INTERNATIONAL MONETARY FUND

Macroeconomic Implications of Climate Challenges: Nigeria

Reginald Darius, Aurelien Billot, Emanuele Massetti, Nate Vernon-Lin

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Macroeconomic Implications of Climate Challenges: Nigeria

Prepared by Reginald Darius, Aurelien Billot, Emanuele Massetti, Nate Vernon-Lin

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July 2025

ABSTRACT: *Climate events significantly impact Nigeria's growth outlook, fiscal sustainability, balance of payments and financial sector, potentially undermining macroeconomic stability. Extreme weather events and their frequency have a direct effect on growth and the balance of payments. An expected sea level rise would pose significant economic cost for Nigeria, damaging infrastructure in coastal areas such as Lagos—the main commercial and financial center. While relatively small, the financial sector is exposed to spillovers to asset quality and may even be directly impacted via its physical presence in Lagos. Fiscal policy will have to address lower tax revenues from lower growth and higher demands for spending on disaster relief, infrastructure repair, and investments in climate adaptation and mitigation. As a result, Nigeria will face fiscal and associated external financing gaps.*

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SELECTED ISSUES PAPERS

Nigeria:Macroeconomic Implications of Climate Challenges

Prepared by Reginald Darius (AFR), Aurelien Billot, Emanuele Massetti, Nate Vernon-Lin (FAD)[1]

[1] This SIP is prepared by Reginald Darius (AFR), Aurelien Billot, Emanuele Massetti, Nate Vernon-Lin (FAD), and is based on in-depth technical background papers on climate adaptation and mitigation.

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NIGERIA

SELECTED ISSUES

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Approved By
The African Department

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CONTENTS

MACROECONOMIC IMPLICATIONS OF CLIMATE CHALLENGES ____ **2**

A. Executive Summary ____ 2

B. Introduction ____ 3

C. Adaptation ____ 4

D. Mitigation ____ 9

FIGURES

1. Climate Disasters ____ 3
2. Temperature - National Average ____ 4
3. Precipitation ____ 5
4. Historical Time Series of Selected Indicators of Extreme Weather ____ 5
5. Macro-economic Impact of Warming and Extreme Weather Events ____ 7
6. Costs of Sea-Level Rise ____ 7
7. Emissions and Emissions-Intensity Relative to Comparator Countries in 2022 ____ 9
8. Nigeria's Emissions Profile ____ 10
9. Emissions Projections and Impact of Recent Reforms ____ 12
10. Mitigation Costs and Needed Emissions Price to Achieve Mitigation Targets ____ 13
11. Impact of Emissions Pricing on Production Costs by Sector ____ 14

TABLES

1. Summary of Nigeria's Mitigation Main Policies ____ 11
2. Trade-offs Across Policy Instruments ____ 15

References ____ 18

MACROECONOMIC IMPLICATIONS OF CLIMATE CHALLENGES[1]

Climate events significantly impact Nigeria's growth outlook, fiscal sustainability, balance of payments and financial sector, potentially undermining macroeconomic stability. Extreme weather events and their frequency have a direct effect on growth and the balance of payments. An expected sea level rise would pose significant economic cost for Nigeria, damaging infrastructure in coastal areas such as Lagos—the main commercial and financial center. While relatively small, the financial sector is exposed to spillovers to asset quality and may even be directly impacted via its physical presence in Lagos. Fiscal policy will have to address lower tax revenues from lower growth and higher demands for spending on disaster relief, infrastructure repair, and investments in climate adaptation and mitigation. As a result, Nigeria will face fiscal and associated external financing gaps.

A. Executive Summary

1. **Growth Impact**: Increasing temperatures and more intense precipitations are expected to reduce growth. In a worst-case scenario, the fastest global warming scenario and with slow adaptation, GDP is projected to be 8 percent lower by 2100 than in a hypothetical scenario without global warming, raising unemployment, worsening food insecurity, and increasing poverty. Adaptation investments in agriculture and resilient infrastructure can reduce this impact of climate events to 3 percent, albeit at a fiscal cost (below). Sea level rise is estimated to cost between 0.1 and 0.4 percent of GDP annually due to loss of life and capital from storm surges in coastal areas. Pursuing Nigeria's mitigation objectives would take another 0.06 to over 0.4 percentage points off GDP growth, depending on the policy design.

2. **Fiscal Impact:** Fiscal revenues would be reduced with lower growth (unit buoyancy). In parallel, the government faces higher spending needs for disaster relief which could reach up to 1½ percent of GDP and adaptation investments of 1 percent of GDP—adaption costs are up to 3 percent of GDP in the authorities' estimates which may include other development spending. These pressures come on top the need to strengthen revenue mobilization to create space for priority spending. However, if Nigeria were to proceed with its 2030 mitigation objectives, associated policy changes could generate 0.2 to 0.6 percent of GDP in additional revenue, some of this could be used to compensate vulnerable households. Taken together, climate events and rising sea levels will give rise to potential fiscal financing gaps.

3. **Balance of Payments Impact:** Extreme weather events, such as floods and droughts, can significantly disrupt agricultural and hydrocarbon production in Nigeria, leading to lower export volumes and at the same time requiring increased imports of food and other essentials. This could put pressure on the exchange rate and reserves. Fiscal financing needs may translate into external

[1] This SIP is prepared by Reginald Darius (AFR), Aurelien Billot, Emanuele Massetti, Nate Vernon-Lin (FAD), and is based on in-depth technical background papers on climate adaptation and mitigation.

financing needs. The authorities are exploring options to tap available external climate financing sources.

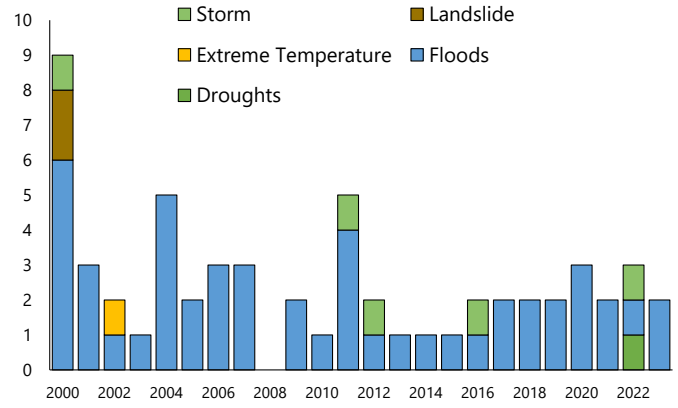
4. Financial Sector Impact: Extreme weather events and sea level rise would damage physical assets leading to higher claims and financial losses for insurers and worsening private sector balance sheets, potentially stressing banks' asset quality. At present, Nigeria's financial sector is small, but is expected to play an increasing role in driving growth over time which would raise its exposure to risks from climate events. The financial sector's physical presence will have to adjust to the projected sea level rise.

B. Introduction

5. Nigeria is vulnerable to extreme weather events which pose risks to macroeconomic stability. Rising temperatures, greater frequency of extreme heat days, and increasing frequency of high-intensity rainfall has resulted in frequent and significant flooding resulting in increased public spending for disaster relief and higher imports. Climate events are projected to create long term challenges for Nigeria, with the expected intensification of heating and precipitations estimated to reduce GDP by 8 percent by 2100, while the projected global sea-level rise is likely to impose cost from 0.1 and 0.4 percent of GDP annually for Nigeria. Fiscal cost associated with disaster relief, adaptation investment and mitigation will place significant pressure on the fiscal position and generate external financing gaps.

6. Nigeria, despite being a low emitter is committed to reducing its carbon footprint, which will generate significant external financing needs. Nigeria has pledged to reduce emissions by 20 percent by 2030 and reach net zero emissions by 2060. However, achieving these ambitious targets, would require rapid uptake of renewable energy, while addressing emissions in the forestry, agriculture, transport, and other sectors. Economic, external financing needs, and fiscal costs of the transition can be large unless mitigation policies are well-designed. Nigeria will require significant international finance to fill the fiscal financing gap and technology flows to implement its Energy Transition Plan (ETP), estimated to require additional investment of USD 410 billion, and achieve its climate targets.

Figure 1. Climate Disasters



Sources: FADCP and IMF staff calculations

7. To support implementation of adaptation measures and meet its emissions target, Nigeria has established relevant climate frameworks. The National Adaptation Plan Framework (NAPF) and the National Strategy and Plan of Action on Climate Change in Nigeria (NASPA-CCN)

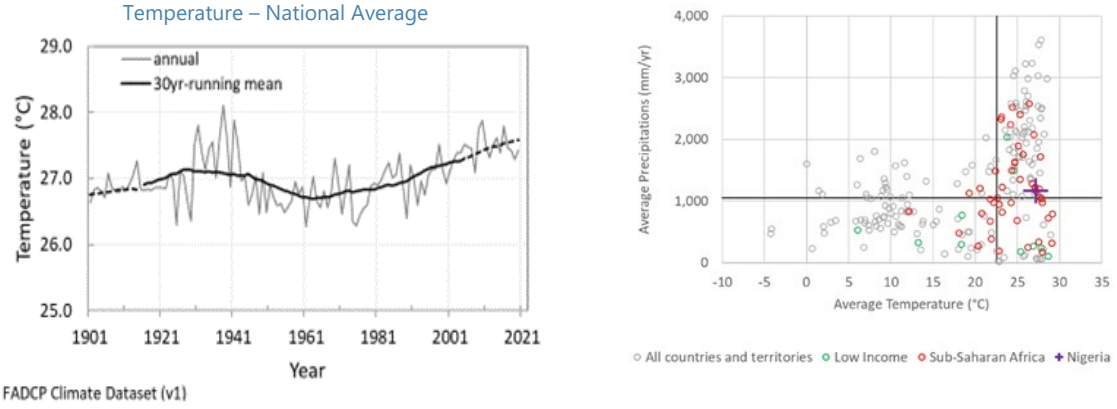
was established to guide the country's adaptation efforts and aligns with Nigeria's Nationally Determined Contributions (NDCs) under the Paris Agreement. The 2021 Climate Change Act established a framework to meet climate targets, with the creation of a coordinating National Council on Climate Change (NCC), chaired by the President, and mandating five-year Paris Agreement aligned carbon budgets and action plans. Nigeria has also contributed to global and regional efforts through its leadership role in the Global Methane Pledge and active participation in the Coalition of Finance Ministers for Climate Action.[2] In its NDC, Nigeria pledged an unconditional 20 percent reduction in emissions by 2030 below business-as-usual and a 47 percent reduction conditional on international support, with a long-term objective of net zero emissions by 2060.

C. Adaptation

Climate Trends and Projections

8. Nigeria's climate is mainly tropical with three distinct zones. The average annual mean temperature of 27-28 °C is unform across Nigeria (Figure 2). Temperatures have been rising from the mid 1970's, with estimates indicating a total increase of 0.7 °C through 2020 relative to the period 1901-1930. The north and west of Nigeria have been warming at a faster pace compared to the south and east. Nigeria is projected to experience further temperature increases between 1.2 and 1.6 °C in 2036-2065 and between 1.4 and 3.2 °C in 2071-2100, with respect to the 1985-2014 period (commonly used reference for climate projections), depending on the emission scenario. Warming will likely be more intense in the north.

Figure 2. Temperature - National Average



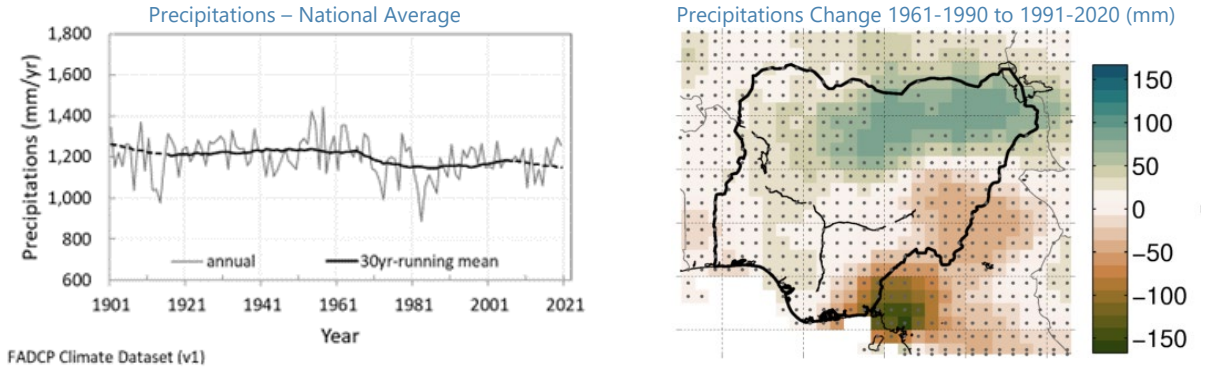
Sources: FADCP Climate Dataset (Massetti and Tagklis, 2024), using CRU data (Harris et al., 2020).
Notes: Average annual temperature (left) and global distribution of average annual temperature and total annual precipitation s during the period 1985-2014 (right).

9. Precipitation levels have remained stable on average since the 1960s (Figure 3), with diverging regional trends. The significant increase in precipitation in the north-east has been

[2] Nigeria was the first African country to include methane in its emissions reduction targets and a "champion" member of the Global Methane Pledge due to its strong existing policies and contributions.

balanced by a modest, decline in the southeast. Southern coastal areas have a Tropical Monsoon Climate, with precipitations of 2,000-3,000 mm. Central areas have Tropical Savannah Climate with wet and dry seasons with total annual rainfall of 1,000-1,500 mm per year on average. Northern regions have Sahelian Hot and Semiarid Climates, with low annual rainfall of around 500-1,000 mm per year on average. Nation-wide precipitations are projected to increase modestly.

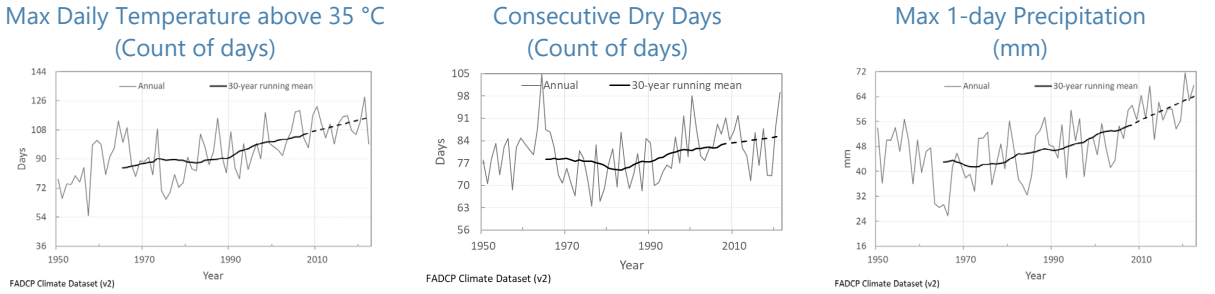
Figure 3. Precipitation



Sources: FADCP Climate Dataset (Massetti and Tagklis, 2024), using CRU data (Harris et al., 2020).
Notes: Total annual precipitations (left) and total annual precipitations change, 1961-1990 to 1991-2020 (mm) (right). Dots in the maps indicate non-significant changes.

10. Extreme temperatures have become more frequent (Figure 4). The number of "hot" days (maximum daily temperature above 35 °C) has increased, dry periods have become longer along the coastline, and intense precipitations (annual maximum rainfall recorded in one single day) has increased nationally and stronger in coastal areas. Most of the country is expected to register significant increases in intense rainfall events which will contribute to increased flood risks.

Figure 4. Historical Time Series of Selected Indicators of Extreme Weather



Sources: FADCP and IMF staff estimates.
Notes: The solid line displays the 30-year average centered around each 30-year period. Edge effects near the beginning and end of the time series may affect the accuracy of the mean in those regions (dashed). Change: 1991-2020 relative to 1961-1990. Dots indicate grid cells with non significant change.

11. The sea-level is increasing slowly with the upward trend likely to continue for centuries. Median projections for Nigeria using a moderate emission scenario (RCP 4.5) indicate that by the end of the century sea-level will increase by 0.71 m with respect to its level in 2000

(Table 1 and Figure 8). With an emission scenario in line with the Paris goal of keeping global mean temperature increase below 2 °C (RCP 2.6), sea-level is projected to increase by 0.60 m. Under the very high emission scenario (RCP 8.5), sea-level is projected to increase by 0.90 m. Staff estimates the annual average cost of SLR without adaptation of about 0.3 percent of GDP for Nigeria between 2020 to 2099, under moderate emission scenario. Costs range between 0.1 and 0.4 percent of GDP annually with the best and worst sea-level rise projections. Most of the cost is attributed to loss of life and capital during storm surges in the densely populated coastal areas of Nigeria.

Macro-Economic Implications

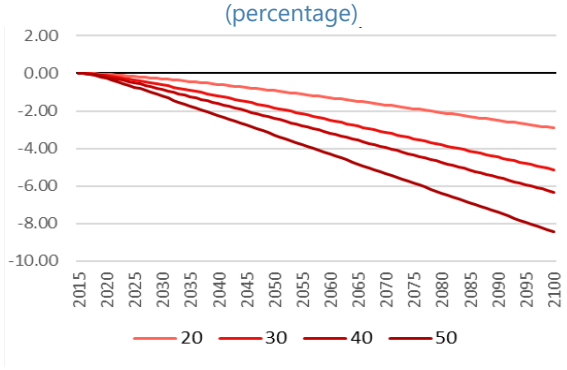
Impact of Slow-Moving Warming and Weather Shocks

12. Climate change is projected to dampen GDP growth with associated reduction in fiscal revenues. Lower growth would further impede per-capita income growth, increase poverty and weaken fiscal revenues further constraining the governments' ability to respond to climate events, and scaling up needed development spending. Under the fastest global warming scenario and with slow adaptation, GDP is projected to decline by up to 8 percent annually by 2100 (Figure 5). While the top-down macro-economic outlook does not allow for quantification of sectoral impacts and transmission channels, bottom-up studies indicate that warming reduces agricultural output by lowering yields, reducing animal welfare, and increasing desertification. Higher temperatures also lower labor productivity across sectors, especially those with mostly outdoor activities, as both manual and cognitive functions decline.

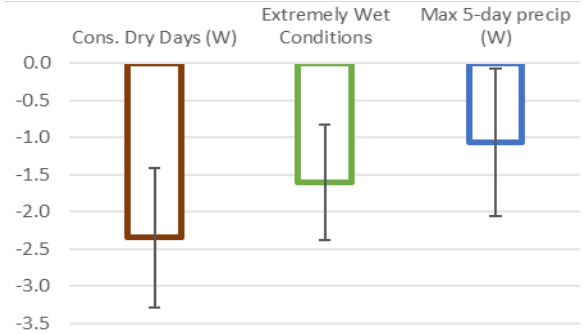
13. Staff estimates suggest that faster adoption can lower costs to 3 percent of GDP but would require higher fiscal spending. Adaptation, in the form of increasing use of heat tolerant crops, increased irrigation, better management practices, measures against desertification, changes from day to night work in construction, and widespread adoption of air conditioning in private and public buildings, can mitigate these losses. Requiring increase government spending to incentivize private sector interventions. Relatedly increased government spending would raise imports in the near term given rise to increase balance of payments pressures. Further challenges may come from changes in extreme weather. Empirical analysis using "big data", and machine learning methods finds that prolonged periods of consecutive dry days, extremely wet conditions, and intense precipitation events already reduce GDP growth in Nigeria by 1 to 2.5 percentage points for each standard deviation above normal levels.

Figure 5. Macro-economic Impact of Warming and Extreme Weather Events

Impact of Warming Trends on Real GDP Level
Fast Warming Scenario
(percentage)



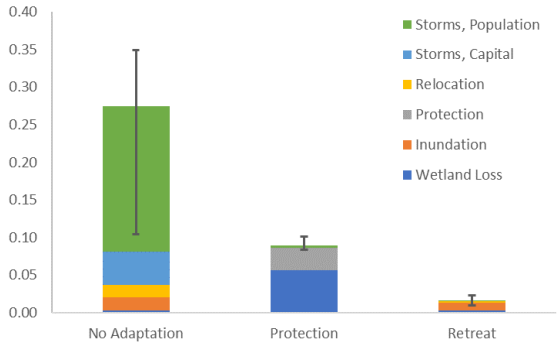
Impact of Weather Extremes on Real GDP
Current Climate
(percentage points)



Sources: Staff estimates using Kahn et al. (2021) and Akyapi, Bellon, and Massetti (2025).
Note: Left panel - Impact of the warming trend implied by the 90th percentile of the SSP3-7.0 CMIP6 ensemble using Kahn et al. (2021) under the assumption that adaptation can offset the warming trend after 20, 30, 40, or 50 years. Right panel – impact of one standard deviation of each climate variable from its long-run average. Consecutive. Dry Days (W): population weighted number of consecutive dry days; Extremely Wet Conditions: PDSI index larger than +4; Max 5-day precip (W): population weighted total precipitations during the 5-day period with the largest total rainfall in Nigeria during a year. Variables selected using the LASSO as in Akyapi, Bellon, and Massetti (2025).

14. Sea level rise would be damaging to growth and place significant pressure on the financial sector particularly insurance companies (Figure 6). Losses are mostly due to storm-surge events becoming more impactful as sea level rises. This will result in increased damages and higher insurance claims. Adaptation can reduce costs substantially but would require additional investments though protection of the coastline, for example by means of beach nourishment, coastal dunes, and dykes, avoid loss of land and storm-surge losses. Planned retreat from the coastline by allowing slow depreciation of existing capital, no construction of new capital, and slow relocation of the population further reduces costs. This strategy does not require investment in physical, and environmental-disrupting protection measures. However, it does require long-term planning, coastal land use regulations, and careful scrutiny of the distributional impacts on the population.

Figure 6. Costs of Sea-Level Rise
(in percentage of GDP)



Source: IMF Staff using the CIAM model (Diaz, 2016).
Notes: Average annual cost using RCP4.5 (Moderate). Whiskers on top of each bar indicate the range of total cost using the 5th and 95th percentile of the probabilistic distribution of sea-level rise. Due to the highly non-linear nature of coastal impacts, adaptation costs, and effectiveness of adaptation measures, ranges are not always symmetric around total costs.

Fiscal and External Financing Implications of Adaptation Policies

15. The authorities are focusing on mainstreaming the 2021 Climate Change Act, by enhancing agency cohesion, and improving stakeholder participation. The NDC is currently under review with a project steering committee established to help broaden ownership. The Ministry of Finance and the Ministry of Budget and Planning aim to set realistic targets, with private funding

through private public partnerships (PPPs) being a key part of the financing strategy. Challenges such as inadequate financing, weak infrastructure, and the need for more inclusive planning remain. Addressing these challenges aided by development of a robust monitoring and evaluation systems is crucial for the successful implementation of Nigeria's climate adaptation strategy. With limited fiscal space, widening external current deficits due to higher imports from rehabilitation following more frequent climate events and large climate related infrastructure spending would generate significant external financing gaps. Which would require external low-cost climate funding from external sources, including through having well designed project proposals.

16. Nigeria's climate adaptation strategy focuses on actions to lessen the impacts of climate events. It includes Climate-Smart Agriculture which seeks to integrate seed improvement, hybridization, and sustainable land management practices. The plan also seeks to expand and conserve ecosystems and maintaining the ecological structure of natural habitats. Local adaptation initiatives are being implemented, focusing on community-based projects that promotes sustainable agriculture, water management, and disaster risk reduction. Supported by efforts to build capacity of local communities, government agencies, and other stakeholders through training programs and workshops to enhance implementation of climate adaptation measure.

17. Adapting to climate events will increase fiscal spending and generate external funding needs. Investment needs for adaptation is uncertain due to differences in methods, definitions, and future scenarios. The authorities estimate climate change adaptation needs at $3.6 billion per year for agriculture and water, $3.6 billion for health, and $6.5 billion for transportation, rising to $24.3 billion per year by 2050, totaling about 3 percent of 2020 GDP [3]. This would represent spending needs in addition to what is required for broader development spending. Implementing adaptation expenditure of that magnitude, would increase fiscal financing needs and import demand generating additional external financing needs. IMF staff estimates are lower, with reinforcing new infrastructure exposed to floods estimated to cost 0.02 percent of GDP annually.

18. Adaptation is most effective when integrated into development planning, and priority is given to policies with positive externalities. Removing market inefficiencies and promoting reforms such as improving access to credit and agricultural extension services can facilitate private adaptation as has occurred in Nigeria (Haider, 2019; Oluwole et al., 2016; Federal Ministry of Environment, 2014). By addressing market inefficiencies, the government enables local communities to plan for climate impacts and set adaptation goals, aligning with the National Adaptation Plan. Nigeria's National Adaptation Plan appropriately highlights the importance of viewing adaptation as a cross-cutting developmental issue and sets the foundation for mainstreaming adaptation. Progress has been made in agriculture through diversifying crops, changing planting dates and implementing management strategies that reduce heat stress (Ifeanyi-obi and Nnadi, 2014). However, there is a clear role for enhancing irrigation facilities to offset natural rainfall variability (Haider, 2019).

[3] Source: Federal Ministry of Environment (2010). The same figures are reported in the Adaptation Communication to the United Nations Framework Convention on Climate Change (UNFCCC) (Federal Republic of Nigeria, 2021).

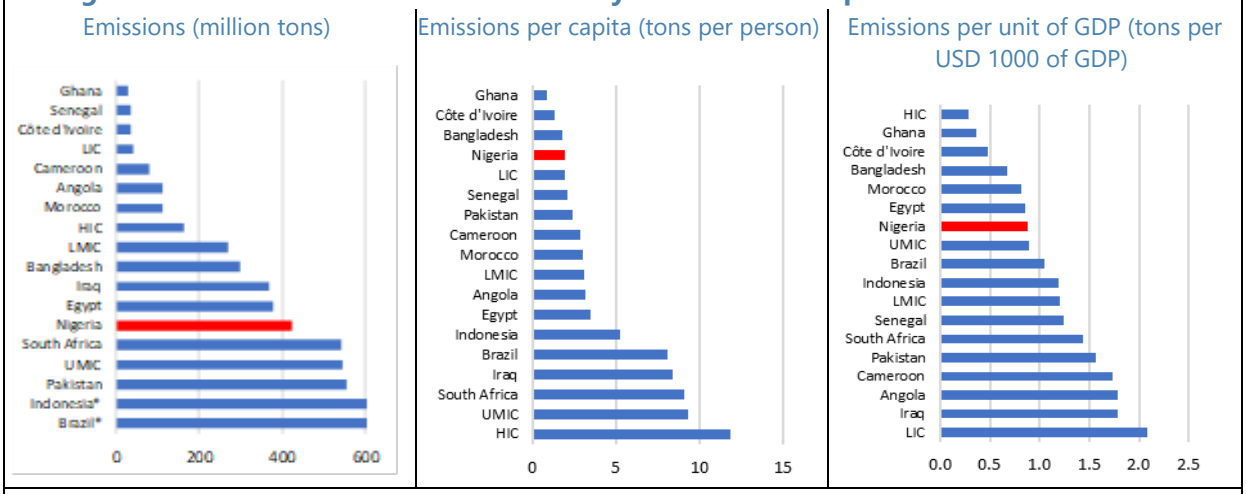
19. Despite limitations, cost-benefit analysis (CBA) can play an important role in helping decision makers to consistently collect, aggregate, and compare information on public adaptation projects. The NAP recognizes the possibility of trade-offs between development and adaptation, and the need to properly manage adaptation to prevent unintended consequences (NAP, p. 19). As exemplified by the analysis of sea-level rise, adaptation investment and policy may entail trade-offs. Investing in stronger infrastructure reduces damages in case of floods but subtracts resources from other development goals. These trade-offs would be better assessed by comparing social costs and benefits using a systematic approach. What to do, when, how, and at what cost ultimately relies on ethical choices that should reflect the preferences of each society. However, CBA, complemented by analysis and correction of distributional impacts, can help decision makers maximize overall social welfare by avoiding wasting scarce resources. To achieve this goal, it is essential that CBA is applied to adaptation as well as to all other development programs in a consistent manner (Bellon and Massetti, 2022a). This is in line with the principle of evidence-based climate change adaptation articulated in the National Adaptation Plan (FME, 2020, p. 20).

D. Mitigation

Background

20. Nigeria accounts for 0.9 percent of global emissions, with emissions per-capita and per unit of GDP broadly in line with that of neighboring and other lower middle-income countries (Figure 7). About half of Nigeria's emissions are from fossil fuel extraction and agriculture. Power generation, transport, buildings, land-use, land-use change, forestry (LULUCF), and waste accounts for the other half of emissions (Figure 7, left panel). The methane and flaring-intensity of oil and gas production are above that of many other hydrocarbon producing countries.

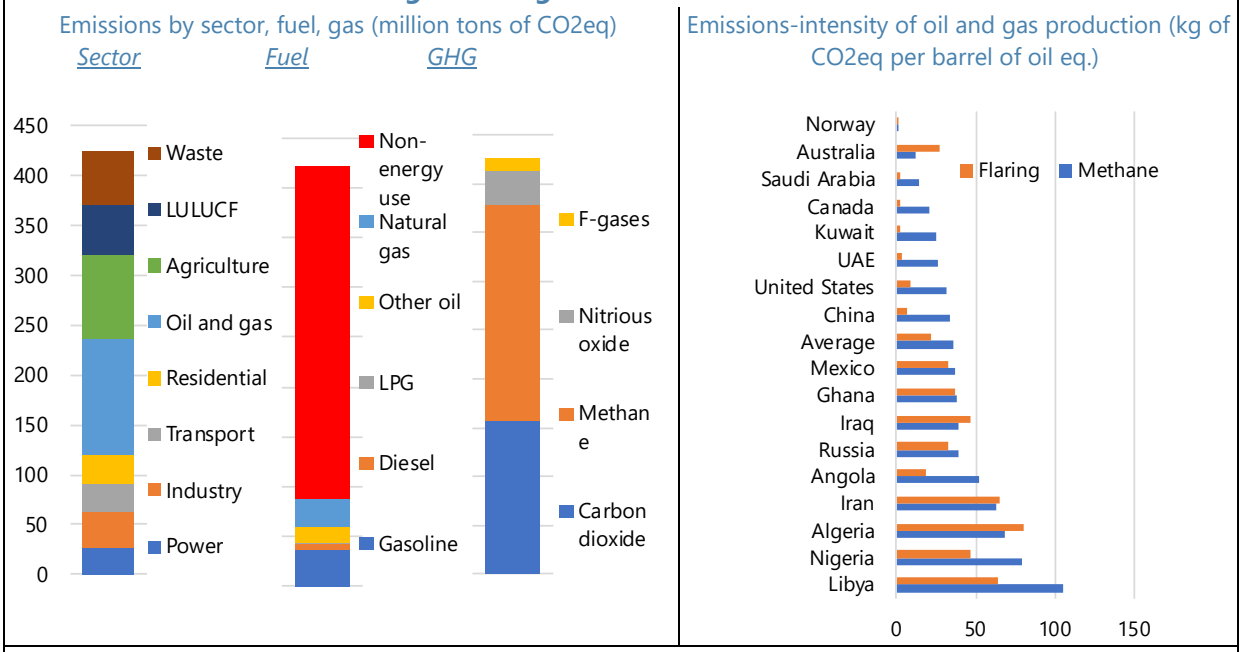
Figure 7. Emissions and Emissions-Intensity Relative to Comparator Countries in 2022



Sources: IMF staff estimates using the Climate Change Indicators Dashboard. Note: emissions include all greenhouse gases. HIC = high income country; UMIC = upper middle-income country; LMIC = lower middle-income country; LIC = low-income country. Total emissions chart capped at 600 million tons, but Brazil and Indonesia's emissions were above 1,400 in 2022 (*).

21. Nigeria's current emissions and economic profile presents opportunities for low-carbon growth. Reducing gas flaring, venting, and leaks would reduce the emissions intensity of fossil fuel production and strengthen the reliability and quantity of gas supply, promoting investment in energy-intensive sectors like heavy industry and power generation, strengthening Nigeria's export competitiveness raising exports with positive impact on the balance of payments, and improving energy security. Addressing low access to and undersupply of electricity and high reliance on off-grid generators would help improve electricity reliability and costs, would promote growth, boost fiscal revenues and exports while reducing greenhouse gas and harmful local pollutants. Supporting cleaner cookstoves would reduce deforestation and help lower premature deaths from air pollution.

Figure 8. Nigeria's Emissions Profile



Source: IMF staff estimates using IMF-WB Climate Policy Assessment Tool (CPAT), IEA 2024, and WB 2024a. Note: methane emissions are converted to CO2 equivalent assuming a 100-year global warming potential of 29.8 and emissions from flaring assume 98 percent destructive efficiency. F-gases = fluorinated gases. See Black et al 2023 for details on CPAT.

Current Policies and Projections

22. Nigeria has a suite of policies to reduce emissions (Table 1). This includes recent regulatory reforms to improve the investment environment through the 2023 Electricity Act[4] and increasing tariffs towards cost-reflective levels. Implicit fuel subsidies were eliminated in September/October of 2024, although all fossil fuels remain free of VAT. The National Climate Change Policy, Long-Term, Low-Emissions Development Strategy (LT-LEDS), and the 2021 Climate Change Act provide the direction of future policies, including the introduction of a carbon tax and

[4] The 2023 Electricity Act provides greater investor protections, allows for bilateral power purchase agreements, expands feed in tariffs, among others. Several of the reforms are not specific to renewables but meant to improve the functioning of the power sector but may indirectly encourage investment in low-carbon power.

carbon credits issued through both voluntary and Paris Agreement Article 6 carbon markets. To achieve targets of zero routine flaring and a 60 percent reduction in methane emissions, the government issued a strong package of guidelines and regulations in 2022-23. Efforts to develop transparent markets for the sale of captured natural gas markets and address barriers for domestic supply includes adjustments to better align domestic natural gas prices with export-parity levels.

Table 1. Nigeria: Summary of Nigeria's Mitigation Main Policies

Policy	Sector	Details	Macro implications
Renewable energy tax exemptions	Power	Solar panels are exempt from import duties; wind- and solar-powered generators and solar panels are exempted from VAT	Fiscal cost, increased imports
Renewable energy auctions	Power	Developing a framework to conduct auctions for large-scale renewable energy projects	Increased investment, limits fiscal costs
Fossil fuel price increases	Transport and power	Gasoline price increase of LCU 238 to 1189 (USD 0.51 to 0.76) per liter; diesel price increase of LCU 844 to 1,441 (USD 1.81 to 0.92) per liter; and natural gas increase of LCU 1116 to 4429 (USD 2.43 to 2.83) per GJ	Fiscal benefit, more fossil fuel available for export
Clean vehicles import and VAT exemption	Transport	Electric and compressed natural gas (CNG) vehicles are exempt from import duties and VAT	Fiscal cost, increased imports
Tax on flared natural gas	Oil and gas	Tax of USD 2 per thousand cubic feet of flared natural gas	Fiscal benefit, more gas for export/domestic use
Emissions related regulations	Oil and gas	Requirements for clean technologies and processes, emissions measurement, a minimum flare efficiency, and more	Fiscal benefit, more gas for export/domestic use

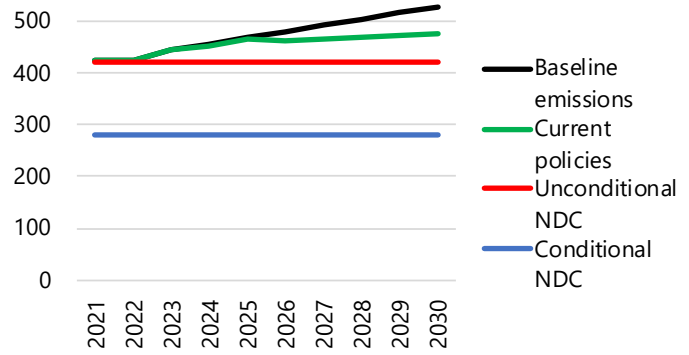
Source: IMF staff. Notes: the table only shows the main mitigation policies and is not comprehensive. GJ = gigajoule.

23. Additional measures are needed to achieve Nigeria's mitigation targets. Using the IMF-World Bank's Climate Policy Assessment Tool (CPAT),[5] baseline emissions are projected assuming no change in policies after 2021. Current policies include the impact of increased fossil fuel prices and emissions regulations in the oil and gas production sector introduced since 2021 (Figure 3). Baseline emissions increase by around 2 percent per year and reach 515 mt of CO2e in 2030. Under current policies, emissions are 10 percent below the baseline, mostly due to oil and gas sector emissions regulations but also increases in gasoline, diesel, and natural gas prices. This implies that a further 10 percent reduction in emissions would be needed to achieve the NDC.

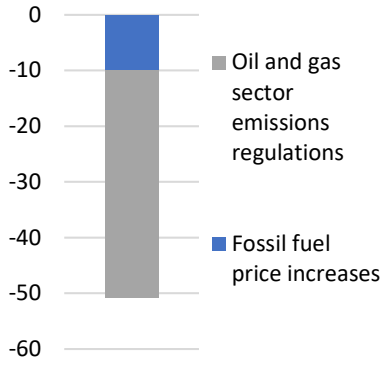
[5] See Black and others 2023 for more information on CPAT. CPAT assesses the impact of mitigation policies on fiscal revenue, emissions, and other macro indicators considering the country-specific structure of the energy, forestry, agricultural, and waste sectors.

Figure 9. Emissions Projections and Impact of Recent Reforms

Emissions under business as usual and current policies (mt of CO2 equivalent)



Impact of recent reforms on emissions in 2030 (mt of CO2 equivalent)



Source: IMF staff estimates using CPAT and IEA 2024. Note: see Table 1 for descriptions of current policies. Only the fossil fuel price increases and oil and gas sector emissions regulations are modelled here. This approach could overestimate emissions reductions if fossil fuel pricing and the oil and gas sector regulations are reversed or have limited enforcement or understate emissions reductions if the non-modelled policies significantly reduced emissions.

Macroeconomic Impact of Policy Options to Achieve Emissions Target

Mitigation Costs, Fiscal and Price Impacts

24. The design of mitigation policies significantly affects the size and distribution of economic costs, social acceptability, and fiscal implications of achieving targets. Emissions pricing minimizes economic costs and raises fiscal revenue but can impact international competitiveness and social equity through higher prices. If revenue is used progressively, it can benefit the poor. Emissions-intensity pricing, which taxes dirtier firms and capital and subsidizes cleaner ones, has higher economic costs but smaller price impacts, reducing distributional and competitiveness concerns. Subsidies are fiscally costly and economically inefficient, while regulatory approaches are more costly than pricing and likely do not significantly increase end-user prices.[6] A combination of policies is likely preferred, with the policy mix varying across sectors to balance economic, social, and environmental goals.[7]

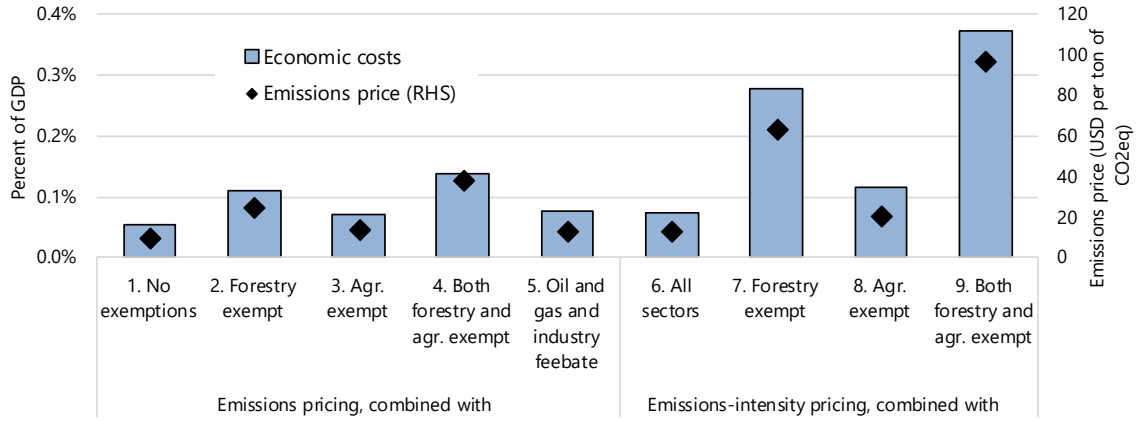
25. Achieving Nigeria's emissions reduction target results in costs ranging from 0.06 to at least 0.40 percent of GDP annually depending on the design of mitigation policies (Figure 3). Meeting Nigeria's NDC through broad-based emissions pricing would incur marginal economic costs (0.06 percent of GDP per year) and requires an emissions price of $10 per ton of CO2e. Exclusion of forestry and agricultural emissions pricing, which may be warranted due to

[6] The most efficient regulatory policy mimics emissions-intensity pricing but, in reality, regulatory policies lead to more costly abatement activities, which increases costs and end-user prices relative to emissions-intensity price.

[7] For additional information on carbon pricing see Parry et al 2022a, sector-specific emissions-intensity pricing see Online Annex 1.4 of IMF 2023, and for methane see Parry et al 2022b.

administrative concerns and plans to sell credits internationally,[8] doubles cost to around 0.13 percent of GDP and requires an emissions price in other sectors of $36 per ton. Exemptions for LPG has minimal fiscal and economic costs impact, as does combining emissions pricing with emissions-intensity pricing for sectors with international competitiveness concerns such as oil and gas production.[9]

Figure 10. Mitigation Costs and Needed Emissions Price to Achieve Mitigation Targets



Source: IMF staff estimates using CPAT.

26. Emissions pricing aligned with Nigeria's NDC substantially improves Nigeria's fiscal position, while emissions-intensity pricing results in a small revenue loss (Figure 5). Revenues under emissions pricing are highest from charges on gasoline and natural gas due to their importance in the energy mix and range from 0.2 to 0.6 percent of GDP depending on the covered sectors. Revenues are highest under scenarios with forestry and agriculture exempt since a higher emissions price is needed for the rest of the economy.[10] Emissions-intensity pricing and regulatory approaches does not directly raise revenues and leads to a small loss since mitigation costs reduce corporate profits (leading to lower CIT) and lower fossil fuel demand reduces revenues from taxes on fossil fuels (mainly diesel).

27. Emissions pricing increases end-user prices, raising distributional, export competitiveness, and acceptability considerations. For example, a $20 per ton emissions price increases oil product prices by 3 percent, electricity by 5 percent, and natural gas by 25 percent. This rise in energy prices, combined with charges on direct emissions, is estimated to raise production

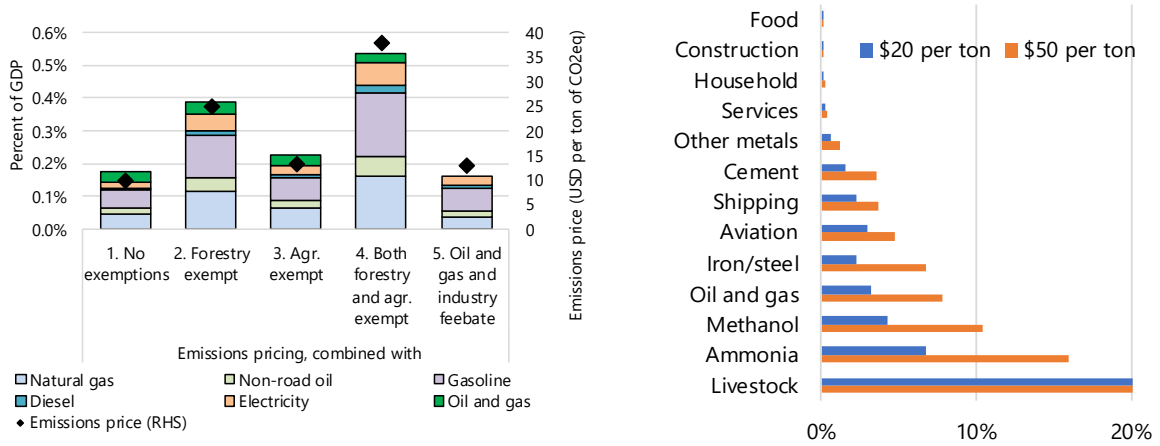
[8] The Paris Agreement's Article 6 facilitates the sale of carbon credits either through bilateral agreements, as outlined in Article 6.2, or via an international mechanism described in article 6.4. In both cases, Nigeria would need to implement a 'corresponding adjustment', meaning that any credits sold would not be counted towards its NDC.

[9] Subsidies are not comprehensively modelled but, in the transport sector, electric vehicle subsidies that achieve the same emissions reduction as emissions pricing result in roughly five times higher costs and generate a fiscal cost 0.2 percent of GDP.

[10] To avoid inflating revenue estimates, receipts collected from agriculture, waste, and forestry sectors are excluded, given the administrative difficulty of pricing these sectors.

costs by 2 to 10 percent in emissions-intensive sectors, potentially affecting international competitiveness for traded products like oil, gas, cement, and fertilizers. Price increases are especially large for livestock (above 20 percent) due to the sectors relatively high emissions-intensity. Emissions-intensity and well-designed regulatory policies results in much smaller price increases (for instance, oil and gas production costs increase by four times less with emissions-intensity pricing), making them more acceptable (especially in sectors like livestock where cost increases are particularly sensitive) unless emissions pricing is combined with targeted mitigating measures.

Figure 11. Impact of Emissions Pricing on Production Costs by Sector



Sources: IMF staff estimates using CPAT.

28. The above analysis highlights the significant macro and acceptability trade-offs across policy options in Nigeria (summarized in Table 4). Broad-based emissions pricing allows Nigeria to achieve its NDC with a cost of 0.05 percent of GDP and price increases of 2 percent for oil products. Limiting sectoral coverage requires more effort in the covered sectors—for example, economic costs and price increases triple if agriculture and forestry are exempt. Emissions-intensity pricing results in about double the economic costs of emissions pricing but causes negligible price increases, improving acceptability and reducing competitiveness impacts. Regulatory policies are somewhat easier to administer but careful design is needed to avoid excessive economic costs, while subsidies are most costly. Emissions pricing aligned with Nigeria's NDC can raise substantial fiscal revenue of 0.2 to 0.6 percent of GDP in 2030, while other policies tend to slightly or, for spending, significantly reduce fiscal space. Administrative needs vary across options and sectors, with pricing not a feasible near-term option in the forestry and agricultural sectors (although it could be possible to apply at limited scope, e.g., large farms and specific land parcels).

Table 2. Nigeria: Trade-offs Across Policy Instruments

	Emissions pricing	Emissions-intensity pricing	Regulatory	Subsidies
Administration - forestry, waste, agriculture, oil/gas	Not feasible in short-term due to lack of measurement and property rights		Somewhat straightforward to monitor compliance	Limited scalability for forestry, unclear for others
Administration - other sectors	Straightforward extension of fuel taxes	Requires capacity to monitor firm or product-level emissions	Straightforward to monitor compliance	
Economic costs	Economic cost of 0.06-0.14% of GDP	Economic cost of 0.07-0.37% of GDP	More costly than emissions-intensity pricing	Unsure, greater than 0.37% of GDP
Fiscal sustainability	Revenue of 0.18-0.55% of GDP	Revenue reduction of at least 0.01% of GDP		Loses revenue (size unknown)
Political acceptability	Price increase of 2-10% for energy products and energy-intensive firms	Revenue neutrality helps with accpetability and reduces impact on energy prices		Can be popular with firms/households

Source: IMF staff illustration. Notes: economic costs and fiscal revenues are shown for a range of sectoral coverages for a policy that achieves Nigeria's NDC.

Policy Package to Support Fiscal Revenue, Exports and Growth

29. To promote durable, effective, and equitable reforms with limited or positive macroeconomic impacts, a well-sequenced and carefully designed policy package is needed. Preparing this package requires detailed policy analysis, complementary measures to protect vulnerable households, enhanced accessibility to alternatives to fossil fuels, and the promotion of financial flows. A potential approach is outlined below, and the IMF is available to support authorities through training on analytical tools, such as CPAT, and dedicated capacity development.

30. Emissions pricing generates substantial fiscal benefits for Nigeria with limited economic impacts, however given recent energy price increases it can be regarded as more of a medium-term priority. Deciding on pricing levels, sectoral and fuel coverage, and the social protection response necessitates a more granular and comprehensive understanding of the firms, households, and regions most impacted.[11] In tandem, actions are needed to strengthen social protection targeting and delivery, improve non-energy emissions measurement,[12] and increase the availability of low carbon alternatives, such as reliable and more accessible on-grid electricity and off-grid solutions. In terms of implementation, emissions pricing should preferably be introduced at

[11] This analysis can partly be done using Nigeria's household budget survey and input-output tables (see Black et al 2023 for analytical details) and should be coupled with consultation across stakeholders.

[12] Administration is straightforward for energy use sectors, such as transport and power generation, as it can be applied as a tax on fuel quantity (e.g., liter) that is based on the fuel's carbon content. Non-energy emissions, such as process emissions, leaks from oil and gas extraction, and forestry require more sophisticated monitoring systems.

a time of strong macroeconomic conditions and low international fuel prices, starting with a low price that gradually increases. Particular attention should also be given to public communication on the rationale for the reform, strategies to address specific stakeholder concerns, and the use of revenue (including targeted compensation) (see IMF 2025). Emissions-intensity pricing and non-pricing (see below) instruments could be introduced as a preliminary step prior to emissions pricing since they likely do not require social protection support due to the smaller price increases.

31. Emissions-intensity pricing and standards may be most appropriate for select sectors or fuels due to export competitiveness and administrative concerns. Cost increases under emissions pricing for emissions-intensive sectors that compete against foreign producers, such as oil, gas, and fertilizers, can lead to a loss in competitiveness worsening the balance of payments in the absence of international coordination. Rendering emissions-intensity pricing (e.g., Australia, Canada) or partial exemptions (the EU, South Africa) potentially more suitable, although emissions pricing is present in some cases (Mauritania, Ghana, Chile). In some sectors, emissions intensity pricing could be implemented in the near term (see below); in other sectors such as forestry, agriculture, oil, and gas, preliminary measures to improve property rights, enforcement, and measurement would be required. The case for pricing policies is weaker in the waste sector given a lack of variation in abatement activities across the sector (e.g., collection and flaring of methane or waste to power).[13] Furthermore, emissions-intensity pricing can also be a long-term complement emissions pricing, as is the case in many countries (China, Ghana, the EU) if political acceptability and competitiveness concerns limits the stringency of emissions pricing.

32. Near term policies could include a mix of emissions intensity pricing, standards, and more targeted tax policies to avoid fiscal costs. Emissions intensity pricing could be applied where administration is feasible (vehicles, power generation). In the agriculture and forestry, emissions could be partly addressed though a range of policies, including the finalization of carbon credits legislation, a tax on unsustainably produced timber, strengthened enforcement of forest protection, promotion of climate smart agricultural practices, and continuation of tax expenditures (and emissions-pricing exemption) on LPG to support clean cooking fuels. Packaging and bottle deposit-refund systems are useful to divert waste to formal landfills (see Matheson 2019 for more). In the power sector, initial competitive tenders for renewable energy coupled with guarantees and land tenure can reduce offtake, land, and foreign exchange risk can increase renewable energy investment.

33. Facilitating both private and concessional financing is crucial to reduce the cost of emissions reductions and promote green growth. Emissions and emissions-intensity pricing provides a price signal to direct private capital to low carbon activities, but complementary policies are needed. High-quality climate data, such as green taxonomies, helps investor make informed decisions and can help increase green bonds issuance. More general improvements in

[13] The efficiency benefits of emissions pricing increase when the cost and specific activities to reduce emissions vary across firms/households in a sector since emissions pricing allows emitters to choose the composition and amount of mitigation activities, while regulatory policies force emitters to take specific actions.

macroeconomic conditions and deepening of domestic credit markets reduce capital costs, which is important given the relatively high upfront cost of green technologies. Additional barriers are present in the power sector, such as electricity purchasers with poor credit and long payback periods—blended finance to help derisk investment, well-designed auctions to grant power purchase agreements, and more may be needed.[14] Public spending to reduce emissions should generally be limited to public goods (e.g., associated infrastructure), mitigating impacts for vulnerable households, and projects with high developmental co-benefits (e.g., electricity access and clean cooking fuels), leaving substantial emissions pricing revenue remaining for general development spending.

[14] See WB 2024b, IMF 2023b, and box 2.3 in IMF 2024 for more.

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