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PHILIPPINES

World Bank Group

COUNTRY CLIMATE AND DEVELOPMENT REPORT

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CONTENTS

Boxes

Tables

Figures

Acknowledgments

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Acronyms and Abbreviations

4Ps	*Pantawid Pamilyang Pilipino* Program (Conditional Cash Transfer Program)
ADS	Accelerated Decarbonization Scenario
ALMP	Active Labor Market Program
ASEAN	Association of Southeast Asian Nations
ASP	Adaptive social protection
AWD	Alternate Wetting and Drying
BARMM	Bangsamoro Autonomous Region in Muslim Mindanao
BAU	Business-as-usual
BFAR	Bureau of Fisheries and Aquatic Resources
BSP	*Bangko Sentral ng Pilipinas* (Central Bank of the Philippines)
CBAM	Carbon border adjustment mechanism
CCAM-DRR	Cabinet Cluster on Climate Change Adaptation, Mitigation, and Disaster Risk Reduction
CCC	Climate Change Commission
CCDR	Country Climate and Development Report
CCET	Climate Change Expenditure Tagging
CDP	Comprehensive Development Plan
CES	Clean Energy Scenario
CGE	Computable General Equilibrium model
CLUP	Comprehensive Land Use Plan
CMIP	Coupled Model Intercomparison Project
CO_2e	Carbon dioxide equivalent
CPAT	Carbon Price Assessment Tool
CPI	Carbon pricing instrument
CPS	Current Policy Scenario
CREATE	Corporate Recovery and Tax Incentives for Enterprises Act
CSA	Climate-smart agriculture
DA	Department of Agriculture
DBM	Department of Budget and Management
DENR	Department of Environment and Natural Resources
DepEd	Department of Education
DILG	Department of the Interior and Local Government
DOE	Department of Energy
DOF	Department of Finance
DOH	Department of Health
DOLE	Department of Labor and Employment
DOST	Department of Science and Technology
DOTr	Department of Transportation
DPWH	Department of Public Works and Highways
DRF	Disaster Risk Financing
DRFI	Disaster Risk Finance and Insurance
DSWD	Department of Social Welfare and Development
DTI	Department of Trade and Industry
DTP	Devolution Transition Plan
DWR	Department of Water Resources
ECT	Emergency Cash Transfer
EPIRA	Electric Power Industry Reform Act
ESG	Environmental, social, governance
EV	Electric vehicle
FDI	Foreign direct investment
FISA	Free Irrigation Service Act
FIT	Feed-in-tariff
FMP	Fishery Management Plan
FSAP	Financial Sector Assessment Program
FSF	Financial Sector Forum
GBRS	Green building rating system
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse gas

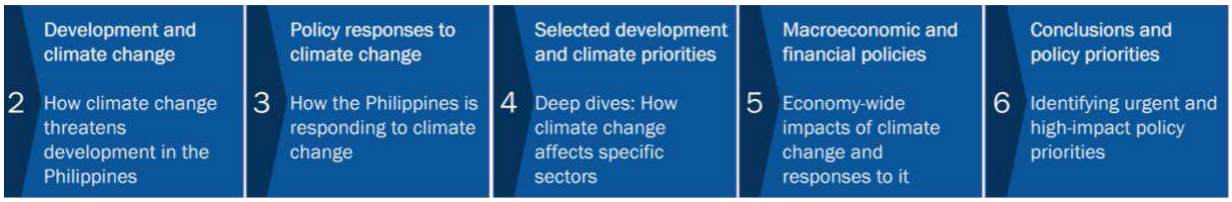
GIDD	Global Income Distribution Dynamics model
GJ	Gigajoule
GOCC	Government-Owned and Controlled Corporation
GVC	Global value chain
GW	Gigawatt
GPP	Green Public Procurement
Ha	Hectare
HEP	Hydro-electric power
IFC	International Finance Corporation
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated water resource management
JICA	Japanese International Cooperation Agency
LCOE	Lower levelized cost of electricity
LGU	Local government unit
LWUA	Local Water Utilities Administration
Mt	Megatonne
MCM	Million cubic meters
$MtCO_2e$	Million tonnes of carbon dioxide equivalent
Mtoe	Million or mega tonnes of oil equivalent
MWSS	Metropolitan Waterworks and Sewerage System
NBS	Nature-based solution
NCCAP	National Climate Change Action Plan
NCR	National Capital Region
NDC	Nationally determined contribution
NDRRMC	National Disaster Risk Reduction and Management Council
NEDA	National Economic Development Authority
NGP	National Greening Program
NIA	National Irrigation Administration
NMT	Non-motorized transport
NOAH	Nationwide Operational Assessment of Hazards
NWRB	National Water Resources Board
O&M	Operations and maintenance
PAGASA	Philippine Atmospheric Geophysical and Astronomical Services Administration
PAPs	Programs, activities, and projects
PCIF	Philippine Catastrophe Insurance Facility
PEP	Philippine Energy Plan
PETS	Philippines Emission Trading System
PFM	Public financial management
Phil-WAVES	Philippines Wealth Accounting and the Valuation of Ecosystem Services program
PHP	Philippine Peso
PPP	Public-private partnership
PSA	Philippine Statistics Authority
PV	Photovoltaic
RBCO	River Basin Control Office
RCP	Representative Concentration Pathway
RE	Renewable energy
REA	Renewable Energy Act
REF	Reference Scenario
RPS	Renewable Portfolio Standard
SDG	Sustainable Development Goal
SFF	Sustainable Finance Framework
SOE	State-owned enterprises
tCO_2e	Tonnes of carbon dioxide equivalent
TFP	Total factor productivity
TWh	Terrawatt hours
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WSS	Water and sanitation service

Executive Summary

Climate change poses major risks for development in the Philippines. Climate shocks, whether in the form of extreme weather events or slow-onset trends—will hamper economic activities, damage infrastructure, and induce deep social disruptions. Adaptation to the risks of climate change—including both extreme events and slow-onset problems—is thus critical for the Philippines. Policy inaction would impose substantial economic and human costs, especially for the poor. Adaptation cannot eliminate the costs of climate change, but it can substantially reduce them. Many adaptation responses also contribute to mitigation; conversely, many mitigation measures generate local co-benefits, such as reduced air pollution. Although the Philippines is a relatively low emitter of greenhouse gas (GHG), it can contribute to global mitigation efforts through an energy transition, including a shift away from coal. The investment costs of such adaptation measures and an energy transition are substantial but not out of reach.

The Philippines Country Climate and Development Report (CCDR) comprehensively analyzes how climate change will affect the country's ability to meet its development goals and pursue green, resilient, and inclusive development. The CCDR helps identify opportunities for climate action by both the public and private sectors and prioritizes the most urgent development challenges impacted by climate change in the Philppines. Even among these, the analysis is brief by necessity. Background papers prepared for the CCDR consider a much broader range of issues and examine them in more detail than is possible here.

Figure ES.1: Structure of the CCDR



Climate and development in the Philippines

The Philippines aims to become a high-income economy by 2045, but climate change risks are making this target elusive. Climate shocks, whether in the form of extreme weather events or slow-onset trends of temperature increases, changing rainfall patterns, and rising sea levels, will hamper economic activities, damage infrastructure, and induce deep social disruptions. Current annual losses from typhoons are estimated to reach 1.2 percent of the Gross Domestic Product (GDP) and as much as 4.6 percent of GDP in extreme cases like Super Typhoon Yolanda (Haiyan) in 2013.

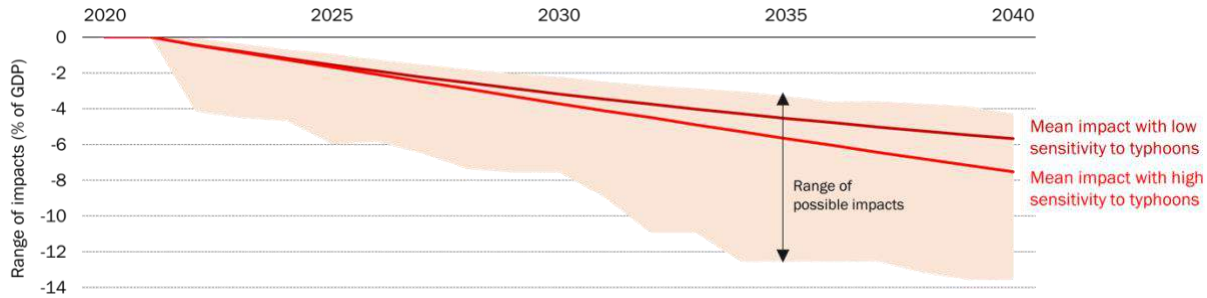
Climate change in the Philippines will continue and accelerate. Mean temperatures in the country have already increased by 0.68°C from 1951–2015, increasing by 0.1°C per decade. Projections made by the Intergovernmental Panel on Climate Change's (IPCC) multi-model ensemble indicate that (a) temperatures in the Philippines will continue to increase by about 1-2°C by the end of the 21st century, depending on the climate scenario; (b) while average rainfall may not change much, variability and intensity are likely to increase; and (c) extreme events will become stronger and more frequent The northern and central parts of the country are projected to become wetter, and the southern part drier throughout the year.

Without action, climate change will impose substantial economic and human costs, affecting the poorest households the most. CCDR estimates show that the economic damages in the Philippines could reach up to 7.6 percent of GDP by 2030 and 13.6 percent of GDP by 2040 (Figure ES.2). All sectors will be affected, with capital-intensive sectors likely to suffer most from extreme events,

and agriculture suffering the most from slow-onset trends. The private sector will be severely affected by both.

Climate change effects will likely vary across and within regions. Basins where water demand already exceeds supply, such as Northwest Luzon and Central-Southern Luzon, or which have little surplus, such as Cagayan, are most vulnerable to changes in water availability. Areas where most agriculture is rainfed will suffer more than irrigated areas, although the latter may be affected by changes in water availability.

Figure ES.2: Climate change is likely to reduce GDP significantly, but the range of possible outcomes is wide



Note: The simulations estimate the possible effects of climate change on agriculture, human health, and labor productivity, combined with more severe typhoons, under different assumptions of economic sensitivity to typhoons. As typhoons are highly variable, a range of possible outcomes is estimated, as shown by the shaded area; the solid lines show the mean estimated outcomes.
Source: CCDR Team estimates based on the MANAGE model

The Philippines is a relatively low emitter of GHG, but emissions are growing. The country's per capita greenhouse gas (GHG) emissions (2.2 tCO_2e) are among the lowest in East Asia, below those of Indonesia (3.7 tCO_2e), Vietnam (4.7 tCO_2e), and China (9 tCO_2e). However, emissions are expected to rise from 234 $MtCO_2e$ in 2020 to 399 $MtCO_2e$ in 2030. The energy sector accounts for 54 percent of total emissions, while agriculture is the second largest source, accounting for a quarter of emissions. Transport is the biggest fossil fuel-consuming sector and the largest source of urban air pollution; moreover, emissions from transport will likely quadruple by 2050 under current scenarios and policies. The overall share of fossil fuels in the primary energy supply increased from 60 to 67 percent from 2010 to 2019 due to the rapid growth of coal-fired power generation and sustained growth in oil demand from transport.

Climate commitments, policies, and capacities

The Philippines has developed a comprehensive set of policies and institutions to address climate change with a whole-of-government approach. Government policies emphasize adaptation, with mitigation actions to be pursued largely as a function of adaptation.

The Philippines' Nationally Determined Contribution (NDC) proposes ambitious goals. The country's updated NDC commits to a 75 percent reduction in cumulative emissions—excluding land-use change and forestry—from 2020 to 2030, relative to projected business-as-usual (BAU) cumulative emissions of 3,340 $MtCO_2e$. However, only 2.71 percent of this proposed reduction is unconditional (reductions that the Philippines will undertake without external support). The unconditional portion of the NDC is likely to be easily met under BAU. Conversely, the conditional portion is highly ambitious and is only likely to be met if net emissions are reduced to zero before 2030. A moratorium on endorsing new greenfield coal-fired power plants was announced in 2020.

The NDC recognizes the private sector as the country's main engine of economic growth and transformation and promotes its engagement in climate change adaptation and mitigation. As state-owned enterprises (SOEs) play a minor role in the economy, the private sector will play a crucial role in meeting the growing demand for climate action, especially with public finances

constrained by the COVID-19 pandemic. Many climate actions will likely be in the direct interest of private sector firms and may translate into opportunities worth USD168 billion between 2020 and 2030. Investment opportunities exist in greening the energy, agriculture, manufacturing, and transportation sectors and in building climate-smart cities. However, many of these opportunities may not materialize due to a lack of financing, limited access to technology or skills, or restrictive regulations on business competition and foreign direct investment (FDI).

The highly decentralized institutional framework in the Philippines challenges the implementation of climate actions and uptake of climate policies at the national and local levels. Climate action responsibilities and authority are often dispersed and duplicative; many policies have only been partially implemented. Local government units (LGUs) are increasingly responsible for climate action but often lack capacity and resources.

Selected development and climate priorities

The CCDR undertakes an in-depth analysis of climate challenges and opportunities for climate-related actions in selected sectors that impact the country's development ambitions. The sectors examined were selected based on (a) the extent to which sectors are likely to be affected by or affect climate change and natural disasters; and (b) where the largest number of people are most vulnerable to climate change and likely to be most severely affected, driving them into poverty. Based on these criteria, the sectors selected to be examined in depth are water, agriculture, energy, and transport. By focusing on these sectors, the CCDR can also address important issues affecting urban areas.

Improving water resource management

- The impact of climate change on water users will vary significantly across the country, with northern and central regions (Luzon and Visayas) expected to become wetter and southern regions (Mindanao) drier.
- Increased water storage could substantially mitigate the impacts of climate change on water users, but the needs remain to be determined.

Key recommendations include (a) increasing water storage capacity to manage variations in precipitation better, (b) implementing integrated water resource management, (c) promoting water-saving irrigation technologies and increasing water use efficiency, (d) improving water supply and sanitation and managing urban water demand, and (e) improving flood water management.

Water is central to the climate change discussion as it supports energy, agriculture, ecosystems, industry, health, and human capital accumulation. Agricultural use dominates water use, but industrial and domestic uses are also important in some regions. The Philippines has abundant water resources, but this is not true throughout the country.

Climate change is expected to affect water availability significantly, but these effects are hard to predict and likely to vary substantially across different parts of the country. Although average precipitation levels may not change significantly, the regional, inter-annual, and intra-annual distribution of precipitation may change. In general, the northern and central parts of the country (Luzon and Visayas) are expected to become wetter on average, while the southern part (Mindanao) is expected to become drier. The number of flood events has increased markedly in Mindanao over the last two decades. It is expected to increase further due to climate change and the increase in tropical cyclones passing through the southern Philippine archipelago.

Changes in water flows may significantly impact economic activities in some areas. Changes in rainfall distribution can increase the risk of flooding in the wet season and water scarcity in the dry season. Where water is already insufficient or close to it, as in Northwest Luzon, Central-Southern Luzon, and Cagayan, any flow reduction would reduce the irrigable area. Climate change will also

increase the burdens on already stressed domestic water supply systems. Many such systems have struggled to keep up with rapid urban growth and have large water supply gaps; Metro Manila's water supply gap is 915 million liters daily. Higher temperatures will likely exacerbate this shortfall, as people use more water to cope, while higher evaporation from reservoirs serving urban systems reduces supply. Major water-related events attributable to climate change will disproportionately hurt poor people.

Increasing water storage capacity would increase resilience. The per capita storage capacity in the Philippines was only 68 m^3 as of 2017, well behind that of neighboring countries such as Vietnam (473 m^3), Malaysia (722 m^3), and Thailand (1,145 m^3). An analysis of water deficits and storage needs in water-stressed Central Luzon estimated that about 4,868 million cubic meters (MCM) will be needed by 2050. This requires an investment of about USD1.8 billion or 0.015 percent of GDP over the period, a relatively small amount given the magnitude of potential benefits. While a full assessment of storage needs is required, in many areas, the need for additional storage is already evident; work in these areas need not await a nationwide assessment.

Nature-based solutions (NBS) can help manage changing precipitation patterns. Reforestation can potentially offer multiple adaptation and mitigation benefits by (a) increasing infiltration to reduce the risk of dry season water scarcity, (b) reducing runoff to lower the risk of wet season floods, and (c) reducing erosion to help preserve the capacity of storage reservoirs downstream. Reforestation also allows the sequestration of significant amounts of carbon in biomass and soils.

Removing obstacles to private sector participation in the water sector could speed adaptation. The water sector suffers from private sector under-investment. Current tariff policies and political pressure to keep water tariffs low discourage private investments. Ensuring that sufficient finance is available for the long-term sustainability of water and sanitation services requires a tariff policy that allows increases for improved services and a financing support mechanism to cover the interim operational shortfall during the initial years. Private companies are unlikely to be interested in small-scale investments in water and sanitation projects. Developing such projects that serve multiple municipalities or cities will be more attractive to the private sector and help promote integrated water-use planning. As with other utilities, foreign equity in water and sanitation companies is limited to 40 percent. Investment is also constrained by land acquisition difficulties and a lengthy water permit process.

Increasing climate resilience in agriculture

- Substantial opportunities exist for win-win actions that increase resilience and reduce emissions.
- Many climate actions require policy reforms rather than significant investments.
- Key recommendations include (a) accelerating the adoption of improved practices such as Alternate Wetting and Drying (AWD); (b) improving resilience through diversification; (c) extending irrigation in rainfed areas, and (d) developing Fishery Management Plans (FMPs) that incorporate adaptive management based on changes in migration patterns and stocking rates.

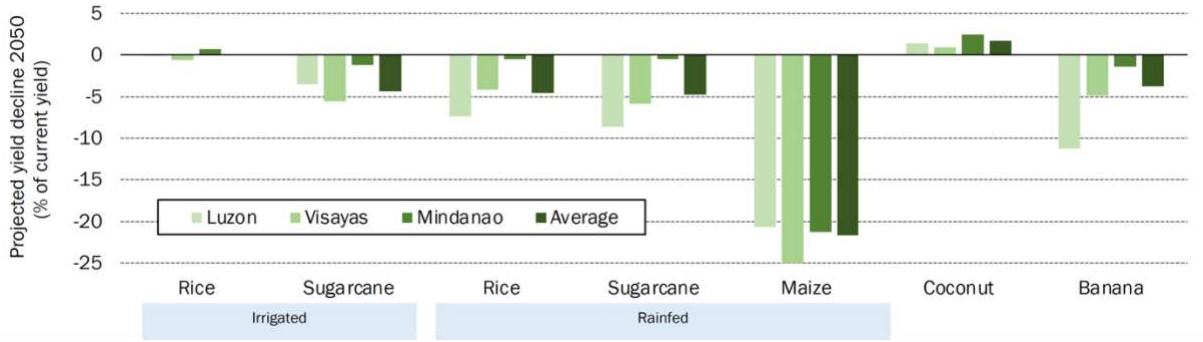
Agriculture remains critically important for food security, employment, and poverty reduction. Agriculture contributes about 10 percent of GDP and employs around 26 percent of the economically-active population. It accounts for about a quarter of national emissions, primarily from methane and nitrous oxide emissions from rice production and livestock, but unlike in other sectors, emissions are not growing.

Slow-onset climate change impacts will cause yields and suitable growing areas of many crops to decline. Rainfed crop yields are particularly likely to be affected by higher temperatures and changing precipitation (Figure ES.3). The areas suitable for producing many crops will shrink, forcing farmers to change crops or cease production altogether. Areas that depend on rainfed agriculture and livestock will tend to fare worse, while areas where most agriculture is irrigated will

tend to fare better—so long as water flows remain sufficient and the infrastructure needed to store and distribute water remains functional. Extreme events may damage growing crops and the infrastructure on which agriculture depends. From 2010 to 2019, about 63 percent of the estimated USD9 billion in damages from natural extreme events and disasters were agricultural. Reduced agricultural production will lead to higher prices, causing significant hardship. Large price increases are foreseen, with the biggest jumps affecting corn, rice, and fruits and vegetables. The poor will be the most affected, as they spend a greater share of their income on food. Under climate change, the number of people at risk of hunger will increase by 8 percent by 2030 and 12.8 percent by 2050.

Climate-Smart Agriculture (CSA) promotes triple wins, raising overall food system productivity while delivering greater resilience and lower emissions. Techniques such as AWD can reduce water use by up to 15–25 percent and cut methane and nitrous oxide emissions by up to 60–70 percent. AWD requires no modifications or design changes to existing irrigation systems and does not entail substantial costs. However, under-pricing of water and other policies constrain the adoption of CSA practices as they disincentivize farmers' efficient water use. Extending irrigation to rainfed areas using water-saving techniques would make these areas much more resilient and productive but may not be financially feasible everywhere.

Figure ES.3: Climate change will reduce many crop yields



Source: Thomas and others (2019).

Toward an energy transition

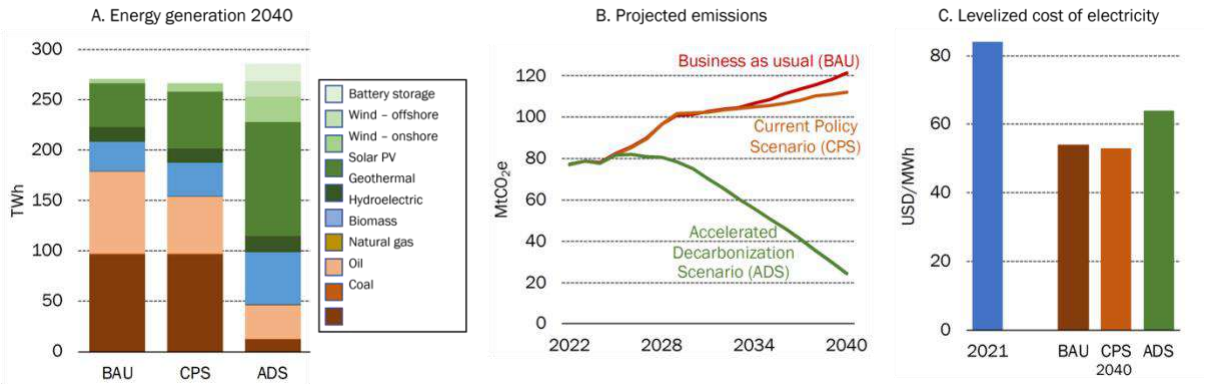
- An energy transition toward a renewable-energy-dominated power system is technically feasible and will enhance energy security and affordability in the Philippines.
- Accelerated decarbonization of the power sector entails substantially more capital investments in solar PV, on-shore and off-shore wind power, and energy storage and transmission compared with the Philippine Energy Plan (PEP) 2020–2040.
- The average cost of electricity is projected to decline compared with the current cost as the power system moves away from coal due to reduced fuel cost and the declining cost of integrating solar and wind energy.
- Key recommendations include: (a) scaling up investments in solar and wind power and corresponding grid capacity and flexibility; and (b) intensifying energy efficiency and demand-side management efforts in buildings and industries.

Energy is the largest contributor to GHG emissions in the Philippines, but the economy is significantly less energy intensive than its regional peers and much less dependent on coal. The primary energy intensity of the Philippines' GDP, which has been falling since 2000, was 6.5 GJ/thousand 2015 USD in 2019, compared with 9.6 in Indonesia and 15.2 in Vietnam. There has been a shift towards fossil fuels in the primary energy mix over the past decade. The government projects electricity demand to triple in the next two decades.

The Philippine power sector has undergone important institutional reforms in the past 20 years, improving competition and private sector participation. These reforms unleashed strong growth in private financing of power generation assets, boosting the total installed generation capacity from 16GW in 2010 to over 26GW in 2020. Philippine power generation assets are generally owned and operated by private corporations. Retail electricity tariffs in the Philippines are 30–40 percent higher than the Association of Southeast Asian Nations (ASEAN) average. The Philippines is one of few countries in the region where the government does not control the domestic prices of most energy products or subsidize energy except for targeted social assistance.

The Philippines is embarking on an ambitious program to scale up renewable energy and phase out investments in new coal-fired power plants but has not announced a timeline for phasing out coal-fired power. An Accelerated Decarbonization Scenario (ADS) would substantially change the mix of power generation technologies (Figure ES.4). Coal-fired power generation would peak in 2025 and then decline to about 15 percent of its peak level by 2040. Natural gas would play an important role as a transition fuel of decreasing significance as other clean technologies become cost-efficient and 'baseload' renewables, such as solar power plus battery storage, are increased. These changes would require substantial investments. Compared with BAU, the present value of capital investments required for ADS would be 53 percent higher by 2030 and 114 percent higher by 2040, based on current estimates of the cost trends of technologies.

Figure ES.4: An energy transition would substantially change the mix of power generation technologies and energy sources in 2040, reducing the levelized cost of electricity compared with 2021 baselines.



Note: The Current Policy Scenario (CPS) is similar to the PEP 2020–2040s Clean Energy Scenario and is aligned with the NDC commitment to peaking coal consumption by 2030. The Accelerated Decarbonization Scenario (ADS) analyzes how power system expansion needs to adapt to reduce annual CO_2 emissions by 80 percent by 2040, compared with BAU.
Source: WB staff analysis based on power sector modeling

The Philippines would benefit from an energy transition toward low- and zero-carbon alternatives. The high capital cost of accelerated decarbonization would be counterbalanced by reduced operating costs (fuel costs, in particular), leading to a lower levelized cost of electricity (LCOE). The system LCOE would be lower than in 2021 under all scenarios. There would also be significant benefits from reduced air pollution. In particular, it would have strong health and socio-economic impacts, with differentiated impacts across different groups, including direct and indirect workers and the broader community. Phasing out coal-fired power would also strand assets. To achieve the 80 percent annual emissions reduction by 2040, only 3 GW of coal-fired power would be in operation, compared with 14 GW under BAU.

Promoting competition in investing and consuming renewable energy (RE) could accelerate the deployment of solar and wind power. Policies and regulations that promote competition in investing and consuming solar and wind power should be implemented. Moving from a feed-in-tariff (FiT) based program to an auction program would increase competition in investment and lower the cost of RE. The private sector already dominates all aspects of investments in the energy sector in the Philippines. Given the additional capital investments required for accelerated

decarbonization, increasing foreign direct investments will be critical to close the financing gap. However, the entry of international private sector investors is still limited in areas critical to the energy transition agenda: a 40 percent ownership threshold still applies to solar and wind projects. The ownership restriction is particularly concerning for developing the Philippines' rich offshore wind resources, which will likely need substantial international know-how and capital in its initial phase. The DOE could amend the implementing rules and regulations of the REA and remove the cap on FDI to accelerate the deployment of FDI in RE projects.

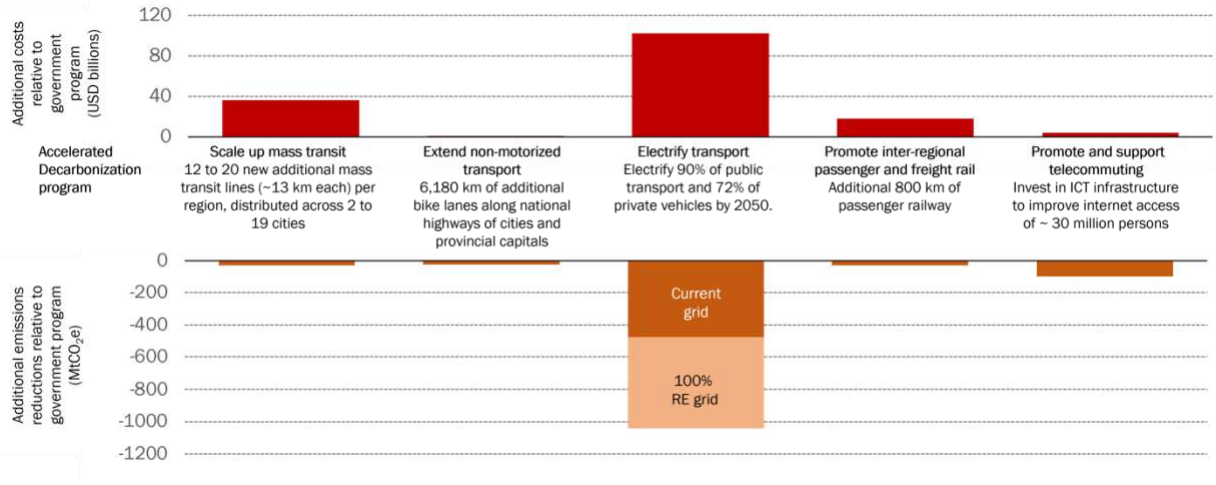
The Government should leverage private sector risk sharing in energy transition financing. Public support would be needed for technologies and applications that involve significant risks to private investors, such as floating solar and offshore wind projects. Such support would de-risk power sector projects, for example, by alleviating grid bottlenecks, ensuring credit-worthy off-take agreements, or providing market-based guarantees. By working with multilateral financial institutions and bilateral partners, the Government can enable blended finance mechanisms to attract private sector capital for accelerated decarbonization.

Reducing emissions from transport

- GHG emissions and local air pollutants from transport would soar under current trends.
- A coordinated, multi-pronged program of interventions can substantially enhance mobility and transport efficiency while reducing emissions.
- Reducing emissions from transport would generate substantial benefits from reduced air pollution.
- Key recommendations include (a) scaling up and prioritizing electrification of the public transport fleet and (b) scaling up and accelerating mass transit development in Metro Manila and other cities.

Urbanization and economic and population growth have led to rapid growth in motorization in the Philippines, accompanied by rising transport emissions. These trends are expected to accelerate in the coming years. The number of vehicles is expected to increase more than five-fold by 2050, with GHG emissions from land transport increasing more than four-fold.

Figure ES.5: Increasing the adoption of electric vehicles would have the largest impact on emissions from transport



Notes: Estimated costs and emissions reductions through 2050
Source: CCDR Transport Team

Implementing the government's low carbon development program will reduce GHG emissions from transport, but much less than the NDC target implies. The Government has proposed several measures to reduce emissions from transport as part of their NDC. However, even if fully implemented, they would reduce emissions by only 45 $MtCO_2e$ by 2030, compared with 301

$MtCO_2e$ needed for unconditional NDC. Numerous options are available to reduce emissions (Figure ES.5). A more ambitious program at an estimated cumulative cost of USD126 billion at 2020 prices could involve simply scaling up several existing initiatives. Electrifying transport would bring the largest benefits, particularly as the power grid becomes greener: emissions in 2050 would be reduced by about 450 $MtCO_2e$ with the current grid, and by over 1,000 $MtCO_2e$ if the power grid was carbon neutral. Low-carbon transport interventions would reduce GHG emissions and bring significant local benefits, including lower air pollution and reduced congestion. The Government is looking to encourage greater private sector participation in low-carbon transport development, such as through the Electric Vehicle Industry Development Act enacted in 2022 to promote domestic production and use of electric vehicles (EVs).

Managing threats and promoting mitigation in urban areas

- Urban areas contribute almost half of Philippine emissions and are particularly vulnerable to climate change.
- In addition to benefiting from adaptation measures, urban dwellers would benefit significantly from many mitigation measures, particularly through reductions in air pollution.
- Key recommendations include: limiting new construction in areas at risk of flooding and storm surges by enforcing land use plans and building design standards and using financial instruments such as insurance.

Cities perform a pivotal development role in the growth and development of the Philippines. Almost half of Filipinos live in urban areas, and the proportion is increasing; the Philippines has the second-highest average urban density in East Asia and the Pacific Region. Philippine cities are also a major source of emissions.

Climate change severely threatens urban infrastructure, economic activity, public service delivery, and human health. The concentration of people, public and private assets, and economic activities in cities concentrates vulnerability to climate change and natural disasters. This is exacerbated by the fact that most Philippine cities are located near rivers or coastal areas, exposing them to both inland flooding and storm surges.

Numerous options could make urban areas more resilient and liveable and emit less. Increasing the energy efficiency of buildings is critical, as the building sector accounts for 54 percent of total power consumption in the Philippines. Moreover, rising ambient temperatures will lead to higher energy use for space cooling. Green buildings would have a lower impact on climate change and can cope with higher temperatures with fewer energy requirements than conventional buildings. Though the initial cost of green buildings is often higher, long-term savings in energy use usually offset this cost. Channeling urban growth away from areas at risk from flooding or storm surges and towards denser, more compact designs would make them more resilient and facilitate the development of mass transit systems.

The Government should intensify energy efficiency efforts in buildings and industries through improved regulations and targeted intervention. Accelerating the adoption of climate-smart building standards is urgent, particularly as buildings are long-lived assets. Retrofitting existing buildings to improve their efficiency is also important. The private sector's role in these areas could be substantial.

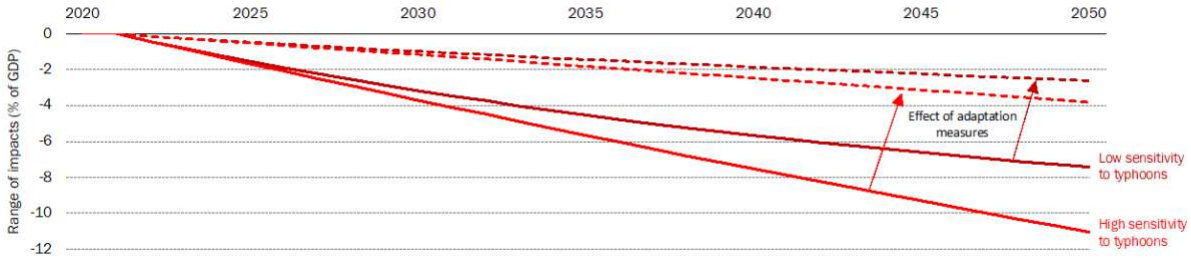
Economy-wide impacts of climate action

Investing in adaptation

- Adaptation measures can reduce the economic losses from climate change by around two-thirds.
- Depending on the financing mechanisms, short-run GDP could be boosted by 0.7 percent compared to the baseline case without investment.
- All sectors would benefit from adaptation, with benefits being highest in capital-intensive industries.

Measures to adapt to climate change could reduce economic losses by around two-thirds. The key adaptation measures are in agriculture and climate-proofing infrastructure. In agriculture, adaptation measures reverse the projected 5.5 percent loss of land and induce a net increase in rice and maize yields. From a macro perspective, however, the most important adaptation measure is to protect vulnerable infrastructure from typhoons, which would avoid a large proportion of the damages. In response to adaptation measures, the mean impact of damages would fall from 3.7 percent to 1.2 percent in 2030 and from 11.0 percent to 3.8 percent in 2050 (Figure ES.6).

Figure ES.6: Adaptation measures could significantly increase GDP relative to the no-adaptation case



Note: We extend the projection period to 2050 to illustrate the sharp increase in damage impact beyond 2040.
Source: CCDR Team estimates based on the MANAGE model.

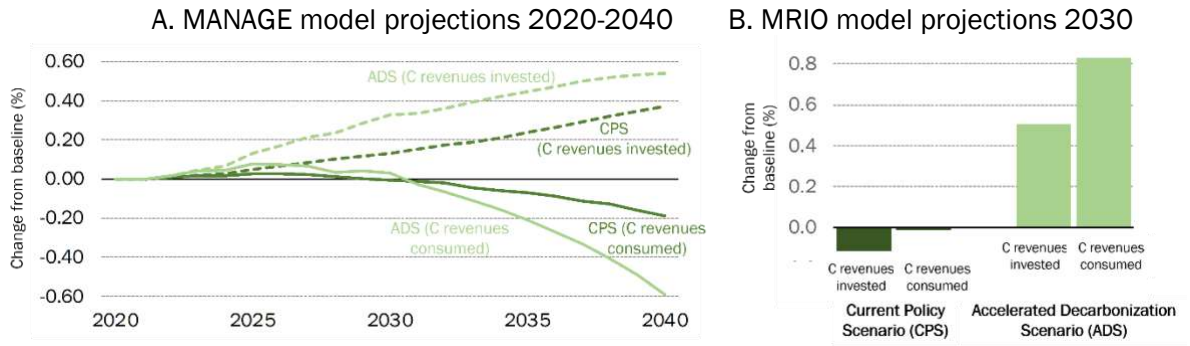
The cost of climate adaptation is substantial but easily outweighed by the economic benefits of reduced climate damage. The cost of new climate-resilient infrastructure in the Philippines is estimated at 0.6 percent of GDP annually, while agricultural measures to boost climate resilience would cost about 0.06 percent annually, bringing total costs to about 0.7 percent of GDP. Even assuming that adaptation investments displace other productive investments, the economic benefits from avoiding damage far outweigh the investment costs at the macro level. Adaptation actions would have net benefits throughout the economy. For example, the agricultural sector would benefit from higher rice and maize yields. Improving the resilience of the capital stock would reduce output loss across all sectors. Capital-intensive sectors would benefit the most. The manufacturing sectors and supply chains that produce the equipment needed for adaptation measures also benefit in the adaptation scenarios. Poverty and economic insecurity would also be reduced, but inequality would be unchanged.

Investing in mitigation

- Mitigation measures would increase GDP by about 0.5 percent in 2040 and generate 80,000 jobs.
- Introducing carbon pricing, as suggested, would lead to less than a 1 percent consumption reduction by 2030 compared to the pre-reform period.
- A carbon tax is progressive, even more so when revenues are redistributed.
- Overall effects on the labor market are expected to be positive but small, with more jobs being created than lost (more so if adaptation investment is taken into account).

The overall economic impact of the mitigation measures up to 2040 is likely to be small but potentially positive, with around a 0.5 percent increase in GDP (Figure ES.7). Investments in the energy sector increase the size of the capital stock and allow higher production. These benefits more than offset any crowding out effects, for example, from displacing investments that could otherwise have added to the capital stock of other sectors. The small impact in the Philippines is due to energy already being expensive, firms not being reliant on cheap energy for profitability, and few domestic fossil fuel sources being displaced. Mitigation measures could also increase employment by nearly 80,000 additional jobs by 2030. Poverty and economic insecurity will fall faster with mitigation measures, although the effect on inequality would be small. The sectors that show the largest output increases are those involved in producing the goods required to transition to a low-carbon economy, such as advanced manufacturing and construction. There is little impact on the economy's other main sectors. Reducing emissions may also facilitate future access to export markets if countries begin to penalize emissions-intensive trade. However, as currently proposed, the EU's Carbon Price Adjustment Mechanism (CBAM) would have minimal impact on the Philippines.

Figure ES.7: The growth impact of an energy transition is likely to be small.



Source: CCDR Team estimates based on MANAGE and MRIO models

Adopting a carbon price would have a very small impact on consumption. The CPS and ADS use carbon prices to reduce emissions (USD5.30 in CPS in 2030 and USD16.60 in ADS). In both cases, this reduces consumption by less than 1 percent by 2030. However, in the short term, before firms and households adjust, higher prices could lead to significant negative poverty impacts—primarily indirectly—through general price increases rather than through the direct effect of higher fuel prices. The negative short-term impacts could be mitigated by recycling carbon tax revenues and spending them on income support or reskilling workers affected by decarbonization measures.

Financing climate actions

- Given the projected loss of physical capital due to climate damage, public and private investments are needed to finance adaptation through climate-resilient infrastructure.
- On the public side, strengthened budget tagging, procurement policies such as Green Public Procurement (GPP), and a layered DRF Strategy implemented by the Government are helping to incentivize climate actions.
- Setting a moderate price on carbon of up to USD5/tCO_2 could signal firms and individuals to adopt low-carbon technologies while raising revenues of up to 0.4 percent of GDP per year.
- On the private side, issuing ESG bonds under the recently introduced Sustainable Finance Framework (SFF) could leverage private climate financing.
- New technology-push and demand-pull policies under development also aim to accelerate the adoption of green technologies and reduce emissions by the private sector.

Mandating climate financing

The source of climate financing depends on the mandate, incentives, and financing terms. Some investments that have adaptation benefits also have private benefits and so may be financed spontaneously by the private sector; a dam for energy generation, for example, would also help manage changing water flows due to rainfall changes. However, given that many adaptation measures provide public goods, their financing is likely to rely more on public finance, like subsidies to make them more attractive, or mandates. Similarly, some mitigation measures can be mandated by private sector actors, such as setting RE targets in the generation mix or requiring climate-proof design of new structures. In such cases, the financing terms could be improved to incentivize mandate uptake by the private sector.

Given the projected loss of physical capital due to climate damage, public and private investments are needed to finance climate-resilient infrastructure. Implementing adaptation measures requires appropriate financing for investments. Mainstreaming climate considerations in public financial management (PFM) is essential. An assessment of the Philippine PFM system indicates room for improvement. Fiscal transfers to subnational governments are only marginally climate-sensitive. Green public procurement (GPP) is increasingly used to gear public investments to achieve environmental objectives.

The Philippines has introduced new mechanisms to improve climate financing options, including issuing ESG bonds under the recently introduced SFF. The Philippines needs to capitalize on recent growth in sustainable private and sovereign debt markets to meet its financing needs to achieve the NDC targets. At the same time, there is an accelerating global trend of investors seeking green investment opportunities. The Philippines' financial sector has yet to tap into the demand for green assets. Several market and institutional barriers must be addressed to scale green finance, including the absence of a relevant taxonomy, which makes it difficult to identify green projects and assets.

Climate-related disasters have had a sizeable negative impact on public finances in the Philippines. To mitigate these impacts, the Government adopted a national Disaster Risk Finance and Insurance (DRFI) Strategy, a key milestone in improving financial planning for disasters. The government continues to roll out new components of this layered DRF Strategy. Its implementation is already showing benefits in ensuring greater resilience to climate disasters.

Incentivizing climate financing

The Government continues to design and implement new technology-push and demand-pull policies to accelerate private sector adoption of green technologies. The technology-push policies are expected to drive significant investment in solar and battery storage technologies without

imposing major burdens on the energy sector or competitiveness. Tax incentives are being used to stimulate demand for green innovation by firms, though the demand for green financing remains constrained. Firms have limited knowledge and awareness about the economic benefits of green technologies.

The financial sector will play a critical role in financing mitigation investments, particularly given the government's limited ability to provide financing. Adopting some form of carbon pricing instruments (CPIs) could induce additional fiscal revenues to finance much-needed climate actions. Carbon prices could be calibrated to minimize the burden of a transition to a low-carbon economy. CCDR simulations indicate that setting a moderate price on carbon of up to USD5/tCO_2 could signal firms and individuals to adopt low-carbon technologies while raising revenues of up to 0.4 percent of GDP per year. The mechanism for carbon pricing is important and can be calibrated to ensure equity.

Amid constrained fiscal resources, the public-private partnership (PPP) framework offers a viable, scalable solution to help the Philippines leverage private resources for climate action. The Philippines benefits from a well-established PPP law and a wealth of experience in PPP implementation. PPPs offer the Government opportunities to introduce and reinforce climate-focused requirements in infrastructure projects, thus promoting sustainable and resilient infrastructure. To promote PPPs in climate financing, the DOF and NEDA could align implementing rules and regulations for climate considerations in project preparation and implementation. Climate resiliency principles and requirements should be introduced in amended regulations to incorporate sustainability better.

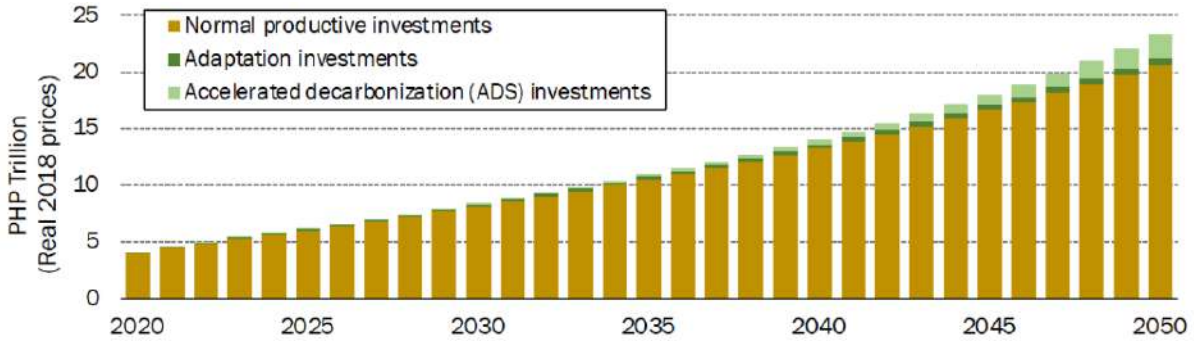
Improving climate financing terms

Climate change can impact sovereign risk and the cost of borrowing through direct and indirect effects on public finances. In addition to developing new sovereign debt and public financial instruments, there is a growing number of global climate funds the Government may wish to tap. To help incentivize private sector engagement and PPPs, the Government may want to consider supporting risk transfer mechanisms to help finance green transition projects. Finally, strengthened budget tagging and procurement policies can also help incentivize the implementation of climate action policies.

Policy recommendations

While climate change significantly threatens development in the Philippines, the country has many options available to reduce risks. Left unaddressed, extreme weather events and slow-onset climate changes would significantly lower economic growth and the well-being of Filipinos. The country, however, has many feasible options to respond to climate risks and has already undertaken a range of responses. In many cases, solutions simply require scaling or fully implementing existing responses rather than developing entirely new ones. The investments required are substantial but not out of reach, representing a relatively small increase over normal, productive investments (see Figure ES.8). Crucially, many of these investments are in the direct interest of individual actors or can be made so by appropriate regulatory and fiscal policy changes. Many actions require no investment, such as ensuring new construction does not occur in areas at risk of floods, storm surges, or sea level rise.

Figure ES.8: The investment requirements needed for adaptation and mitigation actions in the Philippines represent a relatively small increase over normal productive investments



Source: CCDR Team estimates.

The CCDR has identified several priority climate actions, detailed in Chapters 4 and 5 and summarized in Tables ES.1 and ES.2. The tables indicate whether each action is highly urgent, that is, to be implemented in the next five years, or of medium urgency to be implemented later. The tables also indicate whether each action primarily addresses adaptation or mitigation. However, many actions address both methods, and all are intended to help the Philippines meet its development objectives and climate commitments.

Take action to avoid worsening exposure to climate change. Simple actions can reduce future losses from climate change by reducing vulnerability. This includes better flood management, avoiding new construction in areas at known risk of flooding; ensuring new buildings are energy efficient and climate resilient; directing the growth of urban areas in transit-friendly ways; reforming agricultural policies that disincentivize efficient practices, and ceasing building new fossil fuel plants that would be stranded by an energy transition. Most of these actions involve *not doing* something and often require little or no additional expenditures. Some will even bring fiscal benefits, such as carbon taxation, water pricing, and reducing rice subsidies. In some cases, they may involve switching to alternatives that are initially more costly but that are often quickly repaid by reduced long-term operation and maintenance costs and lower risk of loss to extreme events. The tools required to undertake this, such as land suitability maps and building codes, are often already in place in the Philippines and simply need better enforcement.

Make sure the incentives are right. Climate action in the Philippines will primarily have to be undertaken by the private sector, commercial firms, and individual households, especially farm households. It is imperative, therefore, that they have the right incentives. This means (a) ensuring that prices provide the correct signals about the benefits of climate actions and (b) removing obstacles that private actors may face in undertaking climate actions. Farmers can be induced to adopt practices that reduce water use and emissions while increasing productivity by ensuring these practices are more profitable than the status quo. We can induce the private sector to invest in RE by ensuring that RE plants are more profitable than fossil fuel plants. Likewise, private sector investments in electric vehicles and energy-efficient and disaster-resilient buildings depend on their profitability

Remove obstacles to private sector climate action. Even with the right incentives, private sector firms and individual households often face numerous obstacles to undertaking climate actions. The specific obstacles vary, but addressing them may require the following:

- *Ensuring that financing is available.* Many climate actions require significant investments. However, these investments often have return profiles that differ from traditional investments. Financing investments that consider the cost and benefit structure need to be available.

- *Removing regulatory obstacles*. Regulatory reforms to promote FDI, increase competition, lower trade costs, and link firms with global value chains (GVCs) are integral for creating an environment that enables firms to increase productivity and invest in green innovation.
- *Attracting climate actions by foreign investors.* Much of the technology needed to combat climate change exists in foreign markets and could be brought in by foreign investments. In addition to technology, foreign investment brings the best management techniques required to adapt these new technologies to the Philippine market.
- *Ensuring that trained workers are available*. Skills are needed to adapt and run new, green technologies. Technology can have profound effects on labor markets. Green technologies are likely to be no different.
- *Strengthening the financial sector's ability to contribute to climate action*. Many climate actions will have to be undertaken by the private sector, meaning that the financial sector will be critical in offering innovative financing instruments and investment vehicles that reflect the needs of green investments. Ensuring the financial sector can play this role requires strengthening its capacity to offer green financing and ensuring it can protect itself from climate and disaster risks. On the Government side, this requires strengthening the capacity of financial sector regulators to integrate climate risks in their monitoring and supervision, improve climate risk disclosure practices by banks, and accelerate the development and utilization of harmonized taxonomy of green finance and investments.

Climate action in the Philippines must address both extreme and slow-onset events, and responses will need to vary across the country. While efforts are needed to strengthen the management of large-scale disasters like typhoons, slow-onset events should not be neglected. The recommendations include measures to address extreme and slow-onset events, and many address both. The effects of climate change will vary across the country, depending on how climate will change in each area, their socioeconomic conditions, their main economic activities, and the extent and condition of their existing infrastructure. Accordingly, responses must vary. Some areas will see a significant increase in flood risk; those areas need to be prioritized for appropriate risk-reduction measures and response mechanisms. Many areas may not be impacted much by changing precipitation patterns; however, some already have large water deficits that will be exacerbated by climate change; such areas need to be prioritized. Targeted climate actions should also consider poverty and vulnerability; some areas may be less threatened by climate change in an absolute sense, but the people who live there may be less able to respond.

Use adaptive social protection (ASP) to help the poor and vulnerable manage climate change risks and the potential adverse effects of climate action. Even with vigorous adaptation efforts, climate change will affect many people. Some climate actions may also have adverse effects on some groups, such as workers displaced by the move away from high-emission activities or farmers who might have to pay more for irrigation water. Direct support to the affected groups is preferable to perpetuating policies—if present—that cause the problems. The country already has an ASP system that can be scaled to alleviate these problems.

Table ES.1: Priority climate actions by sector

Sector, action	Urgency	Pathway		Dev impact	Lead agency
		A	M		
Water					
Increase water storage capacity to better manage variations in precipitation	High	++		++	DPWH, DENR, RBCO, NWRB
Implement integrated water resource management in river basins	High	++		++	DPWH, DOE, NIA, NDRRMC
Promote water-saving irrigation technologies and increase water use efficiency	High	+		+	DA, NIA
Improve water supply and sanitation and manage urban water demand	High	+		+	DPWH, LWUA, DILG, NWRB, DA, DENR, DOH, LGUs
Improve flood water management	High	++		++	DPWH, MMDA, LGUs
Use NBS to help manage changing precipitation patterns and storm surges	High	++	++	++	DA, DPWH
Agriculture					
Accelerate adoption of improved practices such as AWD	High	+	++	++	DA
Improve resilience in agriculture through diversification	Med	+		+	DA
Extend irrigation in rainfed areas	Med	+		+	DA
Develop Fishery Management Plans that incorporate adaptive management based on on-going data on changes in migration patterns, stocking rates, etc.	High	+		++	DA/BFAR
Energy					
Scale up investments in solar and wind power	High		++	+	DOE
Intensify energy efficiency efforts in buildings and industries	High	+	+	+	DOE
Invest in expanded power-grid capacity and improved renewable energy integration	High		++	+	DOE
Establish a framework to address the early retirement of coal-fired power plants	Med		+		DOE, DOF
Urban					
Limit new construction in areas known to be at risk of flooding and storm surges by enforcing land use plans and building design standards and using financial instruments such as insurance	High	++		++	DHSUD, DPWH, DOF, DILG, LGUs
Promote integrated urban water management for water-secure cities	Med	+		+	DPWH, LGUs, Water districts, LUWA
Direct urban growth toward greater density	Med	+	+	+	NEDA
Transport					
Scale up and prioritize electrification of the public transport fleet	High	+	+		DOTr, LGUs
Scale up and accelerate mass transit development in Metro Manila and cities experiencing rapid urbanization	High	+	+	+	DOTr, LGUs

Notes: A: Adaptation pathway; M: Mitigation pathway; +, ++ indicate the expected magnitude of benefits in terms of increased resilience, reduced emissions, and overall development impact. High urgency measures are intended to be implemented in the short term (<5 years), and Medium Urgency measures are intended to be implemented in the medium term (5-10 years).
Lead Agencies: BFAR: Bureau of Fisheries and Aquatic Resources; BSP: Bangko Sentral ng Pilipinas/Central Bank of the Philippines; CCAM-DRR: Cabinet Cluster on Climate Change Adaptation, Mitigation, and Disaster Risk Reduction; DA: Department of Agriculture; DBM: Department of Budget and Management; DepEd: Department of Education; DILG: Department of the Interior and Local Government; DOE: Department of Energy; DOF: Department of Finance; DOH: Department of Health: DOLE: Department of Labor and Employment; DOTr: Department of Transport; DPWH: Department of Public Works and Highways; DSWD: Department of Social Welfare and Development; DTI: Department of Trade and Industry; FSF: Financial Sector Forum; NEDA: National Economic Development Authority

Table ES.2: Priority climate actions: cross-cutting

Action	Urgency	Pathway		Dev impact	Lead agency
		A	M		
Social protection					
Improve capacity to respond to extreme events by strengthening and increasing funding to ASP programs	High	++		++	DSWD
Strengthen Active Labor Market Programs, such as skills training and green public works, to support affected workers and promote the transition to demanding sectors in energy transition	High	++	+	++	DOLE
Health					
Ensure health facilities are sited and constructed to resist impacts and use medical technologies and products with a lower environmental footprint	Med	++	++	++	DOH
Automate the reporting of climate-related disease outbreaks and conditions and train health workers to recognize and respond to them	Med	++		++	DOH
Education					
Update guidelines and standards for long-term investment in educational facilities to be more resilient and learning-conducive schools	High	++		++	DepEd
Revise the curriculum to enhance students' understanding of climate science	Med		++	++	DepEd
Train teachers, parents, and communities on climate science	Med		++	++	DepEd
Climate finance					
Increase the use of environmental taxes (possibly including carbon taxes or an emissions trading system) to discourage harmful activities while generating revenues	High	++	++	++	DOF, DBM
Strengthen the capacity of financial sector regulators to integrate climate risks in monitoring and supervision and improve bank climate risk management and disclosure practices	High	+	+	+	DOF, BSP
Accelerate the development and use of a harmonized taxonomy of green finance and investments	High	+	+	+	FSF, DF, CCC, DOLE
Stimulate the demand for green activities and strengthen the pipeline of investible projects by accelerating the implementation of existing legislation aimed at stimulating green actions by the private sector	Med	+	+	+	DOF, DTI
Encourage entry of foreign firms that can bring green technology	Med	+	+	+	DOF, DTI, DOE
Investigate constraints that hinder firms from adopting green technology	Med	+	+	+	DF, DTI
Institutional actions					
Focus government spending on tasks that the public sector must undertake	High				All
Improve coordination of climate actions at all levels of government	High				CCAM-DRR
Enhance the capabilities of LGUs to design and implement climate actions	High				DILG
Focus on effective implementation of existing plans and regulations	High				All

Notes: A: Adaptation pathway; M: Mitigation pathway; +, ++ indicate the expected magnitude of benefits in terms of increased resilience, reduced emissions, and overall development impact. High urgency measures are intended to be implemented in the short term (<5 years), and Medium Urgency measures are intended to be implemented in the medium term (5-10 years).
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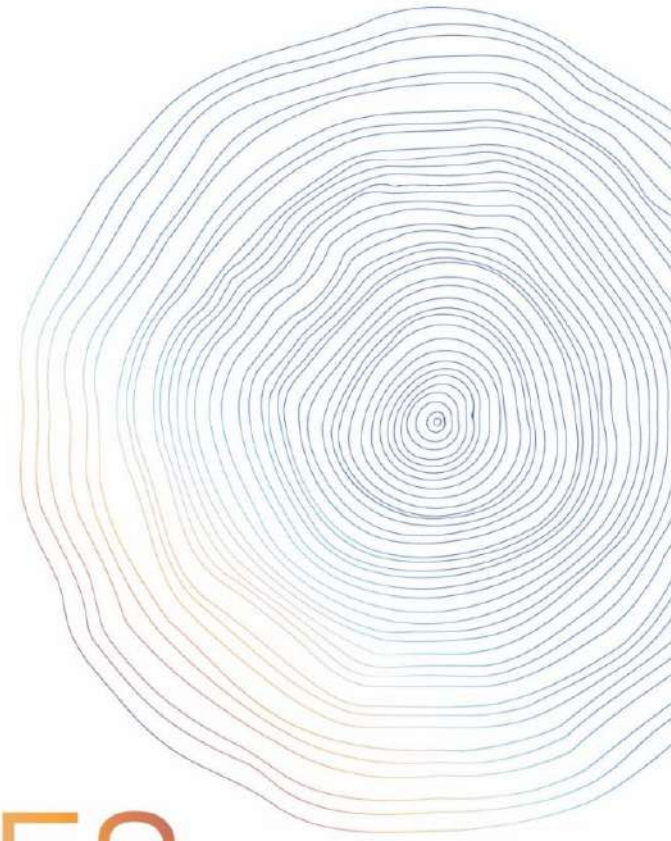


PHILIPPINES

COUNTRY CLIMATE AND DEVELOPMENT REPORT

1

Introduction

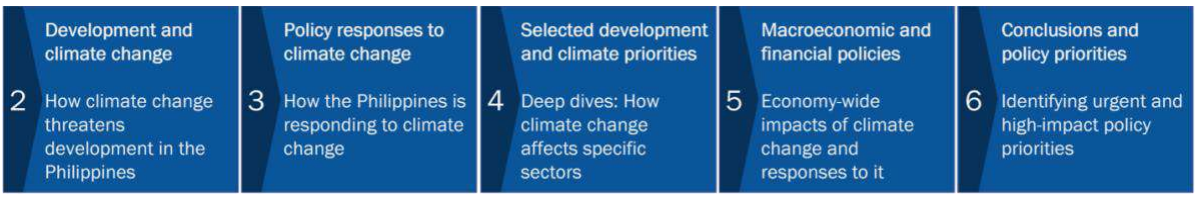
Climate change poses major risks for development in the Philippines. Climate shocks, whether in the form of extreme weather events or slow-onset trends—will hamper economic activities, damage infrastructure, and induce deep social disruptions. Policy inaction would impose substantial economic and human costs, especially on the poor.

The Philippines Country Climate and Development Report (CCDR) comprehensively analyzes how climate change will affect the country's ability to meet its development goals and pursue green, resilient, and inclusive development. The CCDR helps identify opportunities for climate action by both the public and private sectors.

The CCDR shows that climate change poses major risks to development in the Philippines but that the country has many options to address them. If nothing is done, climate change will impose substantial economic and human costs, reducing GDP by as much as 13.6 percent of GDP by 2040, with the poorest households most affected. These effects are likely to vary across and within regions. Adapting to the risks of climate change—including extreme events and slow-onset problems—is critical for the Philippines. It cannot wholly eliminate the costs of climate change, but it can greatly reduce them. Many adaptation responses also contribute to mitigation; conversely, many mitigation measures generate local co-benefits, such as reduced air pollution. Although the Philippines is a relatively low emitter of Greenhouse gases (GHGs), it can contribute to global mitigation efforts through an energy transition, including a transition away from coal. The investment costs of such adaptation measures and energy transition are substantial but not out of reach. A large part of decarbonizing the power system has a relatively low incremental system cost compared with the Government's current plan, mainly involving further expanding renewables such as solar, whose cost is declining. Moreover, it could lead to lower electricity prices. The energy transition should be complemented with energy efficiency measures—notably in transport and buildings—and by encouraging compact city development to facilitate mass transit. The private sector drives economic growth and is pivotal in adaptation and mitigation. As such, appropriate incentives must be in place.

The CCDR prioritizes the most urgent development challenges likely to be impacted by climate change in the Philippines. Even among these, the analysis is necessarily brief. Background papers prepared for the CCDR consider a much broader range of issues and examine them in more detail than is possible here.

Figure 1.1: Structure of the CCDR



Chapter 2 examines the challenges climate change poses for development in the Philippines. Chapter 3 then assesses the country's NDCs and its existing climate policies. Chapter 4 details the sectors and locations most exposed to climate change, examining the likely impacts on economic activities in these sectors and the people who depend on them. The analysis in this chapter relies on a synthesis of prior work complemented, in several instances, on detailed partial-equilibrium modeling prepared specifically for the CCDR. Chapter 5 combines these analytical strands and uses Computable General Equilibrium (CGE) models to assess the impact of climate shocks and climate policy tradeoffs on growth, inequality, and poverty. Chapter 6 summarizes policy recommendations for all key sectors and identifies policy priorities.

2

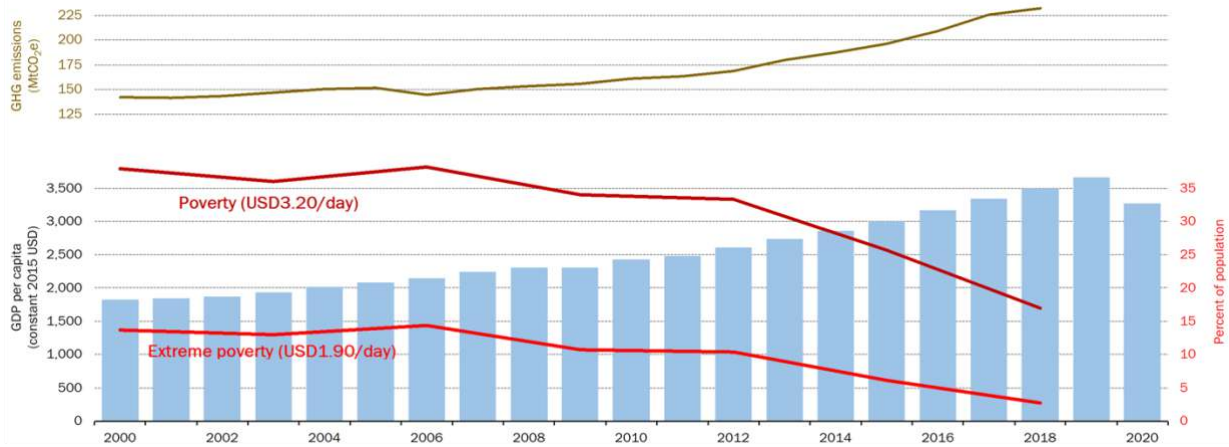
Climate and Development in the Philippines

Climate shocks, in the form of extreme weather events and slow-onset trends, are already hampering economic activities, damaging infrastructure, and disrupting society. These shocks are expected to intensify, threatening the country's development goal of becoming a thriving middle-class society by 2040 and a high-income economy by 2045.

2.1 Context and development priorities and objectives

The Philippines has made considerable progress toward its vision of becoming an upper-middle-income country by 2040. After modest annual growth rates averaging 2.5 percent during 1980–1997, key structural reforms helped the country outperform regional peers, with annual growth rates reaching an average of 6.2 percent from 2010–2019 (Figure 2.1). High growth and job creation, together with increased public spending on education and health, helped millions of Filipinos lift themselves out of poverty, with poverty falling an average of 1.2 percentage points per year between 2010 and 2019. Although many challenges remain, including high inequality and low human capital development, the Philippines seems to be on an upward path, and was poised to graduate to upper middle-income status and achieve its objective to become a prosperous middle-income country free of poverty by 2040 (*AmBisyon Natin* 2040).

Figure 2.1: The Philippines has experienced strong GDP growth and significantly reduced poverty levels; however, GHG emissions have grown



Source: Based on data from the WDI database; poverty lines use 2011 purchasing power parity exchange rates.

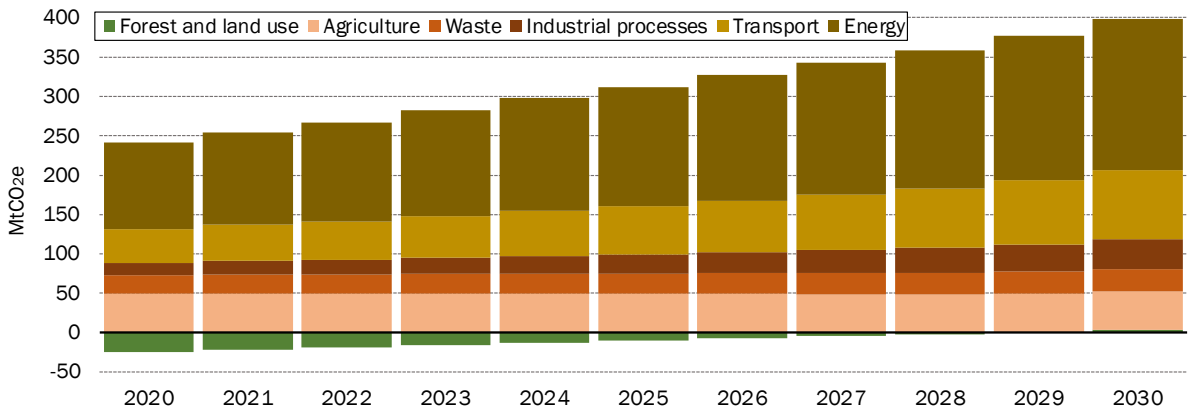
The Philippines still faces many development challenges. The Philippines is making significant progress toward the Sustainable Development Goals (SDGs), but challenges remain (Figure 2.2). Although poverty has declined, there is persistent inequality. Large infrastructure gaps still exist, resulting in high energy and logistics costs, making the country less competitive. Natural capital has been depleted at an average annual rate of about 1 percent of GDP since 1980. Although the depletion rate is slowing, forests and biodiversity continue to be lost, and fisheries are over-exploited. These losses harm the country's growth prospects and threaten the livelihoods of dependents. Although lower than in many other countries in the region, air pollution causes an estimated 66,000 premature deaths a year (Suarez and Garcia, 2021). The country also faces an energy security problem and imports 80 percent of coal for power generation and nearly all its oil, rendering it vulnerable to global energy disruptions.

Figure 2.2: The Philippines still faces major challenges in meeting the Sustainable Development Goals

Source: Adapted from Sustainable Development Report, SDG Dashboard.

GHG emissions in the Philippines are low but growing. Energy and transport are expected to account for most of the growth in Philippine emissions (Figure 2.3). In 2018, total emissions accounted for about 0.8 percent of regional emissions in East Asia and 0.3 percent of the world's total. GHG emissions rose from 90 (megatonnes (Mt) in 1990 to 150 Mt in 2016 and are expected to continue growing. However, the carbon intensity of emissions growth has been low and decreasing compared to peers (Panel A of Figure 2.4). The energy sector accounts for 54 percent of total GHG emissions, while agriculture is the second largest source, accounting for a quarter of emissions. Transport is the biggest fossil fuel-consuming sector and the largest source of urban air pollution. The overall share of fossil fuels in the primary energy supply increased from 60 percent in 2010 to 67 percent in 2019 due to the rapid growth of coal-fired power generation and sustained growth in oil demand from transport. The total primary energy supply is expected to triple to 156 million tonnes of oil equivalent (Mtoe) in 2040, compared with 56 Mtoe in 2020. The country's per capita emissions (2.2 million tonnes of carbon dioxide equivalent or $MtCO_2e$) are among the lowest in East Asia, below those of Indonesia (3.7 tCO_2), Vietnam (4.7 tCO_2), and China (9 tCO_2) (Panel B of Figure 2.4).

Figure 2.3: Emissions in the Philippines are projected to grow

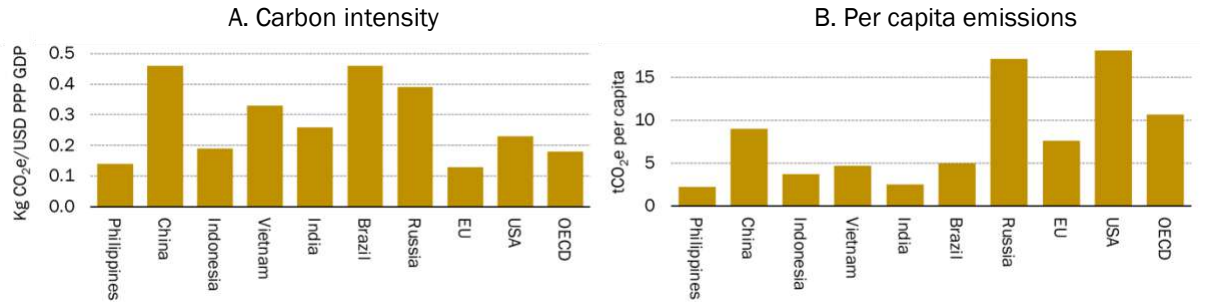


Source: Philippines NDC.

The ongoing challenge for the Philippines is to achieve green, resilient, and inclusive development in a changing domestic and global context. The COVID-19 pandemic interrupted growth and poverty reduction trends, causing the economy to contract by almost 10 percent in 2020 and poverty to increase from 16.7 percent in 2018 to 18.1 percent in 2021 (PSA, 2022a, 2022b). The extraordinary expenditures required during the pandemic resulted in a serious deterioration of the government's fiscal position, exacerbated by the inflationary pressure from the Ukraine-Russia war

and the normalization of monetary policy in advanced economies. The Philippines' competitiveness is constrained by many factors, including a large, informal sector with low productivity, limited access to finance, and large conglomerates that derive significant rents in a domestic market with limited competition. High connectivity costs constrain the digital economy, and high energy costs constrain manufacturing competitiveness. A large infrastructure gap is exacerbated by the country's archipelagic nature and multi-sectoral constraints to building human capital. Addressing these challenges in a fiscally-constrained environment will shift the burden of recovery to the private sector. If the right institutions and incentives are not in place, the country will be unable to achieve green, resilient and inclusive development.

Figure 2.4: Emissions in the Philippines remain among the lowest in East Asia



Note: See Appendix B for additional data on emissions in the Philippines and comparator countries.
Source: Based on data from World Bank *World Development Indicators* database

2.2 Risks from climate change and natural hazards

The Philippine economy is very vulnerable to climate change, both from extreme weather events and slow-onset trends. Climate change may lower the productivity of labor, land, and capital and negatively affect resource endowments and production, especially in agriculture. Climate change impacts may also alter consumption patterns and damage public and private infrastructure, leading to loss of GDP and income, and substantial adverse impacts on Filipinos, and particularly on the poor.

The Philippines has already experienced significant climate change. The mean temperature increase for the country was 0.68°C over the period 1951–2015, increasing by 0.1°C per decade (DOST, 2018). Rainfall has also changed, with some parts of the country experiencing a decrease of more than 20mm/decade, particularly during the dry months from March to May, and an increase of more than 20mm/decade from December to February for eastern parts of the country. Extreme weather, particularly tropical cyclones, have changed their paths towards more southern entry points in the last few decades. Climate change is not just a future concern; it is already affecting many people in the Philippines.

Climate change in the Philippines will continue and accelerate. Projections made by the IPCC's multi-model ensemble indicate that (a) temperatures in the Philippines will continue to increase by about 1–2°C by the end of the 21st century, depending on the climate scenario; (b) average rainfall may not change much, but variability and intensity are likely to increase; (c) extreme events will become stronger and more frequent (see Appendix A). The magnitude and direction of change will likely differ geographically, with the northern and central parts of the country projected to become wetter and the southern parts drier throughout the year.

The Philippines is also highly vulnerable to multiple hazards due to its unique geography. Globally, the country ranks as the eighth country most affected by extreme weather events in 2021, the second highest among Asian countries[1] (Statista, 2021). Climate-related events were the most frequent disasters recorded in the country. An average of 20 typhoons hit the Philippines yearly;

[1] Other indices, such as the Global Climate Risk Index 2021 (Germanwatch, 2021) and the Notre Dame Global Adaptation Initiative (2021) also show the Philippines as being at considerable risk from climate change.

over the past ten years, the country has experienced highly destructive typhoons, with wind strengths above 170 km per hour, almost annually. More intense rains now accompany even weaker typhoons, causing storm surges, heavy flooding, and landslides. Strong typhoons have had grave human, social, and economic costs to the country. These strong typhoons affect nine of 17 Philippine regions, affecting an average of 5 million people, with 850 individual casualties each year in the last 10 years. Annual losses from typhoons have been estimated at 1.2 percent of GDP.[2] In extreme events like Super Typhoon Yolanda (Haiyan) in 2013, losses can reach up to 4.6 percent of GDP. Besides the loss of physical assets, the recently completed IMF-World Bank Financial Sector Assessment Program (FSAP) shows that typhoons can significantly impact banking sector solvency and nonperforming loans (FSAP, 2021).

Sea level rise is likely to have a significant impact on coastal areas. Sea levels have already risen by up to 5.7–7.0 mm per year in some areas due to the country's topography, double the global average from 1951–2015. By 2100, sea levels are projected to climb one-fifth of a meter, regardless of the emission scenario (PAGASA, 2018). Over 7 million Filipinos occupy land within 1m of local average high tide lines, 24 million within 5m, and 36 million within 10m. These populations are increasingly exposed to chronic coastal flooding or permanent inundation as sea levels rise (Kulp and Strauss, 2019).

Damages from climate change are likely to increase. Higher wet-bulb temperatures will severely impact labor productivity, particularly in sectors where work is undertaken outdoors, such as agriculture and construction. In those sectors, productivity is expected to decline by as much as 10 percent for each 1°C rise. Increasing mortality and morbidity will also negatively affect the size of the labor force, further reducing output (Roson and Sartori, 2016). The National Climate Change Action Plan (NCCAP) 2011–2028 recognizes the growing climate impacts. The NCCAP identifies the following areas for action: food security, water sufficiency, ecological and environmental stability, human security, climate-smart industries and services, sustainable energy, and knowledge and capacity development.

Climate change can affect households in several ways, with the poor particularly vulnerable. Climate change and environmental risks affect poverty and inequality through several channels. Rising food prices due to climate-induced drops in agricultural yield will reduce household consumption, particularly among the poor, as food contributes a higher share of their overall consumption (Hallegatte, 2014). Intensive climatic shocks (that is, sudden onset and high severity events such as typhoons, massive floods, or landslides) can cause income shocks through loss or damage of productive assets or increased health expenditures. Persistent extensive climatic shocks of lower severity, such as droughts, can translate into lost labor productivity (Dunne and others, 2013) or drops in agricultural yields and the availability of natural resources. Climate change may also affect households' access to economic opportunities by forcing migration and displacement. Globally, climatic shocks are estimated to cause a yearly average internal displacement of 25.4 million people (Wilkinson and others, 2016). This number is predicted to grow between 25–300 million by 2050, though estimates vary (Gemenne, 2011). The poor are particularly vulnerable to becoming internally displaced, often living in urban areas at greater flood risk or having less economic ability to adapt.

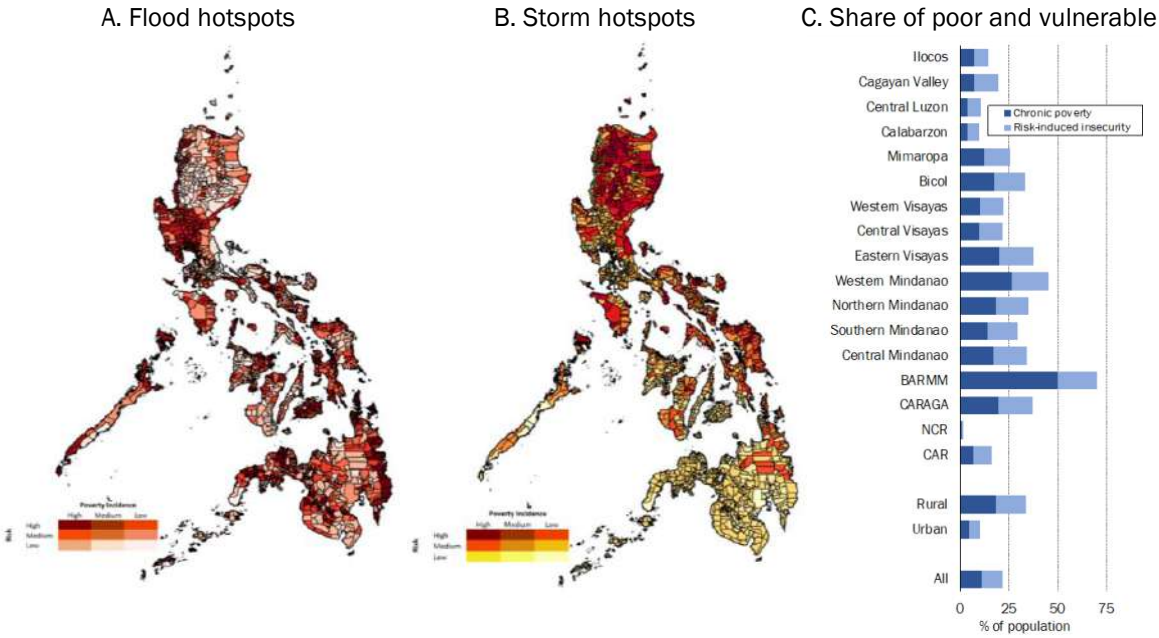
Climate change will disproportionately affect the poor in the Philippines.[3] The poor are the most vulnerable to climate change as they have lower coping capacity, tend to live in cheaper and riskier areas, have fewer safety nets, and often depend on disaster-vulnerable livelihoods such as agriculture and fishing (Figure 2.5). Moreover, many people live close to the poverty line. Reduced family income, displacement, parental absence, and likely migration of families to informal

[2] Estimated using the Philippines Catastrophe Risk Model developed by AIR (World Bank, 2018).

[3] Throughout the CCDR, we define poverty as the population with per capita consumption below USD3.20 per person per day in 2011 Purchasing Power Parity (PPP) terms, which is the World Bank's International Poverty Line for lower middle-income countries. We consider as economically insecure the population with per capita consumption below USD5.50, which the World Bank's International Poverty Line for upper middle-income countries. See World Bank (2018) for more discussion. Inequality is measured using the Gini Index.

settlements due to climate change make children vulnerable to neglect, abuse, poor nutrition, and poor living conditions. This impairs their academic performance or leads to absenteeism. Roughly as many people are vulnerable to becoming impoverished as are already poor (Panel C of Figure 2.5). These vulnerable near-poor people are often not covered by social protection mechanisms. Around 6 percent of the population live in areas with medium- or high-risk of storms and high poverty rates; 5 percent in areas with medium or high-risk of landslides; 11 percent with respect to floods, and 3 percent with respect to drought (World Bank, 2022).[4] Being at risk is not the same as suffering a shock; of the millions at risk, only some will be affected in any given year. Approximately one million Filipinos are impoverished by natural disasters yearly, and an estimated 0.5 million face transient consumption poverty (Walsh and Hallegatte, 2019). Over a third of the non-poor population in most provinces along the Eastern Seaboard is at risk of being pushed into poverty by typhoons (Skoufias and others, 2019).

Figure 2.5: Areas of high poverty are often areas of high environmental risk



Notes: Poverty incidence – Low (<14 percent), Medium (14-27 percent), High (28 percent and above); Storm risk – Low (below median), Medium (50th to 89th percentile), High (90th percentile and above). Chronic poverty refers to people whose income is consistently below the official poverty line; Vulnerable refers to people vulnerable to falling below this line sometimes due to a shock

*Source: P*overty incidence: PSA. Panel C is computed using the World Bank Vulnerability Tool applied to 2018 FIES data.

Women are also likely to be disproportionately vulnerable to climate change impacts but are also effective agents of change. Climate change is likely to affect women differently and often more severely than men due to socio-cultural structures depriving women of access to resources, decision-making power, and information (Basconcillo, 2019; Tatlonghari and others, 2019; Peralta, 2008; OHCHR, 2019). When responding to climate-induced crop failures, more women than men fall into chronic indebtedness from micro-finance or informal borrowing from their social networks. As the managers of household expenses, women face stronger pressure to ensure sufficient resources, while men may be reluctant to request support from their network (Tatlonghari and others, 2019; Peralta, 2008). Women might also be more likely to migrate to improve challenged livelihoods (Tatlonghari and others; World Bank, 2022).

Natural hazards and climate change threaten the private sector and the wider economy in the Philippines. Private sector firms[5] are increasingly aware of climate-related risks and seek to improve their resilience (Casado Asencio and others, 2021). The climate risks and adaptation actions will vary across localities and sectors, but a lack of recent firm-level data on assets,

[4] These figures are not mutually exclusive; some populations in high poverty and at high or medium risk for one risk factor are the same as for another.

[5] The private sector in the Philippines is largely represented by Micro, Small & Medium Enterprises (MSMEs) which account for 99.6 percent of all registered businesses. However, large firms account for about 37 percent of employment.

expenses, financing, operations, managerial capacity, and the use of technologies poses a challenge for policymakers in designing support mechanisms.

Climate change will have various direct and indirect health impacts. The main direct health risks associated with climate change include mortality and morbidity impacts from a gradual increase in temperature, flood and hurricane risks, and worsening air pollution. Wet-bulb temperatures above 35°C can cause serious health issues and death, and the number of such days is expected to soar (see Appendix A). In the Philippines, 61 percent of heat-related deaths are already attributable to climate change (Vicedo-Cabrera and others, 2021). The elderly and infirm are especially affected. Weather also affects the concentration of harmful air pollutants, may shorten the development time of pathogens in vectors, for example, mosquito-, tick-, and rodent-borne diseases, and increase the potential of transmission to humans. Indirect climate health impacts include malnutrition among vulnerable groups from declining agricultural production, falling seafood catches, and higher food prices. Loss of earnings could have similar effects. Extreme climate events may also damage transport systems and health care infrastructure, disrupting access to essential health services. Women were 50 percent more likely to die during Typhoon Haiyan. Women often prioritize the food needs of male household members and children over their own during food shortages (Pross and others, 2020). Activities that cause GHG emissions also contribute to local health impacts through air pollution; transport emissions are particularly concerning in urban areas, as is burning biomass for cooking in rural areas.

Extreme climate events often disrupt Filipino children's education. Typhoon Odette (Rai), which struck in December 2021, affected almost 30,000 schools serving around 12 million students in 11 regions of the Philippines, and caused damage that will cost about USD1.2 billion to repair, or about 10 percent of the Department of Education's annual budget (DepEd, 2022).[6] Slower-onset problems such as rising temperatures also affect education. Prolonged exposure to extreme heat causes heat-related illnesses and discomfort in the classroom, leading to missed school days and lower learning outcomes, especially for young children (UNICEF, 2021). These impacts are concerning, as an educated population is critical for economic development and well-being.

The economic impacts of climate change in the Philippines are highly uncertain but could be substantial and are growing. The increased severity of typhoons will likely remain the largest source of economic costs. Slow-onset trends will also increase costs, particularly through their effects on agricultural yields and labor productivity (see Chapter 5). GDP in 2030 is expected to be at least 3.2-3.7 percent lower than it would have been if climate change ended today (depending on sensitivity to typhoons), with the cost rising to 5.7-7.5 percent of GDP by 2040. However, the impacts could be much worse, depending on typhoon outcomes, potentially reaching 7.6 percent of GDP by 2030 and 13.6 percent of GDP by 2040.

The spatial dimensions of vulnerability to climate and disaster risks are particularly important for the Philippines. The Philippines consists of about 7,640 islands, of which over 2,000 are inhabited. Approximately 51 percent of the population lives in urban areas, which play a pivotal role in the country's growth. Most cities are in coastal areas and are vulnerable to sea level rise, storm surges, and flooding. Cities are also major contributors to GHG emissions through energy consumption, urban transportation, and waste generation. As such, cities would bear the social costs of mitigation measures but enjoy many co-benefits.

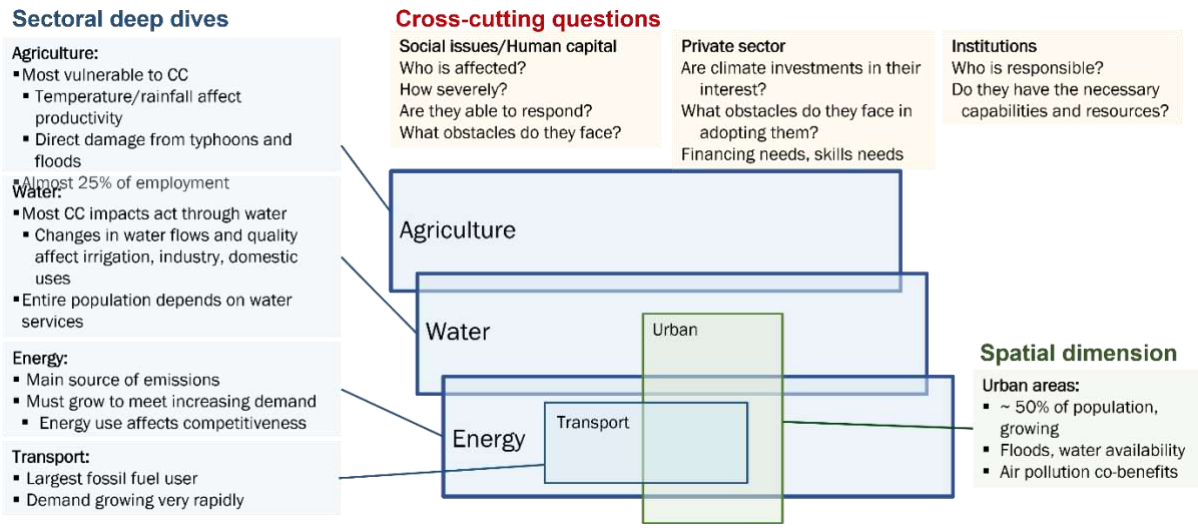
[6] An inventory conducted in 2021 found that most public and secondary school buildings nationwide were at least 25 years old and no longer conformed to current building and fire codes (DepEd, 2021). Schools have often been sited on donated land, even if such land might be exposed to floods or storm surges.

2.3 Understanding how climate change and the responses to it affect the Philippines' development path

Climate change and the responses to it will affect the Philippines in many ways. Climate shocks can negatively affect growth by eroding natural and physical capital, reducing labor productivity, weakening financial stability, altering domestic and external competitiveness, and straining public finances. In turn, policies to address climate shocks can affect aggregate productivity, physical capital, and human capital in various ways. For example, adaptation measures would positively impact short-term growth through Keynesian effects and long-term growth by making economic infrastructure more resilient but are costly and could crowd out other necessary public spending in areas such as health and education. Similarly, mitigation measures that reduce air pollution would strengthen human capital through lower morbidity and mortality but may also increase production costs incurred by the private sector. Climate actions might also displace jobs for low-skill workers in fossil fuel-intensive sectors. Since changes in poverty depend on household income growth and distribution, climate shocks and the policies that address them also impact poverty reduction.

Climate change investments could generate multiple benefits and tradeoffs. Potential benefits include supporting economic recovery, jobs, and innovation; reducing asset losses; and reducing fiscal and financial risks. For example, resilient and green transport connectivity is critical during disasters and increases the logistics system's efficiency, thus reducing transport costs and emissions. A key set of questions facing the Philippines is which adaptation and mitigation policies are in the country's interest when considering costs, benefits, and tradeoffs. For measures that entail tradeoffs, it is important to consider net costs. It is also important to identify any groups who stand to lose and potential obstacles to the transition.

Figure 2.6: The CCDR undertakes deep dives into several critical sectors and spatial dimensions



The CCDR examines the climate and development nexus in the Philippines. The sectors examined in depth were selected based on (a) the extent to which sectors are likely to be affected by or affect climate change and natural disasters, thus altering the country's growth-inequality nexus; and (b) where the largest number of people are most vulnerable to climate change and likely to be most severely affected, driving them into poverty. Based on these criteria, the sectors selected to be examined in depth are agriculture, water, energy, and transport; their characteristics and the reasons for their selection are shown in Figure 2.6. The selected sectors include sectors that are particularly important for adaptation (water and urban), mitigation (energy and transport), and both (agriculture). By focusing on these sectors, the CCDR can also address important issues affecting urban areas. It complements this by examining several cross-cutting issues.

3

Climate Commitments, Policies, and Capacities

- The Philippines has developed a comprehensive set of policies and institutions to address climate change, with a whole-of-government approach.
- Responsibilities and authority over climate action are often dispersed and duplicative; many policies have been only partially implemented.
- LGUs are increasingly responsible for climate action but often lack capacity and resources.

This chapter reviews the country's climate-related national and global commitments. At the national level, it examines the government programs that explicitly and implicitly support climate actions and institutional arrangements.

The Philippines' Nationally Determined Contribution (NDC) has ambitious goals. The country's updated NDC (April 2021) commits to a 75 percent reduction in cumulative emissions (excluding land-use change and forestry) from 2020 to 2030, relative to projected BAU cumulative emissions of 3,340 $MtCO_2e$. However, only 2.71 percent of this proposed reduction is unconditional (reductions that the Philippines will undertake without external support), while 72.29 percent would require external support. The unconditional portion of the NDC is thus very modest and is likely to be easily met under BAU. Conversely, the conditional portion is highly ambitious and will likely only be met if net emissions are reduced to zero before 2030. The NDC recognizes the private sector as the country's main economic growth and transformation engine and promotes its full engagement in climate change adaptation and mitigation.

Recognizing the effects of climate change, the Philippines has developed a comprehensive climate change agenda across sectors and government institutions and has introduced key national policies and legislation (Figure 3.1). Although these policies cover many key issues, the CCDR outlines key coordination and implementation challenges across agencies.

Figure 3.1: The Philippines has developed a comprehensive climate change policy framework

Source: CCDR Team, based on DENR (2020).

Government policies emphasize adaptation, with mitigation actions to be pursued largely as a function of adaptation. The National Framework Strategy on Climate Change 2010–2022 (NFSCC) sets a risk-based framework for national and sub-national climate policies to build (a) the adaptive capacity of communities and increase the resilience of natural ecosystems to climate change and (b) optimize mitigation opportunities toward sustainable development. The strategy considered mitigation an opportunity to capitalize on the country's GHG mitigation potential, leveraging laws like the Renewable Energy Act (REA) while providing development co-benefits, including pollution prevention. The National Climate Change Action Plan 2011-2028 (NCCAP) envisions that public financing will prioritize adaptation to reduce community vulnerability and risks while encouraging private sector participation to optimize mitigation opportunities for sustainable development. The

prioritization of adaptation has remained consistent and was reflected in the Philippines' NDC submission in 2021.

Current institutional arrangements focus heavily on natural disasters. The country has developed several tools, including early warning systems and emergency cash transfers, to help address the consequences of more frequent and severe tropical cyclones and other disasters. However, less attention has been devoted to preparing for slow-onset climate events that do not make headlines, such as rising temperatures and sea levels.

The institutional framework in the Philippines weakens the climate mandate across national and local levels. Currently, the climate agenda is mandated across 22 agencies[7] with limited implementation capacity, including a lack of implementation rules and regulations. The Climate Change Commission (CCC) is the apex coordination body that executes programs through its Climate Change Office. However, its impact has been limited by its lack of resources and weak coordination of climate policy implementation by a wide range of executing agents at national and local levels. The Cabinet Cluster on Climate Change Adaptation, Mitigation and Disaster Risk Reduction (CCAM-DRR) and the National Disaster Risk Reduction and Management Council (NDRRMC) have partially attempted to coordinate and integrate climate actions at the national level through their disaster risk management focus. However, all these bodies are advisory and do not have strong implementation mandates. The implementation responsibilities for adaptation and mitigation lie with individual line departments like the Departments of Energy (DOE), Transportation (DOTr), Agriculture (DA), Environment and Natural Resources (DENR), and Public Works and Highways (DPWH), among others.

Climate action is increasingly being devolved to local governments, risking weakening the capacity to achieve coordinated, comprehensive climate action. Local government units (LGUs) oversee local governance in 81 provinces, 146 cities, 1,488 municipalities, and 42,046 barangays across the country as of September 2020. LGUs are frontline agencies in building communities' climate and disaster resilience. They are mandated to integrate CCA-DRR measures in their two main planning documents—the Comprehensive Land Use Plan (CLUP), which is spatial and long-term, and the Comprehensive Development Plan (CDP), which is multi-sectoral and medium-term.[8] However, LGUs have limited resources and technical capacity and rely extensively on national government agencies to deliver services. This challenge will likely be exacerbated as LGUS take on additional responsibilities with constrained finances. Many climate actions also require multi-jurisdictional coordination mechanisms to be effective, which are lacking.

The Government has adopted fiscal policies and institutional approaches in which subsidies are limited in scope compared to its regional peers. The Philippines began removing fossil fuel subsidies in the 1990s, and key sectors like energy, water, and transport are fully liberalized. The Government has partially integrated climate considerations into its Government-Owned and Controlled Corporation (GOCC) policy framework by mandating banking and energy GOCC entities to support the climate agenda.

The Philippines introduced a Climate Change Expenditure Tagging (CCET) system in 2013 to track budget allocations to climate actions. The percentage share of the climate-tagged budget to the total legislated budget has been consistent from 2017 to 2021 at 6–7 percent.[9] Most of the tagged budget, 95–97 percent, was allocated to adaptation measures. The DPWH had the most climate-tagged programs, activities, and projects (PAPs), responsible for 78–85 percent of tagged PAPs over 2017–2021.[10] followed by DA and DENR. However, gaps need to be filled to support

7 Based on the agencies included in the CCAM-DRR Cabinet Cluster and RA 10174 CCC Advisory Board; the total increases to 26 if agencies under the Inter-Agency Task Force for Sustainable Finance (Green Force) are included.

8 CLUPs cover a minimum of 9 years and are reviewed every 3 years, while CDPs are 3-year plans.

9 The consolidated data is based on the approved PAPs of agencies in the General Appropriations Act (legislated budget).

10 All of DPWH's PAPs are tagged as contributing to adaptation, with typologies including incorporating climate risk considerations in infrastructure (buildings, bridges, water supply, community infrastructure, water storage, coastal defense, etc.) design standards, construction, rehabilitation, upgrading, and improving system planning in transportation, flood control and drainage systems.

implementing these institutional innovations. For instance, despite climate tagging and the whole-government approach adopted, fiscal reporting on climate-related spending and investment remains limited.

The Philippines spends considerable amounts on disaster risk financing. Between 2015 and 2018, the Philippines spent, on average, 0.63 percent of GDP on rehabilitation and reconstruction after disasters, of which the public sector bore almost 80 percent. Out of this spending, 0.20 percent was provided through pre-arranged sources of finance at the national and public agencies level. The rest was funded through regular budgets, reallocations, and general contingency funds. Public infrastructure, social assistance, and disaster rehabilitation for agriculture and housing accounted for most post-disaster costs. However, the data is fragmented, so actual spending is likely higher (World Bank, 2019). In 2015, the Government adopted a national DRFI strategy, a key milestone in improving financial planning for disasters. Guided by this strategy, the Government has since led the implementation of a transformative program to increase financial resilience. It has expanded its portfolio of DRF instruments (Figure 5.14). From 2017 to 2019, the Government financed over PHP3 billion in premiums from the budget through the national parametric insurance program pilot, protecting national government agencies and LGUs against typhoon and earthquake risks (World Bank, 2020a). Every year, the Government allocates resources to the National Disaster Risk Reduction and Management Fund and Quick Response Funds to address the higher frequency of disasters. It has also leveraged contingent lending from international partners. However, household-level penetration of insurance products remains modest at 0.5 percent, mainly due to affordability issues.

Efforts to measure climate change costs remain embryonic. The Philippines, through its Wealth Accounting and Valuation of Ecosystem Services (Phil-WAVES) program, has been a world leader in developing accounts for the value of natural assets. The NEDA Board and the Philippine Statistics Authority (PSA) adopted the UNSD System of Environmental-Economic Accounting. Satellite accounts were developed for several natural assets in vulnerable areas of Laguna de Bay and Palawan, which have been used to asses the costs of loss or damage to natural assets through climate change and other causes.[11] However, these efforts are limited in scope and spatial scale and are not updated regularly. Likewise, efforts to measure the specific costs of climate change have been ad-hoc and limited to specific issues.

The Government has developed frameworks to green the financial sector and instruments at the regulatory level. The Department of Finance (DOF) and the *Bangko Sentral ng Pilipinas* (BSP) launched the Sustainable Finance Roadmap in 2021, followed by the issuance of a sovereign green bond framework. Building on this framework, the BSP is issuing a series of guidelines for banks. The Securities and Exchange Commission has formalized the country's use of ASEAN green bonds and sustainability bond standards. The Insurance Commission facilitates local insurers' development and supply of catastrophe insurance products. The Green Jobs Act established a legal framework to provide tax deductions to incentivize firms to invest in green activities and create green jobs. Firms in green sectors and investing in green activities are eligible for tax deductions under 2021's Corporate Recovery and Tax Incentives for Enterprises (CREATE) Act. The Government of the Philippines is developing definitions and standards to certify green goods, services, and technologies. Once fully developed and operational, these definitions are expected to help banks identify green assets and incentivize green investment.

The role of the private sector will be crucial in meeting the growing demand for climate action. Unlike many other countries in the region, state-owned enterprises (SOEs) play only a minor role in the Philippines' economy. Many climate actions are likely to be in the direct interest of private sector firms. An estimated USD168 billion climate investment opportunity in greening the energy, agriculture, manufacturing, and transportation sectors and building climate-smart cities could

[11] These accounts have already proven their utility by enabling strong policy responses. In Laguna de Bay, for example, they have been used by the Lake Development Authority (LLDA) to justify a massive dismantling of fish pens and a significant reduction in number of fish pen permits issued.

generate 3 million new direct jobs in the Philippines between 2020 and 2030 (IFC, 2021). Some large corporations voluntarily invest in green activities, driven by high energy costs and increasing public attention to climate change and corporate sustainability.[12] However, many of these investment opportunities may not materialize if constraints include a lack of financing and limited access to technology or skills. The COVID-19 pandemic has severely strained public finances, meaning private sector financing is critical in the transition to low-carbon development.

Amid constrained fiscal resources, the PPP framework offers a viable, scalable, and increasingly relevant solution to help the Philippines leverage private resources in climate action. The Philippines benefits from a well-established PPP Law and vast implementation experience. PPPs offer the Government opportunities to introduce and reinforce climate-focused requirements in infrastructure projects promoting sustainable and resilient infrastructure. PPPs are well-placed to deliver on this agenda as, with proper regulation, they promote the discipline to (a) assess project risks, including climate-induced, throughout the project's life cycle, (b) determine the most efficient way to allocate, manage and mitigate these risks, and (c) reflect these analyses in project design and implementation plans.

Private sector energy companies are increasingly investing in adaptation to ensure continued customer service while protecting future revenues, minimizing costs, and reducing losses. The Energy Development Corporation, the largest geothermal energy company in the country, has embedded climate risk into its decision-making. It included intensifying climate-related natural events in its modeling and risk analysis, which led them to invest over USD6 million[13] in additional resilience measures and critical infrastructure. This minimizes risk exposure and ensures a continuous energy supply to consumers and the local community while protecting future revenues, minimizing costs, and reducing losses.

Socially, Filipinos are very concerned about climate change. Recent surveys have found that about three-quarters of respondents in the Philippines believe that climate change is serious and poses an immediate threat to their country and well-being.[14] Most respondents (71 percent) in a 2020 national representative survey said that they would be "at least somewhat affected by climate change" with harm (46 percent), loss of income (21 percent), damage to crops (20 percent), damage to house and property (19 percent), and farming becoming unviable or a change in livelihood (18 percent) ranking as the top five impacts (Bollettino and others, 2020). Residents of the Eastern Visayas were most concerned with farming impacts (40 percent), while those of the National Capital Region (NCR) were most concerned with health impacts (70 percent). A recent World Bank Social Understanding exercise indicates that Filipinos experience and perceive climate change mainly through extreme weather events like typhoons (World Bank and Citibeats, 2022).[15] The exercise also found that the impact of climate change on agriculture is a key concern for respondents, who worry about temperature changes affecting crops and the consequences for livelihoods. Sixty percent of rural respondents' comments are about agriculture, with women particularly concerned about climate change's effect on the sector (61 percent), while men are more worried about the consequences for employment and the economy (52 percent).

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12 For example, cement manufacturers have reduced the use of fossil fuels and increased energy efficiency to lower their energy costs, which make up half of their production costs (World Bank, 2020a); and Globe Telecom, the country's largest mobile network operator, sourced 102 million kWh of electricity from renewable energy and deployed energy efficient technologies in 2021, in an effort to meet its commitment to achieve net zero GHG emissions by 2050.

13 The adaptation project implemented by the Energy Development Corporation was part of a larger capital expenditure program to optimize the output of its geothermal generation. The program was supported by the proceeds of IFC's 15-year USD90 million equivalent green bond issued in 2018, the first internationally rated triple-A Philippine peso-denominated green bond issued by a multilateral development institution.

14 A Statista survey found that 74 percent of respondents believed that climate change was serious and an immediate threat to their country and well-being (Statista, 2022), while the Facebook International Public Opinion on Climate Change survey found that 76 percent of respondents in the Philippines said that climate change is either "extremely" or "very" important to them (Leiserowitz and others, 2021).

15 "Social Understanding" consists of (i) collecting data (social listening from social media and citizen surveys), (ii) understanding (analysis and interpretation of the data), and (iii) acting (development and implementation of strategies based on the identified findings). The approach detects and analyzes complex and constantly evolving narratives about topics that concern citizens. In the Philippines, the World Bank is focusing its Social Understanding on climate change and social risk management to better understand how the broader population perceives issues related to climate change. The Social Understanding exercise consists of social media analysis (62,657 comments on Twitter, Facebook, and blog forums) and citizen surveys (412 responses).

Communities mainly understand climate change through the lens of disaster events like typhoons. This can create a mistaken belief that climate change is simply cyclical and that existing coping strategies will be sufficient. Current coping strategies center on family and community support networks, which cushion people against weather shocks in urban and rural areas.[16] However, as vulnerable coastal communities increasingly experience unfamiliar and unpredictable weather patterns, their current coping strategies are insufficient. Research suggests that the lack of coping capacity for new challenges presented by climate change is rupturing social structures, challenging livelihoods, and deepening poverty (Navarra, 2016).

The Philippines has implemented various ASP programs, many of which are helping people adapt to climate change. The country's flagship social safety net program, *Pantawid Pamilyang Pilipino Program* (4Ps), provides cash assistance to around 4.4 million poor and near-poor households and has been a key instrument for poverty reduction and human capital investment.[17] The 4Ps program has provided additional support in the wake of natural disasters. For example, the Department of Social Welfare and Development (DSWD) provided top-up payments to the 4Ps beneficiaries affected by Typhoon Yolanda (Haiyan) in 2013. With extreme events becoming more frequent and intense, ensuring such mechanisms are systematic and well-funded is critical for timely assistance to reduce the adverse impacts of shocks on people's welfare. Thus, the DSWD institutionalized the Emergency Cash Transfers (ECT) program as one of the ASP mechanisms under the Adaptive and Shock Responsive Social Protection Roadmap. DSWD's community-driven Kalahi-CIDSS development program is another key response mechanism.[18] After Typhoon Yolanda, Kalahi-CIDSS used its Disaster Response Operations Model to support poor communities in planning and implementing small infrastructure projects for urgent recovery, a role repeated in several other emergencies. However, the ECT is still only implemented at a small scale in a pilot area, mainly due to the lack of financing mechanisms.[19] Despite the Philippines' well-established ASP system, social insurance coverage is limited, putting many vulnerable people at risk of poverty during shocks. ASP programs have been used to mitigate harm to specific groups resulting from policies expected to have broad social and economic benefits. For example, the Government provided Unconditional Cash Transfers to existing social assistance beneficiaries (4Ps and Social Pension) and some others to compensate the poor for the adverse effects of tax increases caused by the TRAIN Law of 2016.

The Philippines has also used education to help combat climate change by ensuring students understand the topic and teaching the necessary skills for green jobs. The Climate Change Act mandates the integration of adaptation concepts into health, science, social studies, and values education from kindergarten to senior high school. The Green Jobs Act mandates the basic education sector to teach green skills. The success of these initiatives has been mixed, however, partly as science education shortcomings have limited students' understanding of climate change. Strengthening teacher training on climate change adaptation and improving awareness of climate science among parents and communities via schools is essential to enhance students' understanding and encourage action.

[16] In surveyed coastal communities for instance a well-organized system for extreme weather events has been developed by mapping the location of shelters and assigning vulnerable families to neighboring hosting households for evacuation.

[17] 4Ps was responsible for a quarter of the total poverty reduction between 2006 and 2015 in the country (World Bank, 2018). One study indicates that 4Ps reduced poverty by 1.4 percentage points per year (Acosta and Velarde, 2015).

[18] The Kapit-Bisig Laban sa Kahirapan - Comprehensive and Integrated Delivery of Social Services (Kalahi-CIDSS) program is financed under the World Bank's National Community Driven Development Program (NCDDP).

[19] The country has an annual appropriation for QRF as a major disaster risk financing mechanism, but the size of the funds is small and often insufficient to support a rapid scale up (Qian and others, 2020). The DSWD estimated the required budget for ECT based on historical data on served population by DSWD's relief assistance among disaster-affected population and submitted it to the Department of Finance (DOF) for FY 2022.

4

Selected Development and Climate Priorities

This chapter presents an in-depth analysis of challenges and opportunities for climate-related actions in selected sectors. The CCDR examines how climate change will likely affect each sector, the people who depend on them, and the possible responses to the effects of climate change. The analysis focuses on sectoral effects, but their impact is often felt throughout the economy. Impacts affect the quantity and price of their outputs, the demand for inputs, including labor, goods and services, participants' incomes, and many other linkages. The detailed analyses rely on existing studies, in some cases complemented by new analyses. Additional detail can be found in the background papers.

4.1 Improving water resource management

- The impact of climate change on water users will vary significantly across the country. Northern and central regions (Luzon and Visayas) will likely become wetter, and the southern region (Mindanao) drier.
- Improving water storage could substantially mitigate the impacts of climate change on water users, but the needs have not been determined.
- Key recommendations include (a) increasing water storage capacity to better manage rainfall variations; (b) implementing integrated water resource management; (c) promoting water-saving irrigation technologies and increasing water efficiency; (d) improving water supply and sanitation and managing urban demand, and (e) improving flood management.

4.1.1 Sectoral context

Water is central to the climate change discussion as it supports energy, agriculture, ecosystems, industry, human capital accumulation, and health. Many of the threats posed by climate change to economic growth and the wellbeing of people are likely to act through water. Changes in rainfall patterns will affect water availability for irrigation, industry, domestic use, and hydroelectric power (HEP) generation. The risks of floods and droughts will increase, and more frequent and severe typhoons will damage water infrastructure, affecting water availability for various uses. Water-related issues vary in magnitude across hydrological regions[20] due to differences in climate, topography, soils, land use patterns, and the nature and magnitude of water use.

Agriculture dominates water use, but industrial and domestic uses are also important in some regions. Agriculture is the biggest water consumer, accounting for about 68 billion cubic meters (73 percent) of total yearly withdrawals in 2018 (Figure 4.1). This is mostly from surface water, though groundwater use for irrigation is significant in the Central Mindanao and Central Luzon basins (NWRB, 2016). Agricultural use is followed by industry at 17 percent and municipal supply at 10 percent.[21] Domestic use also relies heavily on groundwater. Water is also important for HEP, which contributes 7.1 percent of total power generation.[22]

The Philippines has abundant water resources, but this is not true everywhere in the country. Total water demand for irrigation (the largest water user by far) only accounts for about 20 percent of available flows. However, in Regions I (Northwest Luzon) and III (Central-Southern Luzon), which account for a quarter of the irrigated area, water demand is nearly double what is available. Region II (Cagayan) only has a small supply surplus compared to demand. There are often conflicts

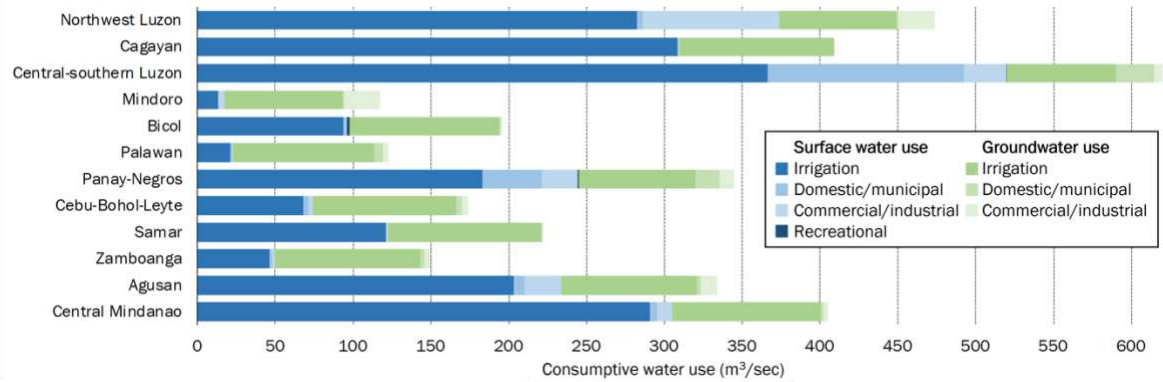
[20] The country is divided into 12 hydrological regions based on rainfall distribution or climate type, watershed characteristics, and water use profile. These hydrological regions align to some extent with the 17 regional administrative divisions in the country.

[21] As of 2020, about 94 percent of the population had at least a basic drinking water service and around 82 percent had basic sanitation service (WHO and UNICEF, 2021). However, some areas have no or very limited WSS service, and others only have water access for a few hours a day and/or with water quality problems.

[22] The total installed HEP capacity in the country as of 2020 is 3,623MW, primarily on Luzon (12 large plants with a capacity of 2,523MW) and Mindanao (9 large plants with a capacity of 1,083MW) (DOE, 2022). The untapped HEP potential is estimated at 13,097MW.

between competing uses in areas with substantial urban areas—particularly in the Central-Southern Luzon basins supplying the NCR.[23] Even though HEP is non-consumptive (except for evaporation), the need to supply domestic water systems may force water to be released at times unsuitable for power generation.

Figure 4.1: The extent and composition of consumptive water uses varies by region



Notes: Based on water extractions permitted by the NWRB

Water use in the Philippines is governed and managed by over 30 institutions with overlapping mandates and functions. The National Water Resources Board (NWRB) regulates all water resources and services nationally. However, irrigation systems are developed and overseen by the National Irrigation Administration (NIA) and for domestic use by the Local Water Utilities Administration (LWUA), the Metropolitan Waterworks and Sewerage System (MWSS), local government units (LGUs), and several others. National government agencies such as the DA, DPWH, DENR, and those of the Interior and Local Government (DILG) also implement water-related programs. LGUs are primarily responsible for providing water and sanitation services (WSS).[24] The many overlapping institutions create conflicting policies, leading to an uncoordinated approach to water issues. For example, water use allocations are based on a first application and reservation basis and not on integrated planning. Regulations and service standards for water and sanitation differ across the country, and budget allocations across agencies do not match sector priorities.

4.1.2 Impact of climate change on water

Climate change will affect water availability significantly, but these effects are hard to predict and will vary substantially in different parts of the country. Average precipitation levels may not change significantly (Appendix A). However, both the regional and the inter-annual and intra-annual distribution of precipitation may change. Higher temperatures will also affect water availability through increased evapotranspiration. The northern and central part of the country will likely become wetter on average, while the south will become drier. The number of flood events has already increased markedly in Mindanao over the last two decades. It is expected to increase further thanks to climate change and more tropical cyclones passing through the southern part of the archipelago (David and others, 2013). Thus, the frequency of flooding is expected to increase with a projected wetter Luzon, while more devastating impacts of less frequent but high-intensity floods are expected in Mindanao (Table 4.1).

[23] The multi-purpose Angat Reservoir, built in 1968, may be the most extreme case of competing uses. It originally supplied 36 m³/s for irrigation and 22 m³/sec for domestic supply, generated electricity from two HEP plants with a total capacity of 236MW and helped control floods. However, the growth of Metro Manila resulted in the allocation of water for domestic use being increased to 46 m³/sec, while that for irrigation was reduced to 21 m³/sec despite additional flow being obtained from the Umiray watershed in 2000. These changes also mean that the 200MW capacity of Angat's main HEP plant is seldom used.

[24] LGUs have various arrangements for WSS, including government-owned and controlled corporations, local water districts, LGU-run utilities, community-based water groups, and private water companies. The private sector, mostly large corporate firms and a few small companies, plays a key role in providing WSS services in many parts of the country, through partnerships with Local Water Districts or LGUs. The regulation of these various water service providers is not consistent, with differences in standards and procedures for service level requirements and tariff setting.

Changes in water flows may significantly impact economic activities in some areas. Where water is already insufficient or close to it, as in Regions I, II, and III, any flow reduction would reduce the irrigable area. Water is generally plentiful in other regions, meaning even significant changes in average flows may have little impact on many areas. Even in these areas, however, changes in rainfall distribution can increase flood risk in the wet season and water scarcity in the dry season, exacerbated by recurrent El Niño occurrences. These impacts would affect irrigation, as discussed in Section 4.2. More frequent low-flow conditions are expected in Central Mindanao, likely resulting in lower HEP production. In many urban areas, water scarcity is felt during the dry season when demand is at its peak (Tabios, 2021). Water service providers must ration water, and households must collect and store water for daily use. Groundwater has also become an option for some water service providers and commercial and industrial users for emergency water supply. Flood-prone areas in Northwest Luzon and Central-Southern Luzon will need proactive measures to protect homes and businesses from recurring high-intensity flooding. A flood management master plan study was prepared in 2012 for Metro Manila after 2009 Typhoon Ketsana.[25] However, problems implementing the Master Plan make it unlikely to be fully implemented.

Table 4.1: The increase in the risks of flooding and drought varies across hydrological regions

	Flooding		*Drought*	
River basins	*Frequency*	*Intensity*	*Frequency*	*Intensity*
Northwest Luzon	Very high	High	Moderate but with an existing deficit	Low but with an existing deficit
Cagayan	Moderate	Low	Low	Very high
Central-southern Luzon	Very high	Very high	Low but with an existing deficit	Low but with an existing deficit
Mindoro	Moderate	Moderate	Low	Low
Bicol	Moderate	High	Moderate	Very high
Palawan	Low	Low	Moderate	Moderate
Panay-Negros	Moderate	Moderate	Low	Moderate
Cebu-Bohol-Leyte	Moderate	Moderate	Low	Moderate
Samar	Moderate	High	Moderate	Moderate
Zamboanga	Low (increasing)	Moderate	High	Moderate
Agusan	Low (increasing)	Low	High	High
Central Mindanao	Low (increasing)	Low	High	Moderate

Notes: Based on analysis of historical flood and drought events using the Global Runoff Reconstruction (GRUN) flooding dataset (Ghiggi and others, 2019) and of the impacts of climate change using the IPCC6 Coupled Model Intercomparison Project (CMIP) model and downscaled CMIP5 model (Villafuerte and others, 2020) and the RCP8.5 scenario.
Source: Analysis by CCDR Team.

Climate change will increase pressure on already stressed domestic water supply systems. Many such systems have struggled to keep up with rapid urban growth. Metro Manila had a water supply gap of more than 600 million liters per day[26] (mld) in 2018 (MWSS, 2019). Metro Cebu's water supply gap increased from 275 mld in 2011 to over 332 mld in 2020 (MCWD, 2020). Higher temperatures will likely exacerbate this shortfall as people use more water to cope, and evaporation from reservoirs reduces supply. Increased rainfall intensity will also increase surface water turbidity, reducing water treatment capacity. Meeting this increased demand will require considerable investment to bring in water from additional sources, substantially improve water delivery efficiency, and manage urban water demand.

Changes in weather patterns will also impact water quality. High rainfall events cause runoff that increases river water's turbidity, lowering water treatment plants' capacity and increasing

[25] Typhoon Ketsana caused substantial damages and losses equivalent to 2.7 percent of the GDP, affected 4.9 million people, and caused more than 1,000 casualties. The Metro Manila Flood Management Master Plan estimates that a 100-year return flood has the potential to impact all of the Metro Manila area (with parts of Rizal), with damages reaching as much as PHP150 billion (in 2015 prices), equivalent to around PHP9,600 per capita.

[26] Based on water demand in Metro Manila plus a 25 percent buffer zone.

treatment costs. Runoff can also carry contaminants like animal waste and pesticides that may contaminate drinking water. Water-related diseases usually follow flooding events due to contamination, and stagnant pools of water created by receding floodwater become breeding grounds for mosquitoes that transmit disease.

Major water-related events attributable to climate change will disproportionately hurt poor people. The poor are likely to be affected through multiple channels: by reducing employment in irrigated agriculture and increasing the price of agricultural products; by reducing the availability of water for household uses such as drinking and cooking; through direct exposure to floods and droughts.[27] The increasing salinity of surface water and groundwater resources due to sea level rise makes potable water less accessible and more expensive for the poor, especially those living in isolated and island areas (World Bank, 2022a). Areas with high-risk potential for flooding or droughts are correlated with areas where the poor are heavily concentrated.

4.1.3 Increasing resilience in water: Recommendations

Operationalize integrated water resource management (IWRM) plans that consider the projected impacts of climate change on water flows. IWRM promotes the coordinated development and management of water, land, and related resources to equitably maximize economic and social welfare without compromising ecosystem sustainability. The ideal is an IWRM plan that integrates climate change projections for a river basin, looks at water availability and water uses prioritizes needs, and lays out the institutional architecture needed for the coordinated management of water resources for a river basin. An IWRM plan considers factors including flood management, irrigation and aquaculture, and HEP. It provides a computational tool for decision-making to manage water competition. While all 18 major river basins in the country have Integrated River Basin Management and Development Plans, these lack water allocation and planning mechanisms and are little more than infrastructure wish lists that do not consider the basins' water availability.

Harmonize the roles of the River Basin Control Office (RBCO) and the NWRB. The River Basin Control Office (RBCO) is intended to be the lead agency to implement the IWRM, but it is underfunded, with no real implementation capacity. Its role must be harmonized with the NWRB, which approves water rights allocation for proper water resource management. The proposed creation of a Department of Water Resources (DWR) is intended to address the management of the country's water resources. A DWR bill is pending in Congress and has been identified as a priority bill by the current administration.

Increase storage capacity to reduce the impacts of more frequent extreme weather conditions. During drought conditions, stored water augments the supply from the natural flow. During extreme rain events, dams and reservoirs can dampen flood heights downstream. The Philippines has over a hundred dams with a total capacity of almost 7 million m^3, including about fifty moderate to large dams and six major multipurpose dams. However, the country's per capita storage capacity was only 68 m^3 as of 2017, well behind that of neighboring countries (FAO-AQUASTAT). An analysis of water deficits and storage needs in water-stressed Central Luzon estimated that about 4,868 million cubic meters (MCM) will be needed by 2050, requiring a USD1.8 billion investment. At about 0.015 percent of GDP over the period, this figure represents a relatively small amount given the magnitude of potential benefits. While a full storage assessment is required, the need for storage is evident in many areas already, and work there should not wait for a nationwide assessment. Increasing storage capacity may require building new facilities, but where there are existing dams, retrofitting or rehabilitating them may be an option. Work on improving existing dams and new water storage can be done in partnership with the DOE.

[27] Farmers in Mindanao, for example, report loss of electricity, lack of potable water, and damaged roads (which make travel and transportation of farm produce difficult) following floods (Chandra and others, 2017).

Prepare and implement flood management master plans. Flood management master plans that use a river-basin approach are needed, especially in flood-prone cities.[28] The DPWH is tasked with developing and implementing national flood management projects in coordination with local governments. Many of these programs have been financed by the Japanese International Cooperation Agency (JICA) and the World Bank, and implementation requires the full support of local governments. The experience of the Metro Manila Flood Management Master Plan is a good example of the need for IWRM to manage competing water uses. In this case, water supply was prioritized over flood management. However, there is a need to ensure that dams are also operated as flood mitigation structures to protect homes and businesses, especially in flood-prone areas. The DPWH is the main agency for flood management work, and the Office of Civil Defense also plays a role in disaster risk management.

Use nature-based solutions (NBS) to help manage changing precipitation patterns. Landscapes with high levels of vegetation cover, such as forests and plantations, can cope better with changing precipitation as they promote infiltration, reducing flood risks in the wet season and increasing water flows in the dry season. Such landscapes also protect downstream reservoirs from sedimentation, thus preserving their ability to store water for use when needed. Moreover, landscapes with high levels of vegetation cover can contribute to mitigation efforts by sequestering carbon in biomass and soils.

Increase the efficiency of water use. Increasing the efficiency of water use, in addition to helping increase productivity, would also reduce pressure on water resources. Such reductions are particularly important in areas with irrigation water deficits, such as Regions I and III, but would also help reduce the threat of seasonal scarcity in all regions. As discussed in the next section, techniques like Alternate Wetting and Drying (AWD) could substantially reduce water use and improve efficiency. Drip or trickle irrigation, in addition to increasing water use efficiency in currently irrigated areas, could also be used to irrigate some currently rainfed areas, thus, reducing their vulnerability to higher temperatures and drought spells.[29] New technologies are also becoming available to facilitate drip irrigation (Ella and Glaser, 2021). However, drip irrigation generally requires relatively high investments and may not be financially viable for many crops. Where irrigation systems require pumping, using solar-powered rather than fuel-powered systems would reduce costs and emissions. As discussed in the next section, however, many of these innovations may not be adopted unless the Free Irrigation Service Act (FISA) is reformed, as this act provides no incentives to farmers to use irrigation water more efficiently. A review of FISA by the NIA is needed.

Improve financing for irrigation investments. The NIA has generally financed irrigation investments, but operations and maintenance (O&M) were usually covered by user fees.[30] In 2018, however, FISA repealed irrigation service fees for farmers with less than eight hectares of farmland.[31] FISA shifted the burden of paying irrigation O&M from farmers to the public treasury, effectively establishing an in-kind transfer scheme (Briones and others, 2020). It is too early to tell whether FISA will meet its goal of improving equity among farmers. However, it certainly discourages economizing water use and complicates irrigation financing.

Remove obstacles to private sector participation. The water sector suffers from under-investment by the private sector. The absence of a common methodology in tariff review and political pressure to keep water tariffs low discourage private investments. As with other utilities, foreign equity in water and sanitation companies is limited to 40 percent. Investment is also constrained by land

[28] The Metro Manila Flood Management Master Plan was approved by the government in 2012. Its total estimated cost of implementation was around PHP352 billion (USD7.5 billion) over 20-25 years, including the cost for resettling people living in danger zones. It included structural and non-structural measures to reduce flooding from river systems, eliminate long-term flooding in the plain of Laguna de Bay, improve urban drainage, and provide flood forecasting and early warning systems as well as recommendations for institutional structures to deal with flood management. However, in 2021; its main proposal for a flood dam structure in Upper Marikina has been cancelled and has been replaced with a water supply dam. The DPWH is working with the private company developing the water supply dam to prepare operational guidelines that incorporate flood management.

[29] Field studies in upland areas of Bukidnon showed that crop yields in drip-irrigated vegetable plots increased by as much as 30-50 percent relative to rainfed conditions (Ella and others, 2012).

[30] In 2015, NIA income from the Irrigation Service Fee (ISF) was about PHP1.8 billion, representing significant cost recovery on irrigation maintenance.

[31] In 2012, holdings of size 7 ha or below accounted for 77.8 percent of all holdings by area, and 98.2 percent of all holdings by number (PSA, 2015).

acquisition difficulties and a lengthy water permit application process (IFC, 2019). Creating a DWR to formulate and plan water resources policy and resource regulation and coordinate with implementing agencies is one possible solution. Another would be for regulators like LWUA and the NWRB to establish appropriate tariff policies that promote viable operations and encourage investments to improve coverage. Ensuring that sufficient finance is available for the longer-term sustainability of water and sanitation services requires a tariff policy that allows increases for improved services and a financing support mechanism to cover operational shortfall during the early years of implementation (IFC, 2019). Private companies are unlikely to be interested in small-scale water and sanitation investments. Developing water supply and sanitation projects that serve multiple municipalities or cities will be more attractive to the private sector.

Improve water supply and sanitation in urban areas and manage urban water demand. Urban areas face water stress as populations and activities grow. Due to climate change, water service providers must also contend with dwindling resources and seasonal scarcity with drier dry seasons. Managing urban water demand by promoting better use of existing supplies is often more cost-effective than developing new water sources. Reducing non-revenue water and decreasing power consumption, coupled with financial incentives or penalties for conservation, can effectively increase the available supply. Water conservation can be encouraged with measures such as water pricing policies, temporary ordinances and restrictions, and the use of water-efficient appliances. Changes in water availability may aggravate limited sanitation. An integrated urban water management system that considers water availability's impact on long-standing urban management problems is needed for water-secure cities. These efforts must be coordinated at the city level, with identified actions delegated to actors, including policy-makers, educators, and the private sector.

4.2 Increasing climate resilience in agriculture

- Substantial opportunities exist for win-win actions that increase resilience and lower emissions.
- Many climate actions require policy reforms rather than significant investments.
- Key recommendations include (a) accelerating the adoption of improved practices, (b) improving resilience through diversification, (c) extending irrigation in rainfed areas, and (d) developing Fishery Management Plans that incorporate adaptive management based on changes in migration patterns and stocking rates.

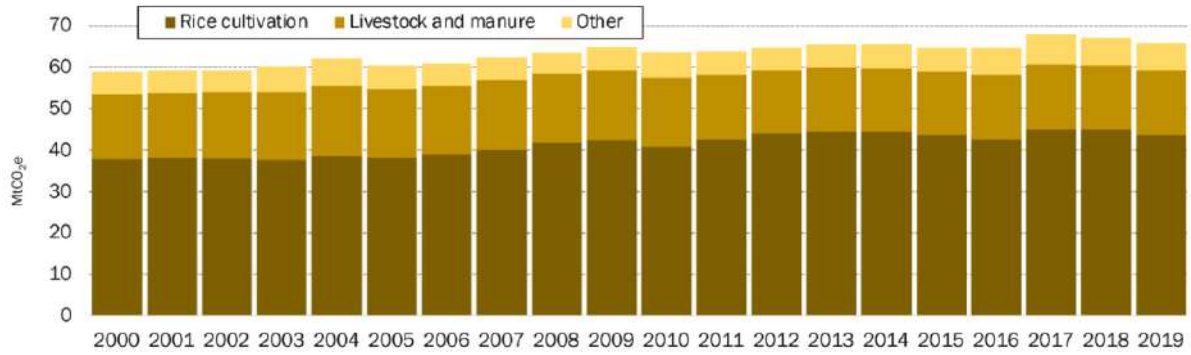
4.2.1 Sectoral context

Agriculture remains critically important for food security, employment, and poverty reduction. Agriculture contributes about 10 percent of GDP and employs around 24 percent of the economically active population (World Bank *Open Data*; FAO, *Food and Agriculture Data*). Rice is the most significant crop, accounting for 21 percent of agricultural value added, followed by livestock (12 percent) and fishing and aquaculture (12 percent). High poverty levels characterize the sector: the 34 percent poverty rate among farmers and fishers is well above the national average of 22 percent (World Bank, 2020b).

The Philippines' agriculture sector continues to underperform compared to its regional peers. Agricultural total factor productivity (TFP) has increased by only 32 percent over the past quarter-century, well below the rates of neighboring countries.[32] Sectoral growth has been dragged down by (a) the low productivity in rice, with yields far below the average for Southeast Asian comparator countries, and (b) the failure to diversify into high-value-added products for local consumption and export. The share of high-value crops in Philippine agriculture rose only slightly over the last two decades—from 19.6 percent in 2000 to 22.9 percent in 2019 (World Bank, 2020b), in contrast to the experience of other regional countries that successfully transformed their agricultural sectors.

[32] Over the same period, agricultural TFP increased by 50 percent in Indonesia, 67 percent in Thailand, 73 percent in Vietnam, and 130 percent in China (World Bank, 2020b).

Figure 4.2: Rice and livestock are the main sources of emissions from the agricultural sector



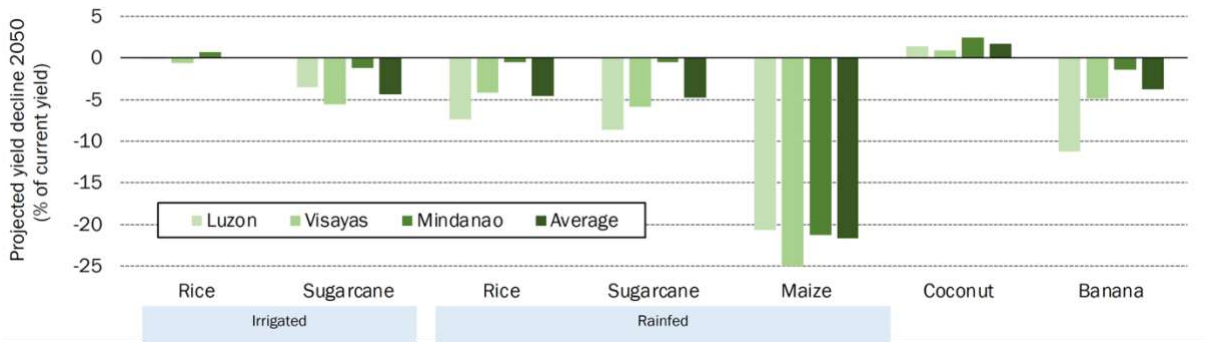
Note: Does not include emissions from forest loss.
Source: FAO data.

Agriculture accounts for roughly a quarter of national GHG emissions. Agriculture generates about 65 $MtCO_2e$ (see Figure 4.2), but unlike in other sectors, emissions are not growing. Emissions from agricultural production arise primarily from methane and nitrous oxide generated by rice production and livestock. Therefore, agriculture can provide mitigation solutions while adapting to climate change. Agriculture has also been a major cause of forest loss, accounting for almost 90 percent of the 1.34 million ha of tree cover lost from 2000 to 2021, equivalent to 788 $MtCO_2e$ of emissions (Global Forest Watch, *Tree Cover Data*).

4.2.2 Impacts of climate change on agriculture

Agriculture is significantly affected by climate shocks that damage crops, livestock, and rural infrastructure. Increasing temperatures affect crop and livestock yields, foster greater pest incidence, and reduce labor productivity. By 2050, agricultural productivity in the Philippines is estimated to decline by 9–21 percent due to climate change (Puhlin and Tapia, 2016). Increasing temperature and ocean acidification also affect fisheries' productivity (see Box 4.1). Sea-based hazards like saltwater intrusion will also have major impacts on coastal and freshwater fisheries, particularly in the marginalized communities of Visayas and Mindanao (Alliance of Bioversity International and CIAT, and WFP, 2021). These impacts will contribute to food deficits, increased food insecurity, and considerable social and economic disruption.

Figure 4.3: Climate change will cause the yields of many crops to decline



Source: Thomas and others (2019).

Slow-onset impacts of climate change will reduce yields and the suitable growing areas of many crops. Rainfed crop yields are particularly likely to be affected by higher temperatures and changing precipitation (Figure 4.3).[33] In 2030, the biggest decline in yield and production is expected for maize, followed by sugarcane, then rice; in 2050, maize will be most affected,

[33] The estimates are based on using global climate models to simulate rainfall and temperature, and the DSSAT crop simulation software package, which 'grows' crops using weather inputs from the global climate models, under parameters corresponding to Philippine agroclimatic conditions.

followed by bananas and rice. The yields of irrigated sugarcane are projected to decline as it is grown in already water-scarce areas; rainfall changes are expected to exacerbate this problem. The largest decline in per-capita consumption relative to the baseline is projected for food corn, followed by rice, sugar, and fruits and vegetables. Conversely, some crops will see their yields increase, though these represent a small part of the total output. The areas suitable for producing many crops will shrink, forcing farmers to change crops or cease production altogether, but the area of fruits and vegetables is expected to increase.

Agriculture, and the infrastructure it depends on, are also at risk from extreme weather events. From 2010 to 2019, about 63 percent of the estimated USD9 billion in damages from extreme natural events and disasters comprised damages to agriculture (PSA, 2020a). The top rice-producing provinces of Nueva Ecija, Isabela, Pangasinan, Iloilo, Cagayan Valley, and Camarines Sur are highly exposed to typhoons, and an observed southward shift in the typhoon belt will bring higher risks to rice-producing provinces in Visayas and even Mindanao (Alliance of Bioversity International and CIAT, and WFP, 2021).

These climate trends will hit the country unequally. Areas that depend on rainfed agriculture and livestock will fare worse (Alliance of Bioversity International and CIAT, and WFP, 2021). Areas where most agriculture is irrigated will fare better, so long as water flows remain sufficient and the infrastructure needed to store and distribute water remains functional.

Female farmers are at a greater disadvantage than men. About a quarter of employed persons in agriculture are women, but their contributions are often poorly captured in statistics. As a result, how women farmers will be affected by climate change is not well-understood. However, their reproductive role and the uneven distribution of resources and household responsibilities leave women farmers with less time to manage climate challenges. In addition, few women own land,[34] limiting their access to credit and technology; women are also seldom targeted for extension services. Loss of on-farm livelihoods more often results in women migrating for work, leaving them vulnerable to sexual exploitation (Chandra and others, 2017).

Reduced agricultural production will lead to higher prices, causing significant hardship. Large price increases are predicted, with the biggest jumps affecting corn, rice, and fruits and vegetables.[35] The poor will be most affected as they spend a greater share of their income on food. Due to climate change, the number of people at risk of hunger is projected to increase by 8 percent by 2030 and 12.8 percent by 2050 (Perez and Rosegrant, 2019). The number of malnourished children will also increase by 1.5 percent in 2030 and by 2.7 percent in 2050, reversing a projected decrease of almost 9 percent by 2030 without climate change. These trends make achieving the SDG of zero hunger and malnutrition much harder. Crop losses and supply chain disruptions will likely cause significant short-term price spikes.

4.2.3 Responding to climate change

Several programs have been launched to help farmers and agricultural communities adapt to climate change. The Government's flagship Philippine Rural Development Project has adopted a CSA approach to reorient the agri-food system and ensure food security in a changing climate.[36] The Adaptation and Mitigation Initiative in Agriculture program helps local communities manage climate risks while pursuing sustainable livelihoods. The Climate Change Adaptation Financing Program helps agricultural households adapt to adverse impacts by providing loans for climate change-resilient practices and technologies. The Survival and Recovery program provides loans to small farmers and fishers affected by natural disasters. Small farmers and fishers practicing or

[34] Only 34 percent of Agrarian Reform beneficiaries with Certificate of Land Ownership Agreements were women in 2015 (FAO, 2022).

[35] As similar trends will affect other countries, the prices of imported agricultural products will also rise.

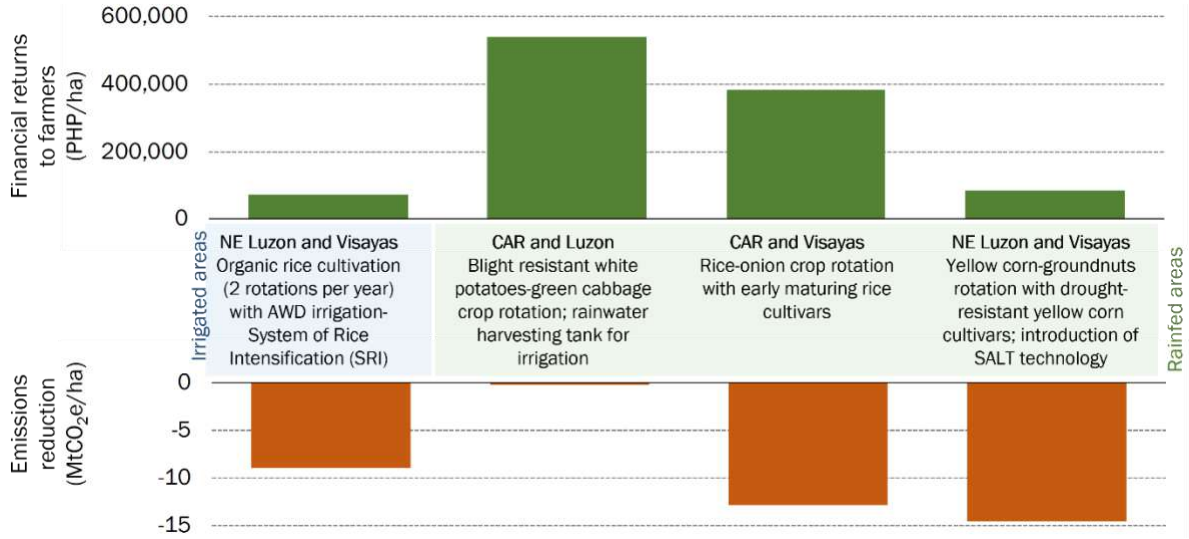
[36] CSA is an integrated approach to managing landscapes—cropland, livestock, forests and fisheries--that addresses the interlinked challenges of food security and climate change.

willing to adopt adaptation measures and technologies can access other Agricultural Credit and Policy Council credit programs.

CSA promotes triple wins, raising overall food system productivity while delivering greater resilience and lower emissions. The need for transformation is particularly acute in rice production, the most important crop economically, the greatest source of emissions, and the greatest water user. Techniques like AWD can reduce water use by up to 15–25 percent (FAO, 2020). With good agriculture practices, AWD can cut methane and nitrous oxide emissions by as much as 60–70 percent (Samoy-Pascual and others, 2019; Runkle and others, 2019). AWD is particularly appealing as it requires no modifications to existing irrigation systems. Adopting AWD only requires adjustments in operating and managing irrigation systems and does not entail substantial costs. CSA has been estimated to offer investment opportunities worth around USD14 billion, potentially creating over 430,000 jobs (IFC, 2021).

Policies, including under-pricing water, constrain the adoption of CSA practices in the Philippines. While some countries have had positive experiences with CSA techniques,[37] others have had disappointing adoption rates. The Philippines, to date, has been in this latter group. Farmers need the right incentives to adopt CSA practices. Figure 4.4 shows indicative returns to farmers from various CSA practices proposed for irrigated and rainfed areas in some regions of the country. The AWD option shown (first column) would be of little interest to farmers. An important factor in these low financial returns to AWD practices—and, hence, in their low adoption—is that Filipino farmers have been shielded from the true cost of water, previously by the non-volumetric water pricing and more recently by water fees being repealed altogether under FISA. Thus, except possibly in farms requiring pump irrigation, AWD practices do not translate into reduced costs for farmers. Efforts to make AWD more attractive by packaging it with subsidies or measures to increase yields, such as improved varieties or inputs, have sometimes been successful but are difficult to scale up and maintain long term. In rainfed areas, options such as rice-onion rotation with early maturing rice cultivars are win-win, while others show tradeoffs between financial and climate benefits.

Figure 4.4: The attractiveness of climate-smart agriculture practices for Filipino farmers varies



Notes: Estimated financial returns are given as net present value over 20 years, discounted at 10 percent, and assume farmers receive loans from the Land Bank.
Source: CCDR team calculations based on data from agricultural development projects financed by the World Bank.

[37] CSA techniques promoted under Vietnam's 1M-5R program in the Mekong Delta (one 'Must' of using improved seeds and five 'Reductions' in irrigation water, seeding rate, nitrogen fertilizer, pesticides, and post-harvest losses in drying and milling) increased farmer yields by 10-18 percent, increased farmer profits by about 28.6 percent, lowered water use by 15-40 percent, and reduced GHG emissions by 7.3 tCO_2e/ha/year.

4.2.4 Increasing resilience in agriculture: Recommendations

Reform policies to ease the transition to CSA. Several policies discourage the adoption of CSA, particularly the lack of water pricing. The FISA Act means farmers have no incentive to use irrigation water efficiently. Fertilizers are often subsidized[38], resulting in over-use, which can be a significant source of emissions.[39] Many policies also focus on specific crops—particularly rice production—and tend to discourage crop diversification, reducing resilience. Instruments that provide direct payments to farmers are being used worldwide, conditional on their adopting CSA practices. Providing payment for adopting water-saving practices may be a workaround to politically unpalatable reforms (Briones and others, 2020).

Extend drip irrigation in rainfed areas to make them more productive and resilient. Rainfed crops tend to have low productivity and will likely be particularly affected by temperature and precipitation changes. Most rainfed areas, however, are unsuitable for traditional flood irrigation. Techniques like drip irrigation can be implemented on sloping lands, boosting productivity while reducing vulnerability to temperature and rainfall changes. Adopting drip irrigation requires heavy investments by farmers,[40] and may not be viable in all areas. It will also likely require substantial assistance, including financing the required investments, and technical assistance to establish drip irrigation and grow new crops. It is important to ensure there are suitable value chains and demand for larger volumes of current and new crops that would be produced and that water sources for drip irrigation systems are established.

Widen the availability of crop insurance and finance products for CSA. Instruments such as crop insurance can help farmers mitigate risks from weather shocks. Several index-based insurance products have been developed and piloted, but further work is needed to ensure that crop insurance matches the requirements of diverse farmers. Appropriate lending instruments are also needed to help farmers finance CSA investments. Insurance schemes are available from the Philippine Crop Insurance Corporation.

Improve the enabling environment for the private sector to drive CSA. The commercial private sector, such as input vendors and firms working in agricultural value chains, could be important in driving CSA adoption but is not incentivized to do so. A first step is identifying government policies that undercut private-sector incentives for change, then working to lower or eliminate barriers stopping the private sector from taking climate-smart action. Removing obstacles may be insufficient, and providing direct financial incentives may be necessary.

Reforest degraded areas while preventing further deforestation. Reforestation can offer multiple adaptation and mitigation benefits in many areas. Reforesting degraded areas could (a) help increase infiltration, reducing the risk of dry season water scarcity, and (b) reduce runoff, lowering the risk of wet season floods. It would also reduce erosion, helping preserve reservoir capacity downstream. Reforestation would also contribute to mitigation efforts by sequestering significant amounts of carbon in biomass and soils. The primary challenges facing reforestation efforts are its high initial costs and the difficulty of maintaining reforested areas over time.[41] The National Greening Program (NGP), implemented from 2011 to 2016, planted 1.3 billion seedlings on 1.7 million ha; the program was then extended to 2028 as the Enhanced NGP. However, continued deforestation has offset the NGP's achievements (Lopez and others, 2020). Policy reforms are needed to reduce agricultural subsidies that encourage expansion into forested lands, and support payments could be contingent on conservation-friendly actions by farmers.

[38] Fertilizer subsidies are a major expense for the DA budget, accounting for 35.5 percent of its budget in the period 2015-2021.

[39] Nitrogen fertilizers produce nitrous oxide, a highly potent GHG that has 265 times more global warming potential by volume than carbon dioxide.

[40] Installing drip irrigation costs around USD4500/ha for a gravity-fed system, and more for systems requiring pumping (Labios and others, 2019).

[41] Eventually, REDD and carbon markets may provide considerable financing for reforestation and forest conservation efforts. At present, however, the outlets for carbon credits from forest-related activities are limited, and the prices are far below the social value of carbon.

Box 4.1: Impact of climate change on fisheries

The Philippines' fisheries sector contributes significantly to the national economy, food security, nutrition, employment, and livelihoods. In 2021, capture fisheries generated PHP178 billion and aquaculture PHP128 billion, accounting for about 1.3 percent of GDP (PSA, 2020b). Philippine fisheries rank 8th globally in production volume, generating exports worth over USD1 billion in 2021. This represented a 37 percent drop compared to the highest value in 2018, about 3.3 percent of export earnings. The sector employs about 1.6 million jobs, 4 percent of the labor force, including low-income families engaged in subsistence fishing in municipal waters, and provides over 50 percent of animal protein for human consumption and 12 percent of the total food intake of Filipinos.

The fisheries sector has a high poverty incidence, declining fish stocks, and struggling aquaculture producers. The sector is among the poorest, with a poverty incidence of 26.2 percent in 2018. Over the last decade, the average fish capture has declined by 20 percent due to factors including excessive and destructive fishing, the open-access regime, and impacts from land-based activities. Aquaculture production has fallen by around 10 percent over the last decade, and most producers are small family businesses producing unprocessed fish with limited value addition for the domestic market.

Climate change threatens fisheries through infrastructure and marine ecosystem damage. Damage to boats, fishing gear, fish pens, and landing sites is common during the typhoon and monsoon seasons and may increase as typhoon intensity increases. Rising sea temperatures and associated acidification and hypoxia are causing some fish species to migrate, which is expected to reduce potential catches from marine fisheries by 24 percent by 2050 (Geronimo, 2018). Fishers in vulnerable areas already report significantly lower catches, changing seasons, and needing to go further out to sea, undermining their income. Coral reefs will be lost or degraded, reducing their benefits, including storm surge protection services valued at USD4 billion per year (Tamayo and others, 2018).

Strengthening fisheries' climate resilience requires a variety of interventions, which climate-informed solutions must complement. Having adaptive management in place will help forecast the fishery migrations and adjust management measures, such as restricting new entries to the sector. Strengthened law enforcement to reduce illegal, unreported, and unregulated (IUU) fishing is required, alongside the protection of critical habitats to ensure environmental and social-economic resilience for fishers. Regular scientific data collection and analysis are needed to understand the impact of climate change on fisheries and aquaculture. Researching and developing alternative gear and fishing methods can improve productivity and reduce waste. Climate-smart design can increase value-addition in the value chain. Improved certification, hygiene standards, and biosecurity will help aquaculture supplement fish supply, aiding food security.

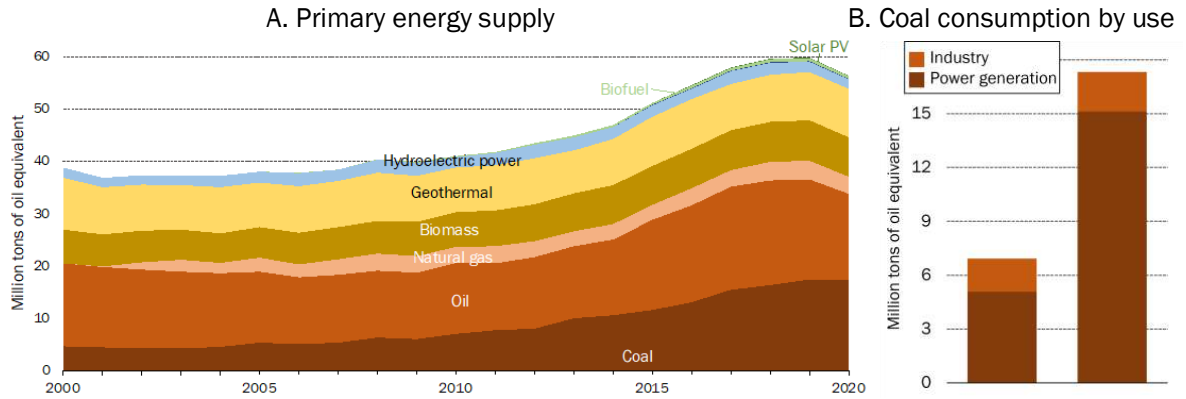
4.3 Toward an energy transition

- An energy transition toward a renewable-energy-dominated power system is technically feasible and will enhance energy security and affordability in the Philippines.
- Rapidly decarbonizing the power sector entails doubling the cumulative capital investments in power systems by 2040, from USD31 to USD62 billion in present value terms.
- The levelized cost of electricity is projected to decline compared with the 2021 baseline as the power system moves away from coal. This is due to reduced fossil fuel costs, and the declining cost of integrating solar and wind energy sources.
- Particular attention is required to mitigate social and economic impacts on affected people and communities in support of a Just Transition.
- Key recommendations include (a) scaling investments in solar and wind power and corresponding grid capacity and flexibility and (b) intensifying energy efficiency and demand-side management efforts in buildings and industries.

4.3.1 Sectoral context

Energy is the largest contributor to GHG emissions in the Philippines, but the economy is significantly less energy intensive than its regional peers and much less dependent on coal. The primary energy intensity of the Philippines' GDP, which has been falling since 2000, was 6.5 GJ/thousand USD in 2019, compared with 9.6 in Indonesia and 15.2 in Vietnam.[42] The share of coal in the primary energy supply, which has steadily increased since 2010 (Figure 4.5), was 29 percent in 2019, compared with 29 in Indonesia and 51 percent in Vietnam. However, coal is used much less in final energy consumption, with only a 6 percent share in 2019, compared with 15 in Indonesia and 26 percent in Vietnam.[43] Final energy consumption in the Philippines has significantly higher shares of oil products and biomass than its peers, underscoring the outsized role of transport in fossil fuel demand and a large rural population that still relies on biomass.

Figure 4.5: Power generation and transport have been driving the increase in fossil fuel consumption



Source: Philippine Energy Statistics, Department of Energy.

There has been a shift towards fossil fuels in the primary energy mix over the past decade. For example, the share of fossil fuels in the primary energy supply increased from 60 percent to 67 percent between 2010 and 2020 due to a large increase in coal-fired power generation and sustained growth in oil demand from transport (Figure 4.5). This trend highlights the fast-growing carbon footprint of energy consumption, which accounted for 59 percent of GHG in the Philippines in 2019, up from 50 percent in 2010 (Climate Watch, 2020). It also heightens energy security concerns: 85 percent of coal and nearly all oil are imported, with such imports accounting for 50 percent of the primary energy supply in 2019.

The Philippines energy sector does not receive significant subsidies. The energy sector reforms that started in the 1990s have eliminated most energy subsidies except for a few targeted ones, such as lifeline subsidies for low-income households and price subsidies for households relying on diesel-powered systems in remote islands financed by non-subsidized rate-payers.

The Philippine power sector has undergone important institutional reforms and technological changes in the past 20 years. Following severe energy supply shortages in the late 1980s and the Asian financial crisis of 1997, the Government enacted the Electric Power Industry Reform Act (EPIRA) in 2001 to improve the quality of service and reduce tariffs by introducing private participation and competition at the wholesale and retail levels. The EPIRA reforms were mostly completed by 2013, making the Philippine power market one of the freest in the region. These reforms led to strong growth in private financing of power generation assets, boosting the total installed generation capacity from 16GW (Gigawatt) in 2010 to over 26GW in 2020. Coal-fired

[42] Date are from IEA, *Energy Statistics Data Browser*. Values for 2019 are used for benchmarking because 2020 values are abnormal due to the economic contraction caused by the COVID-19 pandemic. Values are given in USD for 2015.

[43] The small share of coal in final energy consumption (other than power generation, essentially only for cement) makes coal easier to displace than in other countries, as some applications have no ready substitutes, and potential political opposition to a coal phase-out is limited to a single industry.

power increased from 34 percent of total electricity produced in 2010 to 57 percent in 2020. Solar and on-shore wind energy also grew, accounting for 15 percent of the capacity installed in the same period, growing from zero in 2010 to about 1.5 GW in 2020. However, the overall share of RE generated—mainly hydroelectric and geothermal power—shrank from 26 percent in 2010 to 21 percent in 2020 due to the rapid growth of coal-fired power.

As a result of market reforms, Philippine power generation assets are generally owned and operated by private corporations. Transmission assets are state-owned but have been managed since 2009 by the privately-owned National Grid Corporation of the Philippines under a 25-year concession contract. The distribution segment contains private companies and rural electric cooperatives awarded a monopoly license to distribute electricity to a specific franchise area.

Retail electricity tariffs remain among the highest in ASEAN countries, constraining economic competitiveness. The power sector reforms did not reduce electricity tariffs as hoped. The average retail tariff in the Philippines in early 2021 was USD0.15/kWh, compared with USD0.08/kWh in Indonesia and USD0.11/kWh in Thailand (DOE, 2020), influenced by factors such as domestic taxation, the market power of generation companies due to limited competition, the lack of competition at retail level, and other inefficiencies in the sector (Ravago and others, 2018). The sustained high cost of electricity in the Philippines may have contributed to the premature decline of the industrial share in the economy and suppressed growth in industries where electricity is an important production factor (Ravago and others, 2019). It will be important to avoid harming the economy's competitiveness by increasing energy costs.

The Government estimates that electricity demand will triple in the next two decades, averaging about 6.6 percent per year, driven by factors including population growth, rising standards of living and growth in manufacturing.[44] Meeting this growing demand while transitioning toward a RE-dominated power system poses major financial and technological challenges. Understanding the nature and magnitude of these challenges would help develop appropriate solutions.

4.3.2 Energy transition pathways and implications

The Philippines would benefit from a transition toward low- and zero-carbon energy. This will substantially increase the use of local RE resources while reducing reliance on imported fossil fuels and enhancing energy security. A clean-energy future will be more affordable given the declining cost of integrating solar and wind power, enhancing the economy's competitiveness. Reducing fossil fuel consumption, particularly by electrifying urban transport and reducing coal power, would reduce ambient air pollution in urban areas, improving public health. A transition would also help the country meet its commitments under the Paris Agreement (see Section 3.2).

The Philippines is embarking on an ambitious program to scale up renewable energy and phase out investments in new coal-fired power plants but has not announced a timeline for phasing out coal-fired power. In October 2020, the DOE announced a moratorium on endorsing new greenfield coal-fired power plants. At COP26, the Philippines partially endorsed the 'Global Coal to Clean Power Transition Statement', aiming to phase out coal in power generation.[45] The Philippine Energy Plan (PEP) 2020–2040 proposes stopping the expansion of coal-fired power generation capacity from 2026 onwards. The PEP also proposes substantially increasing the share of natural gas-fired generation and RE, particularly solar, in its Reference (REF) and Clean Energy Scenarios (CES).[46]

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[44] Per capita electricity consumption in the Philippines was 980 kWh in 2019, compared with 990 kWh in Indonesia, 2,300 kWh in Vietnam, 5,040kWh in Malaysia, and 9,370kWh in Singapore.

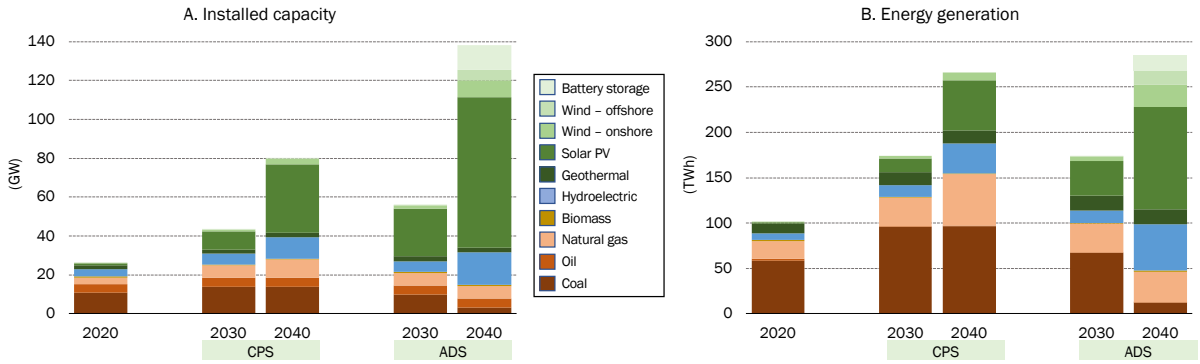
[45] The Philippines endorsed clause 1 (rapidly scaling up clean power generation and energy efficiency) and partially endorsed clauses 2 (rapidly scale up technologies and policies in this decade to achieve a transition away from coal power generation) and 4 (strengthening efforts for a just and inclusive transition away from coal).

[46] The PEP envisions an additional 2.64 GW of new coal-fired power capacity from 2021 to 2025 and no further expansion after 2025 in both REF and CES, and peaking coal-fired power generation by 2030 in CES. The PEP does not envision phasing-out coal-fired plants or phasing down coal-fired generation. Even in CES, coal would still account for 23 percent of total generation in 2040. The leveling-off of coal-fired power would be compensated by expanding natural gas-fired capacity and renewable energy sources. In CES, RE is expected to account for 69 percent of installed capacity and 50 percent of total generation by 2040.

To inform the discussion on clean energy transition pathways, the World Bank conducted an exploratory analysis of accelerated decarbonization of the power sector, aiming at achieving an 80 percent reduction of annual carbon emissions by 2040, compared with BAU:

- **The Business-as-Usual (BAU)** scenario is the baseline, similar to the PEP's REF scenario. This scenario caps coal-fired generation capacity from 2026 onwards but does not set an explicit emissions reduction target.
- **The Current Policy Scenario (CPS)** is similar to the PEP's CES. It represents the Government's current ambitions and is aligned with the NDC's commitment by peaking coal power generation by 2030. The emission reduction target is implicit in peaking coal and demand-side efficiency improvement.
- **The Accelerated Decarbonization Scenario (ADS)** analyzes how power system expansion needs to adapt to achieve an 80 percent reduction in annual CO_2 emissions by 2040, compared with BAU, in response to the same electricity demand growth as in the CPS.[47] The ADS provides useful analytical insights for achieving net zero emissions in the power sector beyond 2040.

Figure 4.6: An energy transition would substantially change the mix of power generation technologies and sources of energy



Source: CCDR Energy team based on power sector modeling.

Accelerated decarbonization would substantially change the mix of power generation technologies. Figure 4.6 shows the projected mix of installed capacity and energy generation in 2040 based on the analysis conducted for the CCDR. Under the ADS, coal-fired power generation would peak in 2025, reaching about 78 TWh compared with 58 TWh in 2020, and would be gradually phased down to about 15 percent of its peak by 2040. Solar PVs would become the dominant technology, accounting for 40 percent of total generation by 2040.[48] Other RE technologies would see substantial growth, as would the battery storage needed to integrate variable renewable energy.[49] Natural gas would play an important role as a transition fuel, with its significance decreasing as other clean technologies become cost-efficient.

Substantial emission reductions are achievable. Figure 4.7 shows the projected emissions paths under each scenario. Under CPS, annual power sector emissions would grow from 70 million tCO_2 in 2020 to 112 million tCO_2 by 2040, 8 percent lower than BAU.[50] Under ADS, on the other hand, power sector emissions would be 80 percent lower than BAU in 2040. Panel A of Figure 4.8 shows

[47] The power system decarbonization analysis does not consider the full range of potential technology choices in part to limit the high uncertainties of technologies that are still at early stages of development (such as carbon capture and storage and green hydrogen) and in part to maintain consistency with the Government's current energy plan (for example, nuclear power is not included in the PEP 2020-2040).

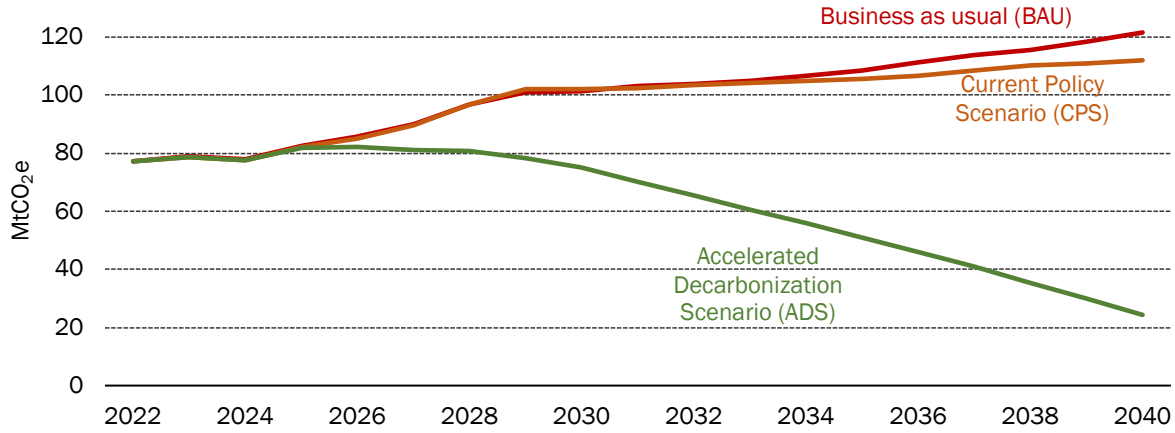
[48] The main constraint to large scale deployment of solar power in the Philippines is land, but under ADS only about 0.8 percent of the country's total land area would be needed for solar power installation in 2040, and large-scale deployment of floating and rooftop solar could significantly cut the demand for land.

[49] The expansion and integration of variable RE in the Philippines will depend on the massive scale-up in the relevant technologies in the global market, and, consequently, on a reduction in their costs.

[50] The main reason CPS does not differ significantly from BAU is that the Government adopted the same outlook for coal-fired power in both its REF (equivalent of BAU) and CES (equivalent of CPS) in the PEP 2020-2040, aligned with the moratorium on approval of greenfield coal-fired power plants.

the capital investments required under each scenario modeled, based on the current estimate of the cost trends of technologies.[51]

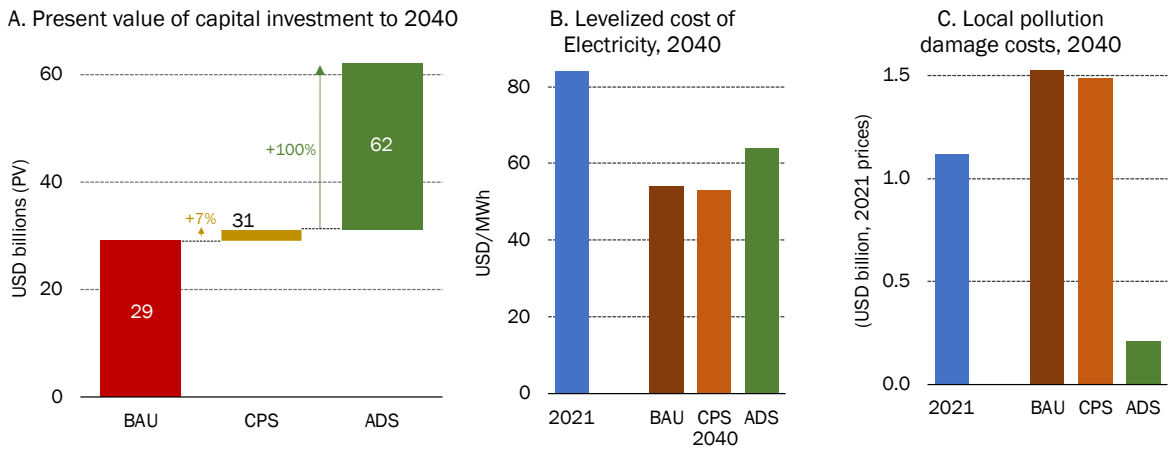
Figure 4.7: Accelerated decarbonization would substantially reduce emissions relative to current plans



Source: CCDR Energy team based on power sector modeling.

Reducing emissions would require substantially more investments than BAU. The present value of cumulative capital investments required for ADS by 2040 would be 100 percent higher than for CPS based on current estimates of the cost trends of technologies (Figure 4.8, Panel A). The net increase in cumulative investment in the ADS vis-à-vis CPS is entirely accounted for by increased investment in RE deployment and integration. In nominal terms (measured in 2021 prices without discounting), the estimated cumulative capital costs of ADS is USD127 billion, compared to USD57 billion in CPS. In particular, the transmission investments required to integrate RE in the ADS are estimated at USD3.1 billion, compared with USD1.5 billion in CPS.

Figure 4.8: Accelerated decarbonization would require a substantial increase in capital spending for renewable energy scale-up and integration but would reduce the levelized cost of electricity and pollution damage costs compared with 2021 levels



Source: CCDR Energy team based on power sector modeling.

Reduced fuel costs would counterbalance the higher capital cost of accelerated decarbonization. The overall power system cost includes capital cost (generation and network), fuel, and operation and maintenance costs. The system LCOE represents the present value of the cost of electricity supply (USD/MWh) of the power system in a given year and may be considered as a proxy for what consumers need to pay for electricity on average. Under ADS, the capital cost component of LCOE increases from 34 to 68 percent from 2021 to 2040, while the fuel cost component decreases from 56 to 11 percent. Such dynamics, combined with the expected decreasing costs of solar and

[51] Additional details on the investment needs and economic costs of the ADS compared to the CPS are provided in Appendix D.

wind technologies, help lower the LCOE of all scenarios compared with 2021 (Panel B of Figure 4.8). For example, under ADS, the LCOE in 2040 would be 24 percent lower than in 2021. This long-term declining LCOE trend is relatively robust and would still hold at significantly slower rates of reduction of technology costs.

Phasing out coal-fired power would lead to substantial stranded assets. The estimated present value of the financial cost of txhese assets, in terms of lost revenues, is USD10 billion under the ADS.[52] To achieve an 80 percent annual emissions reduction by 2040, only 3 GW of coal-fired power would be in operation, compared with 14 GW under BAU. The current fleet of coal-fired power plants (11 GW in 2020) is relatively young, most commissioned since 2010**.** These facilities would be retired between 2028 and 2040, affecting their workforce. Given the large value of the stranded assets in accelerated decarbonization, the active pursuit of solutions must start early.

Energy transition will likely create substantial health benefits through reduced air pollution. Although data are limited, environmental damage cost estimates under the ADS would be reduced by 86 percent in 2040 compared to BAU and by 80 percent compared with 2021 (Panel C of Figure 4.8).[53] Conversely, under BAU and CPS, damages from air pollution would increase.

Accelerated electrification of the transport sector will increase the cost of power sector decarbonization. Electricity demand projections in the CPS and ADS assume a 10 percent penetration of EVs in road transport by 2040. A much higher share of EVs in road transport would significantly increase the electricity demand, increasing investment needs in the power supply

The ADS energy transition pathway would be costlier but generate greater benefits. The ADS would require additional investments (Panel A of Figure 4.8), resulting in an LCOE that is slightly higher LCOE (Panel B) than BAU or CPS, but still well below current levels. However, the ADS would also generate significant local and global environmental benefits. Accounting for reduced local pollution damage costs (Panel C) would likely show that adopting many ADS options is in the Philippines' interest. Pursuing ADS would generate substantial global benefits through a higher cumulative reduction of CO_2 emissions than under BAU or CPS.[54] Thus, it is in the global community's interest, particularly developed countries, to support the Philipines in its clean-energy transition by sharing some incremental financial burdens.

The implications of an energy transition for resilience require further study. Some aspects of the transition will likely increase resilience, while others may reduce it. Some elements of the energy transition are fragile. Solar PV panels, for example, are vulnerable to damage from tropical storms. While there are proven strategies to harden PV systems, they could significantly increase the cost of solar power.[55] Large-scale solar and wind plants are usually sited far from urban areas, and the transmission lines are subject to interruption. Positively, the wide distribution of solar and wind plants could reduce the portion of total power generation affected by a given storm. Similarly, distributed solar installations with battery storage could maintain at least partial local power supplies if transmission lines are disrupted.

4.3.3 Recommendations

Promote competition in investing in and consuming RE to accelerate the deployment of solar and wind power. The Philippines has a large untapped potential for solar and wind energy.[56] To align

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52 The cost of stranded assets in coal-fired generation is estimated based on discounted net revenue drop compared with BAU level and applies market prices. The retirement schedule is based on power system least cost planning to achieve the desired emission reduction goal and predefined techno-economic parameters for retirement. More details of the methodology are included in Annex B3.

53 The emissions of $PM_{2.5}$, NOx, and SOx were calculated based on generation technologies and fuel mix. The pollution costs were estimated using the damage values in from the International Monetary Fund *Getting Prices Right Database* (IMF, 2017).

54 The CCDR estimates that the present values of the global environmental damage cost of CO_2 emissions up to 2040 under the BAU and CPS would be USD51 billion, and USD35 billion under the ADS.

55 Depending on the hardening measures adopted, the overall cost of solar PV systems could increase by up to 50-70 percent (Elsworth and Van Geet, 2020). Wider application of such hardening measures may reduce their cost.

56 Average solar radiation in the Philippines ranges from 128 to 203 W/m^2, giving a potential of about 5.1 kWh/m^2/day. The ADS entails 77 GW solar PV installation, which would require about 0.5 percent of the country's land area—or less, if floating solar and roof-top solar are scaled up. The onshore wind power resources in the Philippines are estimated at 76 GW, while the technical potential of offshore wind power is 178 GW.

accelerated decarbonization with ADS, the share of electricity generation from solar and wind sources will need to increase from 2 percent in 2020 to about 60 percent in 2040. This requires policies and regulations that promote competition in investing in and consuming solar and wind power. Moving from a feed-in-tariff (FiT) program to an auction program would increase competition in investment and lower RE costs. The Government introduced competitive procurement through the Green Energy Auction Program,[57] which auctioned about 1.6 GW of solar and on-shore wind in June 2022 at significantly lower prices than the prevailing FiT. Introducing a mandatory minimum share of RE in the energy supply creates a market demand for RE. The Government also started implementing the Renewable Portfolio Standard (RPS)[58] in 2020, aiming to achieve a 50 percent RE share of total electricity generation by 2040. Both GEAP and RPS will need to be expanded to support accelerated decarbonization.

Incentivize the provision of ancillary services and promote flexibility and grid capacity investment. This will address the challenges of large-scale integration of intermittent solar and wind power. Investments are needed to upgrade the capacity of the transmission and distribution networks, to remove scaling constraints in solar and wind power generation. Price incentives for providing ancillary services could promote investment in energy storage systems, power system automation tools, smart grid technologies, and other measures.

Remove ownership limit to international private investment in solar and wind power. The private sector already dominates all aspects of investments in the country's energy sector. Given the additional capital investments required for accelerated decarbonization, increasing foreign direct investments will be critical to bridging the finance gap. However, a 40 percent ownership threshold still applies to solar and wind projects, as stipulated in the implementation rules and regulations of the REA. The ownership restriction is of particular concern for developing the Philippines' rich offshore wind resources, which will likely need substantial international know-how and capital initially. The DOE could remove the cap on FDI to accelerate the deployment of FDI in RE projects.

Use public resources prudently to leverage private sector risk sharing in energy transition financing. For technologies and applications that present risks to private investors, such as floating solar and offshore wind technologies, public support would be needed to de-risk power sector projects. Such support could alleviate grid bottlenecks, ensure credit-worthy off-take agreements, and provide market-based guarantees. The Government could work with multilateral financial institutions and bilateral partners to enable blended finance mechanisms that attract private sector capital for accelerated decarbonization.

Intensify energy efficiency efforts. Based on sensitivity analysis of the ADS, a 5 percent increase in electricity demand by 2040 would increase the present value of cumulative capital investment by 6 percent by 2040. Thus, cost-effective demand-side efficiency measures to reduce demand are attractive investments on financial merits alone. Improving energy efficiency in residential, commercial, and public buildings through regulations and incentives would help moderate future electricity demand (see Section 4.5).

Improve power system planning to inform energy transition investment decisions. The commonly used least-cost planning tools need amending to consider the costs of carbon, local air pollution, and stranded assets to align future investments with decarbonization goals. It is important to keep abreast of technological changes, assess emerging technology's viability, and maximize RE while managing costs. This approach can help avoid potentially costly long-term carbon lock-in that is not aligned with climate and development objectives.

Establish a framework for retiring coal-fired power plants. To move towards net-zero carbon beyond 2040, the Philippines should start phasing out coal-fired generation by the late 2020s.

[57] Compared with the FIT policy popular in the early phase of solar and wind deployment, a renewable energy auction allows the acquisition of renewable energy generation assets through a competitive tendering process.

[58] RPS is a policy requiring electricity suppliers to provide their customers with a minimum share of electricity from eligible renewable resources.

This complex process will affect energy security, the reliability of power supply, jobs, and communities and involve fair compensation for the financial losses of private investors. The Philippines is a pilot country under the Accelerating Coal Transition Program of the Climate Investment Funds and is supported by the Asian Development Bank, the World Bank, and IFC. This pilot could help design a framework for phasing out coal-fired power.

Ensure a just transition. Energy transitions will have strong socio-economic impacts across different groups, including direct and indirect workers and the broader community. A comprehensive cross-sectoral approach will be required to prepare a framework for a just energy transition process. This will involve key stakeholders in the early consultative planning process, including the Government, the private sector, and communities in the affected areas. The Just Transition process should focus on institutional governance, people and communities, and environmental remediation.

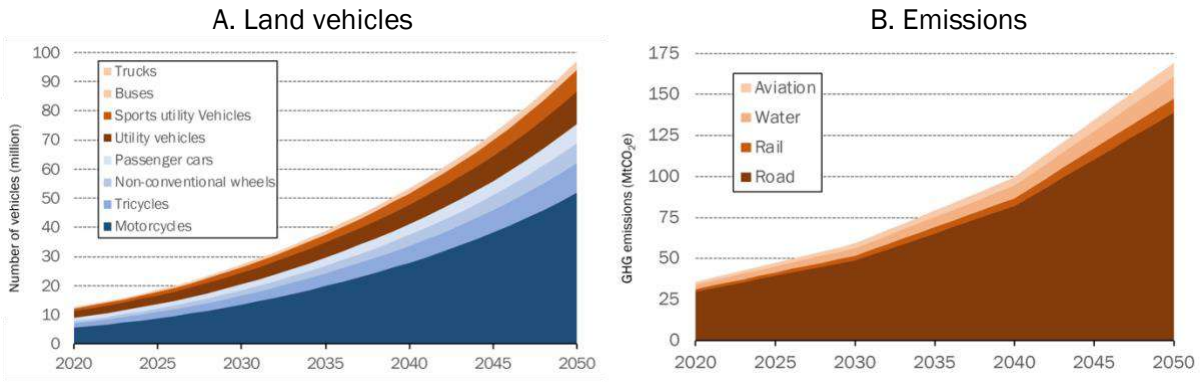
4.4 Reducing emissions from transport

- Emissions of GHGs and local air pollutants from transport would soar under current trends.
- A coordinated, multi-pronged program of interventions can substantially enhance mobility and transport efficiency while reducing emissions and air pollution.
- Key recommendations include (a) scaling and prioritizing electrification of the public transport fleet and (b) scaling and accelerating mass transit development in Metro Manila and other cities.

4.4.1 Sectoral context

Urbanization and economic and population growth have led to increased motorization in the Philippines, accompanied by rising transport emissions. These trends are expected to accelerate in the coming years. The motorized vehicle fleet grew by 6 percent a year between 2010 and 2020, causing transport to contribute about 27 percent of CO_2 emissions from fuel combustion in 2019 (DE, 2020). Under BAU, vehicle numbers will likely increase from 12.5 million in 2020 to 97.2 million in 2050; emissions will grow correspondingly (Figure 4.9). Land transport, especially road transport, accounts for 87.3 percent of emissions from the sector.[59] Under BAU, GHG emissions from land transport would increase more than fourfold by 2050 (from 25 $MtCO_2e$ in 2020 to 147 $MtCO_2e$ by 2050), growing at an average annual rate of 5.3 percent.[60]

Figure 4.9: Under BAU, rapid growth in the number of vehicles will cause GHG Emissions from road transport to more than quadruple by 2050



Source: CCDR transport team calculations.

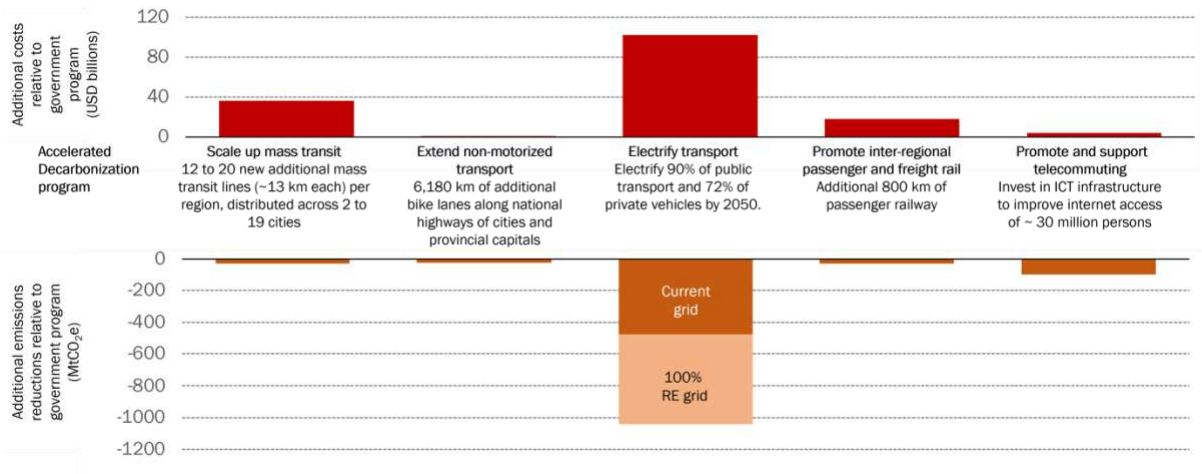
[59] The CCDR focuses on land transport, as it contributes about 92.6 percent of the country's transport sector emissions, with maritime transport contributing 7.3 percent and aviation 0.01 percent (DOTr, 2021).

[60] The economy-wide NDC submitted by the Philippines to the UNFCCC projects a growth in emissions of 1.8 times by 2030. This is consistent with the BAU modeled in this CCDR. On the other hand, the CCDR team is also aware that the Department of Transportation, in its own report, projected an increase in land transport emissions of 3.1 times by 2030 and 10.4 times by 2050. This difference is acknowledged, as the CCDR BAU uses more practical and conservative growth assumptions.

Implementing the Government's low-carbon development program will reduce GHG emissions from transport, but much less than the NDC target implies. The DOTr is the leading agency for implementing the NDC for the transport sector. The CCDR team estimates that full implementation of the government's low-carbon transport programs would reduce land transport emissions by a cumulative 44.63 $MtCO_2e$ by 2030. While this will exceed the Government's NDC unconditional commitment to the transport sector, it is still far from its NDC target of a cumulative reduction in transport emissions of 301.3 $MtCO_2e$ by 2030.

An accelerated decarbonization program that speeds EV adoption and scales mass transit would reduce cumulative land transport GHG emissions by 8.70 percent by 2030 and 18.03 percent by 2040. Figure 4.10 shows the costs and benefits of accelerated decarbonization options.[61] The options included all involve simply scaling up existing programs, for example, scaling mass transit development—primarily Bus Rapid Transit systems—electrifying transport, extending non-motorized transport (NMT) infrastructure, and supporting telecommuting. Electrifying transport, while expensive, offers the greatest potential, contributing about half the potential reduction in this period. The benefits of transport electrification will rise as the RE sector grows and the grid become greener. The emissions reductions from electrifying transport would increase from about 450 $MtCO_2e$ in 2050 with the current grid to over 1,000 $MtCO_2e$ if the power grid was carbon neutral. Mass transit development offers both large GHG emissions reduction and modest investment costs. By 2040, an accelerated decarbonization program's estimated cumulative investment cost will be USD92.9 billion at 2020 constant prices[62]; it could reduce cumulative land transport sector emissions by up to 436.7 $MtCO_2e$ by 2040. The bulk of investment would be for developing EV charging infrastructure (USD55 billion) and subsidizing public transport EVs (USD1.5 billion). Though this program would not meet the NDC target, it would lead to a possible net-zero emissions scenario by 2050.[63]

Figure 4.10: Increasing the adoption of electric vehicles would have the largest impact on emissions from transport



Notes: Estimated costs and emissions reductions through 2050.
Source: CCDR Transport Team calculations,

Low-carbon transport interventions would generate important local benefits and reduce GHG emissions. Health costs would be reduced due to less air pollution.[64] Electrification of public transit can reduce health costs by up to 0.0004 USD per PKM; electrifying jeepneys and buses, for

[61] It should be noted that the effects of individual intervention cannot simply be added, as they depend in part on how they are paired with others. This is considered in the CCDR's modeling.

[62] Total investment costs were estimated using constant 2020 unit prices. These were multiplied to the estimated number of kilometers, vehicles, etc. for each alternative. No assumptions and projections were made on how the cost of each type of infrastructure and technology will evolve through 2050, and thus a discount rate was not used. This can be a subject of a more elaborate economic study.

[63] For perspective, using the average carbon price in East Asia & Pacific of USD9.07 per tCO_2e (World Bank *Carbon Pricing Dashboard*), avoiding 1210.4 $MtCO_2e$ would be equivalent to saving USD10.9 billion. While this is far from the estimated investment requirement, the value of other local benefits have to be considered as well. These are discussed in the next section.

[64] A recent World Bank report estimates the annual costs of air pollution in the Philippines to be USD23 billion, or 6 percent on GDP (World Bank, 2022b).

example, could reduce health costs by up to USD315.5 million per year in 2050 (Lopez and others, 2020). Time would also be saved; DOTr claims the EDSA Busway cut travel time on one of its main segments from 2–3 hours to 45 minutes. The economic cost of transportation in Metro Manila is around USD70 million per day (JICA, 2019). The CCDR recommends prioritizing electrifying transport and scaling quality mass transport infrastructure. It would also be beneficial to frontload 50 to 100 percent of infrastructure projects by 2030 for greater emission reductions by 2040.

4.4.2 Accelerating decarbonization in transport: Recommendations

Scale up existing government programs. The Government is already implementing or planning several actions to reduce transport emissions. However, these initiatives are modest, and scaling them up would generate significant additional benefits. The short-term priorities are to accelerate high-capacity public transport and non-motorized transport (NMT); expand mass transit and NMT development beyond Metro Manila, and jumpstart e-mobility by electrifying the public transport sector. Additional mid-term priorities include encouraging the uptake of greener transport modes.

Enhance the institutional capacity to implement low-carbon transport programs. The current program's progress has been slow, and it is only partially implemented. Actions needed include (a) institutionalizing low-carbon transport programs by developing and legislating a national masterplan; (b) rationalizing the mandates and functions of government agencies for transport development; (c) improving the in-house capacity of government agencies rather than depending on contract-based personnel, as at present.

Encourage greater private sector participation in low-carbon transport development. During the last ten years, the Government allocated USD4.5 billion to reducing land transport GHG emissions. The estimated investment cost for the accelerated decarbonization transport program is USD126.6 billion USD up to 2050, which requires doubling the annual budget for low-carbon transport development by 2030. In 2022, the Government mandated that a Comprehensive Roadmap for the Electric Vehicle Industry be prepared. This includes EV and charging station specifications and infrastructure, supply chain development, skills training plans, and fiscal and non-fiscal incentives. The Government must implement these initiatives effectively to increase private sector investors' confidence in the EV market.

Emphasize resilient transport sector development. The Philippines' transport infrastructure is particularly vulnerable to climate and weather events, yet managing climate-resilient transport assets is not mainstreamed. Agencies often lack complete information on their transport infrastructure data and performance. Further analytical work is needed on transport vulnerability, and agencies must build capacity to mainstream climate-resilient transport development.

4.5 Managing threats and promoting mitigation in urban areas

- Urban areas contribute almost half of Philippine emissions and are particularly vulnerable to climate change.
- Urban dwellers would benefit significantly from adaptation and mitigation measures, particularly those mitigating air pollution.
- Key recommendations include limiting new construction in known flood-risk areas by enforcing land use plans and building design standards and using financial instruments such as insurance.

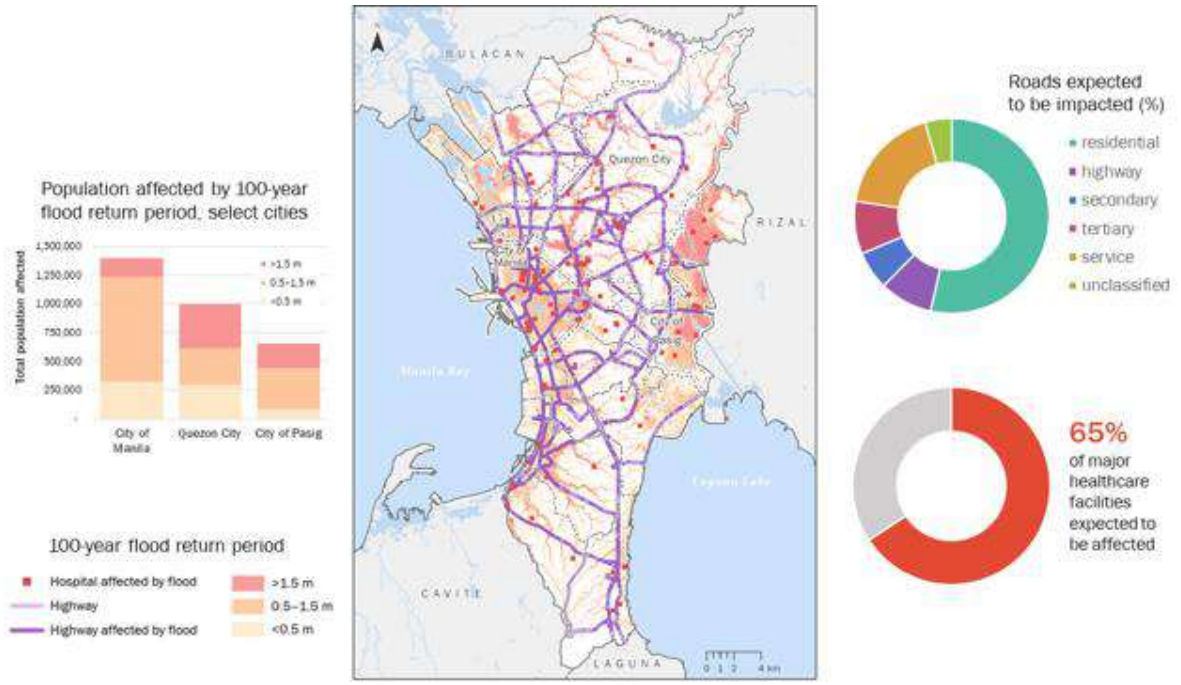
4.5.1 Sectoral context

Philippine cities play a pivotal role in the country's overall growth and development but are a major source of emissions. Recent studies (Dasgupta and others, 2021) indicate that CO_2 concentrations in cities like Manila and Cebu are reaching close to 406 ppm, comparable to other

Southeast Asian cities with extreme air pollution. Almost half of Filipinos live in urban areas, and the proportion is increasing. Cities are the country's engines of economic growth, accounting for around 80 percent of the country's GDP. By itself, the National Capital Region (NCR) hosts 19 percent of the total business establishments and generates around 30 percent of GDP. The seven largest urban areas host 54 percent of formal jobs.

Climate change severely threatens urban infrastructure, economic activity, public service delivery, and human health. The concentration of people, assets, and economic activities allows cities to enjoy economies of scale in providing infrastructure and services. However, cities also concentrate vulnerability to climate change and natural disasters, particularly in coastal areas. Extreme weather events can affect millions of people living in the cities and disrupt economic activities (see Figure 4.11). Beyond extreme events, cities are also vulnerable to slow-onset climate events, including sea level rise and urban heat effects. As cities expand, the changes in land use and spatial development will likely increase environmental stress and the people's vulnerability, especially for the urban poor, informal settler families, and other vulnerable groups.

Figure 4.11: Climate change threatens people and infrastructure in the National Capital Region



Source: CCDR Urban team based on Project NOAH data on flood return periods, road, and facility data from OpenStreetMap.

The building sector could contribute to mitigation and adaptation but is one of the most energy-intensive in the Philippines. Residential and commercial uses account for 54 percent of total power consumption (DOE, 2021). The building sector will likely drive the expected 80 percent growth in energy demand by 2040 (DOE, 2017). Rising ambient temperatures will lead to higher energy use to cool buildings. Space cooling is particularly inefficient due to lax enforcement of building energy codes and the prevalence of inefficient air conditioners. Green buildings[65] could help decarbonize the building sector, reduce buildings' emissions, and make them more comfortable for less cost than most contemporary buildings. Several green building rating systems (GBRS) are available in the Philippines; however, they only had a 3 percent penetration rate for newly constructed floorspace in 2019 (IFC, 2021).[66] This low level of acceptance is partly due to

[65] Green building is defined as "the practice of adopting measures that promote resource management efficiency and site sustainability while minimizing the negative impact of buildings on human health and the environment" (DPHW, 2015).

[66] The Leadership in Energy and Environmental Design (LEED) standard is the dominant GBRS in the Philippines, with a 95 percent share as of 2019. LEED requires a minimum of 5 percent improvement in energy efficiency compared to baseline for new construction and 3 percent for building retrofits. The Excellence in Design for Greater Efficiencies (EDGE) standard introduced to the Philippines by IFC in 2016 has been making inroads (IFC 2021). EDGE requires an energy efficiency of at least 20 percent over baseline, but helps developers and building owners to identify the most cost-effective

their higher initial costs and limited awareness of the benefits of green buildings. However, even widespread adoption of green building standards would still bring slow impacts. As in all countries, most buildings in the Philippines were constructed before energy efficiency was recognized; most are expected to be used for up to three more decades.

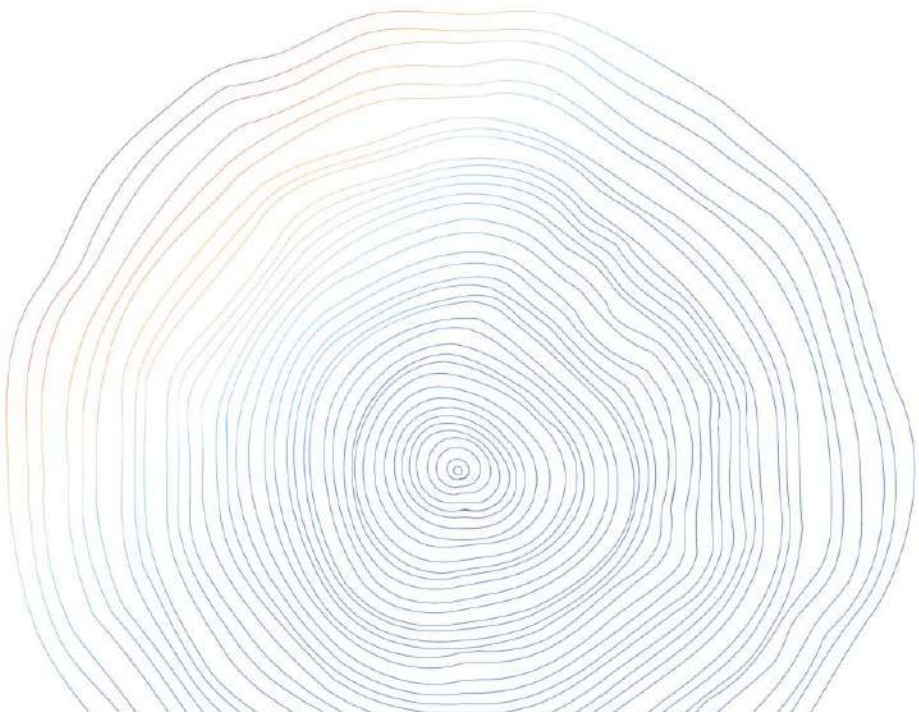
Improving solid waste management could aid mitigation. The country's emissions inventory shows solid waste accounts for 9 percent of emissions. GHGs are generated from decomposing the biodegradable component of municipal solid waste. In the Philippines, over 50 percent of municipal solid waste is biodegradable, and nearly 30 percent is recyclable (EMB, 2018). Under BAU, higher waste generation will likely increase emissions from 12.8 million tCO_2e in 2020 to 19.3 million tCO_2e in 2030.

4.5.2 Building resilient urban areas: Recommendations

Climate-proof critical infrastructure, assets, and services in cities. Delimit coastal hazard lines and enforce them. Cities must better integrate land use, transport, and urban planning to avoid unsustainable decisions that lock cities into poor development patterns. Cities must enhance development guidelines, update building codes and design standards, upgrade emergency response systems, and invest in resilient green infrastructure. Cities must build climate risk databases to inform policy decisions and build public support. Such efforts will require coordination across multiple jurisdictions; without institutional reform, the necessary changes will be difficult to achieve. The private sector could promote waste-to-energy solutions, but this would require amending the Clean Air Act to remove the incineration ban. As most of the country's cities are located along the coast, future development in areas at risk of storm surges or sea level rise must be avoided or designed appropriately. Enforcing standards has been weak to date; one option could be restricting insurance for new developments in at-risk areas.

Intensify energy efficiency efforts in buildings and industries through improved regulations and targeted intervention. As temperatures rise, maintaining living and working conditions in inefficient buildings will rapidly increase cooling costs, increasing emissions. Accelerating the adoption of climate-smart building standards is urgent. Retrofitting existing buildings can improve efficiency, offering a USD14 billion opportunity for investors between 2020 and 2030 (IFC, 2021). The Government should incentivize the construction of energy-efficient buildings and disincentivize inefficient buildings. LGUs and medium-sized companies have difficulty accessing energy-efficient financing and services. The Government should update and improve enforcement of minimum energy performance standards and building energy codes, and boost market uptake of efficient equipment and practices through fiscal incentives under the CREATE Act and Green Jobs Act. Financial institutions could offer innovative financial products that monetize energy savings from building retrofits.

energy efficiency and sustainability measures for their projects, while lowering certification fees, and making the certification process more inclusive and straightforward.



5

Economy-Wide Impacts of Climate Change

This chapter analyzes the economy-wide impacts of climate change and actions in the Philippines, their distributional impacts, and the required fiscal and financing instruments. The chapter draws on the sectoral analyses in the previous chapter. An economy-wide analysis is necessary as the repercussions of climate change extend far beyond individual sectors; a sector-specific approach would not capture the broader poverty and development implications. The economy-wide analysis is based on the results from macroeconomic models (see Box 5.1). Microsimulation modeling provides estimates of impacts on poverty and income distribution.

Climate change damages could cost nearly 14 percent of GDP by 2040, but adaptation measures could reduce these costs by up to two-thirds. Slow-onset events like rainfall variability affect agricultural productivity (see Section 4.1), human health, and labor productivity. However, the largest economic impacts arise from extreme weather events that damage or destroy infrastructure, notably typhoons, which are likely to become more frequent and stronger with a warmer climate. Extreme events also increase risks to the financial sector. Similarly, the Government risks having to cover disaster responses and recovery costs. Modeling shows that climate change could cost as much as 13.6 of GDP by 2040 (Figure 5.1). Up to two-third of these climate impacts might be offset through climate adaptation measures, but these will require substantial public and private financing.

Low-carbon transition scenarios derived from the Government's energy transition plan (PEP 2020–2040) could yield modest yet positive GDP effects compared to BAU, of around 0.5 percent by 2030. Shifting from an energy- to a capital-intensive energy system increases investment. The combined effect of increasing investment in low-carbon energy generation and using carbon tax revenues for growth-sustaining public expenditures will likely increase GDP by 0.5 percent by 2030. However, if carbon tax revenues are used for consumption, the net impact on GDP by 2030 is close to zero. Modeling suggests that the net impact of mitigation actions could be positive in the next few years and the coming decades. There will be an immediate economic boost due to investment stimulus effects. Higher investment and capital accumulation rates could continue if carbon tax rates are maintained and used for investment.

Box 5.1: Models used and key assumptions for the modeling work

Macroeconomic models are large numerical tools that capture the economy's structure and behavioral response of agents (firms, households, government) using economic data. From this, the economic impacts of shocks or policies can be derived.

We use several models, because each has its strengths and weaknesses. The two main models used are based on different assumptions about how the economy works. Both models are based on recent social accounting matrices that show economic interactions at a high level of detail. The MANAGE Computable General Equilibrium (CGE) model focuses on supply-side factors and assumes that the economy always operates at full capacity; results represent a redistribution of the available resources. The MRIO model focuses on the demand side and assumes that the economy always operates below full capacity, meaning that more resources may be brought into production when needed. The results from the two models give a range of potential outcomes, with MRIO and MANAGE results often considered more suitable for the short term and long term, respectively.

Microsimulation modeling is used to identify distributional and poverty effects in all the scenarios. The GIDD model draws on MANAGE results and uses income and expenditure patterns data to estimate impacts on the Gini index and poverty rates. The Carbon Price Assessment Tool (CPAT) distributional model works similarly and provides estimates of impacts on each income quintile.

Finally, a separate estimate of trade impacts was prepared using the ENVISAGE CGE model. ENVISAGE works the same way as MANAGE but is global in scope and can be used to assess CBAMs.

The Modeling Background Note provides additional details on the modeling.

5.1 Damages from climate change

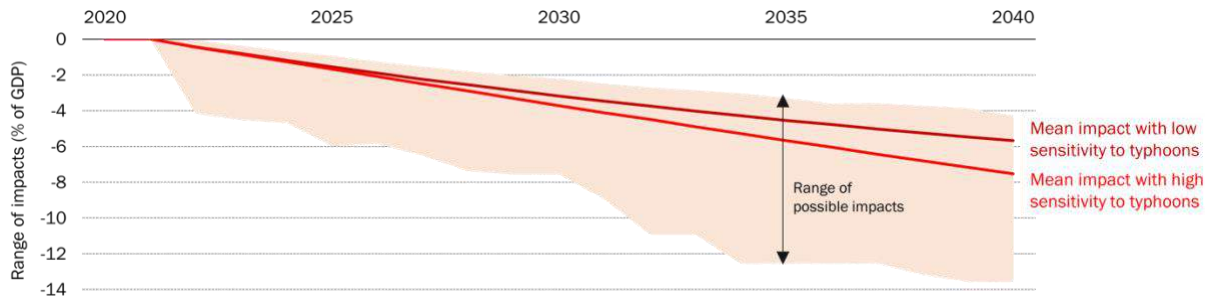
- Increasing intensity and frequency of extreme events and productivity losses could lead to economic damages that amount to 13.6 percent of the country's GDP by 2040.
- All sectors would be affected, with the worst effects in capital-intensive industries; the poor would suffer the most.
- The financial sector would also be affected: for a 1 percent rise in the typhoon damage ratio, the non-performing loan ratio rises by an average of 0.66 percent in the same year.

The economic impact of climate change is substantial, reducing capital stock, decreasing factor productivity, and increasing financial sector risks. Although there is a high level of uncertainty, current analysis point towards potentially substantial costs. Rising temperatures and changing rainfall patterns will likely have negative impacts on human health and labor productivity (Hallegatte and others, 2016) and reduce many crops' yields (see Section 4.2). Most importantly, the frequency and severity of typhoons are likely to increase, with higher damage costs (see, for example, Miyamoto International, 2019). Informing the economy-wide CGE model with these climate impact estimates results in a significant negative impact of climate change on the Philippine economy (see Figure 5.1). Also, stress tests indicate higher risks to the financial sector regarding bank capital adequacy due to more frequent and intense typhoons, especially tail events.

5.1.1 The economic impact of climate change

The economic damages of climate change in the Philippines could reach 7.6 percent of GDP by 2030 and 13.6 percent by 2040. Historical typhoon information is used to calibrate a catastrophe risk model to generate stochastic possible 'next year' events and their destructive potential on capital stock (see Figure 5.1). The average estimated loss of GDP by 2030 is at least 3.2 percent, rising to at least 5.7 percent by 2040. However, the impacts could be much worse, reaching 7.6 percent of GDP by 2030 and 13.6 percent by 2040.

Figure 5.1: Climate change is likely to reduce GDP substantially, but the range of possible outcomes is wide



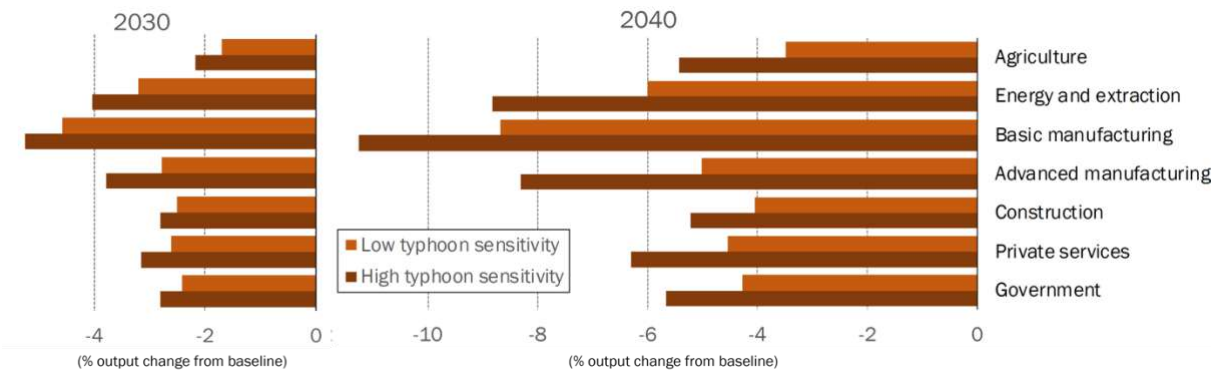
Note: The simulations estimate the possible effects of climate change on agriculture, human health, and labor productivity, combined with more severe typhoons, under different assumptions of economic sensitivity to typhoons. As typhoons are highly variable, a range of possible outcomes is estimated, as shown by the shaded area; the solid lines show the mean estimated outcomes.
Source: CCDR Team estimates based on the MANAGE model

Climate change will affect all sectors, particularly capital-intensive sectors such as energy and manufacturing. The sectors most affected by climate impacts are capital intensive as their capital is vulnerable to typhoons and other extreme events. The model results show that sectors that produce energy and manufacturing goods, which rely on expensive plants and equipment for production, are most affected due to the loss of capital stock. All sectors suffer from some loss of labor productivity. A warmer climate will also reduce agricultural productivity. Without adaptation measures (see Section 5.2), this will lead to a loss of agricultural production of 2 percent by 2030 and 6 percent by 2040, relative to the baseline (Figure 5.2). The lost agricultural production would

mostly be replaced by higher food imports, although higher prices would also reduce demand at the expense of consumer welfare.

These are conservative damage estimates because the modeling approach underestimates the cost of climate damage. Despite widespread recognition of the importance of climate impacts, in the Philippines, limited data could be used in modeling, meaning the analysis does not include all potential climate damages. For example, the impact of wildfires and degradation of natural capital has not been considered, while water stress is only covered in agriculture. Furthermore, the modeling approach assumes that the economy can adapt quickly to sudden shocks like typhoons, which might overlook implementation challenges in disaster response. Results in this section should therefore be interpreted as conservative.

Figure 5.2: Capital-intensive sectors are likely to be most affected by climate change

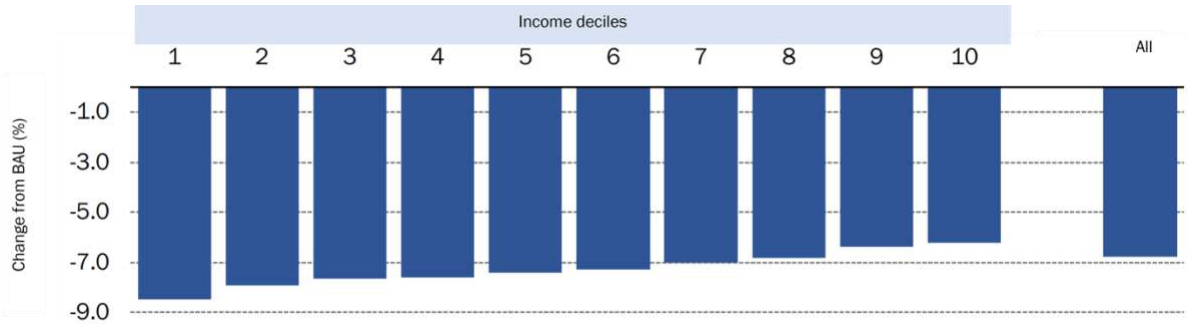


Source: CCDR Team estimates based on the MANAGE model

5.1.2 Distributional impacts of climate change

The effects of climate change will occur during a period of strong economic growth, which will sustain poverty reduction over the coming decades, even without adaptation or mitigation measures, albeit with growing inequality. With GDP per capita projected to grow under BAU, poverty in the Philippines will be nearly eliminated, down from 17 percent currently to 1 percent by 2050. Similarly, economic insecurity will fall from 47 percent to 9 percent over the same period. However, inequality will increase from 43 to 51 points, meaning poverty would have fallen quicker had growth been more inclusive. This contrasts with the trend of the last two decades when falling inequality led to over half of the poverty decline (World Bank 2022).

Figure 5.3: Consumption by poorer households will be most affected by climate change



Note: Estimated impacts in 2040 shown
Source: CCDR Team estimates based on the MANAGE model

Climate change without adaptation will increase the poverty rate by nearly a percentage point, economic insecurity by 3.3 points, and inequality by 0.3 points. Slower economic growth due to climate change will affect households across the income distribution but poorer households more

(see Figure 5.3). In 2040, consumption by the richest 20 percent of people will decline by 6–7 percent compared to a scenario without climate change. Poorer households will experience a greater decline of more than 7.5 percent for the entire bottom half of the distribution, and of more than 8 percent for those in the lowest decile. Consequently, poverty will be 0.9 points higher by 2040 than it would otherwise be without climate change, economic insecurity 3.3 points higher, and inequality 0.3 points higher.

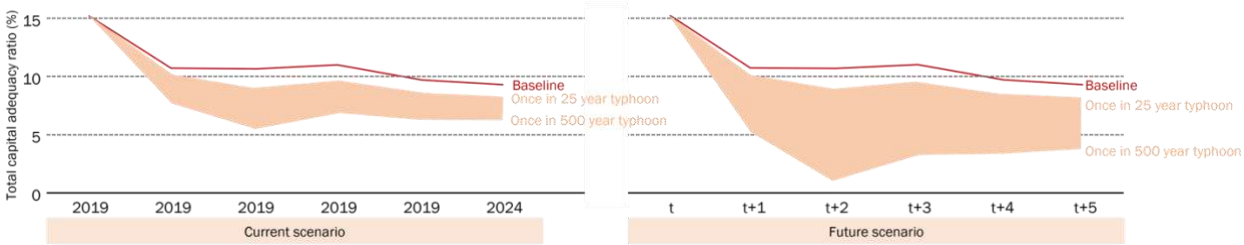
5.1.3 Impact of climate change on the financial sector

The Philippine financial sector is highly vulnerable to climate risks. Climate and environmentally-related financial risks originate from physical and transition sources. Physical risks include extreme weather events and gradual climate changes, while transition risks relate to economic adjustment costs during the transition toward a greener, carbon-neutral economy. These risks could be affected by climate mitigation efforts, as abrupt policies to reduce GHG emissions could have negative short-term economic impacts.

Typhoons impact credit risks significantly. Disasters affect borrowers' repayment capacity and can damage underlying collateral, potentially affecting a bank's profitability and solvency. For the Philippines, regression results show that the occurrence and size of a typhoon have a significant and sizable impact on non-performing loan ratios, providing strong evidence for increases in defaults in the aftermath of a storm (FSAP, 2021). A 1 percent rise in the typhoon damage ratio—the total amount of typhoon damage divided by the GDP of the respective region—increases the non-performing loan ratio by 0.66 percent in the same year on average. The impact remains severe up to two years later but declines in the third year. Interviews with BSP and banks suggest that rural and cooperative banks are the ones most affected by the impacts of typhoons. In contrast to universal banks, these banks predominantly operate in the regions and hold sizable agricultural loan exposures (17.5 percent).

Physical risks can lead to economic costs and losses beyond credit risks. For instance, financial institutions operating in the Philippines face disruptions from physical damage to buildings and infrastructure after storms and natural disasters. These events impact the efficiency with which financial institutions can support affected communities with disaster relief packages and reconstruction loans. Market risks can arise from equity and bond holdings by banks and investors due to catastrophic events and slow-moving impacts of temperature and sea level rise. The insurance sector also faces underwriting risks when large-scale disasters affect their ability to pay claims. Climate change in the next 20–40 years may increase the impact of a severe typhoon on bank capital adequacy nine-fold, especially in tail events such as a joint shock from a severe typhoon plus a pandemic (Figure 5.4) (FSAP, 2021). Results indicate that financial sector authorities and institutions must integrate climate risks into their overall risk assessment and management framework.

Figure 5.4: Climate change can have a significant impact on bank solvency through typhoons



Note: This figure shows the impact of typhoons on bank capital relative to baseline over a period of up to five years after the initial shock materializes, for both scenarios described in the text.
Source: Adapted from FSAP (2021).

Philippine banks are exposed to transition risks through asset holdings in polluting and GHG-intensive industries. The exposure of Philippine banks to the power sector is notable: loans to power generation constitute about 10 percent of their total loan portfolio, with coal accounting for about 80 percent of this. Coal faces significant price competition from cleaner energy sources and regulatory pressure to reduce its share of power generation. In this context, Philippine banks' coal-related assets might lose financial value. To mitigate transition risks and the economic impacts of natural disasters in general, the Government recently adopted the national DRFI strategy, a key milestone in improving financial planning for disasters (see Section 5.4).

5.2 Adaptation actions to reduce the impact of climate change

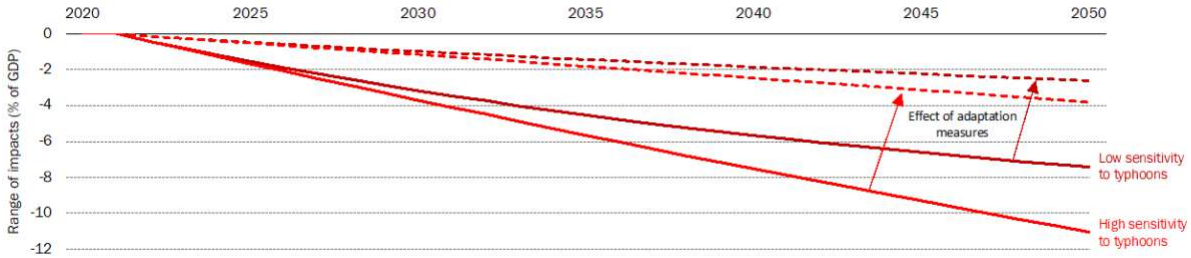
- Adaptation measures can reduce the economic losses from climate change by around two-thirds.
- Depending on the financing mechanisms, short-run GDP could be boosted by 0.7 percent compared to the baseline case without investment.
- All sectors would benefit from adaptation, with benefits being highest in capital-intensive industries.

Actions to manage climate change and shocks will increase aggregate productivity, physical capital, and human capital. In this section, we examine how the Philippines' actions to adapt to climate change would affect its economy. Although some mitigation actions contribute to adaptation, they are not included here and will be considered in the next section. As discussed previously, climate shocks are projected to have a major negative impact on the Philippine economy. Adaptation measures would reduce the impact of these shocks and stimulate new growth and jobs in some sectors (Figure 5.6).

5.2.1 The costs and benefits of adaptation climate actions

Measures to adapt to climate change could reduce economic losses by around two-thirds. The key adaptation measures are in agriculture, infrastructure, and human capital. In agriculture, adaptation measures reverse the projected 5.5 percent loss of land and induce a net increase in rice and corn yields. From a macro perspective, however, the most important adaptation measure is to protect vulnerable infrastructure from typhoons, which would avoid a large proportion of the damages. Finally, health and education interventions preserve labor productivity: investments in health system preparedness, nutrition interventions, increasing awareness, curricula reform, teacher training, and the re-skilling agenda.[67] These adaptation measures could reduce overall damages by 68 percent, and economic losses from human health and labor productivity impacts are assumed to fall by the same amount.[68] These adaptation measures would reduce the mean impact of damages in 2030 from 3.7 percent of GDP to 1.2 percent in response. In 2050, it would fall from 11.0 percent to 3.8 percent (Figure 5.5).

Figure 5.5: Adaptation measures could significantly increase GDP relative to the no-adaptation case



Note: We extend the projection period to 2050 to illustrate the sharp increase in damage impact beyond 2040.
Source: CCDR Team estimates based on the MANAGE model.

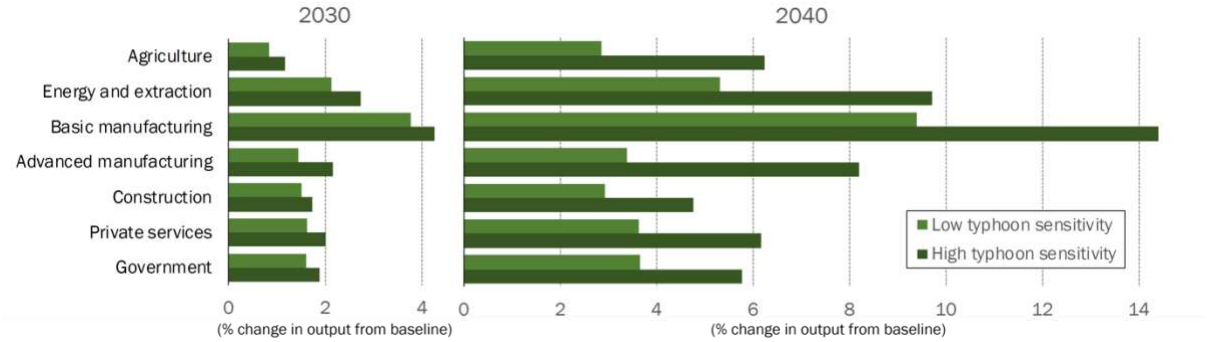
[67] For lack of available data, however, the analysis relies on assumptions on economic losses relating to human health and labor productivity.

[68] Appendix Table B3.1 summarizes the model inputs on adaptation.

The cost of climate adaptation is substantial but easily outweighed by the economic benefits of reduced climate damage. The cost of making vulnerable new infrastructure in the Philippines climate resilient is estimated to be about 0.6 percent of GDP annually. It is important to identify the resilient infrastructure; otherwise, costs could increase five-fold (Hallegatte and others, 2016). The cost of retrofitting existing infrastructure, which is not included in this estimation, would also be higher. The agricultural measures to boost climate resilience would cost the Government about 0.06 percent of GDP annually. The results in Figure 5.5 assume that adaptation investments displace other productive investments. Even so, the economic benefits of avoiding climate damage far outweigh the investment costs at the macro level. However, identifying the distribution of the benefits may be difficult, suggesting a need for public support.

Adaptation actions would have net benefits throughout the economy. For example, the agricultural sector would benefit from measures to boost rice and corn yields. Improving the resilience of the capital stock would reduce the loss of output across all sectors. As typhoons account for the largest share of climate damages in the Philippines, improving the resilience of the capital stock has the biggest effect (Figure 5.6), and the most capital-intensive sectors benefit the most.

Figure 5.6: All sectors will benefit from climate adaptation measures

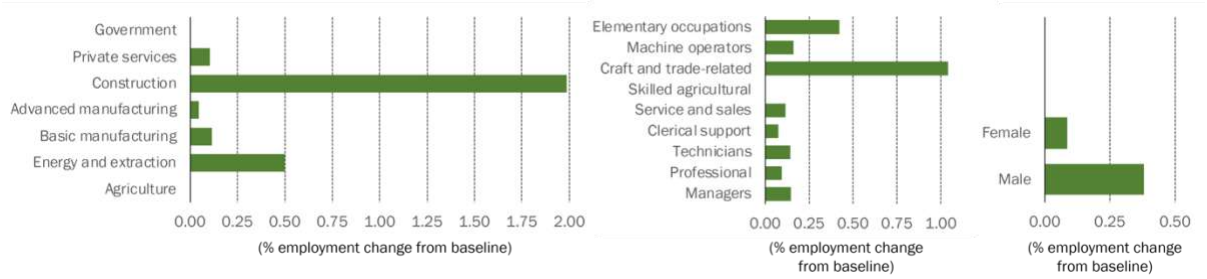


Source: CCDR Team estimates based on the MANAGE model

Adaptation investments would boost short-term economic growth in sectors that improve infrastructure resilience and strengthen these sectors' supply chains. Depending on how they are financed (see Section 5.4), adaptation investments could have a short-term stimulus effect (Figure 5.7).[69] When access to finance is unconstrained, GDP could increase by 0.7 percent compared to the case without investments and the benefits of reduced climate damages. The effects are greatest in the sectors that will contribute to improving the resilience of infrastructure and the supply chains of these sectors. Some of the higher output is obtained through increased labor productivity, but there would also be increases in employment. The impact is largest in construction, and the nature of the work involved suggests that many jobs would involve manual labor, defined as craft and trade-related in the data.

[69] All results cited in this paragraph are based on the MRIO model that assumes that access to finance is unconstrained (through borrowing).

Figure 5.7: Adaptation investments will have a broad range of employment impacts



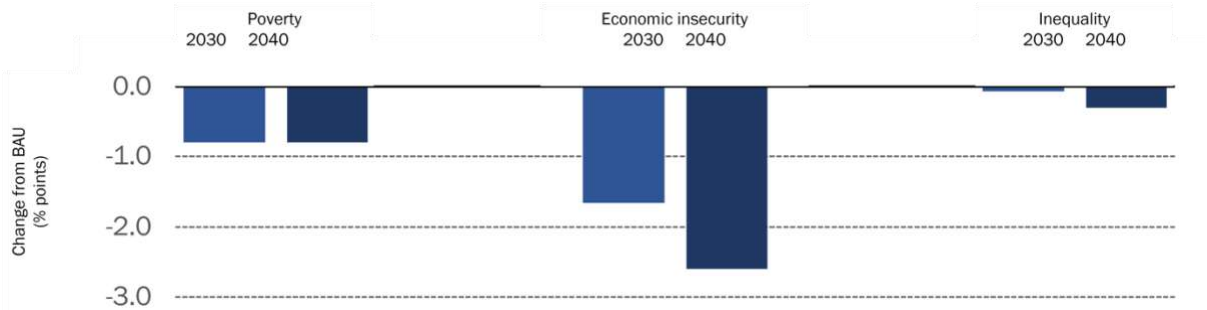
Source: CCDR Team estimates based on MRIO model

5.2.2 Distributional impacts of adaptation measures

Adaptation measures build on poverty reduction under BAU, leading to a percentage point lower poverty and under half a percent lower inequality. The strong growth-driven reduction in poverty and economic insecurity under BAU with climate change also occurs under the adaptation scenario, to a slightly better degree than the BAU (Figure 5.8). By 2030, poverty will be nearly a percentage point lower (0.8 points) than under BAU. As poverty under BAU continues to fall by 2040, this gain stays relatively constant. However, at the higher economic insecurity line, the welfare gain under the adaptation scenario is larger (1.7 points in 2030), a gain that grows over time (2.6 points by 2040). The increase in inequality is also slightly lower than BAU, although the difference is small (0.3 Gini Index points) by 2040.

These modeling results focus on a longer-term horizon where actors have time to adjust to adaptation measures. In the short-term, there could be more significant disruptions. These are explored further in the mitigation section below.

Figure 5.8: Poverty and economic insecurity would decline faster with adaptation measures than under BAU, but there would be little change in inequality trends



Source: CCDR Team estimates based on MANAGE and GIDD models.

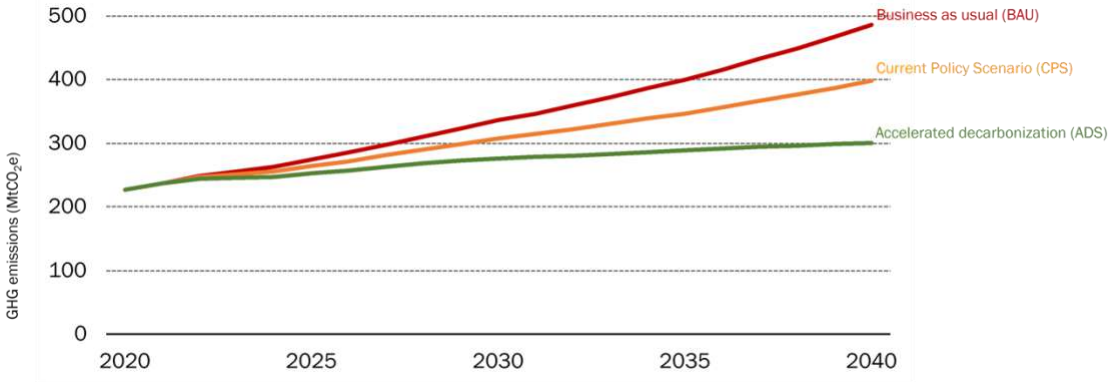
5.3 Mitigation actions stabilizing emission levels

- Mitigation measures could positively impact GDP if carbon tax revenues are used for investment: GDP could increase by about 0.5 percent and generate about 80,000 jobs by 2030.
- Adopting the carbon prices suggested in the two mitigation scenarios will lead to less than a 1 percent consumption reduction by 2030 compared to the pre-reform period.
- Carbon tax and fossil fuel subsidy reform is progressive in itself and more so when it redistributes revenue.
- Positive but small effects on the labor market are expected, with more jobs created than lost, more so if adaptation investment is taken into account.

Many mitigation actions could lead to significant domestic benefits. These include lower electricity prices (see Section 4.3), reduced air pollution (see Section 4.3), and increased

agricultural productivity (see Section 4.2). Reducing emissions may also facilitate future access to export markets if countries begin penalizing emissions-intensive trade (see Section 5.4).

Figure 5.9: Alternative policy scenarios would slow emissions but not reduce them



Source: CCDR Team estimates based on MRIO model.

The most realistic decarbonization scenario from the CPS slows emissions growth; even the proposed ADS only stabilizes overall emission levels. The scenarios described below build on the energy sector deep dive (Section 4.3) and are compared to BAU, which includes moderate climate damages and some measures to adapt to climate change.[70] The CPS and ADS include the same measures to improve energy efficiency and scale up renewable energy as in the energy sector deep dive (Figure 4.6). The ADS also incorporates the energy transition in transport (Section 4.3). Both scenarios also include a carbon price in all sectors to meet emission targets of 30 percent below baseline by 2050 under CPS and 60 percent below baseline under ADS.[71] However, emissions grow rapidly in the baseline regardless of climate damage, and the ADS' overall effect is to stabilize emission levels rather than lead them to net zero (Figure 5.9).[72]

5.3.1 Costs and benefits of climate mitigation actions

Up to 2040, the overall economic impact of mitigation measures will likely be small and could be positive if carbon tax revenues are used for investment.[73] The mitigation measures' economic impact depends on how carbon revenues are recycled. The MANAGE model finds a small positive GDP impact in both scenarios up to 2030 if carbon revenues are transferred entirely to households to compensate them for consumption lost due to the tax. After 2030, there will be a negative impact as the effect of the carbon tax wedge through lower consumption and lower production overtakes the direct transfer to households (Figure 5.10, Panel A). However, the overall economic impact of both scenarios is positive up to 2040 if carbon revenues are used entirely for investment. These positive GDP results reflect a shift from consuming fuel and fuel-related products to investing in the energy sector. This increases the size of the capital stock and allows a higher production level, more than offsetting any crowding-out effects. The MRIO model finds broadly neutral impacts in the CPS but positive impacts for the ADS (Figure 5.10, Panel B) because of an investment stimulus that draws upon the spare economic capacity in the economy. The MRIO model gives slightly better results when carbon revenues are used for consumption due to the

[70] As undertaking adaptation actions is in the country's interest, we use the scenario in the previous section with low typhoon sensitivity with adaptation measures as a baseline for the analysis of mitigation actions. As the Philippines makes a very small contribution to total global emissions, we assume that climate action by the Philippines alone will not affect global climate and so the costs of a warming climate for the Philippines will not change. The choice of baseline does not make much difference to the model results and conclusions from this section, but the mitigation scenarios should be interpreted in the context of climate damages and adaptation measures being implemented.

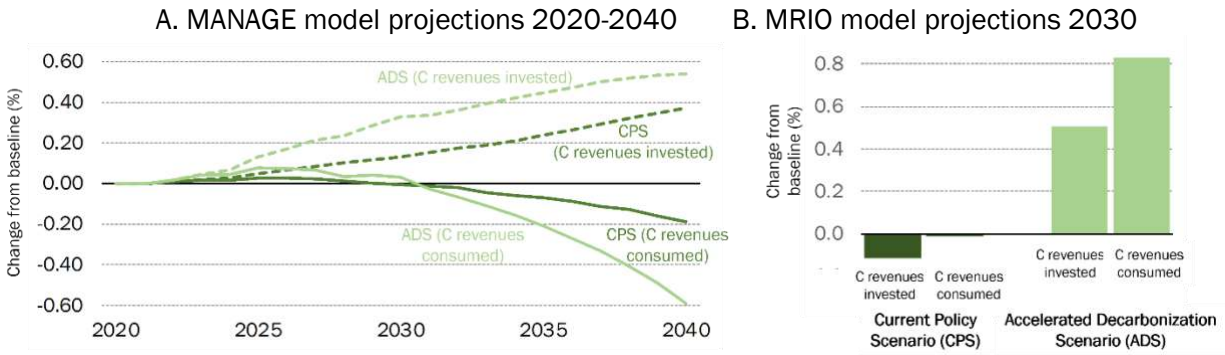
[71] In the CPS, the carbon price is USD5.30 in 2030 and USD18.30 in 2040. In the ADS, the carbon price is USD16.60 in 2030 and USD65.30 in 2040.

[72] Note that these results differ from those shown in Figure 4.5c because they consider all emissions sources rather than just energy.

[73] To avoid results being dependent on a single set of modelling assumptions, both the MANAGE CGE and MRIO models were used to assess the impact of the mitigation measures. Despite their different representations of the economy, the two models find similar impacts of an increase in GDP. of around 0.5 percent in the ADS when carbon tax revenues levied are fully used for investment. The MANAGE model found that GDP would increase primarily because of a shift from consumption to investment that increases the capacity of the economy to produce. The MRIO model found GDP growth occurring due to an investment stimulus that uses otherwise spare capacity in the economy.

lower import content of consumer products. The small impact in both models is due to energy already being expensive in the Philippines, meaning firms do not rely on cheap energy for profitability. The Philippines has already absorbed most of the costs of an energy transition, and so needs less adjustment than its regional peers. Few domestic fossil fuel sources or their labor force would be displaced. It should be noted that these simulations do not include any potential positive effects on GDP from improvements in air quality and labor productivity.

Figure 5.10: The growth impact of an energy transition is likely to be small

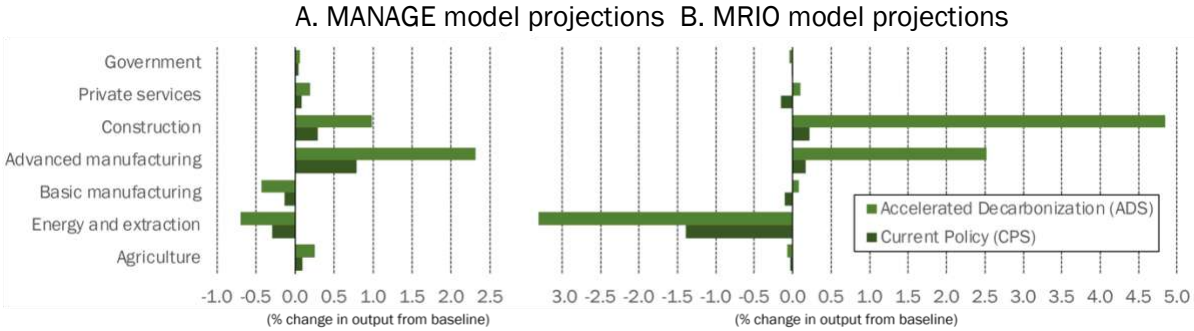


Source: CCDR Team estimates based on MANAGE and MRIO models.

Mitigation measures would support advanced manufacturing and construction growth. The aggregate economic results mask larger impacts in some sectors (Figure 5.11)**.** The sectors that show the largest output increases produce the capital goods required to transition to a low-carbon economy, principally advanced manufacturing and construction. Basic manufacturing is carbon-intensive and loses competitiveness. There are reductions in energy production, reflecting a fall in energy intensity in the economy, indicating transition challenges (see below). There is little impact on the other main sectors of the economy. The two models agree on the likely pattern of sectoral impacts, and the MANAGE results show a similar pattern for 2040 as for 2030.

The mitigation measures could also increase employment by nearly 80,000 jobs by 2030. Assuming that the economy is not operating at full employment, the MRIO tool estimates that around 80,000 net additional jobs could be created by 2030 in the ADS, mostly in the construction and advanced manufacturing sectors. As in the adaptation scenario, the nature of the extra work means many new jobs are manual and would likely be undertaken by men.

Figure 5.11: The impacts of mitigation actions on production in 2030 would vary across sectors



Source: CCDR Team estimates based on MANAGE and MRIO models.

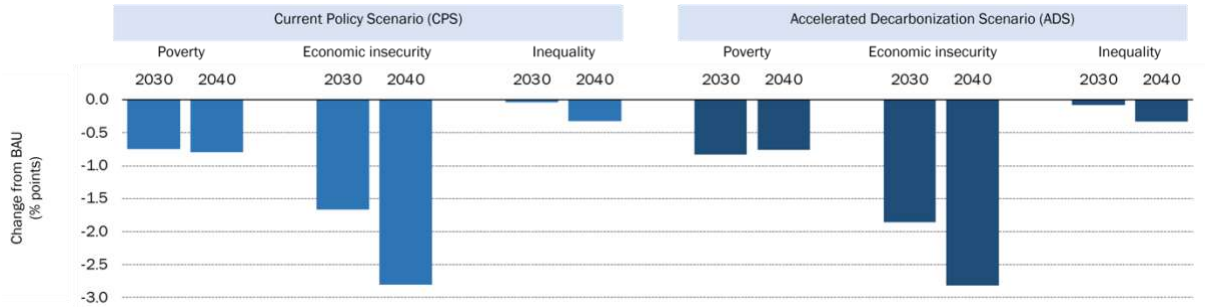
Measures to mitigate GHG emissions in the Philippines could thus boost the economy through the stimulus effect from the required investments. Increased investment, both directly in the energy sector and through carbon tax revenues, could boost the economy's production capacity. It may be possible to achieve a 'double dividend' of reducing emissions while boosting jobs and incomes, incentivizing the private sector to adopt emission-reducing technologies (see Section 5.4).

5.3.2 Distributional impacts of mitigation measures

The distributional impact of mitigation measures is difficult to assess. While the correlation between poverty and climate risks makes the likely distributional impact of adaptation measures intuitive, the impact of mitigation measures is more subtle. The various energy mixes assumed for the mitigation scenarios are associated with different economy-wide shadow carbon prices. Their distributional impacts depend on how these shadow prices affect household income and consumption.[74]

In the long term, mitigation measures could be associated with reductions in poverty and economic insecurity as firms, workers, and consumers adjust to prices. Modeling the CPS and ADS results in similar outcomes to the adaptation ones. Under CPS, poverty will fall similarly under BAU, while economic insecurity will fall slightly more, by around 1.7 points by 2030 and up to 2.8 points by 2040 (Figure 5.12). The increasing inequality of BAU is largely unchanged.

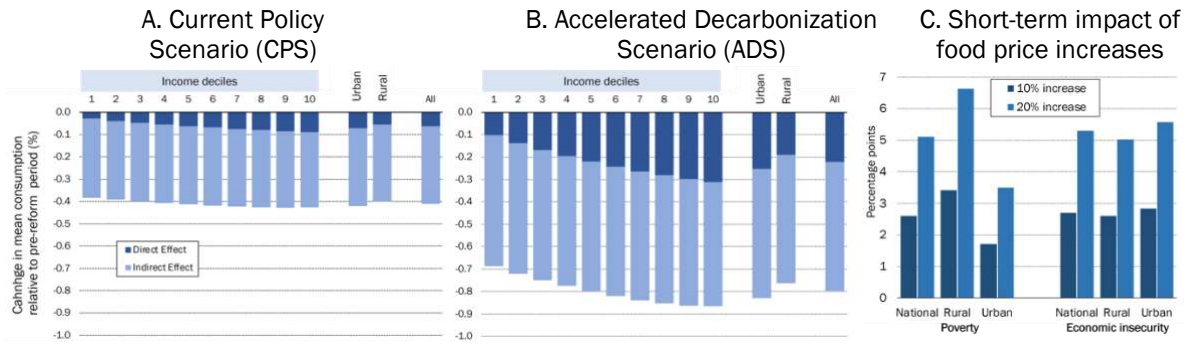
Figure 5.12: Poverty and economic insecurity would fall faster with mitigation measures, but the effect on inequality would be small



Source: CCDR Team estimates based on MANAGE and GIDD models.

Adopting the carbon prices suggested in the two mitigation scenarios will lead to less than a 1 percent consumption reduction by 2030. The burden of impact is progressive, impacting richer households more (Figure 5.13). In addition, the indirect effect through general price increases is expected to be stronger than the direct effect through fuel price increases, partly explaining why the effect is more potent in wealthier households and urban areas. Further investigation of the components of the indirect channel reveals that the food, chemical, and clothing sector are the most affected.

Figure 5.13: Mitigation actions would affect all income groups directly and indirectly



Note: The mean consumption is presented as a percentage of the pre-reform disposable income of consumers in each decile. Estimated impacts in 2030 shown.

Source: Panels A and B, CCDR Team estimates based on CPAT model; panel C: CCDR Team estimates based on FIES 2018.

[74] In the MANAGE model, energy is assumed to be a near-complement with capital in the short-run, but a substitute in the long-run. Thus, rising energy prices tend to lead to rising production costs in the short-run when substitution is low and have a direct negative impact on consumers' surplus, but a long-run response would lead to energy-saving technologies that dampen the cost-push factor and positively impact consumers' surplus.

Before firms and households adjust, higher prices could lead to significant negative poverty impacts in the short-term. Price changes play almost no role in longer-term outcomes. The macro model assumes that firms, workers, and consumers adapt their production technology, employment decisions, and consumption patterns to new prices and wages. However, these adjustments may take some time, and longer-term positive household welfare outcomes may mask short-term adjustment pain. Food and energy account for between half to two-thirds of the consumption of the poorest 50 percent of households, making them very vulnerable to price increases. Moreover, energy indirectly affects household consumption through higher transportation and other input costs. Figure 5.13, Panel C shows the effect on poverty and economic insecurity if adaptation and mitigation measures were to increase food prices by 10 or 20 percent in the short term without corresponding adjustments to household behavior. Under such a scenario, a 10 percent increase in food prices would increase poverty by 2.6 points and economic insecurity by 2.7 points, with impacts in rural areas higher than urban ones. Over time, households would shift to cheaper goods, and producers would change input patterns, so these estimations can be considered the upper bound of short-term welfare loss.

The more ADS induces small increases in labor demand in the agriculture, transportation, education, and construction sectors. One of the medium-term effects of the carbon tax is its effect on the labor market structure. The effect of increasing carbon prices on specific industries and occupations depends on the tax level set and revenue recycling assumptions. MRIO model estimates show that introducing a carbon tax and recycling the revenues in equal shares into clean investment and increased government spending would increase labor demand in agriculture, transportation, education, and construction compared to the pre-reform period. On the other hand, there could be lower labor demand in the wholesale and retail services and manufacturing sectors. In relative terms, the electricity and gas sector is expected to experience the largest labor demand reductions; however, given the sector's small employment share, the effect on total jobs would be minimal.

Negative short-term impacts could be mitigated using carbon tax revenues for income support or reskilling workers affected by decarbonization measures. Reallocating employment from emission-intensive sectors towards "green jobs" will be one of the key issues in the transition to a low-carbon future. The new jobs under adaptation and mitigation (for example, solar panel or electric bike manufacturing) may differ from old jobs (for example, coal mining) in terms of their location and skill requirements. Constraints to mobility could prevent people from taking new jobs. In addition, the new jobs may require different skills than the old jobs. Some of the revenues from carbon taxes could be used to help achieve a just transition by supporting reskilling or relocation. Estimates using CPAT show that recycling carbon tax revenues could reduce inequality by 2.5 percent under CPS and 1 percent under ADS, with the reduction being greatest in rural areas, reaching as high as 3 percent under CPS. The greatest effects on inequality would be achieved using carbon tax revenues for lump-sum transfers to poorer households.

Overall, the largest economic impacts will be felt if the Philippines fails to adapt to climate change. The model results indicate that the largest macroeconomic impacts will occur if the Philippines fails to take measures to adapt to climate change. The poor and vulnerable will also be most affected directly, as they have the least means to adapt to climate change and indirectly due to slower economic growth. Around two-thirds of these adverse impacts could be averted by taking measures to adapt to climate change, notably by changing crop planting and making infrastructure resilient. Ensuring that adaptation measures are effective is critical, therefore. Measures to reduce emissions within the Philippines could also have macroeconomic benefits in terms of slightly higher GDP levels and, at least in the short-term, more jobs. These impacts are mostly much smaller than those associated with climate damage. Depending on how the necessary investment is financed, there could be increases in prices and economic insecurity (compared to a scenario without emission reductions). The next section examines financing climate actions.

5.3.3 Impact of international climate actions

The impact of climate actions by the international community will affect the Philippines' economy and trade. Globally, countries are implementing climate policies that directly and indirectly impact their economies and trading partners. Trading partners implementing their NDCs could affect the Philippine economy by changing trade demand and global prices. Some countries are also considering implementing carbon taxes on imports—such as the EU's CBAM, which would restrict demand for carbon-intensive goods. The likely impact of these changes on the Philippines is unclear. A trading partner's imposition of carbon taxes will lead to a decline in its income, leading to lower overall demand for imports, including any goods imported from the Philippines. Conversely, demand for low carbon-intensive products may increase, and the Philippines might be able to export more. Whether positive or negative, however, these effects are likely to be small. Even if the EU successfully cuts emissions by 55 percent in 2030 relative to 1990, the negative impact on the Philippines would be tiny[75] (Brenton and others, 2022).

5.4 Financing climate actions

- Given the projected loss of physical capital due to climate damage, public and private investments are needed to finance adaptation through climate-resilient infrastructure.
- On the public side, strengthened budget tagging, procurement policies such as green public procurement (GPP, and layered Disaster Risk Financing Strategy implemented by the Government are helping to incentivize climate actions.
- Setting a moderate price on carbon of up to USD5/tCO_2 could signal firms and individuals to adopt low-carbon technologies while raising revenues of up to 0.4 percent of GDP per year.
- On the private side, issuing ESG bonds under the recently introduced Sustainable Finance Framework (SFF could leverage private financing for climate actions.
- New technology-push and demand-pull policies under development by the Government are also aiming to accelerate the adoption of green technologies by the private sector to reduce emissions.

Comprehensive estimates of financing needs for adaptation are not available. The projected investment levels in the MANAGE CGE model give a conservative estimate of 0.7 percent of GDP (0.6 percent for infrastucture and 0.06 percent for agriculture). This cost is most likely an underestimate since only new infrastructure is assumed to be climate-proofed; retrofitting existing infrastructure stock will cost more, although with depreciation and a large volume of the potential destruction of capital projected, by 2035, much of the infrastructure in the Philippines will have been renewed. It is also important to remember that some adaptation measures would not require additional spending. For instance, avoiding building in shock-prone areas would displace investments.

There are significant green investment opportunities in the Philippines, but the current level of investment is low. There are an estimated USD168 billion in green investment opportunities in the Philippines between 2020 and 2030, including USD39 billion for greening the existing and future energy infrastructure, USD104 billion for building climate-smart cities, and USD25 billion for speeding the green transition in select sectors (IFC, 2021). However, the Philippines only attracted an estimated USD0.6 billion in green investment from foreign companies between 2017 and 2021, mostly in renewable energy.[76] This was considerably less than the estimated USD2.5 billion in the preceding five years (2012-16). Furthermore, climate investments between 2017 and 2021 represented just 1 percent of total cross-border investment recorded in the Philippines, which is substantially below that of regional peers.

[75] Exports to the EU account for less than 0.5 percent of Philippine GDP so small macro impacts even from very large EU policies are not surprising.

[76] IFC estimates based on 2012-2021 data from FDI Markets (a service of the Financial Times Ltd.), which tracks greenfield investment project announcements globally. The data reflects the full amounts of investment at the time of project announcement or opening and is different from official data on FDI flows.

The source of climate financing depends on the mandate, incentives, and financing terms. Some adaptation and mitigation measures fall squarely under the Government's responsibility, which can finance them through fiscal policies. Others require regulatory reforms or incentives to drive investment from the private sector. Their financing will have to rely on a suite of instruments (Table 5.1), given the magnitude of investment costs of climate actions. This section discusses the various financing instruments available to the Philippines.

Table 5.1: Climate change financing instruments

	Adaptation	*Mitigation*
Fiscal	Climate-informed public finance	Environmental tax reforms
Finance	Green finance Disaster risk finance (including insurance)	Concessional finance supporting mitigation measures
Private sector	Technology transfer	

5.4.1 Instruments to finance adaptation actions

Implementing adaptation measures requires that appropriate financing is available and that incentives are well aligned. Many adaptation measures would provide direct benefits to individuals or firms and would not require public sector financial support. In these cases, measures may be needed to ensure that incentives are well aligned. For example, farmers have few incentives to adopt water-saving techniques as they do not pay for water (see Section 3.2). Conversely, many measures require public financing as they provide public goods. Providing such support will be difficult in the short term, given the impact of COVID expenditures on public finances that had already been depleted by climate-related disasters, which have caused the loss of public assets, crisis response and reconstruction, and contingent liabilities. Many public sector adaptation actions are likely to be the responsibility of local governments, which poses particular problems for financing. This section, therefore, starts by looking at the role of climate-informed public finance.

5.4.1.1 The role of climate-informed public finance

Mainstreaming climate considerations in PFM is essential. Public expenditures represent 25 percent of GDP. They can have an important positive or negative impact on climate adaptation and mitigation efforts, depending on the type of expenditures and infrastructure they finance. In particular, the Government's ambitious *Build, Build, Build* infrastructure agenda, with a country-wide pipeline of mid-term investments worth USD41 billion, offers a significant opportunity to build low-carbon, climate-resilient infrastructure. Ensuring these expenditures contribute to climate action requires climate-sensitive PFM policies and processes, such as climate budget tagging and climate-sensitive transfers to local governments. This is the thrust of the Coalition of Ministers of Finance for Climate Action, of which the Philippines is part.

An assessment of the Philippine PFM system indicates room for improvement. While the Philippines made early attempts to institutionalize climate budget tagging (see Chapter 3), its implementation remains limited. CCET is based on a list of pro-climate expenditures (largely focused on adaptation) and does not consider the negative impact of expenditures on climate change, such as fuel subsidies. It does not include tax incentives and does not assess their impact on the climate transition. Compliance with budget tagging is low, with only an estimated 10 percent of spending units submitting their climate expenditures as it is not hard-wired into the budget management system.

Given the projected loss of physical capital due to climate damage, public investments are needed to finance adaptation through climate-resilient infrastructure. Climate-related investment projects are identified in the Philippine Development Plan, the Philippine Investment Program, and the three-year rolling infrastructure plan to ensure alignment with the country's climate strategy.

However, large projects are not systematically screened for exposure to physical or transitional climate risks. Neither climate risks nor the projects' impacts on climate change are considered in the appraisal and selection of large projects.[77] Climate mainstreaming could also benefit from integrating currently fragmented PPP and public investment management (PIM) systems to use a unified approach for project identification, appraisal, and implementation (Kim and others, 2010). Likewise, public asset management is a nascent and very decentralized function; the absence of a comprehensive and up-to-date asset valuation and registry limits the vulnerability assessment of critical assets or their insurance against climate disasters. The recent National Asset Management Law (2020) and the development of a national asset registry aim to address these weaknesses.

Fiscal transfers to subnational governments are not climate-sensitive, and their revenues mandated for disaster-related spending are not fully set apart. Although LGUs are on the front lines of climate risks and action, fiscal decentralization is not yet fully climate-informed nor used as a lever to encourage local climate policies. This is a missed opportunity, considering the large share of the internal revenue allotments (IRA) going to LGUs; this is estimated at 3.9 percent of GDP, to be increased by nearly 40 percent in nominal terms in 2022 through the application of the Mandanas ruling. Such transfers also represent the largest source of financing for many LGUs and a unique opportunity to foster climate resilience, adaptation, and mitigation at the local level. There are currently no regular climate-conditional transfers to LGUs. The only mandate partly associated with climate is the Philippine Disaster Risk Reduction Management Law, which mandates allocating at least 5 percent of regular LGU income to support disaster risk management activities. However, the revenue LGUs generate from local taxes, fees, and receipts from economic enterprises, which are mandated to be used for disaster-related spending or set aside in a future disaster trust fund, are partially or wholly missing. This indicates a need to focus on LGUs' capacity to implement their disaster mandate, and accountability and transparency in managing risk funds.

GPP is being introduced to use the public sector's purchasing power to achieve environmental objectives. All government spending on capital outlays and most maintenance, operating, and other expenses fall under public procurement in the Philippines, estimated from the last two years' budgets at PHP 2193 billion. The Philippines adopted a GPP roadmap in 2017 to ensure expenditures promote and support sustainable development. The Philippines has adopted a market-based approach starting with the mandatory use of the green technical specifications developed for 20 priority products under specific timeframes. The goal is to progress from GPP to sustainable public procurement. Given the Government's expenditures, adopting GPP may be an effective climate change and adaptation measure.[78]

5.4.1.2 The role of green financing

Investors seeking green investment opportunities could help finance the adaptation and climate-resilient investment needs of the Philippines. However, this demand is yet to be tapped at scale by the country's financial sector. Investors demanding green and sustainable assets represent over a third (more than USD30 trillion) of total assets under professional management (GSIA, 2018). According to a survey done by Morgan Stanley Investment Management and the Morgan Stanley Institute for Sustainable Investing, climate change is a leading investment theme for these investors (Morgan Stanley, 2019). This opens up a potential opportunity for climate-smart investments in emerging markets. However, benchmarking the Philippines against Indonesia, Malaysia, Thailand, and Vietnam on the depth of their sustainable debt markets reveals that the

[77] NEDA is considering updating the Investment Coordination Committee (ICC) project appraisal and approval guidelines to make them more climate sensitive, building on and complementing the more traditional environmental impact assessments. It is also considering the adoption of a differentiated social discount rate for projects with positive climate externalities to support the government's climate adaptation and mitigation efforts.

[78] Areas for improvement of the GPP include the need for strong linkages between different government institutions and agencies involved in the implementation of the GPP initiative alongside other government initiatives on climate change, particularly the coordination and evaluation and assessment of the actual effects on climate change adaptation and mitigation action of the government's GPP initiatives; establishment of proper monitoring, assessment and reporting mechanism or tool on the impact of the GPP initiatives, including the use of emergency procurement in climate induced disasters; and expansion of the scope of the adopted market-based approach to include the procurement of civil works and infrastructure projects in the GPP Roadmap.

Philippines is lagging. In contrast, sustainable corporate finance in the Philippines is significantly more developed than in sovereign markets.

Several market and institutional barriers need to be addressed to scale green finance, among which is the absence of a green finance taxonomy. The Financial Sector Forum—consisting of BSP, the Security and Exchange Commission, the Insurance Commission, and the DOF—is currently working to adapt the ASEAN green taxonomy to the context of the Philippines. Another constraint is limited capacity and knowledge in financial institutions to originate climate and green investments and manage climate-related risks. This is compounded by the limited availability of green capital market instruments and institutional investors' limited awareness of green assets. The national platform for green or sustainable finance being prepared by the BSP could help alleviate these information asymmetry constraints.

The Philippines started issuing ESG bonds under the recently introduced Sustainable Finance Framework (SFF). Sovereign ESG bonds are aimed at financing capital-intensive climate adaptation and mitigation projects. In March 2022, the Philippines successfully issued its first ESG bond for USD2.25 billion. Before the ESG bond issuance, the Government introduced the Republic's SFF in January 2022 to support its sustainability commitments. Proceeds raised under the SFF will contribute to the Philippines' financing needs to climate-proof its infrastructure stock and deliver on its climate commitments.

5.4.1.3 The role of disaster risk financing

Climate-related disasters have had a sizeable negative impact on public finances. LGUs are the first defense against disasters but face substantial spending needs after major disasters. Given their limited resources and capacities, they generally rely on government assistance, which is often late and insufficient. Between 2015-18, the Philippine Government spent, on average, 4.3 percent of the national budget on rehabilitation and reconstruction after disasters. Out of this spending, 0.20 percent was provided through pre-arranged financing sources by national and public agencies; the rest was funded through budget reallocations and general contingency funds. Over the same period, the national government covered 66-100 percent of post-disaster costs, with most spent on public infrastructure, social assistance, and disaster rehabilitation for agriculture and housing. LGU spending on disasters is often underreported, so actual spending is likely higher (World Bank, 2020c).

Figure 5.14: A risk-layered approach can increase the effectiveness of public disaster risk finance

Sources: World Bank (2020c).

To mitigate the economic impacts of natural disasters, the Government adopted a national DRFI strategy, a key milestone in improving financial planning for disasters. Guided by this strategy (adopted in 2015), the government has led the implementation of a transformative program to increase the country's financial resilience. It has expanded its portfolio of DRF instruments using a layered approach (Figure 5.14). In 2017, the government instituted a national parametric insurance program that transferred typhoon and earthquake risk from the Philippines to the international reinsurance market. In 2018, it doubled coverage to PHP20.5 billion (USD406 million). The program aimed to protect (1) 25 LGUs against emergency losses from major typhoons

and (2) national government agencies against emergency losses from major typhoons and earthquakes for national government assets in these provinces (World Bank, 2021). The government annually allocates resources to the National Disaster Risk Reduction and Management Fund and Quick Response Funds to address disasters. It has also leveraged contingent lending from international partners.

The Government continues to roll out new components of this layered DRF Strategy. In December 2019, the Philippines sponsored a 3-year, USD225 million catastrophe bond (CAT bond) against natural disasters. The CAT bond was issued in two tranches, with up to USD75 million for earthquakes and USD150 million against losses from tropical cyclones (World Bank, 2020a). The CAT bond was triggered by typhoon Rai in 2022, providing a payout of USD52.5 million (Evans, 2022). The government is now preparing the National Indemnity Insurance Program to cover strategic high-risk national government assets with the Bureau of Treasury as the single policyholder. The government is also establishing the Philippine Catastrophe Insurance Facility, which aims to pool disaster risk and facilitate reinsurance of catastrophe exposures. It also aims to reform agricultural insurance and the Philippine Crop Insurance Corporation.[79]

Implementing the DRFI strategy is already helping improve resilience to climate disasters. For example, it allowed the government to (a) increase sovereign finance available rapidly after disasters; (b) narrow the protection gap by mobilizing the private sector to disaster financing; (c) create a greater understanding by budget oversight agencies of disaster impacts and how these translate into government liabilities, promoting the importance of risk reduction. For instance, the payout of the CAT bond was instrumental as it came at a time of increased fiscal constraints imposed by COVID-19. With the above, the government also works on strengthening its risk layering approach whereby different funding sources are made available and after disasters, cheaper and quicker sources are used first.

5.4.2 Instruments to finance mitigation measures

Mitigation investments will need to be sourced mainly from the private sector, incentivized by the government's existing and new regulatory technology-push and demand-pull policies to accelerate the adoption of green technologies. Technology-push policies include regulatory controls (for example, energy efficiency standards), minimum clean energy shares (for example, Renewable Portfolio Standards, RPS), technology restrictions, and carbon pricing instruments (CPIs. Demand-pull policies, on the other hand, include subsidies for green sectors, voluntary purchase of clean energy, and support for research, development, and deployment. This section examines the feasibility and impact of environmental tax reforms, including CPIs. Discussion on policy incentives highlights a gap in firm-level data, followed by a review of public-private financing instruments for mitigation measures.

5.4.2.1 Environmental tax reforms

Energy-related subsidies are relatively low in the Philippines, limiting the scope for Environmental Tax Reforms. While the Philippines has no explicit carbon tax, the Government collects energy taxes through excise taxes on fuels and electricity consumption. Fuel subsidies are low. Two measures qualify as subsidies on energy use based on the Organisation for Economic Co-operation and Development's Taxing Energy Use for Sustainable Development classification: (a) a fuel cash card program for operators of public utility jeepneys to offset the cost of higher excise taxes, and (b) direct budgetary support to the National Power Corporation from Government. The first measure is controversial as jeepneys are super polluters, but phase-out initiatives have been

[79] The high frequency and severity of typhoons, droughts, and floods in the Philippines pose a significant challenge for the country's agricultural insurers and their reinsurers. The catastrophe exposure is cited by insurers as one reason why local private insurance companies have been averse to participating in the agricultural insurance market. To address these challenges, the government is seeking to reform agricultural insurance, increase its cost-effectiveness, value for money, and penetration by: (1) strengthening agricultural insurance product offerings; (2) reforming the Philippines Crop Insurance Corporation; and (3) creating an enabling environment for agricultural insurance reforms.

unsuccessful so far due to political considerations. As energy and fossil fuel subsidies have been largely rationalized over the past few decades, there is limited potential to consolidate expenditure from subsidy reform.

Setting a moderate price on carbon through a carbon tax of USD5/tCO_2, with the possibility of raising it in the future, could signal firms and individuals to adopt low-carbon technologies while raising revenues of up to 0.4 percent of GDP per year. Setting a carbon price aligned with the emission reduction from the Government's CPS between 2022 and 2030 would raise additional revenue from fuel excise, increasing from about USD1 billion in 2023 to about USD3 billion by 2030, with total revenue from fossil fuel excise duties as a share of GDP decreasing from around 4 percent in 2023 to around 3 percent over the same period.

Adding an emissions trading scheme (another form of a CPI) to existing technology-push policies is expected to drive significant investment in solar and battery storage technologies without imposing significant burdens on the energy sectors or industrial competitiveness. The Government is considering an intensity-based emissions trading scheme, given the political sensitivity to adopting a carbon tax, even one as low as USD5/tCO_2. Under the proposed Philippines Emission Trading System (PETS), firms in the power sector could offset the initially high investment costs by lowering fuel costs. A 5 percent change in electricity prices due to PETS, a moratorium on new coal-fired power generation, and RPS would lead to less than a 0.1 percent change in costs (World Bank, forthcoming). However, if the PETS is extended to energy-intensive sectors such as cement, some support may be needed to help domestic cement producers, who face increasing international competition, cushion the impact of higher production costs and reduced margins.

5.4.2.2 Incentives to promote green technology adoption

In parallel with environmental tax reforms, the government is preparing to implement tax incentives to stimulate demand for green innovation by firms. The Green Jobs Act of 2016 and the CREATE Act of 2021 establish frameworks to use tax incentives to promote certain strategic activities, including green activities. The Green Jobs Act will provide tax deductions for firms undertaking skills training, R&D, and importing capital equipment for green activities that create green jobs. The CREATE Act will allow income tax holidays and enhanced tax reductions for export-oriented and domestic firms in strategic sectors, including green agriculture, manufacturing, and services, listed in the Strategic Investment Priority Plan. Eliminating tariffs on imports of green technologies such as EV parts is also being pursued. Full and timely implementation of these tax incentives, along with close monitoring and evaluation of the uptake of tax incentives, is essential to incentivize more adoption of green technologies.

Nevertheless, the demand for green financing remains constrained, with firms having limited knowledge and awareness of the economic benefits of green technologies and available incentives. Firms lack awareness of green technologies that can improve profit margins through reduced electricity, fuels, or materials costs over time and consider green investments to have high perceived risks. Recognizing this information gap, the government is designing a more comprehensive set of policy tools. For instance, the Electric Vehicle Industry Development Act of 2022 mandates the Government to craft the Comprehensive Roadmap for the Electric Vehicle Industry, which will include standards and specifications of EVs as well as charging stations, setting up of the local EV manufacturing industry and supply chain infrastructure, strengthening R&D for EV-related technologies, and training the workforce to deal with EVs. It will also include a charging infrastructure and fiscal and non-fiscal incentives such as removing some tariffs and instituting excise duty exemptions and VAT exemptions for raw materials/parts/capital equipment used in EV manufacture.

These latest developments bring the Philippines closer to what some of its peers are doing. For instance, Thailand promotes automotive parts, smart electronics, aircraft and logistics, and medical and support services in its Eastern Economic Corridor. Firms receive additional corporate

and personal income tax exemptions on top of the standard investment incentives. The corridor comprises special industry promotion zones, target industry promotion zones, and industrial areas. Another example is MSC Malaysia, a special economic zone in central-southern Selangor, Malaysia, serving as a high-technology business district and functioning as the research and development center for IT industries in Malaysia. These examples can enrich DTI's effort to support green sectors linked to GVC, such as EVs.

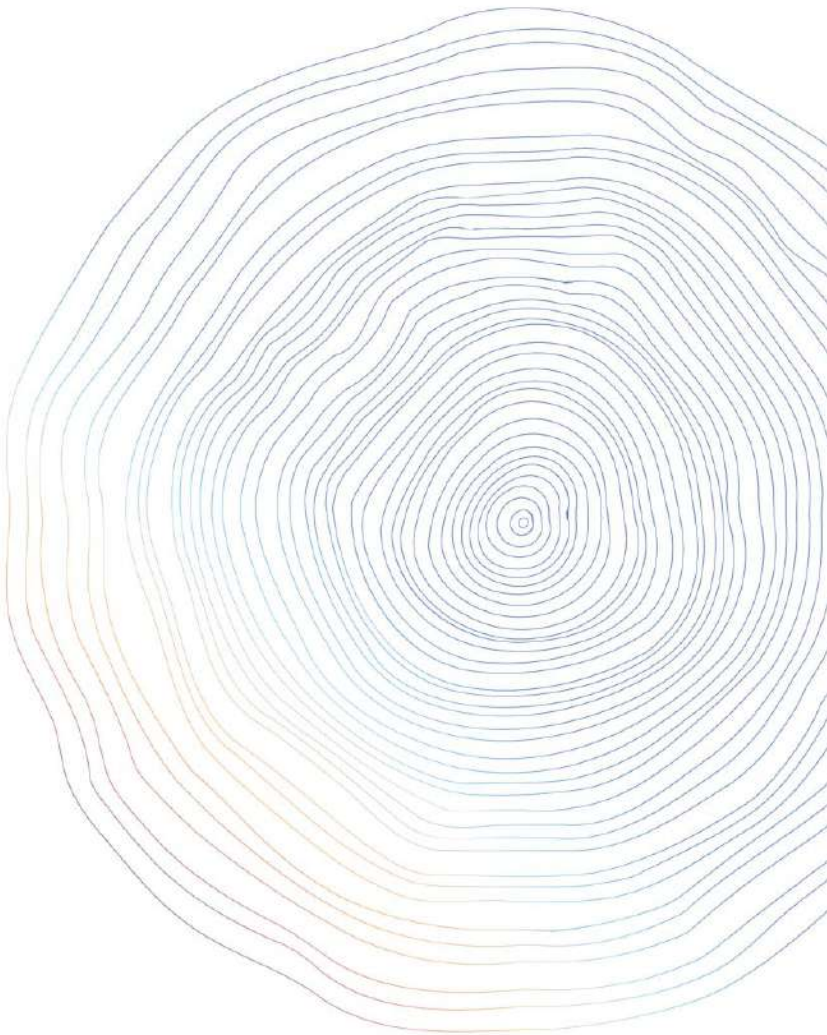
5.4.2.3 Other financing instruments for implementing mitigation measures

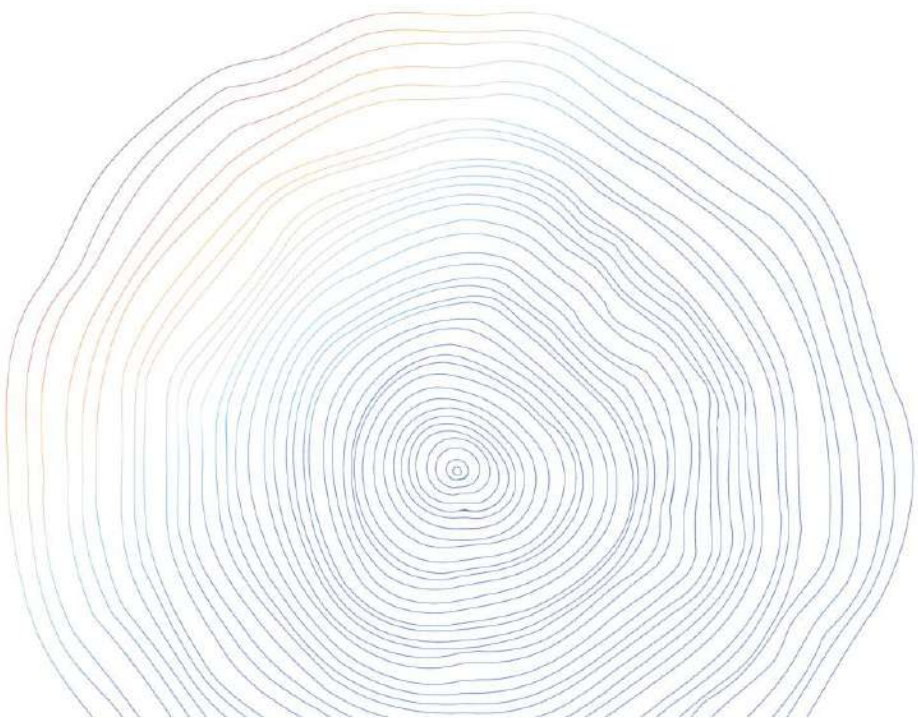
In the context of fiscal policy consolidation, other complementary measures would need to be carefully considered for their budgetary impacts. Examples include grants/subsidies through direct funding transfers or in-kind contributions, such as the provision of technical assistance and risk sharing through lending programs. Such incentives are much more effective if combined with carbon pricing measures encouraging green investment and consumption.

A growing number of international climate funds could be leveraged further. These funds may provide new complementary resources to existing multilateral and International Financial Institutions' financing instruments (including grants and concessional loans) and aim to support the transition to low-carbon solutions and adaptation. For example, several multilateral climate funds, such as the Green Climate Fund, the Adaptation Fund, the Global Environment Facility (GEF), and the Climate Investment Funds, have distributed billions of dollars of climate financing (UN, 2021). Many multilateral financial institutions also fund climate actions. The Government is working with the Climate Investment Funds to finance the early retirement of coal-fired power plants.

Finally, to help incentivize private sector engagement and PPPs, the Government should consider supporting risk transfer mechanisms to help finance green transition projects. One example is the Danish state guarantee model, where the government issued guarantees to help reduce upfront risks, particularly for suppliers for long-term, toll-funded infrastructure investment projects (Holm and Nielsen, 2021).

To promote PPPs in climate financing, the DOF and NEDA could review the provisions of the IRR, bringing it back more in line with internationally-accepted standards and best practices and introducing sound principles for climate considerations in project preparation and implementation. Furthermore, climate resiliency principles and requirements should be introduced in an amended IRR to incorporate sustainability better. Finally, more solicited transactions with a transparent and competitive tender process are recommended to attract credible global private players with greater resources and know-how, particularly in climate and resiliency.





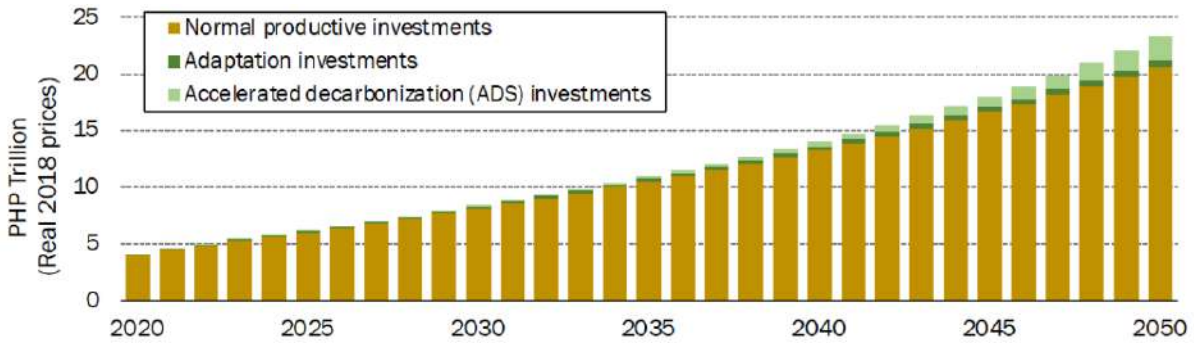
6

Conclusions and Policy Recommendations

While climate change significantly threatens development in the Philippines, the country has many options available to reduce risks. Left unaddressed, extreme weather events and slow-onset changes in temperature and rainfall patterns will significantly lower growth and the wellbeing of Filipinos. The Philippines, however, has many feasible options to respond and has already undertaken a range of responses to climate change. In many cases, solutions require scaling up or fully implementing existing responses rather than developing new ones. The investments required are substantial but not out of reach. As shown in Figure 6.1, they represent a relatively small increase over normal, productive investments. Many of these investments are in the direct interest of individual actors or can be made so by appropriate regulatory and fiscal policy changes. Many actions do not require investments, such as ensuring that new construction does not occur in areas at risk of flooding.

Climate action will bring substantial benefits to the Philippines. This is particularly true of adaptation measures, which would help reduce the negative impacts of climate change, increasing growth substantially compared to if climate change was unaddressed. The benefits of these actions would be felt by all Filipinos but are particularly important for the poor and vulnerable, who would be most severely affected by climate change. Many mitigation actions would also bring substantial domestic co-benefits. Indeed, many such actions should be seen as development actions that also have climate mitigation co-benefits. Many transport sector actions, for example, would be justified based solely on their benefits in terms of reduced air pollution and savings in travel time. Many investments in renewable energy would also be justified solely based on their lower cost—which would allow electricity prices, which are currently much higher than in regional peers, to be brought down. Throughout the CCDR, we have sought to identify such win-win actions.

Figure 6.1: The investment requirements needed for adaptation and mitigation actions in the Philippines represent a relatively small increase over normal productive investments



Source: CCDR Team estimates

The CCDR has identified several priority climate actions. The recommended actions are detailed in Chapters 4 and 5 and summarized in Tables ES.1 and ES.2. The tables indicate whether each action is highly urgent, that is, to be implemented in the short term (the next five years), or of medium urgency, to be implemented later. The tables also indicate whether each action primarily addresses adaptation or mitigation. However, it is important to remember that many address both methods, and all are intended to help the Philippines meet its development objectives and climate commitments.

6.1 Moving forward on climate action

Take action to avoid worsening the problem. Simple actions can reduce future losses from climate change by reducing vulnerability. This includes better flood management and avoiding new construction in flood-prone areas; ensuring new buildings are energy efficient and climate resilient; directing urban growth in transit-friendly ways; reforming agricultural policies that discourage adopting more efficient practices; and ceasing to build fossil fuel plants. As most of these actions

involve *not doing* something, they often require little or no additional expenditures. Some will bring fiscal benefits, for example, carbon taxation, water pricing, and reducing rice subsidies. In some cases, they may involve switching to alternatives that are initially more costly—for example, energy-efficient buildings may be more expensive to build than traditional ones—but reduced long-term cost benefits quickly repay that. In many cases, the tools required to undertake this are already in place and simply need better enforcement (see below).

Make sure the incentives are right. Climate action in the Philippines will primarily have to be undertaken by the private sector, commercial firms, and individual households, especially farm households, making incentivizing them vital. This means (a) ensuring that prices provide the correct signals about the benefits of climate actions and (b) removing obstacles that private actors may face in undertaking climate actions. We can induce farmers to adopt practices that reduce water use and emissions while increasing productivity by ensuring these practices are more profitable than the status quo. We can induce the private sector to invest in RE by ensuring that RE plants are more profitable than fossil fuel plants. Likewise, private sector investments in electric vehicles and energy-efficient and disaster-resilient buildings depend on their profitability. As this issue is so important, we devote Section 6.2 to it.

Climate action in the Philippines must address both extreme and slow-onset events. While there is a need to strengthen efforts to respond to and manage the impacts of large-scale disasters (typhoons, volcanic eruptions, and earthquakes), there is also a need to focus on slow-onset events. The recommendations in Tables 6.1 and 6.2 include measures that address extreme and slow-onset events, and many address both. As detailed in Section 4.1, the frequency and severity of flooding are expected to increase; avoiding new construction in vulnerable areas will reduce the population at risk of these extreme events. Increasing the energy efficiency of buildings will help urban residents deal with the effects of gradually increasing temperatures. Improving water storage will reduce the risk of damaging floods and droughts and, by increasing water availability, allow irrigation to be extended into rainfed areas, thus helping farmers in those areas adapt to higher temperatures.

Responses to climate change need to vary across the country. The effects of climate change will vary across the country. The differences depend on the interactions of many factors, including how climate will change in each area, their socioeconomic conditions, their main economic activities, and the extent and condition of their existing infrastructure. Accordingly, responses also need to vary. As detailed in Section 4.1, some areas will see a significant increase in flood risk; those areas need to be prioritized for appropriate risk-reduction measures and response mechanisms. Many areas use only a fraction of the available water and may not be much affected by changing precipitation patterns. However, some areas already have large water deficits that will be exacerbated by climate change; such areas need to be prioritized.

Target climate actions taking poverty and vulnerability into consideration. Some areas may be less threatened by climate change in an absolute sense but may be affected more severely as the people who live there are less able to respond.

Use ASP to help the poor and vulnerable to manage the risks posed by climate change and the potential adverse effects of climate action. Even with vigorous adaptation efforts, climate change will affect numerous people. Some climate actions may also have adverse effects on some groups, such as workers displaced by the move away from high-emission activities. Direct support to the affected groups is preferable to perpetuating policies (or lack of policies) that are causing the problems (see Section 6.2). The Philippines already has a robust ASP system that can be scaled up to alleviate these problems (see Section 6.3.)

Many climate actions do not require legislative change but improved implementation of existing programs or changes to implementing rules and regulations. For example, strengthening financial sector regulators' capacity to integrate climate risks in monitoring and supervision requires developing regulations, guidelines, and standards but no new legislation. Conversely, some actions would require legislative action, notably introducing CPIs, reforming the FISA Act to improve water efficiency, or establishing a Department of Water Resources.

Table 6.1: Priority climate adaptation and mitigation actions by sector

Sector, action	Urgency	Pathway		Dev impact	Lead agency
		A	M		
Water					
Increase water storage capacity to better manage variations in precipitation	High	++		++	DPWH, DENR, RBCO, NWRB
Implement integrated water resource management in river basins	High	++		++	DPWH, DOE, NIA, NDRRMC
Promote water-saving irrigation technologies and increase water use efficiency	High	+		+	DA, NIA
Improve water supply and sanitation and manage urban water demand	High	+		+	DPWH, LWUA, DILG, NWRB, DA, DENR, DOH, LGUs
Improve flood water management	High	++		++	DPWH, MMDA, LGUs
Use NBS to help manage changing precipitation patterns and storm surges	High	++	++	++	DA, DPWH
Agriculture					
Accelerate adoption of improved practices such as AWD	High	+	++	++	DA
Improve resilience in agriculture through diversification	Med	+		+	DA
Extend irrigation in rainfed areas	Med	+		+	DA
Develop Fishery Management Plans that incorporate adaptive management based on on-going data on changes in migration patterns, stocking rates, etc.	High	+		++	DA/BFAR
Energy					
Scale up investments in solar and wind power	High		++	+	DOE
Intensify energy efficiency efforts in buildings and industries	High	+	+	+	DOE
Invest in expanded power-grid capacity and improved renewable energy integration	High		++	+	DOE
Establish a framework to address the early retirement of coal-fired power plants	Med		+		DOE, DOF
Urban					
Limit new construction in areas known to be at risk of flooding and storm surges by enforcing land use plans and building design standards and using financial instruments such as insurance	High	++		++	DHSUD, DPWH, DOF, DILG, LGUs
Promote integrated urban water management for water-secure cities	Med	+		+	DPWH, LGUs, Water districts, LUWA
Direct urban growth toward greater density	Med	+	+	+	NEDA
Transport					
Scale up and prioritize electrification of the public transport fleet	High	+	+		DOTr, LGUs
Scale up and accelerate mass transit development in Metro Manila and cities experiencing rapid urbanization	High	+	+	+	DOTr, LGUs

Notes: A: Adaptation pathway; M: Mitigation pathway; +, ++ indicate the expected magnitude of benefits in terms of increased resilience, reduced emissions, and overall development impact. High urgency measures are intended to be implemented in the short term (<5 years), and Medium Urgency measures are intended to be implemented in the medium term (5-10 years).
Lead Agencies: BFAR: Bureau of Fisheries and Aquatic Resources; BSP: Bangko Sentral ng Pilipinas/Central Bank of the Philippines; CCAM-DRR: Cabinet Cluster on Climate Change Adaptation, Mitigation, and Disaster Risk Reduction; DA: Department of Agriculture; DBM: Department of Budget and Management; DepEd: Department of Education; DILG: Department of the Interior and Local Government; DOE: Department of Energy; DOF: Department of Finance; DOH: Department of Health: DOLE: Department of Labor and Employment; DOTr: Department of Transport; DPWH: Department of Public Works and Highways; DSWD: Department of Social Welfare and Development; DTI: Department of Trade and Industry; FSF: Financial Sector Forum; NEDA: National Economic Development Authority

Table 6.2: Priority climate actions: cross-cutting

Action	Urgency	Pathway		Dev impact	Lead agency
		A	M		
Social protection					
Improve capacity to respond to extreme events by strengthening and increasing funding to ASP programs	High	++		++	DSWD
Strengthen Active Labor Market Programs, such as skills training and green public works, to support affected workers and promote the transition to demanding sectors in energy transition	High	++	+	++	DOLE
Health					
Ensure health facilities are sited and constructed to resist impacts and use medical technologies and products with a lower environmental footprint	Med	++	++	++	DOH
Automate the reporting of climate-related disease outbreaks and conditions and train health workers to recognize and respond to them	Med	++		++	DOH
Education					
Update guidelines and standards for long-term investment in educational facilities to be more resilient and learning-conducive schools	High	++		++	DepEd
Revise the curriculum to enhance students' understanding of climate science	Med		++	++	DepEd
Train teachers, parents, and communities on climate science	Med		++	++	DepEd
Climate finance					
Increase the use of environmental taxes (possibly including carbon taxes or an emissions trading system) to discourage harmful activities while generating revenues	High	++	++	++	DOF, DBM
Strengthen the capacity of financial sector regulators to integrate climate risks in monitoring and supervision and improve bank climate risk management and disclosure practices	High	+	+	+	DOF, BSP
Accelerate the development and use of a harmonized taxonomy of green finance and investments	High	+	+	+	FSF, DF, CCC, DOLE
Stimulate the demand for green activities and strengthen the pipeline of investible projects by accelerating the implementation of existing legislation aimed at stimulating green actions by the private sector	Med	+	+	+	DOF, DTI
Encourage entry of foreign firms that can bring green technology	Med	+	+	+	DOF, DTI, DOE
Investigate constraints that hinder firms from adopting green technology	Med	+	+	+	DF, DTI
Institutional actions					
Focus government spending on tasks that the public sector must undertake	High				All
Improve coordination of climate actions at all levels of government	High				CCAM-DRR
Enhance the capabilities of LGUs to design and implement climate actions	High				DILG
Focus on effective implementation of existing plans and regulations	High				All

Notes: A: Adaptation pathway; M: Mitigation pathway; +, ++ indicate the expected magnitude of benefits in terms of increased resilience, reduced emissions, and overall development impact. High urgency measures are intended to be implemented in the short term (<5 years), and Medium Urgency measures are intended to be implemented in the medium term (5-10 years).
Lead Agencies: BFAR: Bureau of Fisheries and Aquatic Resources; BSP: Bangko Sentral ng Pilipinas/Central Bank of the Philippines; CCAM-DRR: Cabinet Cluster on Climate Change Adaptation, Mitigation, and Disaster Risk Reduction; DA: Department of Agriculture; DBM: Department of Budget and Management; DepEd: Department of Education; DILG: Department of the Interior and Local Government; DOE: Department of Energy; DOF: Department of Finance; DOH: Department of Health: DOLE: Department of Labor and Employment; DOTr: Department of Transport; DPWH: Department of Public Works and Highways; DSWD: Department of Social Welfare and Development; DTI: Department of Trade and Industry; FSF: Financial Sector Forum; NEDA: National Economic Development Authority

Box 6.1: Some regions will require particular attention

The impact of climate change is likely to vary considerably across the country, with some regions being much more vulnerable than others due to their agro-climatic and socio-economic conditions. These regions will benefit from broad adaptation policies but may also require particular attention.

The Bangsamoro Autonomous Region of Muslim Mindanao (BARMM), for example, has the highest level of poverty (37.2 percent) and the lowest coverage of water supply and sanitation services in the whole country (less than 10 percent) (PSA, 2022). Moreover, most of the poor rely on subsistence-level farming for their livelihood, and food—and agriculture, as discussed in Chapter 4, is one of the sectors likely to be most affected by climate change. Problems are exacerbated by low institutional capacity, a lack of data, uncertainty over access to nationally-funded programs, and fragmented emergency responses between BARMM ministries, provinces, and LGUs. The convergence of strategies and interventions must consider the specific factors to address these challenges.

6.2 Make sure the incentives are right

Ensuring that the incentives are right to undertake climate action is critical. The experience of EPIRA (see Section 4.3) has shown that the private sector reacts strongly when given the right incentives: regulatory reforms in the power sector resulted in installed power generation capacity almost doubling in a decade. The challenge is to channel this potential energy in the right direction. EPIRA was technology neutral, and much of the new capacity was coal-fired. But even then, REs made in-roads. The government has numerous policy instruments to achieve this, as discussed in this section.

6.2.1 Using price signals

Remove perverse incentives. The Philippines lacks the substantial perverse price incentives found in many of its regional peers. In particular, there are no subsidies for energy use. Nevertheless, some sectors, including agriculture and transport, exhibit significant perverse incentives. Perhaps most notably, irrigated farms do not pay for water and thus have no incentive to use it more efficiently. There is also a heavy policy bias supporting the production of rice, which is a large source of very potent GHGs. Jeepneys are subsidized in urban transport. For example, waiving water fees for irrigation is a major factor de-incentivizing more efficient water use. It also costs the government about PHP2 billion annually to cover the cost of irrigation O&M which was previously paid for via user fees. Removing perverse incentives where they exist would simultaneously create incentives for better resource management and ease fiscal burdens on the government.

Use environmental taxes to discourage harmful activities. In addition to discouraging these activities and generating revenue, taxes on environmentally harmful activities will make climate action relatively attractive. In the transport sector, consideration might be given to increasing taxes on standard vehicles or implementing congestion pricing, making owning and using private vehicles more expensive, speeding the transition to EV and public transport. Environmental taxes also generate revenues (see Section 5.4).

Provide direct support to climate-smart actions. Many climate actions generate positive externalities or public goods and appear less valuable to private sector actors than they are to society. In such cases, some form of incentive may be needed to align private incentives with social priorities. This could include explicit subsidies, tax rebates, or some other mechanism. Some steps have been taken toward this, such as the job incentives proposed in the Green Jobs Act. As the Government's fiscal constraints limit its ability to subsidize climate actions, other instruments must be emphasized. For example, regulations could be changed to make insurance more expensive for buildings located in areas at risk of flooding, storm surges, or sea level rises.

There are legitimate concerns over the effects of using price signals to discourage fossil fuel use, but these can be addressed. These concerns are generally based on the possible adverse effects of increasing prices on economic activity and vulnerable groups. In some countries, CCDR analyses have shown that carbon prices could slow economic activities. This does not appear likely in the Philippines, however. The macroeconomic analysis in Chapter 5 shows that even relatively high carbon prices would have a very little macroeconomic impact; as energy is already relatively expensive, firms and households are not dependent on cheap energy. As discussed in Chapter 5, carbon tax revenues could be used to reduce other taxes, offsetting any negative effects on economic activities. As energy often accounts for a relatively high share of expenditures for poorer households, higher fuel prices could affect their wellbeing. However, this concern can be best addressed through ASP programs rather than by keeping prices low. Indeed, this is the approach the Philippines has already adopted. While many countries reduced energy taxes when the Russian invasion of Ukraine sent energy prices soaring, the Philippines provided targeted cash transfers to affected groups through its ASP program.

Provide clear information on climate change and the benefits of climate action. As climate actions may differ from those they are familiar with, firms, communities, and households may be unfamiliar with their benefits. Farmers may be unaware of how new crops or farming techniques affect their productivity or costs. Moreover, there is often an asymmetry between the costs and benefits of climate action. For example, the higher initial cost of energy-efficient buildings and EVs is visible; their lower long-term maintenance and operating costs are not. This problem is likely to gradually diminish as climate actions are more widely adopted and their benefits better known; until this happens, strong efforts are needed to educate firms, communities, and households on their benefits. Climate change-related information must be made understandable and actionable for communities.

6.2.2 Removing obstacles to private sector climate action

Private sector firms and individual households often face numerous obstacles to undertaking climate actions. It is important to note that these obstacles only become an issue when actors want to do something: removing obstacles to activities that firms are not interested in will not increase adoption. Pricing signals are central to the incentive regime to induce transitions to greener production and practices. However, various obstacles may prevent the private sector from undertaking climate actions that are in their interest, which must also be addressed.

Ensure financing is available. Many climate actions require significant investments. However, these investments often have return profiles that differ from traditional investments. EVs and green buildings, for example, have higher upfront costs and lower long-term operating and maintenance costs. Financing investments that consider that cost and benefit structure need to be available.

Remove regulatory obstacles. Regulatory reforms to promote FDI, increase competition, lower trade costs, and link firms with GVCs are integral for creating an environment that enables firms to increase productivity and invest in green innovation. In addition to technology, foreign investment brings the best management techniques required to adapt these new technologies to the Philippine market. Major reforms the Government passed in 2022 will allow foreign majority ownership across previously closed-off sectors. However, the Philippine constitution mandates a 40 percent ownership cap on FDI in companies that explore, develop, and utilize natural resources. Solar and wind have been considered natural resources whose ownership is reserved for Filipinos. Therefore this cap on FDI has forced foreign investors to co-finance projects with domestic partners. The Department of Energy could amend the implementing rules and regulations of the REA, stating that solar and wind are inexhaustible natural resources and remove the cap on FDI to accelerate the deployment of FDI in RE projects.

Attract climate actions by foreign investors. Much of the technology needed to combat climate change exists in foreign markets and could be brought in by foreign investments. In recognition of these benefits to FDI, in March 2022, the Government passed amendments to the Retail Trade Liberalization Act, the Foreign Investment Act, and the Public Service Act. These amendments substantially liberalized the FDI regulatory regime and opened the door for the economy to receive the best green technology in world markets. In addition to technology, foreign investment brings the best management techniques required to adapt these new technologies to the Philippine market. However, to reinforce these FDI reforms, enhanced implementation of existing regulations aimed at protecting intellectual property is needed to incentivize foreign firms to bring and license the latest technology without concerns about that technology being pirated.

Ensure trained workers are available. Skills are needed to adapt and run new, green technologies. Technology can have profound effects on labor markets. Green technologies are likely to be no different. On the supply side, equipping workers with skills that complement the new technologies has lagged, hindering the broader diffusion of innovation within the Philippine economy. If green technologies exhibit similar skill biases, the implications are substantial for the widespread and accelerated adoption required for successful green transitions. In addition, there may be negative distributional issues; in the past, new technologies favoring capital and higher-level skills contributed to a decline in labor's share of income and increased wage inequality. The most needed Government action may be to re-skill the least skilled workers in sectors undergoing green transitions. This will require actions by the Technical Education and Skills Development Authority, DOLE, and the DOE to build a basic understanding of climate science in students.

Strengthen the financial sector's ability to contribute to climate action. The fact that many climate actions will have to be undertaken by the private sector means that the financial sector will play a critical role by offering innovative financing instruments and investment vehicles that reflect green investment needs. Ensuring the financial sector can play this role requires strengthening its capacity to offer green financing and protect itself from climate and disaster risks. On the Government side, this requires strengthening the capacity of financial sector regulators to integrate climate risks in their monitoring and supervision, improve climate risk disclosure practices by banks, and accelerate green finance and investments.

6.3 Improve the effectiveness of government actions

Improve coordination of climate actions at all levels of government. The Philippines has developed a comprehensive set of national policies and legislation to address climate change, but coordination is limited, and implementation has often lagged. As discussed previously, problems often have multiple overlapping and sometimes conflicting mandates and responsibilities. Although coordination bodies have been created, they are not always effective, partly because they are only advisory and lack strong implementation mandates. Stronger coordination mechanisms are vital to avoid duplicative or counterproductive actions.

Enhance the capabilities of LGUs to design and implement climate actions. As LGUs take on more responsibilities—over climate action and other issues—it is important to ensure they have the technical capabilities and resources needed. Moreover, many of the planning tools LGUs rely on, such as CLUPs and CDPs, are limited to their territories. However, effective actions to address problems induced by climate change require coordinated action by neighboring LGUs. Mechanisms need to be developed to enable such coordination.

Focus on effective implementation of existing plans and regulations. The best-designed policies will provide little benefit if they are not implemented. For example, the Green Jobs Act of 2016 establishes frameworks to use tax incentives to promote certain strategic economic activities, including green activities. However, eligible activities have not yet been defined. Likewise, land use plans identifying areas at risk for flooding or storm surges already exist in many areas but are often

not considered when issuing permits for new construction and economic activities. Simply improving the implementation of existing policies will contribute to addressing climate change.

Improve measurement of climate problems and climate actions. Although the Philippines has been a pioneer in environmental accounting, efforts to measure the impacts of climate change and the costs they impose on the country remain limited in scale and scope, often not systematic. Extending these efforts to cover the entire country and carrying them out regularly, ideally annually, would allow the country to understand the effects of climate change better, prioritize and target climate actions, and assess the effect of these actions. The Philippines has implemented CCET for several years, but coverage is not universal and is limited to budgeted amounts and not actual expenditures. As climate actions expand, strengthening the CCET to allow better monitoring that informs development planning and investment programming will be important.

6.4 Help people cope with the effects of climate change and climate actions

People and communities are and will be affected by climate change and associated policies; they must play a proactive role for the Philippines to succeed in its climate change efforts.

Scale up existing ASP programs. The Philippines has a solid base of ASP programs on which it can build to:

- **Mitigate the impact of climate change costs on people.** ASP programs can help the most vulnerable manage climate change shocks. Programs such as 4Ps have already been used to help mitigate typhoon impacts but must be strengthened to face the increased threats climate change poses. There is a need to harmonize existing ASP programs under a coherent policy framework and boost ASP funding. ASP programs could help people adapt to slow-onset, long-term climate impacts by aiding investment in appropriate assets or re-skilling. Such efforts will also likely reduce climate shock vulnerability and emergency relief costs. ASP programs should be implemented where they are most needed. Overlying maps of social protection coverage among vulnerable households in high-risk areas can inform ASP design and implementation.
- **Offset the adverse effects of climate actions.** ASP measures could be developed to support vulnerable workers who may lose jobs in conventional sectors, thus helping ensure an equitable transition. Support from ASP programs could be combined with active labor market policies in geographic areas that have relied heavily on industries negatively affected by climate policies. The already-tested community-driven development platform of Kalahi-CIDSS provides an entry point for inclusive adaptation at the local level by funding community-based interventions that support strengthened livelihood adaptation and climate-resilient infrastructure.

Provide training for green jobs. Re-skilling workers is needed to maximize climate action gains and minimize job losses. Climate change and the responses to it are likely to change the number and skills required for many jobs. Green job opportunities will require new skill sets both for emerging and evolving current jobs. The Philippines has a relatively good technical education and vocational training system.[80] Green public works could provide training and temporary jobs to those who lose jobs in the transition and promote a green economy.[81] Developing comprehensive active labor market policies is critical.

80 The quality of vocational training in the Philippines is ranked 29th in the Global Competitiveness Report 2019.

81 For example, the DOLE may review the design of its employment programs to train at-risk youth to environmentally friendly careers and for the emergency employment TUPAD program to cover not just informal sector workers, but also displaced or vulnerable workers in formal sector. In Fiji, the Jobs for Nature program introduced after the COVID-19 pandemic provides employment opportunities to unemployed workers while contributing to climate change mitigation through protection, restoration, and rehabilitation of the natural environment.

Improve the resilience of the education system. Making education more resilient to climate change will require reevaluation and updating of building standards and the construction of school facilities in adequate sites to make them less vulnerable to extreme events and better able to withstand higher temperatures. Considerable investment may be needed in the short run, but smart investment would save on long-term repair and maintenance expenses.

Implement climate-sensitive health policies. Automating climate-related disease reporting at the facility level will be crucial to tracking climate-related morbidity and health trends in real-time and targeting wider health resources in the most climate-affected regions. Training health workers for climate-related emergencies, including the increased prevalence of mental diseases, would be useful. Climate-resilient health infrastructure and services are indispensable. This includes water and sanitation services which may be compromised by flood or drought, and electricity supply, which may be cut off during extreme weather events. Moreover, using medical technologies and products with a lower environmental footprint contributes to climate resilience and long-term sustainability.

6.5 Fill knowledge gaps

Several important knowledge gaps have been identified. Space and time considerations, as well as data availability, limited the ability of the CCDR team to examine many important issues. Several knowledge gaps need to be filled, including:

- **Needs and priorities for water storage.** Improved water storage would help the Philippines manage more erratic precipitation patterns. Time and data availability prevented a full assessment of available storage and needs as part of the CCDR. Assessing the existing water storage capacity in areas where water constraints are particularly likely to occur is urgent.
- **Using NBS to contribute to adaptation and mitigation.** NBS, such as greater forest cover, can improve resilience in the face of changing precipitation patterns by helping regulate water flows and contributing to mitigation by sequestering carbon. Although the potential for NBS is well understood generally, the potential for specific NBS needs to be assessed to prioritize potential investments in either traditional storage or NBS.
- **Resilience implications of an energy transition.** Shifting from fossil fuels to RE will affect the energy sector's resilience. Some transition aspects are likely to increase resilience (energy production would be more dispersed, and soless vulnerable to single events), while others might reduce it (solar panels could be easily damaged by extreme weather). A thorough assessment of how the energy transition affects resilience and of cost trade-offs is needed.
- **Air pollution.** Reductions in air pollution, and the resulting health benefits, are likely to be important results of changes in energy generation and transport. Although this CCDR made rough calculations of their magnitude, more data collection and analysis are needed to better understand how different energy generation and transport changes would contribute to health benefits, thus allowing prioritization of the most beneficial policies.
- **Transport criticality and vulnerability assessment.** This CCDR examined the role of transport in emissions and air pollution. Another important aspect that could not be covered is the role transport links play in economic activity and the potential for extreme weather events to disrupt these links, particularly in light of the archipelagic nature of the Philippines. Further analytical work on transport network criticality and vulnerability should be carried out. Agencies must build capacity and systems to mainstream climate-resilient transport development.
- **Productive sector's financing needs for transition.** The CCDR could only arrive at a broad assessment of the private sector's experience and views on green investments due to a lack of firm-level data from recent years. A deeper understanding of the constraints affecting firms' green decision-making is needed for evidence-based policy design and review. Similarly, a survey of domestic and foreign investors that have already deployed their capital into green

investments would be useful. As a first step, bottom-up engineering models must be built to model technology transitions at the firm level, along with complementary macro modeling exercises. The models' goal would be to understand the costs of alternative technologies and the incentives required to induce firms to switch technologies. There is ongoing work to conduct a private sector firm-level survey, which would give insight into the level of climate technology adoption by private sector Philippine firms across industries, and barriers and incentives for climate investment. Such firms are diverse in size, technical capabilities, access to financial services, and other dimensions, meaning a 'one-size-fits-all' strategy for private sector climate action is unlikely to be effective. However, developing policies and recommendations that consider firms' diversity requires more granular sectoral information, which a firm-level survey could address.

6.6 The way forward

The challenges climate change poses to the Philippines' ability to meet its development challenges are severe. Inaction will substantially reduce growth and increase hardship for countless Filipinos. However, this report shows that responding to this challenge is well within the country's capacity. Many actions require building on previous work, scaling projects, and improving their implementation. Many sectors need to take new actions, but their cost is relatively modest.

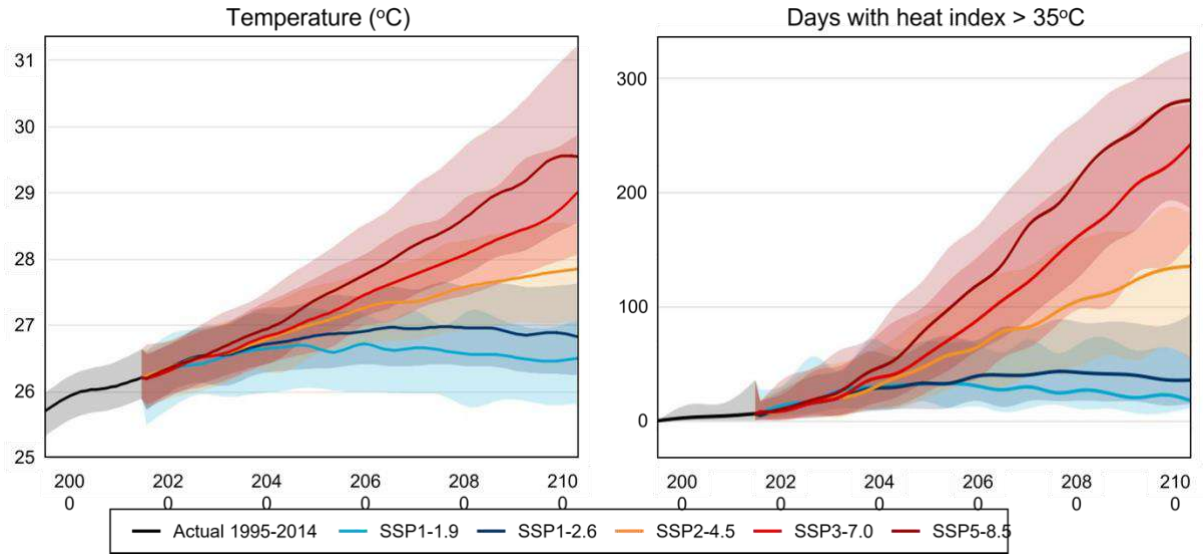
Appendix

Appendix A: Climate Change Projections for the Philippines

This appendix summarizes current projections of climate change in the Philippines over the next century.

Temperatures in the Philippines will continue to increase. Even under relatively limited climate change scenarios, average temperatures are expected to increase by about 1^0C by the end of the century; under more extreme scenarios, they could increase by 2^0C or more, and rise more quickly (Figure A.1). Moreover, the number of extremely hot days is likely to increase dramatically. The number of days with a heat index above 35^0C will soar, from almost none at present to about 50 by mid-century, and potentially many more by the end of the century.

Figure A.1: Mean temperatures in the Philippines are projected to rise significantly under all but the most optimistic scenarios, and the number of days with extreme temperatures will soar



Notes: AR6 Multi-model ensemble
Source: Climate Change Knowledge Portal (acc. Feb.2022)

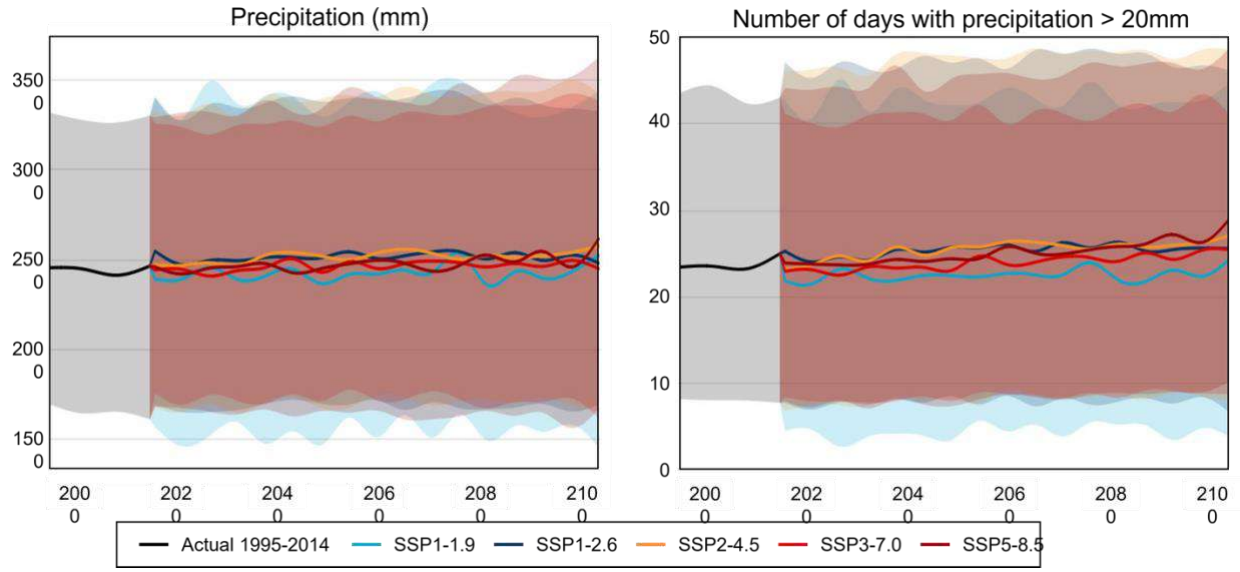
Average precipitation in the Philippines may not change much, but it will likely become more variable. Average annual precipitation will not change significantly from the current level of about 2500mm under any of the climate scenarios (Figure A.2). However, the seasonal distribution may change, with drier dry seasons (January to May) and wetter wet seasons (June-December), increased intensities of extreme rain events, and longer dry days brought upon by more frequent El Nino events. Two out of four models predict lower rainfall during the driest three months of the year (Thomas and others, 2019).

Extreme weather events are likely to become stronger and more frequent. The number of days with more intense rainfall will increase. As shown in Figure A.2, the Philippines has generally had between 20 and 25 days with rainfall exceeding 20mm/day, and rarely more than 40. Under most scenarios, the average number of such days will increase to 25-30, and in some years will approach 50.

Climate change will affect different parts of the country differently. Compared to the 1951-2010 baseline, annual rainfall in 2050 is projected to decline in Northern Luzon and Central and Western Mindanao, but to increase in Central Luzon, Eastern Visayas, and Western Mindanao. Mindanao

will remain the wettest island group, but Visayas is expected to overtake Luzon as the second wettest area.

Figure A.2: Average precipitation in the Philippines may not change much, but it will likely become more variable and more intense



Notes: AR6 Multi-model ensemble
Source: Climate Change Knowledge Portal (acc. Feb.2022)

Appendix B: Additional Data Tables

Table B.1: Cross-country emission overview

Country	*Emissions per capita (tCO_2e per capita)*	*Carbon intensity Kg CO_2e/ USD PPP GDP)*	*Total emissions ($MtCO_2e$)*
Philippines	2.2	0.14	234.3
China	9.0	0.46	12,705.1
Indonesia	3.7	0.19	1,002.4
Vietnam	4.7	0.33	450.1
India	2.5	0.26	3,394.9
Brazil	5.0	0.46	1,057.3
Russia	17.2	0.39	2,476.8
European Union	7.6	0.13	3,383.4
United States	18.3	0.23	6001.2
OECD	10.7	0.18	14,551.2

Source: World Bank *World Development Indicators* (WDI).

Table B.2: Power Investment Needs and Economic Costs: Accelerated Decarbonization Scenario

	Deviation between CPS and ADS	
	NPV (USD billion)	*Change (%)*
Capital costs for new generation and storage	+ 30.4	+ 129
Coal	0	0
Gas	- 0.8	- 32
Solar	+ 14.0	+ 119
Wind (onshore)	+ 2.8	+ 255
Wind (offshore)	+ 4.9	NA
Hydroelectric power and other renewables	+ 4.4	+ 65
Storage (batteries)	+ 5.1	+ 5100
Grid network expansion and upgrade costs	+ 0.7	+ 11
Capital costs of existing generation and grid assets	- 18.4	- 78
Variable operational and maintenance costs	+ 0.3	+ 50
Fixed operational and maintenance costs	+ 3.1	+ 22
Fuel cost	- 8.5	- 15
Total system costs	+ 7.6	+ 6
Local environmental damage costs	- 4.6	- 32
Global environmental damage costs	- 16.0	- 31

Notes: *NA – not applicable since CPS has no offshore wind investment.*
The large decrease in capital cost of the exiting assets in ADS is due to the decomissioning of fossil fuel plants, particularly coal-fired power plants.
The present value of the stranded assets in early retirement of coal-fired power plants under ADS is estimated at about USD10 billion by 2040.
The cumulative costs for grid network expansion and upgrading related to RE integration under the ADS is estimated at USD3.1 billion in 2021 prices, compared to USD1.5 billion under the CPS.
Source: WB staff analysis based on power sector modeling

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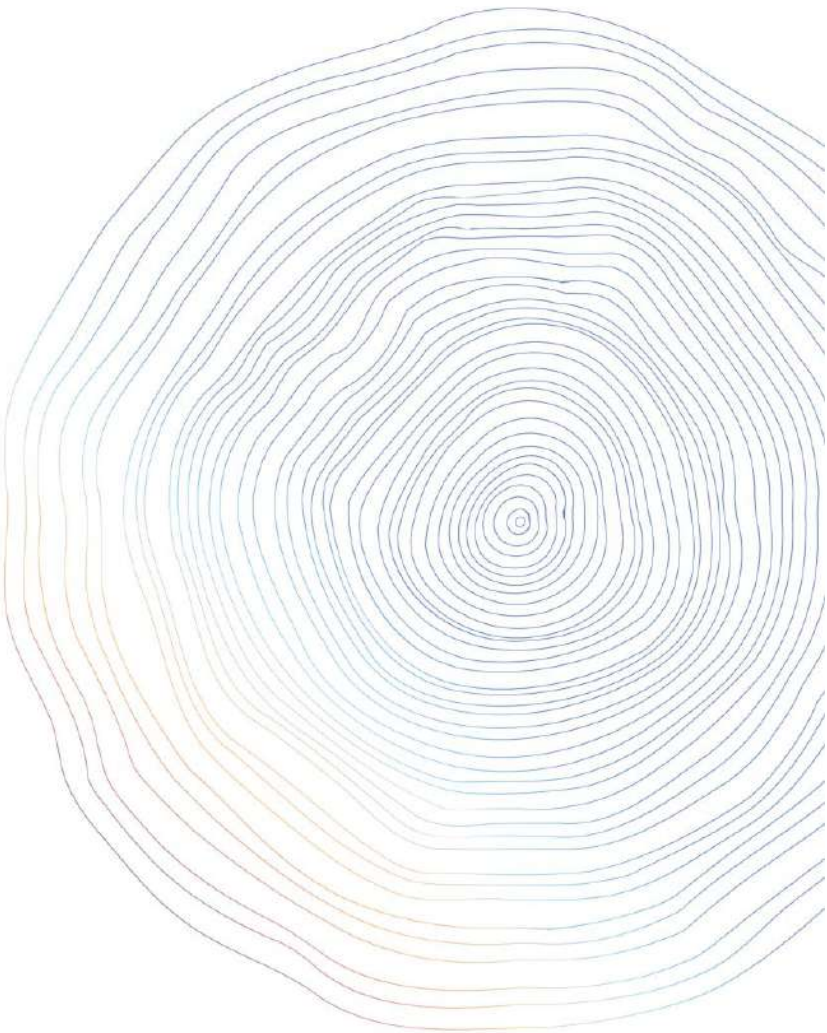
Background Notes

PH-1 Institutional Analysis
PH-2 Water
PH-3 Agriculture
PH-4 Philippine Energy Transition: Towards a Secure, Affordable and Clean Energy Future
PH-5 Transport
PH-6 Macroeconomic modelling in the Philippines CCDR
PH-7 Climate Change and Environmental Risks in the Financial and Private Sector and Opportunities for Green Finance
PH-8 The Distributional Impacts of Climate Change Damage, Adaptation and Mitigation Policies in the Philippines
PH-9 Strengthening Adaptive Social Protection for Climate Change and Disasters
PH-10 Social Impacts of Climate Change in High-Risk Areas of the Philippines
PH-11 Disaster Risk Management in the Philippines



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