments to generate economic growth and jobs, these social and economic benefits will need to be better targeted to the most vulnerable populations to reduce poverty and existing inequities. Communities should also be empowered to co-develop climate solutions to coordinate action and build on local knowledge, through community-level climate risk mapping, planning, participation, and budgeting processes.

South Asia will need to scale up nature-based solutions (NBS) to reduce vulnerability and build resilience to climate change. Designed to protect, sustainably manage, and restore ecosystems, NBS could deliver 37 percent of the cost-effective climate mitigation needed through 2030.[83] Investments in green infrastructure, such as mangroves, wetlands, and watersheds, have proven to be cost-effective for water resource and disaster risk management, as they enhance the performance of traditional gray infrastructure and can sometimes even replace it. Mangroves in Sri Lanka, for instance, also allow for high-value seafood production, showing the larger need to better protect and manage these ecosystems to leverage their potential contributions to climate resilience. NBS and ecosystem protection and restoration, preferably in collaboration with local communities, can increase food and water security, reduce drought and flooding risks, support tourism livelihoods, and deliver cost-effective climate mitigation through increased carbon sequestration.

The region needs to ensure the resilience of infrastructure networks and service delivery systems. The WBG will support infrastructure development in South Asia to reduce emissions as well as to

enhance climate resilience at the system level to help foster trade, build long-term economic growth, and enhance the adaptive capacity of communities. The WBG will utilize a systemic and integrated planning approach at the network and landscape levels for enhanced decision-making, disaster risk financing for critical infrastructure, and contingency planning. An integrated approach is crucial in identifying the most critical and exposed infrastructure assets, shifting development away from vulnerable zones, and ensuring redundancy while minimizing negative impacts on the environment. At the infrastructure level, the focus will be on increasing resilience through innovative technologies, bio-engineering, and long-term climate-smart strategic maintenance. In particular, investments in more resilient transport corridors and rural roads for sustainable transport and logistics services delivery are necessary for access to essential goods and services, such as jobs, education, health, food, and markets in South Asia, where a significant part of the transport network is highly vulnerable to damage from natural disasters. Water and sanitation, transport, energy, telecommunications, health, and education systems will need to incorporate climate risks into long-term and emergency planning, budgeting, engineering, maintenance, and operations to ensure resilience of both infrastructure assets and service delivery to climate change.[84]

Systemic climate resilience requires adaptive governance and institutions. Governments in South Asia need to change how they assess climate risks and plan adaptation and resilience efforts.[85] Climate risks must be factored into all public decision-making processes, from strategy development to budgeting and investment decisions. In addition, climate risks need to be much more explicit in planning and policy processes such as design standards, policy incentives, and land-use planning and zoning regulations. Climate-informed decisions often involve uncertainties across longer timeframes, and scenario planning can identify investments that are robust across a range of future outcomes. Climate resilience is a multi-level and multi-sectoral governance endeavor, requiring effective coordination across national, state, and local government agencies, and the private sector. Private firms should make their supply chains and production processes more resilient, invest in projects that help other businesses and communities adapt, and sell goods and services to support greater resilience.

5. Financing to Support the Transitions

Delivering on the transitions outlined above will require a financial system (public and private, domestic, and international) that can ensure resources flow to climate-smart transitions in a scale and timeframe commensurate to the magnitude of the issues. South Asia will need to focus on:

- Public finance that incorporates climate risks and incentivizes climate action
- A financial sector that directs finance to climate projects and activities
- Targeted incentives via expansion of carbon pricing
- Disaster risk financing systems
- Increased global climate finance transfers

With the SAR Climate Roadmap, the WBG will support the incorporation of climate change into macroeconomic policy, fiscal planning, and public financial management. The WBG will offer countries technical assistance in considering climate change targets, risks, vulnerabilities, and policy objectives in economic forecasts, debt sustainability analyses, fiscal risk assessments and other macroeconomic policy instruments. The WBG will also help to track tax expenditures on fossil fuels and tax incentives for the consumption and production of fossil fuels, feed-in tariffs, investments in low-carbon technologies, and other relevant incentive measures. Further, the WBG will support the consideration of climate change targets, risks, and vulnerabilities in the formulation of fiscal plans and frameworks, and in the

undertaking of expenditure reviews and program evaluations used to inform fiscal policies. Finally, the WBG will support the incorporation of climate change policy considerations in budget guidelines, pre-budget statements and budget documents, and the tagging of climate-related expenditures.

Enabling policies are needed to increase financing for climate resilience and low-carbon growth. With the SAR Climate Roadmap, the WBG will also support policies to establish climate and infrastructure targets and multi-level, integrated systems planning to provide public and private sectors increased policy continuity and a clearer roadmap for long-term market commitments. Transparent taxonomies and standardization of contracts help facilitate capital market solutions. These high-level, cross-cutting enabling factors in South Asian countries will help create security for investors, help organizations and entities plan the transitions, and encourage a shift to the most-needed climate investments.

The WBG will support market-based mechanisms, including carbon pricing, that enhance the commercial viability of low-carbon technologies, reduce the cost of NDC implementation, and raise overall climate ambition. The WBG will offer technical assistance to expand efforts to price carbon in the region. Businesses in the region have shown their support for a well-designed carbon price to drive investment towards climate-smart solutions. India and Sri Lanka already have domestic carbon pricing mechanisms, and other countries in the region are beginning to consider the role of carbon pricing. Building on the experience with the Partnership for Market Readiness, the WBG can support countries in enhancing readiness and implementation of carbon pricing.[86] In South Asia, four countries—Bangladesh, Bhutan, Nepal, and Pakistan—explicitly reference the use of markets in their NDCs. While smaller countries in the region will be early entrants in the voluntary and compliance carbon markets linked to the Paris Agreement, India is expected to play a dominant role as markets develop. The WBG is testing the infrastructure for the carbon markets through the Climate Warehouse program, setting up the Carbon Asset Trading System and the Climate Market Club to test modalities and procedures, and has been supporting the piloting of post-2020 international climate markets in Bangladesh, Bhutan, India, Nepal, and Pakistan for several years.

Integrated disaster risk financing systems are necessary. Disaster-related liabilities are often managed ex-post, which can increase losses and worsen the macro-fiscal impacts of disasters. In addition to embedding a macroeconomic assessment of disaster risk into debt sustainability analyses, many countries are developing disaster risk financing strategies to identify instruments in advance that can release financing when needed to manage the impacts of a disaster. The WBG can support South Asian countries to identify the optimal mix of financial instruments by determining the associated costs, disbursement timeframes, and amount of financing available for events with differing levels of risk.

International climate finance will continue to be limited in the near future as nations respond to the COVID-19 pandemic. Global calls for greater climate ambition must be accompanied by provision of means of implementation, including finance, from developed countries to developing countries, including South Asian countries. Climate finance may be in the form of upfront investments, such as Climate Investment Funds (CIFs) or Green Climate Fund (GCF), or results-based finance, including carbon markets. The WBG is among the most credible global institutions to channel additional climate finance, beyond the current proportion of climate-relevant finance (climate co-benefits), in its lending portfolio in the region. Private finance mobilization and utilizing limited public resources to leverage private finance will be critical to further catalyzing transitions to climate-resilient, low-carbon development

pathways. Utilizing climate finance and WBG concessional finance, guarantees, and expertise to design new financial instruments can leverage international and local capital markets and private finance.

Country-Specific Climate Action Plans for South Asia

Part II includes a set of country-specific WBG climate engagement plans for Afghanistan*, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. Each plan outlines strategic areas of climate ambition, along with short-term (FY 21-22), medium-term (FY 23-24), and long-term (FY 25 and beyond) plans in each area with the WBG's lending, policy, and knowledge instruments. The country climate action plans reflect the urgency and scale of change needed to address climate change by setting objectives and designing programs that evolve towards long-term systemic shifts (see *Table 3*).

Implementation of the SAR Climate Roadmap

The SAR Climate Roadmap will integrate WBG efforts in developing multi-sectoral solutions to increase climate ambition and catalyze climate-resilient, low-carbon development in South Asia, in close cooperation with South Asian policymakers, development partners, civil society, the private sector, and other key stakeholders.

The SAR Climate Roadmap will support the development of key cutting-edge analytical tools to inform country climate planning and development strategies in South Asia. The new CCDRs will provide an opportunity to analyze the short- and medium-term transition costs in South Asian countries, along with social and spatial distributions of expected costs and benefits of climate action and skill development opportunities. The CCDRs capture the interplay between development (including poverty reduction, growth, inequality) and climate policies. The CCDRs investigate how climate change and global decarbonization may impact a country's development path and priorities, as well as potential areas for country action in resilience, adaptation, and mitigation to improve development outcomes. The CCDRs will be developed collaboratively with key stakeholders, and elaborate in more detail the priority reforms and investments that will be needed to accelerate the key transitions.

The WBG's new flagship trust fund, the Climate Support Facility (CSF), will provide technical assistance and advisory services focusing on a post-COVID green recovery, and support countries to enhance their NDCs and in their efforts to integrate climate change into long-term development planning. With this support from the CSF, the SAR Climate Roadmap will develop at least 10 new analytical activities to catalyze transformative climate action in the region. Notable examples for the first phase of CSF-supported projects include developing a renewable energy and battery storage map for Bangladesh, exploring green hydrogen opportunities in India, analyzing potential reforms of Nepal's fertilizer subsidies, and assessing the benefits of climate action for both economic growth and job creation in South Asia. In addition, the WBG will ensure that new Advisory Services and Analytics (ASA) efforts align with the SAR Climate Roadmap and include one climate-related indicator.

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*The World Bank Group continues to follow events in Afghanistan; once the situation becomes clearer, the Bank will be able to assess next steps. In this context, the SAR Climate Roadmap does not include specific plans for Afghanistan.

TABLE 3: Summary of Climate Change Action Plans for SAR Countries

Country	Priority Themes	Notable Proposed Activities
Bangladesh	» Adaptive delta management and coastal resilience » Human capital for resilience » CSA » Low-carbon and resilient infrastructure » Green growth and macro-fiscal resilience	» Technical assistance and investments to support the Bangladesh Delta Plan 2100 » Investments in social protection mechanisms to increase climate shock-responsiveness » Investments and technical assistance in climate-resilient food system transformations through WB/IFC programs » Investments in climate-resilient energy and transport infrastructure systems
Bhutan	» Sustainable renewable natural resources » Resilient infrastructure » Human capital for resilience » Macro-fiscal resilience and risk-informed decision making	» Investments/technical assistance in climate-smart agribusiness » Technical assistance on sustainable hydropower and regional electricity markets » Technical assistance for transport electrification opportunities » Technical assistance for the establishment of the Bhutan Climate Fund
India	» Decarbonization (energy and transport) » Agriculture-water-energy-air nexus » Sustainable urbanization » Mainstreaming resilience » Leveraging finance for climate action	» Investments in renewable energy expansion, electric mobility and battery storage market development, energy efficiency in cooling » Technical assistance in agro-ecological planning, agricultural subsidy reform, and river basin management » Support to cities in resilient services and infrastructure » Technical assistance for adaptive social protection » Technical assistance on fiscal transfer programs for forestry and air pollution
Maldives	» Coastal and infrastructure resilience » Government, island, and atoll council capacity development » Livelihoods resilience » Clean energy	» Development of investment options for nature-based and hybrid coastal protection measures » Investments in PV energy generation capacity
Nepal	» CSA, water, and resilient natural capital » Climate-resilient cities, towns, viable state, and local governments » Clean energy » Climate-smart transport networks » Human development for economic and environmental resilience	» Investments in hydropower generation, transmission, and distribution, with potential for regional power trade » Promotion of CSA innovation in agricultural value chains » Support for federalization of climate and disaster risk management at all levels of government
Pakistan	» Energy decarbonization » Agriculture-water nexus » Climate-resilient infrastructure and communities » Macro-fiscal resilience	» Investments in floating PV systems and technical assistance for battery storage and wholesale power market development » Investments in agricultural productivity and improved water resources management » Support for climate-resilient and resource-efficient design features in the government's housing program
Sri Lanka	» Resilient infrastructure » Integrated landscape management, agriculture, watershed management, and forests » Clean energy » Resilient livelihoods	» Technical assistance for watershed planning and restoration of agro-forest landscapes » Technical assistance for offshore wind and solar development and energy efficiency policies » Investments in climate-resilient infrastructure in priority river basins

The SAR Climate Roadmap will strengthen climate action in South Asia's WBG development policy-based lending packages (DPFs). The SAR Climate Roadmap will promote climate-focused DPFs to influence systemic policy changes and help strengthen the institutional capacity of governments to undertake climate-informed policies and planning, and focus on incorporating at least one climate-relevant institutional or policy reform into all DPFs in the region. The DPFs can support the implementation of standards and regulations, such as building codes and energy efficiency standards, fossil fuel subsidy reforms, adaptation plans, and other policy measures to increase climate action. Notably, DPFs with Catastrophe Deferred Drawdown Options (Cat DDOs) can provide immediate liquidity to countries to address shocks related to natural disasters and other crises.

The SAR Climate Roadmap is grounded in the overall WBG commitment to support countries in addressing climate change and enhancing resilience to the impacts, as set out in the 2025 Targets for Climate Action, the 2021-2025 Climate Change Action Plan, and the IDA19 commitments.[87] In December 2020, the WBG announced an ambitious target of directing 35 percent of its lending portfolio to climate-related actions, on average, over the next five years. This replaces an earlier target of reaching 28 percent by 2020, which was in place over the previous five years. The World Bank—comprising the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA)—will also split the financing evenly between mitigation and adaptation. The SAR Climate Roadmap also will continue to deepen climate mainstreaming throughout the WBG by screening projects for climate risks and building in appropriate risk mitigation measures, disclosing both gross and net GHG emissions, and applying a shadow carbon price for all material investments. Finally, in line with the overall WBG Climate Change Action Plan, all new operations in South Asia will be aligned with the Paris Agreement by July 2023.[88]

The SAR Climate Roadmap will be implemented over the next five fiscal years (2021-25). A tracking and monitoring system for the SAR Climate Roadmap will be put in place, with the country management units monitoring the delivery of their country-specific climate action plans. As the SAR Climate Roadmap also supports the region in delivering the WBG's 2025 Targets for Climate Action, the 2020-2025 Climate Change Action Plan, and the IDA19 commitments, overall regional progress will be measured with the target indicators outlined in these corporate and IDA commitments.

The SAR Climate Roadmap will also utilize a variety of metrics to systematically gauge climate action progress in the region and track measurable improvements in livelihoods and reductions in GHG emissions. First, it will use international metrics of climate-resilient, low-carbon growth that can be obtained through existing data and enable cross-country comparisons, such as the ND-GAIN country index, carbon intensity (emissions per GDP), and the WBG's RISE (Resilience, Inclusion, Sustainability and Efficiency) Framework.[89] Second, an attempt will be made to develop indicators to measure the WBG's impact on emissions and resilience trajectories. Third, the SAR Climate Roadmap will also track aggregate outputs of activities in the country-specific climate action plans, such as hectares of forests covered in integrated landscape efforts, gigawatts of renewable energy generated, and the number of cities with increased climate and disaster resilience. Lastly, the SAR Climate Roadmap will continue to monitor inputs, or the proportion of climate-relevant financing in its lending portfolio (climate co-benefits), and the share of adaptation versus mitigation financing within the IDA/IBRD portfolio.

Endnotes

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A group discusses construction plans for a dam in Sri Lanka. Accelerating climate adaptation is critical to building resilience to the rapidly warming climate in the South Asia region.

—PHOTO: LAKSHMAN NADARAJA/WORLD BANK

PART II: COUNTRY CLIMATE ACTON PLANS

Two farmers work in Bagram. Climate impacts are expected to worsen socio-economic development.
—PHOTO: ISTOCK

AFGHANISTAN*

Climate Vulnerabilities

Afghanistan is identified as a fragility, conflict, and violence (FCV) country that is poorly positioned to cope with shocks due to its long-running insurgency, political turmoil, migration, extensive donor reliance, pervasive poverty, and low growth.[1] Climate impacts, while significant already, are projected to worsen and set back socio-economic development, affecting food and water security, health and well-being, and peace-building efforts. The average annual temperature in Afghanistan has steadily increased by 0.6° C over the past five decades, and this trend is expected to continue into the next five decades, progressively reaching an increase of 1.4-to–4° C.[2] This climatic trend is expected to influence the overall variability in temperature and precipitation (rainfall and snowfall) patterns, consequently resulting in generally drier conditions, heightened risks of flash floods and drought, and a rise in extreme weather events such as heat and cold waves.[3] These changes also are expected to have substantial and cascading impacts on the water, agriculture, health, and human development sectors in interaction with other underlying risk factors in the country. The 2021 Global Climate Index ranks Afghanistan sixth for climate impact and vulnerability, assessed for 2019, climbing from 24th in 2018.

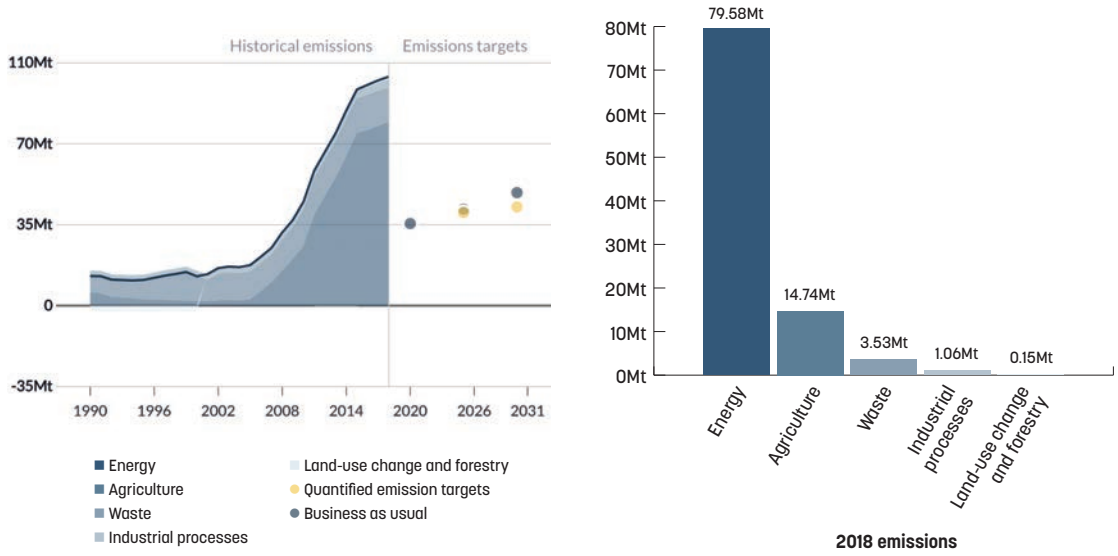
The Helmand, Amu Darya, and Hari Rud river basins are among the most climate-vulnerable river systems in Asia, amplifying the existing shortages of potable/surface water, water storage

*This section was prepared over the course of the year prior to the events of August 15, 2021; it has been subsequently adjusted in response to the changed situation in Afghanistan. The World Bank Group continues to follow events in Afghanistan, and once the situation becomes clearer, the Bank will be able to assess next steps. In this context, the SAR Climate Roadmap does not include specific plans for Afghanistan.

limitations, excessive reliance on snow melt and transboundary watersheds, lack of irrigation and water distribution systems, and overall poor water resource management.[4] The projected decrease in spring-time precipitation, reduction in soil moisture, and intensifying desertification are some factors that will increase the exposure to shocks of agriculture-based livelihoods and ecosystems—which support the livelihood of 85 percent of the Afghan population and constitute a quarter of the country's GDP.[5] Droughts are expected to become a norm, and the increased frequency of droughts due to global warming, coupled with the very low coping capacity of people due to the severe drought in 2018, is impacting crops, livestock, and rangelands that support vulnerable groups such as the 1.5 million nomadic Kuchis.[6] Climate impacts also are expected to decrease water in cities, and the increased frequency and intensity of disasters such as floods and landslides across all 34 provinces presents a formidable threat to lives, well-being, and the economy.

Displacement and urbanization are projected to continue under BAU if no action is taken. Political turmoil and insurgency coupled with natural disasters annually displace hundreds of thousands of Afghans. Forced displacement due to conflict, natural disasters, unemployment, and poverty frequently drive people from rural areas to informal settlements in urban areas, with poor access to social services and infrastructure. Substandard healthcare, education, water, sanitation and hygiene facilities, and drainage and sewer infrastructure further exacerbate the exposure of displaced people and their vulnerability to climate-induced hazards. The 2018 drought forced more than 370,000 people to leave their land for temporary settlements in peri-urban areas, depleting their capital and exacerbating the strain on public services. Severe and recurrent drought continues to threaten the livelihoods of subsistence farmers and vulnerable populations living in rural areas.

FIGURE 6: Sectoral GHG emissions and targets



GHG Emissions

Afghanistan's overall GHG emissions are 45 Mt CO_2e/t per year, and the nation currently has one of the lowest per capita carbon emissions in the world at 0.15 ton per capita and an emission intensity of 0.1 kg per 2017 PPP$ (purchasing price parity dollars) of GDP.[7] The primary contributors to overall GHG emissions are agriculture (64.3 percent), land-use change and forestry (18.8 percent), and

energy (16.2 percent)—all key sectors relevant to the country's long-term economic development.[8] In order to develop into a successful economy, Afghanistan would have to considerably increase its energy use and therefore increase its GHG emissions.

The 2013 Power Sector Master Plan prepared by the Ministry of Energy and Water presented a 20-year electricity demand forecast requiring a base case peak load of 3,500 MW and assessing a gross demand of 18,500 GWh by 2032. To meet this demand, the Power Sector Master Plan identified a combination of increasing domestic energy generation as well as imports.

Nationally Determined Contribution (NDC)

Afghanistan submitted a NDC in 2016 as part of the Paris Agreement. However, major barriers to implementation include a lack of finance, technical and institutional capacities, and reliable down-scaled climate information. The NDC aims to reduce GHG emissions by 13.6 percent compared to BAU by 2030, conditional on external support through a reduction in $CO_{2,}$ $CH_{4,}$ and N_2O in the energy, natural resource management, agriculture, waste management, and mining sectors. With an estimated adaptation cost of $10.8 billion, some of the key adaptation sectors include CSA, sustainable land management, adaptive water management and development of water infrastructure, and watershed and river basin management. The mitigation commitments are estimated to cost $6.6 billion and include the development of renewable resources and energy efficiency, CSA (including livestock and forest management), and solid waste management.

Emerging Priorities

The Global Facility for Disaster Reduction and Recovery (GFDRR) Multi-Hazard Risk Assessment for Afghanistan helped identify areas susceptible to multiple hazards and climatic shocks, consistent with the NDC and Country Partnership Framework (CPF) for FY17-FY20. The CPF was extended in 2019 to cover FY21–FY22 and include among other things a new cross cutting theme on improved climate resilient landscapes and infrastructure. The Afghanistan Reconstruction Trust Fund's 2021-2024 Partnership Framework and Financing Program, approved in June 2021, includes an operating principle on "Building climate change resilience through mainstreaming, targeted interventions, and capacity building". Needs recognized by GFDRR's assessment included strategic engagement, capacity building, early warning and meteorological systems strengthening, and expansion of social safety nets for poor and vulnerable groups, as well as the mainstreaming of climate and disaster resilience in policy planning and investments across various economic sectors, including agriculture, natural resources, education, energy, social development, transport, and urban development.

Considering these developments and analytical evidence, four priority areas with catalytic and complementary impacts on furthering climate change action in Afghanistan have emerged:

- **Climate-Smart Water and Agriculture Management**
- **Resilient Natural Capital**
- **Shock-Responsive Social Protection, Multi-Hazard Risk Information, and Early Warning**
- **Resilient Infrastructure and Clean Energy**

These priority areas are focused on sectors with the biggest emission reduction potential (land use, forestry, and energy), as well as adaptation in sectors that sustain livelihoods and are most vulnerable to the effect of climate change (agriculture, water resources, and infrastructure).

Climate-Smart Water and Agriculture Management

Afghanistan's water and agriculture sectors face important challenges in the context of climate change, especially in relation to water scarcity and drought leading to reduced agriculture productivity, land degradation, and a further increase in already high water and food insecurity. Recent analysis on the impact of climate change on agriculture in Afghanistan (Khulm and Balkhab basins) revealed that short-term impacts on irrigated agriculture can be mitigated with proper water management, while rain-fed agriculture will be more vulnerable with an expected 30-40 percent reduction in productivity that will significantly increase food insecurity and potential famine, given that rain-fed wheat represents 70 percent of the country's wheat production.[9] In addition, important negative impacts are projected in the livestock and forestry sub-sectors, which are major sources of livelihood for the rural poor.

The agriculture sector is largely dominated by smallholders. While farmers still have limited access to improved and climate-resilient varieties of seed, planting materials, and climate-smart technologies, the irrigation and water delivery systems largely remain traditional, with low water delivery efficiency and poor on-farm water management and agricultural practices. This situation further exacerbates water scarcity and vulnerability to climate change, as well as very low agriculture productivity.

To strengthen the resilience of agricultural systems to climate change-related risks, the following areas would need more attention and investment: (i) an integrated approach to promote sustainable management of land and water resources, and mainstreaming of CSA practices to increase water conservation and agricultural productivity, as well as reduce production variability; (ii) adaptation of agricultural systems (crops, animal species, horticulture) to climate change, as well as improved pasture management and feeding practices to support resilience of livestock systems (which may include strengthening agricultural research, developing and testing improved seed varieties, and supporting capacity building and knowledge dissemination); (iii) diversification into drought tolerant/resistant, high-value, and nutritive varieties and breeds that improve food security and nutrition; (iv) development of an agro-meteorological information system, and strengthening crop research and analytics (crop-calendars, etc.) to provide timely agro-meteorological advisories and alerts to farmers, livestock producers, and policy makers; and (v) rehabilitation and improvement of irrigation schemes and adoption of improved water management practices. So far, climate change and agricultural sector development strategies do not provide a coherent future roadmap to adequately deal with climate risk. In addition, the condition and level of adoption of CSA technologies and practices are not known, and the development of consistent planning for investments in the country is lacking.

Resilient Natural Capital

Over 80 percent of people in Afghanistan depend directly or indirectly on natural capital to meet their livelihood requirements. Despite Afghanistan's natural resources' richness and potential, degradation has directly and severely harmed the resilience of the main landscapes and ecosystem services they provide, affecting the livelihoods of the majority of the Afghan population, as well as the country's economic development, particularly in rural areas. Coupled with poverty and a lack of alternatives, the unsustainable use and management of natural resources continues, leading to further degradation and unsustainable practices, as well as contributing to conflict among resource users.

Supporting the resilience of Afghanistan's natural capital will require investment in management, sustainable use, restoration, and conservation. Integrated and collaborative multi-sectoral landscape-based interventions would be needed to derive both ecological and socio-economic benefits. This approach, as defined by the Landscapes for People, Food and Nature initiative, is a long-term collaboration among different groups of land managers and stakeholders to achieve multiple objectives that include agriculture production, provision of ecosystem services, protection of biodiversity, and support for local livelihoods and human health and well-being. Such interventions would improve the livelihoods of vulnerable communities, foster the creation of green jobs, increase resilience to climate change vulnerabilities, support sustainable environmental and social outcomes, reduce land degradation through alternative livelihood programs, enhance ecosystem dependent value chains, create incentives for sustainable utilization of natural resources, and ultimately promote sustainable management and more strategic uses and rehabilitation of ecosystems. They also would provide the needed framework to strengthen human capital, particularly in rural areas, and enhance community income through employment opportunities.

Shock-Responsive Social Protection, Multi-Hazard Risk Information, and Early Warning

Climate change is driving shifts in hydrological regimes of rivers, precipitation variability, and consequently cropping seasons. Increased frequency and intensity of droughts due to climate change has heightened the exposure of agriculture-based livelihoods and ecosystems to varied shocks. Increased temperatures have reduced snow accumulation in the Hindu Kush mountain range, increasing runoff and leading to erratic cycles of flash-flooding and drought. Furthermore, the conflict situation has impeded the maintenance of critical infrastructures needed to mitigate the impact of floods and droughts, such as Qanat and catchment dams. Other than droughts, Afghanistan is exposed to a range of climate-induced and natural hazards, including floods, landslides, avalanches, and earthquake. The 2018 Multi-Hazard Risk Assessment and associated Risk Profile for Afghanistan provide a comprehensive national-level, in-depth multi-hazard risk assessment, covering flood, flash flood, drought, earthquake, snow avalanche, and landslide hazards, as well as detailed asset and exposure modeling, and avails the government risk information relevant for policy planning and investments across various economic sectors.

Establishing accurate and timely hydro-met, early warning, climate, and disaster information services is urgently needed in Afghanistan to minimize human and economic losses. Afghanistan needs to strengthen its policy framework to enable institutional communication and coordination and solidify the entire hydro-met, early warning, and disaster risk management value chain. Coordinated observation networks, forecasting, and early warning services are essential to avoid duplication, to build economies of scale, and to ensure an effective supply chain in the production and delivery of services. Efforts to support the establishment of hydro-met and drought early warning systems as well as a shock-responsive delivery mechanism to build resilience would need to be reinvigorated and expanded to capture other climate-related and natural hazards, such as floods, cold snaps, avalanches, and landslides, that impact road and air services (essential for a land-locked country), reduce the productivity of agriculture, damage critical infrastructure (bridges, tunnels, hospitals), and threaten lives and assets. In addition, Afghanistan could also benefit from regional initiatives in South

and Central Asia that allow it to leap-frog technologies, methods, and systems, as well as enable transboundary risk information exchange.

Resilient Infrastructure and Clean Energy

Infrastructure in Afghanistan is affected by the physical impacts of climate change, including damage due to exposure to flooding. The lack of adequate hazard, exposure, vulnerability, and risk information compounds this problem by under-estimating the true exposure of the economy and Afghan cities and communities to climate, disaster risk, and effectiveness of management measures. Therefore, information on the likely frequency and intensity of climate hazards could inform the design of resilient transport (especially roads), energy, water, and other urban infrastructure to curb climate-induced defects. To minimize losses from disasters, new infrastructure would need to be built in less vulnerable areas and designed to withstand potential climate change impacts over the entire life cycle. In other cases, existing infrastructure would need to be retrofitted to withstand anticipated impacts.

Investments in infrastructure that protect against disasters are also needed to reduce the impact of urban and flash flooding, mitigate avalanche and landslide hazards, improve multi-hazard early warning systems, and mainstream risk information in other key economic sector including urban development, water resources management, transport, energy, etc. These interventions would facilitate the integration of risk considerations into development planning, public policy, and overall investments. This would in turn enable the country to move from response-and-recovery focused disaster risk management to a more pro-active, integrated, and resilient approach that emphasizes risk reduction, mitigation, and preparedness, especially for more frequent and economically destructive hazards such as floods and landslides.

Energy sector infrastructure is also exposed to the impact of climate change, particularly indigenous hydropower that currently delivers about one-third of Afghanistan's electricity supply. Changes in future hydrological regimes will be largely affected by uncertain future precipitation, impacting the hydropower production capacity of Afghanistan.

Approximately 80 percent of Afghanistan's total power capacity of 1,450 MW is imported from neighboring countries. Only 34 percent of the country's population has access to grid electricity, mostly in urban areas, and about 80 percent of the rural population is electrified by solar panels. According to the Energy Services Regulatory Authority, Afghanistan has the potential to produce 220,000 megawatts of electricity from solar energy. The use of solar power is steadily increasing throughout the country. Annual average solar insolation varies from four to 6.5 kWh/m^2/day, with over 300 days of sunshine per year. Domestic hydro power plants have the potential to increase generation outputs to meet the growing energy demand, stabilize the grid to enable integration of intermittent renewable resources, and mitigate GHG emissions.

Endnotes

1. Afghanistan—Multi-hazard risk assessment. Washington, DC: World Bank: https://www.gfdrr.org/sites/default/files/publication/Afghanistan_MHRA.pdf. Since 2000, disasters caused by natural hazards have affected close to 19 million people. An analysis shows that annual expected flood loss nationwide is about $53 million, while a flood with a 20-year return period would affect more than 600,000 people. In addition, landslides are projected to impact over $16 million in GDP, with weather-related fatalities equaling 0.225 percent of GDP. The total economic losses due to natural disasters from 2000 to 2019 amounts to over $173 billion. Droughts have affected 6.5 million people since 2000, and during the recent severe drought of 2018, hundreds of thousands of people were displaced. Long periods of drought can be followed by intense rainfall with catastrophic consequences, including water shortages, and water excess. The flash floods of 2020 killed more than 200 people in eastern Afghanistan. Since 1960, average rainfall in Afghanistan has experienced a slight decline by around two percent per month per decade.
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9. World Bank, Pilot Climate Change Impact Analysis on Hydrology and Agriculture in the Balkhab Watershed, Northern Afghanistan, 2018.

A young girl at a welfare center in Narsingdi, Banglaesh. One in every seven people in Bangladesh is expected to be displaced by climate change by mid-century.

—PHOTO: RAMA GEORGE-ALLEYNE / WORLD BANK

BANGLADESH

Climate Vulnerabilities

Bangladesh experienced rapid social and economic progress in recent decades, reaching lower middle-income status in 2015. However, the COVID-19 pandemic has brought major disruptions to economic activity and worsened the country's economic outlook. The recovery is expected to be gradual, with the growth rate for FY21 projected between 2.6 percent and 5.6 percent. Mobilization of resources to tackle the emerging climate-related issues in this context may become more challenging.

The Global Climate Risk Index ranks Bangladesh as the world's seventh most-affected country over the period 2000-2019, with estimated average annual losses to disaster at around $3 billion, or around one-to-two percent of GDP.[1,2] By mid-century, climate change is likely to cost Bangladesh a further two percent of GDP on top of its baseline losses to climate hazards, a figure which potentially rises to nine percent of GDP by the end of the century if global mitigation action is not increased.[3]

Floods, coastal and riverine erosion, and cyclones are recurrent and worsening. Floods and riverbank erosion affect about 1 million people annually in Bangladesh, and the normal precipitation during the monsoon season every year causes 20–30 percent of the country to become inundated.[4,5] Tropical cyclone winds hit the coast about once a year (>63 kilometers per hour) while cyclone wind speeds are influenced by inland decay, topography, and the presence of vegetation such as the Sundarbans. The coastal zone comprises 19 districts with a population of 41 million people, with predictions that up to 12 million of them could become internal climate migrants by 2050.[6] Internal

mobility is also tied to household capacity to cope with and adapt to environmental changes, and is related to socio-economic barriers including gender, which can affect migration and mobility. Extreme events are expected to compound these vulnerabilities and, for many households, increase the risk of falling back into poverty.[7]

Internal climate migrants along with rural-urban migration will put additional pressure on Bangladeshi cities.[8] Even if the most optimistic climate scenario materializes, internal migration will be a pressing issue in places like Dhaka and Chittagong, where urban services and infrastructure are already overwhelmed.[9] Urban poor and those engaged in economic activities exposed to climate shocks are likely to face severe implications from climate impacts. The COVID-19 crisis, which disproportionately affected urban areas compared to rural areas, has provided a glimpse of the kind of disruption that could come from climate change.

Extreme weather events—including intense floods, drought, and storms—are also undermining the performance of the agricultural sector. Flooding in Bangladesh is a near-constant phenomenon. While regular low-intensity floods have usually been beneficial, extreme floods result in precipitous crop losses, damage to aquaculture infrastructure and loss of aquaculture fish stocks, livestock death, and rural population displacement—which all adversely affect agricultural performance. Agricultural droughts, especially in the northern parts of the country, frequently lead to crop failure, livestock death, land degradation, and reduced groundwater replenishment. The prospect of changing temperatures and precipitation patterns, combined with the uncertainty of the timing and magnitude of extreme events as well as rising sea levels, will impact the agriculture sector. Under current scenarios, production of rice is predicted to fall by eight percent by the year 2050, and wheat production is expected to decrease by 32 percent. Yields of pulses will reduce by 8.8 percent, oilseed-rapeseed by 6.3 percent, vegetables (as a group) by 5.3 percent, and other crops (including jute) by 3.3 percent.[10] In the fisheries sector, increased temperatures will lead to a reduction in the availability of dissolved oxygen, resulting in reduced growth and reproduction success of most fish species. The more frequent occurrence of hypoxic conditions because of temperature increases is expected to bring a reduction of the growth rate and reproductive output of cultured fish species. Other climate impacts on the fisheries sector will include increased disease spread, competition, parasitism, and predation, affecting overall aquaculture productivity and having negative consequences on livelihoods, especially for the poor and marginalized smallholder farmers.

GHG Emissions

Bangladesh's growth has been accompanied by a rise in GHG emissions, which increased from 116 million metric tons in 1990 to 221 million metric tons in 2018—a 92 percent jump. While the country's 2018 GHG emissions contributed less than 0.35 percent of global emissions, total GHG emissions are predicted to increase by 46 percent in 2030 under a BAU scenario.[11,12] Currently, agriculture is the leading contributor to these emissions with 40 percent, followed by the energy sector at 39 percent of total emissions. GHG emissions across the power, transport, and industry sectors are together expected to represent 69 percent of total emissions by 2030 under a BAU scenario. About 32 percent of agriculture sector emissions come from rice production, with 31 percent from enteric fermentation, 12 percent from manure and poultry litter management, and the remainder from five sub-sector activities. In a BAU scenario, agricultural emissions are likely to increase from 74.6 Mt CO_2e in 2012 to 89.2 Mt CO_2e in 2030, largely driven by enteric fermentation.

Nationally Determined Contribution (NDC)

Bangladesh's Intended NDC (2015) had a target of 15 percent reduction in GHG emissions relative to BAU by 2030, of which 10 percent is conditional on getting international support.[13] The NDC (2021) proposed a 6.7 percent reduction in the unconditional and an additional 15.1 percent reduction in the conditional scenario.[14] Under the unconditional scenario, Bangladesh has a target to implement renewable energy projects of 911.8 MW, increase fuel efficiency by 5 percent (improvement of road traffic congestion), 10 percent modal shift from road to rail, achieve 10 percent energy efficiency in industrial sub-sector, reduce 14 percent emission from brick kilns, and increase tree cover from 22.37 percent (2014) to 24 percent by 2030. Other conditional targets (by 2030) include 4114.3 MW renewable energy projects, 15 percent improvement in fuel efficiency (improvement of road traffic congestion), 25 percent modal shift from road to rail, 20 percent energy efficiency in the industrial sub-sector, 47 percent emission reduction in brick kilns, and 4102 solar irrigation pumps (generating 164 MW) for agriculture. NDC baseline GHG emissions (2012) account for 169 Mt CO_2e. The BAU projection for 2030 is 409.4 Mt CO_2e, an increase of 2.4 times from baseline emissions. A 6.7 percent reduction as per the NDC unconditional target would imply a cut of 27.6 Mt CO_2e, and a 15.1 percent reduction in GHG emissions in conditional scenario would imply a cut of additional 61.9 Mt CO_2e.

Progress in reducing emissions is not proving to be easy in Bangladesh.[15] The share of fossil fuels in electricity production is very high, increasing from 95 percent to almost 99 percent between 2000 and 2015. Existing power plants are mostly oil- and gas-fired, and a planned major expansion of coal power plants, projected to reach a share of 35 percent by 2041, risks locking Bangladesh into a carbon-intensive development path.

So far, the share of electricity produced from renewable sources (excluding hydro) has remained low, with a slight increase from zero in 2010 to 0.3 percent in 2015.[16] Including hydro, the share of renewable energy in total electricity output was only 1.2 percent in 2015.[17] Increases in capacities for renewable energy technologies have mainly concentrated on solar PV. Bangladesh is already importing up to 1,160 MW from India, and imports contributed over nine percent of electricity in fiscal year 2019–2020. Bangladesh has made progress in the last decade in addressing distribution losses, reducing them from 15 percent in 2000 to about 10 percent in fiscal year 2019–2020.[18]

In addition to the NDC, the government has developed the Bangladesh Delta Plan 2100 (BDP2100) to build climate resilience into the country's development plans. The BDP2100 follows the principles of adaptive delta management and identifies investment projects to link short- to medium-term development targets and investment programs with the long-term goal of climate-sensitive and sustainable development. The plan highlights cross-sectoral coordination and implementation across line ministries, local government institutions, and local communities, with due focus on safeguarding the livelihoods of vulnerable groups.[19] Focus "hotspots" defined in the BDP2100 include: 1) the coastal zone; 2) rivers and estuaries region; 3) urban areas; 4) Barind and drought-prone region; 5) Chittagong Hill Tracts; 6) Haor and wetland region; and 7) a cross-cutting hotspot that addresses common issues across the other hotspots.

Emerging Priorities

Green growth that provides economic opportunities for Bangladesh's poor and vulnerable is not constrained by the demand for climate-sensitive and low-carbon development. Embedding the

climate agenda into policies and investments not only makes them more comprehensive in tackling multi-dimensional development challenges, but also often makes them more cost-effective in providing co-benefits, and more durable in the face of climate change. However, citizen groups and civil society actors have concerns that a low-carbon agenda will impact the country's economic growth and development. Equity concerns revolve around the country's relatively low historical contributions to GHG emissions as compared to other developed countries.

The recovery from COVID-19 could provide an opportunity for green, resilient, and inclusive recovery, which in turn requires effective linking of short-term relief to long-term climate sensitive growth and resilience. While shock-responsive social protection systems are supported through ongoing engagements, also needed are greater commitment to climate-resilient transport infrastructure, which helps undisrupted delivery; CSA, to reduce the vulnerability of small/marginal farmers; and conscious outreach to excluded, vulnerable populations.

Strengthening social resilience—the capacity of all members of society to thrive despite shocks—requires a stronger focus on poverty reduction and addressing the underlying causes of vulnerability. Economic recovery after COVID-19 and the transition to a climate-resilient economy necessitates a holistic government and societal approach, including locally led climate action that doesn't compound risks facing poor and marginalized communities. Bangladesh's Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) incorporates strengthening local disaster committees and indigenous knowledge for water management, while priority actions identified in the Bangladesh Climate Change Strategy and Action Plan included actions to increase the resilience of vulnerable groups such as women and children, and capacity building of local institutional actors to manage climate change. Socially inclusive approaches focused on women, migrants, and other groups that experience exclusion can bring in unique perspectives and innovative solutions that can benefit all.

Support is needed for Bangladesh's comprehensive and multi-sectoral approach, which sets the country on a more climate-resilient development pathway and lays the groundwork for more climate-smart private investment. Possible actions include improving the government's institutional capacity to conduct climate-related macro-fiscal risk analysis, implementing climate-smart fiscal policies such as fossil fuel subsidy phase outs and carbon pricing, and creating incentives for greener investments to help attract financing from international actors and the private sector, including the Green Climate Fund, the Adaptation Fund, the Least Developed Countries Fund, and other CIFs managed by the World Bank Group (WBG) such as the Strategic Climate Fund. Another opportunity for Bangladesh could come from enabling participation in international carbon markets to leverage revenues for its low-carbon development activities, which in turn can increase the viability of such investments.

The WBG has a long history in supporting Bangladesh in low-carbon and climate-resilient development. Over $5.9 billion was committed for operations with climate co-benefits from FY2011-20, with a record high 56 percent of climate co-benefits in FY2019, which was the institution's largest nominal amount of climate co-benefits at more than $1.24 billion. IFC has committed $200 million in climate-related investments in the last five years.

Given these priorities and opportunities, the Bangladesh Climate Change Action Plan (CCAP) outlines the strategic approach to significantly address the country's climate risk while contributing to the government's longer-term green growth vision and attracting the private sector. In addition to requiring that all investments incorporate climate change, the Bangladesh CCAP will systematically help the country: (1) build resilience through the BDP2100 and CSA; (2) protect the most vulnerable through an Adaptive Social Protection system; and (3) anticipate emerging health risks; and ensure that infrastructure investments are low-carbon and resilient. This ties into the **longer-term green growth vision** of the government of Bangladesh, aligned with the BDP2100 and the 8th Five Year Plan, and taking as a guiding principle the second Perspective Plan 2021-2041. The following five themes are identified as priority areas for building resilience and combatting climate change:

- **Adaptive Delta Management and Coastal Resilience**
- **Climate-smart Agriculture (CSA) and Food Systems Transformation**
- **Human Capital for Resilience**
- **Low-Carbon and Resilient Infrastructure**
- **Green Growth and Macro-Fiscal Resilience**

Adaptive Delta Management and Coastal Resilience

Despite major progress in reducing deaths from cyclones and storm surges, and emerging adaptive delta management practices, sustainable and resilient growth in Bangladesh will depend on its ability to manage the delta environment. The coastal zone spans 580 kilometers along the Bay of Bengal, and 41 million people—nearly 28 percent of the population—live in the 19 coastal districts. The coastal areas have a higher percentage of people living below the absolute poverty line compared to the rest of the country. The coast is extremely vulnerable to climate-related hazards such as cyclones, storm surge, coastal erosion, and sea level rise, with 8 million people currently vulnerable to inundation depths greater than three meters due to cyclonic storm surges. The number is expected to increase to 13.5 million people by 2050. The government has been working since the 1960s to develop a safe and inhabitable coastal zone with the development of polders—areas of low-lying land protected by embankments. Since Cyclone Bhola in 1970, which killed up to 300,000 people, $10 billion has been invested in the development of disaster mitigation and preparedness systems, both structural (i.e., embankments, cyclone shelters) and non-structural (i.e., early warning systems, community-based disaster risk management).

The coastal landscape is built on the confluence of three large rivers: the Ganges, the Brahmaputra, and the Meghna (GBM), forming the largest delta in Asia and delivering an enormous amount of sediment in the Bay of Bengal. The natural shape of the coastal zone is controlled by dynamic interaction between the influx of water and sediment inputs from the GBM system. Tidal riverbanks erode and accrete, chars are formed and thereafter migrate and disappear, and the coastlines erode and accrete. This is an ever-evolving process of adaptation at different temporal and spatial scales, requiring a holistic approach with actions and interventions at the delta level.

The highly populated low-lying coastal areas require massive investments to manage existing natural barriers and support new infrastructure. There is substantial need to rehabilitate and upgrade polders and enhance the resilience of coastal areas to cyclones, and tidal and flood

inundations. Despite significant progress, important gaps persist. On the infrastructure side, only 10 out of 130 existing polders have been improved and rehabilitated (including embankments, bank protection, hydraulic structures, irrigation, and other steps) and there is a gap of about 5,000 multi-purpose disaster shelters needed to cover populations vulnerable to cyclones. Erosion and retreat of the coastline endangers the stability of embankments and results in significant losses of valuable arable land. The southwestern part hosts the Sundarbans mangrove forest, the largest mangrove system in the world, which is at risk from encroachment and salinity intrusion and needs improved management.

The BDP2100 identifies the main challenges, provides a vision, and identifies six hotspots and seven strategies and investment plans that are at varying stages of prioritization and implementation. On the institutional side, the BDP2100 recognizes the centrality of an adaptive delta management approach and supports coordination and implementation mechanisms for its ambitious objectives and an investment plan.

As the lead coordinating development partner, the WBG intends to play a strategic role in helping the government structure the Bangladesh delta program and to bring other donors to provide systematic and impactful investment and planning support. The WBG will both invest in and promote the plan for adaptive delta management and provide planning support to the country to develop a longer-term strategy for the resilience of the coastal zone and the delta.

Resilient NBS can help the deltas, Sunbardans, mangroves, the greater southwest area, and Chattogram hill tracts landscape to better manage climate impacts such as floods, droughts, and increased salinity. Landscape management with expanded spatial and environmental analysis may allow for better answers to seasonality and the natural system's used to adapt to climate-induced events.

Climate-Smart Agriculture (CSA) and Food Systems Transformation

Climate change, including sea-level rise, increased average temperatures, and precipitation variability with an increase in extreme events, can threaten Bangladesh's agricultural success story over the past 25 years. The country's agricultural productivity growth has been among the highest in the world and supported around 87 percent of rural households. Rising temperatures will affect the yield of the country's two major staple crops—Aman and Boro rice. High water stress can lead to rice yield losses as high as 70 percent. Soil salinity is affecting 62 percent of coastal land, and sea level rise may reduce available cropland by about 25 percent in coastal areas. Unseasonal and extreme events affect crops and increase the risks of infestations and low productivity.

The WBG supported the preparation of the Bangladesh CSAIP (2019), which identifies five investment packages at a cost of over $800 million to support the pathway to climate-resilient growth. As the sector supports 87 percent of rural households, this vital investment should be linked to supporting agro-food processing, infrastructure, logistics, widening of safety nets (if needed), earth observation, provision of hydromet and agromet data, and early warning systems for farmers. The CSAIP develops concrete investment opportunities to be pursued under the BDP2100 umbrella. CSA investments along the agri-food value chain, building on IFC involvement, are critical. IFC is looking to

contribute to crop diversification, resilience of agro-ecosystem, and small-scale farmer participation. Key focus areas for IFC's investment are agri-logistics, agri-tech, machines and fertilizers (aimed at resource efficiency), and food processing with lower wastage and higher value addition. IFC is also looking to improve access to financing for small and marginal farmers.

Scaling up CSA strategies and investments will deliver a triple win of higher agricultural productivity, increased resilience to climate change, and lower GHG emissions. Due to the substantial needs of water in agriculture and the overall agricultural dependence of the country, the water-agriculture nexus is a critical area of focus. Activities to address these challenges are elaborated in the CSAIP.[20] Potential activities include enhancing the drought resistance and water efficiency of crops, rehabilitating irrigation and drainage infrastructure, improving access to high quality inputs and seeds, capacity building, technical backstopping, and access to finance to strengthen adoption of climate- and water-smart production, value-addition, and better marketing practices. Renewable energy also can make a significant contribution to the climate mitigation effort in the agriculture sector through progressive replacement of the 1.2 million diesel irrigation pumps with solar PV irrigation, along with improved efficiency and refrigerants in the cold chain. Co-location of solar PV with agriculture ("agri-voltaics") could also provide both rural development and climate mitigation opportunities.

Providing accurate and actionable information to farmers is crucial. Through the Bangladesh weather and climate services regional project, the WBG has been working with the Department of Agricultural Extension, agricultural research institutions, and agricultural universities to establish a complete program to develop and deliver information and train farmers and other producers on the use of agro-meteorological information services such as delivery of agro-met advisories, establishing the Bangladesh Agro-met Information System, and providing alerts and early warning relevant to safeguarding crops or enhancing productivity. Establishing an agro-met division at the Department of Agricultural Extension could expand these efforts by improving the availability of weather information and customization at upazila and union parishad levels.

The WBG is considering a program with the Ministry of Agriculture to strengthen private sector engagement for a larger food system transformation. The program would focus on constraints and opportunities in different nodes of agri-food value chains (e.g., inputs supply, aggregation, value-chain organization and processing, good agricultural practices, waste reduction, urban food policy) along with support services (e.g., agro-logistics including cold chain development, innovation in processing and packaging, mechanization, food safety, access to finance, access to markets), and business environment (e.g., subsidies, tariffs and agri-trade policy, regulatory system, investment climate).

Human Capital for Resilience

Ongoing engagements focus on supporting social protection and jobs, health (health systems, nutrition, and population), and education to include a strong focus on adaptation and supporting the poor and vulnerable to cope with climate change impacts. In social protection, these include climate-responsive and adaptive social protection measures that build the resilience of the poorest and most vulnerable people to climate change before shocks occur; prevent people from falling into poverty after shocks occur, and support job creation. Health sector measures can build climate-smart

and disaster-proof health infrastructure and healthcare delivery, and significantly scale-up pandemic preparedness. Education operations will include climate change in curricula and extra curricular activities at schools, train teachers on climate change issues, provide skills to cope with climate disaster impacts and for green technologies, create incentives for research and innovation in tertiary education involving sustainable solutions for climate change issues, and update school infrastructure to ensure it is climate-smart.

Adaptive social protection is a critical tool to help poor and vulnerable households and communities better cope and become more resilient to climate change. The "adaptive" approach integrates basic social protection interventions with disaster risk management and climate change adaptation measures by having programs with built-in mechanisms to expand rapidly in response to shocks. For example, drawing on climate early warning systems, countries can anticipate climate-related events such as droughts and quickly scale up cash transfers to those affected or likely to be affected, using the infrastructure of existing social safety net programs. Adaptive social protection systems can also contribute by promoting resilient livelihoods anchored in good environmental practices, as well as investing in local infrastructure conducive to environmental preservation.

Deaths from environmental risks (including climate-related) as a share of total deaths in Bangladesh is 23 percent,[21] the highest in the SAR, and climate change is expected to amplify already significant environmental health risks. The entire population in Bangladesh is exposed to ambient concentrations of PM2.5, which is also an important short-lived climate pollutant. Frequent flooding increases the risks of vector-borne and other infectious diseases. In addition, around 20 million people in the coastal areas are affected by salinity in their drinking water, which causes health issues (diarrhea and cholera). Furthermore, the intensity and frequency of extreme heat events are putting the elderly, children, the chronically ill, the socially isolated, and at-risk occupational groups at increased risk. Going forward, tackling the health dimensions of climate change will be critical, including preparing communities for changing patterns of vector-borne and other infectious diseases, as well as reducing the health sector's carbon footprint. Bangladesh would greatly benefit from ensuring climate information is included in an Integrated Disease Surveillance and Response (IDSR) system, with early warning for climate-sensitive health risks; developing a national health and climate action plan at the country level and facilitating climate financing to strengthen public health outcomes; strengthening client capacity in areas related to climate change and health, and implementing activities to increase climate resilience of health infrastructure. In terms of mitigation, the health sector will need to play a role in reducing carbon emissions by focusing on energy efficiency management such as carrying out energy audits to identify potential savings and making building designs for healthcare facilities prioritize carbon reduction and incorporate adaptation and resiliency to climate shocks.

Bangladesh's education and training systems are increasingly being exposed to climate change-related hazards, and schools need to be more climate-resilient. Education and training programs have been severely affected by flooding. Education institutions need more durable construction materials and climate responsive features and would benefit from the inclusion of trainings and awareness programs to safeguard against disaster events.

The education sector needs to play a major role in building climate change knowledge and resilience through educating and training children, youths, and communities, and incentivizing research and

innovation for green technologies. Climate change responsiveness in basic education needs to be enhanced by integrating climate change issues in curriculum of specific subjects such as science, social studies, and languages, and building teachers' knowledge and teaching skills on climate change issues. In Bangladesh, students are often effective communicators of new knowledge to their parents, family members, and communities in general.

Technical education and skills development can provide skilling/re-skilling opportunities for vulnerable populations to cope with climate change shocks and for industries and infrastructure sectors to adopt more energy-efficient green technologies. Climate change-induced disasters can lead to prolonged school closures and serious learning losses. In response to COVID-19 induced lockdowns, educational institutions in Bangladesh have accelerated the use of technologies such as online/distance teaching and learning, tech-based assessment and monitoring, and other ed-tech solutions. However, significant challenges remain in accessibility, connectivity, and quality. Building on the experience, education and training systems in Bangladesh need to make further investments in strengthening online and distance teaching and learning delivery capabilities, along with other non-tech/low-tech solutions, to ensure continuity of education service delivery in the face of climate change-induced disasters.

Low-Carbon and Resilient Infrastructure

Mainstreaming climate resilience and disaster risk management will be a central feature of low-carbon and resilient infrastructure investments supported by the WBG. Transport and power are at the center of Bangladesh's development plans, given their strategic importance and the large-scale ongoing and planned investments. Climate-resilient transport infrastructure is essential to provide non-disruptive trade, connectivity to economic poles, jobs, schools, etc., as well as essential relief and health services, and is the backbone of livable and productive cities. A resilient power network is critical to securing sustainable and affordable electricity to support the rapidly growing economy towards becoming a developed nation by 2050.

Resilient public service infrastructure and risk-informed land use planning are critical to achieve sustainable urbanization. This includes the need for: (i) risk-informed master planning, capital investment and asset management planning, and disaster risk management planning; (ii) resilient urban infrastructure, focusing on water, wastewater, and solid waste management; (iii) green urban transportation, shifting from private to bus and urban rail modes, and shifting from fossil fuel to electric vehicles and other greener technologies in urban transport; and (iv) green manufacturing and industry (which is highlighted as a priority in Bangladesh's NDC) to help key industries shift to more energy-efficient technologies and optimize natural resource use.

Urbanization in Bangladesh has been mostly unplanned, resulting in severe shortfalls in infrastructure, service delivery, and housing, and an urban economy that is underperforming relative to its potential. Ad-hoc development has increased vulnerabilities to climate change-related impacts such as urban flooding and vulnerabilities associated with food access and food safety. Supporting cities to improve their capacity for planning, municipal finance, and service delivery can set them on a more resilient, low-carbon and sustainable growth trajectory, unlike the unplanned

growth patterns of the past. Bangladesh also needs to support local governments to become capable and accountable for the management of urban agglomerations. Strengthening the financial capacity of local governments to undertake priority mitigation/adaptation measures through more robust municipal financing systems (e.g., fiscal transfer mechanisms, private sector intervention, etc.) will be a critical part of a climate-smart urbanization agenda.

Strengthening connectivity remains a challenge when more than 50 percent of all road types are exposed to different levels of flooding. The impacts of climate change are more pronounced in the West, especially the Southwest region, and natural hazards are expected to be more intense in the future. An additional 20 percent monsoon rainfall by 2050 is predicted for the GBM basin, suggesting more severe inland flooding that will damage roads, impair accessibility, and result in disproportionately high costs to bring them back to service. The risk of severe droughts with increasing temperatures leads to softening and cracking of pavements. The WBG is currently providing support to increase resilience of the highway network through the Western Economic Corridor and Regional Enhancement Program (WECARE) and Climate Adaptation and Resilience for South Asia (CARE) that supports the development of climate data systems for enhanced decision-making for highway and rural road development. At the rural level, the WBG has supported the government in piloting the integration of climate resilience engineering measures in road designs in the aftermath of the 2017 flood, and expanding the use of performance-based maintenance contracts to ensure the preservation of over 400 kilometers of rural roads. More efforts are now required to support the government in mainstreaming the integration of climate resilience measures in the designs of rural roads and waterways infrastructure (e.g., ghatts, jetties).

Bangladesh's road transport sector, considered the backbone of its export-driven economy, is a growing source of national emissions. Highway congestion and political disturbances are long-standing issues that cause significant delays in the transport of goods to and from the Chittagong port, considered the busiest international seaport in the Bay of Bengal. Trucking remains the dominant mode for providing freight services in Bangladesh, representing up to 80 percent of the freight mode share. The trucking sector in SAR is highly fragmented, informal, and inefficient. Like in most countries in the region, trucks are old and small, and the ownership structure is highly fragmented resulting in empty backhauls. Although heavy commercial vehicles constitute only seven percent of total national vehicle registrations, they are responsible for 50-67 percent of carbon emissions.[22] Tackling the growing freight emissions while continuing to support the overall sector will require investing in inland water transport and broader policies that aim to formalize the trucking sector, and create better, fuller trucks. Operational measures such as truck-sharing, route optimization, or relaxation of delivery rows to increase transport capacity will be key strategic actions to drive the reduction of freight emissions.

Increasing urbanization and a lack of investments in transport infrastructure has resulted in increased urban transport emissions. Dhaka does not have any mass transit system, with old and often malfunctioning small buses and some informal para-transit as the only travel options. Mitigation measures that help cities develop high-quality, financially sustainable, and affordable public transport systems should remain a key focus of the transport strategy.

Bangladesh faces significant challenges in securing sustainable and affordable electricity to support its rapidly growing economy, as it pursues its aspirations to become a developed nation by 2050.

Power sector growth has overshot demand with further power plants coming online (coal and liquefied natural gas (LNG)/gas) and major investment in a new LNG terminal and coal import infrastructure. In addition, electricity tariffs do not fully cover costs of supply, leading to a need for significant government subsidies that stress utilities and government funds. Opportunities to lower generation costs include phasing out liquid fuel-based generation, decreasing costs of renewable energy, improving energy efficiency, mobilizing more commercial finance, and increasing private sector participation.

Bangladesh's electricity transmission and distribution network are vulnerable to disruptions resulting from climate change and extreme weather events. The electricity sector globally is undergoing rapid change and transformation driven by a confluence of factors—reduction in the cost of distributed renewable energy, advancements in battery energy storage systems (BESS), electric mobility, digitalization, and flexible demand — affecting the entire power sector value chain and providing opportunities to mitigate and adapt to climate change. A coordinated deployment of renewable energy and BESS, demand response, electric mobility, energy efficiency, digital technologies, as well as continued investments in transmission and distribution networks can help Bangladesh reduce its dependence on fossil fuel-based generation and make the electricity supply more efficient, reliable, and affordable.

The WBG energy sector portfolio is already supporting Bangladesh's complex energy transition through both investment project finance and Analytics/Advisory operations. Portfolio projects include support for sustainable energy access, renewable energy, strengthened transmission and distribution (to extend and strengthen networks and reduce losses), efficiency of gas-based generation, and dispatch improvement, as well institutional strengthening and development of policy and regulatory frameworks. In renewable energy, the WBG will continue supporting the scaling up of renewable energy markets in both utility scale and rooftop PV segments. The ongoing Scaling Up Renewable Energy Project (SREP) provides financing for adding significant grid connected utility scale and rooftop PV renewable energy capacities (310 MW), leverages and mobilizes private sector participation and financing, and builds renewable energy market and institutional capacity. IFC is providing transaction advisory to launch a competitive renewable energy tender at a public land site to create best practice, replicable models. The tender preparation is also supported by SREP through environmental and social safeguard documentation, and potentially stapled financing under SREP for private sector renewable energy project developers. The WBG will also provide further support on systematic identification and allocation of land sites for renewable energy development.

In demand side energy efficiency, the WBG will support the further strengthening of the institutional and regulatory frameworks, and design of implementation models and delivery mechanisms. These models and mechanisms are being developed under ongoing Advisory Services and Analytics and expected to include development of the energy service company market and tailor-made financing mechanisms.

To address climate migration and improve low-carbon development, it will be crucial to strengthen adaptive capacity of urban areas through adequate provision of resilient and inclusive infrastructure and services. Large cities like Dhaka and Chittagong will need to plan for climate migration through longer-term planning and investments in climate resilience. Secondary and tertiary towns will also need support to meet demands of climate and rural-urban migration in the coming years. All urban

areas will need improved emergency preparedness to manage growing impacts from climate shocks and stresses. Within this framework, the WBG has been investing in improving capacity and functioning of local governments through the Local Governance Support Project 3 and the Municipal Governance and Services Project. The on-going Dhaka City Neighborhood Upgrading Project has focused on improvements in public spaces to enhance their accessibility, safety, and climate resilience. The Local Government COVID-19 Response and Recovery Project will build on the WBG's prior engagement in urban, social protection, and disaster risk management sectors to support local government institutions in improving preparedness to climate and disaster shocks and building back better.

Green Growth and Macro-Fiscal Resilience

Climate change impacts are increasing pressures on Bangladesh's economy and could lead to major economic losses. More frequent disasters would divert limited revenue away from growth-enhancing development expenditure. In the power sector, a shift to renewables and e-mobility could create stranded fossil fuel assets, posing macro-fiscal risks.

Macro-fiscal and financial regulatory policies that mainstream and incentivize climate action into public expenditure and private finance can help the country build a low-carbon and climate-resilient growth pathway. With the economic slowdown due to COVID-19, mobilizing resources to tackle emerging climate change-related issues may become more challenging. At the same time, there is a growing dialogue related to a just transition, referring to a fair shift from a carbon-based, extractive economy to a regenerative economy that protects workers' rights and poor and marginalized groups. As green growth policies and investments can deepen prevailing exclusion of certain groups as well as create new marginalized or excluded groups, assessment is necessary to understand how climate policies can deliver social co-benefits (e.g., improved health, food safety, better jobs, etc., that may result from green growth) and ways to make sure those co-benefits are equally shared and contribute to improve inclusion.

Taking a green growth approach can enhance the institutional capacity to set goals and prioritize and enhance multi-sectoral collaboration. Implementing a green recovery will require effective institutional frameworks for long-term strategic planning and investments that align with citizens' interests and nation building. This will prioritize short- and medium-term actions and create investment opportunities for the private sector. Successful approaches will cross sectors, involve multiple line ministries, and involve technology solutions.

Responding effectively to the impact of climate change will depend on designing an appropriate set of fiscal policies to help mobilize public and private sources of finance. Introducing appropriate pricing of the carbon externality, whether through carbon pricing instruments, reduction or elimination of fossil fuel subsidies, or a carbon tax, can incentivize investments in low-carbon industry through climate-friendly ventures and discourage harmful ones, such as taxation of polluting industries.

While the government has recognized many of the fiscal risks related to climate change through its policy documents, a need has arisen to improve technical capabilities to conduct fiscal projections with climate risks. The medium- and long-term investment plans envisaged in the 8th Five-Year Plan

and the BDP2100 will have operations and maintenance spending needs that need to be incorporated into fiscal projections in the Medium-Term Budget Framework and Medium-Term Macroeconomic Policy Statement. For projects with public private partnership (PPP) arrangements, various contingent and direct fiscal commitments need to be monitored and associated fiscal risks managed.

Bangladesh Bank announced it would prioritize mainstreaming sustainability into the financial sector by setting a minimum green finance target. A well-coordinated green finance framework can help signal a strategic shift towards investment in low carbon sectors. To better manage and reduce the fiscal impact of severe disasters—the costs of which exceed the resources that can be set aside as a budget contingency line—the government could use catastrophe bonds and insurance instruments leveraging IFC's Sustainable Banking Network.

The COVID-19 pandemic challenges Bangladesh's ambitious growth targets and exacerbates existing economic, environmental, and social policy failure, but creates an opportunity to build back greener. When the immediate crisis is over and economies begin to re-emerge, the nature of those economies will be determined to a significant degree by decisions made on policy and investment at this critical time. Achieving Bangladesh's objective to reach upper middle-income status through cleaner and more resilient growth will depend on further developing and strengthening a range of complementary policies and systems for environmental protection, urban development, social resilience, and industrial management. The government has announced 23 stimulus packages worth 4.5 percent of GDP, including support to export-oriented industries to pay short-term wages; two-year loans to factory owners at two percent interest; working capital loan facilities to affected industries; subsidies and refinance schemes for the agriculture sector; an allocation of $5 billion to facilitate imports of raw materials, and some social safety net measures for returnee migrants. Influencing these programs to invest in green growth solutions and stronger dialogue to help pivot future stimulus programs towards green growth will be important.

The WBG is undertaking a CCDR to help Bangladesh strengthen climate resilience and to prepare a roadmap for key sectoral transitions that are needed to secure sustainable and inclusive growth while transitioning to a low-carbon economy. Expected areas of focus include: decarbonization of the economy; Delta plan resilience and prosperity; agriculture-water-landscapes nexus; climate-smart urbanization; and cross-cutting analysis of green jobs, skills and adaptive safety nets.

TABLE 4: Overall summary of priority engagements

THEMES	PROPOSED ACTIVITIES	
	Near-Term (Year 1-2)	Medium- to Long-Term (Year 3-5)
Adaptive Delta Management and Coastal Resilience	» Support strategic plan for long-term adaptive planning and riverine and coastal management investments, and financing strategy for first set of projects under the BDP2100.	» Support policy-based reform agenda for coastal resilience and adaptable delta management.
Climate-Smart Agriculture (CSA) and Food Systems Transformation	» Strengthen private sector engagement for a food sector transformation.	» Results-based investment for food systems transformation, agriculture diversification, food safety, and private sector participation in input market.
Human Capital for Resilience	» Review of existing shock responsive social protection system mechanisms to identify key reforms.	» Investment project/policy operation to establish an adaptive social protection System.
Low-Carbon and Resilient Infrastructure	» Support the development of the Energy and Power Master Plan.	» Investments in resilient infrastructure and low-carbon energy and transport systems.
Green Growth and Macro-Fiscal Resilience	» Conduct green growth diagnostics and roadmap including on support to NDC.	» Green growth and climate change policy operation series.

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Bhutan is the first carbon-negative country in the world, with forest coverage exceeding 70 percent.
—PHOTO: CURT CARNEMARK / WORLD BANK

BHUTAN

Climate Vulnerabilities

With forest coverage exceeding 70 percent, Bhutan is the first carbon-negative country in the world. The Constitution stipulates that at least 60 percent of all land must be covered by forests at any time, and the small, landlocked country nestled in the Himalayas has protected nearly half its land area to preserve biodiversity.

Bhutan's key economic sectors of agriculture, hydropower, tourism, forestry, and water resources are heavily dependent on climatic conditions. Water resource management is closely tied to hydropower production and agriculture, as well as the conservation and sustainable management of forests. Hydropower accounts for 24 percent of total GDP and agriculture accounts for 16 percent. Tourism, which relies on the country's traditional connections with nature, is the single largest contributor of convertible currency to Bhutan and the second-largest income earner after hydropower. Changes in river flows and rainfall patterns caused by climate change may hold further implications for the country's hydropower production. Under a BAU scenario, climate change impact on key sectors may lead to economic losses equivalent to 1.4 percent of GDP by 2050, and 6.6 percent by the end of the century.[1]

Climatic and environmental changes threaten Bhutan's biodiversity-rich forest landscape, raising concerns for its constitutional mandate and low-carbon development pathway. Climate-related impacts such as drying water sources, changes in wildlife migration, agriculture, and forest cover,

and loss of biodiversity can increase ecosystem vulnerability. Sustainable forest management is essential to improving ecosystem resilience and ensuring that Bhutan can continue to be a net carbon-negative economy.

Agriculture in Bhutan, which employs close to 50 percent of the population, faces growing climate impacts, including frequent disasters, glacial outbursts, and the emergence of new diseases and pests in an environment where farming is limited due to rough topography and high elevations.[2] Farmers are using adaptive strategies such as plant protection chemicals, improved varieties, land fallowing, and diverse management practices.[3]

Infrastructure and development activities located in areas of climate and disaster risk remain a challenge. Hill-cutting to build roads and buildings can increase landslide risk, and locating infrastructure in the banks of rivers can increase flood risk, raising the potential for greater losses in a disaster event. The WBG has been supporting government efforts to strengthen resilience to adverse natural events, focusing on seismic resilience, hydrometeorological and climate services, resilient infrastructure development, and climate change adaptation and mitigation.

The International Health Regulations/Joint External Evaluation (2017) and the Global Health Security Index 2019 identified weaknesses in Bhutan's capability to prevent, detect, and respond to public health emergencies. Climate change, climate-induced disasters, and other related shocks can lead to significant losses in human capital and result in the adoption of adverse coping strategies such as skipped meals, reduced nutrition, and reduced school attendance. Climate variability and change are also linked to the emergence and re-emergence of infectious diseases, and higher disease incidence, transmission, and outbreaks.

GHG Emissions

Bhutan is at present carbon negative and aims to remain carbon neutral, building on a commitment made in 2009 and reconfirmed in its Nationally Determined Contribution (NDC) (2015).[4] Historic emissions of the last year for which data are available (2018) were 1.16 $MtCO_2e$. Projections for GHG emissions (excluding forestry) under current policies are for 5.9 $MtCO_2e$ by 2030, making it increasingly difficult for Bhutan to stay within carbon or GHG neutrality. Bhutan's current policy trajectory in 2030 is around 4.5 to 4.8 $MtCO_2e$ per annum, which is at least double 2010 levels (excluding LULUCF).[5]

The forestry and hydropower sectors are pivotal for the Bhutanese carbon neutrality pledge, as their sequestration and off-setting capacities currently exceed GHG emissions from other sectors to achieve carbon negativity/neutrality. The government has pledged in its NDC to maintain current levels of forest cover, currently at 71 percent and estimated to provide ecosystem services worth nearly $400 million to nearly $1.3 billion per year.

The government is addressing the substantial increase in non-forest–related emissions through measures including the National Strategy and Action Plan for Low Carbon Development, Bhutan Transport 2040, and the 2010 Economic Development Policy.[6,7,8] Bhutan's Draft Energy Efficiency Roadmap defines the rationale for energy efficiency and its purpose of enhancing energy security through potential energy savings. Other measures in the NDC include fuel substitution and increased

mass transit. The identified interventions, however, are to be preceded by a proper feasibility study, clear institutional roles and responsibilities of the agencies, budget requirement, identification of financial source, and international collaboration.[9]

Nationally Determined Contribution (NDC)

Bhutan's Second NDC 2021 reflects its commitment to remaining carbon-neutral by ensuring that GHG emissions do not exceed the sink capacity of its forests.[10] The second NDC charts a way for Bhutan to continue pursuing a low emission development pathway towards Bhutan's national objectives for sustainable development while meeting Bhutan's obligations under the Paris Agreement. The Third National GHG Inventory shows that Bhutan's GHG emissions (including forest emissions) in 2015 amounts to just 3.8 $MtCO_2e$, which is negligible on a global scale.[11] In the same year, Bhutan's forests sequestered 9.4 $MtCO_2$ resulting in net negative emissions of 5.6 million tons of CO_2. In this regard, Bhutan continues to remain carbon neutral. While Bhutan's first NDC covered broad priority action areas, the second NDC further enhances actions by elaborating priority mitigation actions in the form of Low Emission Development Strategy (e.g., Food Security, Human Settlement, Industries, Surface Transport), roadmaps (e.g., Energy Efficiency Roadmap 2019), policies (e.g., National Energy Efficiency & Conservation Policy 2019), and strategies (e.g., REDD+, Waste Management, etc.). Climate change has been integrated into 12th Five Year Plan (2018-2023) with "Climate Neutrality, Climate and Disaster Resilience" identified as the sixth National Key Result Area. The Climate Change Policy of the Kingdom of Bhutan 2020 was adopted with a vision for "a prosperous, resilient and carbon neutral Bhutan where the pursuit of gross national happiness for the present and future generations is secure under a changing climate." The national institutions for coordination of climate change actions across key agencies and stakeholder groups have been revitalized with the Climate Change Coordination Committee (C4) from the previous Multisectoral Technical Committee on Climate Change.

The WBG's 2021-2024 CPF for Bhutan supports the country's intention to remain carbon neutral, pursue a low-emission development path, and meet its commitments to the Paris Agreement, and will seek to maximize climate adaptation and mitigation co-benefits.[12] At the same time, the CPF will aim to reduce the country's vulnerability to climate change and natural disasters, and to create new economic opportunities through a shift from conservation and subsistence use to conservation and the sustainable management of natural resources.

Emerging Priorities

To continue on a low-carbon development pathway, the government will need to strengthen support to key economic and environmental sectors while facilitating a transition towards renewable energy, energy efficiency, and low-carbon urbanization, transport, and industry. Bhutan's mitigation capacity is strongly linked to a low-carbon development path while sustaining forest cover and offsetting forest loss due to development activities. In addition, Bhutan's high vulnerability to the impacts of climate change, particularly in significant sectors dependent on water resources such as hydropower, agriculture, tourism, and forestry, makes increasing environmental and social resilience especially important. Strengthening Bhutan's economic resilience will require diversification of the economic basis, with key roles for the private sector in job creation.[13]

While the conservation and sustainable management of forests is needed to ensure that Bhutan meets its climate commitments, the country must also address increasing emissions from other

sources such as the building industry, the transport sector, and waste management. Technology transfer may be needed for addressing growing emissions from these sectors. Through trade and partnerships with neighboring countries such as India, Bhutan may source affordable low-emission alternatives such as electric vehicles while supplying the significant amount of hydropower it produces domestically, thereby reducing and off-setting carbon emissions for both sides.

Investments in social protection, health, and education will help avoid human capital losses that might result in increased poverty and vulnerability. The Ministry of Labour and Human Recourses has found the Social Protection System can be improved to build economic resilience at the household level. This system complements and expands economic opportunities, particularly for low-income households, and protects the population against exogenous, economic, and natural shocks that typically have a disproportionate impact on the poor and vulnerable. As reflected in the CPF, health sector resilience is essential to address emerging and climate-induced disease outbreaks and infectious disease transmission patterns. Improving health sector resilience will require a coordinated and multi-sectoral approach that leverages the country's disaster risk management arrangements to safeguard national and global health security. A key priority is to expand digital connectivity for enhancing public service delivery and aid risk-based decisions, as well as for increasing opportunities for investment.

The government's Climate Change Policy (CCP) recognizes the interconnectedness between climate policy and education. Climate change-induced disasters that often change the country's topography and impact vulnerable rural and mountainous populations require schools and other services involving schooling to maintain appropriate emergency plans. Bhutan's vision to remain climate neutral requires building awareness, knowledge, and capacities. The Ministry of Education, according to the CCP, is mandated to develop curriculum on environment and climate change and impart knowledge throughout the education system in order to build appropriate skills and capacities.

Meaningful citizen participation underpinned by accurate, transparent, and timely information will also be critical to ensuring political and social acceptability of strategies to address climate change. Opportunities exist in engaging women who are often leading community forest committees and management groups in the country. While community forestry is fast growing in Bhutan, more could be done to ensure equitable and active participation, both to avoid elite capture of resources and advance meaningful participation in landscape-level decision-making processes.

Research has found that climate policies in Bhutan work best with integrated and inclusive approaches to resilience at the infrastructural, community, and institutional levels.[14] Collective action and social organization are critical in both mitigating climate change and adapting to it. Community resilience enables communities to better plan for where to site infrastructure, homes, and farmland, and respond to calamities and emergency situations using traditional and other methods of communication. Women, migrants, persons with disabilities, indigenous, and other groups that experience exclusion have unique perspectives and often innovative solutions that can benefit all of society.

These interlinkages necessitate critical investments in improving disaster and climate risk information in Bhutan to strengthen systems for decision-making in weather dependent sectors. The WBG has been engaging the government in strengthening climate resilience with support through small investments, technical assistance, analytical work focusing on resilience, hydrometeorological

and climate services, and capacity for disaster risk management. However, disaster risk and climate data are currently sparse and disaggregated, often skewing baseline comparisons for interventions. Improved risk information and data systems and related risk information policy frameworks will better support policy making and enhance the effectiveness of risk mitigation infrastructure investments. More informed decision-making will have positive implications for climate adaptation across time periods, from more urgent disaster response and relief to long-term development, strengthened by identification of macro-economic vulnerabilities. More comprehensive information systems will improve the investment climate for key development sectors such as agriculture and hydropower.

Financing for climate actions in Bhutan may benefit from diversification. Through an umbrella agreement with the government of India and accompanying debt financing, Bhutan has developed four GW of a planned 10 GW of hydropower capacity. Such bilateral partnerships can help Bhutan transition to lower-carbon, climate-resilient alternatives. The private sector is well-placed to provide investment into the agriculture and forest sectors, with opportunities identified by targeted market assessments/studies. In addition, Bhutan may pursue opportunities in the voluntary carbon market for its natural assets. Opportunities exist for channeling funds and decision-making on climate (and multi-hazard) risk management to the local level, including support for developing and strengthening local capacity for participatory identification of risks and investment priorities to build resilience to shocks, stresses, and shifting climatic conditions.

Support for Bhutan's continued resilient and low-carbon development should be drawn from a combination of international funding from granting organizations, climate funds, and development banks, and from Bhutan's own public and private investments. Strengthening the sustainable management and utilization of its forests and other natural resources will allow for more independent and resilient long-term growth to increase competitiveness and job opportunities. Closing current gaps requires private investment and innovation in resilient and low-carbon infrastructure to curb emissions as the country faces rapid urbanization and industrialization. Across the board, institutional capacity building will aid in better policy and decision-making and increase the likelihood of Bhutan meeting its NDC and development targets.

The WBG's CPF (2021-2024) for Bhutan focuses on two strategic areas—human capital and resilience. Aligning the WBG's core competencies with the government's development plans and strategies identifies four priority areas:

- **Sustainable, Renewable Natural Resources**
- **Resilient Infrastructure**
- **Human Capital Resilience**
- **Macro-Fiscal Resilience and Risk-Informed Decision-Making**

Sustainable, Renewable Natural Resources

Agriculture

Climate change is expected to further impact agricultural production and productivity. Most of Bhutan's fertile agricultural land, and over 70 percent of its settlements, are located along the main drainage basins, which puts them at high risk of flooding. Modeling projections show rising temperatures

across Bhutan, which will reduce water availability (which increases fallow land), increase erratic and excessive rainfall patterns (which decreases arable land), and increase the threat of glacier lake outburst floods. Irrigation infrastructure in Bhutan is poor and vulnerable, with leaking earthen canals, increasing competition over water use, and high susceptibility to climate change effects such as floods and landslides. Overall, the climate change impacts on agriculture are mixed, with an expansion in viable land for production but a reduction in maize yields and the number of poultry for egg production.

Increasing resilience to the impacts of climate change in the agriculture sector is a major priority under the Food Security and Agricultural Productivity Project (FSAPP) supported by the WBG. The project under the Ministry of Agriculture and Forests involves an $8 million grant approved in 2017 and a recent $4.6 million in additional financing. CSA practices are central to the project for improved food security and nutrition, with a focus on productivity enhancement of rice, vegetables, pulses, and potatoes, and higher value crops such as spices (specifically large cardamom and ginger), other vegetables, and citrus for both local and export markets. IFC is planning an advisory program with an FDI company interested in high-value agri-produce and adopting CSA practices in one of the FSAPP targeted districts. FSAPP will also be used as a platform to pilot improved agro-met service delivery at the farmer-level.

Water Management

Bhutan needs to address challenges in water management as an integral element of managing its natural resources. The sector has policies and frameworks to manage water security, but there is limited institutional and technical capacity. The 12th Five Year Plan identifies factors driving pressure on the quantity and quality of water resources in the country—increasing demand for hydropower production, drinking water supply, agriculture, rapid urbanization, and socio-economic development, as well as climate change. The Water Act 2011 and Water Policy 2009 emphasize the need for integrated water source management to enhance the performance of the water sector, and the Water Act enlisted the National Environment Commission Secretariat (NECS) as the apex water resources coordinating agency. However, NECS and sector agencies need enhanced technical capacity to fully implement the Water Act and the National Integrated Water Resource Management Plan 2016. Approaches for water governance, allocation, and agriculture practices should be underpinned by principles of community and citizen engagement, particularly engagement with groups that have had less access to decision-making.

Forestry

Bhutan could expand its forest economy and create opportunities for new jobs, sources of income, and livelihoods while meeting its NDC and constitutional commitments. Forestry contributed between 2.4 and 2.9 percent of GDP between 2013-2015, steadily growing to $43 million. For harvesting forest areas, an annual allowable cut based on area, volume, and rotation age is established. However, harvesting the allocated volume of timber is constrained by inadequate equipment, lack of skilled manpower, and poor planning. Forestry's low share of GDP is also reflected by low employment numbers, with only 0.5 percent of Bhutan's labor force (1,500 workers) working in the sector in 2012. With 20 percent of agricultural land left fallow, private forest plantations could be an attractive alternative source of livelihood. There also is a need to support the implementation of the national REDD+ (Reducing Emissions from Deforestation and Forest Degradation) strategy, which proposes policies and measures for climate resilient development pathways in forestry and sectors

impacting forests. Community forestry is a key part of Bhutan's model for fostering state-community partnerships on forest management and generates income and forest products for households and communities. There are opportunities to help forest-dependent communities adopt new approaches to forest conservation and sustainable use.

Systematic data on the economic contribution of Bhutan's forests under different management regimes will help inform forest management policies. Opportunities exist to assess, document, and integrate viable traditional knowledge-based approaches to forest management, particularly as historically traditional measures have promoted the regeneration and conservation of Bhutan's forests.[15] Hydropower construction and transmission line development are the two main causes of deforestation. Timber harvesting, firewood, and forest fires are the major drivers of forest degradation. Livestock is also a substantial but largely understudied driver of forest degradation. A Country Strategic Environment Assessment for Bhutan (under preparation) could help address many of the current knowledge gaps.

A jointly developed Forest Engagement Note for Bhutan identifies investment opportunities for enhancing sustainable forest management, including the increase of timber harvesting volume within sustainable harvesting levels; the development of forest-based industries; the use of wood-based construction materials; building expertise on wood engineering and architecture, and moving parts of the timber market from a fixed-price to a competitive system. Potential challenges include the strong sense of favoring forest conservation over forest utilization; lack of capacity and technologies for sustainable forest management; lack of skilled labor in forest-based industries, and lack of funding to invest in the development and modernization of the forestry sector and industries. The WBG can support the government to explore and implement some of the identified investment options. Meaningful participation of forest-dependent communities in the formulation and implementation of sustainable forest management strategies is critical to Bhutan's shift to decentralization in the forestry sector. Some rural communities have perceived the demand for timber for socio-economic development as detrimental to the ecosystem services provided by forests.[16]

Shifting phenological and seasonal changes induced by climate change are expected to increasingly affect forests and trees through new pests, parasites, diseases, and forest fires. The growing incidence of forest fires is one of the most pressing threats to forest ecosystem services in Bhutan, particularly in the eastern and western forests of pine and oak that are more susceptible to burning. Improved knowledge of these challenges will help with sustainable forest management and mitigating risks for forest fires.

Capacity

There is a lack of institutional, infrastructure, human, and technical capacity in dealing with climate change and its effects on agriculture, forest biodiversity, food security, and water resources. The understanding and awareness of the impacts of climate change are deemed limited at all levels. Farmers' awareness of CSA practices is relatively limited, yet farmers are already making autonomous adjustments to the impacts of climate change, including crop and income diversification, land fallowing, and other management measures. The effects of climate change are likely to vary across districts, with temperatures rising much faster in the northern areas. Because most agricultural production is rain-fed, it is vulnerable to climate variability and climate extremes, yet weather information is largely

unavailable for many farmers. The only climate information provided to the public is a 24-hour weather forecast issued by the National Center for Hydrology and Meteorology, distributed through the local TV stations, and a three-day forecast on their website. A survey conducted in 2015, as part of the Hydrometeorological Services and Disaster Resilience Regional Project of the World Bank, identified demand for seasonal rainfall outlooks, forecasts of the onset of the monsoon, and weather forecasts (daily and seven-day rainfall and temperature forecasts). The WBG has supported the piloting of agro-met services, but this is still at a nascent stage and critically needs further investment.

Resilient Infrastructure

Construction, while one of the country's key economic activities, faces challenges to improving the quality of construction practices and builders/developers. As Bhutan's urban population is projected to increase from 38 percent in 2017 to 57 percent by 2047, driven by rural-urban migration, failures in integrating resilience into the built environment could pose a catastrophic impact on the country's ability to sustain growth and undermine the government's development efforts.[17] The government has prioritized a balanced spatial development with adequate access by the population to services, living conditions, and economic opportunities. Bhutan's road network remains vulnerable to premature failures and adverse natural events due to difficult alignment of the major road networks along unstable and steep terrain and inherent exposure to natural hazards.

Bhutan has significant hydropower resources that should be sustainably developed to address domestic energy shortages and provide low-carbon energy to the region. Large hydrological flows in Bhutan can produce surplus power to help India and Bangladesh meet rising peak demand in hot summer months. Bhutan's hydropower potential is 30 GW, of which 23.8 GW has been identified as techno-economically feasible.[18] Ensuring that construction and operation practices for the development of new projects do not pose an environmental threat to Bhutan's fragile ecosystem is essential.

While Bhutan has abundant water resources, with one of the highest reported water availabilities per capita in the region, access to water remains a challenge. The population suffers from low access because of its topography and climate variations. Rapid urbanization and insufficient infrastructure make the security and sustainability of water services even more challenging. Although nearly all households in Bhutan have access to improved water sources, primarily piped water, about 40 percent of households have intermittent water supplies ranging from six-to-12 hours per day.[19] Due to future rapid changes in weather patterns, more than 13,000 rural households could face seasonal drinking water shortages due to limited capacity to store water between seasons on mountain slopes where most people live. With the influence of climate change, water stress and water quality may become even worse. A lack of skilled professionals and appropriate training organizations, coupled with financial constraints, limit the effective operation and management of water and wastewater treatment plants. Community-driven development approaches, some led by the WBG, that devolve the management of irrigation systems and water resources have promoted local participation and increased water supply and coverage for rural, agricultural communities.

Emissions from transport are rapidly increasing in line with private vehicle ownership.[20] The number of light vehicles, including taxis, have more than tripled between 2000 and 2017, from 25,000

to almost 90,000.[21] The capital city of Thimphu, which accounts for over 15 percent of Bhutan's total population, faces challenges such as local air pollution, traffic congestion, and inefficient land use. Since the transport sector relies entirely on imported fossil fuels, the rapid increase of vehicles has resulted in increased diesel and petrol imports, from $10 million in 2002 to $115 million in 2016. Aside from the fiscal pressure on the economy and energy security concerns, the increased vehicle emissions threaten Bhutan's carbon neutrality goals. Bhutan's National Strategy and Action Plan for Low Carbon Development suggests potential for a 15 percent cut in road transport GHG emissions by 2040.

Bhutan must improve the resilience of built environment construction and enhance geo-hazard risk management. The construction sector contributed 16 percent to the country's GDP, second to agriculture, livestock, and forestry. However, the 2016 Performance Audit of Development Marketplace identified inadequate application of resilient engineering design standards and lack of proper planning, design, and workmanship in construction works. There are major investments in the construction industry, but it faces several challenges, including lack of legal and regulatory framework and limited capacity to monitor implementation, resulting in lower quality construction and compromised safety practices. A systematic approach to prioritize and adopt cost-effective measures for maintenance of roads is needed. Greater adoption of green designs and sustainable technologies can also have further implications outside of public infrastructure.

Bhutan's National Transmission Grid Master Plan envisions a significant increase in high voltage direct current transmission connections with India by 2040.[22] Of Bhutan's total generation of 7,000 GWh, nearly two thirds—4,500 GWh—was exported to India.[23] Interconnecting the Bangladesh, Bhutan, India, and Nepal power system can help address electricity shortages, drive down supply costs, reduce carbon emissions, and increase the resilience of the system. Efficiency gains from regional integration in BBIN can cumulatively reduce capital expenditure by $17 billion and save 120 $MtCO_2$ from 2011 to 2045.[24] A trilateral memorandum of understanding was proposed in 2017 and is expected to be signed between Bangladesh, Bhutan, and India for the joint development of a 1,125 MW hydropower project in Bhutan to export electricity to Bangladesh via India.[25] The WBG can play a catalytic role to enable greater regional energy connectivity and cooperation.

To mitigate transport sector emissions, Bhutan will need to enhance its enabling environment around public transport and electric vehicles. Innovative low emission transport systems for urban mobility and a modal shift in transport towards public transport can help reduce traffic congestion, manage upfront investment costs, and is an attractive private sector investment opportunity. The WBG can play an important role in mitigating the high upfront cost of introducing new transport technologies. Implementation of green transport systems also requires planning, awareness raising, policy incentives, and investments to develop the market, while leveraging global technology developments. Further analytical work can also map out political economy of carbon-related sectors to assess stakeholders' interests, influence, and resources; identify ways to engage stakeholders in sector reforms; and identify potential political, economic, and social risks stemming from green growth and renewable energy programs. For example, electric vehicles can be more expensive than vehicles using internal combustion engines. Exemptions in import duties and sales tax implemented by the government have been insufficient to catalyze the switch toward electric vehicles. The availability of charging infrastructure for electric vehicles is one of the key elements contributing to market penetration.

Human Capital for Resilience

Bhutan needs to continue its efforts to build a strong foundation for a climate-smart human development system. This involves enhancing social protection and jobs, health resilience, and education programs and systems to promote adaptation and support for the poor and vulnerable to cope with climate change impacts. Climate-responsive and adaptive social protection measures can (i) build the resilience of the poorest and most vulnerable people to climate change; (ii) prevent people from falling into poverty; (iii) support job creation; and (iv) increase knowledge and improve awareness about climate change and its impacts. Interventions in both health and education sectors can promote utilization of climate-smart technologies to reduce carbon emissions. For example, rehabilitation of health facilities, early childhood and education centers, and schools can benefit from using climate-smart, alternative energy sources and disaster-proof infrastructure. In addition, health operations can focus on a one-health approach to improving health resilience. Education operations can also include climate change into school curricula, include scope for advocacy and awareness among students, provide youth with skills to contribute towards climate resilience and green growth, incentivize research and innovation in tertiary education for creating sustainable solutions for climate change issues, include green topics in training curricula of teachers and school principals, and update infrastructure and maintenance policy of government to ensure that it is climate-smart.

Communities hold knowledge and expertise that can shape mitigation and adaptation decisions and actions. Local communities and indigenous peoples have been using their traditional knowledge to respond to the challenges associated with climate change—often in the absence of external support. Mechanisms to promote local climate action also include community-driven development, a model to which the WBG has committed significant financing over the past several decades, and devolved climate finance approaches. Such approaches can help mobilize or strengthen the capacity of local institutions to promote climate resilience, build on local capacities, and promote meaningful partnerships between communities, school management, and local authorities.

Enhanced capacity could be leveraged to prevent, detect, and respond to public health emergencies, including emerging and climate-induced diseases. This requires a coordinated and multi-sectoral approach that leverages the country's disaster risk management governance and institutional arrangements. Bhutan would greatly benefit from the following interventions to help it adapt and become more resilient to climate change, including: (i) inclusion of climate information in an IDSR system, with early warning for climate-sensitive health risks; (ii) carrying out a climate and health vulnerability assessment to inform the development of a national health and climate action plan and facilitate climate financing to strengthen public health outcomes; (iii) strengthening client capacity in areas related to climate change and health; (iv) development of a "one health" framework that includes risk-mapping to identify priority vector-borne diseases; and (v) implementing activities to increase climate resilience of health infrastructure.

Development of a human-centered, climate-responsive social protection system would allow for a holistic approach to mitigation, recovery, and resilience of individuals against shocks. This would involve: a) creation of a dynamic social registry through increased inter-operability and integration of relevant administrative information systems to allow quick identification of affected populations in case of risk and better budgeting; b) creation of a cross-sectoral adaptive social protection strategy for

promoting economic inclusion and for improving resilience of households and communities to shocks as well as improved awareness of climate change; and c) promotion of accompanying measures for poor and vulnerable households, which include those living in areas highly vulnerable to climate change, to provide counseling and communication campaigns on climate-responsive approaches to improve awareness about climate change and its impacts.[26]

In terms of reducing GHG emissions, the human development sectors can help by developing a strategy, operational manual, and safeguard procedures for basic upgrades of service facilities that includes renewable energy and other strategies. This would involve incorporation of energy efficiency measures in design and construction of basic services infrastructure as mitigation measures, and promotion of basic upgrading of early childhood and education centers, schools, and health facilities, which include healthcare waste management and sanitation facilities, as well as medical stores.

Macro-Fiscal Resilience and Risk-Informed Decision-Making

Highly climate vulnerable sectors such as hydropower, tourism, and agriculture currently account for a significant portion of Bhutan's economy, creating an urgent agenda for Bhutan to improve its macro-fiscal resilience. Extreme weather leads to fluctuations in hydropower, the main driver of growth and an important source of revenue for the government, and affects agricultural production, the main source of livelihoods for the poor.

To prioritize resilience in development planning, solid risk information is needed, but disaster risk and climate data is sparse and disaggregated. Currently, different technical departments and agencies are responsible for monitoring, assessing, and mitigating the impacts of different hazards. The absence of an enabling environment to share information and coordinate between them is leading to duplication of efforts and ineffective use of resources.

Efforts to increase macro-fiscal resilience and improve decision-making can build on the country's strong commitment to the preservation of natural resources and provide unique opportunities for Bhutan's growth and underserved populations. Potential entry-points for this strategic objective include:

- **Increase private sector participation and economic diversification—**The CPF emphasizes the need for building a new foundation for long-term economic growth by leveraging the private sector and digital technologies. Private sector participation in the economy is limited, with state-owned enterprises and commercially oriented government-linked companies playing a key role in Bhutan's economy. The non-hydro physical capital stock, such as roads and information and communication technology infrastructure, remains low. Improving the investment climate is critical to create more private sector jobs in the non-hydro sector.

- **Incorporate climate change aspects in the national budget, medium-term fiscal framework (MTFF), and fiscal risks analysis**—While climate change policies and strategies feature prominently in Five Year Plans, climate change adaptation and mitigation measures are not fully integrated in the budgeting process and are not included in the MTFF and fiscal risks analysis. To contribute to better incorporation of climate change aspects in the budgeting and analytical

process, the tracking and monitoring of public spending to address climate change could be improved. A Climate Fiscal Framework (CFF) has not been adapted in Bhutan.

» **Utilize disaster risk financing instruments**—Bhutan includes fiscal buffers in the budget report to cope with the immediate consequences of natural disasters and monsoon restoration. To better manage and reduce the fiscal impact of severe natural disasters, the government could utilize disaster risk financing instruments such as catastrophe bonds and insurance schemes.

» **Leverage international carbon markets**—Bhutan is exploring the possibility of engaging international carbon markets to leverage revenues for its development and conservation efforts, and to diversify its economy through the development of new low-carbon infrastructure sectors. The establishment of the Bhutan Climate Fund, an innovative financing mechanism to monetize emission offsets from hydropower exports, could help address this challenge.

» **Build on the development of the Green Finance Roadmap**—The Royal Revenue Authority approved an inclusive green finance road map in 2020, which can help signal a strategic shift towards investment in low-carbon sectors.

» **Prioritize investments with a dynamic risk information platform and decision support tool** to help the government invest in more resilient and sustainable infrastructure while reducing its contingent liability from the impact of adverse natural events.

Current gaps include (i) consolidating and expanding work on climate change-related fiscal/macro risks; (ii) furthering dialogue with the government on options for climate-smart fiscal policies that contribute to the climate agenda; (iii) expanding private sector participation and diversification beyond hydropower; (iv) supporting the government's prioritization of economic diversification; (v) developing information-based tools, technology, and decision instruments and creating a systematic approach for information-sharing and stakeholder coordination; and (vi) supporting Bhutan in joining the Sustainable Banking Network.

TABLE 5: Overall summary of priority engagements

THEMES	PROPOSED ACTIVITIES	
	Near-Term (Year 1-2)	Medium- to Long-Term (Year 3-5)
Sustainable, Renewable Natural Resources	» Advisory/Analytics to enhance sustainable forest management.	» Investment/Advisory/Analytics for climate-smart agribusiness.
Resilient Infrastructure	» Technical assistance on sustainable hydropower and regional electricity markets program.	» Investment support for the mainstreaming of risk-based service delivery in key economic sectors.
Human Capital for Resilience	» Human capital DPF to enhance economic resilience and human capital.	» Technical assistance for transport electrification opportunities.
Macro-Fiscal Resilience and Risk-Informed Decision-Making	» Support the establishment of the Bhutan Climate Fund.	» Investment for the establishment of a National Weather and Flood Warning Center.

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26. For example, to promote investment in economic inclusion activities and small labor-intensive activities such as constructing flood protection barriers, soil and water conservation, etc., as part of existent employment programs such as PMEP and LL development plans.

Children in the low-income suburb of Gwaltoli. Climate change is expected to lead to increases in poverty.

—PHOTO: GRAHAM CROUCH / WORLD BANK

INDIA

Climate Vulnerabilities

India is a large, diverse, and complex lower middle-income country, highly vulnerable to climate change. With a population of nearly 1.4 billion (2019 estimate) and covering an area of 3.28 million square kilometers, the seventh-largest country in land area, India is the third-largest economy by purchasing power parity in the world with a GDP of $2.87 trillion (2019) and a per capita income of $2,120.[1] Climate change is expected to have severe adverse impacts on its human development, economic growth, and ecological resources. The economic standstill due to the COVID-19 pandemic had to sharp reductions in GHG emissions in the short term, but emissions will start increasing again at previous rates unless India develops a green COVID-19 recovery strategy.

The HSBC Global Research report (2018) ranked India as the most vulnerable country to climate change among 67 evaluated, based on indicators related to vulnerability, energy transition risks, and response capacity.[2] Most impacted will be marginal farmers, coastal and mountain communities, low-income families, and forest communities, with women, girls, and under-privileged groups at the most risk.

About 650 million rural Indians are dependent on rain-fed agriculture for their livelihoods, while 250 million Indians living along its 7,516-kilometer coastline are at high risk due to sea level rise and extreme weather events such as cyclones and tidal surges.[3,4] Ecological resources such as forests are already under stress from rising temperatures and changes in precipitation patterns, and over 10 percent of the thousands of glaciers in the Himalayas have retreated.[5] The country has around

1,200 large and small islands that are highly vulnerable to climate change impacts such as sea level rise, increasing ocean temperatures, and changing rainfall patterns. In terms of livelihood impacts, the agriculture sector will be the most affected as it includes more than half of households in severe hotspots. India's estimated countrywide agricultural loss in 2030 will be more than $7 billion due to climate change, which overall will severely affect the income of 10 percent of the population.[6]

India is one of the most vulnerable countries to natural disasters due to its vast size and varied geography, high population density, unplanned urbanization, high levels of socio-economic deprivation, relatively lower levels of income, inadequate social security mechanisms, and low institutional capacity. Overall, absolute losses incurred by India in 2019 arising from extreme weather events amounted to nearly $69 billion (in purchasing power parity), the highest of any country in the world.[7,8] India faces high disaster risk levels, ranked 38 out of 191 countries by the 2022 INFORM Risk Index.[9] It has very high exposure to hazards (ranked 24) and limited coping capacity (ranked 91). India's vulnerability risk in India is also driven by its high levels of socio-economic deprivation and vulnerability (ranked 57).[10] Nearly 60 percent of India's land area is prone to earthquakes of moderate to very high intensity; 12 percent of land is prone to flood and river erosion; 5,700 kilometers of coastline is prone to cyclones and tsunamis; 68 percent of the cultivable land is vulnerable to drought; hilly areas are at risk from landslides and avalanches; and 15 percent of landmass is susceptible to landslides.[11] More than 5,100 cities and towns are prone to urban flooding, further exacerbated by climate change, varying rainfall patterns, and practices like reclaiming wetlands for development and choking avenues of natural drainage.[12] Multiple factors amplify disaster risk in India—notably social vulnerability—with 150–200 million people remaining undernourished and high levels of exposure driven by unplanned development in risk-prone zones. According to Action Aid (2020) on internal climate migration, an estimated 14 million people in India may have migrated in 2020 due to the slow onset of climate change events.[13]

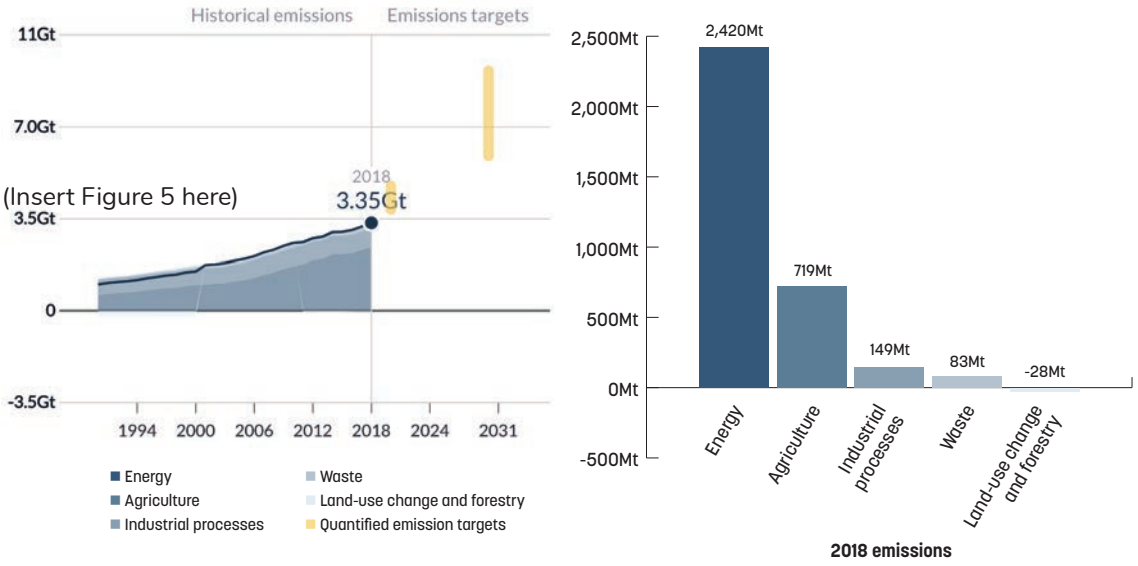
Climate change, climate-induced disasters, and other related shocks can lead to significant losses in human capital and increases in poverty and vulnerability. These shocks can force the poor and vulnerable to adopt adverse coping strategies such as selling assets, reducing intake of nutritious food, and reducing attendance or taking children out of school to work. This threatens to worsen India's already high prevalence of stunting and wasting among children under 5 years old and reduce access to education services, as schools are not properly equipped and staffed during shocks, or resilient in the aftermath of crises.

GHG Emissions

India is one of the world's fastest-growing economies and is also a major energy producing and consuming country, making it the world's third-largest emitter of GHG emissions.[14] Over the past few decades, India's emissions have risen more than the global average, increasing its share of global CO2 emissions from 1.3 percent in 1970 to 6.3 percent in 2015.[15] In comparison, China was responsible for 5.2 percent and the United States for 29.1 percent in 1970, and 28.6 percent and 14.9 percent, respectively, in 2015.[16] Total emissions grew from 4.7 percent a year in the 1970s, to 5.8 percent a year in the 2000s. However, India has seen a reduction of 13 percent in the emissions intensity of its economy during the past decade, despite a rise in final energy consumption and electricity generation.[17] India's total GHG emissions in 2018 stood at 3.4Gt, led by the energy sector at 2.42Gt

(*Figure 5*).[18] In 2040, GHG emissions could rise by 50 percent from 2019 levels, which would make India the world's second-largest emitting country behind China.

FIGURE 5: Sectoral GHG emissions and targets



(Insert Figure 5 here)

In terms of energy consumption, India is one of the largest electricity markets in the world, comparable to the power systems of the European Union, China, Russia, and the United States. The government of India has focused on keeping up with a strong growth in demand while expanding energy access to millions of consumers every year. Future power consumption will be driven by growing electricity access, urbanization, ownership of appliances, and economic growth. Against this backdrop, the key challenge for India will be to ramp up access to high-quality basic services without getting locked into a high-emissions trajectory. The dominant source of CO_2 emissions in India is the combustion of coal, which contributed 67 percent of total fossil CO_2 emissions in 2015.[19] Although there is more coal in the energy mix than other fuels, the contribution of coal to fossil fuel emissions in India has been generally declining since the 1940s, when coal accounted for more than 95 percent of all emissions. Both natural gas and oil have been gaining share in India's total energy supply—oil particularly between 1940 and 1970, and gas since 1980.

India's per capita emissions today are 1.6 tonnes of CO_2, well below the global average of 4.4 tonnes, while its share of global total CO_2 emissions is approximately 6.4 percent.[20] According to NITI Aayog, total primary energy is expected to almost triple between 2017 and 2042.[21]Under current policy projections, GHG emissions (excluding LULUCF) are projected to increase by nearly 50 percent and 100 percent from 2010 levels by 2020 and 2030, respectively. The share of non-commercial biomass is expected to fall given increased access to modern forms of energy. Owing to its domestic availability, coal will continue to be the most dominant source of energy because of its perceived cost advantage relative to other energy sources. It is seen as a form of energy security compared to imported fuels such as oil and natural gas. India is expected to have one of the highest rates of economic growth by 2040, and its population is expected to increase to become the world's largest around 2027.[22] Most energy demand will come from the industry and transport sectors, further

enhanced by rising population and urbanization levels.[23] Per capita emissions are expected to rise to 3.7 tCO_2e per capita by 2030.[24] The costs of inaction expressed as amount of total GDP losses are projected to be $1.2 trillion under a carbon-intensive scenario.[25] At the same time, India's emission intensity of GDP decreased by 24 percent between 2005 and 2016.[26] Subsequently, it is on track to achieve its pre-2020 climate action goals.

Climate change benefits can be concurrently achieved while pursuing clean air targets. According to the World Health Organization, across the G20 economies, 14 of the 20 most polluted cities are in India and over 50 percent of the cities studied throughout India have critical levels of PM10 pollution.[27] In 2017, outdoor air pollution caused around 670,000 premature deaths in the country, a six-fold increase since 2000.[28] In South Asia, India accounts for most of the PM2.5-attributable deaths—about 980,000.[29] Actions to attain India's PM2.5 reduction target of 30 percent in its National Clean Air Program by 2024-25 require fundamental transformations in the Indian energy, transport, industrial production, waste management, and agricultural systems that need to be part of an integrated approach. These clean air measures will not only reduce the primary and precursor emissions of PM2.5, but also lower CO_2 and black carbon emissions for direct climate benefits. A "clean air" pathway for achieving the above-mentioned air quality targets would reduce India's CO_2 emissions by 12 percent by 2025, 23 percent by 2030, and 42 percent by 2040, while black carbon emissions would shrink by 51 percent, 81 percent, and 90 percent in the same time frames.[30]

Nationally Determined Contribution (NDC)

With the signing of the Paris Agreement in 2015 and steps taken towards a decarbonized future, India seeks to achieve climate leadership in the global arena. The NDC commitments include achieving by 2030: (i) a 33-35 percent reduction in its GDP emissions intensity below 2005 levels; (ii) a 40 percent share of renewables in power generation, contingent on technology transfer and availability of finance; and (iii) an additional cumulative carbon sink of 2.5–3.0 $GtCO_2e$ with increased afforestation and tree cover. Other commitments are to better adapt to climate change by enhancing investments in development programs in sectors vulnerable to climate change related to agriculture, water resources, the Himalayan region, coastal regions, health, and disaster management. India has taken the lead in climate risk management, including a nationwide network of early warning systems and multiple initiatives to promote energy efficiency in consumer products and among micro, small and medium enterprises (MSMEs). India is also aiming to achieve 225 GW of renewable energy capacity by 2022, including rooftop solar generation, more than its 175 GW target as per the Paris Agreement. India recorded its lowest-ever solar power tariffs in 2020 (below INR2.5/kWh), making them 50 percent cheaper than coal, even with subsidies removed.[31] India took the lead to establish the International Solar Alliance, an inter-governmental organization of more than 120 countries working towards efficient exploitation of solar energy and reduced dependence on fossil fuels. However, India has yet to submit its second NDC of updated commitments or arrive at a zero-carbon growth strategy. The country's current NDC targets would only limit its emissions to 6-6.3 $GtCO_2e$ by 2030. It needs to reduce its emissions to below 4.5 $GtCO_2e$ by 2030 and to below 3.2 $GtCO_2e$ by 2050 to be within its fair-share range compatible with a global 1.5 degrees C scenario.[32]

Emerging Priorities

As India achieves its development transitions, it can help the world secure a climate transition. Cutting across different sectors—energy, urban, agriculture, transport, and water—the success with

which India navigates these transitions will determine the country's ability to achieve its aspirations of high middle-income status to lift millions of Indians from the threat of poverty and vulnerability. The nation's ability to achieve its core development transitions beyond its NDC commitments will play a critical role in ensuring the sustainability of the planet.

Climate change considerations are key to sustained and inclusive growth as India aspires to become a $5 trillion economy by 2024 and continue to grow sustainably in ensuing years.[33] As underscored by various development programs of the government, the country has committed itself to achieving inclusive growth and providing basic services to all its citizens in a sustainable manner. Supporting further broadening and deepening of this approach, this Climate Change Action Plan (CCAP) adopts a decentralized strategy in which local communities and governments are informed, empowered, and enabled to undertake short- and long-term initiatives on pursuing climate-resilient growth.

A twin focus is required—reducing GHG emissions and enhancing adaptation outcomes by increasing climate finance, improving and expanding diagnostics to prioritize climate-related actions, and focusing on climate results to deliver inclusive development impact. Adopting a "whole of the economy" approach to simultaneously achieve robust, inclusive growth and climate goals requires an integrated and interconnected strategy across geographies (local, state, national, agro-climatic zones), key social and economic sectors, and people (multiple stakeholders).

Given the development dynamics in a democratic and federal polity with three tiers of government and the competing demands for resources by different sectors and groups, India faces formidable and complex challenges in pursuing economic growth in the face of climate change. The diverse geographic, socio-economic, and traditional nature of India makes it difficult for a uniform, federally driven policy to effect changes in all areas. Every state has varied intensity and exposure to climate and disaster risks, and response mechanisms would also have to be different, requiring state and local level policies to build on federal actions and commitments to ensure that local priorities are addressed. Such a complex and diverse set of climate change challenges cannot be solved with the current approach, instead requiring a fundamental shift in the way India looks at and pursues social and economic growth. Key drivers of this transition to a climate-resilient economy include structural and governance reforms, new knowledge and innovations, improved capacity from national to local levels, inclusive and accountable frameworks on designing and achieving sustainable growth strategies, and broad-based partnerships, including with the private sector and the civil society. Necessary steps include creating an institutional and policy landscape for resilience and resource efficient growth at the national, state, and local levels, sustainably managing increasing urbanization to achieve the nation's full socio-economic potential and addressing inadequate financial resources and capacity among states as well as inadequate social protection mechanisms.

Both the public and private sectors will find it difficult to invest in climate projects unless benefits are clearly visible, communicated, and experienced. Fortunately, new disruptive technologies are becoming available to accelerate and expand climate-resilient planning and design, cost-effective implementation, multi-stakeholder engagement, and effective monitoring and evaluation with the ability to carry out informed course correction. Such disruptive fourth industrial revolution (4IR) technologies include artificial intelligence (AI), big data, robotics, 3D and 4D printing, the Internet of Things (IoT), blockchain, drones, and virtual and augmented reality (VR/AR).

A low-carbon, climate-resilient, and greener development model will deliver better results for communities, the economy, and the environment. The International Labour Organization projects that in 2030, 2.2 percent of total working hours worldwide will be lost because of higher temperatures—the equivalent of 80 million full-time jobs—with more than half lost in South Asia, including India.[34] Sectors most affected will be agriculture (60 percent) and construction (19 percent).[35] The poorest areas of India will suffer the most significant economic losses, as they have fewer resources to adapt effectively to increased temperatures, which will reinforce already existing socio-economic disparities.

To simultaneously attain robust economic development and climate benefits, India needs more investments in renewable energy, green transport systems, sustainable agriculture, climate-resilient municipal services, energy efficiency, and natural capital investment for ecosystem resilience and regeneration. According to the Global Commission on Adaptation, investments in adaptation consistently deliver high returns and create more jobs than traditional investments.[36] Such investments also protect communities and natural ecosystems, with superior local benefits. Incorporating climate resilience into social and economic sectors will make the Indian economy resilient, more equitable, healthier, and stronger. The New Climate Economy report showed that ambitious climate action does not need to cost much more than BAU growth, while the costs of inaction continue to mount.[37] A survey of 231 central bank officials, finance ministry officials, and other economic experts from G20 countries showed that green projects create more jobs, deliver higher short-term returns per dollar spent, and lead to increased long-term cost savings in comparison to traditional fiscal stimulus.[38]

As India grows and its economy transforms, heavy industry sectors will be essential to provide the materials to support a modern economy. These include iron and steel, cement (and concrete), petrochemicals, aluminium, fertilizers, and bricks. The GHG emissions from industries grew at a compound rate of nine percent—rising from 315 million tonnes (Mt) of CO_2e in 2005 to 623 Mt CO_2e in 2013.[39] Another category of the manufacturing sector that consumes fossil fuels is the informal sector, consisting of MSMEs and other unorganized manufacturing units. Major manufacturing units in this sector are food and agro-processing, coal and coke briquetting, foundries, lime/limestone processing, and brick kilns. The informal sector contributed 45 percent of the total manufacturing output and accounts for 71 percent of the employment in the manufacturing sector.[40]

India needs to investigate the least-cost combination of options that can significantly reduce energy and CO_2 emissions in the industrial sector, while enabling the Indian economy to continue to grow and alleviate energy poverty. A first step in this transition would be to facilitate the energy-intensive industries to shift to higher energy efficiency and cleaner fuels. Enhancing energy efficiency is also an effective way of fighting air pollution by reducing power demand, improving economic productivity per unit of air pollution. Using energy efficiency as an entry point to assess and mitigate both climate and air pollution emissions can provide a win-win outcome. In addition, India should invest in development and emergence of new and future green technologies—such as electronic vehicles (EVs), batteries, hydrogen, energy-efficient cooling, and other appliances. India has already announced plans to support such industries, which fits in well with the intent of the "Make in India" and "Start-up India" programs and will allow the nation to create jobs while shifting to use of greener products and technologies.

Climate change considerations are key to sustained and inclusive growth in India, and the WBG is strongly promoting resource-efficient growth in this direction. The World Bank's 2018–22 CPF for India lists three focus areas towards supporting high, broad-based, and sustainable growth: (i) promoting resource-efficient growth; (ii) enhancing competitiveness and enabling job creation; and (iii) investing in human capital. While climate concerns apply across the spectrum of WBG activities in India, the focus area of "promoting resource-efficient growth" has direct applicability. The CPF further lists a strong focus on the private sector in strengthening public institutions and providing technical expertise to develop market mechanisms to finance climate mitigation activities.

Aligning the WBG's core competencies with the government's development plans and strategies identifies five priority areas for India:

- **Decarbonization (Energy, Industry, and Transport Transitions)**
- **Agriculture-Water-Energy-Air Nexus**
- **Sustainable Urbanization**
- **Mainstreaming Resilience**
- **Macro-Fiscal Sustainability**

Decarbonization (Energy, Industry, and Transport Transitions)

India has been aggressively shifting towards electricity generated by solar, wind, and hydroelectric power, with an ambitious target set to have 175 GW of renewable installed capacity by 2022 and 450 GW by 2030. In 2020-21, India generated 1,381 TWh of electricity from a total installed capacity of 388 GW, with about 60 percent from fossil-based resources.[41] Even if India were to achieve its ambitious renewable energy targets, its share of coal in the generation mix could still be from 48- 54 percent by 2040.[42] In addition to realizing a transition to greener forms of energy production and distribution, the country would also need to focus on enhancing energy efficiency and reducing GHG emissions in key sectors such as industry, transport, and space cooling.

The WBG will focus on helping India accelerate the transition to renewable energy sources as fast as possible while still meeting the growing energy needs. It is critical for India's growth plans to provide sustainable, reliable, affordable modern energy to all. The energy transition would have five important areas of focus: (i) **a core energy transition** that includes expansion of non-conventional energy sources—especially solar and hybrid technologies and an increase in the energy storage infrastructure, including deployment of new technologies; (ii) **increased supply side efficiency** including a financially sustainable power transmission and distribution sector to ensure continued investment in renewable energy; (iii) **demand-side efficiency** to enhance energy efficiency in industry, MSMEs, and homes; (iv) an **industrial energy transition** including decarbonization of high-heat industries such as cement, iron, and steel; and (v) a **just transition**, which is critical to ensure that workers, local communities, and small businesses do not suffer, and that stranded asset issues are addressed due to the phase-out of coal to meet climate change goals.

Underpinned by strong policy support, India has created one of the fastest-growing renewable energy markets in the world, effectively removing 50 GW of coal power from forward planning over the past two years. Continued expansion of India's renewable energy capacity will require

strengthening the sector's fiscal and investment environment, and stronger, more diverse flows of private capital. Increased system flexibility through the development of complimentary markets for battery storage and e-mobility as well as cross-border trade will need be introduced quickly. Accelerated development of flexible hydropower and pumped storage through improved land and environmental permitting, along with stronger development frameworks, will be critical. Strengthened and expanded green corridors, infrastructure, and markets enabling regional power trade and a more flexible wholesale power market need to be developed.

Going beyond concentrated development in resource-rich regions, renewable energy production needs to be expanded to other locations and brought closer to consumption centers. A recent transaction showed that solar is already cheaper than coal in the country.[43] In addition, distributed renewable energy technologies such as small hydro, rooftop solar, and biomass will accelerate employment creation. The recently announced National Hydrogen Mission and the National Mission on Transformative Mobility and Battery Storage will be critical for creating wider energy storage options essential to meeting intermittencies (of renewable energy) in the future, thereby ensuring regional and national energy security, access, and availability.[44] Creation of power exchanges/markets can help facilitate energy transition by maximizing resource efficiency, bringing down costs of power procurement, and reducing renewable energy curtailment. Integrating energy storage solutions with EV charging infrastructure can also mitigate the grid management challenges of peaking power from e-mobility. The greatest risk to investment in energy transitions and perpetuating India's reliance on coal thermal power generation is the heavily indebted distribution system. More than 18 percent of energy generated is lost within the distribution system, while the outstanding debt of distribution companies (DISCOMs) at the end of FY19 is estimated to be above $30 billion.[45] The widening revenue gap makes it impossible to spur capital investments to upgrade distribution infrastructure or increase clean energy procurement. Further, the stranded asset risk within the thermal power sector must be addressed.

India must plan for a just transition from coal to ensure that no one gets left behind. Use of coal in power generation could peak by the late 2020s.[46] Further, given low renewable energy prices, the existing coal fleet is facing declining utilization rates and mounting financial pressures, with thermal capacity retiring faster than new capacity is coming online. In fact, stranded asset risk within the thermal power sector is currently estimated at $40-$60 billion.[47] Coal miners as well as entire communities and several states, industries, and sectors (including Indian Railways) rely on the coal economy, making it crucial that India proactively plans the phasing-out of coal to ensure that key stakeholders—especially, workers, local communities, and small businesses—do not suffer. Social dialogue with the affected communities, a broader stakeholder engagement, and creation of adequate and appropriate social safety nets will be necessary.[48] Targeted decommissioning of inefficient thermal power plants would save the power sector up to $3.1 billion that could be shared with participating DISCOMs or pay for the transition of the coal-dependent workforce.[49] Training or re-skilling workers from the coal sector will mean direct employment for them in the renewable energy sector. The solar sector alone would require a total of 256,000 skilled, 320,000 semi-skilled, and another 570,000 unskilled people by 2050.[50] The issue of stranded assets should also be addressed, given that the domestic financial sector is already burdened with significant non-performing thermal power assets. The planning and preparation for early retirement, closure, or repurposing of coal mines and power plants and associated industries and stakeholders should be organized around three pillars—policy and strategy

development; people and communities; and land and environmental remediation. Providing greener jobs and social support systems for people affected by the transition is critical to achieve a smoother shift to sustainable energy while maintaining a robust and inclusive growth trajectory.

Improving end-use efficiency to meet the increasing energy demand in India is the most economical option. Energy efficiency can be addressed by transit-oriented development, efficient logistic planning, reducing specific energy consumption for major industries, increasing efficiency of power generation and reduction in losses, improving building design to minimize cooling (and heating) requirements, and penetration of high efficiency appliances. To inculcate sustainable development along with the growth in the industrial sector, the government has introduced the Perform Achieve and Trade scheme under the National Mission for Enhanced Energy Efficiency (2011). The Indian Bureau of Energy Efficiency estimates that only five percent of India's energy service company (ESCO) market has been tapped to date. Stronger policy designed to drive demand within industrial and MSME sectors, well-structured and bankable business models, and innovative financing structures will need to be further developed to drive market-based energy efficiency across the economy.

Through the "Make in India" initiative, the government is aiming to increase the share of manufacturing in the country's GDP from the current 16 percent to 25 percent by 2022.[51] Managing how India industrializes over the coming decades, and which policies govern these processes, will be of crucial significance for viability of the sector and for global emission trends. To limit industrial pollution, the Ministry of Environment, Forestry, and Climate Change (MoEFCC) in 2016 released a categorization mechanism of industries based on their pollution load to ensure consistency with environmental objectives. These aim at enhancing energy and resource efficiency in energy intensive industries. Options including fuel switching away from fossil fuels to low- or zero-carbon fuels, deploying carbon capture and storage technology, and the use of biomass as a feedstock in the manufacture of petrochemical products should be encouraged.[52] Electrification within industry will be critical, as will the greater utilization of gas as an alternative to other fossil fuels. Further, sustainable waste management and energy efficiency through retrofitting, new technologies, and fuel options are imperative for India's industrial sector to reach net-zero emissions in the long run. The policy framework in harder-to-abate sectors to facilitate an industry transition must focus on developing longer-term technology roadmaps and collaborative research, development, and deployment (RD+D) programs at the global scale for the heat treatment applications sectors and associated technologies. The National Hydrogen Mission is also essential to decarbonize heavy industries such as steel and cement, and it holds the key to clean electric mobility that doesn't depend on rare minerals.

Transport contributes 13 percent, making it the second largest contributor to India's CO2 emissions after the industrial sector.[53] Energy demand from transport is expected to double by 2040.[54] India could reduce energy consumption and emissions in the transport sector through three focus areas: (i) decarbonizing passenger transport, encouraging the use of multimodal public transport, nonmotorized transport and better integrated urban and transport planning; ii) decarbonizing logistics/ freight transport, by encouraging the use of efficient and lower cost modes like rail, inland waterways; and facilitating the modernization of the trucking fleet; and (iii) facilitating the transition towards zero emission vehicles (such as e-mobility, green fuels and hydrogen fuel cells).

For passenger transport, an "Avoid-Shift-Improve" framework may be adopted. "Avoid" strategies aim to reduce the number of kilometers traveled though more efficient urban growth, compact cities, and transit-oriented development. "Shift" strategies aim to increase the use of more efficient solutions such as integrated public transport, shared mobility, walking, and cycling, resulting in an estimated 43 percent reduction in carbon emissions (90 million tons of CO_2) from urban passenger transport compared to a BAU scenario.[55] Electric mobility, green fuels, and use of hydrogen fuel cells are prime examples of "Improve" strategies.

For freight, the focus will be on trucks, which account for over 70 percent of all energy used and are the fastest growing segment in freight transport energy use, doubling since 2010.[56] Enabling freight decarbonization will require a) moving trips to more energy and cost-efficient modes like rail, waterways, and intermodal transport; b) encouraging bigger, fuller trucks; and c) reducing empty backhauls. The Eastern and Western dedicated freight rail corridors, being developed with an investment of about $13 billion, are expected to reduce about 15 million tons of CO_2 emissions per year.[57]

Lastly, enabling the development of zero-emission vehicle technologies (electric mobility, green fuels, and use of hydrogen fuel cells) will require prioritizing the development of suitable charging networks and developing scalable business models attractive to concessional and commercial financing. According to analysis by the Council on Energy, Environment, and Water, in a scenario in which EVs account for 30 percent of total vehicle sales in India by 2030, GHG emissions will go down by 4 percent, particulate matter emissions by 17 percent, and CO_2 emissions by 18 percent.[58] Moving ahead, the transport transition would require: (i) clear, well publicized norms and standards around efficient urban and transport planning especially non-motorized transport that offers co-benefits of reduced air pollution; ii) targets towards the adoption of innovative zero emission technologies (electric mobility) to improve efficiency, as well as to reduce air pollution and enhance energy security; iii) an approach to harness private finance towards green transport projects and technologies; and (iv) technical support to cities and states to build capacity and ensure integration of all modes of transport.

Cooling is another segment that needs energy efficiency interventions, considering that air conditioning in India could add up to 113 TWh in energy demand growth by 2027.[59] The aggregated nationwide cooling demand is projected to octuple by 2037-38 as compared to the 2017-18 baseline.[60] Emissions from cooling, both directly from refrigerant leakage and indirectly from the energy consumed by cooling devices, adversely impacts India's climate goals. Efficient and sustainable cooling can help create green jobs, reduce food losses, improve healthcare solutions, manage energy demand, and contribute to climate adaptation (through NBS). Sustainable cooling is a multi-dimensional, multisectoral challenge that requires devising policies to address the interdependencies that exists among the economic, energy, technological, social, and political systems. The cooling agenda sits in the center of three global agreements—the Paris Climate Agreement, the Montreal Protocol with its Kigali Amendment, and the UN Sustainable Development Goals (SDGs).

The WBG is already collaborating on different energy storage initiatives to scale up the uptake of renewables in India and actively engaging on electric mobility. It will invest to promote generation, integration, and enabling infrastructure for renewable energy. This support will cover on-grid, offgrid, and distributed renewable energy including the use of renewables for electrification of heating, cooling, and transportation. IFC will work with the sponsors and the private sector to support proven

abatement measures and pilot innovative technologies, including on circular economy, energy and resource efficiency, and renewables. Already, there are ongoing IFC projects to identify and leverage private sector financing solutions and to help develop the energy storage market. With the right policy framework and PPP structures, there is significant opportunity for private capital mobilization in regional power trade and e-mobility.

Agriculture-Water-Energy-Air Nexus

Nearly two-thirds of India's people depend directly or indirectly on the agricultural sector for their livelihoods.[61] Rain-fed agriculture in India makes up nearly 51 percent of the net sown area and is responsible for 40 percent of total food production.[62] Changes in temperature, both annual averages and highs and lows, will not only affect productivity but also impact water demand, favor weed and pest proliferation, and influence cropping choices in different agro-climactic zones. Nearly 820 million people in India's river basins face high to extreme water stress.[63] Growing populations, increasing urbanization, and rapid economic development have translated into demand for water outstripping supply in many areas as well as growing inter-sectoral competition for available water. Demand for water is projected to nearly double by 2050, rising in all sectors—particularly in the industrial and domestic sectors—and placing pressure on agriculture, which currently accounts for 90 percent of water use.[64] With about 20.5 million tube wells, groundwater economy uses about almost a quarter of the energy produced in the country, making it a key source of GHG emissions.[65]

The sustainability aspects of the agriculture sector are crucial, with direct links to water management, electricity, and fossil fuel consumption, as well as air pollution. This makes agriculture the sector most vulnerable to climate change, owing to the vagaries of temperature and rainfall. The key river basins in India, which are populated by 800 million people, are likely to face extreme water stress.[66] Higher temperatures will lead to higher evapo-transpiration and to higher demand for water by agriculture. Degradation, affecting an estimated 30 percent of all land in India, reduces its ability to act as a carbon sink and as natural water storage.[67] There are about four percent of the world's freshwater resources in India, but it is home to about 18 percent of the world's population, which underscores the criticality of efficient water resources management to support India's development aspirations.[68] The energy intensity of agriculture can be mainly observed in groundwater irrigation carried out via electric and diesel pumps. Such practices are not only energy inefficient but also lead to groundwater depletion. Unsound agricultural practices such as clearing the fields by stubble burning have led to seasonal smog with serious public health repercussions.

There are opportunities to address the challenges of the nexus in geographically vulnerable areas. Scaling up sustainable agricultural practices in the Ganga basin, home to more than 500 million people and highly dependent on agriculture for incomes and livelihoods, will lead to multi-sectoral benefits.[69] The Indo Gangetic Plain contributes about 34 percent of India's CO_2 emissions and 41 precent of its black carbon emissions.[70] This region has the highest current air pollution levels, and the main sources of CO_2 emissions are industry and power plants. However, air pollution caused by agricultural practices, mainly crop residue burning, is a significant contributor to black carbon, a sub-component of the most important air pollutant PM2.5 formed by incomplete combustion of fuels, and is also a particularly aggressive contributor to climate change. Household and rural heating biomass burning

still prevalent in this densely populated region is the leading source of black carbon emissions, even after accounting for good progress and reductions from liquified petroleum gas expansion programs (Ujjwala). Black carbon can have significant direct and indirect impacts on climate, the cryosphere, and agriculture, and therefore food security and human health. The nexus between air pollution, water management, energy consumption, and agriculture can be systematically explored, and investments can be synergized in this area for better outcomes. The WBG, through various interventions in different states in the Ganga basin, can create a multi-sectoral initiative that builds on distinct investments to achieve an integrated approach.

Scaling up CSA can go a long way in ensuring that the challenge of the agriculture-water-energy-air nexus is addressed in a holistic manner. WBG engagements in India focus on climate resilience in agricultural growth and rural development through CSA practices. For example, the engagement in Maharashtra involves small and marginal farmers and aims to reduce the risks of climate-related crop failure and to enhance farmers' income. This intervention is crucial for the farming community in Maharashtra as severe droughts in the past have affected the state's agricultural performance. A similar engagement in Odisha for integrated irrigation and for supporting farmers with small holdings also targets reduction of agricultural GHG emissions. Adoption of agro-ecological approaches to planning are also an innovative and efficient way of making food systems resilient by restoring ecosystem services and biodiversity in the context of climate change. The World Bank's Resilient Kerala Program supports the establishment and management of agro-ecological zones in Kerala with an aim to make the agriculture sector resilient to disasters.

Given the resource intensiveness of agriculture in India and the constraints posed by climate change, the agriculture sector faces major productivity and efficiency issues. About 650 million rural Indians depend on rain-fed agriculture for their livelihood.[71] Since more than half of households in severe climate hotspots are in agriculture, the sector will be the most affected in terms of livelihood impacts. For instance, loss of farm revenue due to extreme temperatures and rainfall shocks is estimated to be minus-12 percent for monsoon (kharif) and minus-six percent for winter (rabi) crops, with more impacts on unirrigated systems. The estimated countrywide agricultural loss in 2030 is projected to be over $7 billion.[72] Moreover, India's complex system of agriculture and food subsidies, initially designed to support poor farmers, has become entrenched and is negatively impacting the country's resource base, encouraging overuse of fertilizer, perpetuating poor water management, and contributing directly to land degradation.[73] Production inefficiency due to the prevalence of small landholdings, inadequate access to adequate water management technology, and sub-optimal cropping patterns (e.g., water-intensive crops in water-scarce areas) further dampens productivity and increases the fiscal burden of current subsidy and support programs. China's experience is instructive to understand India's potential scope for improvement in these vital indicators: each unit of land generates four times more GDP than in India, and each unit of irrigation water produces five times more agricultural GDP than in India.

Expanding the natural capital base in production landscapes will facilitate agriculture, improve soil health, reduce runoff, increase pollinators, and help produce organic inputs. There is a good possibility of expanding the scope and scale of watershed and irrigation projects by injecting a landscape approach that will invest in building off-farm natural capital in combination with on-farm forestry initiatives. This will not only expand carbon sinks but make agriculture resilient to climate

shocks and increase critical ecosystem services in the landscape. Investing in organic farming directly affects the physical environment of farming communities, helps in fighting the effects of global warming, and incentivizes sustainable agricultural methods. Suitable fertilizer and market reforms will encourage farmers to shift to more sustainable crops and cropping practices that accrue profits and ensure the sustainability of their livelihoods. One such intervention by the WBG in this area has been in Himachal Pradesh through a project that supports source sustainability and climate-resilient rain-fed agriculture.[74] The project entails high-efficiency irrigation, climate-resilient crop varieties, and maximizing financial returns on water use. Such interventions can guide the larger approach of moving away from extreme water dependence in agriculture by efficient allocation of water resources.

An overall improvement in food systems from production to consumers can strengthen food security and improve the efficiency of food production, value addition/processing, and consumption (for better access and nutrition). Improved management of inputs, such as water and energy, along with significantly improved ability to process and store food for maximum access and minimum waste, will reduce the overall climate footprint of this sector. India is one of the world's largest fruit, vegetable, and milk producers, yet limited infrastructure for packaging, handling, and transportation leads to post-harvest losses for food commodities, including 6 percent of cereals, 8 percent of pulse, 10 percent of oil seeds, and 15 percent of fruits and vegetables.[75] Reducing food loss and waste will lead to reduced emissions and more sustainable use of natural resources while increasing food supply in local markets and making prices more affordable to strengthen food and nutrition security. Better planning and monitoring are needed to reduce post-harvest losses, both on farm (due to unscientific/uncontrolled storage facilities) and in transport and logistics (due to underdeveloped infrastructure).

By working with public and private clients, the WBG will support investments that unlock "triplewin" benefits related to rice cultivation, livestock systems, agro-forestry, landscape management and restoration, and/or integrated value-chain management. The WBG will support India to repurpose public agriculture support programs to provide better incentives for farmers to invest in NBS and optimize agriculture's role as a carbon sink. Further, the WBG will help implement food system diagnostics to identify cost-effective climate priorities across the value-chain, including food loss and waste. The IFC's food loss calculator will help quantify the GHG benefits/cost savings of projects and reduce food waste across supply chains.

Sustainable Urbanization

India is urbanizing rapidly, with the urban population reaching close to 50 percent of the total population in the next three decades.[76] According to 2011 Census data, the urban population accounted for 31 percent of the total population, but it contributed 63 percent of the GDP, which is projected to increase.[77,78] By 2030, 70 percent of new employment in India will be generated in cities, and the number of urban households in the middle class will more than quadruple. Indian cities are projected to add 416 million urban dwellers between 2018-2050, create economic opportunities, and provide urban services while ensuring environmental sustainability and prudent management of natural resources like land and water.[79] The country's urbanization trajectory will have crucial implications on its future GHG emission levels.

Unplanned urbanization is reflected in the almost 65 million Indians who lived in urban slums, according to the 2011 Census, as well as the 13.7 percent of the urban population that lived below the national poverty line that year.[80] Increasing urban population and incomes have contribute to increased generation of solid and liquid waste by households and industry. Due to inadequate treatment and disposal, such waste becomes a significant source of GHG emissions, contributing nearly four percent of the country's total emissions.

Unplanned urbanization has led to increased vulnerability to natural disasters. Overburdened drainage and frenzied, unregulated construction without paying heed to the natural topography and hydro-geomorphology lead to increased instances of urban flooding.[81] Climate change impacts such as rising average temperatures and more frequent extreme weather events will only add to this vulnerability.

While urbanization is widely viewed as a key engine of development, urban population growth gives rise to both opportunities and challenges. Annual household emissions from electricity usage in Indian cities is 1.76 tons carbon dioxide, whereas corresponding values from China and the United States are 1.3 times and 7.4 times higher, respectively.[82] The government has announced an ambitious goal of achieving "Housing for All" by 2022 and taken a series of steps towards achieving this goal. At the same time, the importance of a climate-smart housing sector is widely recognized, particularly in the context of India's commitments to reduce GHG emissions by 33-35 percent by 2030 through household energy consumption as well as through land use, construction activities, and by way of materials sourcing, usage, and logistics-driven impacts. However, total final energy demand in India will triple from 2012 to 2040, primarily due to increasing urbanization, according to a NITI Aayog report.[83] The transport and industry sectors account for a major share of total final energy demand. Increased construction and energy consumption in the form of transport, cooking, heating, and other factors has led to high levels of air pollution in several cities. This vulnerability is further exacerbated by the increased frequency of extreme weather events due to climate change impacts such as rising average temperatures.

Indian cities, drivers of poverty reduction and sources of good jobs, present a unique opportunity for climate-resilient growth in the country. With much urbanization yet to occur, there is an opportunity to plan and build in ways that realize the benefits of urbanization while reducing GHG emissions. The three pillars to achieve sustainable urbanization are: spatial, structural and infrastructure resilience; resilient and sustainable services, and institutions and finance.

Strong governance is crucial to achieving climate-resilient and smart urban transformation through an integrated, multi-sectoral approach. In India, the governance structures need strengthening. Municipalities remain the most important institutions as they are entrusted to provide multiple civil services, often in the face of inadequate human and financial resources. Climate change can impact Indian urban residents through loss of livelihood opportunities and incomes, such as loss of community and informal social nets due to forced migration; reduced resilience to future shocks; reduced affordability and access to public services, and greater vulnerability to unsustainable debt exposure that could be necessary in times of crisis due to an extreme weather event. Sectoral approaches have been found deficient in dealing with such multi-sector outcomes resulting from climate change and disaster events. An integrated, whole-of-government approach includes stronger institutions, innovative green development frameworks and financing instruments, improved governance and

accountability, and strengthened capacities at the state and city level. This whole-of-government approach has enabled the WBG to help address some of the most challenging cross-cutting urban development issues.

A key role of the WBG in India will be to support sustainable and inclusive urbanization towards higher economic growth, reduced GHG emissions, increased resilience, and more livable cities that foster innovation and enterprises. The WBG will do this by applying its experience in leveraging green financing, convening multi-stakeholders, providing technical expertise, and sharing global knowledge. The key pathways will be: (i) investing in institutional capacity and governance mechanisms, policy reforms, and inclusive and disaster-resilient urban planning; (ii) addressing service and infrastructure gaps while improving financial sustainability; (iii) protecting and restoring natural capital in urban areas; and (iv) achieving the economic potential of urban areas. It will support selected states and cities with enhanced access to tools and assistance to integrate risk in urban planning and land use, strengthen capacity, increase building resilience, and expand access to more financing and global and regional partnerships. Another key pathway is to promote integrated solid waste management and circular economy approaches across the value chain. For example, the World Bank's Shimla-Himachal Pradesh Water Supply and Sewerage Services Improvement Program is supporting the government of Himachal Pradesh in improving water supply and sewerage services that are efficient (energy and water-use efficiency) and financially sustainable by strengthening the policy and institutional development program in target areas in the state. The program highlights the need for a framework for integrated management of water resources.

Lessons also are available from the World Bank-funded Chennai City Partnership, a multisectoral Program-for-Results operation with a focus on urban mobility (strengthening bus service delivery, municipal pedestrian infrastructure and women's safety in public spaces), water resource management and resilience (including flood management), water supply and sanitation, municipal public healthcare services, municipal solid waste management, and emergency management and response. Similarly, the multi-sectoral Resilient Kerala Program focuses on strengthening the state's institutional and financial capacity through an inclusive and participatory approach for managing shocks from climate change, natural disasters, and disease outbreaks. Going forward, the WBG could emulate these models and work with a handful of cities while focusing on investments related to resilient infrastructure, green and resilient services, and knowledge exchange, and helping to develop the capacity of related institutions for integrated planning and services.

Mainstreaming Resilience

The Climate Risk Index 2021 ranked India as one of the most vulnerable countries to climate change, based in part on potential impacts and a high level of vulnerability.[84] In addition, India is also one of the most vulnerable countries to natural disasters; in 2019, it incurred almost $69 billion (in purchasing power parity) in absolute losses arising from extreme weather events, the highest of any country in the world.[85,86] The most climate- and disaster-vulnerable populations include more than 500 million people living in coastal areas[87], nearly 50 million in the Indian Himalayan region[88], and about 275 million forest dependent people[89] and 120 million small and marginal farmers living within the mainland.[90] In addition, poor and disadvantaged people in India face a high level of socio-

economic vulnerability. The rising intensity of disaster events such as cyclones and flooding, uneven and extreme precipitation, landslides and soil erosion, threatened biodiversity, rising pollution, and increased incidences of public health issues—all worsened by climate change—are adversely impacting social and human capital as well as infrastructure, which are critical to socio-economic welfare and growth. To mainstream resilience across sectors and populations, key adaptation approaches include: (i) climate- and disaster-resilient infrastructure; (ii) focusing on climate-resilient livelihoods; (iii) social safety nets for those impacted by climate change; (iv) investments in building up natural capital such as forests, wetlands, mangroves, water bodies, and clean air; and (v) dynamic and evolving healthcare systems to respond to emerging challenges. A key focus will be on holistic and participatory planning approaches to integrate social, economic, and ecological dimensions into policies, planning, and development activities.

Infrastructure will be affected by climate change and disaster events, but also play an essential role in building resilience. Going forward, it will be imperative to develop new infrastructure assets that are prioritized, planned, designed, built, and operated to account for climate change that may occur over their operational lifetimes. For existing infrastructure, government agencies will need to come up with strategies and interventions to retrofit or manage them differently. Additional infrastructure to mitigate the impact of climate change can also be developed, including traditional infrastructure such as sea walls and other engineered solutions, as well as natural infrastructure, such as wetlands and other NBS. In road transport, paved roads are particularly vulnerable to temperature extremes, while unpaved roads and bridges are vulnerable to precipitation extremes. Rail system failures are often related to high temperatures, and urban public transport systems are more vulnerable to flooding. Crucially, even disaster-resilient transport systems must adapt to climate change to maintain reliability in order to enable transport's role in economic and social development.

India needs to modernize and strengthen its social protection system to cater to new risks emerging from climate change. Nearly half the households in India are vulnerable to climate change, and the majority of the workforce (90 percent) is informal without adequate social security benefits.[91,92] Evidence shows that adaptive social protection systems are essential to building resilience to shocks and ensuring timely delivery of social assistance that can mitigate losses and protect the poor. India needs to transform its fragmented social protection schemes into an integrated and adaptive system as a core component of its climate agenda.

Coastal stretches, the Indian Himalayan Region (IHR) and the peninsular mountain ranges (Aravalli, Vindhya, Satpura, Western and Eastern Ghats) are among the most vulnerable to climate change impacts. These regions are inhabited by several socio-economically underprivileged communities including Scheduled Tribes, and the sustainability of livelihoods is largely dependent on the continued vitality of the local natural resource base. The impacts of climate change are already being seen and felt by coastal communities across India as increased intensity and frequency of cyclones, sea level rise inundating critical coastal areas and infrastructure, diminishing fishery stocks, loss of coral reefs, and changing shorelines (land and seascape) due to erosion and accretion. Over 75 percent of India's coastline is vulnerable to cyclones and tsunamis.[93] In the period 1891–2018, India's West Coast faced 126 cyclones while the more vulnerable East Coast experienced 520 cyclones.[94] Similarly, the IHR as well as the Eastern and Western Ghats face increasing incidents of climate change-driven extreme weather events (floods in Kerala, landslides in Kerala and Karnataka, glacial and cloud bursts in IHR states).

The WBG can provide a range of resilience enhancing solutions to support India's economic development in extremely vulnerable geographical areas with large socio-economically disadvantaged communities, such as the coastal and mountainous or hilly regions. As India's climate change challenges intensify, investments in early warning systems, resilient infrastructure, and NBS will play a critical role in building resilience. These investments, when subsumed under a holistic approach, will ensure that governments can achieve the objectives of sustainable development and economic growth while creating green jobs and livelihoods. Currently, the WBG has ongoing operations including Integrated Coastal Zone Management, a National Cyclone Risk Mitigation Project, and disaster risk management in coastal states. These projects aim to address the crucial issues of multi-hazard risk management, thereby enhancing coastal resource efficiency and strategic infrastructure investments. The WBG also has key investments in mountain states like Himachal Pradesh, Meghalaya, and Uttarakhand looking at multi-sectoral approaches to mainstreaming resilience in planning and development activities. The WBG will underpin development and adoption of NBS to enhance livelihoods by supporting ecosystem functions and biodiversity

Sustainable forestry offers an opportunity to reduce carbon emissions and increase incomes for the poor. The forest and tree cover in India amounts to 81 million hectares, or 25 percent of the geographical area, yet contributes less than two percent to GDP.[95,96,97] However, more than 300 million vulnerable and tribal people depend on the forests for their livelihoods and subsistence needs (e.g., 40 percent of their energy and 30 percent of fodder).[98] Harvesting non-timber forest products, a sector valued at $25 billion a year, will help more than 5 million households enhance both incomes and resilience.[99] One-third of India's total GHG emissions emanate from land degradation of both poor-quality agricultural land (mosaic landscapes) and open forest/scrublands.[100] Reducing degradation will cut these emissions, while land restoration actively captures and then stores carbon.

India has pledged to restore 26 million hectares of degraded land by 2030. In parallel, India set an ambitious NDC target of sequestering 2.5-3 billion tons of CO_2e by 2030 through improvements in tree and forest cover and quality.[101] Potential exists to increase this to 3-4.5 billion tons of CO_2e by 2040.[102] Transitioning to a productive, economic, and sustainable forestry regime will unlock resilience, adaptation, and mitigation benefits, while ensuring ecological security and generating green jobs, green value chains, and incomes. There are three transformational pathways for combined forest protection and landscape restoration by 2040: (i) avoiding deforestation of 18 million hectares could reduce emissions by 0.4 billion tons of CO2, and the forest will then go on to capture and store more carbon as it grows; (ii) restoring 34 million hectares of degraded forest landscapes could sequester 1.7 billion tons of CO2; and (iii) restoring 87 million hectares of production/mosaic landscapes could sequester 1-2 billion tons of CO_2. [103,104,105] Notably, these pathways would also generate over 20 million green jobs contributing directly to the principles of building back better and greener. At the same time, India is also looking to re-orient its national forest service for developing new competencies that will help enhance ecosystem services and economic returns from forests. Through investments, technical assistance, and analytical work, the WBG can help India meet its national and international commitments as well as results-oriented utilization of the Ecological Fund Transfer recommended by the 15th Finance Commission.

Climate change is expected to have major health impacts in India, including vector-borne diseases, increasing malnutrition, and related health disorders such as child stunting, with the poor likely to

be the most severely affected. Likely health impacts of climate change include increased heat stress-related mortality and morbidity, particularly in urban areas and among agricultural workers; expanded transmission windows for malaria and dengue; and increased flood-related mortality and morbidity, including an increase in gastro-intestinal disease from degraded water quality. Climate change affects men and women differently due to biological, socio-economic, and cultural factors. In India, it threatens to widen existing gender-based health disparities. The WBG will support interventions to build gender-inclusive, climate-smart, and disaster-proof healthcare infrastructure and delivery systems, and significantly scale up pandemic preparedness. In addition, the WBG will support interventions to strengthen the adaptive capacity and resilience of the health sector, including ensuring climate information is included in an IDSR system, with early warning for climate sensitive health risks; and carrying out a climate and health vulnerability assessment to inform the development of a national health and climate action plan and facilitate climate financing to strengthen public health outcomes.

Macro-Fiscal Sustainability

The climate finance landscape in India is highly heterogeneous, fragmented, and dispersed. The government of India finances climate action through climate funds (routed through the union budget), direct budgetary allocations, and mechanisms aimed at leveraging private climate finance. Through its budgetary allocations, the government supports several adaptation and mitigation actions through the eight national missions under the National Action Plan on Climate Change as well as the State Action Plans on Climate Change at the sub-national level. The Compensatory Afforestation Fund established in 2016 primarily aims to help state governments in conservation, protection, and expansion of forest resources. The government also supports climate action through reductions in subsidies, increases in taxes on petroleum and diesel, market mechanisms such as the Perform Achieve and Trade scheme and Renewable Energy Certificates, and regulatory regimes such as Renewable Purchase Obligations. These multiple sources/channels of climate finance mean that no main agency directs or streamlines the funds towards national climate goals. Addressing the gap in planning and stewardship should become a priority so that climate considerations can be mainstreamed in the government's plans and finances. India's NDC stated that $2.5 trillion (at 2014-15 prices) additional financing was required for mitigation and adaptation measures for the 15-year period until 2030.[106]

Budgetary support is the main source of public climate finance in India, with most of the money coming as sectoral funding for ministries but not dedicated specifically to climate-related action. Additional budgetary allocations have been made from the 13th Finance Commission onwards, mainly recommended through three types of grants to state governments for forest cover, renewables, and the water sector. In 2011, the Ministry of Finance set up a Climate Change Finance Unit (CCFU) to advise and guide the MoEFCC as well as lead on global climate finance issues. The CCFU has included climate finance in economic surveys, contributed to the design of the National Adaptation Fund, and brought together stakeholders including civil society on climate finance issues for contributions to the Green Climate Fund. Another significant source has been the National Clean Energy Fund, which is a cess or tax on coal amounting to $11.6 billion from 2010-11 to 2017-18. Retaining the funds for forest conservation, the 15th Finance Commission has directed additional funding for combatting climate change and reducing environmental risks such as air pollution. It recommended a grant amount of $4.14 billion for the State Disaster Risk Management Fund, while the allocation for the National

Disaster Risk Management Fund is $1.77 billion.[107] It has also proposed $1.6 billion in funds for air quality management as a major focus area and an equal amount for solid waste management. Sikkim imposes a cess on non-biodegradable materials, Delhi levies a tax on every litre of diesel, Himachal Pradesh has a voluntary green tax, and multiple states impose a green tax on older vehicles.

Mainstreaming climate change mitigation and adaptation objectives in macro-economic policy making, planning, and budgetary decisions will be key to averting the effects of climate change. The government is aware of the economic consequences of climate change: both the economic risks posed by its mounting impacts, as well as opportunities of climate action that could unlock investments and create more jobs. Responding effectively to the impact of climate change will depend on designing an appropriate set of fiscal policies and instruments. This in turn will require active engagement of the diverse public and private sector actors at national and sub-national level who are now investing in mitigation and resilience enhancing efforts. The identification of climate co-benefits of development schemes could form a starting point of estimating additional funding needs of the government for exclusive climate actions. This would also pave the way for considering incremental changes in the existing design of ongoing developmental programs to focus more on climate mitigation or adaptation.

International and private climate financing sources are expected to play an important role. The financial markets can play a significant role to catalyze private financing for low-carbon infrastructure development and business. Addressing the barriers to green finance and developing capital market instruments and risk mitigation tools for climate finance are critical for India to achieve its climate change commitments. The country follows a combination of carbon pricing instruments and regulatory policies to leverage private finance. India is the second-largest recipient of Clean Development Mechanism projects after China. The Indian Renewable Energy Development Agency and the Power Finance Corporation, two government-backed non-banking finance companies, lead debt financing of renewable energy projects in India. Another example of leveraging private finance is foreign currency loans to finance renewable energy projects in India.[108]

The statistical system for data-driven climate policy making needs to be strengthened. The effectiveness of India's climate mitigation and adaptation policies will depend in part on availability of data to inform these policies. The System of National Accounts does not provide sufficient information on natural assets such as forests and water to support policy making and to track progress of programs and initiatives. It also does not track emissions—neither GHG emissions nor pollutants that lead to air pollution—limiting effectiveness of policy decisions. The WBG, through its Investment Project Financing (IPF) project and technical assistance, is supporting the Ministry of Statistics and Programme Implementation to develop a comprehensive set of environmental accounts to support data-informed natural resource policies and programs, including on climate change mitigation and adaptation. For example, the energy account will inform and track progress of India's renewable energy policies; forest accounts will enable tracking of carbon storage and sequestration potential of forests in India; urban accounts will improve understanding of what is done in cities to mitigate the effects of climate change, and coastal/marine ecosystems accounts will deepen the understanding of the impact of ocean rise and increased water temperature in coastal environments, and inform policies to adapt to climate change.

A "whole of government approach" could help integrate climate resilience sectoral actions in budget and investment planning. The government can play a pro-active role in accelerating a just transition to a low-carbon and climate-resilient economy through macro-economic and fiscal policy, public financial management, and, where applicable, financial regulation. Discussions with the WBG are underway to: (i) analyze the main challenges to sustainable and inclusive growth in India, including from the effects of climate change; (ii) assess the potential for green investment strategies to underpin faster economic growth going forward; and (iii) examine green fiscal and sectoral policies. To better manage and reduce the fiscal impact of severe natural disasters—the costs of which exceed the resources that can be set aside as budget contingency lines—the authorities could consider resorting to catastrophe bonds and insurance instruments. Public procurement policies can also be leveraged to encourage climate-smart investments.

The WBG will partner with public and private clients to use resources efficiently and effectively and mobilize climate finance at scale. Such approaches will include increased private sector mobilization, enhanced de-risking through guarantees, increased domestic public resource mobilization, and using small amounts of concessional donor funds to leverage private capital to develop and scale new climate-smart technologies and new business models. Greening finance initiatives and deepening capital markets is a prime focus area for IFC, which is looking to engage with financial institutions to develop a climate risk and disclosure toolkit following the Reserve Bank of India's (RBI's) increased focus on the Task Force on Climate-Related Financial Disclosure findings. IFC has continued its support for green bonds for renewable energy projects in India. Notably, the WBG will help strengthen the framework, system, and capabilities of government at the national and state levels, bolster the ability of financial markets to conduct climate-related fiscal/macro-economic risk analysis, and design policies and fiscal instruments to deal with climate change through government-led engagement, strengthening financial markets, and leveraging inter-governmental fiscal transfers.

TABLE 6: Overall summary of priority engagements

THEMES	PROPOSED ACTIVITIES	
	Near-Term (Year 1-2)	Medium- to Long-Term (Year 3-5)
Decarbonization (Energy, Industry, and Transport Transitions)	» Electricity distribution grid modernization. » Power Sector Development Program. » Support expansion of renewables — Rooftop solar for residential sector, Rooftop Solar Guarantee Facility for MSMEs, Pilots for access through renewal, solarization of agriculture feeder, agro photovoltaics, energy storage, wind-solar hybrids, floating solar, offshore wind across states (IFC engagement with Solar Energy Corporation of India Limited). Support scale-up of battery storage, energy storage solutions. » Supporting energy transition of India power sector (including private DISCOMs through IFC). » Intermodal station development. » Scale-up support to state-level urban mobility programs focused on bus transport, walking, and cycling; Digitization for urban mobility and spatial transformation.	» Energy storage markets. » Ongoing IFC projects to identify private sector financing solutions and help develop the energy storage market. » Energy and transport teams at the World Bank and IFC collaborating on a multi-phase programmatic approach to develop demand and grow markets for battery energy storage and e-mobility. » Emission reduction and building efficiency in MSMEs. » Support implementation of the India Cooling Action Plan.

Agriculture-Water-Energy-Air Nexus	» Investment and technical assistance across the agribusiness supply chain with focus on enhancing crop productivity and reducing food losses including agri-warehousing and logistics (IFC). » Agricultural transformation including agro-ecological planning, restoring soil health, and addressing issues of productivity in areas with severely stressed natural resource base.	» Augment institutional capacities and systems for increased resilience, efficiency, productivity, and seafood safety in the fisheries and aquaculture sector. » Sustainable fisheries and enhancing fish food safety. » Integrated river basin management. » Rejuvenating watersheds for agricultural resilience. » Leveraging the private sector for renewable energy-based nitrogen fertilizers production (IFC).
Sustainable Urbanization	» Strengthen critical public infrastructure in high- to very high-risk seismic zones. » Support sustainable and climate-smart urbanization by focusing on a) strengthening urban planning, finance, and service institutions; and b) facilitating climate-smart policies and investments (e.g., Gujarat, Kerala and Chennai). » Support planning and policy for low-carbon and resilient urban development, including issues of green construction, brownfield redevelopment, and leveraging integrated transport and land use planning. » IFC is developing the India Cities Strategy and will be involved in a critical infrastructure investment project in Kerala with the Kerala Infrastructure Investment Fund Board (KIIFB).	» Climate-resilient and sustainable services, including water, urban mobility, public health. » IFC investments in cities directly via municipalities or via private sector intermediaries along with providing technical assistance and capacity building programs.
Mainstreaming Resilience	» Support programs that build up adaptive social protection systems in select states (West Bengal, Odisha and Kerala) at national level, and strengthen integration between the social protection, disaster risk management, and food security systems. » Investments in pandemic preparedness, public health, and OneHealth to adapt to and mitigate the impacts of climate change on zoonotic diseases. » Develop comprehensive frameworks for climate and disaster resilient infrastructure development strategies across all modes of transport, multi-modal integration, and logistics.	» Develop climate-resilient asset management strategies for highways, railways, and waterways. » Forests—Support projects in select states that follow a landscape approach for ecological restoration and expand the natural capital base. » Strengthening emergency management capacities (including Early Warning Systems) » Support investments in climate and disaster resilient infrastructure and systems » India Climate Diagnostics. » Enhancing governance capabilities for building back better.
Macro-Fiscal Sustainability	» Climate Change Public Expenditure and Institutional Review for selected states. » Strengthen state transversal systems and capabilities for improving governance and management of public finances. » IFC is looking to engage with financial institutions to develop a climate risk and disclosure toolkit in line with RBI's increased focus on the Task Force on Climate-related Financial Disclosures (TFCD).	» Develop a module on RBI's capacity to issue a green finance framework, including design and disclosure standards for green finance instruments in collaboration with IFC to reflect private sector financial initiatives. » Deepening capital markets by subscribing bonds issued by local financial institutions (IFC).

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95. All lands, more than one hectare in area, with a tree canopy density of more than 10 percent irrespective of ownership and legal status. Such lands may not necessarily be a recorded forest area. It also includes orchards, bamboo, and palm.

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103. *Landscape restoration* aims to restore closed forests to the landscape. This type of restoration is more likely in deforested or degraded forest landscapes (i.e., open to moderately dense forest, and scrubland) with low population density that are also areas where closed forests formerly dominated the landscape.

104. *Mosaic restoration* integrates trees into mixed-use landscapes, such as agricultural lands and settlements, where trees can support people through improved water quality, increased soil fertility, and other ecosystem services. This type of restoration is more likely in deforested or degraded forest landscapes with moderate to high population density.

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108. Major players in the market are development finance institutions, such as the IFC, Deutsche Investitions-und Entwicklungsgesellschaft (DEG), Overseas Private Investment Corporation (OPIC), and Asian Development Bank (ADB); and EXIM Banks, such as the EXIM Bank of the United States, the EXIM Bank of China, and the Japan Bank for International Cooperation (JBIC). India has also engaged with the Global Environment Facility (GEF), Special Climate Change Fund (SCCF), Adaptation Fund (AF) and the Clean Technology Fund (CTF) to address its climate financing needs.

Fishermen offload tuna to a market in Malé. Fisheries are a primary source of jobs in Maldives and are vulnerable to climate change.
—PHOTO: ISTOCK

MALDIVES

Climate Vulnerability

Maldives, an archipelago of almost 1,200 islands of which 186 are inhabited, is highly vulnerable to natural hazards and extreme climate events due to its fragile ecological profile and low elevation, combined with its economic dependence on a limited number of blue economy sectors (fisheries and nature-based tourism). With sea level rising and extreme weather events increasing in frequency and intensity, Maldives is considered one of the world's most vulnerable countries. The main climate change threats to Maldives are warmer sea-surface temperatures and their impact on coral health and fisheries, variability of rainfall, sea level rise, more frequent and intense storms, and increases in temperature that can lead to disease outbreaks.[1] The consequences of high-frequency events such as monsoonal flooding, storms, costal erosion, salt-water intrusion, and sea level rise, as well as less frequent events such as earthquakes, tsunamis, cyclones, flash floods and prolonged dry periods, threaten lives and livelihoods of Maldives, the most densely populated country in South Asia (1,802 people per square kilometer).[2] If poorly managed, climate change would exacerbate the impact of disaster events and could cause annual economic losses of more than 12 percent of GDP by 2100.[3]

Coastal erosion from sea level rise and storms has increased over recent decades. More than 80 percent of the islands face erosion issues, with about 30 islands currently identified as critically eroded from impacts including loss of beaches and vegetation, damage to human settlements, loss of critical infrastructure, and flooding and inundation due to storm surges. Government resources are insufficient to provide a lasting solution for coastal protection to most of the inhabited islands.

The two main sources of jobs and livelihoods in Maldives are tourism and fisheries, and both are extremely climate sensitive. Tourism, which accounts for two-thirds of GDP, is based on the health and attractiveness of Maldives's coastal natural assets. The large share of tourism in the Maldives economy makes it vulnerable to fluctuations in the global economy. The second largest economic sector is fisheries, which contributes around 4.5 percent of the country's nominal GDP and provides direct or indirect income to more than 20 percent of the population.[4] Both fisheries and a vast portion of the tourism industry's infrastructure are in regions that are within 100 meters of the coastline, which makes the Maldivian economy particularly sensitive to sea level rise and coastal storms.

Lack of suitable surface water has aggravated Maldives' heavy dependence on desalinated groundwater to meet its water needs. Freshwater in Maldives is limited to natural, shallow, rain-fed aquifers as well as rainwater and brackish water found in a small number of large islands.[5] Deterioration of groundwater quality is mainly due to saltwater intrusion due to sea level rise and over-extraction and contamination from untreated waste disposal and seepage from septic tanks. The drinking water shortages arise in the inhabited islands during February to April, which are the driest months. From 2008-2017, the main sources of implicit contingent liabilities have been relief payments and the purchase and distribution of emergency water (80 percent of total post-disaster expenditure).

The COVID-19 pandemic has created a secondary fiscal crisis, resulting in deep budget cuts over the medium term that now threaten important progress on many of the essential climate resilience goals and targets in the government's Strategic Action Plan (SAP) for 2019-2023. Investments and policy objectives prioritized in the SAP that are critical for climate resilience, environmental security, and ecosystem sustainability could be derailed or substantially delayed due to current fiscal pressures. The severe disruption of global supply chains has threatened food security and exacerbates the impacts of climate vulnerabilities.

The government of Maldives has developed sound policies and plans to change its focus from a traditional reactive approach to a more comprehensive approach to manage climate and disaster risk. In addition to the SAP, steps include: (i) the Disaster Management Act and the 7th National Disaster Management Plan; (ii) the National Emergency Operations Plan; (iii) the second National Environmental Action Plan; (iv) the National Adaptation Programme of Action and Nationally Determined Contribution Implementation Plan; (v) the Climate Change Policy Framework; (vi) the Health Master Plan 2016-2025; (vii) the Construction Act; and (viii) the government's Telecom Policy that emphasizes an Emergency Communication Plan. The National Water and Sewerage Policy provides a framework for coordinated action for the provision of adequate water and sewerage services in Maldives, and the proper management of water resources.

The Disaster Management Act of 2015 is the cornerstone of the government's Disaster Risk Management program led by the National Disaster Management Authority (NDMA). The NDMA has moved from coordinating relief efforts to a more holistic model of mainstreaming disaster risk reduction and preparedness in the national development agenda. The NDMA has been promoting a community-based approach to disaster risk reduction through its Community Based Disaster Risk Reduction (CBDRR) Framework.

The government also has finalized a National Spatial Plan (NSP) that focuses on a 20-year roadmap

for infrastructure, spatial development, and decentralization. The NSP aims to put people at the center of development, ensuring that no island and no person is left behind. The NSP envisages the decentralized development of regional hubs, sub-regional centers, and other islands, with a focus on reducing overcrowding and congestion in the capital, where approximately 300,000 live in an area of 8.3 square kilometers.

GHG Emissions

Although Maldives has a negligible carbon footprint in global terms, it relies on imported diesel to meet almost all its power needs. According to the Maldives Energy Balance 2011, Maldives contributed about 1 million tons of CO_2 emissions in 2011, or 0.003 percent of global emissions. Diesel consumption contributes around 80 percent of the total Maldives emissions, 90 percent of which is from electricity generation and transport. In 2019, Maldives imported over 700,000 metric tons of fuel — 80 percent of it diesel fuel — which translated into a costly import bill of $465 million, equivalent to a fifth of all imports and 8.3 percent of GDP.[6] The case for accelerating renewable energy sources is based on reducing dependency on imported diesel.

Nationally Determined Contribution (NDC)

The 2016 NDC identified 10 priority areas for adaptation, including coastal protection, safeguarding reefs and biodiversity, infrastructure resilience, food security, water security, improving public health systems, tourism, fisheries, early warning, and systematic observation, as well as cross cutting issues. Adaptation activities in Maldives need to be designed to reduce risks associated with the full spectrum of weather, climate, and oceanic hazards, from extreme events to the consequences of long-term climate change. The NDC noted opportunities to support resilience for the most vulnerable communities through strengthening local institutions, improving access to basic services, and supporting livelihood resilience, and committed Maldives to reducing its GHG emissions by 10 percent unconditionally and by 14 percent conditionally, if adequate financing became available.

In the 2020 update of the NDC, Maldives made ambitious plans to reduce emissions by 26 percent by 2030 through increased use of renewable energy sources, despite a lack of space for solar photovoltaics (PVs) and storage.[7]

Emerging Priorities

Accelerating the transition to renewable energy will help Maldives achieve the ambitious mitigation target in the revised NDC. Maldives is heavily dependent on conventional energy sources and the increasing energy demand is currently met by imported fossil fuels; in fact, 10 percent of GDP is spent on fossil fuels.[8] The transport sector alone accounts for 31 percent of overall energy consumption and is growing.[9] An integrated, sustainable, and low-emission transport sector in Maldives with eMobility solutions is a priority for tackling high emissions and air pollution in Malé, the capital.

In recent years, the government has embarked on an ambitious infrastructure program prioritizing resilience, including developing a reclaimed island—Hulhumale—to meet massive and growing housing demand, as well as industrial and commercial needs in the greater Malé region. Major construction includes the expansion of the international airport, land reclamation, the Malé-Hulhumale connecting bridge, the new Indira Gandhi Memorial Hospital, large social housing projects, and the planned development of a new port around Ghulifalhu. Strengthening of adaptation actions and opportunities

and building climate-resilient infrastructure and communities is a policy goal in the Maldives National Climate Change Policy Framework 2015-2025.

Tightening local development planning to include climate risks and enhance and enforce the building codes are priorities for Maldives in response to the need to properly regulate the construction industry to ensure sustainability and reduce climate vulnerability. Capacity strengthening at various levels of the government (including the Ministry of National Planning and Infrastructure) is required to enforce 13 regulations passed under the Construction Act to ensure resilience is a focus of building design and construction as the government addresses the on-going housing shortage. More stringent requirements should be linked to disaster risk reduction efforts in planning and zoning regulations to provide a holistic regulatory framework that promotes resilience.

Investing in coastal resilience is a critical priority for Maldives, as integrated coastal management is essential to increase resilience in other vulnerable sectors and infrastructure. Construction costs for shore protection in Maldives is very high due to transport of materials and accessibility to the outer islands. The limited government resources are insufficient to provide a lasting solution for coastal protection for most of the inhabited islands, forcing Maldives to require low-cost, local, NBS with conventional hard coastal protection measures to maintain shorelines in the widely dispersed inhabited islands.

The capacity of the islands to respond locally to climate change impacts and disasters is very low, a challenge that is amplified as the country decentralizes power to local councils. A lack of institutional and technological capacity to confront climate change impacts locally, combined with high dependency on imported food, fuel, and basic commodities, could compromise climate actions. Developing resilient communities is a priority in the SAP that would require investment in coastal protection, a transition to renewable energy, innovative water filtration and purification systems, and enhancing local human capacity to respond to emergencies including climate change-induced disasters.

Insufficient forecasting and early warning of extreme weather is making the nation more vulnerable to storm surges, especially on the small outer islands, where information disparities occur. The government needs to strengthen emergency preparedness and modernize weather forecasting and early warning systems to help communities act well in advance of extreme weather events and disasters.

Water security is critical to enhance climate and disaster resilience in the country. The Ministry of Environment, supported by the UN Development Program and funded by the Green Climate Fund, is leading a five-year project to provide safe and uninterrupted drinking water through a decentralized dry season water supply mechanism.

Diversifying the country's tourism-focused economy and fisheries exports is important to build back better from the COVID-19 crisis while becoming more climate resilient. The fisheries sector is critical for the country's national economy and forms the most important primary economic activity in many of the islands. Fisheries are also an important source of employment for men with lower levels of education living outside Malé. Species diversification in the Maldivian fishery industry could develop into commercially viable activities and employment opportunities. Community-driven approaches could strengthen the local capacity to manage intertwined climate, disaster, and environmental risks.

Equipping rural people with knowledge and methods to increase the productivity of their fishing, crops, and livestock in the face of adverse climatic conditions is essential to improving food security. Outside Malé, fishing and subsistence agriculture are the main sources of food security and livelihoods. The scarcity of arable land is a binding constraint on most small inhabited islands.

Investing in human capital and retraining workers can help Maldives build back more resilient to future climate change shocks after COVID-19. The transition to renewable energy and green buildings requires new skill sets for operating and maintaining such facilities. A long-term strategy to build human capital to support all priority sectors will help ensure resilience.

In light of the above priorities, and in alignment with the World Bank Group's (WBG's) core competencies, four priority areas have been identified as having catalytic and complementary impacts on furthering climate change action in Maldives:

- **Coastal and Infrastructure Resilience**
- **Government Island and Atoll Council Capacity to Address Disasters and Climate Change**
- **Livelihoods Resilience and Diversification of Economic Activities**
- **Accelerating Renewable Energy Integration and Sustainable Energy**

The World Bank portfolio in Maldives consists of nine active operations with total net commitment of $148 million. Therefore, it is important to leverage other funding sources such as climate funds, innovative financing solutions, the private sector, and bilateral co-financing in order to achieve transformative impact.

Coastal and Infrastructure Resilience

Coastal erosion threatens coastal and beach environments, as well as the safety of critical infrastructures and human settlements. The Maldives government has been implementing a limited number of coastal protections works, such as rock boulder revetments and sand and cement bag structures, due to budgetary and technical limitations.

Prioritizing nature as the first line of defense for coastal protection is beneficial, especially when government resources are limited. Coastal conservation and NBS such as beach nourishment, artificial reefs, and mangrove reforestation have the potential to be applied as stand-alone or hybrid solutions to lower the cost of built structures and extend their life cycles. Capacity to implement these solutions, along with traditional knowledge and meaningful participation of local communities and guidelines, are needed to widely apply such measures throughout Maldives.

No guidance or regulation currently covers land reclamation that is widely required for regional development. This gap needs to be filled to ensure the construction safety of the sites and reduce the impacts of current and future climate-related hazards. The Ministry of National Planning, Housing and Infrastructure (MNPHI) has the responsibility for Land Use Planning and the Building Code maintenance. Identification of disaster-prone zones to strengthen land use and adaptation is a priority for MNPHI.

The Maldives Building Act of 2017 is a promising start, and new policies and regulations for the construction industry should focus on sustainability and resilience of the built environment. Integration of climate change and disaster risk reduction in the Building Code will ensure resilience is addressed in building design and construction. Establishing a clear and effective structure to monitor building construction at the local level is needed. IFC is in discussions with financial institutions to support affordable housing in Maldives and would like to mainstream green and climate resilience construction. One possibility is to retrofit resilience features and green building elements in the 7,000-unit housing project completed in Hulhumalé to make the dwellings safer for inhabitants. The government's regional development policy focuses on decentralizing development to other islands to reduce overcrowding and congestion in the capital, as well as vulnerability to climate-induced hazards.

Government, Island, and Atoll Council Capacity to Address Disasters and Climate Change

The Maldives archipelago consists of 26 atolls with people inhabiting 186 of the 1,190 islands spread out over 960 kilometers. As a result, the government has recently decentralized responsibilities to Atoll and Island Councils that face challenges in implementing local development activities, providing services, managing waste, and promoting climate-smart livelihoods and food production. Government capacity to address disasters such as tsunamis is extremely limited, and sea level rise monitoring as well as forecasting and early warning systems are needed.

The decentralization law was revised in 2019 to devolve powers for local councils to provide utility services, maintain roads, repair harbors, carry out some infrastructure construction, and collect all earnings from land rentals in their jurisdiction, as well as a portion of revenue from leasing islands and lagoons and revenue-raising.[10] The National Spatial Plan and regional development plans are intended to develop a system of competitive, environmentally sustainable, and resilient regions. Empowering local authorities to implement the regulations through localized decision-making is important to address immediate needs and to ensure climate-resilient development at the island or atoll level.

A stronger series of regional hubs is needed to respond to disasters, as well as financing in case of such events. Only 53 island Community Disaster Management Plans have been developed in the last six years, showing how the National Disaster Management Authority needs to invest more in such plans using the provisions in the National Community Based Disaster Risk Reduction Framework to mainstream disaster risk reduction in local development planning with community participation.

The Maldives Meteorological Services (MMS) need resources and capacity to regularly maintain geographically dispersed Automatic Weather Stations and other monitoring equipment necessary for monitoring impacts of climate change and high-impact weather. MMS finds it difficult to maintain weather stations in remote islands, and some newly installed Automatic Weather Stations have become obsolete due to lack of maintenance. In addition, it is difficult to find skilled people in remote islands to record the readings in manual weather stations. Maldives lacks a marine waves and ocean currents observation station that is essential to monitor sea level rise and tsunamis. Development of early warning systems by improving weather monitoring networks on the ground, strengthened forecasting capabilities, and building capacity at the MMS are essential to fill existing gaps.

Livelihoods Resilience and Diversification of Economic Activities

Economic growth in Maldives has been mainly driven by the development of a resort-based, high-end tourism sector that has created limited backward linkages with the local island economies, uses a large share of foreign labor, and depends on private sector investments. Rapid expansion of guesthouses on local islands has provided new economic opportunities for communities. Periods of global recession and the ongoing COVID-19 pandemic, with resulting decreases in tourist arrivals, have been particularly difficult for Maldives. Limited opportunities for economic diversification and heavy reliance on international trade pose additional challenges to withstand the impacts of climate change, disasters, and shocks like the COVID-19 lockdown.

All staple food, medicines, medical equipment, and other essential supplies are imported to Maldives. Severe disruptions in the global supply chains have an impact on food security that will exacerbate the impacts of the climate vulnerabilities. The COVID-19 pandemic is an opportunity to diversify the economy, specifically the fisheries sector, and invest in small-scale agriculture to revive food production and create jobs.

Fisheries, the second largest economic sector, provides direct or indirect income to more than 20 percent of the population, and the bulk of the country's food security. Tuna remains the single most important export commodity of Maldives, earning about $160 million a year.[11] The Maldives Seafood Processors and Exporters Association has stated that fish exports to European countries have decreased due to the COVID-19 pandemic.[12] Diversifying sustainable uses of marine fishery resources and developing complementary food production by hydroponics and other technologies can create job and income opportunities to help Maldives become resilient to future climate shocks.

Educational attainment is relatively low, with three-quarters of the population aged 15 and older —approximately 200,000 people—having achieved the equivalent of lower secondary education or below. More than a third of the population has only primary education or below. This large share of school dropouts prevents young Maldivians from taking up available better-quality jobs. To overcome labor supply constraints, employers have relied on migrant workers for both low- and high-skill jobs. Opportunities should exist for workers to engage in self-employment and new job niches such as monitoring climate change impacts, coral reefs, and other ecosystems, as well as working at weather stations on remote islands and in community-based conservation of natural systems.

Accelerating Renewable Energy Integration and Sustainable Energy

Maldives achieved universal access to electricity in 2008, and the government has developed an investment plan to expand renewable energy in the country. Achieving the full renewable energy deployment potential in Maldives requires supporting renewable energy deployment in the private sector. Renewables supported by battery storage can cut down on imported fossil fuel. The cost of electricity production can double on more remote outer islands, where fuel supply costs are higher. Preparing outer islands for sustainable energy development, deployment of clean energy sources, and renewable energy capacity enhancement of the Ministry of Environment are immediate priorities, along with improved energy efficiency in building code and low-emission transport. Supportive and

regulatory measures for GHG emission mitigation also need to be strengthened. Some proposals include development and implementation of a mechanism for monitoring, reporting, and verification of compliance with targets, establishment of a fund to facilitate enabling activities for mitigation, and establishment of a project development facility for investments in mitigation projects.

The first large, planned WBG investment—Accelerating Renewable Energy Integration and Sustainable Energy (ARISE)—lays the foundation for further investment in clean energy and e-mobility. Another possible vehicle is an IFC investment facility to support the greening of resort islands through renewable energy and energy efficiency in buildings and transport. The Accelerating Sustainable Private Investments in Renewable Energy (ASPIRE) project implemented by the Ministry of Finance and Ministry of Environment develops local capacity and helps structure and deliver a tariff buy-down for planned projects while providing a security package to cover payment shortfalls. The expertise of the relatively young ASPIRE project is evolving and will need the support of technical training and gender-support training.

The government sees the transport sector as a significant source of pollution and would like a more comprehensive transport strategy, including electric mobility. While most of the country's islands are relatively air pollution-free, air quality in Malé is on the decline as more people move to the city.[13] With the cost of owning two-wheeled electric vehicles becoming attractive compared to two-wheeled internal combustion vehicles, the private sector in Maldives is looking at the business case for setting up charging infrastructure and leasing models. IFC will seek to explore private sector opportunities for investments in sustainable transportation projects to help Maldives meet its NDC goals.

TABLE 7: Overall summary of priority engagements

THEMES	PROPOSED ACTIVITIES	
	Near-Term (Year 1-2)	Medium- to Long-Term (Year 3-5)
Coastal and Infrastructure Resilience	» Strengthening capacity to enforce the Construction Act and Increasing resilience of infrastructure through developing building codes.	» Country Environmental Analysis including assessment of potential green/climate bonds, debt for nature swaps, reef credits, and other innovative forms of financing beyond conventional lending.
Government, Island and Atoll Council Capacity to Address Disasters and Climate Change	» Strengthening the National Disaster Management Authority's capacity through regional island hubs and community disaster preparedness plans. » Strengthening the Maldives Meteorological Services with resources and capacity (Phase I). » Regular maintenance of Automatic Weather Stations and other monitoring equipment with community support.	» Continue strengthening National Disaster Management Authority's capacity through regional island hubs and community disaster preparedness plans. » Strengthening the Maldives Meteorological Services with resources and capacity (Phase II) for decentralized service delivery using impact-based forecasting and early warning Phase II. » Continue regular maintenance of Automatic Weather Stations and other monitoring equipment with community involvement. » Strengthening capacity of Local (Atoll and Island) Councils planning and development management systems to address development challenges and climate change.

Livelihoods Resilience and Diversification of Economic Activities	» Enhancing knowledge on climate issues among teachers and students, with lessons on growing climate change issues and disasters.	» Improve technical and vocational skills and foster employment in sectors that contribute to livelihoods resilience. » Diversification and climate proofing of fisheries through enhanced investment in marine and coastal zone protection and fisheries sector development.
Accelerating Renewable Energy Integration and Sustainable Energy	» Renewable Energy/Battery Storage: The World Bank-led ARISE project intends to mobilize private sector investment in solar PV generation capacity and support BESS deployment. IFC is working closely with the team and will evaluate investment opportunities in both solar generation and battery storage on a commercial basis along with MIGA.	» Renewable Energy/Battery Storage: The World Bank-led ARISE project will build on the short-term engagement to continue to mobilize private sector investment in solar PV generation capacity and support BESS deployment. The IFC is working closely with the team and will evaluate investment opportunities in both solar generation and battery storage on commercial basis along with MIGA. » Engage and facilitate private sector participation in providing expertise and specialized services needed to increase energy efficiency across sectors. » Support transition to e-mobility.

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A woman and her child walk through rural Nepal on a hot day. Nepal's ecosystems are at risk due to severe droughts.

—PHOTO: AISHA FAQUIR/ WORLD BANK

NEPAL

Climate Vulnerabilities

Nepal ranks as the 44th most climate vulnerable and 64th least ready country in the world by the ND-GAIN Country Index, and is among the top 10 countries with the highest occurrence of climate-induced disasters such as floods, landslides, forest fires, and droughts.[1, 2] The number of flooding events has doubled in recent years, and storm, erosion, and landslide events also are increasing, resulting in loss of life and livelihoods. Damage to homes, agriculture, and infrastructure, including hydropower facilities and rural roads, has been extensive. In addition to deaths from drowning, flooding and drought cause extensive indirect health effects, including impacts on food production, water provision, ecosystem disruption, infectious disease outbreak, and vector distribution.

Nepal's diverse ecosystems and natural capital—which provide vital ecosystem services for the poor in remote locations—are at risk because of increasing frequency and severity of drought, erosion, biodiversity loss, forest fires, and diseases. Mean annual temperatures throughout Nepal are projected to increase from 0.5° C to 2.0° C by the 2030s, and precipitation changes, especially during the monsoon, are projected to range from a decrease of 14 percent to an increase of 40 percent by the 2030s.[3] The risk of flooding in the river basins of the non-Himalayan region due to higher monsoon precipitation also is projected to increase substantially over the same time period. Current climate variability and extreme events already account[4] for an estimated loss of 1.5 to two percent of GDP. The future economic cost of climate change in Nepal could be an additional two to three percent of current GDP per year by mid-century.

Nepal's climate vulnerabilities emerge from an interaction of climatic factors involving its fragile mountainous topography and ecosystems, monsoon-driven hydrology, unplanned settlements, lack of resilient infrastructure, and an economy that has sustained several shocks in the recent past (the Gorkha earthquake and fuel crisis in 2015, floods in 2017, landslides, and the ongoing COVID-19 pandemic in 2020)**.** The effects of rising mean annual temperatures are increasingly evident in the high mountains, as permafrost and glaciers have melted, dangerous glacier lakes have formed, and landslides are occurring more frequently. A reduction in winter snow and greater rainfall variability in Nepal are predicted[5] to have adverse impacts on water security, hydropower potential, food production, and biodiversity. The frequency of droughts is likely to increase, particularly during the winter months and especially in the western Terai plains, with considerable impact on the primarily (75 percent) rain-fed agriculture. Nepal's rapid urbanization rate (six percent per year in some cities), coupled with the absence of guidelines and technical standards for good-quality infrastructure, threatens the prosperity of municipalities already vulnerable to climate hazards.

Strengthening social resilience—the capacity of all members of society to thrive despite shocks—requires a strong focus on poverty reduction and addressing the underlying causes of vulnerability. Local communities and indigenous peoples are important knowledge holders with much to contribute to disaster and climate risk management and should be treated as partners in resilience-building.

During the COVID-19 crisis, the government of Nepal articulated its Relief, Recovery and Resilience (3R) plan to build back greener and better, with climate action as a key element. Aligned with the 3R plan, development partners led by the WBG and UK Foreign, Commonwealth, and Development Office coalesced around a "building back greener" framework to mobilize investments over the next three years to secure jobs and livelihoods, build resilience, strengthen social inclusion, enhance sustainability, and promote efficiency. By the end of December 2020, the WBG had announced an existing, confirmed pipeline of nearly $1 billion, and a tentative portfolio of about the same amount for delivery in FY23-24, with details to be further developed in dialogue with the government of Nepal. Within that portfolio, nearly all operations include opportunities to advance climate action. In addition, some options for financing new operations are emerging. Building on the 3R plan, the government and development partners—led by the WBG and the United Kingdom—established an ambitious successor platform called Green, Resilient, Inclusive Development (GRID) to shift from crisis response to green recovery and long-term growth and sustainable development. In September 2021, the Government of Nepal and development partners signed the Kathmandu Declaration, paving the way for a Green, Resilient, and Inclusive Development in Nepal through a Strategic Action Plan (SAP). The GRID-SAP aims to harness natural capital to create jobs and ensure food and water security by focusing on agriculture, sustainable forest management, eco-tourism, and water resource management. An increased focus will be placed on renewable energy, urban development, and transportation, along with resilient infrastructure. The climate change actions described below would also feature in the GRID.

GHG Emissions

Nepal is one of the lowest global emitters of GHG emissions in aggregate terms at 0.027 percent of global emissions.[6] As of 2018, Nepal's total GHG emissions were 54.6 Mt CO_2e with emissions from agriculture comprising 47 percent, followed by energy at 43 percent, land-use change and forestry at 6.1 percent, industrial processes at 1.7 percent, and waste at 1.8 percent.[7] The primary energy

sources in the country are biofuels and waste (72 percent), oil (19 percent), coal (six percent), and hydroelectricity (three percent).[8]

For 2030, Nepal is projected to have an increase in GHG emissions of 31–36 percent from 2019 levels, resulting in emissions below its fair share levels even for a 1.5° C increase targeted by the Paris Agreement.[9, 10] At the beginning of 2019, a study by the Forest Research and Training Centre in Nepal found that the country's forest area has nearly doubled, from 26 percent of land area in 1992 to 45 percent in 2016. This makes Nepal an exception to the global trend of deforestation.

Nationally Determined Contribution (NDC)

Nepal's second NDC submitted to the UNFCCC in December 2020 asserted the nation's priorities on clean and renewable energy, promoting e-mobility, low-carbon infrastructure, and NBS. The second NDC envisions socio-economic prosperity by creating climate-resilient communities and aims to minimize the impact of climate change while achieving net-zero GHG emissions by 2050. The updated commitments draw on lessons captured while implementing its ambitious first pledge in 2016 to reaffirm its commitment to the Paris Agreement. To guide attainment of ambitious NDC targets, Nepal is developing its National Adaptation Plan (NAP) and corresponding climate finance strategy and roadmap and introducing climate-resilient adaptation planning in all 753 local governments by 2030.

Specific targets on adaptation and mitigation under the second NDC by year 2030 include:

- Maintaining 45 percent of the total area of the country under forest cover; extending protected areas to 30 percent; sustainably managing 50 percent of Tarai and Inner Tarai forests and 25 percent of middle hills and mountain forests;
- Establishing a multi-hazard monitoring and early warning system covering all provinces;
- Promoting intercropping, agroforestry, conservation tillage, and livestock and agricultural waste management, and ensuring increased access of CSA technologies to women, indigenous people, smallholder farmers, and marginalized groups;
- Expanding clean energy generation from approximately 1,400 MW to 15,000 MW, with at least five percent of the total generated from mini- and micro-hydro power, solar, and wind energy;
- Achieving use of electric stoves by 25 percent of households as the primary mode of cooking;
- Having 90 percent of all private passenger vehicle sales, including two-wheeled, and 60 percent of all four-wheeled public passenger vehicle sales be electric, and developing 200 kilometers of electric rail network for public commuting and mass transportation of goods;
- Formulating appropriate guidelines and establishing a mechanism to monitor emissions from large industry by 2025, including curbing coal consumption and air pollution from the brick and cement industries;
- Formulating and implementing nature-based tourism plans in at least five main tourist destinations by 2025 and ensuring at least five tourist destinations are carbon-neutral by 2030; and
- Halting the burning of healthcare waste in 1,400 healthcare facilities by 2030 through adoption of non-burn technologies.

Emerging Priorities

Climate change action in Nepal is guided by a National Climate Change Policy (2019), which aligns with the recently adopted federal system. Climate change has been prioritized in other relevant government planning, policy, and legislative frameworks, including the post-COVID 3R plan.[11] The WBG's CPF for FY 2019-2023 focuses on achieving greater inclusion for poor, vulnerable, and marginalized groups, with greater resilience against climate change, natural disasters, and other exogenous shocks. An ongoing Performance and Learning Review (PLR) of the CPF will provide a basis for deepening dialogue on climate investment with the government of Nepal, development partners, and the private sector.

Considering these developments and in alignment with its core competencies, the WBG has identified five priority areas as having transformational and complementary impacts on furthering climate change actions in Nepal:

- **Climate-Smart Agriculture (CSA), Water, and Resilient Natural Capital**
- **Climate-Resilient Cities, Towns, and Local Service Delivery**
- **Clean Energy**
- **Climate-Smart Transport Networks**
- **Human Development for Economic and Environmental Resilience**

Some of the WBG-executed analytics and technical assistance identified under these priority areas could be supported under a strategic, multi-sector Programmatic Advisory Support and Analytics program on building back greener. The program could support analytics, technical assistance, planning, and dialogues with the client and development partners and would pool in resources from internal and external sources.

Climate-Smart Agriculture (CSA), Water, and Resilient Natural Capital

Well-managed agricultural land, soil, water resources, forests, protected areas, and wetlands deliver both resilience and climate mitigation benefits. This priority area focuses on strengthening farmers' livelihoods and resilience, shifting the forest sector strategy from conservation and subsistence to conservation and sustainable use, and promoting an integrated spatial approach to managing landscapes and watersheds at local levels.

The slow growth of Nepal's agriculture sector in recent years has been associated with sub-optimal farming practices including insufficient irrigation, unavailability of agricultural inputs (particularly seed and fertilizers), and an increasing trend of land fallowing and abandonment. Around 55 percent of agricultural land is reported to be irrigated, yet year-round provision of water is often limited, making major crops like rice and wheat highly dependent on rainfall and potentially causing new conflicts over water resources.

Changes in precipitation patterns and increased weather-related hazards due to climate change are likely to affect agriculture, causing higher yield variability and production risks. By 2050, yields of maize, potato, sugarcane, and lentils could decrease compared to a BAU scenario, while wheat yields could increase.[12] Opportunities exist for more productivity due to increased runoff and warmer

temperatures in higher altitudes, but soil fertility, water availability, and availability of appropriate seed will be limiting factors.[13] Declining availability of water for agricultural uses at critical times, from impacts such as decreasing soil moisture or prolonged droughts, could result in crop failures and productivity losses. Challenges posed by climate change will continue to be the most severe for poor communities that rely on weather-dependent, rain-fed agriculture to sustain their livelihoods. In addition, most poor households are net food buyers and suffer from food and nutrition insecurity exacerbated by the COVID-19 pandemic, which has affected the import of traded goods, labor availability for harvesting, and planting of commodities.

CSA practices in production and along the value chain aim to increase agricultural productivity and incomes of farmers, strengthen adaptive capacity, build resilience to climate change, and reduce GHG emissions while enhancing carbon sequestration where possible. CSA practices have the potential to strengthen households' resilience against disruptions in food markets—such as those caused by the COVID-19 pandemic—by increasing food availability and diversification at the household level or reducing labor time during the production cycle. While CSA practices have considerable potential, the extent of adoption in Nepal is unclear. Additionally, further assessment is needed on viable traditional knowledge-based approaches to CSA, such as well-managed shifting cultivation.[14]

CSA technologies and approaches vary by production system and agro-ecological zone. The recently released Nepal CSAIP identifies key policy actions and investment priorities to support a productive, resilient, and low-emissions agriculture sector. The CSAIP highlights CSA practices and options with the highest potential to address Nepal's climate challenges and achieve climate commitments and agriculture sector goals, including: (i) strengthening crop and land management practices, particularly on-farm soil and water conservation, for structure and stability, also contributing to better soil carbon content; (ii) targeting improved water and irrigation management for rice, vegetables, potato, and sugarcane, such as using wastewater collection and rainwater harvesting techniques, or implementing efficient irrigation such as ridge and furrows in potatoes, solar-based irrigation in rice, or micro-irrigation in vegetables, and combining irrigation infrastructure with participatory community watershed management measures (such as terraces, planting pits, and forest and vegetation management) to ensure more reliable water supply; (iii) improving access to livestock feed (such as pastures and fodder development) and improving animal health services; (iv) on-farm integrated livestock, crop, and agroforestry systems; and (v) access to quality and varied seeds and breeds for adapting to the changing climate and improving productivity.

Several pathways can support adoption of CSA practices and the need to adjust to the new federal structure of Nepal: (i) improving knowledge transfer through capacity building and providing access to information (e.g., weather forecasts, agro-met services); (ii) supporting commercial business models, such as private sector provision of production inputs and services; and (iii) supporting the enabling environment at provincial level through improved targeting, policy development, and removing bottlenecks.[15] Under the WBG's CSF, a baseline assessment is underway to identify the current status of fertilizer subsidies including impact (production, welfare, environmental externalities) and alternatives to reduce negative externalities while supporting CSA and small farmer incomes. The redesign options will focus on repurposing or refocusing fertilizer subsidies towards a climate resilient and sustainable agricultural sector development.

There is also potential for private sector engagement in CSA promotion and innovation, including weather-based insurance, ICT-based agro-advisory services, development and marketing of climate-resilient seeds, and the promotion of agricultural machinery and tools. The banking sector can play an important role by increasing access to financial services to enable investments in capital-intensive CSA practices like solar-based irrigation, micro-irrigation systems, or cattle shed improvement. There is a need for assessing the constraints for increased private sector investment in this field and for removing barriers through effective public-private-partnerships.

Nepal has managed over the past 30 years to reverse an alarming trend of deforestation and forest degradation by investing in community-based forests management and forest conservation. Community forestry has been very successful but has taken a conservation approach, and the country is now trying to shift to a sustainable production approach, which requires better governance. Other sectors of Nepal's economy have seen forests and the forest sector mainly as a risk or barrier for their investments, such as heavy regulations to allow for forest clearance (including the requirement of land-for-land compensation). Nepal has no comprehensive and transparent forest/biodiversity offset mechanism, so forest losses are often not offset or established offsets are poorly managed. In addition, forests provide important ecosystem services such as reduced flooding, erosion, landslide, and drought risks by storing water (forests are sponges that regulate water flow), habitats, non-timber forest products, and carbon.

The degradation of forests poses a major threat to the well-being and cultural survival of indigenous peoples of Nepal. In addition, government-owned forests, national parks and conservation areas, leaseholds and community forests, and hydropower and other development projects have continued to negatively impact Nepal's indigenous peoples.

Indigenous peoples hold a wealth of valuable traditional knowledge around sustainable forest management, biodiversity, agriculture, and adaptation that has evolved over generations, and growing evidence shows their management of forests delivers major mitigation co-benefits and environmental services by acting as buffers against deforestation and large-scale carbon emissions.[16, 17] For climate-smart development to be truly sustainable, it must meaningfully engage and aim to address underlying drivers of vulnerability faced by indigenous peoples, especially forest-dependent communities. Solutions that integrate viable traditional knowledge with modern scientific approaches and a strong expert/non-expert dialogue are also much more likely to be successful and scalable.

Some of the potential investment operations under the GRID Action Plan could be rationalized into strategic programs, such as a spatial community-based landscape/watershed management approach, to help generate multiple climate benefits from interventions. For example, restoration of degraded forests, grazing and crop lands, including stabilizing steep slopes along transport corridors, could reduce landslide incidence while complementing small irrigation construction while also delivering jobs, in addition to reduced emissions and lower yield variability. Such a multi-sector, spatial operation could also spatially complement strategic reservoirs, reducing climate and other risks while extending infrastructure lifespans and returns on investment.

Climate-Resilient Cities, Towns, and Local Service Delivery

Approximately 26 percent of Nepal's population lives in urban areas, and the annual urban population growth rate (about six percent) is significantly higher than the regional average (three to four percent). At least 50 percent of Nepal's economy is concentrated in urban areas, and by 2050, almost 50 percent of its population will be living in urban areas. Nepal's high vulnerability to climate change adds mounting pressure to its already strained urban infrastructure and services, which highlights the importance of focusing on strengthening urban resilience to climate change. The concentration of assets, economic activity, and an increasingly larger share of the population requires attention to making cities resilient and adaptable to impacts from climate variability and change.

Climate change impacts add mounting pressure to Nepal's already strained urban infrastructure, which highlights the importance of focusing on strengthening urban resilience to climate change. The absence of guidelines and technical standards for good-quality infrastructure decreases the resilience of municipalities to climate hazards. With a rapidly urbanizing population and high rural-urban migration, urban resilience is critically important for the country. To address the growing urban needs, the WBG intends to further deepen and expand the dialogue with mayors, key ministries, and provincial decision-makers on climate change and adaptation by: (i) building on the ongoing TAs to support the government in designing and implementing the program for urban resilience with an investment as well as an analytical and regulatory reform agenda; and (ii) continuing to work on the policy and regulatory agenda related to enhancing resilience and climate adaptation at the city level. In particular, poorly managed solid waste is a serious problem by contributing GHG emissions and reducing the effectiveness of drainage infrastructure in cities. The WBG is well-placed to continue to work closely with the government on solid waste management.[18]

There is a need for comprehensive resilience building focused at the sub-national level, addressing the climate and disaster risks facing cities and towns as well as new local-level governments. Targeted interventions in labor-intensive urban service delivery and disaster risk reduction and management activities would provide much needed jobs and economic recovery opportunities in the short- to medium-term, while reducing disaster risks through structural and non-structural measures.[19]

Devolving disaster risk mitigation, preparedness, and response, as well as decision-making and financing for climate change adaptation interventions, is important due to the remoteness and isolation of many rural communities. The rural communities bear the brunt of disasters and climate change impacts first, with a time lag between disaster occurrence and assistance arriving due to infrastructure and accessibility limitations. The 2015 Constitution devolves disaster risk management to all tiers of governance, especially to urban/rural municipalities, referred to as local level. As local governments are relatively newly formed entities and the country has very recently transformed to a federal structure, it is necessary that federalization of the disaster risk management agenda is supported to enable communities to enhance resilience, not only to disasters but also to the impacts of climate change.

Clean Energy

Nepal's annual average per capita electricity consumption is about 250 kWh, which is significantly lower than the global and regional averages. Significant investment is required in the electricity generation sector, including transmission and distribution infrastructure, with a focus on achieving greater social inclusion and equality in the distributive impact of energy sector development to support Nepal in meeting its target of ensuring energy access to all.[20] The WBG has been providing policy and infrastructure support for Nepal's electricity sector development, including policy financing for establishment of a conducive regulatory/legal framework, development of market mechanisms, and infrastructure support for construction of high voltage transmission lines, solar farms, mini-grids, and distribution system extension. The WBG also is considering investing in a 1,060 MW hydropower project. However, additional investment is required in generation infrastructure to increase the share of clean energy, such as development of Nepal's hydropower for export to increase public revenues and contribute significantly to regional power integration.

Nepal and India are working on regulations and rules of engagement for cross-border power trading. As energy trading across the region is dependent on transmission and wheeling of power through India (the largest power market in South Asia), India's lead on regulation will be key for market development. IFC could provide key support in promoting regional power trading.

Climate-Smart Transport Network

Nepal's road network is vulnerable to climate-related hazards related to extreme weather events such as heavy rainfall, flooding, and landslides, which are increasing in frequency and intensity. Moving goods and people within the borders of Nepal is a complex endeavor, mainly because of the unique and challenging topography, along with land-locked borders and high vulnerability to climate risks. A clear and informed strategy is needed to develop a climate-resilient transport network, demonstrating how investing in resilient infrastructure is economically efficient despite a possible higher upfront cost.

Overall goals for transport sector strategies and policies include resilience to climate and disaster shocks, reducing GHG emissions, and enhancing environmental risk management. The WBG can provide analytical services and advisory support to the government to enhance upstream strategic planning, strengthen environmental risk management, and mainstream engineering best practices as well as new cost-efficient technologies. On the planning side, that could be support for the development and approval and effective implementation of a country level strategy for green and resilient roads for enhanced regional and national trade, and the development and implementation of digital easy-to-use tools to collect, update, and integrate climate-related information for better decision-making.

Nepal needs the development of low-carbon and oil-independent transport solutions for energy security as well as to deal with climate change and air pollution concerns. A long-term goal can be total independence from oil and implementing zero tailpipe emission technology, with electric vehicles becoming a solution to shift the transport sector from fossil fuels to electricity, improve air quality, and create a sustainable market for hydropower. By 2025, Nepal is expected to have installed capacity of

7 GW, which, even under the high economic growth scenario, is not expected to be fully consumed domestically. The WBG can help increase understanding of distributional impacts and social co-benefits associated with a shift to electricity, particularly for low-income and marginalized groups, and design appropriate policy, programmatic, and project level responses to catalyze the shift to e-mobility in both private and public transport spheres. IFC is planning to initiate e-mobility upstream work to identify several key opportunities in the sector, in coordination with the World Bank. There is significant opportunity for private capital mobilization if the right policy framework and PPP structures are coupled with private sector interest in transitioning away from diesel vehicles, especially within public transport.

Human Development for Economic and Environmental Resilience

Climate change, climate-induced disasters, and other related shocks can lead to significant losses in human capital, with important socio-economic consequences and increases in poverty and vulnerability in Nepal. For example, these shocks can force people, especially those who are poor and vulnerable, to engage in negative coping strategies like skipping meals, reducing intake of nutritious food, taking children out of school to support their families, and forgoing healthcare services. In addition, shocks can reduce access to health and education services, as health facilities and schools lack proper equipment and staff during shocks, or resilience after crises. The WBG can work with government and local communities to assess vulnerability to climate risks and shocks, inform people about climate sensitive health risks, enhance disaster risk management and early warning systems, and improve resilience of healthcare facilities to climate shocks.

Cross-Cutting Theme: Social Sustainability and Inclusive Community Resilience

Nepal's poor and marginalized communities are disproportionately vulnerable to the impacts associated with climate change. This vulnerability context is shaped by pre-existing patterns of poverty and exclusion, high dependence on climate sensitive livelihoods, limited access to the resources, basic services, safety nets, and insurance critical for coping and adapting, and limited voice in political and decision-making processes. These factors translate into limited capacity to respond to climate-related (and multi-hazard) shocks and stresses in the present and to build resilience to changing conditions over time.

Local communities and indigenous peoples, while victims of climate change, also use their traditional knowledge to respond to disasters and climate related challenges—often in the complete absence of external support. Emerging research has shown that incorporating traditional knowledge into climate change policies can lead to the development of effective mitigation and adaptation strategies that are cost-efficient, participatory, and sustainable.[21] In Nepal, agriculture, forestry and other land use accounts for more than 80 percent of total GHG emissions, suggesting that crucial mitigation decisions potentially lie in the hands of farmers, pastoralists, forest-dependent people, and other land managers.

Opportunities to promote locally led climate action could involve devolution of climate finance to the local level, where communities and local governments are often the first to respond in times of crisis, as evident with COVID-19. Nepal's National Adaptation Programme of Action has stressed that 80 percent of climate change finance will go to local communities, yet there is a lack of clarity about

how to ensure such distribution. The government of Nepal has identified mechanisms and frameworks focused on piloting local- and community-based adaptation plans called Local Adaptation Plans of Action (LAPAs) that use partnerships with community forest associations, grassroots organizations, and local governments to initiate and implement adaptation strategies. Although beset by challenges of governance and exclusion of the most marginalized, LAPAs offer opportunities for bottom-up planning and community organizations to be at the forefront of climate change interventions. The climate action plan would target the following areas to catalyze locally led and inclusive climate resilience across the priority themes:

- Understand and track the social and distributional impacts of mitigation policies and social co-benefits;
- Channel resources to the local level to reinforce efforts by communities to build resilience and adapt to climate change;
- Facilitate processes to support key transitions; and
- Proactively engage and invest in youth in climate action. This could open avenues for disruption and bringing in innovation. The continued engagement and capacity building of young people in climate resilience could also help address the issue of out-migration.

The WBG will be undertaking a CCDR to support the Government of Nepal in achieving its objectives for a green, resilient, and inclusive recovery. This report will help to inform Nepal's GRID Strategic Action Plan (2021-2030) to provide a framework for economic development in the context of long-term sustainability and fiscal realities. Expected areas of analysis include: green recovery and transition macroeconomics; the agriculture-food-water-forestry nexus and investment plans; energy transition and hydropower development; strengthening human development and systemic resilience in the context of federalism; and green finance.

TABLE 8: Overall summary of priority engagements

THEMES	PROPOSED ACTIVITIES	
	Near-Term (Year 1-2)	Medium- to Long-Term (Year 3-5)
CSA, Water, and Resilient Natural Capital	» Development Policy Credit (DPC) series in fiscal federalism and energy addressing renewables, energy efficiency, solid waste, environmental management, and macro-fiscal policies. » New DPC series on Green, Resilient, Inclusive Development. » Supplement investment in water supply and sanitation services in rural and urban municipalities and consider associated community watershed protection measures. » Incorporate recommendations of the Climate-Smart Agriculture Investment Plan into current and planned agriculture lending. » Potential new spatially integrated investments in the agriculture, water, and forest nexus, community livelihoods, and reducing climate risks to infrastructure.	» Continue DPC phases to strengthen policy outcomes for climate.
Resilient Cities, Towns, and Local Service Delivery	» Scale up investment in sub-national disaster risk management agencies, local governments, community resilience, and resilient infrastructure in rural communities and urban municipalities.	» Scale up public/private investment in protected areas and tourism.
Clean Energy	» DPC series in fiscal federalism and energy addressing renewables, energy efficiency, solid waste, environmental management, and macro-fiscal policies.	» Accelerate the energy transition with additional investments in renewable energy infrastructure and modernization of management practices and tools, complemented with opportunities for private sector participation in generation and transmission. » Enable creation of a regional power pool allowing for efficient cross-border power trading.
Climate-Smart Transport Network	» Invest in resilient road networks and connectivity through ongoing and new major transport and trade projects along highway corridors. » Implement the Integrated Planning Model for climate-resilient transport networks.	» Pilot financial protection strategies/ disaster risk financing mechanisms for signature bridges or other structures. » Develop and implement a green and resilient transport corridor concept for ecological sustainability and green jobs creation. » Promote gradual adoption of electric vehicles.
Human Development for Economic and Environmental Resilience		» Investment in adaptive shock-responsive safety nets linked to green jobs, livelihoods, and skills development.

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19. It is estimated that urban Nepal generates 4,900 tons of solid waste daily and ~1.8 million tons per annum. About 600 tons of plastic waste is produced and dispersed every day in a hazardous manner and less than 50% of generated waste is collected. This situation has subsequent negative effects on (i) water quality, (ii) environmental health, (iii) economic inefficiencies, and (iv) contributing to climate change through GHG emissions.
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A cattle farmer takes his herd for grazing. Wind power is improving lives around the Jhimpir wind corridor while helping Pakistan meet its energy goals.
—PHOTO: KHAULA JAMIL/IFC

PAKISTAN

Climate Vulnerabilities

Climate change and natural disasters pose a major challenge to Pakistan's development. Pakistan is the 36th most vulnerable country to climate change and the 36th least-ready country in the ND-Gain Country Index, and ranks as the fifth most affected country by climate change shocks during the period of 1990-2018.[1] An estimated population of 49 million resides in areas at risk of a four-to-five percent decline in quality of life by 2030 due to climate change. The country is increasingly exposed and vulnerable to various natural hazards, particularly floods, cyclones, droughts, and earthquakes. Combined with these vulnerabilities, disasters have caused significant loss of life, economic damage, and reversal of development gains over the last 15 years.[2,3] Increasingly intense and frequent floods have caused substantial physical damage affecting more than 30 million people since 2010, with damages and losses exceeding $14 billion. In addition, flooding causes extensive direct and indirect health effects, including impacts on food production, water provision, ecosystem disruption, infectious disease outbreak, and vector distribution. According to a World Bank study, floods alone affect 3 million people annually in Pakistan.[4] The same study projected that a recurrence of the 2010 floods today would cause damages of up to $2.4 billion to the housing sector, compared to $1.5 billion in 2010. Increasing temperatures are causing northern glaciers to melt, creating around 3,000 glacial lakes, 33 of which are prone to glacial lake outburst floods. Annual monsoon showers frequently trigger disasters such as urban and riverine floods that inundate vast swathes of land. In the South, Sindh and Balochistan are more prone to water scarcity and drought, receiving as low as 200-250 millimeters of rainfall per year.[5] Pakistan is also exposed to rising sea levels with a projected increase of 60 centimeters in mean sea

level by the end of century.[6] This trend is affecting communities along the coast in addition to harming coastal ecosystems such as the Indus River delta, which is losing its sedimentation at the rate of one millimeter per year.[7]

Natural hazards continue to affect Pakistan's human and physical capital while the country transitions from an agriculture-based economy to a semi-industrialized, service-based economy. The agriculture sector employs around half of the employed workforce, contributing 24 percent of GDP as the largest source of exports.[8] However, the agriculture sector continues to face increased risks from both long- and short-term climate variability, including extreme events such as floods and droughts. At the same time, Pakistan is one of the fastest urbanizing countries in South Asia, with cities rapidly emerging as the drivers of economic growth. Unplanned urbanization is also amplifying climate risks to service delivery as expanding cities grapple with challenges of solid waste management, water supply and drainage, affordable housing, and resilience to extreme events. The cross-sectoral climate vulnerability of the country also poses risk to macro-fiscal sustainability as extreme events unravel development gains and divert limited public financing towards recovery efforts.

GHG Emissions

According to Pakistan's NDC analysis, the country's total GHG emissions were estimated to be 404 Mt CO_2e in 2015 and projected to increase by 300 percent from 2015-2030. The emission projections were based on an ambitious target of sustained seven percent GDP growth across sectors in the same period. Given the trend of GDP growth over the past five years, coupled with the recent economic shock from the COVID-19 pandemic, the increase in future emissions is likely to lag the NDC projections.

Decarbonizing Pakistan's energy sector is critical for mitigating the projected GHG emissions. The NDC analysis predicts energy sector emissions to rise 380 percent from 2015-2030, the highest increase among economic sectors. Therefore, the most efficient mitigation pathway for Pakistan would be to focus on the energy sector, which in turn has underlying drivers spanning multiple sectors. Data from Climate Watch for 2018 indicate that most emissions from Pakistan's energy sector (210 Mt CO_2e) are from electricity/heating (60 Mt CO_2e) and transport (57 Mt CO_2e).

Nationally Determined Contribution (NDC)

Pakistan committed to reduce up to 20 percent of its projected GHG emissions under BAU by 2030, subject to availability of international grants to meet the total abatement cost of $40 billion. The mitigation commitments include improving efficiency in the electricity grid and coal-based power generation and increasing the share of renewable energy options. For adaptation, the NDC calls for development of a NAP that will create a framework for including medium- and long-term climate change concerns in national sectoral policies, strategies, and programs. The NDC estimates Pakistan adaptation costs at $2-$3.8 billion annually and focuses on integrated water resources management to reduce flood risks and enhance food security as adaptation priorities for the short-term. The WBG, through its CSF, plans to support achievement of Pakistan's established NDC ambition with a focus on social and economic aspects of big systems transitions. This engagement will develop actionable outputs for decision-makers for supporting green recovery and longer-term green growth trajectories.

Emerging Priorities

Pakistan's priority sectors for climate change include energy, water, agriculture, and infrastructure, with an over-arching focus on the resilience of communities. National priorities for climate change, especially adaptation, have been identified in several policies and programs, including the National Climate Change Policy (2012), the National Climate Change Policy Implementation Framework (2014-2030), and the NDC.

In light of these developments and in alignment with the WBG's core competencies, four priority areas have been identified as having catalytic and complementary impacts on climate action in the country, aligned with the recommendations/commitments from the NDC, Pakistan@100, and the upcoming CPF with the WBG:

- **Energy Decarbonization**
- **Agriculture-Water Nexus**
- **Climate-Resilient Infrastructure and Communities**
- **Macro-Fiscal Sustainability**

Energy Decarbonization

While Pakistan remains a low GHG emitter at the global scale, the country can achieve significant economic gains by focusing on mitigation action in the energy sector. Energy decarbonization is also central to achieve the ambitious government targets for 60 percent power generation from renewable sources and 30 percent use of e-vehicles by 2030. The bulk of GHG emissions in Pakistan are driven by the energy sector, as the country has locked itself into carbon-intensive fuel sources, mainly oil and natural gas, to power electricity, transport, and domestic consumption. There is also a challenge of fugitive emissions from the natural gas sector, where leakages from the network affect financial sustainability and also release methane, a potent GHG, into the atmosphere. The decarbonization pathways must also be aligned with the principles of a just transition to ensure equitable and sustainable outcomes.

Power Sector

Because of weak planning and limited access to financing, Pakistan has been unable to develop its large and affordable hydropower potential or utilize cost-effective solar and wind potential. Pakistan imports nearly a third of its energy resources, which increases the basket cost of electricity. Meanwhile, Pakistan's excellent renewable energy potential has not been realized, with solar and wind representing just four percent of total installed capacity, and two percent of actual generation. In addition, there has been a general neglect of energy efficiency over the past decade or so due to the lack of an institutional champion and weak incentives, resulting in a substantial gap in access to energy, especially in remote rural areas.

Recent analysis commissioned by the WBG shows that solar and wind are now the least-cost forms of generation in Pakistan, and an economically optimal expansion of capacity would lead to over 20 GW of new solar and wind power over the next 10 years, representing 30 percent of installed capacity by 2030. The WBG analysis also highlights that energy production from new-build domestic and imported coal power plants is no longer economical, even before consideration of the environmental impacts of increased GHG emissions. The WBG analysis informed Pakistan's new renewable energy

policy of 2020, which has aggressive goals on wind and solar power expansion.

A further study by the WBG shows that Pakistan can achieve 20 percent of total capacity from solar and wind by 2025 with minimal upgrades to the electricity grid by utilizing spare capacity at existing substations. In addition, good potential for solar and wind exists in each of the four provinces, allowing the economic benefits to be widely distributed. To achieve 30 percent from solar and wind by 2030 will require more substantial investments, including the development of a six GW solar and wind park in western Balochistan and an associated high-voltage DC line over 1,000 kilometers. The private sector is eager to invest in new solar and wind capacity, evidenced by IFC's recent programmatic support for six private wind-power projects totaling 310 MW, but it is critical that Pakistan immediately implements a robust competitive bidding regime to create competition and lower tariffs. Public sector investment can then focus on the grid infrastructure and development of large solar and/or wind parks on public lands, where needed.

Pakistan also has remaining vast resources of hydropower, which the Indicative Generation Capacity Expansion Plan, a 10-year national electricity document, advocates developing as a priority. Including hydropower, the national goal is to have 65 percent renewable energy (hydro, solar, wind) in the energy mix by 2030. Hydropower opportunities to be developed by the government are located mainly on the main Indus River, but opportunities also exist for private investments in small and medium hydropower on tributaries to the Indus and on the canal system.

Renewable energy offers the opportunity to make real progress in closing the gap in access to electricity, in particular through the deployment of off-grid solar, the development of small hydropower mini-grids, and through solar-powered irrigation. There is a need for improved data on energy access and a clear policy and action plan for achieving universal electricity access, but delivery will rely heavily on private sector participation and investment. IFC is already engaged with the private sector for renewable distributed generation solutions for the commercial and industrial sectors.

Transportation and Domestic (Cooking/Heating) Sectors

Transportation and domestic (cooking/heating) sectors with a predominant reliance on fossil fuels (mainly oil and natural gas) present another significant entry point for emissions reduction. Natural gas is the major energy source in Pakistan, accounting for almost half of total energy consumption. Besides use of gas as fuel for vehicles, cooking, and heating, the fertilizer industry is also a large consumer of natural gas. Leakage of natural gas from distribution networks is also a major challenge, as methane is one of the most potent GHG gases. Additionally, the transport sector is also a major consumer of petroleum and diesel.

For the transport sector, transitioning to electric vehicles will be transformative in the medium term, but several short-term interventions need to be prioritized. Improved fuel quality, emission standards, and the renewal of fleet are needed to reduce carbon emissions from the existing vehicle stock. Most important is the need to develop significant public transport and rail transport for people and goods, which has the potential to tremendously reduce emissions in the short term.

Major knowledge gaps exist in this sector, while WBG engagement remains limited. A new electrical

vehicle policy was notified in 2020, covering buses, trucks, and two- and three-wheeled vehicles. The energy efficiency policy is under preparation and will include guidance to improve efficiency of gas heaters. However, there is no up-to-date analytical work on the potential of transitioning to cleaner energy for transport, cooking, and heating.

Agriculture-Water Nexus

Agriculture in Pakistan is significantly affected by short-term climate variability and longer-term climate change. Periods of severe drought followed by devastating floods are common and have contributed to low crop yields, loss of livestock, damage to irrigation infrastructure, and food shortages in recent years. Temperatures are projected to increase and will likely speed up crop growth cycles and shorten the time between sowing and harvesting, affecting crop yields.[9] Under a 3° C warming scenario, water demand is projected to be pushed up by more than 50 percent by 2047, putting pressure on the sector to meet its targets with virtually fixed water supply and increasing climatic variability, along with competing demand from non-agricultural sectors.

Agriculture in Pakistan relies heavily on irrigation and accounts for 95 percent of freshwater withdrawals. Inefficient water use in agriculture costs Pakistan an estimated four percent of GDP, and the country is in the lowest 10 percent in the world in terms of water productivity in agriculture. The four major crops that account for 80 percent of water use contribute less than five percent of GDP. The national and provincial governments have made substantial investments in the past to expand agricultural growth, with little attention to improving water productivity. There also has been significant infrastructure investment in the Indus Basin Irrigation System to improve surface water delivery, but little coordinated investment in on-farm water management in the beneficiary command areas. Public investment in groundwater has been in response to waterlogging, while development of groundwater infrastructure for agricultural use has mostly come through private and unregulated investment. As a result, groundwater is over-exploited, arable land is almost fully used, 90 percent of plowing is already mechanized, and fertilizer use is high.[10] The next big boost in agriculture productivity will have to come from increased productivity of water in agriculture, including crop diversification away from water-intensive crops. Climate change intensifies the urgent need for this shift.

A paradigm shift is needed in the provincial policy and governance structures, where the irrigation and agriculture sectors operate in silos with little coordination, and with no mechanisms and incentives for collaboration. In addition, the political economy around water and agriculture has created distortionary market incentives that need to be addressed through policy, legal, and institutional reform. As a result, the natural environment is being degraded, evidenced by the persistence of waterlogging and salinity in agricultural areas of Sindh, groundwater depletion in parts of Punjab and Balochistan, and pollution and contamination of wetlands and water bodies across the country. These challenges may be aggravated by extreme climate events, such as droughts and floods. While infrastructure investment and capacity building in irrigation and agriculture are still needed, they must be couched in a governance framework that maximizes the economic, social, and environmental outcomes from water use in the country, with a focus on water use in agriculture, while considering and mitigating the potentially negative impacts of climate change.

The government recognizes the urgent need for better water management as evidenced by the National Water Policy of 2018 that highlighted the various drivers of water insecurity in Pakistan and identified climate change as one of the major drivers of water stress. It also reinforced the need to adopt an integrated water resources management approach. Provinces have since also initiated policy and legal reform processes to update their water management governance architecture. The improvement of irrigation systems and increase in CSA were part of Pakistan's NDC in 2015. Given the existing momentum towards reform, there is a very good opportunity to provide technical support to provinces to help address the water management needs.

The WBG is supporting the government in improving the performances of its agriculture and irrigation sectors, based on recommendations from the 2019 *Getting More from Water* report.[11] There is emphasis at the provincial level on rehabilitation and remodeling of hydraulic structures coupled with institutional strengthening and capacity building to improve surface water management. Such policy reforms and targeted programs have the potential to support Pakistan's climate mitigation goals. An e-voucher fertilizer subsidy system**,** in place since 2015-16, has the potential to support low-emission fertilizer management, and an improved assessment and collection of canal water charges (*abiana*) and subsidies for on-farm irrigation water management will support improved and low-emission irrigation water management. The Transformative Carbon Assets Facility plans to support the development and deployment of reforms and price mechanisms that incentivize low-emission practices and aims to reward improved policy delivery by providing payments for actual emission reductions.[12] These payments could provide further incentives for policy reform.

However, there is scope for maximizing climate adaptation and resilience outcomes from the WBG's work on the water-agriculture nexus. Supporting CSA and water management practice and technologies on farms and along the value chain through knowledge generation, policy dialogue, capacity building, investment, and results-based incentives is critical. In addition, there needs to be more coordination between the WBG's Water and Agriculture global practices (GPs), such as co-location of Agriculture and Water GP projects to maximize the macro-economic and social and environmental outcomes (including climate mitigation) in a given area; communication and consensus between the GPs when advising clients on water management; and promoting greater inter-sectoral collaboration between irrigation and agriculture departments, as well as environment protection departments.

Climate-Resilient Infrastructure and Communities

While Pakistan has made significant gains over recent decades in reducing poverty despite modest economic growth, climate change and the resulting rise in risk from increasing floods, landslides, heatwaves, droughts, and seasonal shifts and erratic weather patterns represent a critical threat to continued poverty reduction efforts.

Urban Infrastructure

Poverty figures are consistently lower in urban areas than rural areas, which means that urbanization has represented a strong driver for poverty reduction. At the same time, rapidly growing urban areas also have tended to concentrate risks and vulnerabilities with increasing congestion and sprawl,

widening infrastructure gaps, including in critical transport and logistics infrastructure, and reduced livability, growing slums and unavailability of adequate housing, and frequent economic disruptions and losses from calamities. Unregulated land use and weak building control, as well as inadequate management of solid waste and wastewater, are exacerbating vulnerabilities and increasing disaster risks for cities across the country. National and sub-national governments are struggling to prioritize needs for developing new infrastructure, rehabilitation and maintenance of existing assets, and improved governance and urban management systems, within limited fiscal resources.

Urban areas in Pakistan are highly vulnerable to shocks from climate-induced extreme events. The increased intensity and frequency of floods alone has caused substantial physical damage, affecting more than 30 million people since 2010, with damages and losses exceeding $14 billion. While several interventions have been undertaken to address various aspects of flood management in the country, there is a need to develop a holistic program to address both infrastructure and institutional aspects of flood resilience.

Outside urban centers, forest land cover has been decreasing across the country. In 2016, Pakistan's total forest land cover was estimated at 4.7 million hectares (5.4 percent of the total land area), which was cited in Pakistan's NDC as extremely inadequate when considering exposure of the country to future climatic threats. In addition, the annual deforestation rate of Pakistan is 0.39 percent (2012-2016) and is increasing. For the last two years, Pakistan has enhanced its dependence on NBS—such as the ambitious Ten Billion Tree Tsunami Program—to reach its climate commitments under the Paris Agreement, and there is potential to adopt NBS for addressing issues of urban resilience and generating green jobs for communities.

Cities in Pakistan need to establish effective planning, risk mitigation, infrastructure delivery, and asset management systems to maximize efficiency and value-for-money in public sector development spending. This will require better information on local risk factors such as vulnerability to landslides, seismic zoning, or risks specific to riparian and coastal settlements. Also, provincial and local governments need to have the knowledge and skills to make use of such information for conducting affordability analyses to determine thresholds for acceptable versus intolerable risks based on available resources, development, and master planning; developing engineering designs for public infrastructure, and updating land use regulations, building codes, and building control, as well as operations and maintenance processes. The use of design features for climate adaptation and disaster resilience will ensure that critical public infrastructure and assets are not debilitated in the case of a calamity. Development planning and decision-making processes should be enabled to analyze risks and ensure that mitigation features are included in designs. Similarly, a focus on good maintenance offers one of the highest returns to infrastructure spending and could act as a kind of investment in asset preservation.

The government has launched the Naya Pakistan Housing Program (NPHP) to better serve the housing needs of low-income people in the country. The program sets an ambitious delivery target of 5 million houses, which is a unique opportunity to shape the built environment, improve resilience, and avoid carbon lock-in with investments in assets that are energy-inefficient, polluting, and expensive. In addition, attention to design factors such as orientation, shading, natural ventilation, insulation, window-to-wall ratio, materials, and color can lead to greener units with a lower carbon footprint.

The WBG has an ongoing dialogue with the national and Punjab governments on supporting the NPHP, and IFC will aim to catalyze private capital into the housing sector through interventions with local banks and pilot PPPS in affordable housing and new housing finance companies by leveraging its investment in the Pakistan Mortgage Refinance Company.

IFC is working on reforms for builders and lenders to increase access to affordable and green housing. To spur private investment in the sector, IFC is building a pipeline of property developers that will incorporate green principals in infrastructure development and leverage governance and institutional reforms to support PPPs and investments in urban transport and solid waste management. Through an integrated investment-advisory initiative for cities, IFC will aim to support fiscally constrained provincial governments in developing sustainable urban infrastructure solutions.

The WBG has supported flood mitigation investments focusing on infrastructure and institutional strengthening in Punjab and Sindh. Beyond these investments, there is a need to integrate resilience across urban infrastructure development to address the evolving nature of challenges being posed by climatic extremes in the country. This approach should encompass elements of strategic infrastructure development as well as institutional reforms to mitigate the impact of extreme events in urban areas.

Human Development and Community Resilience

Climate change and other related shocks can lead to significant losses in human capital, with long-term socio-economic consequences. These shocks can force people, especially those who are poor and vulnerable, to engage in negative coping strategies like reduced nutrition intake, taking children out of school, and forgoing healthcare services. In addition, shocks can reduce access to health and education services, as health facilities and schools are not properly equipped and staffed during shocks, or resilient in the aftermath of crisis. Such consequences can lead to significant human capital losses that can have important economic and social consequences and lead to increases in poverty and vulnerability in the country.

Pakistan has a well-developed social safety net program that was recently leveraged to protect marginalized populations from the economic shocks of the COVID-19 pandemic. The WBG has been supporting the government in improving the shock response capabilities of this program through improved targeting and trigger mechanisms. The program has strong elements of adaptive social protection that can be leveraged by hard-wiring future climate response to improve the resilience of vulnerable communities.

Coastal communities, smallholder farmers, women, and people living in poverty in rural and urban areas are known to be particularly vulnerable to climate change and disasters. This vulnerability context is shaped by pre-existing patterns of poverty and marginalization, high dependence on climate sensitive livelihoods, limited access to resources, and a limited voice in decision-making processes. Decades of research and data on the social impacts of disasters demonstrates that the impacts of climate extremes are determined primarily by social vulnerability. The COVID-19 crisis further lays bare existing social inequalities and the need to build back better and fairer.

Pakistan's high exposure to climate risks renders it vulnerable to shocks on the health and education systems. To enhance the resilience of vulnerable households to climate shocks and contribute to the protection of human capital investments, timely implementation of shock-responsive social protection programs will be key. Similarly, if Pakistan is to reach its goal of universal health coverage, moving towards more sustainable and resilient climate-smart health systems will be critical. Changes in climate are creating new challenges for health systems, such as rising incidence of water and vector-borne diseases, which will require collaborative and multi-sectoral approaches to achieve optimal health outcomes. The WBG can help build country-level adaptive capacity and resilience to the impacts of climate change through our interventions in the health and social protection sectors.

Macro-Fiscal Sustainability

Coupled with rapid population growth and uncontrolled urbanization, climate hazards have a disproportionate and growing impact on the poor. Despite the significant fiscal and macro-economic implications, work programs around climate change mitigation and adaptation are poorly integrated into the decision-making process of Pakistan's Ministry of Finance and the State Bank of Pakistan (SBP). In addition, the impacts of climate change are not measured by the macro-fiscal tools used by policymakers in Pakistan.

The WBG's engagement in Pakistan covers a range of macro-fiscal reforms through development policy operations, investment projects, analytical work, and technical assistance, including efforts to strengthen the resilience of the economy to climate-related shocks and encourage environmentally friendly investments and consumption patterns. The SBP is a member of IFC's Sustainable Banking Network, which can be leveraged to strengthen green financial regulation/approaches in the country.

Fiscal shocks from climate-induced extreme events pose a major risk to the macro-fiscal sustainability of Pakistan. Given the high vulnerability to climate change impacts, there is a need to develop and make operational disaster risk financing instruments to mitigate fiscal shocks. Disaster response funds exist at the national and sub-national level, but there is a need to restructure these financial windows into comprehensive risk-financing mechanisms suitable to the needs of the country.

To reduce the pressure on public resources resulting from climate-related shocks, the WBG has been engaged with the government on strengthening the fiscal resilience of Pakistan. As part of this technical assistance engagement, the WBG prepared an options paper for disaster risk financing (DRF) that serves as a key input for the development of a national DRF strategy by the National Disaster Risk Management Fund, with support from the Ministry of Finance and National Disaster Management Authority. The national DRF strategy would adopt a risk-layering approach and seek to identify the appropriate mix of risk transfer and risk retention instruments according to the levels of risk and severity of disasters. This would take into account the ability and willingness of both the domestic and international insurance sector, as well as look at potential instruments for risk-pooling, social protection, reserve funds, and the relevance of WBG instruments such as the Contingent Emergency Response Component and contingent lines of credit such as the Cat DDOs.

To support climate-informed decision-making, the WGB has developed a Macro-Structural Model and a Computable General Equilibrium Model with embedded climate modules for Pakistan. These models have helped in addressing gaps in macro-fiscal modeling by integrating a climate change module into existing macro-fiscal tools, calibrating the models to Pakistan's economy, and providing basic training to relevant stakeholders in Pakistan in the use of the models. The initial results suggest that macro-fiscal modeling is a useful and flexible tool for the analysis of climate change economics in Pakistan. Integration of these tools in the decision-making process will improve fiscal resilience of Pakistan against climate shocks.

To encourage environmentally friendly investments and consumption patterns, the WBG is working with the Ministry of Commerce to develop a framework to understand the extent that import duties favor or discourage the consumption of environmentally friendly goods by households, and the use of environmentally friendly technologies by firms. In Punjab, the Punjab Green Development Program (PGDP) is supporting targeted polluting industries (brick, leather, iron/steel, etc.) to invest in resource efficiency and cleaner production technologies to reduce their pollution discharges, including GHG emissions. Responding to mounting plastics pollution issues, PGDP is supporting Punjab to develop a comprehensive plastics management strategy to control plastics production and consumption and management of plastics wastes. In addition, a provincial green financing strategy is being developed to further promote green investments in small and medium enterprises (SMEs), and investments in environmental infrastructures (for example, wastewater treatment plants and waste management facilities). The technical assistance envisioned focuses on identifying an action plan for Pakistan's import duty policy to increase the feasibility of environmentally friendly investments, as well as the consumption of environmentally friendly goods, decarbonizing the economy, and increasing climate resilience by boosting sound strategies for adaptation to climate change.

Specifically, the technical assistance consists of a detailed analysis of the import duty structure to identify environmentally friendly items from the point of view of final consumption by households, and also from the point of view of the demand by firms for investment and intermediate consumption. Another role is the preparation of a strategy for tariff rationalization that considers this information. These activities are expected to increase the stock of knowledge on how import duties contribute (or not) to increase adaptation to climate change, so that trade policies can be designed taking this information into consideration. They will also help Pakistan position itself in relation to the possibility of countries or trade blocs imposing carbon duties on their imports.

Institutionalization of these analytical tools for climate-informed decision-making is a long-term engagement that needs to be anchored under Resilient Institutions for Sustainable Economy (RISE), the WBG's core lending program for Pakistan. The RISE Development Policy Loan (DPL) series focuses on macro-fiscal management issues in the country and has played a pivotal role in the establishment of the Macro-Fiscal Policy Unit (MFPU) at the Ministry of Finance. Continuing this activity under RISE-II will help train MFPU staff to use the MS and CGE models that include climate change parameters. The MFPU is expected to prepare a MTFF that will help authorities incorporate mitigation and adaptation policies with the ultimate objective of fiscal sustainability.

Raising revenues is a key macro-fiscal policy direction for the country. Carbon taxation to facilitate clean energy transition will incentivize reduced GHG emissions and provide a source of domestic

revenue mobilization for the government. The WBG is engaged with the Ministry of Climate Change to provide potential technical support on a feasible carbon-pricing mechanism for Pakistan. There is also a need to rethink fiscal resource allocation and taxation regimes to allocate proportionate focus on climate vulnerabilities.

The government is also keen to tap rising global demand for green debt as it pushes forward with plans to increase renewable and hydroelectric generation to 60 percent of total electricity by 2030. IFC will seek to support capital market development through issuance of thematic bonds such as green bonds and municipal bonds.

The WBG will be undertaking a CCDR to support the Government of Pakistan in strengthening resilience to climate change and to prepare a roadmap for key sectoral transitions necessary to secure sustainable and inclusive growth and poverty reduction while transitioning to a low-carbon economy. Building upon Pakistan's development priorities, the CCDR will identify the needs and opportunities to advance Pakistan's development objectives. Potential focus areas include: industrial sector decarbonization; NBS for resilience; mitigation and food security in the agriculture-water-landscapes nexus; greening cities for resilience and sustainable development; and reform of environmentally damaging subsidies. There will also be an overarching focus on the creation of green jobs, a just transition, climate/green financing and private sector mobilization.

TABLE 9: Overall summary of priority engagements

THEMES	PROPOSED ACTIVITIES	
	Near-Term (Year 1-2)	Medium- to Long-Term (Year 3-5)
Energy Decarbonization	» Support for floating solar PV on the Tarbela complex.	» Focus on expansion of the Dasu Hydropower Project and renewable energy development projects.
Agriculture-Water Nexus	» Support reforms to remove inefficient agricultural subsidies and switch to supporting water efficient crops, efficient irrigation, extension services, and improved value chains. » Increase agricultural productivity and improve water resources management to support rural development and environmental sustainability. » Strengthen governance, management, and recapitalization of key irrigation schemes/Water Boards down to community/farmer level, with a special focus on demand side management/ water efficiency including water conveyancing, reliable water delivery, and efficient crop irrigation.	» Support new legislation, policy, and implementation of governance reforms for water allocation between provinces and sectors down to farmer level engagement in pilot areas. Include provision of new water pricing schemes along with new seeds programs for improved productivity (i.e., create win-win management practices). » Strengthen government water-agriculture data analysis capacity and water accounts at a federal and provincial level for water resources-agriculture planning and management. » Support capacity building, strengthening institutions, and climate-smart investments for the agriculture sector.

Climate-Resilient Infrastructure and Communities	» Develop and incentivize the use of climate-resilient and energy-efficient design features under planned support for the government's housing development program. » Strengthen development of master plans, land-use regulations, and building codes for affordable and green housing. » Climate-proofing of education and health facilities to build resilience to shocks. » Inclusion of climate and sustainability issues in national curriculum.	» Housing, and local government systems strengthened to improve resilience of rural water and supply sanitation schemes. » Invest in design and delivery of cleaner, safer, and resilient solutions for drainage systems, municipal solid waste, and wastewater in urban areas. » Climate adaptive and resilient social protection systems that help to provide immediate support to shock-affected families in the event of a crisis.
Macro-Fiscal Sustainability	» Include climate relevant prior actions in upcoming DPCs. » Further deepen analytical understanding of macro fiscal and economic impacts of climate-related shocks to underpin policy dialogue on disaster risk financing.	» Improve fiscal resilience from climatic shocks through disaster risk financing instruments at national and provincial levels.

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A worker tends to the paddy field. Droughts threaten rice harvests and, in turn, food security in Sri Lanka.
—PHOTO: ISTOCK

SRI LANKA

Climate Vulnerability

Under a worst-case climate change scenario, Sri Lanka's GDP could decline by 7.7 percent, and 90 percent of the country's population could be at medium to high risk of climate impacts by 2050.[1] Due to climate change, average temperatures in Sri Lanka are expected to increase by 1.0-1.5° C by 2050.[2] Climate change projections suggest the dry zones will become dryer and the wet zones will become wetter, with rainfall projected to increase by 48 percent for the southwest monsoon by 2050 and to decrease by 28 percent for the northeast monsoon.[3] The most frequent climate hazards are floods, droughts, landslides, storm surges, and cyclones. These hazards pose a significant threat to economic and social development. The annual average fiscal loss associated with disasters in Sri Lanka is estimated to be more than $380 million.[4]

Flooding is the most frequent and costly natural hazard, causing an estimated annual loss of $240 million. The frequency of occurrence and scale of flooding in several river basins have been increasing in recent years. Due to the increased sophistication of the economy, the damage caused by the 2016 and 2017 floods and landslides was significantly higher ($1.2 billion) than the annual average losses over the last two decades.[5] Should a 100-year flood occur, losses could reach over $1.8 billion.

Droughts are also heavily impacting Sri Lanka. During the 2010-18 period, 11.7 million people were affected by drought. Most of the domestic food requirements, including rice, is produced in drought-prone regions. The failure of two harvests in 2017 caused concern for food security as rice prices

reached an all-time high. Drought also impacts hydropower generation, which accounts for nearly 40 percent of the total electricity generation capacity.

Climate change also amplifies coastal erosion and storm surges, and damages coastal natural capital such as reefs and mangroves that provide natural climate resilience as well as livelihoods. Nearly 33 percent of the island's population lives within one kilometer of the 1,340-kilometer coastline, which is extremely vulnerable to tsunamis, storm surges, and sea level rise. The coastal zone includes 65 percent of the country's urbanized areas, half of its built infrastructure, about 50 percent of tourism facilities, and 90 percent of manufacturing. Beach erosion is the most immediate environmental threat to coastal fishing communities and coastal infrastructure. Salinity intrusion negatively impacts agriculture production and availability of drinking water in the coastal belt.

Sri Lanka has formulated policies, national plans, and strategies to address climate change. The government's overall development vision, the Presidential Manifesto of 2019, highlights measures to manage climate risks.[6] The country released the Climate Change Policy in 2012 (currently being revised), which articulates broad national priorities.[7] Sri Lanka's NAP (2016-2025) identifies the most vulnerable sectors to the adverse effects of climate change.[8] National priorities set out in these strategies include ensuring food security (agriculture, livestock and fisheries), improving efficient water use and irrigation, restoring coastal and marine systems, and making urban infrastructure and roads more resilient. Climate change mitigation efforts target energy, transportation, industry, waste, and forestry.

GHG Emissions

While Sri Lanka's GHG emissions represent less than 0.1 percent of global emissions, efforts to mitigate climate change are still a priority. Sri Lanka's total GHG emissions in 2018 were over 37 Mt CO_2e, with 1.71 CO_2e per capita and 420 CO_2e per million dollars GDP. The energy sector (including transport) accounted for 64 percent of total GHG emissions in 2018, due to heavy dependence on fossil fuels. The agriculture sector represented 16 percent of total emissions, followed by the waste sector (nine percent), industry (six percent), and land-use change (five percent).[9]

The bulk of Sri Lanka's primary energy supply comes from oil and coal, and demand continues to grow. While almost 40 percent of Sri Lanka's electricity came from hydropower in 2017, the share of coal in power generation has been increasing since 2010. There are plans to add 300-600 MW of coal-based power generation, raising the risk of locking in higher GHG emissions and missing renewable energy targets. Efforts underway to introduce more renewable energy projects include a 100 MW wind plant. Biomass is the main energy source for 15 million very poor households, increasing human capital risks from indoor air pollution and medium-term climate risks from forest degradation that leads to erosion and emissions. The intersection of clean energy, clean cooking, green infrastructure, and landscapes presents investment opportunities in both human and natural capital as well as climate security.

Nationally Determined Contribution (NDC)

Sri Lanka submitted an updated NDC in July 2021. Notably, it commits to a 32 percent increase in forest cover and a 14.5 percent GHG emissions reduction in six sectors: power (electricity generation), transport, industry, waste, forestry, and agriculture.[10]

Emerging Priorities

The improvement of hydro-met services, which offer real-time weather, water, and climate updates as well as early warning for communities and sectors, is critical to minimize climate impacts. Sri Lanka's forecasting and early warning system needs to evolve into an impact-based forecasting and warning service with a focus on translating weather and hydrological information into sector- and location-specific impacts, which helps communities to act well in advance. Landslide forecasting has already developed into impact-based warnings that have saved many lives through timely evacuation and disaster risk reduction. Weather forecasts are being used extensively in the agricultural sector for informing the timing of cultivating, spraying, and harvesting. Sri Lanka can build on these successes and expand tailored forecasting to other sectors to optimize operations and maximize economic outputs—for example, in the water and energy sectors.

Transport disruptions due to landslides and floods are common during monsoon rains, affecting rural connectivity to markets, healthcare, education, employment opportunities, and other critical basic services. The road sector will need to use risk-reducing, nature-based, and infrastructure technologies and improved asset management to ensure systematic maintenance, planning of infrastructure development, and preparedness for landslides, flooding, and other risks. Road construction is one main driver for erosion, slope failures, and landslides, necessitating sound watershed management, vegetation retention, and NBS to slow uncontrolled run-off from extreme rainfall in mountainous terrain.

Investing in resilient infrastructure is important to reduce financial losses from climate disasters. Sri Lanka's losses in the housing, roads, and relief sectors from natural disasters are estimated, on average, at $380 million per year. Rapid and unplanned urbanization is resulting in a growing number of slum dwellers, and overburdened infrastructure and services. Sri Lanka has not carried out a comprehensive mapping exercise to identify vulnerable areas in the country, and the relocation of the climate change and disaster impacted population has been reactive and ad-hoc. In addition, urban planning and human settlements are two areas that received limited attention despite their importance in helping to close the adaptation deficit. The regional strategic and spatial plans at the local authority level need to be aligned with the Presidential Manifesto. Ensuring that the revised spatial plans respond to climate change could be an entry point for improving resilient infrastructure in urban areas.

The Presidential Manifesto acknowledges that the urbanization process in Sri Lanka has been uneven. Cities will be connected via a comprehensive road and rail network to foster economic growth in major urban centers outside Colombo to produce a more spatially balanced distribution of economic opportunities and reduce congestion in the capital. There is an opportunity to work with the government to re-envision urbanization in the country and ensure that the implementation of the Presidential Manifesto is resilient and inclusive and avoids repeating issues that exist in many South Asian cities.

Given that fisheries, aquaculture, tourism, and lives depend on the sensitive coastal environment, comprehensive approaches to disaster and climate risk management are needed. Innovative engineered and NBS and investment in natural assets, such as improving salinity protection measures and protecting against sea water intrusion in waterways, are promising options. The coastal forests

including mangroves are critical risk-reducing assets that store more carbon than an equivalent-sized inland forest.

Integrated landscape management—including forest, soil, and water resources for various livelihoods systems and disaster risk buffers—offers an opportunity to increase resilience and reduce GHG emissions.[11] For example, preliminary estimates suggest that the country's commitment to restore up to 200,000 hectares of forest landscapes would result in sequestering more than 35 million tons of CO_2 over two decades, which is more than the country's total CO_2 emissions of 27.6 million tons in 2019.[12] Restoration of forest landscapes can also create longer-term green jobs in rural areas, opportunities for development and engagement of the private sector, and livelihoods for communities.

Water scarcity and prolonged dry periods are a growing problem, requiring coping strategies that build on alternative water sources, traditional community knowledge, and social dynamics. Extreme variability of rainfall, which is already defining features of Sri Lanka's climate, calls for new WBG-integrated water management engagements. Agriculture, especially crop production, is highly dependent on the prevailing weather conditions and therefore highly sensitive to climate change. In particular, there is a need to better manage soil and water, especially irrigated water, to reduce the reliance of smallholders on monsoons and facilitate a shift to value-added crops. Drought monitoring, forecasting, and early warning, and adjusting the crop calendar to the changing climate, are priorities for the agriculture sector. Improving agriculture productivity and diversification through the adoption of CSA practices and improved on-farm water management are essential, along with private sector capabilities that can be leveraged to maximize climate change mitigation and adaptation, such as introducing innovative technology and developing resilient seed varieties.

Community engagement and socially inclusive approaches to meaningfully involve farmers in climate-related decisions, building on their own on-going adaptation measures and knowledge, are critical to encourage adoption and formulation of CSA practices. Recent progress in adopting modern, climate-smart approaches include the government's inauguration of a 28-kilometer irrigation tunnel in the dry zone, the longest in South Asia; rehabilitation of 5,000 traditional Tank Cascade System irrigation reservoirs across the island, and a focus on sustainable dairy production.

Sri Lanka has achieved significant progress in increasing safe water coverage at the national level, achieving the Millennium Development Goal targets in this sector set for 2015, yet regional disparities still prevail. The country lacks quality sanitation facilities in some rural and urban households, and sanitation facilities in schools and public places in most cities are in a poor condition and inadequate, which takes on new urgency due to the COVID-19 pandemic. Complementary integrated watershed management can boost the resilience and cost-effectiveness of water supply systems.

Increasing the energy supply from solar and wind is a priority area in the 2019 Sri Lanka Energy Policy and the Long-term Generation Expansion Plan (LTGEP) 2020-2039 of the Ceylon Electricity Board.[13, 14] The cumulative Other Renewable Energy capacities envisaged by the LTGEP at the end of 20 years are 1,323 MW from wind, 2,210 MW from solar, 654 MW from mini-hydro, and 144 MW from biomass. However, to meet the government's stated objective of hydro and other renewable energy contributing 80 percent of the energy mix by 2030, a much more ambitious plan would be needed.

Social safety nets are needed to help the poor out of distress due to climate shocks, which can lead to loss of life and assets, unemployment, or sickness. The targeting needs to consider climate vulnerable population groups. To help people graduate from poverty, vocational programs are needed, particularly for green jobs, which will contribute to mitigating climate change and protecting the environment while ensuring resilient livelihoods.

In alignment with national priorities and the WBG's core competencies, four priority areas have been identified for engagement due to their catalytic and complementary impacts on advancing climate change action in Sri Lanka:

- **Infrastructure Resilience**
- **Integrated Landscape Management for Agriculture, Water Resources, and Forests**
- **Clean Energy**
- **Resilient Livelihoods**

Infrastructure Resilience

Infrastructure is affected by the physical impacts of climate change and, at the same time, plays a critical role in building resilience to those impacts. To minimize losses from disasters, new infrastructure will need to be built in less vulnerable areas and designed to withstand potential climate change impacts over its entire lifecycle. Existing infrastructure needs to be retrofitted to withstand anticipated impacts. NBS are often efficient and cost-effective measures to adapt to climate change and can be combined with conventionally engineered measures such as hybrid low-cost solutions, including wetland buffers, urban rain gardens, restoring and protecting mangroves, and slope stabilization using vegetation and forests. The WBG will focus on helping Sri Lanka increase infrastructure resilience in the transport sector, in cities, in the coastal zone, and through improvement of hydro-meteorological services.

Significant modification of strategies, infrastructure, systems, and practices will be needed to withstand the effects of climate change. Appropriate adaptation measures for infrastructure and the overall system ability to cope in extreme weather event situations should be carefully assessed in view of emerging risks. "No regrets" investments, which provide benefits and are justified from economic, social, and environmental perspectives whether or not natural hazard events or climate change take place, are needed for both "hard" adaptation measures such as infrastructure and "soft" adaptation measures such as incentives and demand management.

Where possible, infrastructure should be designed to cope with climate change. For example, multi-purpose water infrastructure for water capture and storage, water and wastewater re-use, storm water management, and flood control will help Sri Lanka cope with new risks emerging from the variability of rainfall. The Climate Resilience Multi-Phased Programmatic Approach, already approved by the WBG, includes multi-purpose water infrastructure for flood mitigation, water supply, and other uses.

The government has prioritized the effective use of weather, climate, and water information, along with resilient infrastructure investments, to withstand the effects of climate change.

Success of the impact-based forecasting and early warning system depends on close coordination among all stakeholders, including meteorological, hydrological, landslide forecasting, and disaster management agencies. The productivity of economic sectors, including agriculture, hydropower, transport, and energy, relies on accurate hydro-meteorological information. To improve the service delivery to these sectors, a focus is needed on translating weather and hydrological information into sector and location specific impacts for local use by affected people. Installing equipment to monitor sea level rise, storm surges, and tidal waves and their impact on coastal communities is a key priority measure for coastal resilience.

The transport sector experiences some of the highest economic damage during monsoons due to landslides and flooding. Climate-proofing roads that carry 95 percent of passengers and 98 percent of freight in Sri Lank**a** to ensure year-round availability of transport lines will reduce negative impacts and improve the resilience of communities. Developing all-season roads with accompanying drainage, slope stabilization, natural solutions, and watershed protection is essential.

Mainstreaming climate resilience in physical and urban planning, as well as building approval regulations, is critical for enhancing the resilience of urban areas. Rapid urbanization, if not properly managed, will result in inequitable impacts and high economic losses. Risk-sensitive land-use planning, along with the provision of adequate services such as waste collection will help Sri Lanka cope with the impacts of climate change. NBS like urban wetlands complement standard flood mitigation solutions like canals and pumping stations, due to their natural water retention capacity that reduces and smoothens flood peaks. Wetlands also provide a range of additional ecosystem services with important economic and social value, such as helping alleviate the effects of urban heat due to evaporative cooling.

Investments to withstand the effects of sea level rise and salinity intrusion impacting agricultural land and drinking water supply are also needed. The main water supply to Colombo on the Kelani River and water supplies to many coastal towns are under threat of salinity intrusion. Priority actions should include investments in salinity protection measures, such as salinity barriers to protect drinking water supplies, diversification of crops with saline tolerant varieties, and phytoremediation of affected agricultural land with mangroves/natural vegetation. Investment and policy actions for ecosystem-based sustainable coastal and marine fisheries management, including sustainable coastal aquaculture development, will help maintain and enhance the sector's contribution to the economy and food security. Mangroves provide multiple ecosystem services—as windbreak and shoreline stabilizer, and as a buffer for storms in coastal area. Managing the mangrove ecosystem in line with the government's ambition to protect all mangroves is a key priority to benefit resilience, carbon storage, livelihoods, and nutrition as nurseries for high-value fisheries and seafood.

Providing solutions to solid waste management issues will help address health hazards, pollution, and GHG emissions. Waste collection and disposal have become a serious problem in Sri Lanka with the expansion of urban population and the rapid changes in the consumption pattern. The NDC commitments for the waste sector are directly or indirectly influencing the reduction of GHG emissions in the waste sector by modifying, adopting, and applying appropriate technology during the period of 2020-2030, including: introducing source separation; improving waste collection mechanisms; monitoring of waste management activities; systematic management of industrial/

hazardous and clinical waste; improving the compost preparation system and introducing a market for produced compost; introducing energy generation by waste (waste-to-energy programs), and designing and implementing comprehensive solid waste management strategies for 40–60 percent of local authorities before 2030. There is potential for private sector involvement in implementing these NDC commitments.

Integrated Landscape Management for Agriculture, Water Resources, and Forests

Climate change has been intensifying pressure for the efficient and equitable use of Sri Lanka's water and land resources. The WBG can continue, scale up, and leverage engagements in integrated watershed management, climate-smart agricultural systems, and forest landscapes. These three areas will need to be addressed in conjunction to optimize multiple economic benefits as well as climate adaptation and mitigation.

To sustain its water resources, the country's past infrastructure-driven approach to water exploitation will need to transition to an integrated water resources management approach, or watershed approach, which is being piloted with new WBG lending. Investments focusing on integrated management of water, land, forests, and the production systems dependent on them are required to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment. Such an approach will address all the key interconnected issues such as water prioritization among sectors, watershed planning, groundwater exploitation, surface water capture and use, increased reliability through investment and rehabilitation, and establishment of a modern institutional and legal framework, as well as citizen engagement and inclusion.

Sri Lanka can benefit from a more strategic basin management approach for developing water infrastructure to ensure the successful reduction of floods and droughts under current and future climate variability by using the 10 river basin investment plans developed under the Climate Resilience Improvement Project as the starting point. Integrated watershed management uses sustainable land management practices to optimize multiple benefits from land and water resources. Approaches for water governance, allocation, and agriculture practices need to be underpinned by principles of community and citizen engagement

Agriculture is particularly affected by variable water availability. The agriculture sector contributes around seven percent to GDP and employs 27 percent of the population. Of the country's approximately 2.3 million hectares of agricultural land, around 80 percent is under smallholder production, with around 1.7 million smallholder farmers. Sustainably managed irrigation and reservoir operation based on weather/climate forecasts can minimize the impacts of erratic changes in precipitation due to climate change. Community engagement and socially inclusive approaches to meaningfully involve farmers in decision-making and knowledge-sharing can help encourage identification and adoption of new agricultural practices. Diversifying crops and favoring those that are tolerant to heat, water stress, and extreme weather also will reduce vulnerability of farmers to crop failures. Sri Lanka's traditional Tank Cascade System for irrigation is wearing down, requiring modernization through rehabilitation

that can deliver multiple benefits. Rice intensification, with which Sri Lanka has significant experience, can also rationalize water use and reduce methane, a potent GHG. The private sector needs to play an important role in CSA by providing financing, enhancing the sustainability of interventions, promoting innovation, increasing uptake, and helping bring interventions to scale.

Sri Lanka's dairy sector can contribute to climate change mitigation by reducing its GHG emissions. The dairy sector has been identified by the government as one of the key sectors to contribute to the projected annual national economic growth by improving food security, nutrition, creation of employment opportunities, generation of income, and foreign exchange earnings. A low-emissions development strategy can be implemented for the dairy sector through the adoption of performance-enhancing technologies and use of incentives, which would also increase milk yields. At the same time, this sector presents an opportunity for vulnerable households to become more resilient because dairy animals support and diversify family income. Investing in the dairy industry sector can have significant development impact and create employment opportunities throughout the supply chain.

Restoration and integrated management of forest landscapes and ecosystems—including production forests, mangroves, protected areas, rangelands, pastures, and crop lands—provides resilience to floods and drought and other climate risks, reduces and sequesters GHG emissions, secures livelihoods and jobs, and provides a multiplier effect on the rural economy. Restoration of forest landscapes, including mangroves, would have positive long-term effects on local weather patterns, sink a significant amount of carbon, reduce soil erosion and risks of disasters such as flash floods, and decrease sedimentation of water tanks and hydropower reservoirs. Agroforestry systems, through the integration of trees and crops, can increase resource-use efficiency while acting as a carbon sink.

Community-driven approaches could help channel support to the local level, deliver results on the ground, and strengthen risk management strategies. In its development vision, the government proposes village-level boards and centers to coordinate development activities, and to facilitate necessary technology, research, and equipment required for agriculture, fisheries, and small industries.[15] Opportunities exist for supporting opportunities for devolved climate finance through channeling funds and decision-making on climate (and multi-hazard) risk management to the local level. This includes support for developing and strengthening local capacity for participatory identification of risks, and investment priorities to build resilience to shocks, stresses, and shifting climatic conditions. Research has found that social networks can have the potential to both encourage and constrain adaptation practices, and that gender, livelihood considerations, and social capital can influence resilience with differential impacts for members of communities.

Clean Energy

Heavy dependence on fossil fuel electricity generation has increased emissions in Sri Lanka. To transition to a cleaner energy mix, the government has set a target of renewable energy and hydro contributing 80 percent of energy by 2030. Both solar and wind energy demonstrate excellent, very large technical potential. However, only a small fraction of it has been developed so far, with small-scale renewable energy projects (up to 10 MW) contributing over 700 MW to installed generation capacity.

The only large-scale project to date is the Ceylon Electricity Board 100 MW wind project at Mannar. Rooftop solar PV installations to date have primarily been small installations at residential buildings and small companies. Increased renewable energy, particularly utility scale solar and wind projects, would help reduce costs of power generation, diversify the energy mix, and reduce dependence on oil-based generation. Wind and solar also would lower environmental impacts and help Sri Lanka meet its climate change objectives. The government can increasingly seek to develop renewable energy projects through PPPs to mobilize commercial finance and private sector participation.

The WBG has supported detailed pre-feasibility studies for the proposed Pooneryn (up to 390 MW) and Monaragala (50-100 MW) large scale renewable energy projects. Following this work, the IFC has provided transaction advisory services to structure a competitive tender for PPPs at Pooneryn. In a first stage, a 100 MW wind PPP project at Pooneryn is being considered by the government, with a private developer proposed to implement the wind generation assets and the required transmission link to evacuate the power. Further capacities at Pooneryn would require additional transmission investments, likely implemented by the Ceylon Electricity Board. Transmission/substation infrastructure investments would also be required at Monaragala. Further analytical work can also map out the political economy of carbon-related sectors to assess stakeholders' interests, influence, and resources, identify ways to engage stakeholders in a sector reform, and identify potential political and social risks stemming from green growth and renewable energy programs.

To scale up renewable energy, Sri Lanka needs to identify and prepare several project sites (including environmental and social assessment and land acquisition in line with best practices), seek to increase project sizes, and organize well-structured competitive tenders with appropriate risk allocation and mitigation. This would allow the country to attract international investors and favorable financing terms, and achieve tariffs comparable with other renewable energy projects in the region. Appropriate transmission infrastructure investments are also likely to be needed for some of the projects. The potentials for floating PV and, for the medium term, offshore wind need to be further analyzed.

Floating solar can provide an increasingly economic solution, helping to utilize the country's existing hydro power and transmission facilities and irrigation reservoirs more strategically and in an optimized manner. It can also help address the challenge of allocating sufficient land for renewable energy, constrained by Sri Lanka's large protected areas, topography, and competing economic uses. Added benefits include the ability to utilize existing transmission infrastructure in cases where hydropower is already generated. Floating systems can also perform better than solar panels installed on land, because evaporating water keeps them cooler, leading to more efficient operation.

Increased effort on demand-side energy efficiency is another cost-effective way to reduce energy expenditure and GHG emissions. Sri Lanka has made progress in setting up the policy framework for energy efficiency and has implemented some activities, notably on efficient lighting. Commercial, public, and industrial buildings contribute 60 percent of the electricity consumption, with large energy efficiency potential remaining mostly untapped and identified by the government as a key priority. The energy efficiency potential is estimated to be 30-50 percent, mainly due to inefficient air conditioning, ventilation, and lighting. Sustainable implementation and financing mechanisms for building energy efficiency need to be developed and fostered, including strengthening of the energy service company market.

Sri Lanka does not have a monitoring, reporting, and verification (MRV) system or a National Registry to track emissions. Developing a new carbon pricing instrument (CPI) that could complement the Sri Lanka Carbon Crediting Scheme and contribute to Sri Lanka's NDC goals is required. Designing a national MRV and registry system and piloting a national MRV system, with an initial focus on project/facility-level emissions and emission reductions, will fulfill the technical and institutional/ regulatory readiness to support Implementation of CPIs.

Resilient Livelihoods

Many households in Sri Lanka remain vulnerable to falling back into poverty after climate-induced shocks. A well-designed and adequately funded safety net system is essential to addressing these challenges of vulnerability. Safety net systems need to be well-established to ensure speedy identification and targeting, thereby reducing response time. An efficient social protection delivery system should ensure "last-mile delivery" of services. Children, especially girls, are more likely to engage in day labor after a disaster, even when schools remain open. For women in Sri Lanka, flooding events are proven to have gendered impacts. The experiences of marginalization and exclusion are multiplied in some cases. Women who are the single head of households, and those from religious and ethnic minority groups, find it more difficult to access information, get support to manage risks, and access social networks when disaster strikes. A special focus on poor women therefore makes sense when designing safety nets.

Specialized training, education, and employment programs—particularly for green jobs — combined with specific sector support to help create jobs are needed to help people graduate from poverty. Core components of such a program would include training for both technical and life skills to prepare the unskilled for employment, as well as development of soft skills and mentoring to navigate and succeed in the workforce. Job-placement and apprenticeship programs also help to support linkages with employers. Focus needs to be given to green jobs that will help in the transition to a resilient, de-carbonized economy. Such a transition not only has the potential to mitigate climate change, but it can also become a driver of growth by creating green jobs in different sectors such as agriculture, forestry, environmental restoration, infrastructure works, manufacturing, research and development, nature-based tourism, waste management, maintenance, and other services. Green jobs support the efficient consumption of energy, limit GHG emissions, and minimize waste while preserving and restoring the environment and helping to adapt to climate change. Equally, aspects pertaining to school health for children, such as home-grown gardens that foster self-sufficiency in school nutrition, can also help to avoid soil erosion in the plantations sector. Water and sanitation are equally important focuses to support a healthy learning environment.

TABLE 10: Overall summary of priority engagements

THEMES	PROPOSED ACTIVITIES	
	Near-Term (Year 1-2)	Medium- to Long-Term (Year 3-5)
Infrastructure Resilience	» Climate Resilience Multiphase Programmatic Approach (MPA) including multi-purpose water infrastructure, salinity protection, forecasting and early warning. » IPF on resilient rural roads connectivity and integrated rural development, including implementation of the Integrated Planning Model for Climate-Resilient Transport Networks. » Programmatic advisory support on building back greener. » IPF on land management, land tenure, local livelihoods, and low carbon cities (rural/urban linkages complementing roads connectivity IPF).	» MPA for multi-purpose water infrastructure, salinity protection, forecasting and early warning, combining nature-based and grey solutions. » Advisory support for urban transformation with land use planning, green infrastructure, energy efficiency, and climate resilient building codes, solid waste management. » Next generation of urban development investments, promoting livable and competitive urban agglomerations with infrastructure resilience and flood reduction systems combining nature-based solution and climate smart infrastructure.
Integrated Landscape Management for Agriculture, Water Resources, and Forests	» Additional Finance: Embed CSA practices into existing agriculture projects and supplement Agriculture Modernization Project. » Advisory support on drought risk assessment and preparedness strategies. » IPF: Implementation of water supply investments to address drought risk. » Advisory support on the coastal economy including fisheries, aquaculture, and marine ecosystems.	» Strengthen irrigation, extension services, and hydro-met information. » Scale up investment in CSA (WB and IFC). » Modernize the dairy sector to improve productivity and reduce emissions. » Effective, multi-sector watershed management for improved water supply, irrigation systems, and flood and drought management. » Investment in production and conservation of forest landscapes, including agro-forestry systems, community driven livelihoods, and PPPs in forest plantations. » Blue economy investments in fisheries, aquaculture, and marine ecosystems.
Clean Energy	» Feasibility study on floating solar. » Advisory support for the development of an offshore wind deployment strategy.	» IPF: Support developing rooftop PV and large-scale renewable energy project, including offshore wind and floating solar, and transmission infrastructure, including exploring PPPs (WB and IFC). » Advisory support on energy efficiency in the building sector, cooling systems, etc. leading to downstream investment. » Advisory support to implement carbon pricing instruments. » Advisory services and investments (including risk-sharing facilities) to promote sustainable energy financing (IFC). » Smart grid investments.
Resilient Livelihoods	» IPF on skills for employment, particularly focusing on green jobs.	» Expanding safety nets, targeting the climate vulnerable population.

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A woman stops at a water well in Sri Lanka. The primary climate-related risks in South Asia are flood damages, food and water insecurity, and extreme heat from rising temperatures.

—PHOTO: DOMINIC SANSONI / WORLD BANK